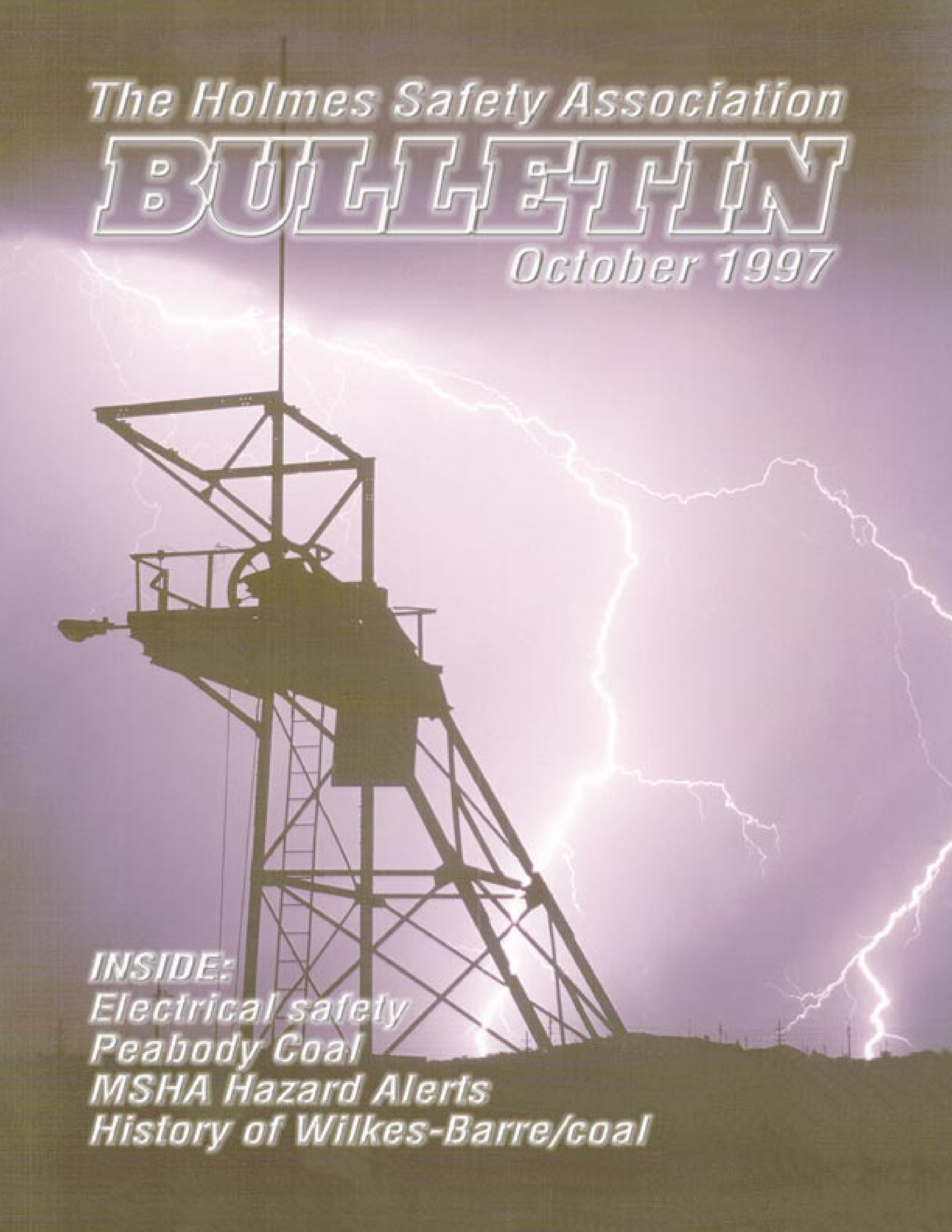
The Holmes Safety Association

BULLETIN

October 1997



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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.

COVER: Thanks to Norman R. Carlson of Zonge Engineering and Research for this month's cover photo of the head frame at the No. 6 shaft of the San Xavier Mine, Pima County, Arizona, silhouetted by a summer thunderstorm. A lead-zinc mine dating from the 1880s, the San Xavier mine was once the largest underground mine in the Pima district. The No. 6 shaft and adjoining area is now a mining laboratory owned and operated by the University of Arizona in Tucson, Arizona. ©1997 Norman R. Carlson [If you have a potential cover photo, please send an 8" x 10" print to the editor, Fred Bigio, MSHA, 4015 Wilson Blvd., Arlington, VA 22203-1954]

KEEP US IN CIRCULATION
PASS US ALONG

Training future mine emergency responders Part 1: Who should be trained and how?

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

Since 1991, Pittsburgh Research Center (PRC-formerly part of the Bureau of Mines) researchers have recorded extensive interviews with 30 individuals who are experts in the area of mine emergency response. These individuals, who have an average of 35 years of mining experience and 29 years of mine emergency response experience, related stories and observations from events that they experienced during their combined 850 plus years in mine emergency response. The purpose of this effort was to gather information that could be passed on to both today's and tomorrow's mine emergency responders to train and guide them in handling future events.

This is the first of two articles which report the responses that these experts gave when asked how they think people who may have to respond to a future mine emergency should be trained. During the interviews they discussed how training should be conducted, who should be trained, and what topics should be included. This article will cover the first two areas: what training methodologies would be most effective and who needs to participate.

Methods for Emergency Response Training

The emergency response veterans who mentioned specific methods they think should be used for training future responders discussed three types of training: mine emergency response development (MERD) exercises, mock disasters, and tabletop simulations. Nine of the veterans said that some form of interactive simulated emergency response training would be the most beneficial. In addition, several other ideas were discussed.

Three of the experts felt that Mine Emergency Response Development (MERD) exercises should be used to train responders. Historically, MERDs have been fashioned to be approximately day-long role play events designed to present a realistic mine emergency scenario in the classroom to personnel who may be responding to an event. The overall objective of these exercises is to teach participants how to respond to a mine emergency in a correct, timely, well organized manner that ensures the safety of all individuals who will be involved in the emergency. At least one expert felt that every mine, regardless of its size, should conduct a MERD exercise:

> I think we should require each mine, to have them put on their own MERD program. ...I think we could do it right at the mines. You know, we go to [classroom settings] and we set up mine offices, and mine foreman's office and stuff. Out there at the mines, it's the real thing ...I think ...it would be more real, and get more people involved.

Another form of enhanced mine emergency response training is the mock mine disaster. Like MERDs, mock disasters are role play exercises designed to present a realistic mine emergency scenario. The major differences are that mock disasters make use of actual mine facilities and involve mine personnel who play their traditional roles at the operation. Three emergency response experts felt that conducting periodic mock disasters at mines would be an ideal way to train personnel. One veteran expressed his views on the utility of using mock disasters as training and assessment tools:

> ...to me, training is number one ...continue training the people. Renew them again, by having mock disasters ...Bring in [consultants] that can actually just sit down and watch, and then come up with recommendations of what they've noticed during the emergency that was supposed to have been done, and was not done... where's our downfall, etc....

In addition to the role play simulations discussed above, three response experts suggested that paper-and-pencil simulations of actual mine emergencies would be useful as training aids. Interviewees suggested that these simulations could be conducted in a classroom or in the offices at a mine site and used to train both command center personnel as well as other individuals who might be involved in the response. One expert talked about the success of using such simulations of actual mine emergencies to train personnel at his company:

All the little things that seem

to be taken for granted ...you run (personnel) through a couple of exercises, and ...you suddenly find out, "Hey these" ..."I never thought of that." And [the exercise] brings all these little things to the front.

Continuing in his discussion about training with table top simulations based on actual mine emergencies that have occurred, this veteran said:

First, it was just hypothetical situations. And they didn't seem to prove too much, cause they were too hypothetical, "Maybe this, maybe that." So, then we just decided to take incidents—actual incidents that occurred and relive them. And it really brings things out, you know. "Are you prepared for this? Are you prepared for that?" ...When you speak of an actual situation in front of these guys, and they start to solve problems, then you can see ...you see the panic starting to climb. You've got these men missing, and whatever you're doing is going wrong... You want to do this to ventilation, and the answer is "No, that won't work, because the ventilation door is burnt up. You can't shut that door." "Oh, what are we going to do now? I can't shut the door."

...So, it really proved it's working ...

One veteran responder proposed that operators have mine emergency response veterans come to the mine and make presentations on their past experiences, especially regarding critical phases of events. He suggested that mine operators could videotape the presentations and then show them to personnel who would be responding to emergencies. A second expert felt that training for future responders should begin early in their career, preferably at the college level, when students are receiving their formal training in mining engineering:

...I strongly believe that's where it's (emergency response training) got to start is at the university... where you've got graduate students that are taking the mining engineering discipline... That [should be] a credited part of their required diploma... [where] they have to take emergency management training as part of that. So that when these engineers or whatever get into the workforce, they end up being mine superintendent... They've got that background.

A third response veteran suggested that a text-based document, providing recommendations for

handling emergencies be compiled and distributed to mine operators. This veteran felt that such a manuscript might be developed as a "how to" manual and taken to the finest detail to ensure that all possible elements are covered. He believed that a document like this would be helpful, especially if written to be used by any size or type of mine.

Who should be trained in emergency response procedures

In sharing their thoughts on training future mine emergency responders, veterans mentioned specific groups of individuals they thought should be thoroughly trained in mine emergency response procedures. Their target audience included: mine management, top (corporate) management, and regulatory personnel.

It is clear from their responses that veterans believe that both mine and corporate managers would benefit from training in mine emergency response. A 40 year veteran shared his thoughts on training mine management:

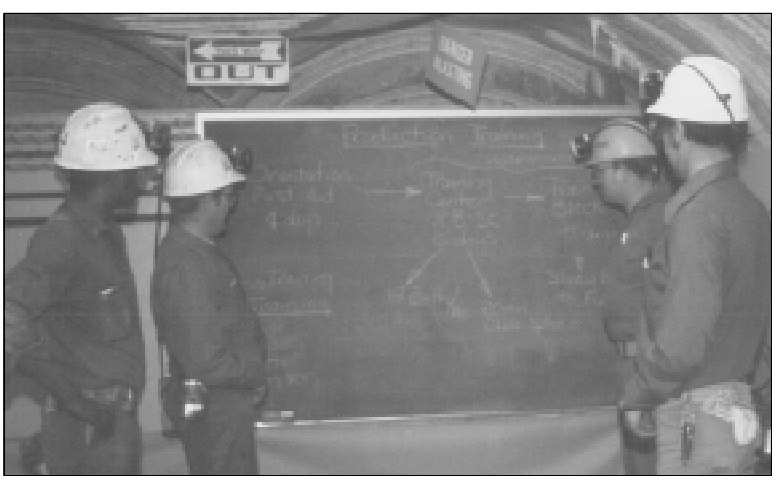
> ...I would take the person that is responsible at the mine, and... the mine foreman on each shift, and [they] would have mine emergency training continuously... (and) I don't mean a shot of seven hours, and that's it... I would (also) test [them] periodically.

