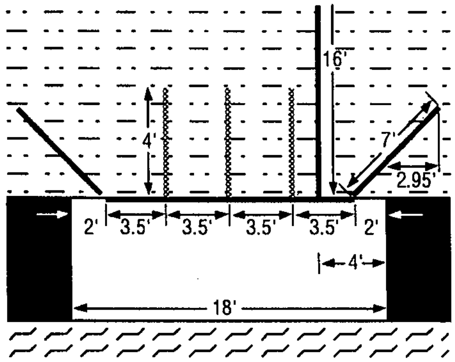
BULLETIN

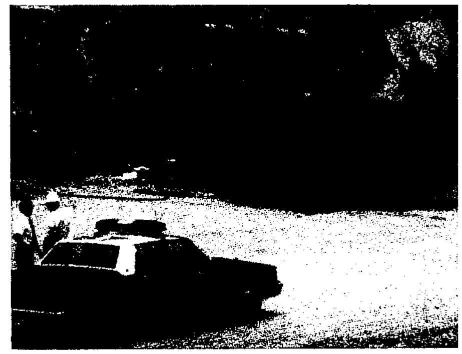
January 1994

Contents



Page 9

Page 16


Page 19

Please note: The views and conclusions expressed in HSA Bulletin articles are those of the authors and should not be interpreted as representing official policy of the Mine Safety and Health Administration.

KEEP US IN CIRCULATION

The Holmes Safety Association Bulletin contains safety articles on a variety of subjects: fatal accident abstracts, studies, posters and other 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.

Welcome new members

NAME	CHAPTER NO.	LOCATION
Tenney Const. Co.,Inc.	10669	Cottonwood, CA
Tracy Materials, Inc.	10670	Greenwich, NY
South Wallingford Plant	10671	Wallingford, VT
Fuller Sand & Gravel	10672	Danby, VT
J.K.L. Slate Co.	10673	Granville, NY
Empire Sand & Gravel Co., Inc.	10674	Billings, MT
Franklin Mill	10675	Franklin, NC
R & R Minerals, Inc.	10676	Millersburg, OH
Boorhem-Fields/Blackrock	10677	Blackrock, AR
Verkler Quarry	10678	Blackrock, AR
Black Springs	10679	Norman, AR
Intermountain Ireco, Inc.	10680	Whitehall, MT
Don Colgan	10681	Homer City, PA
Contra Costa Electric	10682	Bakersfield, CA
Nu West	10683	San Bernardino, CA
Somerset	10684	Hollsopple, PA
Seahawk Mine	10685	Townsend, MT
Southern Crane & Elevator	10686	Plano, TX
McIntosh Construction Co.	10687	Redding, CA
Lynn Trucking Co.	10688	Whitesville, WV
Teichent Aggregates	10689	Sacramento, CA
Beehive Mining	10690	North Pole, AK
Midwest Material Company	10691	Lacon, IL
North Central Materials, Inc.	10692	Manteno, IL
Tilcon New York, Inc.	10693	Haverstraw, NY

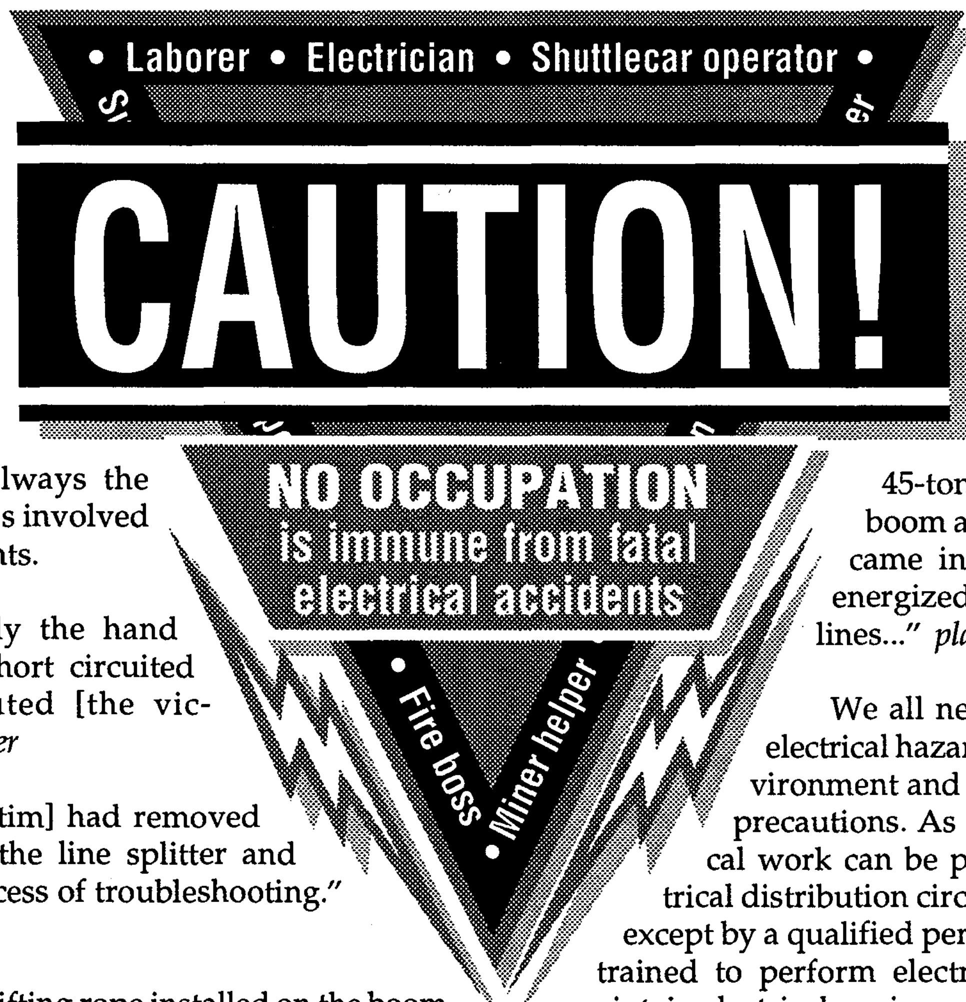
NAME	CHAPTER NO.	LOCATION
Donager No. 1 Mine	10694	Beaver, WV
Snoqualmie Falls	10695	Snoqualmie, WA
Santosh	10696	Scappoose, OR
Cobb Rock	10697	Beaverton, OR
Steilacoom Pit	10698	Tacoma, WA
Arlian Excavating	10699	Big Timber, MT
Otay Pit & Mill	10700	Chula Vista, CA
Dewitt Sand & Gravel	10701	Santa Rosa, CA
Sonoma Rock	10702	Sonoma, CA
Olancha Mine	10703	Olancha, CA
Red Hill Quarry	10704	Little Lake, CA
Orange Street Operation	10705	Redlands, CA
Masic Soil Conservation Co.	10706	Schoharie, NY
Collins Sand & Stone, Inc.	10707	Fairfax, VT
D & F Excavating & Paving	10708	Middlebury, VT
Barrett Paving Material	10709	Constable, NY
Barrett Paving—North Region	10710	Norwood, NY
Harlan Ky-Va Coal, Inc., #3	10711	Dayhoit, KY
Limousine Coal, Inc.	10712	Torrance, CA
Delco Coal, Inc., No. 1 Mine	10713	Dayhoit, KY
Delco Coal, Inc., No. 2 Mine	10714	Dayhoit, KY
Joseph P. Carrara & Sons	10715	New Haven, VT
Linda Sand & Gravel	10716	Marysville, CA
Mann Bros., Inc.	10717	Elkhorn, WI
Western Construction, Inc.	10718	Boise, ID

Fatal electrical accident alert

Listed below is the fatal accident history for the past five years in the coal mining industry.

	1988	1989	1990	1991	1992
UG mines	1	2	5	4	1
Surface areas of UG	1		2		
Preparation plants			1		
Surface mines	1	2			
Total	3	4	8	4	2

As of December 20, there were 8 fatal electrical accidents in the coal mining industry. Four were at underground mines, one at a surface mine, and three at preparation plants. A brief review of the preliminary accident report tells us that it's not always the electrician that's involved in fatal accidents.



"Apparently the hand held control short circuited and electrocuted [the victim]..." *carpenter*

"... [the victim] had removed the covers of the line splitter and was in the process of troubleshooting." *electrician*

"the metal lifting rope installed on the boom came into contact with one phase of a high voltage power line..." *assistant rigger*

"While holding onto the railrunner, the victim came into contact with the 300 volt DC trolley wire..." *fire boss*

"The victim was in a highline bucket truck repairing a power line to a pump (12,470 volt line) or lighting arrestor..." *electrical engineer*

"...was found lying on the mine floor beside the outby end of the Stampler feeder..." *scoop operator*

"...[the victim,] who was unqualified to perform electrical work, came in contact with an energized conductor—while trouble shooting..." *mine manager*

"The victim was setting the right rear leveling jack on the 45-ton crane when the boom and hook assembly came in contact with the energized 12,470 volt power lines..." *plant operator*

We all need to be aware of electrical hazards in our work environment and take the necessary precautions. As always, no electrical work can be performed on electrical distribution circuits or equipment, except by a qualified person or by a person trained to perform electrical work and to maintain electrical equipment under the direct supervision of a qualified person.

Holmes Safety Association Monthly safety topic

Fatal machinery accident

GENERAL INFORMATION: A 40-year-old mechanic, with 13-1/2 years of mining experience, was killed when he was crushed between the rib and the cutter head of a remotely operated continuous miner.

The mine produces an average of 900 tons of coal from one continuous-mining machine section each day. Employment is provided for 26 underground and 4 surface employees. The mine works two production and one maintenance shifts a day, five days a week.

DESCRIPTION OF ACCIDENT: At about 11:30 p.m., the maintenance crew entered the mine and traveled to the North Mains 003 working section. Upon arrival on the section, the foreman made an examination of the section and issued work assignments to everyone except the victim. The victim was assigned to complete repairs to the continuous-mining machine.

