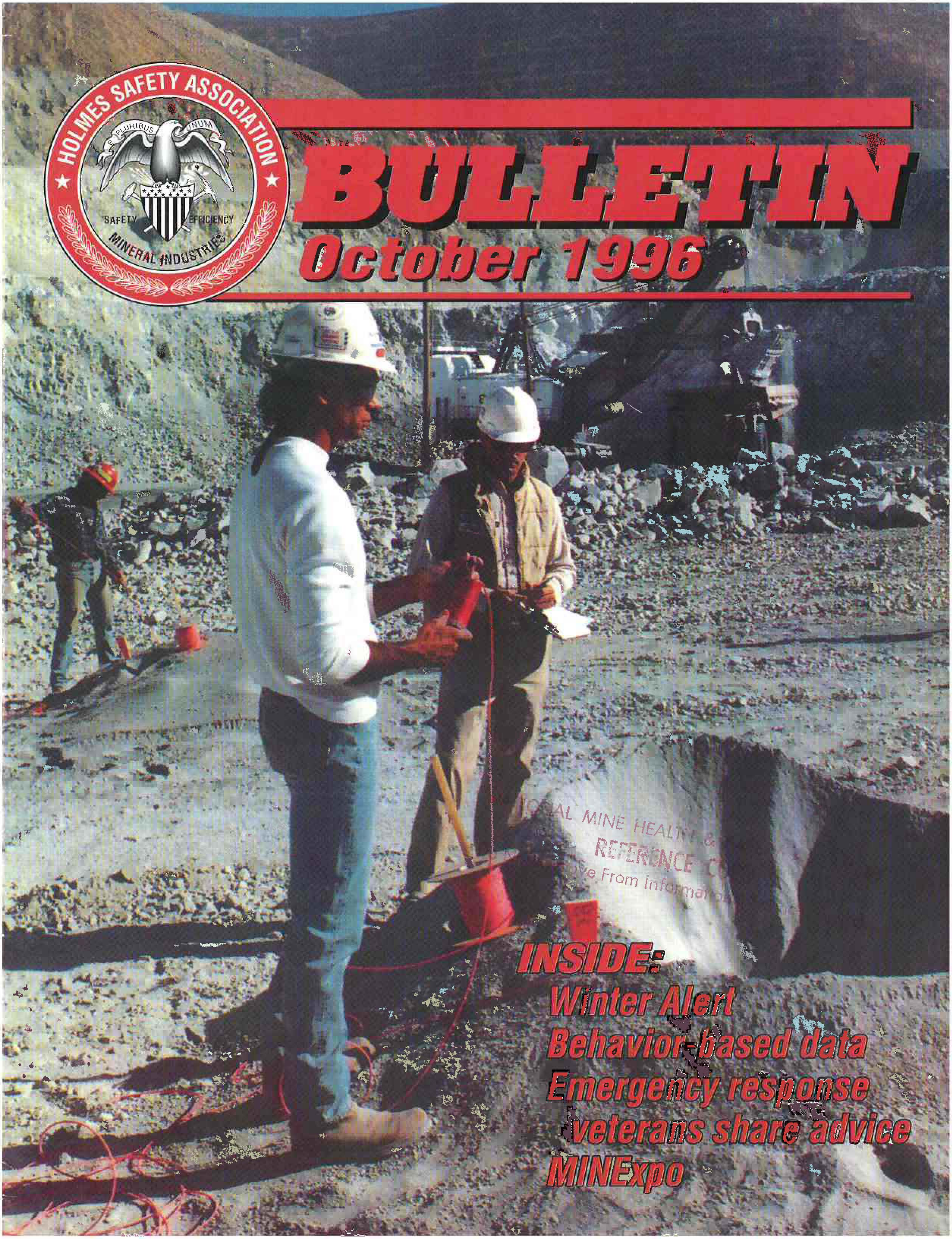
HOLMES SAFETY ASSOCIATION

BULLETIN

October 1996



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The *Holmes Safety Association Bulletin* contains safety articles on a variety of subjects: fatal accident abstracts, studies, posters, and other health and safety-related topics. This information is provided free of charge and is designed to assist in presentations to groups of mine and plant workers during on-the-job safety meetings.

PLEASE NOTE: The views and conclusions expressed in *Bulletin* articles are those of the authors and should not be interpreted as representing official policy or, in the case of a product, represent endorsement by the Mine Safety and Health Administration.

THIS MONTH'S COVER: Thanks to H.L. Boling of Phelps Dodge Morenci, Inc. This came from the April image in the 1994 calendar and was captioned as follows: "Over 600,000 tons of material must be broken by the blasting crews each day to meet Morenci's production requirements."

KEEP US IN CIRCULATION
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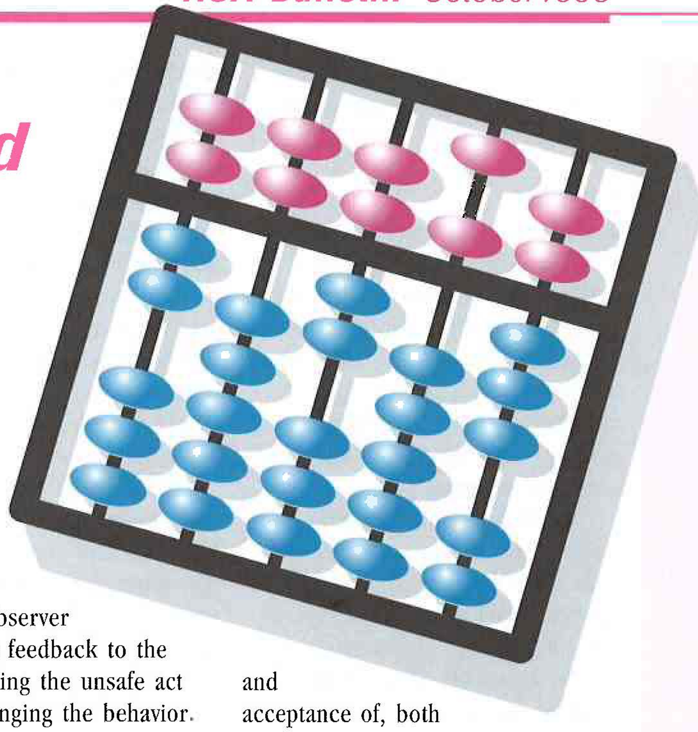
ADDING VALUE to behavior-based data

Make the best use of your behavioral safety data by identifying the root causes of injuries and allocating your resources properly

By Larry Perkinson, CSP



The age of computers has brought us the ability to generate volumes of information. However, the wide use of these data-generating marvels has not, in most cases, cured a particular malady among many safety professionals. Let's call it "datatonic paralysis"—the failure to collect and use the data we generate in a way that most effectively helps us identify and solve problems.

Behavioral observation is one of the best potential data-gathering and analysis processes I have seen recently. In this article, we will identify the strengths and weaknesses of types of behavioral data collection. We will then define and encourage the use of system-based causal analysis as applied to behavioral observation data. And finally, we will identify a model for prioritizing resource allocation for problem-solving.

An overview of behavioral observation systems is necessary to see the development of the process and how data have been used in the past.

Problems with the data

Perhaps the most widely known observation system has been simple behavioral sampling. This generic process often consists of training management personnel to observe for unsafe acts.

A standard list printed on a card provides the observer with the acts to look for. When such an act is observed, the observer gives immediate feedback to the observee regarding the unsafe act in hopes of changing the behavior. The data regarding the type of unsafe act are checked off on the card and the cards turned in periodically to be totaled by type and area/department/shift, etc.

A strength of this type of data is that it can be categorized. The data fit into certain categories which can be tracked over a period of time.

But there are weaknesses of this type of data accumulation, too. Most companies do not treat the data statistically; that is, they do not apply statistical tests to determine if variations up or down are random chance or have true significance. Often, they end up applying resources to a "problem" that is normal, random variation.

Many companies miss the boat on employee involvement by having only management perform the formal observations. It is often difficult for supervisors to take off the "boss" hat and put on the "observer" hat. The observation process needs to be as positive as possible, but it is difficult for employees to view their supervisor's displeasure as anything but discipline. Using peer employees to make observations certainly increases employee involvement in, and acceptance of, both the process and the data generated.

Interpretation of whether the observed act was unsafe or not is another problem associated with behavior-based data. Often, there is no operational definition or standard of "safe" behavior written out with which to compare the alleged "unsafe" behavior. This creates a range of opinion among observers as to what constitutes unsafe behavior in the given categories and makes the data less useful or meaningful.

In "The Behavior-Based Safety Process: Managing Involvement for an Injury-Free Culture," (Van Nostrand-Reinhold, 1990), Thomas R. Krause suggests that operational definitions be developed for what safe behavior is and that observers commit these definitions to memory. Any behavior that violates the definition is considered at risk behavior.

Some data-gathering processes pose a problem in the area of feedback. Often, the feedback is that the observee was "unsafe"; he or she was caught doing something wrong. There may have been many things the observee did right during the period of the observation, but he or she got no "credit" for them.

This can lead to a poor reception for the observer, the data and the process.

On their best behavior

Another area of concern expressed by many people regarding the validity of observational data is the "Hawthorne" effect, which can be defined as "confounding influences on research outcomes caused by the subjects' reaction to being studied," according to Professors Long and Metazoan.

"Psychologists and sociologists," they continued, "do not agree on what the effect is or how it operates. They do, however, agree that when people are being observed, and are aware of it, behavior changes."

How valid are the data we have gathered? Are our subjects not on their "best" behavior when being observed? Does feedback from clandestine observations generate resentment among employees because they feel "spied" on? Would employees want to become involved in a process that required spying?

I have heard the theory that it is OK for employees to perform safely while being observed, even if that is not the way they normally perform their jobs. Employees will eventually make the connection that if it is smart to do it safely when being observed, this theory holds, it must be dumb to take risks when not being observed.

The problem with this theory is that without seeing the normal behaviors that place people at risk, the system-based causes remain unaddressed, thereby acting as triggers for continuing the behaviors.

Failure to address the system-based, or root, cause of the behavior is the most significant flaw in many behavior-based data collection systems.

It does no good during an observation to point out to observees that they need to get help when lifting a load when that is the way they were trained, or the procedure says to do it without help, or they know the supervisor has seen them do it hundreds of times and never said anything because it gets out more production.

By addressing only the behavior itself, the observee may change the behavior for the moment, but as soon as the observer is gone or the press for production hits, the old behavior reasserts itself.

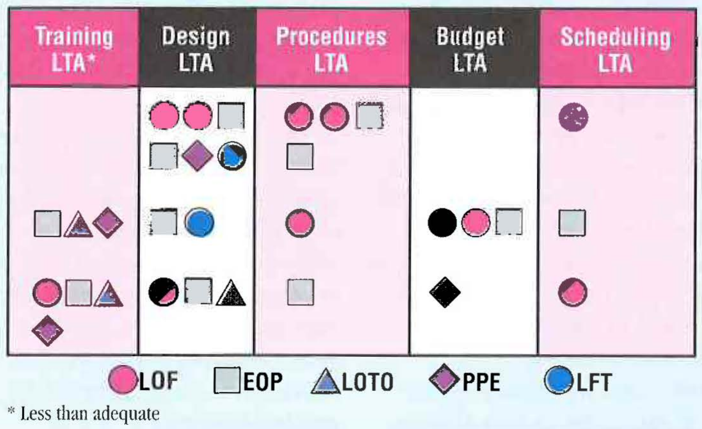
Correct uses

We emerge with the necessity for two types of behavioral observations. The first type seeks to involve employees and give positive feedback (the credit) that rewards employees and reinforces safe behaviors. The at-risk behaviors are pointed out and information on why they were performed is recorded.