In terms of training for corporate officials, another veteran responder said:

> ...you ought to have a situation where you have, primarily the top officers of the company involved, with regard to mine emergencies. Because when the emergency does happen, then they are the people that do get into that... I think they ought to be prepared more. And some of them that you have, probably never been involved in anything.

At least five veterans believe that both state and federal regulatory personnel should be thoroughly trained in mine emergency response. At least one of these experts felt that not enough emergency response training is provided to mine inspectors:

> ...we go to the Academy and we take too many senior people and I think it needs to filter down to the individual inspector 'cause any mine fire, that individual inspector is the person that's going to have to go out and really deal with [the emergency], in the initial quick stages of it.



Conclusions

When experts were asked how they would train future mine emergency responders, they responded in terms of how training should be conducted and who should be trained. Many believed that some form of interactive simulated response training is the best method. Three types of simulation were discussed including mock disasters, MERD exercises, and tabletop exercises. The need to adequately train mine or corporate management personnel in emergency response procedures was discussed. As one expert indicated, managers will be the ones who will be playing major roles in the decision making process at the command center. In addition to mine management, it was suggested that enforcement personnel should also be thoroughly trained in emergency response. As mentioned by one veteran, more and improved training for these individuals will enhance their ability to respond to a mine emergency when it occurs.

Why is the issue of training future mine emergency responders so important? The answer to this question can be found in one veteran's comment:

> ...a lot of people [have] come and gone since 1969. And we're having less problems. So, in the next 10 to 15 years, there's just going to be a hand-full of people that's had any experience.

In short, fewer major mine emergencies are occurring. As seasoned emergency response personnel depart from the mining industry, there will be fewer individuals in the future who have firsthand experience in mine emergency response. If the suggestions made by mine emergency veterans for training future responders are followed, the industry will be better prepared to handle emergencies that arise.

You'll get a crack out of this—Thunder and Lightning

Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Nearly 1,800 thunderstorms are occurring at any moment around the world. That's 16 million a year!

Despite their small size, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year then tornadoes. Lightning averages 93 deaths and 300 injuries each year. Heavy rains from thunderstorms can lead to flash flooding—the number one thunderstorm killer… nearly 140 fatalities each year.

Of the estimated 100,000 thunderstorms that occur each year in the United States, only about 10 percent are classified as severe. The National Weather Service considers a thunderstorm severe if it produces hail at least 3/4-inch in diameter, wind 58 mph or higher, or tornadoes.

When thunderstorms approach…

Remember: if you can hear thunder, you are close enough to the storm to be struck by lightning. Go to safe shelter immediately.

Move to a sturdy building or car. Do not take shelter in small sheds, under isolated trees, or in convertible automobiles. If lightning is occurring and a sturdy shelter is not available, get inside a hard top automobile and keep the windows up. Get out of boats and away from water. Do not take a bath or a shower. Telephone lines and metal pipes can conduct electricity. Unplug appliances not necessary for obtaining weather information. Avoid using the telephone or any electrical appliances. Use phones ONLY in an emergency.

Turn off air conditioners. Power surges from lightning can overload the compressors. Get to higher ground if flash flooding or flooding is possible. Once flooding begins, abandon cars and climb to higher ground. Do not attempt to drive to safety. Note: Most flashflood deaths occur in automobiles.

If caught outdoors and no shelter is nearby…

Find a low spot away from trees, fences, and poles. Make sure the place that you pick is not subject to flooding.

If you are in the woods, take shelter under the shorter trees.

If you feel your skin tingle or your hair stand on end, squat low to the ground on the balls of your feet. Place your hands on your knees with your head between them. Make yourself the smallest target possible, and minimize your contact with the ground.

Lightning—Nature's fireworks

Lightning results from the buildup and discharge of electrical energy between positively and negatively charged areas. The average flash could light a 1 00-watt light bulb for more than 3 months. Most lightning occurs within the cloud or between the cloud and the ground. The air near a lightning strike is heated to 50,000° F—hotter than the surface of the sun! The rapid heating and cooling of air near the lightning channel causes a shock wave that results in thunder.

To estimate the distance in miles between you and the lightning flash, count the seconds between the lightning and the thunder and divide by five.

What to listen for…

SEVERE THUNDERSTORM WATCH: tells you when and where severe thunderstorms are more likely to occur. Watch the sky and stay tuned to know when warnings are issued. Watches are intended to heighten public awareness and should not be confused with warnings.

SEVERE THUNDERSTORM WARNING: issued when severe weather has been reported by spotters or indicated by radar. Warnings indicate imminent danger to life and property to those in the path of the storm.

Also… listen for: *Tornado Watch* or *Warning and Flash Flood Watch* or *Warning.*

*Reprinted from the U.S. Department of Labor's **Safety And Health Bulletin No. 97-11**, dated August 1997. A publication of the Office of the Assistant Secretary for Administration and Management, Washington, D.C. 20210.*

Readers: Please work extra SAFELY during the Winter Alert!

Electrical safety… When tag-out/ lock-out isn't possible

By Norman R. Carlson of Zonge Engineering & Research Organization, Inc.

If current trends continue, an increasing number of electrical geophysical crews will be doing work on mine property in the coming years, possibly exposing mine workers to electrical hazards for which they have not been trained. This article reviews some of the safety training that geophysical crews themselves receive.

Electrical geophysics is an exploration method that is most often used on mine property long before that property becomes a mine. By measuring the electrical properties of the ground, such as resistivity and induced polarization, geologists and geophysicists often can locate and map the structure and ore that eventually becomes a working mine. In recent years, as these geophysical methods have improved and as mining methods have changed, electrical surveys have become more common at active, working mines; they are now used at mines to explore for new reserves, to map leaching activities (on dumps and for *in situ* mining), and in mapping or monitoring environmental problems.

The geophysical contractors must have MSHA certification to work on mine property, of course, but their job-specific training must also include electrical safety concepts that aren't normally covered by standard tag-out/ lock-out procedures. While operating on mine property, these crews may also expose mine employees to these nonstandard hazards.

Training always begins with a review of the dangers of electrical shock. The effect of electrical shock is usually categorized by how much current is traveling through or along the body. The chart in Figure 1 shows the levels of danger, from 5 milliamps (considered the maximum harmless current) up to a several hundred milliamps (causing severe burns, stopping the heart, and death). The current that the body is subjected to is determined by the voltage of the electrical source and by the resistance of the body. Along the surface of dry skin, for example, resistance may be as high as 100,000 ohms; wet, sweaty skin may be as low as 1000 ohms, and a path through the body (which contains a lot of fluid, of course) can be as low as 400 ohms. This large range of resistances is one reason why injuries from electrical shock are so unpredictable. If the path is along the dry skin of an arm (high resistance), the damage may be minimal. If the path is through the body (low resistance) serious injury or death may occur. The type and frequency of the current (AC or DC) is also a factor in the harmfulness of an electrical shock; in Figure 1, 60 Hz AC (60 cycles per second) is assumed, since this is so common. Geophysical transmitters may range from DC to 10,000 Hz, however.

Unfortunately, electrical currents often travel from the hand (grasping a wire) through the trunk of the body and then through the foot to the ground. The resistance of this path can range from 400 to 600 ohms; thus we use 500 ohms as a typical value for estimating how dangerous different voltage levels are. Using Ohm's law and this typical resistance of 500 ohms, the chart in Figure 1 shows the current (in milliamps) that corresponds to some common voltage levels. For example, the voltage in most homes is 110 volts; at 500 ohms resistance, this corresponds to 220 milliamps, a level that is capable of causing severe burns and death. Operating way above this level, most mine voltages and geophysical transmitters are potentially lethal. Death from ventricular fibrillation can occur at levels as low as 100 milliamps, which coincides with the ***lowest*** voltage tap on many geophysical transmitters. Only the small, battery-powered environmental transmitters are limited to voltage levels that are usually too low to cause death.

In an electrical geophysical survey, a controlled electrical signal (usually at relatively high voltage) is transmitted along wires and into the ground, often through aluminum or copper stakes called electrodes. At various distances away, this signal is measured and recorded. By determining how the ground has changed that electrical signal, characteristics of the geology and groundwater can be interpreted.

Depending on the type of geophysical survey, crew members are often at different locations along the survey lines, sometimes spread out over several miles; power is being transmitted along wires to some electrodes, while others are being prepared or removed. Strict adherence to safety policies and constant communication are necessary to avoid accidents, such as having the transmitter operator turn on power to an electrode that is still being worked on, or having one of the crew members start to disconnect wires and remove an electrode while it is still in use. These situations are potentially fatal; note the common transmitter voltages on the chart in Figure 1.

Despite what appears to be an "accident-waiting-to-happen" scenario, in 25 years of field crew operations, sometimes with as many as 12 electrical crews running simultaneously, our company has never suffered an electrical fatality, or even an electrical lost-time injury. One of the reasons for this record is training. Each year in its annual crew chief training sessions, as well as during federally-required MSHA training, Zonge emphasizes the electrical dangers inherent in its field work. To be as easily remembered as possible, crew members are taught the key safety concepts as part of a 3-Phase Positive safety approach. The three phases are *Positive Communication*, *Positive Switching*, and *Positive Attitude.*

Positive Communication—To prevent turning on power to an electrode where people may still be working, transmitter operators are required to obtain a positive response from every crew member before turning on power to an electrode. A positive response is usually by radio, such as "I'm clear of electrode six". A positive response is ***not*** two clicks of the radio microphone (which is a common way to respond in the affirmative when using hand-held radios). A positive response is also ***not*** waving to the transmitter operator, since this kind of communication, like clicking the microphone, can be misunderstood. Microphone clicks may have come from some other radio source, and the person waving in the distance