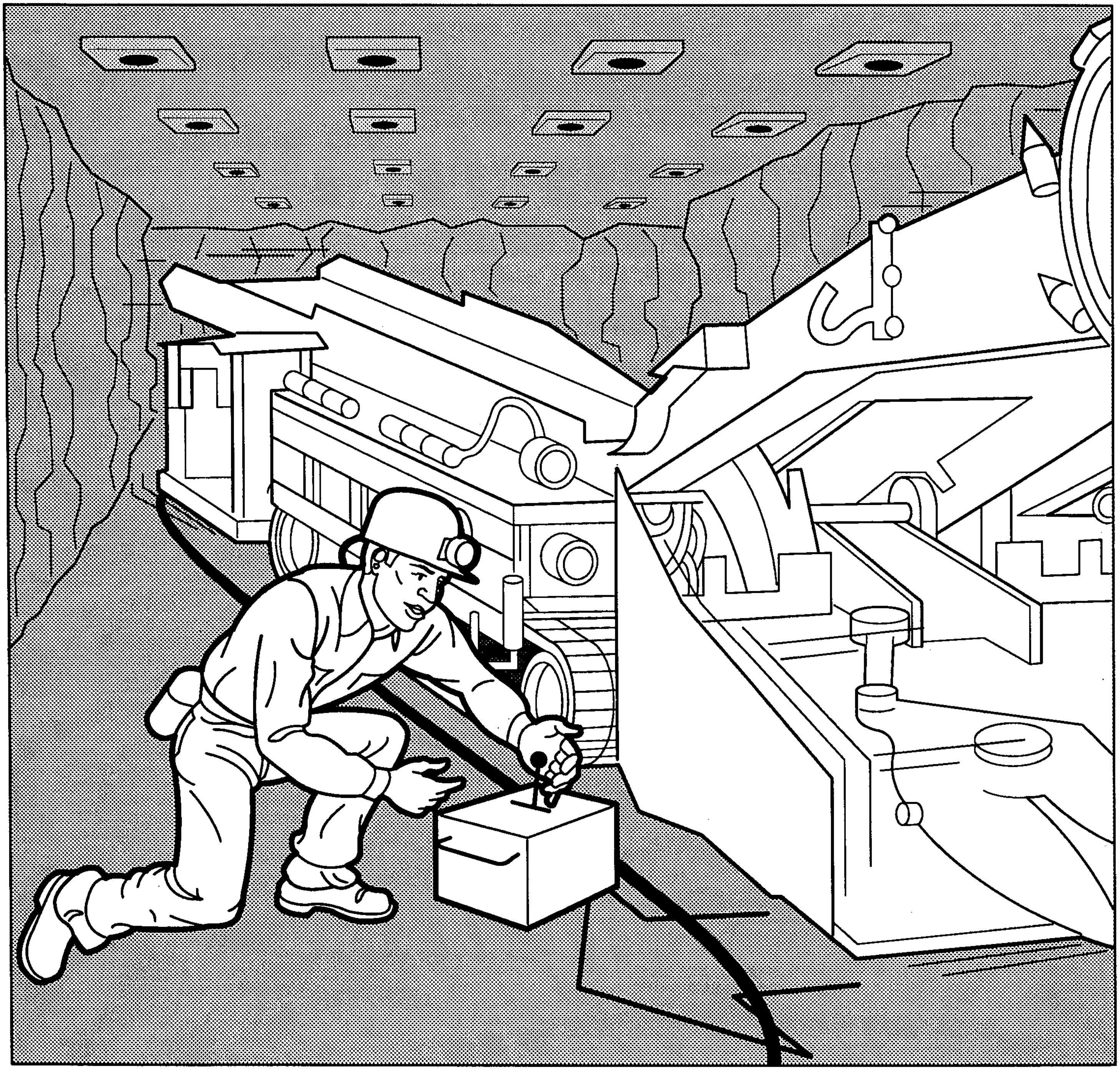
The continuous-mining machine was located in the last open crosscut between Nos. 3 and 4 entries. Although there were no witnesses, it is believed that the victim energized the continuous-mining machine, moved the machine approximately 10 to 15 feet into the No. 4 intersection, and began preparations to install the right side cutting head drum.

At about 4:50 a.m., the foreman left the belt tail to start his preshift examination. He traveled outby along the belt to the No. 2 belt drive. He then entered the No. 2 intake entry and traveled inby to the working section. The foreman then traveled inby in No. 4 entry toward the working face. The foreman could hear the pump motor of the continuous miner running and could see the lights were on. At about 5:45 a.m., the foreman arrived at the last open crosscut between Nos. 3 and 4 entries and observed the victim with his back against the outby coal rib and the right side of the cutterhead against his chest. The foreman checked for vital signs and found none. He then reached between the cutterhead and the victim and tried to move the continuous miner with the radio remote transmitter which was located between the victim's chest and the cutterhead. However, the mining machine would not tram. Using the on/off switch of the radio remote transmitter, he turned the pump motor off. He proceeded to the belt tail and informed two roof bolters of the accident and instructed them to go to the continuous miner and try to move it away from the coal rib to free the victim. The foreman telephoned the surface and gave instructions to call for an ambulance and to notify the superintendent and the mine foreman.

Attempts to move the miner with a hydraulic porta-power unit failed. Calls were made for another radio remote transmitter. A spare radio unit was not available at the mine and a spare was requested from a sister mine.

The mine examiner, an Emergency Medical Technician, arrived on the scene about 6:00 a.m. He checked the victim for vital signs and found none. About 6:20 a.m., the section foreman arrived on the section with the borrowed radio remote transmitter. He tried the transmitter, but the pump motor still would not start. He then pried the radio remote transmitter from the victim. With this unit, he started the pump motor, raised the cutterhead, but could not tram the machine.

A mechanic arrived on the section and changed the frequency on the radio remote transmitter and attempted to start the pump motor. However, with this change, the continuous miner still could not be started. At about 7:10 a.m., the safety director arrived on the section. A decision was made to by-pass the "man in position" switch to allow the machine to be controlled manually



from the operator's compartment. Following the procedure, the miner still would not tram.

About 7:30 a.m., the shop foreman and the scoop operator arrived on the section with two inflatable (75-ton capacity) air bags. When the bags were inflated the machine moved about 5 inches, allowing the victim to be removed, placed on a stretcher, and transported to the surface. Upon arrival on the surface, the victim was pronounced dead at 7:50 a.m. by the county coroner.

CONCLUSION: Although there were no eyewitnesses to the accident, the investigators concluded that the victim placed himself in a vulnerable position between the machine and the coal rib. The victim was operating the radio remote control transmitter from a location in front of the machine, thus all control functions would have been 180 degrees from the normal operation. Any operation of the controls may have resulted in a movement opposite to what the operator expected.

Impact assessment and blast design for surface mines with low-frequency vibration problems

Objective

Identify abnormal low-frequency blast vibrations. Develop blast design procedures for such adverse vibration cases, including the selection of delay times based on ground conditions, vibration frequency, and structural response.

The problem

Research by the Bureau of Mines and others has demonstrated how structural response and the potential for cracking and other damage depends on blast vibration frequency in addition to particle velocity amplitude. The Bureau has published recommended criteria for blasting near low-rise residential-type structures; criteria that specified frequency-dependent amplitudes.

The typical vibration frequency from surface mine and quarry blasting is 20 hertz (Hz). Sites have been found, however, that regularly produce ground-roll-type waves with frequencies as low as 4 Hz. The most serious cases are those where vibration frequencies fall in the natural frequency range for structures of 4 to 12 Hz. Such vibrations have a higher potential for causing damage to residential structures, particularly at the low end of this frequency range, because of the resulting high strains these frequencies produce in structural materials.

Vibration frequencies are influenced by such variables as geology, distance, and blast design (mainly delay intervals), and blast design is a controllable variable. At a minimum, operators must be able to identify a low-frequency problem, know what measures can be used to minimize the impacts, and what tools are required to provide increased design control of blast vibrations.

The approach

The Bureau studied low-frequency blasting vibrations from surface coal mines in Indiana with support of the Office of Surface Mining, Reclamation and Enforcement. The first mine investigated had extensive near-surface abandoned workings and a history of low-frequency vibration problems. The Bureau's propagation array data were supplemented by a year's worth of company- and State-collected data. During the year in which the data were collected, the mine employed a variety of blast designs including casting.

This first study was followed by a survey study of eight other Indiana surface coal mines. The objectives of the survey study were to determine if the low-frequency problem was site specific or widespread, how it was related to local geology and specifically sites undermined by old workings, and the importance of the blasting techniques in use.

Test results

Researchers found that many of the sites had occasionally experienced low-frequency (below 10 Hz) and long duration (up to 8 seconds) blast vibrations. It was also found that such vibrations could be generated at both undermined sites and those with thick, low-velocity surface layers. Based on traditional methods for calculating charge weights per delay, vibration amplitudes were found to be abnormally nigh. This finding added to the evidence that the long-standing 8-millisecond minimum separation criterion was not sufficient to separate charges for such low-frequency cases. In addition, vibration frequencies were predominantly determined by the propagating media (geologic structure, composition, and old mine workings) and were slightly, if at all, responsive to changes in delay intervals. It is significant that these production blasts used standard pyrotechnic initiators with standard delay errors.

Some preliminary tests with experimental precision timing suggests increased control of both vibration characteristics and fragmentation performance. For low-frequency problem sites, this would mean an increased range at which blast design can influence vibration. Sites that were not previously controllable may become so. Widespread availability of precision initiators promises to greatly expand the capability for effective, efficient, and safe blasting.

For more information

The results of the Bureau's vibrations studies have been published in several Reports of Investigations (RI) including: RI 8507, "Structure Response and Damage Produced by Ground Vibration From Surface Mine Blasting;" RI 8896, "Effects of Repeated Blasting on a Wood-Frame House;" RI 9026, "Effects of Millisecond-Delay Intervals on Vibration and Air blast From Surface Coal Mine Blasting;" RI 9226, "Comparative Study of Blasting Vibrations From Indiana Surface Coal Mines;" and, RI 9078, "Low-Frequency Vibrations Produced by Surface Mine Blasting Over Abandoned Underground Mines."

To learn more about these studies or obtain copies of these reports, contact:

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Twin Cities Research Center
U.S. Bureau of Mines
5629 Minnehaha Avenue South
Minneapolis, MN 55417-3099
(612-725-4598 or 612-725-4574)

*Reprinted from the Bureau of Mines' April 1990 issue of **Technology News.***

"No-fault" insurance

Case 1: You are driving on a city street and there's a car ahead pulled off to the right side of the road with its right turn signal flashing. Just as you're about to pass it, it pulls away from the curb and you plow into its left rear door.

Case 2: You are stopped in an intersection waiting for a break in traffic to make your left turn. Suddenly, some idiot rear-ends you, driving you into the on-coming traffic where you are broad-sided. Fortunately, no one is seriously hurt.

Who's at fault in these accidents? In both, the police will charge the driver of the other vehicle. But in both, you could have prevented the accident by practicing defensive driving skills.

When about to pass the car at the curb, a defensive driver would have noted the possible danger signal that there was still someone behind the wheel, ignored the right turn signal, slowed down, and "covered" the brake and horn in order to be able to use both at the slightest movement of the other vehicle's left-front tire. He/she would also have been aware of any other vehicles around and had an escape route planned.

When waiting for the left turn, a defensive driver would have checked the mirrors every two seconds to look for potential trouble, had an escape route planned, and kept his/her front wheels straight rather than turned to the left, so that if he/she was hit, the car would be driven forward rather than into the path of on-coming traffic.

When an accident happens, it's nice to be able to report to family and friends that "It was the other guy's fault" - nice if you're still uninjured and alive to report it. In both of the above accidents, someone could have been killed. Then, whose fault it was becomes a lot less important.

Defensive driving involves two things effective seeing habits, and maintaining appropriate space around your vehicle, not just in front of you, but all around. It is a set of skills that can be learned like any other. And if practiced until they become habit, defensive driving skills could save your life or the lives of family members.

Defensive driving is your insurance that even when it is the other guy's fault, you'll live to tell about it.

*Reprinted from Ontario, Canada's Mines Accident Prevention Association's September 1993 issue of **Safety Reminder.***

Anticollision systems for large mine-haulage trucks

Objective

Prevent collisions between large mine-haulage trucks and smaller vehicles parked in areas not visible to the haulage-truck operator.

Approach

Two electronic systems were developed to detect the presence of vehicles in the blind areas of a parked haulage truck. The systems can warn haulage-truck operators of presence of vehicles that are blocked from view. The systems do not apply for trucks in travel.