The second type is for data-gathering purposes only to get a true measurement of at-risk

Scene of an accident in which a haulage truck rolled over a berm and dropped 100' to the ground resulting in the loss of a life. ▶

Figure 1.—System-based cause distribution of behaviors



based in the management system.

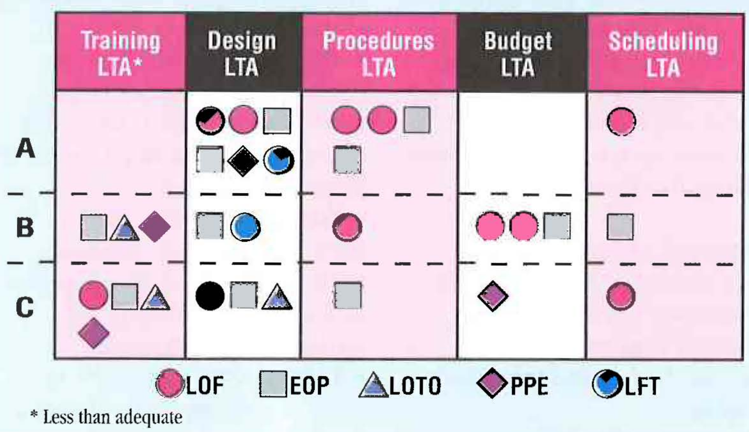
How can arriving at these system-based causes add value to the observation process? You can look at it like an oil leak in a plant where I once worked. When several inspections in a row cited oil on the floor under a press, the supervisor remarked, "Yeah, we soak it up with an absorbent and sweep, but it just keeps coming back." Until they fix the leak, the problem will never go away.

Until we "fix" the system-based causes, the incidents they create will continue to pop up again, but

System-based causation analysis identifies how at-risk behavior can lead to accidents and what areas need to be improved to eliminate such behavior.

Breaking behaviors into three tiers prioritizes causes of accidents so the ones most likely to result in death or major loss (Tier A) can be addressed first.

Figure 2.—System-based cause distribution of behaviors



behaviors. These would be performed by a few selected people to narrow the variation in definitions of safe and at-risk behavior. They would be made for similar segments of time under similar operating conditions for each area or department.

Employees would not necessarily know that the observer is making observations, so the observer should be someone "usual" to the area. No feedback would be given to employees to preclude the "spying" accusation. However, an imminently dangerous activity would certainly be addressed immediately.

System-based causes can be arrived at during employee problem-solving meetings when the behaviors are discussed without the stigma of identifying the employee involved. This type of observation negates the "Hawthorne" effect described earlier and provides a truer picture of what is happening in the organization.

Once system-based causal data from behavioral observations are gathered, how best can the information be used? Early in this article, I covered the categorization of data related to the type of at-risk behavior observed. This same technique needs to be applied to the system-based causes of the at-risk behavior. System-based causes are arrived at by asking "Why did this behavior occur?"

A problem-solving technique referred to as the "5W1H" method involves asking why five levels deep, then asking how can we prevent this from happening again. For example, in an incident where a ladder rung broke and an employee fell, I would ask:

Q: Why did the rung *break?*
A: It had been overloaded.
Q: Why had it been overloaded ?
A: It was used as an A-frame lifting device.
Q: Why was it used as a lifting device?
A: There are no such devices for the purpose on site…, etc.

By asking at least five whys, we begin to arrive at causes that are unlike the oil leak, in different places all over an organization.

Expert guidance

There are many sources that can assist in categorizing system-based causes. They include the works of: Frank Bird, *Systematic Causal Analysis Technique* (SCAT); William G. Johnson, *Management Oversight and Risk Tree* (MORT); and Bill Pope, *Triadic Analysis of Flawed Systems* (TAFS).

While several observation processes attempt to make a determination of system-based causes, they tend to focus on two techniques that do not give adequate attention to the management system.

The first technique attempts to

solicit from the observees why they felt they had to act in a way that placed them at risk. This focuses attention on the system-based causes but, unfortunately, it tends to remain isolated to a particular incident, behavior or event. Even when the "why" is recorded and shows up on a report, it is generally not categorized and tabulated so that trends in system-based causes can be detected and analyzed.

Another technique used to analyze behavioral data is to group behaviors together and try to find common causes for that group. Unfortunately, while the behaviors may be similar or even identical in definition, they may be precipitated by completely different system-based causes. Thus, we find ourselves spending our limited resources on symptoms rather than battling the disease.

Analysis techniques

Let's assume we have behavioral observation data that show the following observed behaviors, followed by the number of times observed:

- Working in the Line of Fire of an Energy Source (LOF)—10
- Eyes not on Path of Travel (EOP)—8
- Lockout/Tagout Violations (LOTO)—6
- Personal Protective Equipment Violations (PPE)—4
- Lifting (LFT)—2

It appears as if the LOF category heads our Pareto chart and we should look for ways to encourage or facilitate people staying out of the path of potential energy release. However, let's see where each of these behaviors falls in system-based cause categories (see Figure 1).

The distribution of behaviors in the system-based cause categories shows that Line of Fire (LOF) is distributed over all five categories. Solutions addressing the LOF issue would have to be very broad and it is unlikely any particular solution would address even a majority of the cause categories.

If we look at the cause category rather than the behavior type, however, we see that the design of equipment and processes accounted for one-third of all of the at-risk behaviors observed. Now, we have a single cause that we can focus on that would eliminate one-third of the at-risk behaviors.

Let's consider another parameter in the model to help allocate resources. Let's divide the cause categories into three tiers representing possible or likely outcomes of the behaviors (see Figure 2):

- **TIER C**—Behaviors likely to result in minor, nondisabling injury, minor product, equipment or environmental damage, or minor process interruption.
- **TIER B**—Behaviors likely to result in permanently disabling injury, serious product, equipment or environmental damage, or serious process interruption.
- **TIER A**—Behaviors likely to result in fatal injury or major loss to product, equipment, process or the environment.

This analysis reinforces our decision to address Design Less Than Adequate concerns, because in addition to having the most behaviors in the cause category, it also holds the most Tier A behaviors. This analysis also identifies our secondary area to work on. While seven behaviors are found in the training category and only six in the procedure category, four of the six in the procedure category are Tier A behaviors.

The causes categories listed here are very general in nature. Categories used in actual systems should be more specific to narrow down causes to something less broad than "Training." Also, the tier definitions could be defined more specifically with dollar amounts of damage or hours of process downtime, etc. The number of tiers could also be expanded to suit a particular facility or organization.

The strengths and weaknesses of various methods of behavioral data collection have been discussed and some possible ideas on how to apply system-based causal analysis to observation data proposed. We have also looked at a possible system for using behavioral data to prioritize resource allocation for problem-solving.

In today's business climate, we must make sure everything we do adds the most value for the investment we make and supports the mission of the organization. Using analysis tools such as these will maximize the potential of behavioral observation processes.

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Larry Perkinson, CSP, serves on the board of directors of the National Safety Management Society and is NSMS's director of international education and development. For information on the NSMS seminar "Breaking Safety Paradigms: Pursuing the Business Mission," which is taught by Perkinson, contact NSMS at (800) 321-2910. Perkinson has worked in safety management positions with three Fortune 500 companies, most recently with Michelin Tire Corp.

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Emergency response veterans share the lessons they've learned

By Launa Mallett, Research sociologist, Charles Vaught, Mining engineer and Michael J. Brnich, Jr., Mining engineer, U.S. Department of Energy Pittsburgh Research Center, Pittsburgh, PA.

Since 1991 the Pittsburgh Research Center (PRC formerly part of the U.S. Bureau of Mines) has been tapping a valuable resource—researchers have recorded extensive interviews with 30 individuals who are recognized as experts in the area of mine emergency response. These veterans related stories and observations from events experienced during as many as 47 years of response activities. Overall, the response veterans averaged 29 years of mine emergency response experience and 35 years mining experience. Individuals

interviewed included representatives from mining companies, the UMWA, and state and federal government agencies. This information was gathered so that it could be provided to today's miners and to tomorrow's emergency response personnel. It is hoped the collective wisdom that has been obtained can be used to help train new responders and guide those decisions which will have to be made on the scenes of future events.

During the interviews, the emergency response experts were asked to discuss lessons they had learned through experience. The interviewers asked them to tell what they had learned that would cause them to handle similar situations differently and to tell about things they saw at past events that they would warn others not to do in the future. In response, the experts discussed a variety of things. Most of their responses, however, touched on some of the same topics including: preparedness, experience, people on-site, mine rescue teams, and decision making. A summary of their responses provides an overview of the lessons learned on-site at the largest mine disasters in the country.

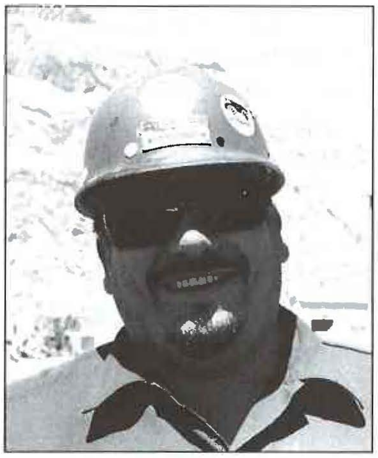
Preparedness

The most common lesson that experts reported dealt with aspects of preparedness. Almost a third of those interviewed suggested that future responders would better handle situations if they have been properly trained and if appropriate preparations have been made at the mine site. One expert suggested that responders 'Get a good procedure. Work on it. Everybody agree on it and write it up and practice, practice, practice." Another said that, "It's just a matter to me of organization and if you have the right organization, you don't have that many problems with it."

There was particular concern expressed about the need to develop a strategy for having appropriate personnel available when required. To accomplish this, staff needs must be determined:

> [I learned that] I would staff different. And as an example, this last accident that we had, we sent individuals up to handle the mine site, but we didn't think of our own needs within that office. As an example, we had a secretary there, this secretary, we should have sent back up for her. She ended up being the secretary, the phone answerer, the coffee pot girl, frankly, girl Friday. And we didn't worry one iota about wearing her out, the hours that she worked. [It] didn't enter our minds, and I said if we ever did anything again, that has demands like that, I would staff from the, not just the top people, but you got to staff down below. You got to prepare for that too.

Once staffing needs have been determined, it is critical that responders know what is expected of them before they arrive on a scene. As one expert said, "...everybody should have a clear-cut understanding



of what their responsibilities are, what their role is, and where they fit into the emergency structured "I

All photos courtesy of H.L. Boling of Phelps Dodge Morenci in Arizona. They are used for interest only and were originally provided for another article and do not necessarily reflect the views of PDM.

think everybody needs to understand exactly what you re trying to do, whatever it may be." Preplanning, for both personnel and other resources, is a means of saving time:

> One of the biggest lessons I learned is once you've arrived on the site, get your backup, get your support, and call for help. You are not invincible. You need help. And get your resources, and get your backup behind you... You will need them. All your resource and material, ...not necessarily to have the equipment on the property—underground. I mean, you can overload with ...a whole bunch of equipment you may never need. But you should have your resources, your check list. If you want to call [to determine] where this equipment is and how soon can I get it here? Do I need it? ...That first fire that I was involved in, and I said that I was going to be the big hero, and I was going to be there. And I was there until 12:00 at night before I called for help. And then, when I called for help, it was a mad scramble, and I should have been calling for that help at eight o'clock in the morning. When I arrived on the property, I should have made those phone calls. "Hey, I'm at the mine. We've got the emergency. You guys are on standby. Get this stuff ready... We may need it." It doesn't necessarily have to come to the property, unless there's a good chance you're going to use it, but at least have it ready.