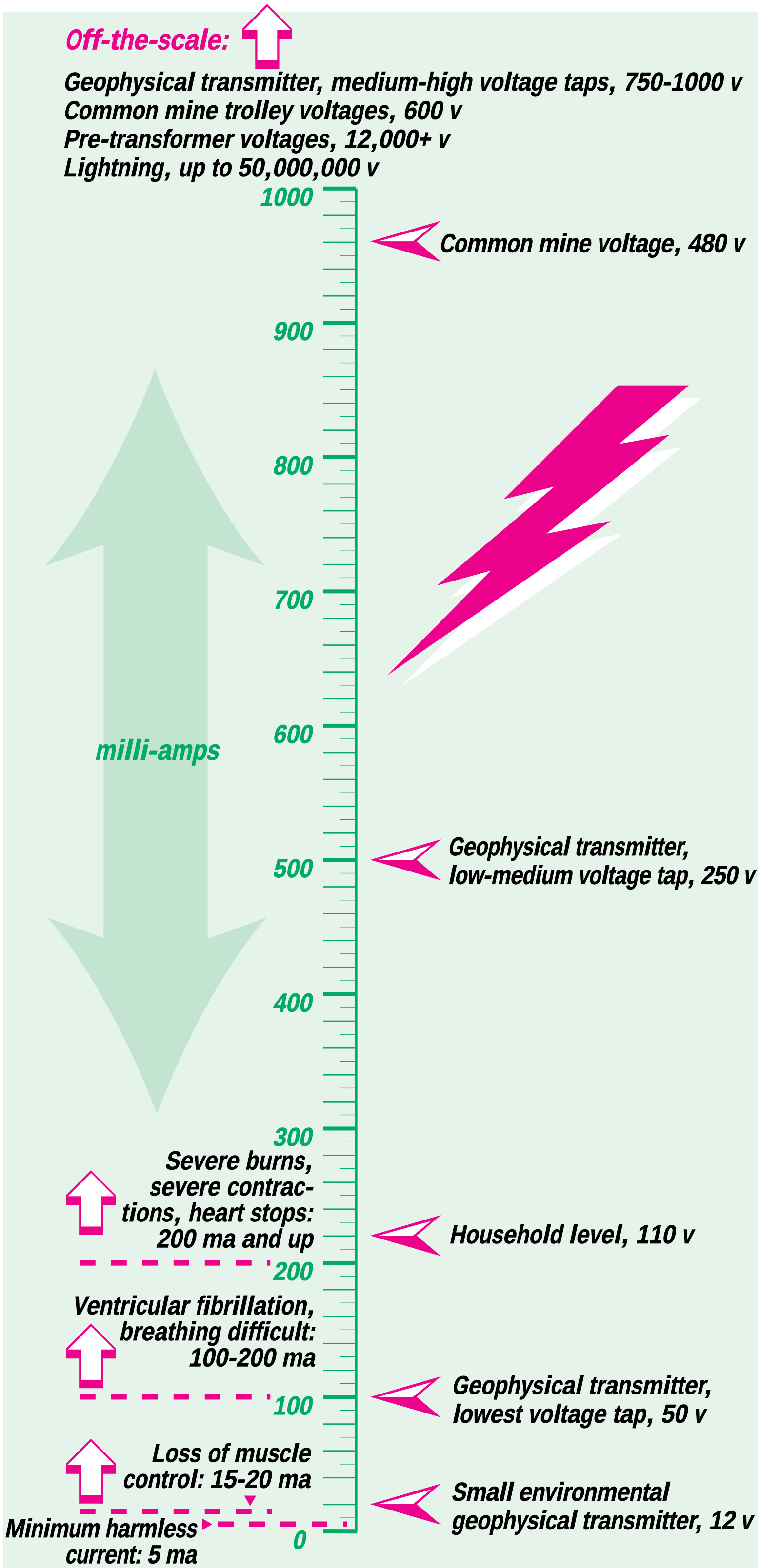


Figure 1.—Chart of electrical hazard levels with typical voltages, assuming a common path from a hand to the trunk and through a foot (about 500 ohms resistance).

may not even be who the operator thinks he or she is (or that person may be waving to say "No, don't turn on the power yet!"). Working at mines virtually always means that there are other people using radios in the area, and that there will be non-crew members in the vicinity of the survey.

Positive Switching on Equipment—Positive switching refers to safeguards built into our geophysical transmitters. The equipment is designed so that an operator cannot accidentally transmit signal by bumping a switch with an elbow, or leaning on a "transmit" button. Signal transmission can occur only as a result of a positive, two-step action, and these two steps must occur within a short, fixed time interval. For example, most of the transmitters require that a RESET/TRANSMIT switch be moved first to the RESET position and then (in the opposite direction) to the TRANSMIT position within two seconds to transmit signal. Simply moving the switch to TRANSMIT (bumping it with an elbow or a coffee cup) will not transmit; moving the switch to RESET and then TRANSMIT in 2.1 seconds will not transmit. A positive, conscious effort is needed to transmit current. As long as this kind of switching is working properly, the chances of accidentally transmitting while someone is working on wires or electrodes is extremely small.

These safeguards are a critical part of the equipment, and operators are instructed that if they discover that a transmitter *will* transmit without the positive, two-step process, that equipment is considered "down" and unusable. The crew should not use the faulty transmitter to finish the day or even the survey line; the survey should stop at that point until the positive switching is repaired or until a replacement transmitter is received.

Positive "Attitude"—(No, this is not an emotional state that we try to instill in our co-workers, though that would create a better work environment.) The "positive" in positive attitude refers to how we want a crew member to answer when he or she is thinking "I wonder if this wire is energized..." Employees are instructed to always assume that the answer is positive, i.e., "Yes, it's energized." Simply stated, treat every wire as if it is energized until you've confirmed that it is not.

We also want this "positive" attitude passed on to any other people at the mine that may happen upon some of our wires. As long as our crews are on site, mine workers and other contractors should be told to assume that any wire they encounter is energized. It is also important that everyone understand that the size of the wire isn't really very important. Our typical transmitter wires, carrying 600 volts, are just 14 gauge; smaller than most of the cords on home appliances. A wire doesn't have to be a bulky, heavily-insulated, inch-thick cable to carry lethal levels of voltage.

One additional electrical hazard that has special implications for geophysical crews (and the people around them) is lightning. Lightning is far more threatening than most people think. Tornadoes, hurricanes, floods, and earthquakes are more dramatic, and get more exposure on the evening news, but lightning causes more deaths every year in the U.S. than any of these other natural disasters. At voltages that can be as high as 50 **million** volts, lightning would obviously be well off the chart in Figure 1.

Lightning is particularly dangerous for geophysical crews because of the long wires on the ground. Current from a lightning strike can easily be propagated thousands of feet along wires, causing damage or injury to equipment or people in contact with the wire. And lightning does not need to strike a wire directly to cause damage; even a nearmiss of several thousand feet can induce enough voltage in a long wire to be dangerous. On one of our own crews, a lightning strike more than a mile from a 2,000 foot long wire generated enough voltage to arc across a 6 inch gap at the transmitter truck. As a result, part of the safety training for lightning storms includes disconnecting all wires from equipment, and physically moving those wires away from people and trucks. Once wires are cleared, crew members take standard precautions during electrical storms, moving indoors or into vehicles if possible, staying clear of tall objects and out of open areas.

Both lightning and geophysical crews pose electrical hazards that are not subject to tag-out/lock-out precautions. In the view of some mine operators, both should simply be avoided, but when that is not possible, awareness and compliance with safety procedures will minimize the chance of an electrical accident.

Sources:
***Electrical Hazards**, U.S. Department of Labor, Mine Safety and Health Administration, National Mine Health and Safety Academy, Safety Manual No. 9; Community First Aid & Safety, American Red Cross, Mosby Lifeline, 1993.*

*Reprinted and expanded from a safety article in **Background Noise**, Issue 3, a newsletter of Zonge Engineering & Research Organization, Inc.*

About the Author: Norman R. Carlson is Chief Geophysicist of Zonge Engineering & Research Organization, Inc., a geophysical survey contractor and equipment manufacturer. He has been at Zonge for 18 years, and is also an MSHA instructor as well as an instructor in First Aid and CPR for the American Red Cross, Southern Arizona Chapter. He can be contacted at 3322 E. Fort Lowell Rd., Tucson, Arizona, 85716.

Teamwork pays big dividends for Peabody Coal

Peabody Coal's Camp Business Unit, (CBU) near Morganfield in Union County, Ky., employs more than 650 people and shipped 5.9 million tons of coal in fiscal 1996. It has two underground mines, a Prep Plant, and an Overland Conveyor to the Ohio River. Camp #1 Mine has five continuous miner sections using both continuous face haulage and shuttle car haulage. Camp #11 Mine has Peabody Coal's only longwall mining section and uses two continuous miner sections with battery coal haulers for development.

Peabody Coal Company, headquartered in Charleston, W.Va., operates 8 Midwestern mines which shipped 19.8 million tons of coal in fiscal year 1996 principally for use as a fuel in electric power generation. It is a wholly-owned subsidiary of Peabody Holding Company, Inc.

At Peabody Coal Company's CBU, recent headlines in the company paper have read:

> "Camp #1, Camp #11, and Camp Terminal receive Holmes Safety Awards for working below National Average of MSHA non-fatal days lost rate in 1996;" "Camp #1 recognized as Safest Underground Mine in Western Kentucky District for 1996;" "Camp #11 receives Peabody Award as Safest Underground Mine in Company for fiscal 1997;" "Camp #11 selected for Kentucky Department of Mines and Minerals Statewide Publications;" "Production at CBU on rise."

Right, the delegation from the Camp Complex at the Awards Banquet of the Green River Safety Council of the Holmes Safety Assoc.
Front row, left to right: Randy Wolfe; Larry Holt; and Jim Allen. Back row, left to right: Billy Ralph Risinger; Clif Alexander; Don Willoughby; Clif McKee; Larry Cleveland; Duane Childers; and Alan Zaborac.

It has not always been this way for Peabody Coal Company's largest business unit.

For example, in 1994, Camp #11 Mine had started an ambitious plan for the future. Close to $30 million had been invested in a new longwall and other equipment to be installed in the Kentucky #9 seam. Things were moving rapidly in regard to recalling laid-off employees, new mining development methods, and developing long range budgets and plans. But many problems surfaced as the longwall began producing. Accident rates and violations per inspection day rates were very high. Mining costs were prohibitive and relations between the company, the union, and MSHA became tense.

Morale was at an all time low. It looked to all observers like Camp #11 Mine together with investments related to the longwall was doomed. Further, if Camp #11 were closed, the entire complex would probably close.

Fast forward to mid-summer of 1997. Mining costs have dropped considerably. Camp #11 can boast of a safety incidence rate for last fiscal year of 4.52—the lowest within the entire Peabody group. Violations per inspection day have dramatically decreased to less than one violation for every two days of inspection.

Below, a tour group in Camp #11 Mine at a sign emphasizing teamwork and preventive thinking.
Left to right: Brad Williams; Rich Reynolds; Rex Music; Butch Hackney; Aaron Jackson; Dennis Wallace; Gene Higley; Bob Danko; Bobby Meadows; Ed Wyatt; Duane Childers; Paul Sparks; and Paul Ezell.

There is a spirit of cooperation, respect and trust between Peabody Coal Company, MSHA, and the UMWA. Productivity has greatly increased. The mine is clean and neat, with a program being implemented for cleaning up and illuminating the charging stations, transformers, belt headers, and dinner holes. Signs are located in key areas underground promoting safety, accident prevention, and teamwork. A communications center with all mine statistics and costs is provided in the employee washhouse. Camp #11 has gone from the brink of closing to a first class, highly productive operation. How did this happen? What did they do?