How it works

The systems use electronic transmitting techniques-one system is based on low-frequency radio waves and the other on very-high-frequency radio waves. Each system requires that a signal transmitter be mounted on the smaller vehicle to be detected. Continuous signals from this transmitter are sensed by receiving antennas mounted on the right front and rear of the large haulage truck. Upon receiving a signal, the receiver energizes warning lights and a buzzer in the cab of the haulage truck, alerting the operator to a possible collision hazard. Detection distance is adjustable, depending upon the size of the haulage truck, but a minimum of 30 feet was the design goal.

Test results

In-mine testing and debugging of each system took place over several years at both surface metal and surface coal mines. Each system type performed well and accomplished the goal of monitoring the blind areas of a parked haulage truck. During testing the low-frequency system prevented a possible accident by alerting a haulage truck operator to the presence of a pickup in the blind area of the truck.

The systems tested address only the problem of relatively restricted blind areas around large mine-haulage trucks. The detection distances are intended to be small, which restricts the systems to use when the haulage truck first starts moving.

Each system offers an approach to collision protection. Additional system improvements with respect to costs, maintenance, and ruggedness would be desirable, and further private sector product development efforts are recommended.

For more information

More information on the Bureau's hardware development and in-mine evaluation is available in Report of Investigations (RI) 9212, "Anticollision Systems for Large Mine-Haulage Trucks." For single copies of this RI or additional technical information, contact the principal investigator:

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Twin Cities Research Center
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5629 Minnehaha Avenue South
Minneapolis, MN 55417-3099
(612-725-4631)

Reprinted from the Bureau of Mines' April 1990 issue of Technology News.

REMINDER: The Winter Alert is still in effect!

- *Rockdust*
- *Preshift and onshift checks*
- *Check for methane frequently*
- *Keep equipment maintained*
- *Check the roof—especially near mine entrances*
- *Check ventilation often*
- *NEVER smoke underground!*

Mettiki overcomes abutment pressures

Mine operators join forces with university and roof support manufacturer

By Thomas M. Wynne, John C. Stankus, and Syd S. Peng

Beginning in 1976 as a continuous miner operation, the Mettiki Coal Corp., located in Garret County, Maryland, has mined low-volatile steam coal from the Upper Freeport seam. In late 1985, longwall mining was introduced to gain a more competitive edge in the marketplace. The Mettiki mine now averages 2.5 million tons per year.

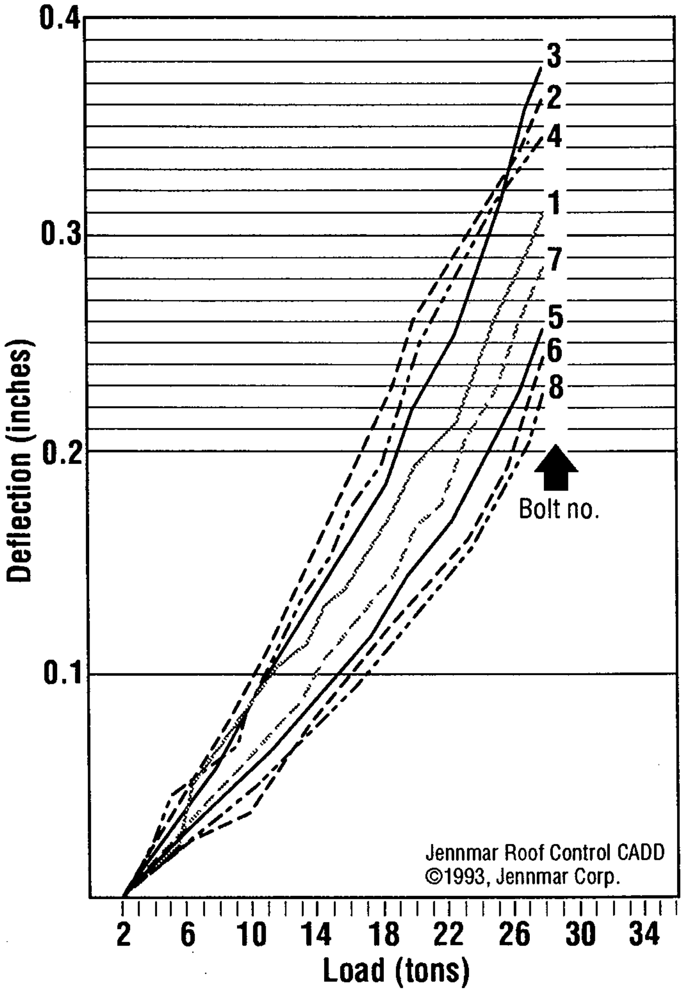
When recovering the longwall faces on the first two panels, the mine saw adverse roof conditions due to high abutment pressures. On the third panel, the longwall mined into a predeveloped recovery room, sometimes referred to as a teardown room. The teardown room was 16-feet wide and had one row of concrete fiber-reinforced cribs adjacent to the coal block, which were cut by the shearer prior to longwall completion.

This teardown system worked well for the next 11 panels until reaching the first panel in the D-mine reserve—panel 14. Roof control problems were encountered when the wire mesh was installed 35 feet before the end of that panel. When the panel's advance rate was slowed to install the wire mesh, the abutment pressures overrode into the small coal block between the shields and the teardown room.

The second panel in the D-mine reserve—panel 15 encountered similar problems. The immediate roof in front of the shields failed before reaching the teardown room. The wire mesh process in panel 15 was stopped and polyurethane glue was injected into the roof to provide stability to the immediate roof. The longwall remained 20 feet from the teardown room for two weeks until the gluing process was complete. The remaining coal block was mined, but material costs and production losses were extremely expensive.

As a result, a new solution was needed for recovering panel 16. Conventional methods (i.e., wire mesh and bolting the immediate roof), such as those previously attempted, were ruled out due to the high abutment loads that had been experienced in the previous panels. A method was needed that would eliminate the exposure of

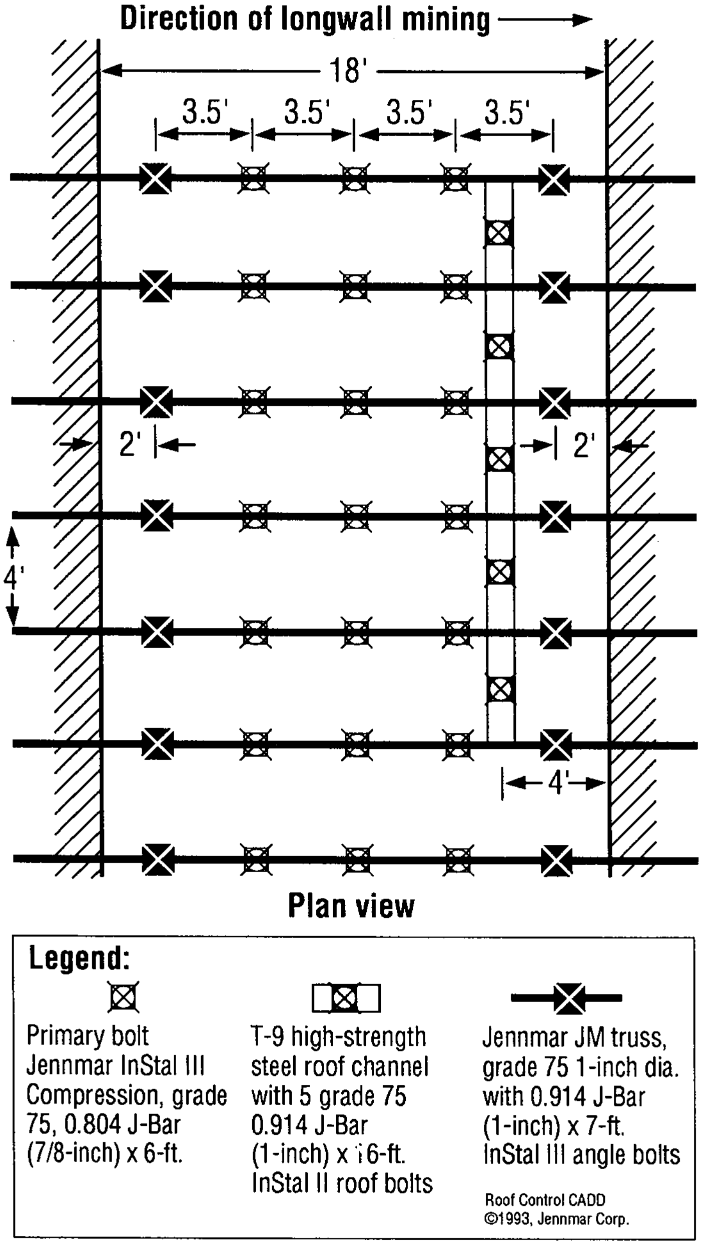
Figure 1.—A computer plot of the pull test shows applied load versus recorded bolt head deflection.



Tests 1-4 Jennmar InStal II, grade 75, 0.914 J-Bar (1-inch) x 16 ft., W/J-15' expansion shell with shear pin, high-strength steel coupler with roll pin, anti-friction and round hardened-steel washer, 2 equivalent ft. resin

Tests 5-8 Jennmar InStal II, grade 75, 0.914 J-Bar (1-inch) x 7 ft., W/J-15' expansion shell with shear pin, anti-friction and round hardened-steel washer, 2 equivalent ft. resin

Figure 2.—As the first stage of primary roof support (plan view) in the 18-foot-wide pre-driven room is installed, the 16-foot bolts and T-9 channels were placed close to the outby rib. Trusses were installed for the entire length of the recovery room.



face workers to hazardous conditions.

Mettiki decided to develop a 36-foot- wide teardown room. The area's roof would be prescreened and reinforced, eliminating any slowdown in the longwall's advance rate. The roof support for the 36-foot-wide room would require similar or greater strength than that of the Freeport coal pillar.

A joint project was proposed involving Mettiki Coal, Jennmar Corp., and West Virginia University's (WVU) mining engineering department. Mettiki Coal initially proposed the basic recovery plan and Jennmar was chosen to design the support plan and manufacture the systems to be used in both the recovery room and adjacent recovery chutes. To collect as much data as possible for future longwall applications, WVU designed and implemented detailed instrumentation in the recovery area. After thorough reviews by Mettiki, Jennmar, and WVU, the final plan was submitted to MSHA for approval.

Roof control plan

Jennmar designed a roof control plan for the proposed full-face recovery room and three chutes coming off the room. The three chutes would be used for removing equipment from the recovery room.

Figure 3.—A cross-sectional view shows the anchorage depth.