As this quotation suggests, time saved by forethought and preparation can become valuable during a response.

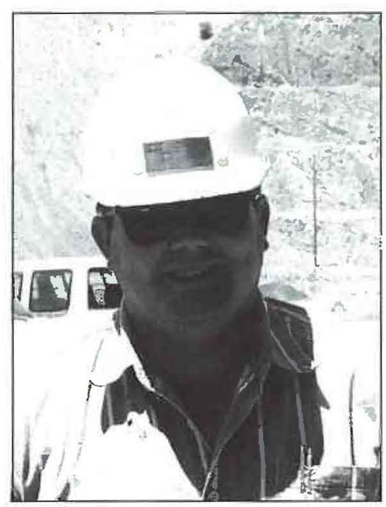
Experience

All of the experts provided glimpses of what it was like to be on-site during responses to major mine emergencies. When asked what they had learned that should be passed on to future generations, five of them discussed how experience influences the effectiveness of responders. One veteran used the example of an emergency operation with which he had been involved early in his career. He concluded that what had taken him 30 hours to complete then would require only half the time now because of his experience. The five individuals also suggested ways to make the most of the learning opportunities that responses create. They talked about the hands-on learning that occurs during a response, about the value of reviewing events and sharing what can be learned from them, and about simulating emergency conditions to give trainees a preview of what they may encounter.

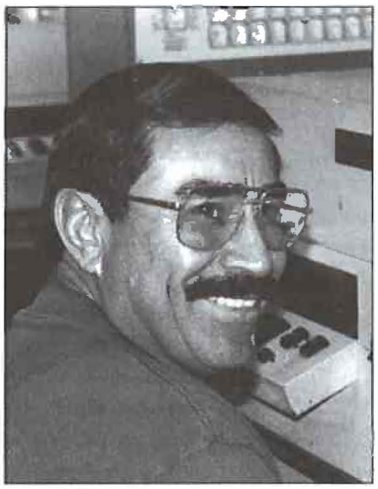
The five veterans recounted that most of their training occurred during responses. One individual discussed how learning can take place under these circumstances. He was not a decision-maker in his first few responses. Instead, he talked with the experienced person who was in charge. This experienced responder explained not only what should be done, but also the technical information that supported each decision. The novice workers asked questions throughout the response and gained invaluable knowledge from the seasoned Teacher." During the interview, this subject expressed his opinion that some aspects of mine emergency response have to be learned on-site through experience. He further pointed out that while presence during responses provides opportunities for learning, it is up to the individuals involved to ensure that teaching and learning take place.

Those who stressed experience during their interviews also thought that learning could and should take place through the review of events. One respondent related a story about reviewing an event to determine causation. He explained how pieces of the puzzle didn't fit together until well after the event when all testimonies had been reviewed and a report was being written. When this collected information was put together, an analysis became possible and recommendations could be developed to prevent a similar situation from occurring in the future. The significance of summary reports, or formalized hindsight, was also mentioned in terms of the importance of sharing these documents with others in the industry: '...what we do is, we send [our association] a report, which they can take then and pass it on to other areas. Where... by our misfortune, they can learn by it too."

It was also suggested that experience can be gained through simulated emergencies. One expert



argued there should be available facilities in which mock emergencies can be staged, exposing trainees to something like a real event. Fire training would include responses to burns in controlled environments, for example. "You learn from your mistakes... Give them opportunities to make the mistakes where no one is going to get hurt. And then we'll have people [who've been trained], and this is what we need because this is ...not something you learn in books."



People on-site

Lessons that had been learned regarding who should and should not be allowed on mine property during a response were passed on by four of the experts. They expressed concern about people who were not taking active roles in a response but who added complexity to the situation by interfering and/or simply contributing to overcrowding by their presence. These four individuals also addressed the special needs of victims' family members.

Control of site access had been discussed in another portion of the interview, but the experts felt this issue was important enough that future responders should learn from their experiences:

> [There] were situations where people had, I guess, influence ...with the company that got into the area that wasn't really needed. I think that there should be a very strict policy on the number of people that come in... And I don't think that any of them that I know about, really adhered to that policy rigidly enough. I think maybe that in all cases there'd been some people in the area that shouldn't have been there.

The concern of extra people hampering response efforts is one consideration. A related (and equally important) issue is the safety of these bystanders:

> ...maybe [when] there'd been a rock fall, there's a little too much chance taken around that rock fall. With too many people when you ought to have a little bit less number of people in the area trying to get the person cleared of the rock. I don't think you need eight or ten people around trying to clear the rock, when they were in each other's way. And if there's another fall, you just have that many more people killed.

Generally, it was agreed there should be as many people as needed to conduct an efficient and effective response on the mine site and no more.

It was mentioned, however, that special provisions should be made for the family members of missing miners:

> [With my experience] I would [now] know that family members are going to be there, and they are going to be very, very apprehensive. Someone with compassion needs to pay a lot of attention to family members and be able to brief them and to make sure that their pastors, their religious leaders, whoever they may be, [are] aware of the situation and invite them to come and be with the family members.

One expert agreed with the need to be as supportive as possible with family members, but warned that it should be clearly established who is and is not considered "family." He noted that in one case, family friends who were allowed to accompany the family abused their access to mine property in an attempt to gain more information about the victims. It is not surprising that these friends were interested in obtaining as much information as possible, but their activities hampered the efforts of responders. None of the veterans described this type of problem with actual relatives of victims and all felt they should be given every consideration possible.

All photos courtesy of H.L. Boling of Phelps Dodge Morenci in Arizona.

Mine rescue teams

Four experts had thoughts regarding mine rescue teams that they felt should be communicated to future responders. One issue related to this topic is the problem of response times. Since team members may be away from the mine when an event occurs or may be called to a mine other than the one where they work, time is required to assemble a team. One suggestion for dealing with this delay is to use a mixed team: "... you [aren't] going to call 14 men and 14 of them be at home ...if I didn't get as many men from one team as I wanted to ...I took one or

All photos courtesy of H.L. Boling of Phelps Dodge Morenci in Arizona.

two from the other team." This person cautioned that while response time is important, it must be emphasized that team members (and other responders) should not endanger themselves by driving to the response in an unsafe manner. "There's no need to cause some more injury to yourself or someone else, just to get there two seconds, or two minutes earlier."

Another important issue relating to mine rescue teams is communication between a team and the command center. It was argued that teams sometimes do not follow directions of the command center and that they sometimes do not report back appropriately:

> If you let [the teams] go and not know what they're doing, or for them to ...just call back what they want to tell you, how are you going to make a decision on the surface? You'll make the wrong decision probably three-fourths of the time, because you don't know the information. And if they don't tell you, there's no way to know.

According to those interviewed, mine rescue teams should be the eyes and hands of their command center but this has not always happened during responses. As stated above, roles and responsibilities must be clarified for everyone involved in the response before an event occurs.

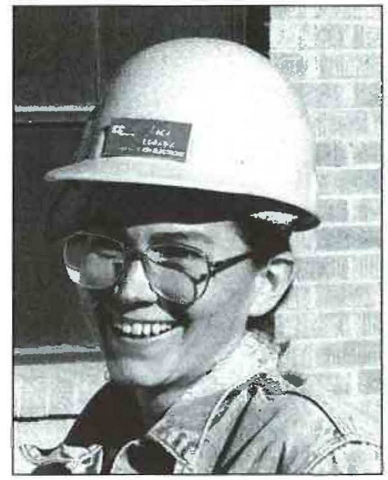
Decision making

One set of questions on the interview guide covered the area of decision making. Three of the people who were interviewed thought some aspect of this issue should also be brought up when speaking of lessons they would like to pass on. In all three cases the focus was on interactions between responsible individuals in the command center. It was pointed out that interplay between multiple people is helpful: "... it's best to have somebody that you can talk to because no one person [can always know the best thing to do]. They just don't make them that smart."

On the other hand, conflict between individuals in the command center can be a problem. One person related the story of a "skirmish" that occurred between representatives of regulatory agencies during a response. Another pointed out that, as stated above with regard to planning, command center personnel must know their roles: "I have no problem with the four agencies (company, federal, state, and union), as long as they understand that ...it's the responsibility of the company to call the shots." This individual stated that the government agencies and the union should provide personnel to assist the company if they need it and to discuss with them any decision that may create a hazard. He further reflected that when "... a person at a coal company has the knowledge of rescue and recovery work, it makes the job easier, and I think you get along better. Where a person does not have the knowledge, you'll have to question him more: 'Why are you doing this?' And the plans generally change [as a result of your questions]." A decision maker whose plans are questioned may want to remember this advice from one of the experts interviewed: "Well, quick decisions is often bad. Try to count to ten anyhow, before you make a decision... And a wise man changes his mind, and a fool never does."

Conclusions

During the interviews with PRC staff members, the experienced mine emergency responders covered a myriad of issues. The most commonly



mentioned topic was preparedness. Implicit in their observations is the notion that it is critical to have a well-designed mine emergency plan which has been tested. Additionally, the importance of practice was reiterated as a basic theme. The veterans also talked about the value of experience and suggested that some of this experience could be gotten through practice during such activities as mock emergencies. Almost half the responders mentioned the advisability of rehearsing for actual events before they happened.

A second theme, which ran through discussions, was the essential nature of good communications and control. Over and over respondents talked about the importance of having reliable information about what rescue teams underground were doing. They also considered it crucial to stay abreast of the activities of various parties on the surface. These individuals recognized that the quality of decisions made during a response was directly related to the adequacy of available knowledge and how it was imparted. The implication is that, once an emergency plan has been developed and rehearsal is instituted, particular attention should be paid to the delineation of roles and establishment of communication protocols. If these things are done, future responders will be better prepared to handle the emergencies they face.

Fatality summary January-September 1996

This article updates the status of fatalities occurring in both coal and metal/nonmetal mines from January through September of 1996. Based on preliminary accident reports, as of September 30, 1996, fifty-seven fatalities have occurred at coal and metal/nonmetal mining operations. During this period, coal experienced 25 fatalities and metal/nonmetal had 32 fatalities. Powered haulage fatalities in both coal and metal/nonmetal were the most frequent accident classification, causing 33 percent of the fatal injuries.