The answer rests with one word—teamwork. All of these accomplishments have been achieved through teamwork and encouraging and allowing ***ALL*** of the employees to have ownership and pride in their place of work. For the CBU operations, the turnaround began when conditions began to improve at Camp #11 and with the introduction of the Labor Management Positive Change Process (LMPCP) at all locations. Through this forum, the union and the company began to meet and share sensitive information such as mine supply costs, sales information regarding tonnage and customers, strategic plans for the future, budget information, and so on.

Over time, trust and respect were earned by both groups. The "teams" began to work together toward a common goal. The management staff began to understand the frustrations of the hourly workforce. The union representatives began to understand the reasoning behind the decisions management had made. They began to work together, with input from all parties, on reaching crucial decisions such as what price to bid on coal contracts, and what costs the mines could afford on equipment and supplies. Teams were formed to address every major problem area facing the mines. The teams were comprised of representatives of both management and the hourly workforce and met no less than twice a month. The hourly representatives on these teams volunteered to participate and came from jobs related to the specific area being addressed. Although Camp #1 Mine has always been very consistent with production, approximately 3 years ago they faced a challenge with falling sales prices. Through the LMPCP process, Camp #1 employees developed an innovative work schedule that was voted in by the local union membership under a Memorandum of Understanding (MOU). This MOU enabled Camp #1 to increase production, cut mining costs, and significantly improve their safety record. This mine was recognized early on as one of the leaders in the industry in regard to the LMPCP effort.

In the safety area at both Camp #1 and Camp #11, major improvements in the incidence rates have been achieved through increased awareness, excellent communication, and innovative thinking. For example, the Camp #11 safety team developed a new, totally innovative, "hands on" training plan for its annual retraining classes and has received widespread recognition and praise from MSHA, the Kentucky Department of Mines and Minerals, UMWA District and International offices as well as Peabody's Corporate Staff. A major focus of all the safety teams at each Camp Business Unit location is to make safety contacts with individuals and to promote a positive attitude. In the last 24 months, Camp #9 Prep and Camp Terminal had a need to increase operating time, tons

Pictured at left are, from left to right: Paul Ezell; Paul Sparks; Bob Danko; Clif McKee; John Franklin, Commissioner of the Kentucky Department of Mines and Minerals; and Blair Lamb.

Bulletin board displaying everything from training to work schedules to maintenance plans.

An underground fire fighting station featuring fire extinguishers, turnout gear, PA-80s, safety wagon with hoses/quick couplings, assorted tools, and a foam-generating machine.

produced and tons shipped. They not only have achieved this, but also continued to improve their safety records. Camp #9 presently has no reportable injuries for the current Peabody fiscal year, and Camp Terminal has twice gone over 12-month periods with no reportable accidents.

With all the changes in the last three to four years, the most obvious change that can be noticed by all at the CBU is that the attitude of the workforce has improved dramatically. Emphasizing teamwork and allowing all employees to have a voice in their future has paid off at the CBU.

MSHA offers two "Power-Off" options when making repairs to longwall systems

When making repairs or performing maintenance on longwall equipment, operators can effectively "lock-out" the electrical system by using a visual disconnect or by opening the vacuum contact (circuit breaker) in the power circuit involved.

These are the options MSHA is offering operators in order to comply with §75.1725(c), which requires that equipment power be turned off and the equipment blocked against movement before repairs are performed.

This regulation applies any time mechanical repairs or maintenance are performed on the shearer, face conveyor, or stage loader, according to MSHA Program Policy Letter No. P97-V-I issued on Sept. 1.

According to the policy letter, power may be removed from the longwall equipment by one of the following methods:

1. Utilizing a visual disconnect such as a cable coupler or the gang-operated disconnect located in the master controller or a separate controller; or

2. Opening the vacuum contact (circuit breaker) in the power circuit involved. This can be accomplished by placing a lockout switch in the lockout position along the face conveyor, in the area where the work is to be performed, and placing the "run" selector switch at the master controller in the "off" position.

MSHA said that all miners who perform longwall equipment maintenance must receive task training as required by §48.7(a)(3) and §48.7(c). This training must include clear instructions regarding the type of disconnect that will be used to meet the power-off requirement of §75.1725(c).

Colorado offers videos

Denver—The Colorado Division of Minerals and Geology has produced a number of safety videotapes that mine operators might want to include in their training libraries.

William York-Feirn, mine safety and training program coordinator, unveiled the series at the Colo. Safety Assn.'s Western Mine Safety and Health Workshop here. The videos, most of which sell for $10 apiece, include products aimed at underground mines, sand and gravel operations, and processing plants. Each video examines a particular aspect of safety. Among the topics covered are: powered haulage equipment, ground control and highwalls, stockpiles, explosives, and electrical hazards.

For a list of products and an order form, call Shirley Just at the Colorado Division of Minerals and Geology at 303-866-3567.

Change thwarts safety device in West Virginia coal death

A safeguard against inadvertent tram operation on a remote-control continuous miner was altered in such a way to nullify this key safety feature, a fatality investigation found.

A 30-year-old continuous miner operator was killed Oct. 21, 1996 at a deep coal mine in Wyoming County, W.Va., while running a National Mine Service (Eimco) 2460 continuous miner. The victim was using a radio remote control device to run the machine.

"While tramming the machine, the victim placed himself between the machine and the solid coal rib," MSHA's fatality report stated. "The trailing cable of the machine fell from its carrying position, contacting the remote control and splitting the tram control levers, which caused the boom end of the machine to move to the right, crushing the victim between the machine, roof, and coal rib."

Importantly, the radio remote control box was rendered unsafe because the lift lever actuator slide had been taped in an upward position, defeating the safety feature. MSHA tests indicated the unit would have worked had it not be taped upward. The company was issued a 104(a) citation, stating in part that equipment was not kept in a safe condition, a violation of Sect. 75.1725(a) because the tape had allowed the tram levers to function without the operator having to release the lift lever actuator slide.

The continuous miner operator at the mine keeps the machine's trailing cable as part of his job. A miner's helper is not employed at this mine.

According to miner testimony, the victim might have attempted to hang the trailing cable onto the side cable hooks located along the side of the machine and at the right rear side of the operator's deck. Or he might have reached into the operator's compartment for some unknown reason, "when the trailing cable fell and struck the left tram lever, causing the machine to veer to the right."

One of the first miners on the scene to help free the victim was a scoop operator—the victim's brother.

The report was issued through MSHA District 4, Earnest Teaster Jr., Manager, 100 Bluestone Rd., Mount Hope, W.Va. 25880.

*Reprinted from the June 16, 1997, issue of the **Mine Regulation Reporter**—*

Wayne Barber, Editor, 1616 N. Fort Myer Drive, Suite 1000, Arlington, VA 22209. Telephone: 703-528-1244, 800-424-2908, FAX: 703-528-4926, E-mail: minereg@pasha.com, Hotline Service: 703-816-8643.

Radio waves replace stench gas

The foul odor of stench gas could disappear from underground mines forever if a new radio alert system proves effective.

Currently in use at Royal Oak's Pamour #1 mine in Timmins, Ontario, [Canada] the system relies on low-frequency radio waves to transmit a warning signal in case of an emergency. The low-frequency signal travels through the rock and makes the miners' cap lamps flash, letting them know they need to take emergency precautions.

Marketed by a Unionville, Ontario company, MineAlert can replace the stench gas used by many mines as an emergency warning system. In its liquid form, stench gas is a dangerous fire risk, and it's becoming more difficult to obtain it and get it shipped to the mine, said Royal Oak safety Supervisor Keith Gilbert.

Stench gas travels through the mine's ventilation system, so it can take as long as 15 to 20 minutes to reach and alert everyone of an emergency. With the low-frequency radio system, workers in all areas of the mine get the message within about two minutes.

In addition, Gilbert explained, the radio system can be turned off and on with the flick of a switch. When stench gas is used, it lingers in the mine for some time after, making it difficult for workers to know whether the smell is a new emergency signal or simply the after-effects of the old one.

Royal Oak has never had to use the MineAlert system for a genuine emergency. It has tested the system a number of times, and except for some glitches when it was installed, it seems to be effective and well-accepted by employees, Gilbert said. The mine will keep its stench gas system as a back-up.

Coal dust explosibility meter

Objective

To enable mine operators and mine inspectors to make quick and accurate measurements of the explosible nature of coal and rock dust mixtures.

The problem

Past research has shown that the accumulation of coal dust in underground coal mines can be rendered nonexplosible by adding efficient quantities of inert rock dust, such as limestone dust. Federal regulations for underground coal mines require mine operators to dust mine corridors with an inert rock dust and maintain a total incombustible content of at least 65% in the entries and at least 80% in the returns, where the coal dust is expected to be finer in size. Currently, samples of the deposited coal and rock dust are collected for surface analysis of the inert percentage, which consists of rock dust, ash, and moisture. The processing time for this analysis can be as long as 2 weeks. In addition, research has shown that the explosibility of samples, especially those containing finer coal dust, is not reliably estimated from measurements of their incombustible percentages. The National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Research Center (PRC), has devised a prototype handheld instrument that can provide a direct assessment of the potential explosibility of a coal and rock dust mixture.

How it works

The coal dust explosibility meter (CDEM) is a portable optical device that determines whether or not a coal and rock dust mixture is explosible (figure 1). It consists of an optical probe connected to a small electronics box with a digital display. The principle of operation of the CDEM is

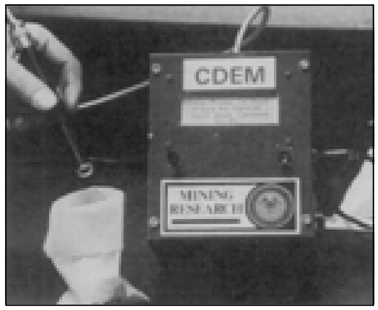


Figure 1.—The CDEM is used to analyze the composition of a coal and rock dust mixture.

based on the measurement of infrared radiation reflected from the surface of a homogeneous mixture of two substances with different optical reflectances, such as light colored rock dust and dark coal dust (figure 2). Near-infrared radiation is emitted by a light-emitting diode in the optical module located behind the window of the optical probe. When the meter is inserted in the dust mixture, the infrared radiation reflects off the dust's surface and back to the silicon photodiode sensor, also located in the optical module. For a given coal volatility, the normalized optical reflectance of such mixtures is relatively constant at the limit of explosibility (the amount of rock dust required to inert) and independent of the coal dust particle size. Samples whose normalized reflectance measures below the threshold would be identified as explosible; samples with reflectances greater than the threshold would be nonexplosible.