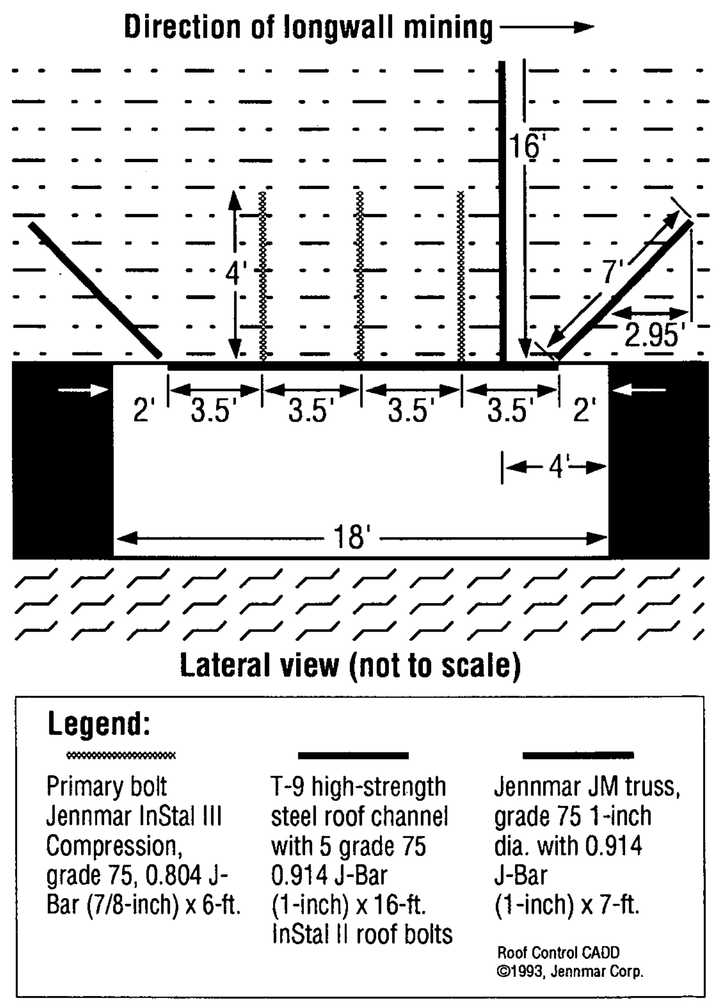
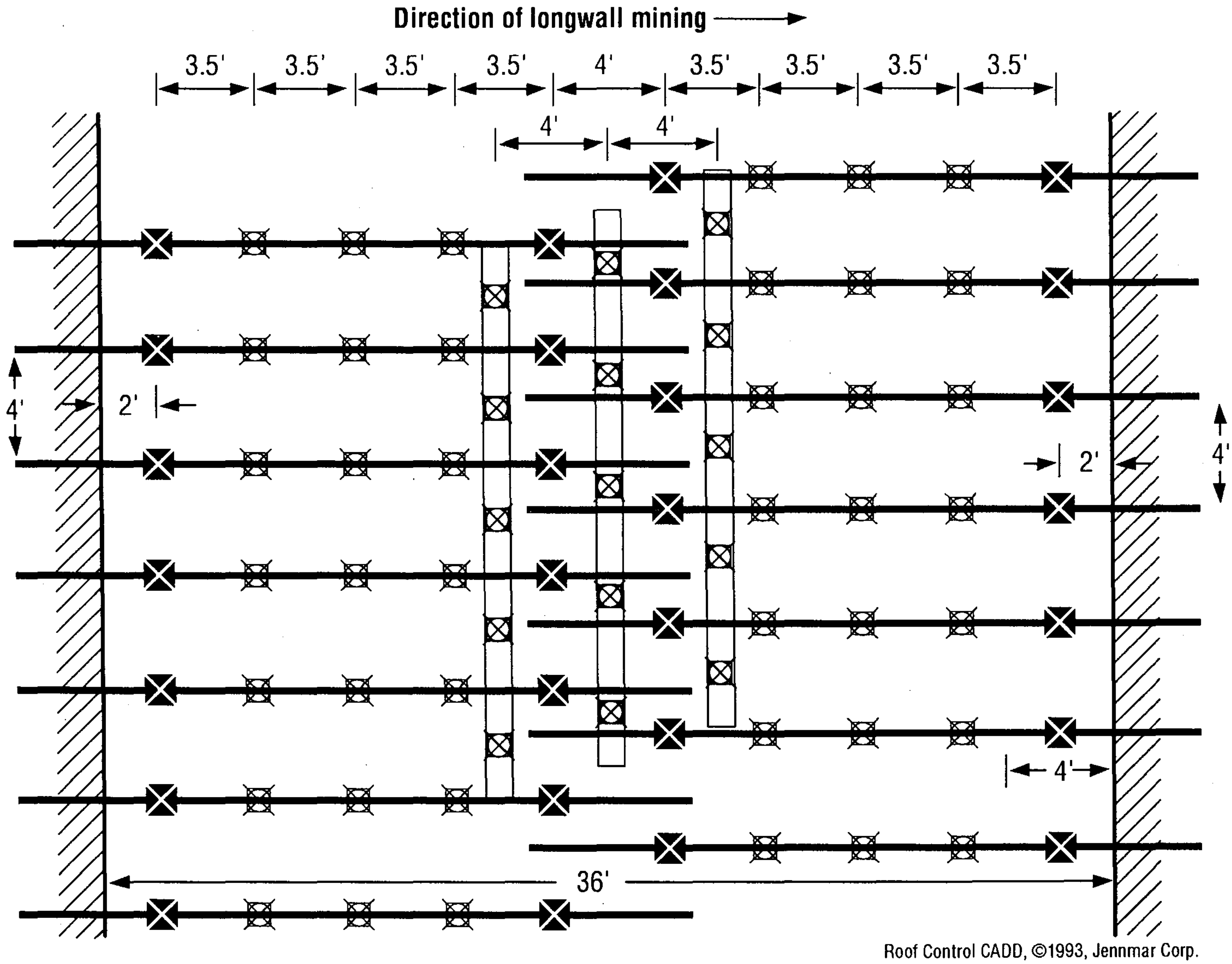


Figure 4.—This plan view describes the final bolting arrangement in the recovery room after it has been widened from 18 feet to 36 feet. The 16- foot bolts and the T-9 channel were instrumental in the roof control plan.

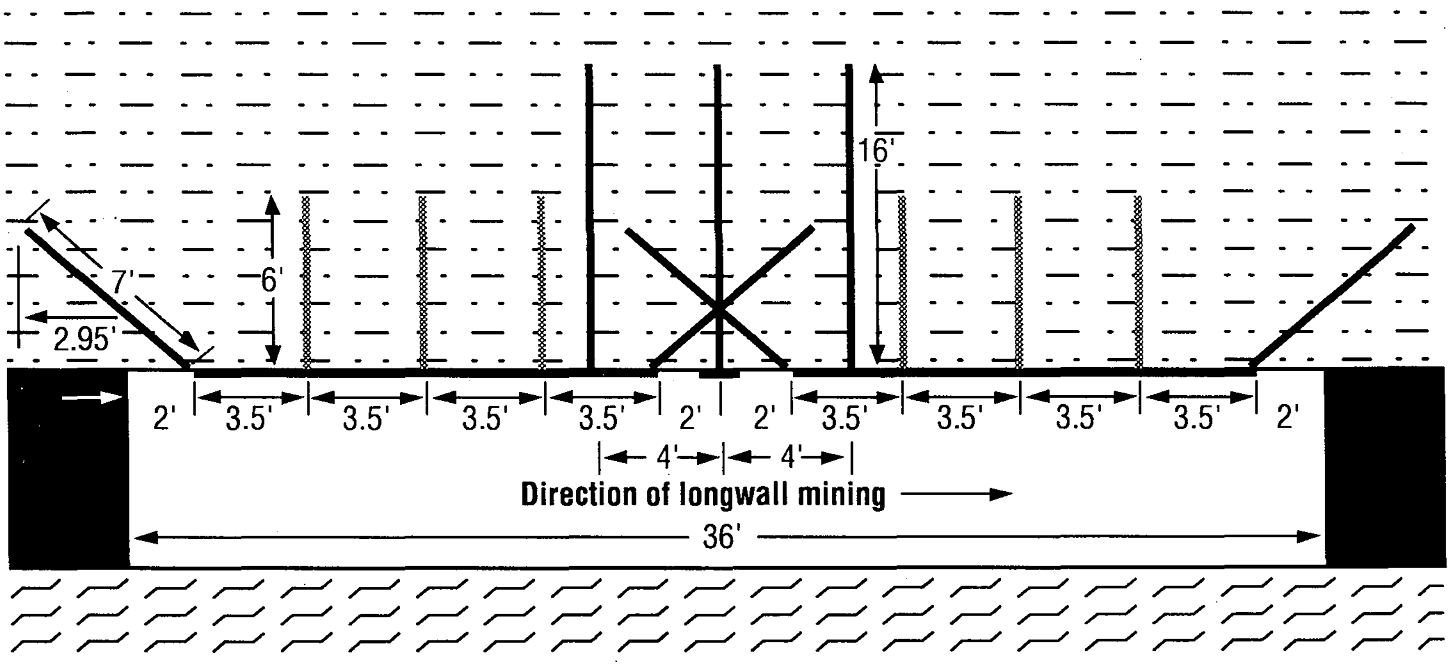


The preliminary plan, as proposed by Mettiki personnel, called for a 36-foot-wide recovery room that would be wire-meshed and wire-roped prior to the longwall recovery. The room would run the entire panel width of the 750-R termination line.

The plan called for the longwall to mine directly into the room without the normal delays associated with wire mesh and roof bolting. The room and chutes were to be developed in three stages. Initial 18-foot-wide entries would be driven across the panel at the termination line. Concrete fiber-reinforced cribs were to be installed on the longwall side of the entry. The outby side of the entry would then be mined and widened an additional 18 feet, making the total width of the room 36 feet. Support systems then were to be installed in the widened portion of the room. The third stage called for supplemental support systems in the three entries chosen to serve as recovery chutes.

Before final design of an appropriate roof control system began, an intensive stratascope analysis of the mine roof strata was conducted in the recovery room and in the outby entries, including the three chosen for recovery chutes. The immediate mine roof was found to be comprised of laminated light to medium grey, sandy shale and

Figure 5.—A cross-sectional view of the final recovery room shows how the 16-foot bolts that were placed at the midspan of the entry bear the brunt of pressure.



Legend:

Primary bolt Jennmar InStal III Compression, grade 75, 0.804 J-Bar (7/8-inch) x 6-ft.

T-9 high-strength steel roof channel with 5 grade 75 0.914 J-Bar (1-inch) x 16-ft. InStal II roof bolts

Jennmar JM truss, grade 75 1-inch dia. with 0.914 J-Bar (1-inch) x 7-ft. InStal III angle bolts

Roof Control CADD, ©1993, Jennmar Corp.

shale. Some sandstone was detected higher up in the strata.

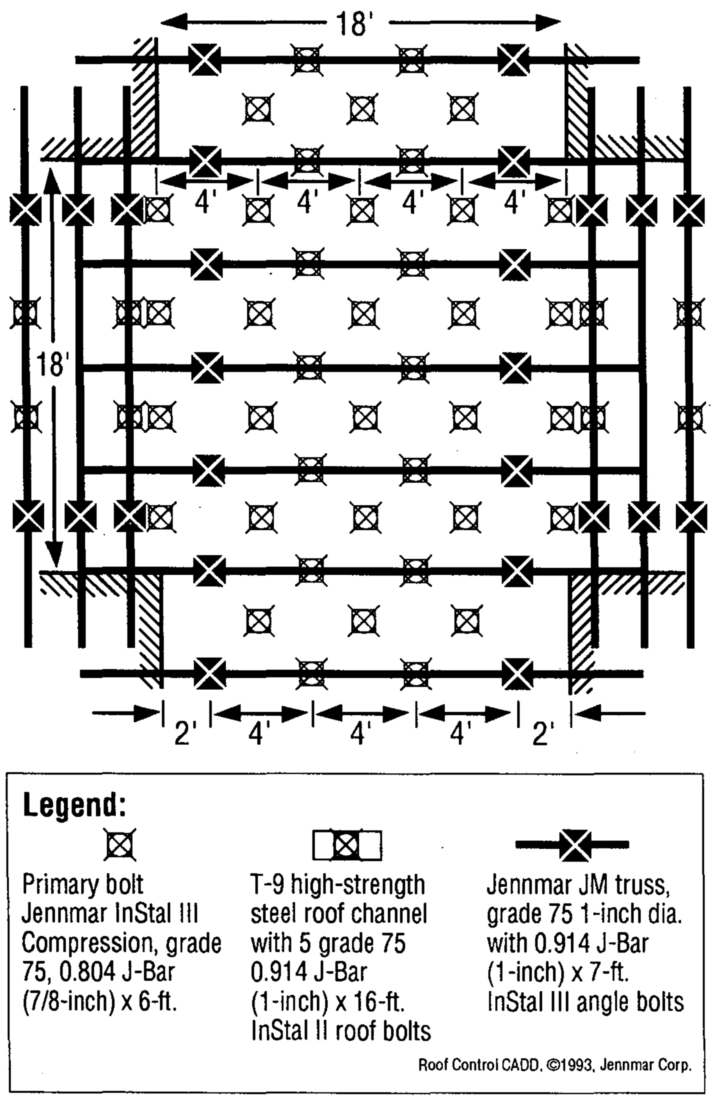
The stratascope analysis did not indicate any significant fractures or bed separations in the immediate mine roof strata. This observation would indicate that an adequate beaming effect was being achieved with the primary support system. Due to the frontal abutment pressures experienced, however, larger and stronger support systems would be required to supplement the primary plan in both the recovery room and the chutes.