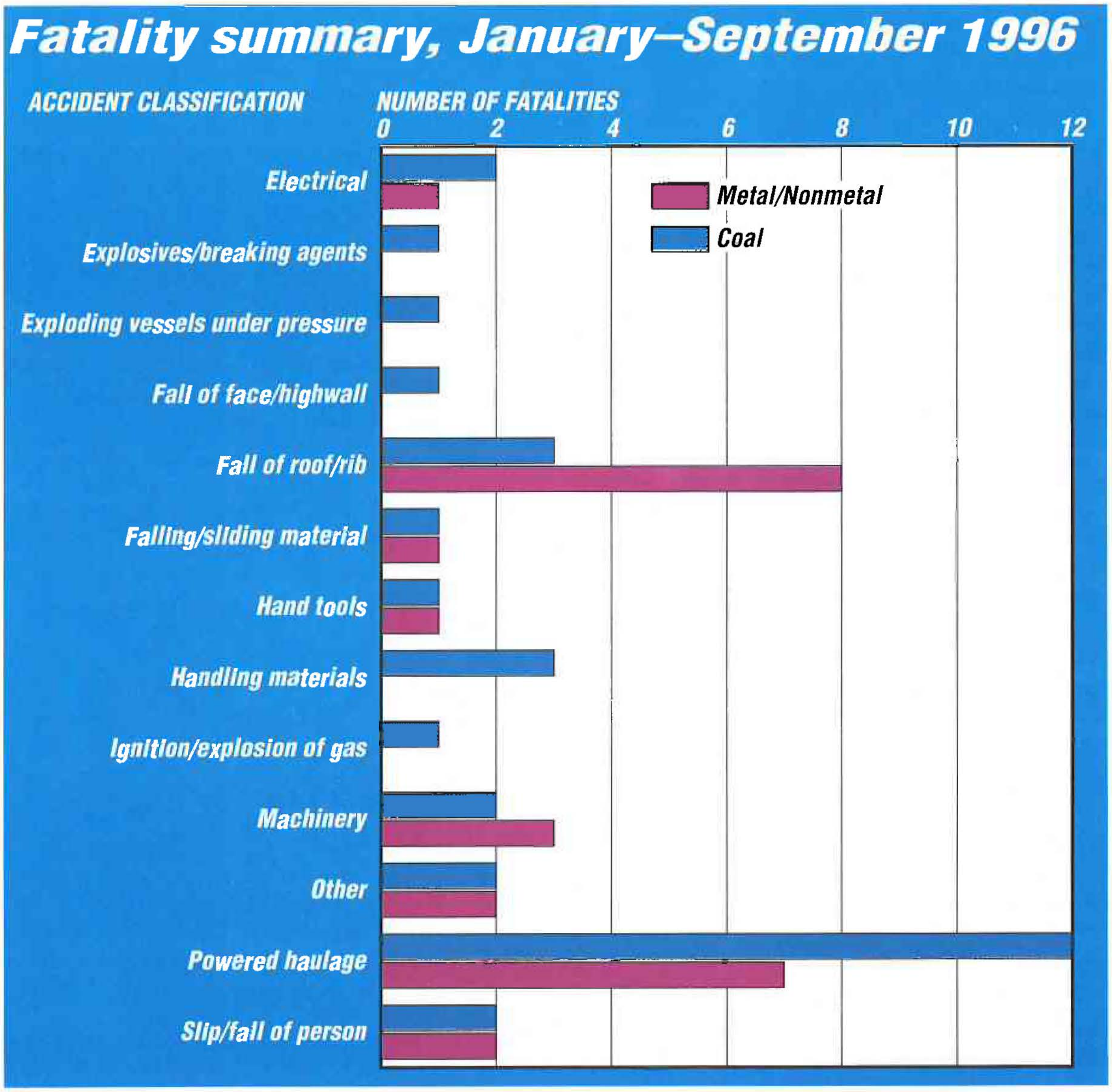
Coal mining

Eight of the fatalities were classified as fall of roof/rib and seven of the fatalities were classified as powered haulage. Nine coal fatalities occurred in West Virginia and seven occurred in Kentucky. Nineteen fatalities occurred underground and six occurred on the surface.

Metal/Nonmetal Mining

Twelve of the fatalities were classified as powered haulage. Fall of roof/rib and handling materials accounted for three fatalities each. Ten fatalities occurred at limestone operations and eight occurred at sand and gravel operations. Twenty-three fatalities occurreed at surface operations, and nine fatalities occurred underground.

Submitted by Jimmie Shumate, National Mine Academy, Beckley, WV



Illinois regulates non-coal blasting

The Illinois Dept. of Natural Resources created a new division to oversee all mine blasting—including aggregate quarries .

"With the enactment of *Public Act 89-26* ...the departmcnt will for the first time regulate blasting operations at noncoal (aggregate) mining operations," a June 24 memo from Illinois Mines and Minerals Director Fred Bowman said.

The new Blasting and Explosives Div. will contain the coal and aggregate blasting programs, the aggregate reclamation program and the explosives program. The supervisor of the new division is Scott Schmitz, who was chief of the Land Reclamation Div.

The explosives program now will be handled administratively out of Springfield rather than Benton. *Schmitz can be reached at 217-782-9976.*

Reprinted from the July 29, 1996, issue of the ***Mine Regulation Reporter***—

Mine officials failed to see hazards of using jacks to guide equipment

An investigation concluded that a fatal machinery accident at the underground coal mine occurred because mine officials did not foresee the hazards of using duke jacks to steer heavy equipment.

The victim, a mechanic—41 years-old at the time of the accident—was one of a crew assigned to move the stageloader assembly of a longwall from one crosscut to another on April 10. The victim sustained fatal injuries when he was struck in the lower chest by a duke jack.

He and his crew used the duke jack, a telescoping hydraulic prop, to keep the 60-ton stageloader assembly away from the rib as the assembly was pushed through the entry by two Westfalia headgate "walking shields." The operation was conducted in stages. Between each push, the duke jack had to be picked up and reset between notches in the coal of the rib and the stageloader assembly. Before the jack could be released, a part called the "wand" had to be removed to allow fluid to escape from the cylinder.

The victim was positioned to retrieve the duke jack after the crew's third push when the jack sprang free. Other miners heard a loud pop like a "roof bolt breaking" and a moan from the victim. He was found sitting with the duke jack across his lower legs. He died following surgery later that day.

Investigation finds evidence of great force on jack

After the accident, miners reported seeing a cloud of rock dust that had been knocked from the rib. The coal between the notches in the rib had been crushed.

A cam on the duke jack's prop head plate, which had been wedged against the frame of the stageloader, broke off during the push. Miners found the wand on the mine floor near the victim and the jack. A gouge on the side of the duke jack indicated the drive motor of the stageloader assembly had applied lateral force during the push.

"As a result of the high lateral force placed on the duke jack," investigators said, "the duke jack sprang free, striking the victim, when one or more of the following occurred: Coal around the notch in the rib crushed out, the cam broke away from the prop head plate of the duke jack or the victim attempted to remove the wand."

Management and labor at the mine had drafted a 44-page plan to move the longwall, including moving the 60-ton stageloader assembly as a unit. The plan did not discuss steering the stageloader assembly or the use of duke jacks. Mine officials and miners told investigators that it was common practice to use duke jacks for many chores when moving heavy equipment.

Reprinted from the July 29, 1996, issue of the ***Mine Regulation Reporter***—

Mines can submit water data on disk

The Kentucky Dept. of Surface Mining Reclamation and Enforcement (DSMRE) soon hopes to allow coal companies to submit water monitoring data electronically if they desire.

They have a computer program that allows regulators to accept information on 3.5 inch diskettes, an agency memo stated. The data files must use standard ASCII text "and be structured according to DSMRE file specifications," the agency said.

"DSMRE encourages industry to explore and use this option. It will be necessary to implement this option on a limited basis at first, since it will take some time for us to gear up," the memo noted. "Please bear with us as we work through the inevitable bugs and glitches together."

Call Fred Craig at 502-564-2340

Reprinted from the July 29, 1996, issue of the ***Mine Regulation Reporter***—

Safety timeline, 1911-1996

1911—Demonstration at the Bureau of Mines Experimental Mine shows coal dust can fuel mine explosions.

- Four mine rescue teams and 41 first aid teams participate in the first National Mine Rescue and First Aid Contest.

1912—Bureau of Mines establishes testing protocols for "explosion proof" mine equipment.

1915—Electric lamps replace open lights in underground mines.

1920—About 60% of coal is mined with the help of electric equipment.

1922—The first mechanical methane detector is approved. Canaries and flame safety lamps remain standard gas detectors.

1924—The first filter-type self-rescuer is approved.

1925—The National Sentinels of Safety award program is established.

1930—Permissible explosives are used in coal mining. The use of blackpowder for blasting declines by 51%.

- Most underground mines have mechanical ventilation fans; few rely on underground furnaces for moving air.

1939—Central Mine Rescue Stations provide rapid response to emergencies throughout the nation.

1940—Electric lamps are used by 53% of underground miners.

1945—Twenty percent of underground mines use rock dust for explosion prevention.

1946—Annual coal mining fatalities drop below 1,000 for the first time in the 20th century.

1950s—Roof bolting is adopted.

1960s—Continuous mining is the lead production method in underground mines.

1970—Machine-mounted methane monitors are required.

- Filter-type self-rescuers are required.
- Respirable dust monitoring and control is required.

1970s—Diesel equipment is introduced in underground face areas.

1974—The first requirement for protective cabs or overhead canopies on electric underground face equipment is established.

1976—All mobile surface mine equipment are required to have rollover protective structures.

1978—Miner safety training is required.

1981—Self-contained self-rescuers that provide oxygen are required.

All underground mines have two rescue teams on call.

1983—Annual mine fatalities fall under 100 for the first time in the 20th century.

1988—Temporary roof supports are required by federal law.

1989—Mobile surface equipment with backup alarms are required.

Late 1980s—Remote atmospheric monitoring systems enhance safety in some large underground mines.

1990—Annual coal production tops 1 billion tons.

Source: MSHA
*Reprinted from the September 1996 edition of **Coal** magazine; Industry Retrospective Section.*

Winners of the first annual training materials competition

In late March 1996, letters were sent by MSHA inviting miner training instructors to enter a training materials competition. The letter explained the competition and outlined the criteria for judging.

On October 15, a panel of three judges, with no connection to the entrants, studied the entries and selected nine individual winners and the grand prize winner.

Winners in each of the 9 categories and the grand prize winner received plaques with certificates—all entries received certificates.

Ten plaques will be mounted on the wall at the National Mine Academy in Beckley, W.Va., where the winners names will be engraved on the plaque each year.

The following were winners in this year's competition:

Academia

Coal: Pennsylvania State University (Harvey Roles II, training video)

Metal/Nonmetal: Pennsylvania State University (Harvey Roles I, training video)

General: Pennsylvania State University: Foreman's Handbook

State

Coal: State of Virginia ("Hazard Alert—Live Tomorrow")

Metal/Nonmetal: New York State ("Back Facts")

General: State of Illinois ("Degraded Image Hazard Recognition")

Industry

Coal: Vigo Coal Co. ("Refresher Training Exercise")

Metal/Nonmetal: Rohrer's Quarry, Inc. ("That Will Never Happen to Me")

General: Pryce Parker ("Effective Communication")

Grand prize

Pennsylvania State University

Cold weather holds dangers for miners

By Ken Ward Jr., Charleston Daily Gazette Staff Writer

Federal mine safety officials are again warning coal operators and miners that the onset of colder weather creates more hazards in mines.

The U.S. Mine Safety and Health Administration last week issued its annual "winter alert" to warn of the increased risk of mine explosions.

Historically, some of the nation's worst mining disasters occurred between October and March.

"We want to communicate the important message that colder weather brings additional hazards to the underground coal mining environment that must be addressed," said MSHA chief Davitt McAteer.

"And we want miners as well as their spouses, their children and other relatives to know that these hazards can be prevented when proper precautions are taken, "McAteer said.

All coal mines contain methane. When the barometer falls during colder weather, more of that methane migrates into mine air than normal. Pockets of the explosive gas may accumulate in areas where methane tests are infrequent.

Colder weather also tends to dry out the air coming into the mine brings moisture that condenses on mine surfaces and traps the coal dust. However, the drying effect of colder air makes coal dust more likely to get suspended in the mine atmosphere. This can also contribute to explosions.

Mine explosions have historically been more likely to claim multiple lives than other type of mining accident.

In December 1907, an explosion in Monongah killed 362 miners. It was the worst mining accident in U.S. history.

More recently, four miners were killed in a March 1992 explosion at Consolidation Coal Co.'s Blacksville No. 1 Mine near Morgantown. Eight miners died in a December 1992 blast at the Southmountain No. 3 Mine in Wise County, Va.

"Unfortunately, tragic mine explosions claim multiple victims and can wreak havoc on mining communities when fathers, sons, or mother, or daughters are suddenly taken away," McAteer said.

"This year, we want our winter alert message to reach all miners' family members so that they all fully understand the hazard colder weather brings and how fatal mining accident can be prevented during this time of year," he said.