Test results

The limit of explosibility for many coals was determined in PRC's 20-liter explosibility chamber using several types of rock dust. As expected, the percentage of rock dust required to inert the coal dust increases for finer coal dust size. Coals with mass median particle sizes in the range of 10 to 70 µm required 90% to 60% rock dust, respectively, to be inerted. At the finest particle sizes, mixtures are still explosible even above the federally mandated 80% rock dust requirement for return airways, confirming the fact

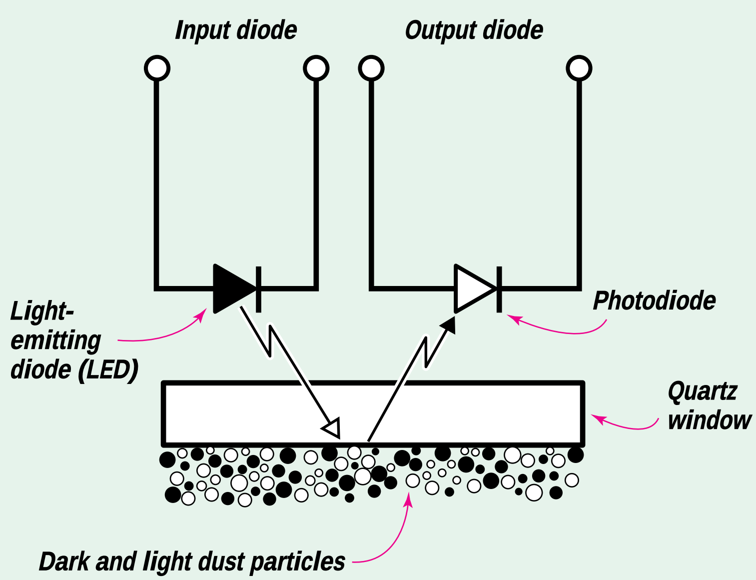


Figure 2.—Drawing depicting principle for measuring the optical reflectivity of a coal and rock dust sample

that measuring the rock dust concentration is not sufficient to determine the explosibility of a sample.

For each mixture, the CDEM optical reflectance was measured at the limit of flammability and was found to be constant over the range of particle sizes for a given coal volatility. In practice, the normalized reflectance to which the meter alarm would be set would depend on the volatility of the coal seam in which the instrument was being used. The CDEM thus provides a measurement of the explosibility of a dust sample over the entire range of coal dust sizes, rather than being restricted to the two coal sizes (intake and return) in current regulations.

Continued efforts

Currently, the CDEM could provide an efficient method to determine the explosibility of air-dried, homogeneous samples at surface laboratories at the mine site. Research is in progress to measure and correct for the presence of moisture in the samples by measuring the electrical resistivity in addition to the reflectivity. This correction would allow the CDEM to be used on samples directly from the mine and possibly to provide an in situ explosibility measurement to eliminate the danger of operating under hazardous conditions while samples are processed. The CDEM could provide mine operators and safety inspectors with a valuable means for determining the explosible nature of coal and rock dust deposits.

Efforts are currently underway to commercialize the CDEM, along with a related instrument, the reflectance rock dust meter, which provides a direct measurement of the rock dust percentage in mine dust samples.

For more information

To obtain a free copy of a technical paper on the CDEM or answers to technical questions about the device, contact Carrie E. Lucci or Kenneth L. Cashdollar, National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Research Center, Cochrans Mill Rd., P.O. Box 18070, Pittsburgh, PA 15236-0070, phone (412) 892-4308 or (412) 892-6753, fax (412) 892-6595, e-mail: chl4@cdc.gov or kgcO@cdc.gov

Mention of any company name or product does not constitute endorsement by NIOSH [or the Mine Safety and Health Administration].

To receive additional information about mining issues or other occupational safety and health problems, call 1-80035-NIOSH (1-800-356-4674), or visit the NIOSH Home Page on the World Wide Web at http://www.cdc.gov/niosh/homepage.html

As of October 1996, the safety and health research functions of the former U.S. Bureau of Mines are located in the National Institute for Occupational Safety and Health (NIOSH).

*Reprinted from the July 1997 issue of **NIOSH Technology News, No. 461**, a publication of the U.S. Department of Health and Human Services Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.*

MSHA Hazard Alert

Customer and delivery drivers

Thirteen customer or delivery drivers have died at metal and nonmetal mine sites in the past five years. In a recent accident, a haul truck struck 2 persons at an Illinois sand and gravel operation, killing one and critically injuring the other. Unsafe factors in these accidents included:

- Drivers allowed outside truck cabs for socializing;
- Safe locations not designated for drivers to work outside truck cabs;
- Congested loading and delivery areas;
- Unstable stockpiles;
- Defective backup alarms;
- Restricted visibility;
- Inattention;
- Drivers placing themselves in an unsafe location;
- Failure to set parking brakes;
- No established traffic pattern; and
- Communication failures.

Customer and delivery drivers spend only a fraction of their time at mine sites and may not understand a mine's work practices. Operators should provide hazard training and require drivers to follow mine rules.

If there are customer or delivery drivers coming to your mine, help protect them by observing these rules:

- Require drivers to stay in their trucks unless their work requires otherwise.
- Provide loading and delivery points away from mine work and other mine traffic patterns if drivers must get out of their trucks.
- Limit customer and delivery drivers to specified areas of the mine.
- Establish and enforce safe procedures for customers and delivery drivers.
- Enforce speed limits for customer and delivery drivers.
- Establish procedures that minimize backing up.

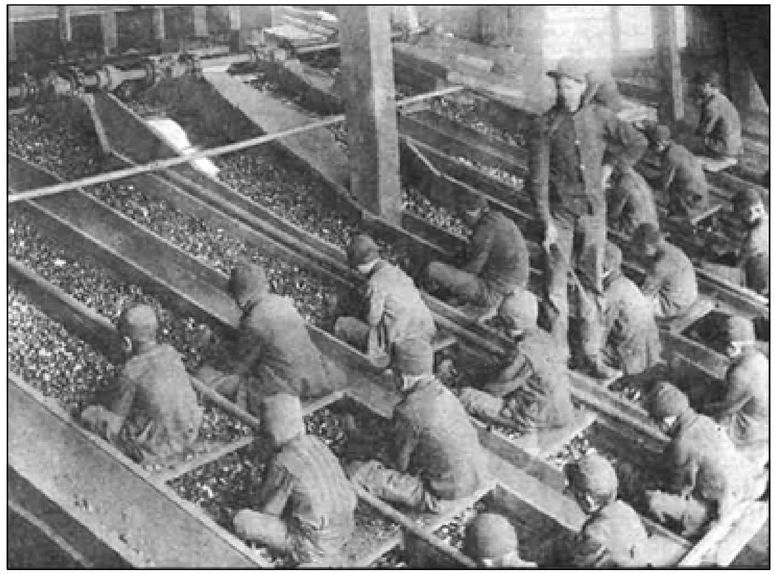
History of Wilkes-Barre and coal are linked

Settlers

During the early 1700s various Indian tribes, such as the Shawanese, Delaware and Nanticoke, settled in the fertile valley of Wilkes-Barre. In 1768, a group of settlers, led by Major John Durke, built Fort Durkee near Ross Street. They named the area for John Wilkes and Isaac Barre. Several battles took place in the following years, but the settlers were finally recognized as the owners of the land. By the turn of the century, the area had a newspaper, a post office, and a court house.

Black Gold

In the late 1800s and early 1900s, hundreds of thousands of immigrants flocked to the region to work the anthracite coal. This transformed the Wyoming Valley from an isolated farming area to a metropolis. However, the costs of extracting the clean-burning coal from the deep mine shafts were great in human and environmental terms. One out of every four mine workers was a boy. Boys as young as 7 worked the breakers, sorting out rocks from the coal. “When mining was at its peak in this area, almost every day the papers carried an account of someone being killed… The most common injury was from fallen rock,” said William Hastie.



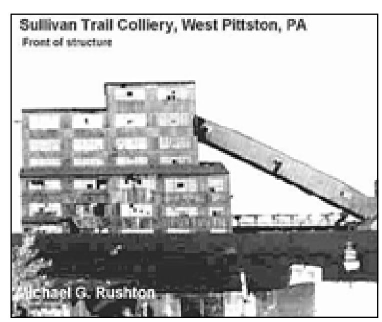
Breaker boys sorting coal under the watchful eye of a whip-weilding supervisor.

A 1950s era photo of miners in the dinner hole.

Road to riches

The success of coal brought a steady stream of entrepreneurs who grew very rich and powerful. J.C. Atkins built the Wilkes-Barre Lace Manufacturing Co., and Fred Kirby opened his first five-and-dime stores at 172 E. Market St. Men like Charles Parrish and the Coxe brothers owned mines, powder mills, timber companies, and railroads. In 1857, Charles Stegmaier began brewing beer on Hazle St, and he was turning out over 200,000 barrels a year by 1916. Silk and garment mills became major employers for mining woman with companies such as the Empire Silk Mill importing silk from Japan.

Railroads, boats, and buses competed for shipping dominance, but railroads eventually won out. However, Frank Martz opened what is now the very successful Martz Trailways bus line in 1908. The Boston Store opened in 1879, and Pomeroys followed in 1927.

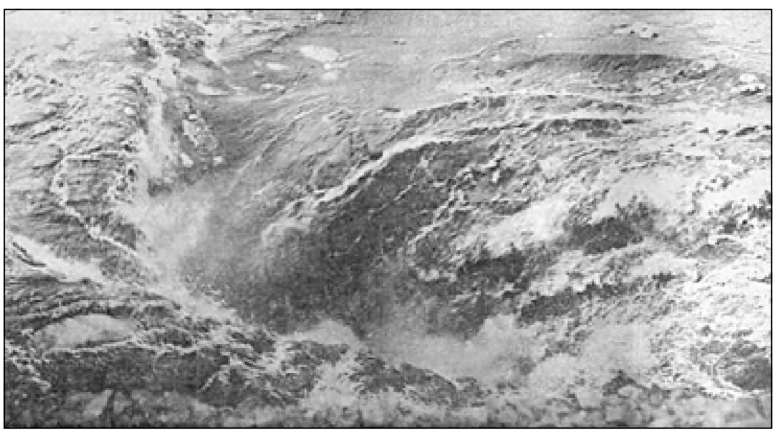


A front view of the Sullivan Trail Colliery of West Pittston, Penna.

Decline of anthracite

As the stock market crashed in 1929, the coal industry struggled, but it never recovered after World War II. By the 1920s consumers gradually

One of 30 railroad gondola cars and 400 mine cars dumped into the brink in the massive effort to fill the breach and stop the underground flooding.



A view of the huge sinkhole that appeared in the Susquehanna River in 1959.

switched from coal to oil, gas, and electricity. One by one, the collieries were shutdown, and mine operators moved on to other enterprises, leaving the area with an unemployment rate in excess of 12% after the war.