The primary support system in this area usually consists of 6-foot-long, 7/8-inch-diameter J-Bar, InStal Compression roof bolts (all bolts referred to in this article are grade 75). This bolt comes equipped with a resin compression ring and anti-friction washer and is installed at an average load of 25,000 pounds (lb). A minimum of 2 equivalent feet of resin is used with each installation.

The design goal of the roof control systems was to "stiffen" the recovery room and chutes to such a degree that the abutment pressures would override these areas and safely dissipate over the outby coal pillars. To provide a large safety factor for a first-time attempt at a recovery room this wide, the primary support system in the recovery room and chutes was supplemented with 1-inch-diameter JM roof truss systems using 7-ft-long, 1-inch diameter J-Bar, InStal angle bolts.

Truss systems were chosen primarily to deal with anticipated high abutment pressures. Installing the angle bolts as close as possible to the coal rib on the longwall side of the room also ensured support interaction between the shield and truss system before the longwall cut into the recovery room. This interaction would prevent any roof failures between the shield tips and the recovery room at the moment just prior to cutting through into the recovery room when only a narrow fender of coal remained.

Figure 6.—Crosscuts in the recovery chutes were beefed up with trusses as well.



Prior to implementation of any of the larger support systems, pull tests were conducted to determine anchorage capacity. From the pull test data, it was determined that the anchorage capacity of the roof strata at the various anchorage horizons was more than adequate.

Trusses were placed in conjunction with the primary system. In addition to the truss systems, supplemental support in the form of 16-foot-long, 1 -inch diameter vertical bolts were installed with high-strength T-9 roof channels. These bolts and channels were installed "skin to skin" for the entire length of the room. Opposing the channel on the longwall side, concrete fiber-reinforced cribs were set in place before the room was widened.

Widening the recovery room to 36 feet necessitated the most complex part in the design of the roof support plan. Again, 1-inch-diameter truss systems were chosen for the widened area. The spacing of the trusses was offset 2 feet from the previously installed trusses (Figures 2 and 3). The offset in spacing was designed to prevent any interference in angle bolt anchorage between trusses, avoid excessive stress concentrations in localized areas and ensure more uniform roof reinforcement.

More importantly, however, the offset in truss spacing permitted the installation of the 16-foot vertical bolts and channels (Figures 4 and 5). The vertical bolting at midspan is the key design feature. A span of this width would be very difficult to support by truss bolts alone; placing the 16-foot vertical bolts and channels with the offset provides complete support interaction between all of the systems.

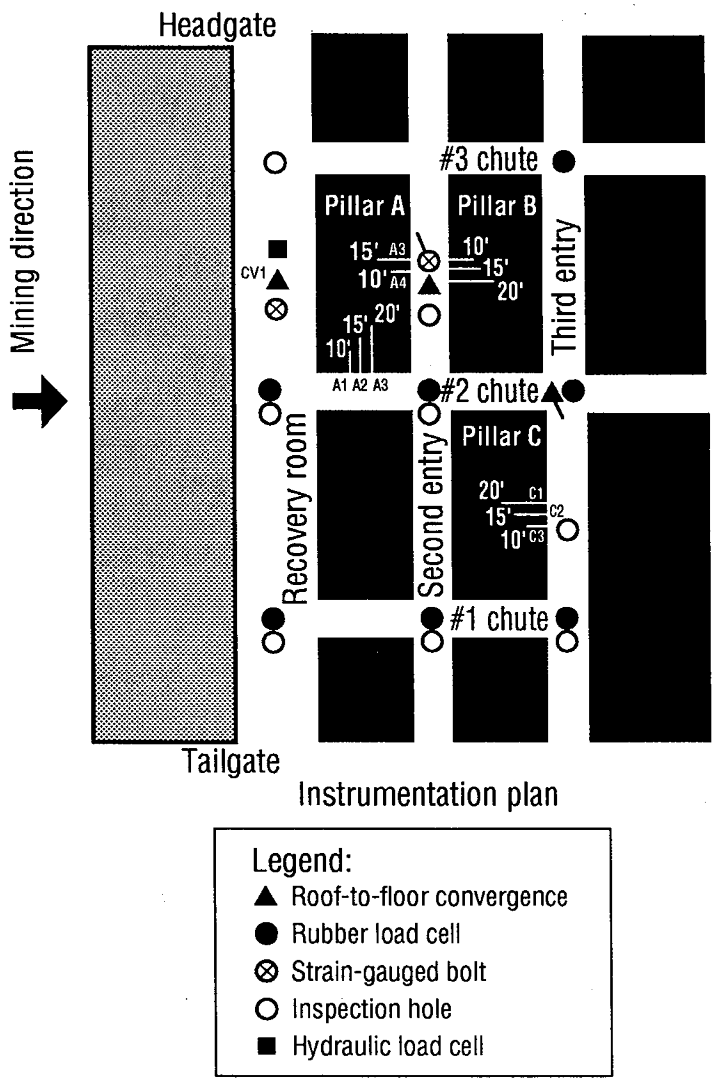
As will be seen later, the 16-foot bolts relieved much of the pressure from the shields when it came time to lower and remove each shield. Once the support systems, wire mesh, and wire rope was complete, concrete fiber-reinforced cribbing also was installed in this side of the recovery room.

The final stage in the support plan called for the installation of supplemental support in the three entries chosen to serve as recovery chutes. Trusses were spaced 4 feet apart for the entire length of all three chutes. Each 4-way intersection was further supplemented with 26, 16-foot, 1 -inch-diameter vertical bolts (Figure 6). These bolts were installed with high-strength, 8-inch x 8-inch x 0.5-inch bearing plates. Also, carrier trusses were installed in each intersection to prevent any possible roof failure due to the pressure shift that could be induced by the trusses installed in the entry.

Rock mechanics

To provide a quantitative assessment of the roof control plan for safe and economic longwall recovery in subsequent panels, the following rock mechanics instrumentation plan was implemented (Figure 7):

Figure 7.—WVU used a rigorous instrumentation plan that allowed the operator to check for overkill.



- 11 vibrating-wire stress meters were installed 10-, 15-, and 20-feet deep into the pillars to measure abutment pressure in Pillars A, B and C;
- Two roof-to-floor convergence stations were installed to measure entry stability in the recovery room and the intersection of #2 chute and #3 entry;
- Two strain-gauged bolts were installed to measure bolt load at various roof horizons in the recovery room and the #2 entry;
- Seven calibrated rubber load cells were installed between the roof line and bearing plate to measure overall bolt loading;
- High-capacity hydraulic load cells were installed on two concrete cribs in the recovery room to measure abutment loads; and
- Eight boreholes were drilled into the roof for stratascope analysis to monitor the development of fractures/bed separations.

Readings were taken regularly beginning when the longwall face was 45 feet from the recovery room until two weeks after the recovery operation was completed. The computer program *"Roofbolt"* was used to calibrate the measured data which will be used on future recovery support plans.

The measured maximum value of 50,000 lb. was well below the bolt yield of the l-inch-diameter systems chosen. This value, however, did exceed the yield strength of a 7/8-inch rod, so it was appropriate to use 1-inch diameter material for the entire design.

The gob edge of Pillar A yielded 15-feet deep and the remaining portion remained intact. Thus, pillar size was sufficient to protect the integrity of the second entry. The loads imposed on the concrete cribs during the whole process were well below the ultimate strength of the concrete cribs. Thus, in future panels, reducing the amount of concrete cribs would be desirable.

The longwall cut successfully into the recovery room without any incidents. As the face approached the recovery room, it was able to maintain a normal rate of advance mainly because the roof and coal face remained intact throughout the recovery operations.

The longwall cut across the recovery room and through the remaining concrete cribs without incident. All three recovery chutes remained intact, enabling quick withdrawal of face equipment. The vertical 16-foot l-inch diameter bolts and channels installed in the center of the recovery room caused the roof to "hang," enabling workers to lower and turn individual shields without adverse roof pressure experienced on previous moves. The entire move was completed in record time with no roof control problems.

Reprinted from the May 1993 issue of ***Coal*** *magazine.*

Author information: *Wynne is engineering manager for Mettiki Coal Corp., Stankus is a vice president for Jennmar Corp., and Peng is chairman of the mining engineering department at West Virginia University.*


CHECK
THE ROOF
frequently
while
working

Technological advances to self-contained self-rescuers can help save lives in mine emergencies

Steve Walker, Sales Representative, MSA
Third Vice President, Holmes Safety Association

People involved in the mining industry are well aware that prevention of mine disasters, such as fires, explosions or cave-ins, represents the best means for protecting the lives of underground miners. But we also know that we live in an imperfect world fraught with miscalculations, human error and circumstances at times beyond our control. That's precisely why the Mine Safety and Health Administration (MSHA) requires the stocking of a self-rescuer for every miner underground.

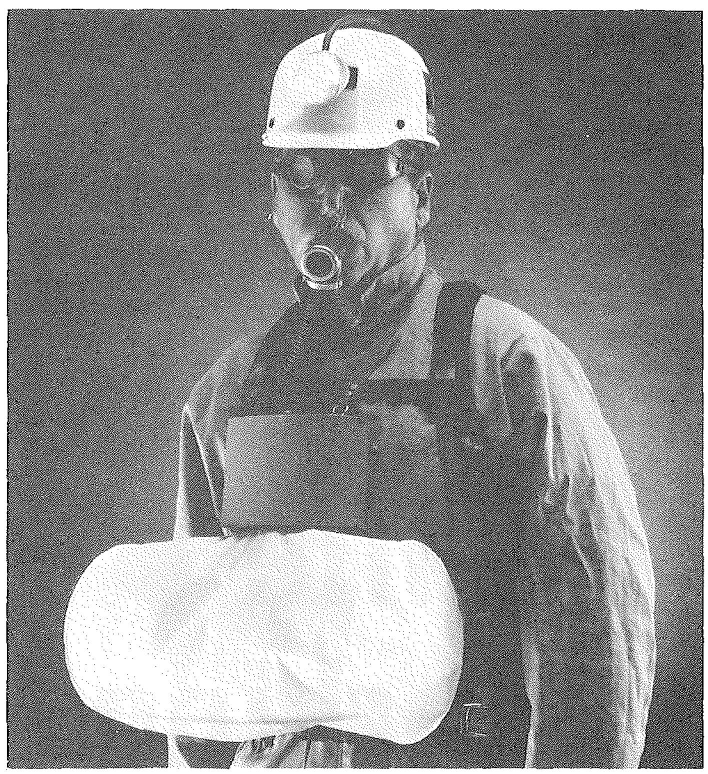
The purpose of self-rescuers is to provide miners that are either trapped or find themselves confronted with unbreathable atmospheres with a fighting chance to escape or hold out until rescue. We all know that underground miners caught in an emergency situation face little likelihood of survival without a suitable air source at hand.