During the winter alert, MSHA encourages mine operators to make frequent checks for methane and to maintain proper ventilation in underground workings, paying special attention to areas that are not frequently traveled.

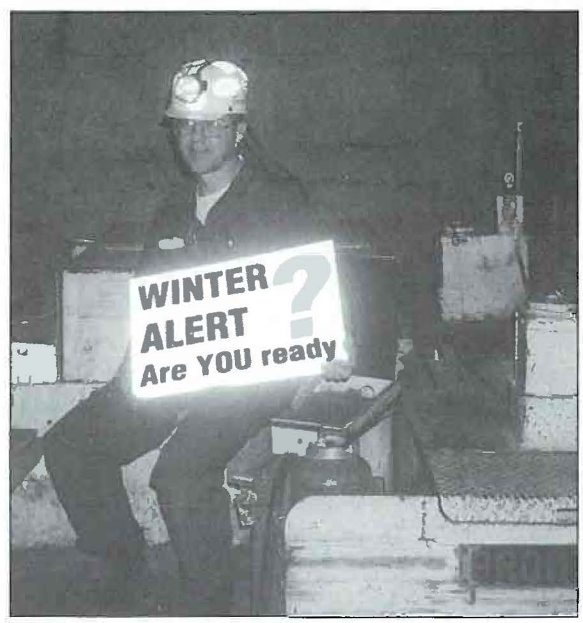
MSHA also urges miners and mine operators to do the following:

- Consistently follow mines' approved ventilation plan.
- Conduct thorough pre-shift, on-shift and weekly checks for methane and other hazards.
- Keep potential ignition sources out of working areas.
- Complete rock dusting in all areas of the mine.
- Never smoke or carry smoking materials into an underground mine and never allow others to do so.

MSHA also urges mine operators to examine hoists, elevators, haulage and transportation equipment for ice buildup. MSHA advises that miners review training procedures on emergency escape routes and the correct use of self-rescue breathing devices.

Reprinted from the October 14, 1996, edition of the Charleston Gazette.

WINTER ALERT... Are you ready?



Gary Jessey, editor of Acquire's Coal Today, poses with the reflective sign used during the 1995 "Winter Alert" season. Gary's suggestion to the editor of this publication was the genesis for the creation of these signs—be on the lookout for the 1996 "Winter Alert" sign.

WINTER ALERT

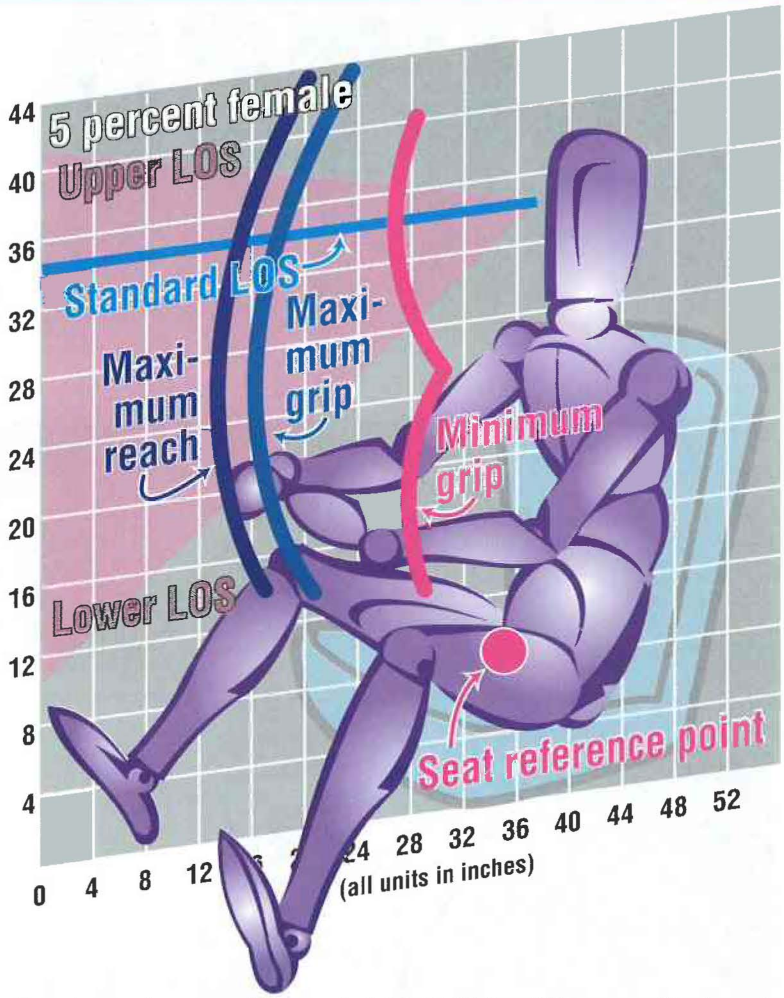
Take extra care with:

- Ventilation
- Mine examinations
- Control of ignition sources
- Rock dusting

U.S. Department of Labor — Mine Safety and Health Administration

Tips for safer mining equipment

Simple design principles can improve equipment safety in mines



Reach envelopes and lines of sight (LOS) for fifth-percentile female operators in 42-inch workstation heights

Equipment is the primary cause of injury in 11% of all mining accidents and a secondary cause in another 10%. Purchasers should select new equipment carefully to ensure that the machine incorporates good ergonomic design criteria that maximize the safety of their mine workers.

One potential problem area is the workstation—the control center of the machine. Safety problems often occur when the workstation provides insufficient clearance or visibility to the operator or has controls that are difficult to reach. This is especially true for underground mines, where confined space is an issue. In reclined or stooped postures, operators will have less strength and agility and often experience reduced visibility.

We have conducted and published much research in Human Factors design of mining machine workstations. This information is currently being compiled into a series of Human Factors design recommendation reports.

The reports will cover many topics, including workstation layout, control design, seating, and visibility. Each topic has a list of basic or first principles of design. Understanding these principles is the key to designing or purchasing a workstation that is both safe and efficient. Following is a sampling of these main topics and first principles.

Workstation Layout

• The workstation should fit operators from the 5th- to 95th-percentile range. In other words, it should fit all but the smallest 5% and largest 5% of the mining population. Consider the limitations of operators with shorter arms when identifying the arm reach envelope for the location of controls (see schematic on page 1). For clearance requirements for the head, knees, etc., use data from the largest members of the user population.

• Where practical, distribute the workload as evenly as possible between hands and feet. Position emergency controls and primary controls that require precision operation for easy access by either hand.

• Anticipate all potential safety hazards and required emergency actions before starting to design.

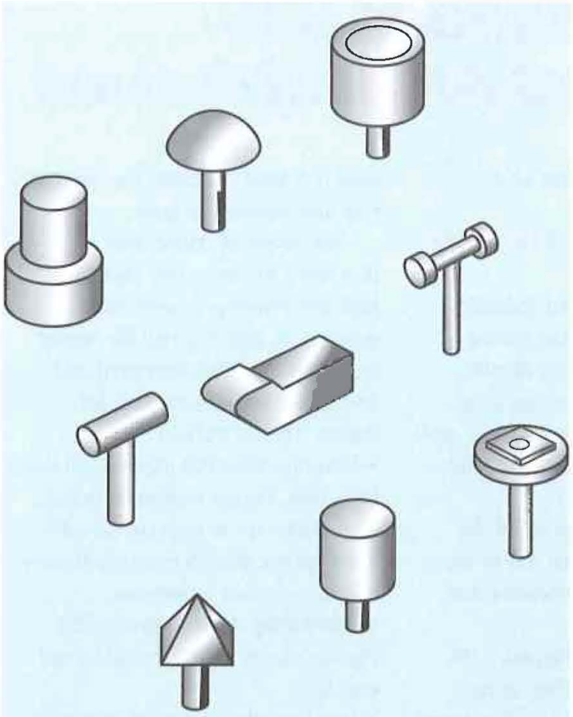
• Maintain the relative placement of controls and displays for similar types of equipment. This takes advantage of established habits and helps to eliminate confusion when moving from one machine to another.

Control design

• Design controls to comply with anthropometric data on human operators. For example, push buttons should be large enough to activate easily with a gloved hand. The force required to engage a panic bar should not exceed the capabilities of the operator in his or her normal operating position.

• Ensure that the operator can identify the proper controls quickly and accurately. For example, critical controls should be larger than noncritical controls.

• Where feasible, the speed of a vehicle or component should be



Several recommended knob shapes for roof bolters wearing gloves.

proportional to the displacement of the control from its rest position and in the same direction.

• Controls should have sufficient resistance to reduce the possibility of inadvertent activation by the weight of a hand or foot.

• Design controls to withstand or guard against abuse, such as from falling roof and ribs or from the forces imposed during a panic response in an emergency stop. Also, design control surfaces to prevent slipping.

Seating

• The seat should fit and adjust to body dimensions, distribute weight to relieve pressure points, and support posture. In other words, the seat should be comfortable.

• The seat should provide design features to guard against shocks caused by rough roadways and minor collisions that tend to unseat a person.

• The seat should not hinder the operator's ability to control the machine. For example, the seat back should not interfere with shoulder movement.

• The seat should not hinder the operator's ability to enter or exit the workstation. For example, it should be possible to move arm rests out of the way.

• Design the seat so that mine personnel can easily maintain or replace it. Use modular components when possible.

Visibility

• The workstation should provide an unobstructed line of site to locations or objects that should be visible to perform a job safely and efficiently.

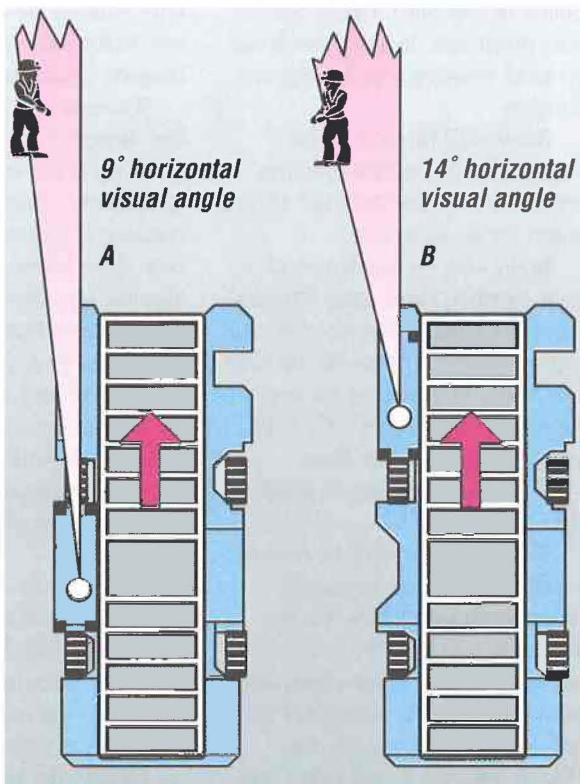
• Provide enough contrast between the luminance of the object or location of interest and the surrounding background to ensure that the task can be performed safely and efficiently.

Our design recommendations will be useful to everyone in the industry, not just machine designers. For instance, the first report will include a Maintainability Design Checklist for coal mining equipment. The checklist provides a summary of design review points so that equipment buyers can evaluate the maintainability of new or existing underground equipment. It specifically focuses on identifying design features that impact downtime, repair costs, labor hours, and maintenance expertise required.

Our first recommendation report will be published in late 1996 and will cover underground mobile mining equipment. A subsequent report will address surface mining equipment. The report will also be published as a World Wide Web page on the Internet (accessible via http://www.usbm.gov). Users contacting the web page will be able to pose questions directly to experts in Human Factors design.

Richard L. Unger, Civil Engineer, (412) 892-4372 (ungerrl@ptmba.usbm.gov).