Knox Mine Disaster

Many miners suffered slow but fatal lung diseases from the coal dust they breathed, in addition to the violent deaths from mine accidents. However, the final blow occurred in January of 1959. The swollen Susquehanna River pushed through the roof of the Ewen Colliery River Slope section of the Knox Mine near Port Griffith.

Susquehanna River rushing into the mines

Twelve miners died, but thousands more lost their jobs as the entire network of underground mines flooded and forced the end of deep mining in the area. "To close the huge hole in the river bed through which millions of gallons of water poured, the tracks of the Lehigh Valley Railroad were diverted and 30 railroad gondola cars and 400 mine cars were pushed into the brink," wrote Donald Miller and Richard Sharpless in the "Kingdom of Coal."

The Agnes Flood

Unfortunately, this was not the only major disaster to hit the area. On June 23, 1972, tropical storm Agnes swept through the area. In her wake, she left 18 inches of rain, 6 people dead, 25,000 homes nearly destroyed, and $1 billion in damages. The river rose to 40.9 feet, 18.9 feet above flood stage, and 4 feet above the levees that were built after the flood of 1936, which crested at 33 feet. Although 2,278 businesses in Wilkes-Barre were damaged by the 9 feet of water that flooded the square, downtown Wilkes-Barre has been totally revitalized by the new businesses and buildings that have sprung up after the tragedy.

Source of Data: ***The*** *[Wilkes-Barre]* ***Times Leader****, PROFILE, April 27, 1991. Photos Courtesy Wyoming [Co.] Historical and Geological Society.*

August sees seven mining-related deaths

Two miners died in coal mining related accidents and five in metal/nonmetal accidents according to MSHA's preliminary reports, which show 69 fatalities so far this year. In addition, a security guard was electrocuted at a mine site, but MSHA has not yet determined if that will be classified as a mining-related accident.

Three of the fatalities involved haulage accidents.

Charles Head, 36, a truck driver at American Borate Co.'s underground Billie Mine in Furnace Creek, Calif., who had five weeks' experience, was killed when he was run over by a Wagner LHD loader on Aug. 28.

Head, who was driving an Eimco truck, and the LHD driver, drove their equipment to an area to load muck into the truck. The LHD operator noticed his tires were low, so he drove to the maintenance shop for service. On his return, he noticed the truck parked with its lights on and he thought it was waiting to load. He proceeded to scoop a load of muck and when he returned he noticed that the truck did not move in position to load. The LHD driver then discovered Head's body lying in the haulage drift near the truck. It is believed that the LHD driver ran Head over when going to get the load of muck.

Harlan McKelvey, 63, was killed on Aug. 19 in a passenger van accident at Falkirk Mining Co.'s mine in Underwood, N.D. He was traveling from one area of the mine to another with three others in a passenger van when the van hit a 22-inch high gravel windrow that was in the center of the haul road. McKelvey was ejected from the vehicle. One passenger received back injuries and two received cuts and bruises.

Samuel Jinkins, 45, a continuous mining machine helper was killed in a haulage accident on Aug. 24 at C.W. Mining Co.'s Bear Canyon #2 Mine in Huntington, Utah. Jinkins was running along side a shuttle car as it went through an entry. He slipped and fell in front of the cable reel compartment of the car and was crushed between the compartment and the mine floor. He had four weeks' experience.

Wilson McDaniel, 45, a delivery truck driver was killed Aug. 6 at Englehard Corp.'s Toddville Plant in McIntyre, Ga. When unloading PVC pipe from a flatbed trailer, he cut a rope securing the pipe, and the pipe rolled off, crushing him.

Lisa McDowell, 19, was a passenger in a contractor's dump truck when she was electrocuted on Aug. 8 at Stavola Construction Materials Inc.'s traprock facility in Bound Brook, N.J. The driver had dumped a load of stone at a stock pile and was pulling forward to clear the tailgate when the raised bed of the trailer contacted the power line. The driver and another passenger jumped clear and McDowell was electrocuted when she stepped down from the cab. The driver was employed by Overland Services Inc. of Clarksburg, N.J.

Charles Street, 36, was killed in a falling-materials accident on Aug. 18 at Material Service Corp.'s Thorton Quarry in Thorton, Ill. Street, a contract driver for Jack Gray Transport Inc., backed up to a stockpile to dump off a canceled load of material. As he dumped, he realized that he forgot to unhook the tailgate chain, and went to the rear of the truck to do so. The stockpile behind the truck sloughed down and buried him.

Mark Hoffman, 46, died on Aug. 20 from injuries received Aug. 19 in an accident at United Rock Products Irwindale Plant in Irwindale, Calif. Hoffman, who was an electrician for Busy Bee Electric Inc., was walking or sitting on a steel beam and fell 10-12 feet to a rock crusher being constructed at the #2 Pit.

OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
W	I	N	T	E	R

ALERT reminder: ● *Always maintain adequate mine ventilation and make frequent checks for methane and proper airflow.* ● *Know your mine's ventilation plan and escapeways. Properly maintain methane detection devices. Communicate changing mine conditions to one another during each shift and to the oncoming shift.* ● *Control coal dust with frequent applications of rock dust.* ● *Make frequent visual and sound checks of mine roof during each shift. NEVER travel under unsupported roof.*

Safety modifications suggested for low-profile battery-powered scoops

Scoops operating in low coal can go through a simple modification of welding heavy-duty standards around the operator's compartment to prevent accidents in which scoop operators accidentally contact the mine roof.

In a recent Program Information Bulletin, MSHA said that this modification was made to a scoop in a Pennsylvania coal mine after a scoop operator was pinned against the mine roof when he mistakenly lowered the scoop bucket to the mine floor. Due to the low mining height, a cab or canopy was not required.

A review of reportable accidents for the past 4 years revealed a number of accidents where miners were injured by contacting the roof while operating battery-powered scoops in low coal. Most of the accidents resulted after scoops ran over objects in the roadway. The mining height at the accident sites ranged from 38 to 45 inches.

Another suggested modification to prevent the operator from contacting the mine roof is to enlarge the operator's compartment allowing the operator to better fit within the compartment.

MSHA said that other scoop modifications or accident prevention measures may be appropriate for varying mine conditions. The agency is asking all mine operators and scoop manufacturers to review scoop-related accidents to determine the most effective means of preventing such accidents.

Metal/Nonmetal stressing education to help combat increase in fatalities

MSHA is going to step up efforts to prevent mine accidents, according to "Bud" Narramore of MSHA, who is the acting head of Metal/Nonmetal.

Narramore, speaking to the Institute on Mining, Health, Safety, and Research held in Salt Lake City, expressed concern about the increase in fatalities that has occurred recently. At the time of the conference, 45 fatalities had been reported at metal/nonmetal operations; at this time last year, the number was at 33.

According to Narramore, of those 45 fatalities, 15 were contractor accidents and 30 were miner accidents of which about 50% had no training or improper training.

In order to stem the growing number of fatalities, Narramore announced that beginning in September, MSHA will be putting field personnel in mines for two weeks in order to educate and inform workers. "We plan on going into every mine that we can reach to try an get the word out to miners, mine management, and supervisors that this can't go on, " he said. "We're going try to get whatever time we can with them—lunch hours, walking through the plants, the mines, whatever. But we have to tell them something."

Narramore also talked about establishing national and local meetings in order to reach out to those who conduct training, as well as state agencies and trade associations. "We would continue this until the end of the year, but hopefully, it won't be necessary for too long."

He urged the mine operators to join with MSHA and work with the agency to bring down the accident rates by offering input and attending the meetings.

Narramore went on to stress the partnership between companies and regulatory agencies. "Regulations don't replace thinking. We have to realize that laws and regulations by themselves do not eliminate accidents and fatalities," he said. Companies must work to identify hazards and take care of them, he said. Through a partnership, many accidents can be avoided and the workplace can become safer.

"Everyday, millions of men and women get up to go to work and return home safely to their families at the end of the day, and in exchange for their pay, they do not expect to put their lives or health at risk, and that's they way that it should be."

20

Machine-mounted continuous respirable dust monitor

Objective

To continuously monitor, display, and record concentration levels of respirable coal mine dust in mines to an accuracy of ±25% with a 95% confidence level for at least 30 days without servicing.

Approach

The National Institute for Occupational Safety and Health (NIOSH) has developed a machine-mounted continuous respirable dust monitor (MMCRDM) based on the tapered-element oscillating microbalance (TEOM®) sensing technology. The sensor can be mounted on mobile mining equipment and can continuously and accurately measure respirable coal mine dust mass concentrations despite the rigors of the underground mine environment. Readings of dust levels are stored in computer memory and displayed to the machine operator. The display shows dust levels averaged over various intervals and a graph of the shift average as a function of time. The monitor also incorporates several automatic diagnostic functions to detect system failure or tampering.

Such a monitor will enable mine operators and regulatory personnel to identify specific mining practices that expose mine workers to excessive dust levels. Using information provided by the monitor, mine personnel can optimize mining procedures to reduce dust exposure to miners.

How it works

The TEOM® sensor in the MMCRDM uses a tapered vibrating tube to measure the mass of dust sampled from mine air. This tube or element (figure 2) is hollow and made of metal or an elastic, grass-like

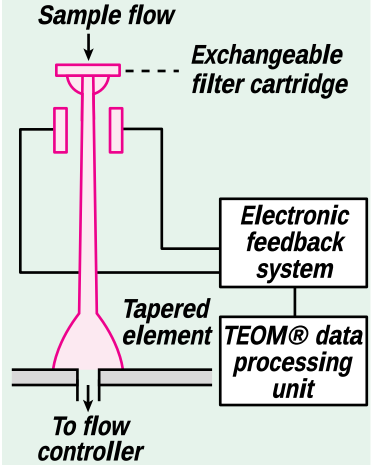


Figure 1.—Schematic of the TEOM® dust sensor

material. The wide end of the tube is firmly anchored; the narrow end supports a replaceable filter and is permitted to oscillate. By drawing air through the hollow tube, the monitor collects dust from the mine air on the filter. As the filter collects dust, its increase in mass causes the tapered element to vibrate slower. By measuring the change in frequency, an onboard computer calculates how much dust was collected on the filter.

An electronic feedback system keeps the element vibrating. The details of the feedback system vary by model; typically, however, the tapered element moves across the light path between a light-emitting diode and a phototransistor. Phototransistors generate electrical signals according to how much light they receive. The light-blocking effect of the vibrating element regulates the output signal of the phototransistor, which is then amplified. Part of the amplified signal is used to provide just enough energy to keep the element vibrating. The other part of the signal from the phototransistor goes to a counter and data-processing stage. Here, the frequency of oscillation of the tapered element is calculated and stored in memory.