Self-rescuers have long been a staple of the miner's safety equipment inventory. However, recent advances in technology have resulted in the development of self-rescuers that enhance a miner's chances of survival even further.

An example of this new generation of self-rescuers is the recently revamped Portal-Pack® self-contained self-rescuer (SCSR) from MSA, which contains a host of new features that probably could not even have been imagined 77 years ago when MSA introduced the world's first self-rescuer.

Unlike Filter Self-Rescuers (FSRs) that only purify air, the Portal-Pack SCSR actually gener-

The ergonomically designed Portal-Pack SCSR fits comfortably against the wearer's body when worn on the belt.



The Portal-Pack SCSR is the lightest 60-minute SCSR available and the only SCSR with a communications capability.

ates its own oxygen, sustaining life not only in the presence of smoke and toxic gases but also in areas that lack oxygen.

It is also the only SCSR to feature a voicemitter, a communications device that allows the wearer to speak without removing the mouthpiece. This ability to communicate can be beneficial during an emergency, particularly when visibility is poor and when a search/rescue is under way. The voicemitter can transform muffled speech into clearly enunciated calls for help.

Weighing only 5.4 pounds (2.43 kg), the Portal-Pack SCSR is the lightest 60-minute SCSR available. Its ergonomic design permits a comfortable fit against the wearer's body when worn on a belt.

The Portal-Pack SCSR is rated to supply 60 minutes of respirable air under moderate-to-heavy workloads. If the wearer remains at rest, the Portal-Pack SCSR can provide air for more than four hours, precious time during which a rescue can be accomplished.

Oxygen is generated through internal chemical reactions from two sources. One source of oxygen is a "chlorate candle," which is used to start the unit. Another involves potassium superoxide (KO_2), which produces oxygen when exposed to moisture exhaled in the breath of the user. The rate of the latter chemical reaction is determined by the amount of moisture and carbon dioxide in the user's breath. In other words, oxygen is produced and carbon dioxide is removed according to the user's breathing rate. The Portal-Pack SCSR operates independently of the surrounding atmosphere and is the only SCSR certified to operate in temperatures as cold as -25° F.

When in use, the Portal-Pack SCSR produces oxygen with an inhalation temperature of less than 115° F (46.1° C) in ambient air of 75° F (23.8° C), far below the breathing temperatures of FSRs.

The Portal-Pack SCSR uses a breathing bag to form an oxygen reservoir. The bag is resistant to abrasion, pinholes and punctures. A mouthpiece, including a nose clip, is connected to a breathing tube, which passes through the chemical canister to the breathing bag. The Portal-Pack SCSR is secured to the user with adjustable neck and waist straps. Goggles are included with the unit to prevent eye irritation from smoke.

The unit's silicone-wrapped stainless steel case provides durability. Two moisture indicators, one for each seal, ensure that the Portal-Pack SCSR's seals are not broken and that the unit will function properly in the event of an emergency.

New ground continues to be broken in the development of innovative safety products for the mining industry. The features incorporated in the Portal-Pack SCSR provide one of the most reliable, versatile self-contained self-rescuers on the market today. Improvements in safety equipment like this will help to ease the concerns of miners and make mines safer places in which to work.

What is safety?

From the safe foreman

What is safety? To find the answer to this question, let us define what an injury is. We can say that an injury is an undesirable event or damage to the body. We have all read of causes of injury, and invariably all of these accounts make use of such terms as serious, major, severe, minor, disabling and so on. Have you ever wondered why an injury must be clarified into such categories?

After all, any injury, no matter how slight, is undesirable. What are the differences among the injuries just listed and what makes these injuries more or less severe?

In every case of injury there is some incident that often occurs during a fraction of a second, causing an injury. Whether the injury is slight or severe is merely the result of some slight element of chance. And what are the consequence of these incidents?

An injury to an eye could be minor, requiring only irrigation or could be extreme, resulting in loss of an eye. Injury to an arm could be a minor bruise or could be a fracture or amputation. The same may be said of injuries to the leg.

What are the other consequences of these injuries? Think of the impact on your family and friends who are concerned about your welfare.

It's about time we stop separating injuries according to their severity. All injuries are undesirable.

None of us want to get hurt. Suffering an injury is against human nature. We are born with natural reflexes that protect U9 against possible injury. For example, our eyelids blink to protect the eye. Our fingers and hands will draw back from contact with hot objects. In case of fright, we develop goose bumps. These are all involuntary actions over which we have no control but that are part of our built-in defense against injury and harm.

It is conscious actions or failures that result in injury, in spite of our involuntary natural defenses.

But what are the incidents that cause us to change our way of thinking. Most often accidents are given as the cause of injury but we should remember that accidents don't happen, they are caused. If we become too accustomed to using the word accident, we become complacent, believing that these accidents are unavoidable. That is one of the definitions of the word "accident."

It is about time that we all learn that the incidents which cause injury can be avoided, therefore, the resulting injury can be prevented. If you need any proof of this, reexamine the record of injuries in your own plant, mine or construction operation. Study closely the investigative results of each of the injuries which occurred during the past year.

If an injury investigation is done thoroughly and properly, it will uncover as many as two or three causes for the incident that resulted in the injury. Examine the causes for your recent injuries and find out from your experience what could have been done to prevent the needless injuries in each of these cases. Try to reconstruct the actual situation and determine who could have done something differently to prevent the incident from happening.

This does not suggest that you find out who was to blame. (No one is to blame). The term "blame" is destructive and we should change our thinking to a more constructive attitude.

In order to be constructive, find out who is to be made aware of the cause or causes for the incident in order that the same thing can be prevented from happening in the future. This is the main reason for accident or injury investigation.

The first person who should be made aware is the employee. And this employee needs the help of a second person, the immediate supervisor.

It is the immediate supervisor who knows all the job details and requirements, the nature of the machine or equipment used, the possible hazards and the steps that must be taken to avoid injury. The supervisor can convey this knowledge only through training. After training and instruction the supervisor must follow up with reinstruction and close, watchful supervision of employees. It is important for every supervisor to make certain that the employee has learned.

The immediate supervisor has a superior, and there are others in the management chain. Each has a set of responsibilities regarding the employee.

Our objective must be total injury prevention, which means we must prevent the incident that results in the injury. Injury prevention is one task that your management expects you to perform well. And since an incident and an injury can occur at any moment, it is necessary that we give our full attention. Our motto should be not only "safety first," but "safety first, second, and always."

Reprinted from the State of Nevada's Division of Mine Inspection's May-October 1993 issue of ***Mine Safety Sense.***

Instability hazards in handling and storing materials

Part 1 of 3: Review of accidents

by John Fredland, Kelvin Wu, and Donald Kirkwood, Pittsburgh Safety and Health Technology Center, MSHA

Figure 1.—Accident caused by collapse of stockpile edge while truck was in process of dumping over side of pile.

Many accidents occur in the mining industry as a result of the instability of material during handling and processing operations. Accidents due to dump point instability at stockpiles, for example, occur with alarming frequency. Miners must be trained to be better aware of these hazards. Part 1 of this article will review the recent accident experience and Parts 2 and 3 will provide specific recommendations on safe working procedures at surge piles and at truck-built stockpiles.

Background

An integral part of the mining process is the handling and storage of large volumes of material. Raw product must be temporarily stored to provide a steady flow of material for processing; processed material must be temporarily stored to provide sufficient supply to meet fluctuating customer demand. Waste products must be handled and permanently disposed of.

In performing these activities, miners are normally dealing with material in a loose condition, and often operating heavy equipment directly on such material. The instability of this material, and the lack of appreciation for the potential hazards, has been a major cause of accidents in the mining industry. Too often operating procedures do not adequately take into account the behavior of the loose material, and place too much reliance on the strength of such material. Mine operators need to review their training and operating procedures regularly to ensure that, in handling and storing materials, hazardous conditions are recognized and avoided.

Table 1.—Number of accidents/fatalities involving material instability.

	Accidents/**Fatalities**
Stockpile or ore pile dump point instability	48/**7**
Waste or spoil pile dump point instability	28/**1**
"Overtravel" at dump point	36/**6**
Slide of material from above worker in bin, at pile, etc.	26/**8**
Slide onto loading equipment as material was being loaded from toe of pile	16/1
Collapse of bridged material beneath worker, equipment at bin, surge pile, etc.	12/**4**
Collapse of edge of haulroad	20/**1**
Totals	**186/28**

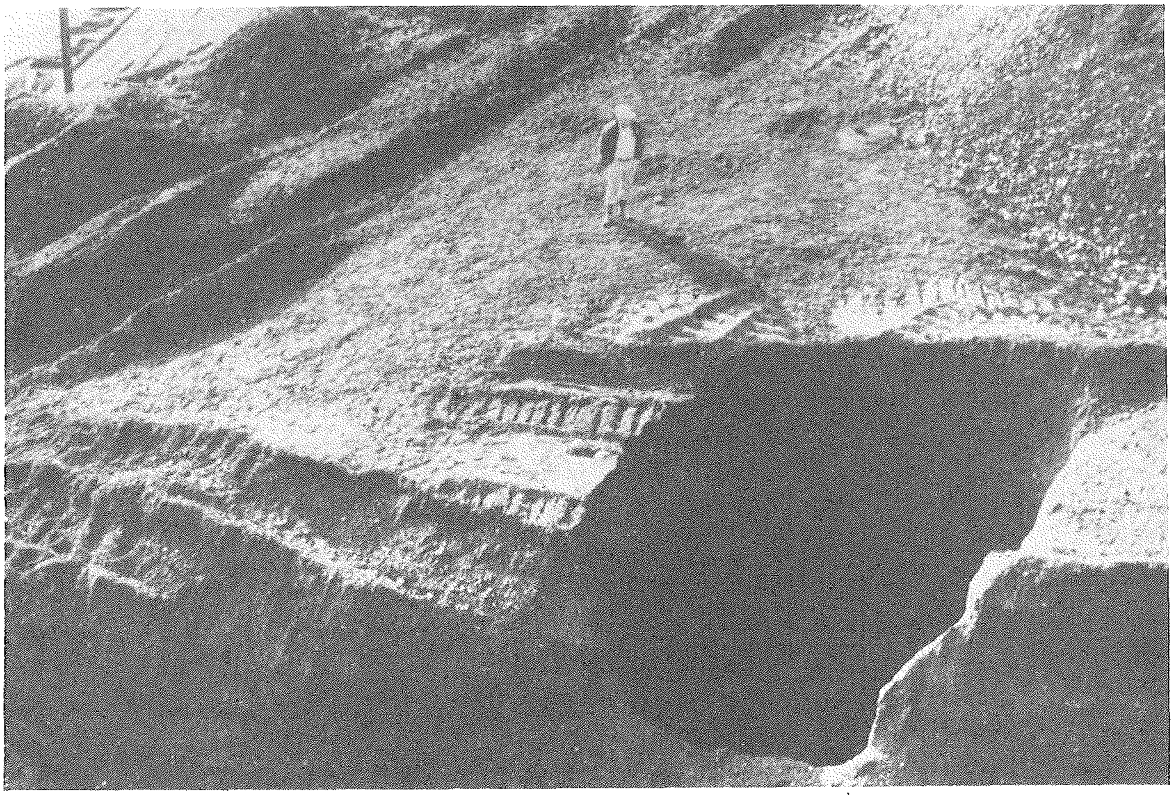


Figure 2.—Surge pile accident where dozer has collapsed a bridged-over area and fallen into the hidden void—note figure above center for scale.