Reprinted from the August 1996 edition of the U.S. Department of Energy's ***Mining Health and Safety UPDATE,*** *Vol. 1, No. 2—the latest developments in Federal mine health and safety research.*



Shuttle car A requires a smaller angle to see an obstruction than shuttle car B.

Advisory panel concludes with degree of consensus on dust issues

In a rare moment for the coal industry, the recommendations of the Black Lung Advisory Committee drew praise from both industry and labor.

Not only did the panel draw kind words from industry and union quarters, but two-thirds of the three dozen or so recommendations were adopted unanimously.

Mildly astonishing is the way industry attorney Edward Green described that development.

Industry people on the committee are expected to dissent on 11 of the some three-dozen items and those issues fall into two categories, said Green, a lawyer with Crowell and Moring in Washington.

The panel called for walkaround rights for miners during all dust-sampling. Industry believes walkaround rights are statutory and cannot be expanded without legislation, Green said. Industry also favors personal sampling over atmospheric sampling.

But overall Green, National Mining Assn. Safety Vice President Bruce Watzman and the UMW all had praise for the committee.

In the end, everybody sort of came together, Green said. Watzman called it a good, balanced effort. If implemented, the proposals will make real strides in protecting the health of the nations coal miners, said UMW safety administrator Joe Main.

If implemented, may be a key phrase.

The panel concluded its meeting in Lexington, Ky., by issuing its recommendations, which will be made final and expanded upon in a report due out in a few weeks. The report will form the foundation for new MSHA regulations—a slow process featuring formal notice and comment.

Its the beginning of what will be a long process, Watzman said.

MSHA will run the whole sampling show

The panel, that included industry, organized labor and non-mining representatives, spent six months studying respirable dust sampling, medical surveillance procedures, and measures to control coal and silica dust in the mines.

The committee concluded the dust-sampling fraud that led to more than 150 criminal convictions, has hurt credibility of the operator-controlled program, said Main, who was a member of the panel. For years, the union has urged that the operators be removed from the dust-sampling process, Main said.

While MSHA has piled up many wins in criminal cases, it ran into a brick wall on the civil side and is now looking to settle major civil litigation against industry.

Watzman said companies often find themselves in a Catch-22 on dust sampling. If the samples are in compliance, [they] were accused of cheating. If they are not in compliance, [they] were cited. Industry likes the idea of routine X-rays and medical surveillance of workers exposed to dust, and wishes it could have started long ago, Watzman said.

Main, meanwhile, praised rank-and-file UMW miners for their testimony at various public hearings before the committee.

Panel points run gamut from true dust levels to medical tests

When the Black Lung Advisory Committee was formed, the Labor Dept. sought a panel to look at the big picture, not an isolated aspect of dust problems in coal mines.

If the breadth of its recommendations is a good indicator, the committee may have reached its goal.

The proposals range from decreasing the respirable dust standard itself and lowering miners' silica exposure to ensuring real-life production levels are being measured and establishing medical tracking for miners. The list includes:

- Lowering allowable exposure to coal mine dust. During a phase-in period, deep mines are to increase use of water sprays, scrubbers on continuous miners and other techniques.
- Establishing separate permissible exposure limits (PELs) for silica and coal dust.
- Lowering silica exposure of miners. But MSHA must confirm the accuracy of its analytical procedures to assure that actual exposures are recognized.
- Keeping environmental controls as the primary way to maintain safe dust levels in active mine workings. Respiratory protective equipment should not replace these controls except as interim measures.
- Developing an administrative review process for approval of new or revised plans to permit plan testing. Importantly, MSHA should define the range of production levels, which must be maintained during sampling, to ensure a realistic picture. Critics have said mines often slow production, and reduce dust levels whiles tests occur.
- Giving miners the same 103(f) walkaround rights as they do under MSHA general inspections—a move opposed by industry.
- Specifying circumstances where dust control plans are needed for strip mines and other surface facilities.
- Speeding development of a continuous personal monitor.
- Conducting chest radiographs at the time of employment and then, at specific intervals, spirometry and questionnaire information should be

collected. This testing will allow identification of miners with possible early dust-related problems. Confidential medical exam programs should be developed by NIOSH.

*Reprinted from the August 12, 1996, edition of **Mine Regulation Reporter** Section: No. 16, Vol. 9; ISSN: 1040-8223*

Katherine Henry becomes acting surface mining director

Washington, D.C., Sept. 19—Kathrine L. Henry takes over today as acting director of the Interior Department's Office of Surface Mining Reclamation and Enforcement (OSM), following the resignation of Director Robert J. Uram.

"OSM is on a successful course thanks to the management reforms, programmatic reinventions, and standards of integrity that were put in place under Bob Uram's leadership over the past 2 years," Henry said. "As Acting Director, I intend to build on that success, relying heavily on OSM's dedicated civil service employees, whose talent and professionalism are essential to operate the programs that make the Surface Mining Control and Reclamation Act work."

Henry noted that OSM's Mission and Vision Statement, adopted in 1994, will continue to provide practical daily guidance for the full spectrum of OSM business lines. "OSM's surest route to continued success is teamwork aimed at enforcing the law, preventing environmental harm, and restoring abandoned mine lands to productive use," Henry said. "By 'teamwork,' I mean not only how OSM operates internally, but to the greatest extent possible how OSM interacts with states, Indian tribes, coal mine operators, and coalfield citizens. The bottom line is protecting the environment and people's homes wherever coal is being mined, plus making sure that the land is fully restored when mining is complete. That's what the Mission and Vision Statement is all about."

Kathrine Henry's previous position in the Department of the Interior was Associate Solicitor for Mineral Resources, whose client bureaus included OSM. Her assignment as Acting Director of OSM was announced August 15, 1996, by Secretary of the Interior Bruce Babbitt.

OSM mission

Our mission is to carry out the requirements of the Surface Mining Control and Reclamation Act (SMCRA) in cooperation with States and Tribes. Our primary objectives are to ensure that coal mines are operated in a manner that protects citizens and the environment during mining and assures that the land is restored to beneficial use following mining, and to mitigate the effects of past mining by aggressively pursuing reclamation of abandoned coal mines.

OSM Vision

In regulating active coal mining, we will maintain compliance at high levels and ensure that all mines are properly operated and promptly reclaimed to the standards established under the Act. We will emphasize prevention and ensure that long-term environmental problems do not occur. We will ensure that the premining productivity of the land is restored. In reclaiming abandoned mine lands, we will aggressively pursue reclamation with a primary emphasis on correcting the most serious problems related to public health, safety, and the general welfare. We will ensure maximum public benefit through the prompt and fair distribution of public funds.

In cooperating with State regulatory authorities, the primary enforcers of SMCRA, and with Tribes, we will promote a shared commitment to the goals of the Act. We will develop comprehensive understandings about the fairness, effectiveness, and efficiency of SMCRA programs. We will provide constructive program reviews, oversight monitoring, and technical assistance that focus on results. We will act independently to protect the public interest in situations of imminent harm or when a State does not implement an approved regulatory program. In dealing with those who are affected by mining and reclamation, we will ensure the protection of citizens from abusive mining practices, be responsive to their concerns, and allow them full access to information needed to evaluate the effect of mining on their health, safety, general welfare, and property. In our relations with the coal industry, we will have clear, fair, and consistently applied policies and will respect the importance of coal production as a source of our Nation's energy supply. In all communications, we will maintain open, courteous, constructive, and timely dialogue and will use information to understand and improve our programs and those of our State and Tribal partners. In demonstrating leadership in mining and reclamation, we will promote the development of the highest quality technical information and research and will seek the transfer of technology to those who would benefit. In meeting our responsibilities, we will be a diverse, competent, innovative, and highly-trained work force. We will serve with integrity, and demonstrate technical, legal, administrative, and professional excellence at all times. We will constantly strive to create a more responsive, efficient, and effective process for achieving SMCRA's objectives.

Two who died in mine ignored warnings

By: Ian Harmer, Bee Correspondent, Virginia City, Nev.

Public safety officials in this historic mining town are not expected to take new precautions following the weekend deaths of a Winters father of three and a friend who were asphyxiated after ignoring warning signs around an abandoned mine.

Jonathan Reece of Winters, [Nev.] and his friend John Montgomery of Virginia City, [Nev.] both 35, died Sunday from lack of oxygen, according to an autopsy Monday by the Washoe County coroner.

The two men were found about 75 feet inside the mouth of the New Savage Mine, which parallels workings first opened 136 years ago.

"We got a call from an alert passer-by who saw vehicles parked near the mine and was concerned that something might be wrong," said Storey County sheriff's spokesman John Tyson. "When he saw the same vehicles still there after a couple of hours, he raised the alarm."

Tyson said to get into the mine, the two men had to pass a large sign warning "Keep Out--Bad Air," then climb through chicken wire and crawl under timber nailed across the entrance.

"There's not much anyone can do in a case like this," Tyson said. "We can't post guards and patrol these places 24 hours a day--there's 780 miles of old mine workings around and under Virginia City. You have to hope people will use their common sense and heed clearly posted warnings."

Tyson added that Montgomery, a music teacher, had lived in Virginia City for several years and could be expected to be aware of the dangers of venturing into old mines." "Bad air' means just what it says--air gets trapped in these places, there's no circulation, and in time it disintegrates into pools and bubbles of carbon dioxide," Tyson said. "What carbon dioxide does is make you feel dizzy and disoriented and then, in effect, you go to sleep. "What happened is they got into one of these concentrated pockets, they can't smell it, it disoriented them and they simply went to sleep. It's hard to say how far in they went, but my guess is they were probably on their way out when they were overcome."

Tyson said because authorities believe the victims were fully aware of the dangers they faced, further action was not likely. "The sign, the fence and the boards over the entrance all made it quite clear that no one should go in there, but they still did it," he said. The New Savage Mine operated between 1978 and 1983. It's one of hundreds of mines on the Comstock Lode, the world's richest silver vein. The Comstock produced more than $500 million in silver and gold last century. The maze of shafts and drifts beneath Virginia City is notorious for its deadly gases. Hundreds of miners died in the dangerous conditions.

*Reprinted from the September 3, 1996 Metro Final edition of the **Sacramento Bee**; Metro Section; Pg. B1.*

Into the darkness...

In Tarentum, retired miners take the curious 125 feet underground to see the history of mining at the mine and museum.

Coal mining has had a harrowing history. From about 1800 to 1860, a miner normally would enter the earth alone, equipped only with a candle and pick. Mining later entered an age when it was almost slave labor, when miners and their families lived in company towns and shopped in company stores. But today, modern machines, air-flow controls, and roof supports have all but eliminated the three hazards of mining: physical collapse, asphyxiation, and cave-ins.

This progression of mining is chronicled at the Tour-Ed Mine and Museum in Tarentum, where retired coal miners lead tours from 1 to 4 p.m. daily except Tuesday. The tours continue through Labor Day.

Ray Woodall, of the Logan's Ferry section of Plum, was a miner for 21 years and has been superintendent of the Tour-Ed mine for the past seven years. He is one of six people who lead as many as 300 visitors a day into the 52-degree depths of the upper Freeport coal seam.

After a short lecture on the history of mining equipment, the tourists pile into a small trolley that takes them 125 feet into the darkness of the mine. Woodall was leading the tour when free-lance writer Kelly D. Burgess donned a hard hat and joined 20 other people on a ride through history. He talked about mining's history during the tour.

Coal is formed by vegetation falling into a swamp, and dirt falling on top of that. This forms bituminous coal, a soft coal, which is what we mine in this area.