Unlike many aerosol measurement technologies (e.g., light scattering) that measure some aerosol parameter

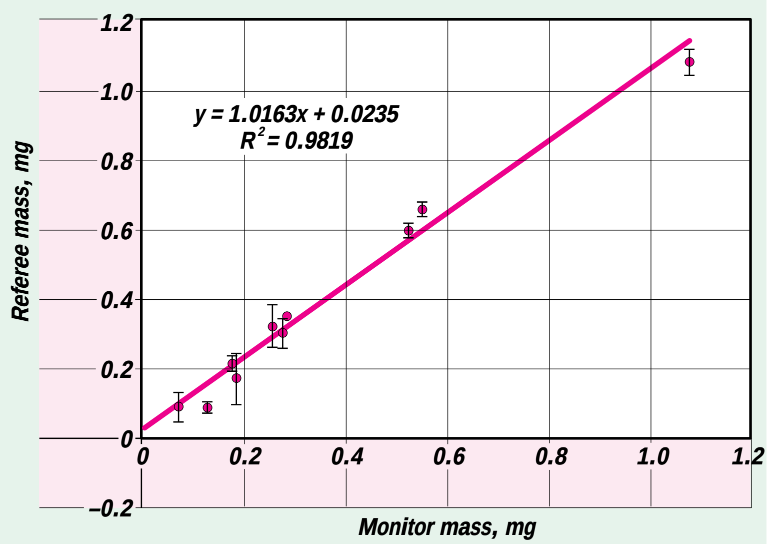


Figure 2.—Mass comparison between referee samplers and the continuous respirable dust monitor

correlated with mass, the TEOM® technique measures mass directly. Used with a cyclone or other appropriate dust size preclassifier, the instrument collects and measures respirable dust mass. However, because the TEOM® instrument indiscriminately measures mass collected on the filter, it would falsely assess any collected water droplets as aerosol mass. Changes in mine air humidity and temperature could also affect the response of the instrument. To eliminate or reduce the effects of humidity and temperature variations on the sensor, the monitor controls the inlet temperature to 50˚ C. Under these conditions, water aerosols evaporate, leaving only solid particles on the filter. Also, because TEOM® instruments operate by measuring the change in frequency of a vibrating element, vibrations from external sources can interfere with the measurement. A special suspension system was designed for the MMCRDM to prevent vibrations from the mining machine from disrupting the operation of the sensor.

Results

In initial tests, only the TEOM® transducer/sensor with the sample inlet and sample preclassifier were mounted on a continuous miner. Measurements were taken of mining machine vibration and respirable dust levels at the position of the sensor. Except for a consistent bias introduced by the preclassifier used in that version of the MMCRDM, the respirable dust readings compared well with those measured with conventional samplers. Baseline drift for the unit was less than 1 μg, suggesting that the sensor is adequately protected from environmental factors such as vibration and humidity.

In subsequent tests, preproduction versions of the MMCRDM were tested on both continuous and longwall mining sections. Figure 3 shows a comparison of total mass measured between the monitor and referee samplers using inlets and preclassifiers identical to those of the monitor. The comparison measurements are highly correlated and are well within the accuracy specifications of the monitor, ±25% with a confidence of 95%.

The Mine Safety and Health Administration plans to test 10 production versions of the MMCRDM in mines throughout the United States to help determine how best to use them to protect the health of miners.

Patent Status

NIOSH is not applying for a patent on this development; however, Rupprecht and Patashnick Co., Inc., Albany, NY, has patented the TEOM® aerosol mass-sensing technology. Commercial units are expected to be available in late 1997.

For more information

For more information about the MMCRDM and status of the development effort, contact Kenneth L. Williams or Bruce K. Cantrell, Ph.D., NIOSH Pittsburgh Research Center, Cochrans Mill Rd., P.O. Box 18070, Pittsburgh, PA 15236-0070, phone: (412) 892-6646 or (412) 892-4019, fax: (412) 892-6764, e-mail: kfw5@cdc.gov or bec4@cdc.gov

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MSHA Hazard Alert

Overtraveling roadways, berms, and water hazards cost lives

Since January 1995, 15 miners have lost their lives when the equipment they were operating or riding, either traveled through an established berm, overtraveled roadways and then overturned, or carried them into a pond or other water hazard.

These types of accidents can be reduced or eliminated if mine operators do the following:

• Enforce rules governing speed, direction of travel, right of way and use of headlights.
• Design haulage roads and traffic patterns to minimize the chances for operator error.
• Establish and maintain berms along elevated roadways and around water hazards which meet or exceed MSHA requirements.
• Route traffic away from water hazards and congested areas.
• Establish a preventive maintenance program which identifies and eliminates equipment defects before operation.
• Require operators to wear seat belts.

Security guard electrocuted at Ky. mine site

A security guard was electrocuted while standing atop a 4,160-volt transformer at a southeastern Kentucky mine site.

The Harlan County, Ky. Coroner said the victim, 53, of Closplint was killed instantly. A spokeswoman for the Department of Mines and Minerals said the victim was still standing inside the substation when his body was discovered around 10:50 pm, Aug. 18.

The accident occurred at the T.M. Fuels' Holmes Mill 1-A Mine—a contractor for Kricol Mining Co.

Officials could not immediately say why the victim would have climbed onto the transformer.

MSHA said it has not yet been determined if this case will be listed as a mining-related fatality.

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MSHA's first Assistant Secretary dies

MSHA lost one of its pioneers Aug. 29th in the passing of Bob Lagather, a career Labor Dept. employee who was MSHA's first assistant secretary. He died at his childhood home in Minnesota at the age of 71.

Lagather played a larger role in drafting the 1977 Mine Act—strengthening the 1969 Act and moving the enforcement agency from Interior to the Labor Dept.

He also made the decision to require self-contained self-rescuers for all underground coal miners.

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R&D BRIEFS: Productivity study

A recent study done by Miningtek found management and accounting systems to be the biggest obstacles to improving operating profit in the mining industry, as these systems tend to mask real costs and conceal opportunities to improve productivity.

The study, which tested data from 10 mines, reallocated costs according to real mining activities using labor, geology, mine layout, and cost data from a West Rand mine which produces about 210,000 tons of ore a month at an average depth of 1,400 meters. The results were built into a computer model, which was used to test what-if scenarios for existing productivity-improving techniques.

Success rates and cost data from six key techniques were applied to the model. The conclusion was that known systems could boost operating profit by 210 percent a ton milled, cut working costs by 1.5 percent, and boost ore grade by 13.3 percent.

The study found that the single most cost-effective way mines can boost productivity was by improving the drilling and blasting precision.

Most mines only blast once every three days, and while increasing the number of blasts gets the most attention, the model shows improved drilling produces a greater financial payoff more quickly. The techniques tested were:

- Leaving hydraulic overhead supports in place during blasting—though hydraulic drills cost more to maintain, they drill faster than pneumatic drills and require only one operator;
- Backfilling: filling the void left after blasting with a mixture of water concrete and crushed rock adds cost but improves safety and ventilation while cutting power and refrigeration costs;
- Precision ignition with electronic or percussion detonators;
- Water jetting accelerates the process of knocking down loose rock after a blast; and
- New systems for moving ore, known as continuous scrapers, cost 10 times as much as conventional systems but halve operating costs.

For further Information: Nick MacNulty of Miningtek, Johannesburg, S. Africa

MSHA Hazard Alert

Power line electrocutions

Cranes or trucks have come in contact with overhead power lines causing ten mining fatalities in the past four years.

If you operate equipment or work near overhead power lines, help protect yourself by observing these rules:

1. Follow safe job procedures.
2. Assume that all power lines are energized and stay a safe distance away at all times.
3. Boom guards, insulated lines, ground rods, and proximity warning devices have safety limitations. Power lines may still need to be deenergized and safe clearances maintained.
4. Know the location of all power lines. If equipment is moved in an area where power lines restrict clearance, a spotter should direct the machine's movement.
5. Warning signs should be posted at all locations where overhead power lines cross roadways and work areas. Areas where power lines restrict the safe operation of mobile equipment should be conspicuously marked.

The National Institute of Occupational Safety and Health (NIOSH) recently published an alert, "Preventing Electrocutions of Crane Operators and Crew Members Working Near Overhead Power Lines," DHHS (NIOSH) Publication No. 95-108. Request a copy by telephoning (800) 356-4674.

When you are out in public, have you noticed how many fire extinguishers you see in buildings? How many people, in your opinion, know how to properly use these extinguishers?

1. A fire extinguisher does not substitute for the fire department.

2. Always remember that you and your workmates are the most important persons at the fire site. Don't attempt to fight a fire that appears out of control. Get out and notify mine management

3. Remember the "P-A-S-S" word:
PULL—Pull the pin.
AIM—Aim the nozzle at the base of the flames.
SQUEEZE—Squeeze the handle lever.
SWEEP—Sweep the agent across the base of the flames.

Always allow yourself a safe route of escape. Fire extinguishers aren't made to put out big fires; they are made to put out small fires *BEFORE* they become big. Regularly inspect your extinguishers, and report any defects immediately!

Text reprinted from the The Penn State Small Mine Safety Newsletter, Vol. 1, created by the faculty, Miner Safety Training Program, Department of Mineral Engineering, The Pennsylvania State University; Joseph P. Flick, editor

Hazard Alert
Electrical

Since January 1986, 54 miners have been electrocuted operating or maintaining equipment.

"Improper lockout" claimed the lives of 23 miners:

Mechanical work—lockout and tag power circuits prior to working on equipment.
Electrical troubleshooting—lockout, tag, and ground power circuits that are to be deenergized prior to working on equipment. Do not troubleshoot high voltage circuit while energized.

Contact with overhead power lines took the lives of 12 miners:

Overhead power lines should be at least 10 feet above the extended reach of the largest unit of equipment used. Do not place stock piles under overhead power lines. Typically, overhead power lines are not covered with insulation.

Inadequate grounding was attributed to the deaths of 11 miners

Electrical equipment frames should be grounded by an effective equipment grounding conductor. The national electrical code can be used as a guide in installing an effective equipment grounding conductor.

Eight miners died in "other" electrocutions

Power tools must be either double insulated or provided with a frame ground.
All extension cords must be provided with a grounding conductor. Electrical equipment used in wet locations create an increased shock hazard and must be given extra care and maintenance.

Putting stress on hold

By Carol Krucoff
Special to The Washington Post

One of life's greatest conveniences is also one of its toughest tyrants. The telephone lets us talk to almost anyone, anytime, anywhere. But the price is often a pain in the neck—literally.

When it rings, we drop everything and dive for it. Many of us spend long hours in offices attached to the receiver, then continue yammering into cellular phones in our cars and regular handsets at home.