Review of accident information

The Mine Safety and Health Administration maintains information on the accidents reported by the mining industry. A general review of this information, over the five year period through 1992, indicates that 150 accidents were reported that were directly attributable to the instability of material in handling and processing operations. Another 36 accidents were attributed to "overtravel" of equipment at a dump point, but instability of the dump point may also have been a contributing factor in many of these cases.

A breakdown of these accidents is shown in Table 1. An attempt was made to include only those reported accidents which involved instability of material as it was being disposed of, handled, or processed. Cases involving highwall or face instability are not included. These numbers include all reported incidents, even those where no injury may have resulted. As indicated, fatalities did occur in 28 of the 186 listed accidents.

It should be noted that this review of accident data was done to identify the main areas of concern and the main factors involved. The available information on contributing factors is often limited and some judgments have been made to arrive at the accident categories.

Based on the accident records, surge piles, and truck-built stockpiles, are areas of particular concern. The accompanying photographs illustrate two accident scenes at these types of facilities.

Surge piles

The main problem with surge piles occurs when the equipment which works on the pile travels directly over the location of the draw-off point. This activity promotes the formation of a bridge over the draw-point by compacting the pile material, while at the same time exposing the equipment operator to the potential hazard of a hidden void.

Truck-built stockpiles

The major problem at truck-built stockpiles occurs when trucks attempt to end-dump in an area where the toe of the slope has been loaded-out and oversteepened. In these cases the edge of the pile may collapse under the heavy weight of the loaded haul truck. This danger can be eliminated if the trucks dump back from the edge of the pile.

The keys to material handling safety are to provide training to miners so that they understand and appreciate the hazards involved, and to regularly review procedures to ensure that hazardous situations are being avoided. Parts 2 and 3 of this article will deal specifically with the safety precautions that should be taken at surge piles and truck-built stockpiles.

Defective tools and equipment

Our accident database contains thousands of accidents where one of the factors involved was the use of defective tools or equipment. Here's just one example:

Three workers were given the job of removing the 9,000 pound stationary jaw of a crusher for repair. They were to use a 15 ton overhead crane to lift the jaw and place it on the floor. The crane was operated using a suspended control pendant. After raising the load, the worker at the controls pressed the button to trolley it to a position where it could be lowered. Both the trolley button and the warning horn button stuck, but the operator was able to rectify the problem without mishap.

The jaw was then lowered to the floor. The workers discovered that they needed to flip the jaw on its side in order to access a bolt that needed to be removed. They raised it again and found that they needed to attach a second sling in order to flip it. One worker prepared to attach the sling while the person controlling the crane lowered the) jaw. When it was about 12 inches from the floor, the worker with the sling motioned for the operator to stop lowering the) jaw. He was attempting to attach the sling when he felt pressure on his right boot. He yelled for the operator to raise the jaw, but the control button to lower the load had also jammed, and it took several attempts before the victim's foot could be freed. Fortunately, considering the weight involved, the victim suffered only a broken toe.

There is a long list of ways to ensure that our tools do not become the source of an injury. It runs from considering safety and reliability when making purchasing decisions, through establishing preventative maintenance programs, to ensuring that pre-op checks are routinely performed by everyone. It is also important that no one ever feel so pressured to get the job done quickly that they continue to use equipment that they know to be less than 100 percent. The workers in this incident should obviously have heeded the warning given by the first stuck button

The tools and equipment you use can be thought of as extensions of your body. You would not continue to work with a broken arm—the pain would stop you immediately. But when you continue to use broken or defective equipment, you're running the risk that the pain might come later.

Reprinted from the Ontario, Canada's Mines Accident Prevention Association's November 1993 issue of ***Safety Reminder****.*

Measurement and control of diesel particulate emissions

Objective

Provide the U.S. mining industry with the means to measure and control exhaust emissions of diesel engines used in underground mines.

Approach

Diesel research is divided into four primary areas: exhaust aerosol measurement, particulate control, gaseous emission control, and chemical and biological characterization of particulate matter. Diesel research is frequently cosponsored by industry; collaborative research ventures between industry, academia, other government agencies, and the Bureau are common.

Diesel research at the Bureau is conducted in the diesel engine research facility at the Bureau's Twin Cities Research Center (TCRC). This facility is a state-of-the-art laboratory capable of performing emissions testing, exhaust control evaluations, and safety tests.

Background

Exposure of mine workers to airborne contaminants from diesel engine exhaust is potentially harmful. The National Institute for Occupational Safety and Health has recommended that whole diesel exhaust be regarded as "a potential occupational carcinogen" and that "reductions in exposure to diesel exhaust in the workplace would reduce the risk." The U.S. Mine Safety and Health Administration (MSHA) convened an Advisory Committee on Standards and Regulations for Diesel-Powered Equipment and is beginning to implement its recommendations, which cover health, safety, and certification and approval issues surrounding the use of diesels underground. In January 1992, MSHA published an advance notice of proposed rulemaking to regulate diesel particulate matter in underground mines.

Bureau research results

Information Circular (IC) 9324 is the proceedings of an Information and Technology Transfer Seminar on the measurement and control of diesel particulate emissions, to be held in Minneapolis, MN, on September 29-30, 1992. IC 9324 summarizes Bureau research to measure and control diesel exhaust emissions in underground mines. Topics include health issues associated vita the use of diesel equipment underground, regulations, measurement techniques for diesel exhaust aerosol, levels of diesel exhaust pollutants found in mines, and a wide variety of exhaust emission control devices.

Although the Bureau does not conduct health research, awareness of the health issues surrounding the use of diesel equipment underground is important to focus and establish the scope of the Bureau's diesel research program. Specific diesel exhaust pollutants are targeted for measurement and control.

Measurement and characterization of diesel exhaust aerosol are critical to maintaining a healthful working environment. Bureau-developed techniques to measure diesel exhaust aerosol in coal and metal-nonmetal mines were used to evaluate the effectiveness of a disposable diesel exhaust filter on air quality in underground coal mines. The Bureau collected samples of diesel particulate matter in coal and metal-nonmetal mines and analyzed them for polycyclic aromatic hydrocarbon content and mutagenic activity. These analyses help to characterize mine air quality and to determine the effectiveness of emission control technology.

Future regulations and emission control technology will affect the use of diesel-powered equipment underground. The Bureau is evaluating new engine and fuel technologies that have come about in response to the Environmental Protection Agency's requirements for cleaner exhaust emissions. In addition, the Bureau has developed and evaluated diesel emission control devices, including oxidation catalytic converters, disposable and reusable filters, ceramic diesel particulate filters, and a ceramic, regenerable-fiber, coil filter. Each of these devices can be used in underground mines to decrease a miner's exposure to diesel pollutants.

For more information

A copy of IC 9324, "Diesels in Underground Minces: Measurement and Control of Particulate Emissions," can be obtained from—

Publications Distribution U.S. Bureau of Mines Cochrans Mill Road P.O. Box 18070 Pittsburgh, PA 15236

Additional technical information can be obtained from—

Aerosol measurement:

Bruce K. Cantrell, Supervisor of the dust and aerosol technology research group at TCRC, (612) 725-4607.

Particulate control:

Robert W. Waytulonis, Supervisor of the diesel research group at TCRC, (612) 725-4760.

The Bureau's research program in health safety and mining technology:
J. Harrison Daniel, Staff engineer, Division of Health, Safety, and Mining Technology, Washington, DC, (202) 501-9309.

Reprinted from the Bureau of Mines' July 1992 issue of ***Technology News.***

NIOSH warns workers about explosive respirator cylinders

A 47-year-old firefighter died recently when the gas cylinder in his respirator exploded as he was refilling it with compressed air. The worker was killed when the neck portion of the cylinder separated and struck him in the upper chest and neck. According to the National Institute for Occupational Safety and Health (NIOSH), this is not the first incident in which this model cylinder, the DOT-E 7235 4500 PSI has exploded.

They cylinders are used on self-contained breathing apparatus by firefighters, hazardous materials hazmat) workers, emergency medical service personnel, and workers throughout the chemical and manufacturing industries.

The Institute has received several reports of these cylinders leaking or exploding, as a result of metal fatigue in the neck area. Recognizing the hazard, NIOSH and the U.S. Department of Transportation (DOT) in October 1985, began requiring that these cylinders be retrofitted with a steel reinforcing ring. The cylinder causing this death was not retrofitted and was in service beyond its maximum 15-year service life. NIOSH urges all workers using these cylinders to make sure that they are both retrofitted and within the approved service life.

"It is a travesty that the very devices used to protect workers are in fact causing injury and death," said NIOSH Director, Dr. J. Donald Millar. "These cylinders are critical for worker safety in extremely hazardous situations. We must ensure that workers can rely on their effectiveness and their safety."

NIOSH estimates that as many as 8,000 of these cylinders may remain in service without the required retrofit. Furthermore, the potential for rupture may increase as the cylinder nears the end of its service life. NIOSH urgently requests your assistance in informing workers who use this cylinder of the potential hazard and the prevention measures detailed below.

If you are using a compressed gas cylinder, NIOSH urges you to take the following precautions:

- Immediately inspect all compressed gas cylinders in your possession or your work area.
- Immediately remove from service any DOT-E 7235 4500 PSI cylinder that does not have a steel reinforcing ring on the neck area.
- Immediately remove from service any DOT-E 7235 4500 PSI cylinder that has exceeded the 15-year service life. This life can be determined by the earliest date stamped on the neck of the cylinder. Pressure (i.e., hydrostatic) retesting cannot extend service life beyond 15 years.
- Identify the last hydrostatic retest date stamped on the neck and remove the cylinder from service if the date is more than 3 years old.
- Treat all compressed gas cylinders with caution and follow the manufacturer's recommended safe work practices when refilling (i.e. charging), handling, and disposing of any charged cylinders.
- NIOSH urgently requests your assistance in bringing the information and recommendations in this UPDATE to the attention of employers, workers, and volunteers who may be exposed to DOT-E 7235 4500 PSI cylinders. Although two lower pressure cylinders, the DOT-E 7235 2216 PSI and DOT-E 7235 3000 PSI cylinders, are identical in appearance, there have been no reported problems with these devices.

For additional technical information, contact Richard W. Metzler of the Division of Safety Research, NIOSH, at (304) 284-5713.

For more information about this or other occupational safety and health concerns, call toll-free: 1-800-35-NIOSH.