There are four major coal seams in this area: the Pittsburgh seam, the upper Freeport seam, the lower Freeport seam, and the Kittanning seam. The Pittsburgh seam is the one you read about in the paper; it's the one that causes about 75 percent of mine subsidence, because it's mined within 25 feet of the surface. About 100 years ago, the northern part of Allegheny County primarily was farm land, and the companies were just taking out the coal without regard to the future. They didn't leave very good maps. Lo and behold, 100 years later, we have towns above the mines, and they start to sink because of mine subsidence.

Coal originally was discovered when dirt washed off the side of the hill and exposed layers of rocks, and one of those layers of rock would be coal. All the miners had to do was to scrape the coal off the side of the hill.

In those early days of mining, a light was not needed because the miners were out in the open. As the miners began to go deeper and deeper into the coal seam, they needed some type of light. They used the most modern type of light they had at that time, called a stick light. It was an iron stick with a point and a candle stuck on it. The miner would take four or five of them into the mine with him and pound the stick light into a post or coal seam. It was the best thing they had at that time.

Later, oil was discovered and the coal miner was quick to adopt oil lanterns because he could go from using a small, dim light to using a bright oil flame. Unfortunately, this created two situations for the coal miner to deal with. The first was that the oil came in a small oil can and there was no way to stick it into the wall. The miner needed two hands with which to work, so he needed something to hold the light. His solution was a cloth hat. The ladies in the coal camps used to sew the cloth caps for their men to take to the blacksmith, who would add a bracket to the cap so the light could be mounted.

There was one problem with the cloth hat: Occasionally, it would become soiled with oil and catch fire.

Later, carbide was discovered. It's a very strange mineral that bubbles when water is poured on it. When it bubbles, it gives off a burnable gas, so a light was designed around it. The gas comes out of the can attached to the top of the hat, and there is a flint that lights the gas. It works much like a modern lighter. These lights lasted about four or five hours before you had to refill the carbide chamber.

Eventually, open flames in coal mines were outlawed, so in our modern mines we use a battery light. It is a bulb light, sealed and mounted on a hat, with a cord that runs down to the battery pack at the hip. We also always carry a spare bulb in case one goes out; if the light goes out inside the mine it's so dark you can't see your hand in front of your face, so you have no sense of direction. That makes the spare bulb a necessity.

Losing your light source is not the most dangerous part of mining, though. Methane gas is. Methane is a product of the decomposition of organic material. You can't hear it, see it, smell it, or taste it, and that's what makes this poisonous gas so dangerous.

The early miners got rid of the gas by burning it, which was the job of the fire boss. He would go into the mine before anyone else. He had a long pole with a torch at the end, and he would lie on the floor, stick his pole up into the working place, and ignite the gas. The gas would burn over the top of his head and when it was gone, the men would come in to work. Not surprisingly, the work of the fire boss created a lot of widows.

The first actual gas detection device was a canary. The canary was taken into the mine, and its cage was hung from the ceiling. As long as the bird was alive, the miners knew it was safe to keep working.

We can't use canaries today, because in a modern mine we have to test for gas every 20 minutes every day of the year and we would kill a lot of canaries that way. Instead we use two different things. One is a flame safety lamp, which was invented in 1879. It allows us to test for gas without actually having an open flame in the mine. The other method is called a methadometer and it's a small, hand-held meter also known as a Baccarat canary. It is yellow in honor of those first living gas meters.

All of these improvements in mining have eliminated many of the risks that miners used to face every time they went into a mine. Now, it's still a difficult job, but it's not the killer it used to be.

* Want to visit the Tour-Ed Mine and Museum? Time is growing short this season. The mine is open during the week (except Tuesdays) through Labor Day, and it is open for two weekends after Labor Day before closing for the season.

In addition to the mine, visitors can see a working sawmill, a model strip mine, and the exhibits in the museum, which depict mining-town life in the early 1900s.

Tour-Ed is home to the largest collection of mine memorabilia in the state. The tour is accessible to the handicapped. Cost is $6 for adults and $3 for children. Call 224-4720 for information regarding group discounts.

Pittsburgh Post-Gazette
August 11, 1996, Sunday, Voices North Edition
Section: Metro, Pg. VN-3 Load-Date: August 14, 1996 Byline: Kelly D. Burgess

Machines get credit for safety

By: John Zebrowski

An old miner's song, composed in the early days of mechanization, laments, "Can't you feel the rock dust in your lungs? It'll cut down a miner when he is still young."

Black lung, or coal miner's pneumoconiosis, was accelerated by mechanization.

"Mechanization generated a whole lot more dust on the coal face," said Frank Hearl, branch chief at the National Institute for Occupational Safety and Health. "It's safe to say this had a negative effect on miner's health."

As early as the mid-1700s, coal doctors in Britain were writing about lung diseases peculiar to miners. "Miner's asthma" - shortness of breath, coughing and chronic bronchitis - was considered a normal part of mining.

Kicking up dust

The first continuous miners made things worse. They were incredibly dusty machines.

"It used to be so dusty you couldn't see anything," said Ronnie Phillips, superintendent for a Talon Resources Inc. mine in Logan County. "You couldn't see the face, you could barely see the [continuous] miner at all. Sometimes it was like operating blindfolded."

Limits on the amount of dust continuous miners could produce were not implemented until 1970. But the United Mine Workers union did have an idea of the health hazards the machine caused.

In his book "Fire in the Hole," Curtis Seltzer quotes then UMW head Tony Boyle as saying in 1963, "We may be mechanizing the coal industry past the point of safety."

Still, it wasn't until the UMW's national convention five years later that the union addressed the seriousness of black lung. At the time, more than 125,000 miners were estimated to be afflicted.

Today, those numbers are much lower. An ongoing study of black lung by NIOSH shows incidence rates falling rapidly after 1970. One phase of the study, performed between 1970 and 1973, found 11.1 percent of miners surveyed suffering from black lung. The phase from 1987 to 1991 shows only 3.6 percent with the disease. And the latest phase, as yet unpublished, shows it tracking even lower.

Scrubber 'the best thing'

Much of the improvement can be attributed to better ventilation in mines today. Of course, the free-fall in jobs has greatly reduced the number of miners exposed to dust. But the most important change is a simple mechanism installed on the continuous miner called a scrubber.

"It's the best thing that ever happened to the miner," said Talon Resources mine superintendent Ronnie Phillips.

Phillips came into the mines in the early 1970s. But he didn't see a scrubber until he started working in Talon Resources mines four years ago.

A scrubber is essentially a powerful fan with water sprayers hooked up to it. Watching it in action is like viewing a magic trick. The machine cuts into the coal face, stirring up black coal dust in its headlights. The dust hangs in a cloud in front of the continuous miner for a brief moment, and then disappears, sucked into the machine by the scrubbers. It is then deposited behind in small piles.

But while the scrubber has helped reduce black lung, it has not eliminated it. Even with the longwall, which is considered the safest form of underground mining, dust is a major problem. Since it mines coal more quickly than even a continuous miner, it stirs up dust even more fiercely.

"Longwall mining is certainly not immune to dust problems," said Kathy Snyder, spokeswoman for the Mine Safety and Health Administration. "In some cases, it has been even harder to control."

Deaths by roof cave-ins and while hauling coal from the site have also increased since the continuous miner's introduction. But other fatalities, most obviously resulting from the use of explosives, have dropped.

"It's a good piece of equipment," said Rick Glover, region 3 international safety representative for the United Mine Workers. "Any safety problems have resulted not so much from the machine but in some of the ways it has been used."

Longwall the next step

While the continuous miner is accepted as a safety improvement over conventional mining, the longwall is considered the next step. With a metal shield that acts as a mobile roof, the operator is never exposed to the coal top. The way it mines, from inside the mine out, makes roof bolting unnecessary. As coal is cleared, the machine moves toward the surface and the roof collapses behind it.

"The longwall is a dramatic improvement in safety," Glover said.

Regardless of which machine deserves the most credit for improving mine safety, the fact remains that mining is far less dangerous today than in 1948.

Nationally, mine fatalities have dropped from 643 in 1950 to 45 last year. In 1948, 277 people were killed in mining accidents in West Virginia. By 1960, the year the first longwall was introduced, that number had dropped to 115. Last year, 16 West Virginian miners died in accidents.

Of course, other factors have played a role in making mines less dangerous. The 1969 Coal Mine Health and Safety Act, which allowed the Federal government to police mine safety, is considered by many to be the most crucial step forward. The fact that there are 100,000 fewer jobs than in 1948 obviously played a role. But it was the continuous miner that made the initial strides.

"Without question, the use of the continuous miner has substantially contributed to safer conditions in mines," said Chris Hamilton, Vice President for the West Virginia Coal Association.

Reprinted from the August 11, 1996 issue of the Charleston Newspapers Sunday Daily Gazette and Mail; News Section, page 12A.

High-voltage circuit breakers

Robert L. Phillips, Mine Safety and Heath Specialist, MSHA Coal Mine Safety & Health

Due to rapid growth demands the mine electrical power system is probably the most complex and least understood area of the mine environment. This lack of understanding is created by the introduction of new, extremely cyclic and dynamic electric loads placed on a sometimes old existing power-distribution system that must be constantly extended and relocated throughout the mine property. This is why properly adjusted circuit breaker protection for the mine electrical system is critical. A high-voltage circuit breaker is primarily an interrupting device that is also used, in some cases, as a switch. In other words a circuit breaker is designed to open and close a circuit and to open the circuit automatically at a specified current setting without injury to itself when it is properly rated and correctly installed and maintained. Automatic or manual operation is intended where the circuit current is not in excess of rated continuous current of the circuit breaker. A system abnormality, such as a fault or an overload will cause automatic operation of the circuit breaker. Surface installed oil circuit breakers (OCB's) are used extensively in underground applications to protect high-voltage circuits. The most common used OCB for protection of underground high-voltage circuits is the dead-tank type. This design consists of a steel tank that is filled with oil and has a cover with porcelain or other composition bushings or insulators through which the conductors are carried. The assembly is oil tight. Internally there are three, double-pole contacts that are mechanically interconnected, immersed in oil, and mounted in one tank. f The tank is insulated to prevent arcing to the inner wall when the circuit breaker is called upon to interrupt excessive high currents that can be generated when a fault condition exists. A vent with oil-separating properties allows gases to escape but not the internal oil. The typical voltage ratings for OCB's corresponding to mine system voltages are 4,160, 7,200 and 13,200 volts, with 25,000 volts used in some surface mines. Common continuous current ratings are 400, 600, 800, 1,200, and 2,000 amperes. The majority of high-voltage mining systems do not require an OCB to have a current rating of more than 400 to 600 amperes. There are two very important parameters to consider when selecting an OCB to protect a high-voltage system. These are the interrupting and close-and-latch ratings. Typically a rating of 12,000 amperes RMS symmetrical interrupt is common while the typical close-and-latch rating is 20,000 amperes RMS asymmetrical. Since a high-voltage circuit breaker terminates current flow within a few cycles of the first peak cycle, the close-and-latch rating must be higher than the interrupting rating. Most generally circuit breakers are given an interrupting-capacity class rather than a rating which makes them easier to identify. The interrupting-classes are expressed in megavolt amperes (MVA), such as 100, 250, 350, 500, and 750 MVA. The OCB's construction and operation utilize an effective arc interrupter system that employs the cathodespot phenomenon combined with arc lengthening and arc deionization that occurs within oil-filled insulating chambers that surround the parting contacts. These chambers are intended to contain the developing high gas pressures produced when oil is vaporized from the arc established between the parting contacts of an OCB and thereby reduce any pressure that may develop within the OCB's main oil tank. These gases after cooling, are vented into the atmosphere. The operating mechanism on an OCB's is typically an electric motor with a spring-gravity release that is triggered by a shunt-trip or under-voltage release device. This operational scheme allows the OCB to be electrically engaged as well as tripped. A recent mining accident illustrates how while trying to clear a fault condition by the repetitive closing of the OCB caused unexpected pressure piling which resulted in failure of the oil tank. Two miners, standing near the circuit breaker, were severely burned by hot oil that ignited when the tank ruptured. One miner later died as a result of extensive burn injuries. If proper trouble shooting principles were established and followed this accident could have been prevented. When the circuit breaker opened automatically, a determination should have been made as to why the breaker opened by looking at the indicator flags of the associated short-circuit, overcurrent, ground-fault or ground-monitor relays that are mounted within the circuit breaker cabinet. Once a visual determination, as to what caused the problem, is made then the high-voltage system can be disconnected and the cable with the ground-fault can be isolated. Once isolation is achieved, the ground-fault in the cable can be located by the use of diagnostic equipment such as a cable fault detector. This device is to be used in conjunction with the manufacturers special precautions that are shipped with the cable fault detector. There may be cases where cable fault detectors are not available and that portion of the faulted cable would have to be replaced with another cable. The faulted cable can then be sent to a repair shop where the fault can be found and the cable repaired. Circuit breakers that are rated for the intended voltage and current or MVA class, and properly installed, maintained and used will provide the electric system with the required protection without presenting a safety hazard. When they are improperly rated or improperly installed and maintained or misused they can and will present a safety hazard.