Most Americans get little or no physical activity, typically claiming "lack of time." Yet while at home, the average person spends 34 minutes on personal calls during a typical day, according to a survey conducted for American Telephone & Telegraph Corp. by Louis Harris and Associates.

To tame the telephone tyrant, here are six strategies for "phone fitness":

1. Never squeeze the receiver between your shoulder and neck. If you frequently make lengthy calls, invest in a headset to free your upper body from the tension of cradling the phone. (Electronics shops and office supply stores sell headsets for about $60 and up.) Speakerphones also offer hands-off use and are neck-savers when you're stuck on hold listening to Muzak.

2. Alternate ears. Most right-handed people hold the phone with their left hand at their left ear, and left-handed people usually do the opposite. Over time, these patterns can cause muscle imbalance and tension that can lead to pain and injury. Try answering and holding the phone with your right hand and right ear on even-numbered days and your left hand and left ear on odd-numbered days.

3. Whenever possible, stand and stretch while on the phone. Most Americans spend the majority of their days sitting, then wonder why they suffer from back pain, stiff muscles, and tight joints. AT&T encourages its customer service associates to stand and stretch while on the phone, notes Paula Lindabury, a site administrator at the company's Atlanta office. Many employees have ergonomic desks that enable them to raise and lower their computer keyboards, she says, so they can work while standing and sitting.

"We tell our employees to think of themselves as 'computer athletes' and run contests to see which group did more stretching," Lindabury says. "Sitting still is dangerous because lack of motion can cause injury." If you must sit, do some shoulder shrugs, neck rotations, or leg stretches.

At home, use a cordless phone and walk around while talking. Climb stairs or get on an exercise machine to work out while you chat. Remember, a good way to tell that you're exercising at a moderate intensity is the "talk test," which means you can carry on a conversation while moving.

4. Keep some "body tools" by the phone. While talking, massage tension spots with self-massagers such as the "knobble," a small, wooden acupressure knob, or the "theracane," which you soothe

hard-to-reach sore spots in your back. Available from Stretching, Inc. (800-333-1307). Or strengthen your hands and arms by gripping an egg-shaped Eggsercizer (800-858-EGGS).

5. Never answer on the first ring. Telephone calls frequently disrupt our already harried lives. So instead of racing for the receiver, "take a six-second tranquilizer," says Ronald Nathan, a professor of family practice at Albany Medical College in New York and author of several books on stress management. Wait six seconds, or about two rings before picking up the phone," he says. "Use that time to take a deep breath and visualize yourself as relaxed as a rag doll."

6. Try a "telephone meditation." Buddhist monks use temple bells to remind them to come back to the present moment, says Vietnamese Zen master Thich Nhat Hanh in his guide to mindfulness meditation, "Peace Is Every Step" (Bantam, 1991). "Every time we hear the bell," he writes, stop talking, stop our thinking, and return to ourselves breathing in and out and smiling."

Instead of being "victims of our own telephone," Nhat Hanh suggests that "the next time you hear the phone ring just stay where you are, breathe in and out consciously, smile to yourself, and recite this verse (which monks say when temple bells ring): 'Listen, listen. This wonderful sound brings me back to my true self.'" And remember: There's no law stating that you MUST answer the phone. Let a machine screen calls, and refuse to let the telephone interrupt important events, like your workout or a family dinner.

*Reprinted from the August 26, 1997 edition of the Washington Post's **Health** magazine.*

Some simple steps to lessen stress

Stressed out? Tense muscles, frequent headaches, fatigue, irritability and changes in your normal eating habits are all warning signs.

Prolonged stress not only makes you feel bad—it can literally make you sick. Stress raises your blood pressure and floods your system with hormones that magnify your risk for heart disease and other serious illnesses.

You may not be able to get rid of the sources of stress that challenge you, but you can learn to react more positively to them. Even if you're not calm by nature, you can reduce the ill effects of stress. How?

• Exercise regularly. Aerobic exercise such as brisk walking reduces stress hormones, improves mood, boosts fitness and regulates weight.
• Eat well, and include plenty of fruits and vegetables in your diet.
• Cut back on alcohol and caffeine.
• Get enough sleep. Fatigue magnifies stress.
• Learn—and then use—time management skills to create more free time for yourself.
• Cultivate enjoyable personal activities.
• Ask friends and relatives for needed support.
• Accentuate the positive and minimize the negative. For starters, replace critical, negative thoughts such as "I should never have done that," with more realistic positive messages, such as "I'll try to do things differently next time."
• Practice relaxation regularly. Here's one way to do it:

1. Sit comfortably with your eyes closed.
2. Relax all your muscles and begin to become aware of your breathing. Breathe slowly and deeply.
3. Each time you breathe out, repeat a phrase or word, such as "Relax," to yourself.
4. Ignore distracting thoughts that may intrude.
5. Continue relaxing and repeating your chosen phrase or word for 10 to 20 minutes.
6. Sit quietly for several minutes longer.

By making stress reduction techniques a priority in your schedule, you can look forward to a healthier body and a brighter outlook on the challenges in your life.

*Reprinted from the Fall 1997 issue of Georgetown University Medical Center's **Healthy Decisions**.*

Readers: Urge your buddies to work extra SAFELY during the Winter Alert!

THE LAST WORD…

Success is 99 percent failure—Soichiro Honda

The only time people dislike gossip is when you gossip about them.—Will Rogers

The chief value of money lies in the fact that one lives in a world in which it is overestimated.—H. L. Mencken

Good enough never is—Debbi Fields

Shoot for the moon… even if you miss you'll be among the stars.

Lots of people want to ride with you in the limo, but what you want is someone who will take the bus with you when the limo breaks down—Oprah Winfrey

The will to win is not nearly as important as the will to prepare to win.

I have a prodigious quantity of mind; it takes me as much as a week sometimes to make it up.—Mark Twain

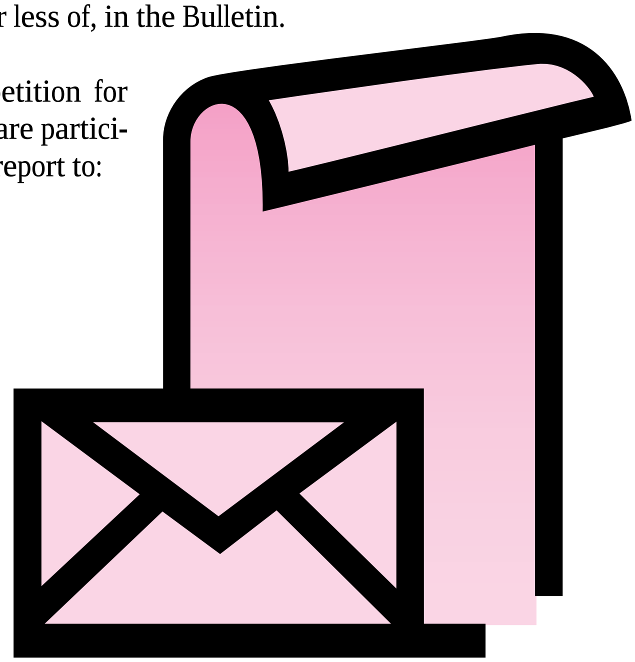
The only place you find success before work is in the dictionary.—May V. Smith

Be the change you want to see in the world.—Gandhi

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 1997 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 or at: MSHA—US DOL, 5th floor—EPD #535A, 4015 Wilson Blvd., Arlington, VA 22203-1984. Phone us at (we love to hear from you): (703) 235-1400

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*We are short of articles on metal/quarry safety and welcome **any** materials that you submit to the Holmes Safety Association Bulletin. We **DESPERATELY NEED** color photographs (8" x 10" glossy prints are preferred however, color negatives are acceptable—we will make the enlargements) for our covers. We **ALSO NEED** color or black and white photographs of general mining operations—underground or surface. We cannot guarantee that they will be published. If they are, we will credit the contributor(s) within the magazine. All submissions will be returned unless indicated.*

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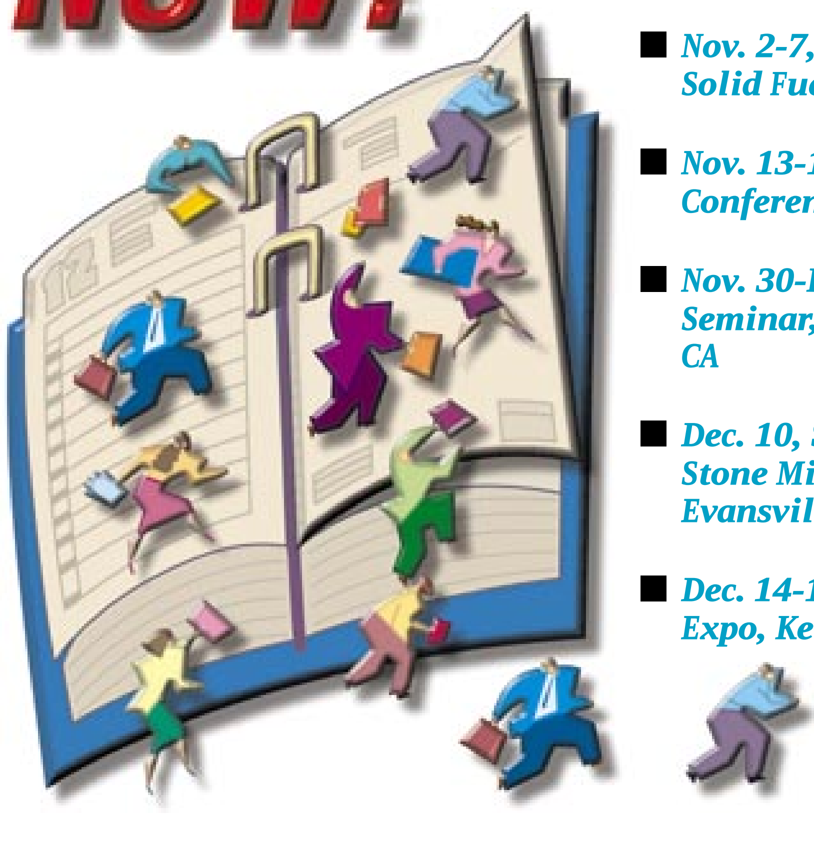

- *Nov. 2-7, Impact of Mineral Impurities in Solid Fuel Combustion, Kona, HI*
- *Nov. 13-14, Eighth Pennsylvania Blasting Conference, PSU Conf. Ctr., State College, PA*
- *Nov. 30-Dec. 3, 33rd Annual Int'l Cement Seminar, Century Plaza Hotel, Los Angeles, CA*
- *Dec. 10, Safety Seminar for Underground Stone Mines, Holiday Inn–Airport, Evansville, IN*
- *Dec. 14-16, Louisville Construction/Mining Expo, Kentucky Fair/Expo Ctr., Louisville, KY*