MINExpo: Live in Las Vegas

By: Written and compiled by Mary E. Fischer from information supplied by the National Mining Assoc.

For four days, 500,000^2 feet of the Las Vegas Convention Center was the stomping ground for mining decision makers, from mining company operators to major mining equipment manufacturers from around the world. These members of the mining industry had the opportunity to exchange ideas as Las Vegas hosted MINExpo International '96, this past Sept. 9-12, 1996. The estimated 25,000 attendees faced the challenges of creating environmental strategies and of mastering new technology to revolutionize the industry.

Glen Barton, group president of Caterpillar and MINExpo chairman, believes MINExpo '96 is an opportunity to get a better feel for the issues and challenges facing the industry.

"It's an opportunity for the mining industry to update itself on the complete range of equipment, technologies, and services available to it," Barton said. "To have the opportunity to discuss solutions with such a wide range of suppliers individually would take weeks and weeks of travel ...time most mining people do not have available."

One challenge the mining industry faces is the development of strategies for the protection and preservation of the environment. The industry emphasizes the creation of new methods and techniques capable of safeguarding the natural conditions of the environment, without inhibiting established mining operations. MINExpo's exhibition of "clean" brown coal technology and equipment, which reduces the harmful effects to miners, as well as reclamation equipment and systems, depicts the industry's attentive look at total mine site development and environmental strategies.

More than 800 manufacturers will display both innovative and tried and true products and services at the international convention. High-tech software, hardware, and integrated systems have revolutionized the way tasks can be performed in the industry. Computer systems operate equipment more efficiently and help streamline administrative procedures. MINExpo provides attendees with an accurate picture of the advances.

Attendees participated in educational sessions that addressed major policy issues such as mining technology, health and safety, and human resources. More than 70 speakers offered insight into current issues.

New educational sessions focused on computer modeling of mining systems, case studies of recent successful mining operations, rapid underground development, trends on mining technology for conveyors, truck haulage and pumping, and minimizing the cost of environmental remediation.

But MINExpo '96 was not only be an intense, four-day conference program for mining industry members. Attendees had the opportunity to explore Las Vegas, home to some of the most celebrated entertainers and popular attractions in the country. Plays, impersonation revues, comedy clubs, concerts, and theme parks were among the adventures found there.

Arizona honors Frank Sepulveda

Frank G. Sepulveda retired as Senior Arizona Deputy Mine Inspector on September 25, 1996, after serving as a deputy mine inspector for 28 years. In recognition of Frank Sepulveda's dedication to mine safety, Arizona Governor Fife Symington proclaimed September 26, 1996, as "Frank Sepulveda Day" throughout the state. In addition to the proclamation from Governor Symington, Frank was honored with recognition awards from both the State Mine Inspector and the Southwest Mine Safety Engineers at the Sixth International Mine Safety and Health Conference, held in Casa Grande October 8-11, 1996.

Born in 1935, Frank graduated from Superior High School in Superior, Ariz. After graduating from the University of Phoenix with a BA in management, he worked 9 years as an underground miner, plus a year at the smelter, for Magma Copper Co. at the Magma mine at Superior. Following this, he worked a year at the Nevada Test Site as a miner and welder, leaving to be a supervisor for Morrison-Knudsen in the development of the Andina mine in Chile. On his return to the U.S., Frank became a Deputy Mine Inspector, serving four elected State Mine Inspectors: Vern (Red) McCutchen, Bert Romero, Vern McCutchen (a second time), Jim McCutchen, and Douglas Martin. Only one other inspector in Arizona's history has served longer—J.C. Anglin served from 1922 until 1952.

The mining industry, and especially the State Mine Inspector's office, will miss Frank's experience and expertise. Frank is one of those rare individuals of whom one can say that "he made a difference in the health and safety of miners." He leaves with our best wishes for a long and happy retirement.

◀ ***Frank Sepulveda, at right, receives a plaque commemorating his service to the state from Arizona Governor Fyfe Symington.***

Submitted by Bill Hawes, Assistant Mine Inspector

SAFE words of wisdom

"Safety is an essential element of good business, and regardless of its motive (humanitarian or economic) the cost is much more easily sustained than the price paid for the lack of it."

"Everybody's responsibility is nobody's responsibility."

"Safe production is a continuous, never-ending commitment to improvement."

"Safe production is never an accident, it is always the result of high intention, sincere effort, intelligent direction and skillful execution; it represents the wise choice of many altematives."

"If it's not safe, don't do it."

"Always include the word safe with the word production."

"Train because you care about people."

"When a supervisor ignores safety violations, he implicitly OKs them."

"To prevent accidents you must believe you can. Make zero accidents your goal."

*Reprinted from the July 12, 1996, issue of Michigan's State Grants Mine Safety Training Newsletter 96-3: **Michigan Mine Safety.** Produced by the Mining Engineering Department of Michigan Technological University in Houghton.*

THE LAST WORD...

Some people get married due to a lack of judgement, divorced due to a lack of patience, and remarried due to a lack of memory.

One honest man wrote a letter to the Internal Revenue Service. He said: "I haven't been able to sleep since I cheated in last year's income tax. Enclosed please find $1,000—if I find I still can't sleep—I'll send you the rest of the money.

Consider the postage stamp—it's usefulness lies in its ability to stick to one thing until it gets there.

An egotist is a self-made man who worships his creator.

The trouble with mood music is, nobody ever agrees what mood we're in.

The only trouble with being a good sport is that you have to lose to prove it.

There's only a slight difference between keeping your chin up and sticking your neck out—but the difference is well worth knowing.

Experience is the best teacher. One reason: you get individual instruction.

People come in three classes: the few who make things happen; the many who watch things happen; and the overwhelming majority who have little or no idea what happened.

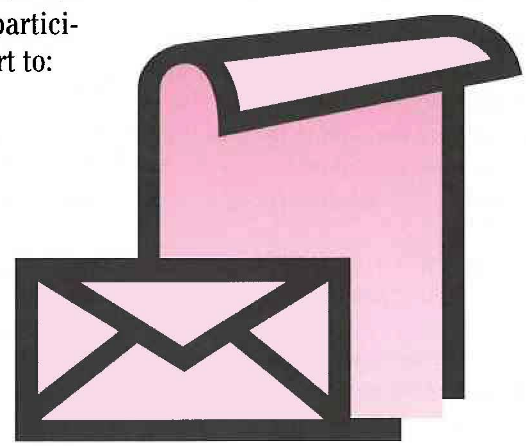
Defending his buddy's poor driving record, a man is reported by state police to have said, "He wouldn't have such a bad record if the police didn't keep arresting him.'

NOTICE: We welcome any materials that you submit to the Holmes Safety Association Bulletin. We DESPERATELY need color photographs suitable for use on the front cover of the ***Bulletin.*** We cannot guarantee that they will be published, but if they are, we will list the contributor(s). Please let us know what you would like to see more of, or less of, in the Bulletin.

REMINDER: The District Council Safety Competition for 1996 is underway—please remember that if you are participating this year, you need to mail your quarterly report to:

Mine Safety & Health Administration
Educational Policy and Development
Holmes Safety Association Bulletin
P.O. Box 4187
Falls Church, Virginia 22044-0187

Please address all editorial comments to the editor, Fred Bigio, at the above address. Phone: (703) 235-1400



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This month's cover: A JOY 4LS longwall shearer, courtesy of Joy Technologies, Inc. We welcome ***any*** *materials that you submit to the Holmes Safety Association* ***Bulletin****. We especially need color photographs (8" x 10" or larger—color negatives are acceptable) for our covers. We cannot guarantee that they will be published, but if they are, we will list the contributor(s).*

Because of the recent federal shutdown, we did not publish the January issue of the Bulletin. We regret any inconvenience.

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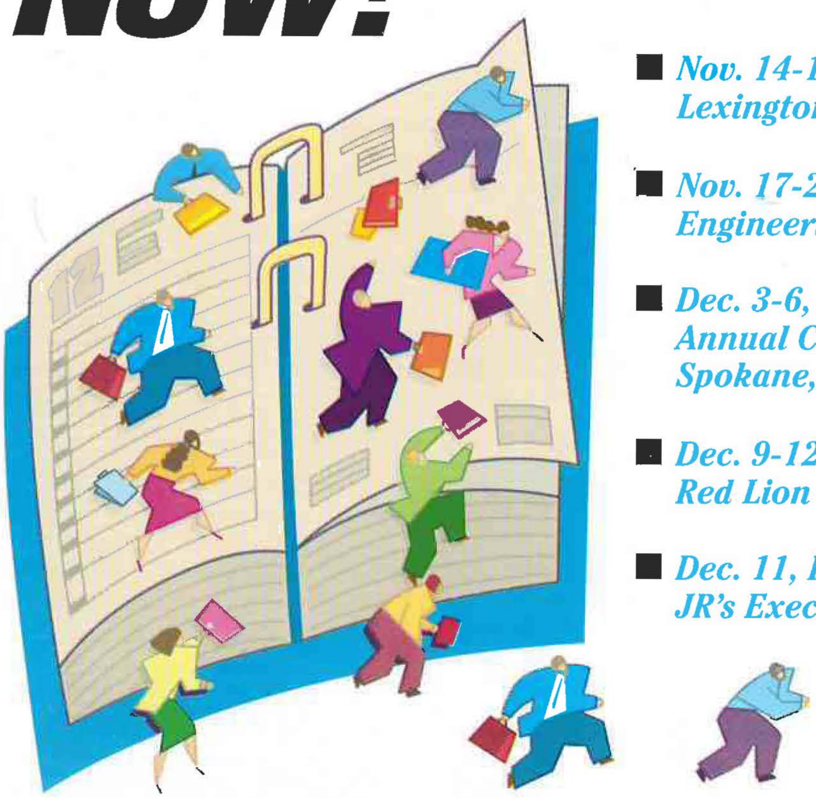

- *Nov. 14-15, Kentucky Mining Institute, Lexington, KY*
- *Nov. 17-22, International Mechanical Engineering Cong./Expo., Atlanta, GA*
- *Dec. 3-6, Northwest Mining Assoc., 102nd Annual Convention, Sheraton Hotel, Spokane, WA*
- *Dec. 9-12, Certified Inspector Program, Red Lion Inn at the Quay, Vancouver, WA*
- *Dec. 11, Roof and Rib Seminar, JR's Executive Inn, Paducah, KY*