Reprinted from the NIOSH August 2, 1993 issue of ***Update.***

Holmes Safety Association Monthly safety topic

Fatal powered haulage accident

GENERAL INFORMATION: A 37-year-old contractor electrician, was fatally injured when he was pushed over the highwall by a forklift while he and his coworkers attempted to lower an electrical cable to the quarry floor. The victim had a total of 9 years experience as a journeyman electrician, the last 3 years with this company.

The operation was a multi-bench, open pit gold mine. The mine and mill normally operated three 8-hour shifts a day, 7 days a week. A total of 143 persons was employed.

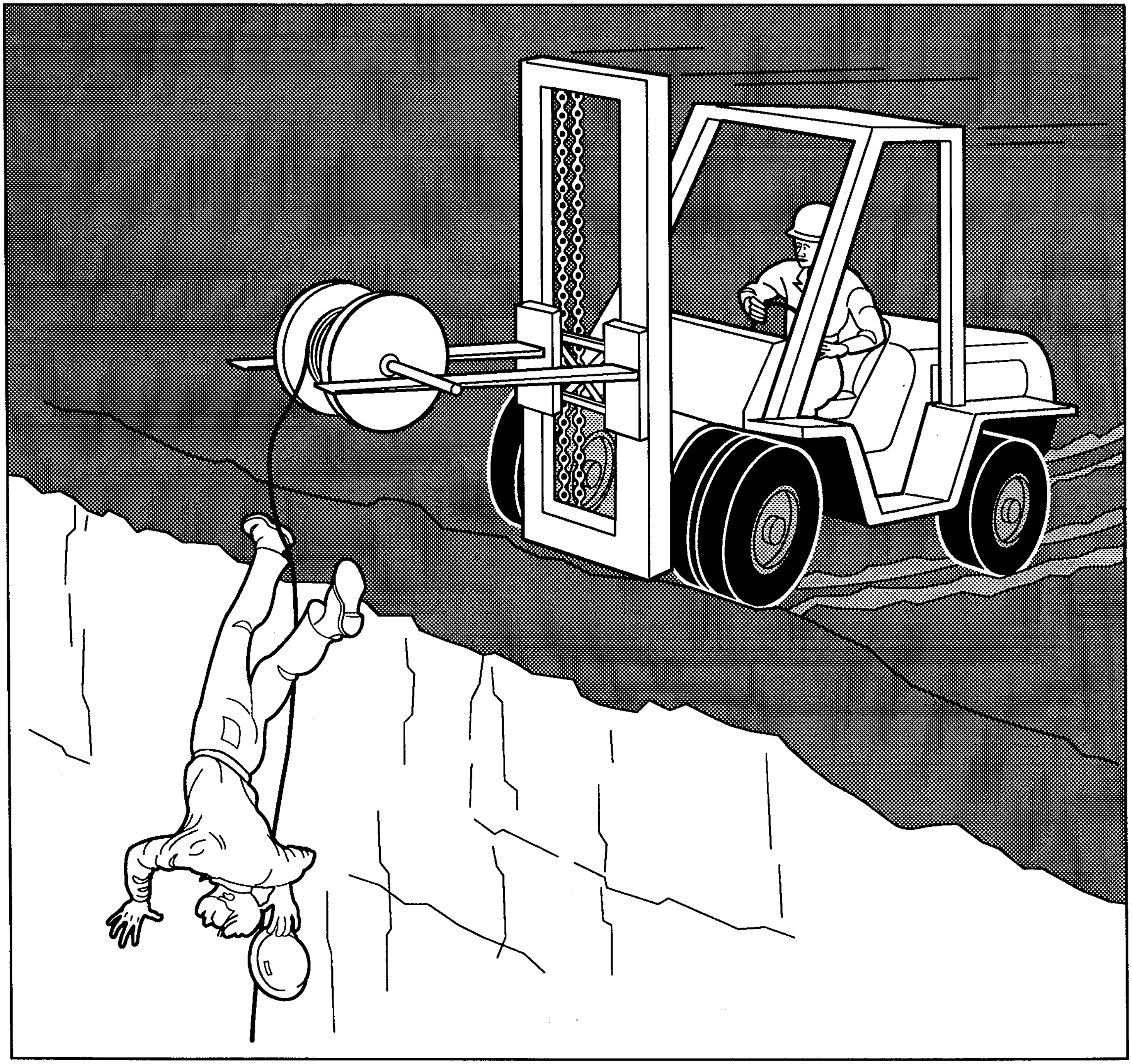
Gold was mined by removing the overburden with self-loading scrapers. The underlying matrix was drilled, blasted and loaded onto trucks for transport to the cone crusher. The crushed ore was transported by belt conveyor to the sag mill, then to the ball mill for further size reduction. Water, lime, and sodium cyanide was added to create a 40 percent solid slurry prior to the ore reaching the cyclones, where sizing was accomplished. From the cyclones, the slurry entered the first three of 10 tanks where gold was leached out before carbon was added in the remaining seven tanks and additional extraction took place.

DESCRIPTION OF ACCIDENT: On the day of the accident, the victim reported to work at 7:00 a.m., his assigned starting time. He worked with another electrician during the morning.

About 10:30 a.m., the electrical supervisor, instructed the victim and another electrician to run an electrical cable from the top of the south wall of the south pit to the bottom. The supervisor discussed the project with the two electricians at the job site—how to get the cable down and over the multi-benched highwall. He assigned the victim as the loadman for this job and prior to leaving the site, told them he did not want anyone near the edge of the highwall.

Shortly after 1:00 p.m., the victim and the other electrician were joined by two additional electricians at the job site on the south wall. The four electricians ran a nylon rope from the top of the highwall to the bottom by throwing a rock attached to the rope over the edge. The rope was to be tied to the end of the electrical cable to guide the cable to the pit floor.

One of the electricians obtained a forklift and met the other three men at the laydown yard where the four of them loaded the spool of electrical cable and the 10-foot section of pipe onto a truck. They proceeded to the south wall where the forklift driver positioned the forklift behind the truck. The other three men unloaded the spool from the truck, put the pipe through the spool and secured the pipe to each fork with a 6-inch "C" clamp. The forklift operator then positioned the cable spool approximately 10- to 15-feet away from the edge of the highwall with the forks raised about four feet from ground level. The victim stepped between the forks and directly in front of the spool. Another electrician handed him the nylon rope to tie onto the loose end of the cable while another was standing off to the side watching. At about the same time, the forklift operator, who was still seated on the forklift with his foot on the brake, set the park brake, turned the engine off, took his foot off the brake pedal and started to dismount. The forklift immediately began to roll forward toward the edge of the highwall. He immediately depressed the brake pedal, the inch brake pedal, and then both pedals at the same time but was not able to stop the forklift. As the forklift continued to roll forward, the cable spool pushed the victim backwards and over the edge of the highwall. The front wheels of the forklift rolled approximately halfway up the side of the berm, then rolled back, resting at the base of the berm with the forklift operator still on the forklift.



The victim fell a vertical distance of 86 feet to the second bench. His co-workers immediately went to the victim and began administering first aid. The mine office was informed of the accident and an ambulance was summoned. The victim was placed on a scoop stretcher and lifted to the top bench by his co-workers and several mine employees. A short time later he was transported by helicopter to the trauma center at the hospital where he was pronounced dead on arrival.

CONCLUSION: The direct cause of the accident was the inability to stop the forklift due to an ineffective park brake and the failure of the service brake. A contributing factor to the accident was An inadequate inspection of the forklift before placing it in operation. A pre-shift inspection performed in accordance with the manufacturer's recommendations would have affirmed the ineffectiveness of the brake system.

Putting your respiratory protection program to work

If you currently use any form of respiratory protection—or should be using it—you need a respiratory protection program in place according to OSHA. The specific guidelines for establishing and maintaining your program can be found in OSHA's 29 CFR 1910.134. The steps in this article will give you a general outline of that standard and help you know where to begin in implementing a formal program.

Evaluate your workplace

A thorough workplace evaluation to determine the level of dangerous airborne contaminants is the best place for you to start your program. A complete evaluation by a professional industrial hygienist will provide you with the information you need. What specifics the industrial hygienist looks for will vary with types of industry and location.

Once you have the hygienist's findings, read all local, state and federal laws governing respiratory protection. Regulations vary from region to region and responsibility lies with the employer to seek out and follow all regulations regarding safe workplace procedures.

If you've already put respiratory practices in place, it's still a good idea to have your workplace checked annually to ensure that what was working before still works.

Conditions can change—starting a new manufacturing process, introducing a new chemical or cleaning agent, reorganizing the physical workplace so airborne contaminants are mixing in new ratios—making new precautions necessary.

The written program

Your first step to compliance is the written program. For it's here that you will document all the rules, guidelines and practices followed at your workplace.

In it, you'll provide information on which areas or processes in your plant require respiratory protection, what types of respirators are used, how often training occurs and more.

Once your written program is completed, all employees exposed to respiratory hazards should receive their own copy. Holding a safety meeting to review and discuss the program could be very beneficial for everyone.

Make sure there is no room for misinterpretation or misunderstanding. Employee support of the program is vital to its success. Fully explain the dangers, the necessary precautions and your dedication to their safety.

Choosing a respirator

The type of respirator you must make available to employees is solely determined by the type of hazards you've identified.

Keep in mind that any respirator used should be approved and accepted by standards established by competent authorities such as NIOSH and MSHA.

In addition to the type and form of chemical, you must also know its concentration, workers' exposure time, how the chemical is being used in the work process, what kinds of ventilation are already in place and other specifics.

Involving your employees in the selection process could be beneficial in ensuring their support. You may want to set up a committee to try on different brands and judge them on comfort, fit and ease of use.

Because no two situations are alike, no single respirator is good for everyone. Know the differences between maintenance-free, air-purifying and supplied-air respirators so you choose intelligently.

Worker training

Training is crucial to the success of your program. According to ANSI Z88.2-1980, the supervisor, the enduser and the person issuing respirators must be given adequate training by a qualified person.

Training must occur before anyone can work in an area that requires respiratory protection. You must train all wearers annually to stay in compliance.

But remember—only employees physically able to do the required work and wear the required equipment can use respirators. Workers must be medically evaluated annually to determine their ability to perform their job.

Giving your employees as much information as possible about the need and reasons for wearing a respirator helps motivate them to wear and maintain the equipment.

Respirator assignment

Now you're ready to hand out respirators to employees. Ideally, each employee would receive his/her own respirator for his/her exclusive use.

Permanently mark the respirator to indicate the wearer—taking care not to harm the respirator.

Core, cleaning and storage

OSHA requires you to clean and disinfect respirators before issuance and after each use. Emergency-use respirators must be cleaned and disinfected after every use.

To clean your respirator, take off all cartridges, filters, headbands, and filter holders. Then completely disassemble the rest of the respirator.

Wash the facepiece in soapy water or in the cleaning solution recommended by the manufacturer. Follow with a disinfecting rinse.

Finally, rinse the facepiece in warm water and let it air dry on a shelf or countertop in a clean, moderately heated, dry area—avoiding dust, sunlight, moisture and chemicals.

Hanging respirators to dry could cause distortion and alter the face-to-mask seal. Most manufacturers recommend a clean plastic bag for contaminant-free storage.

Inspection and maintenance

Daily inspection of respirators—before and after use—is imperative to their successful use. Any slight imperfection could damage the face-to-mask seal and in turn, be dangerous to the wearer.

Before putting your respirator on and after taking it off, inspect the respirator and check all valves and valve seats for dirt. Inspect all parts for wear and damage. Replace them immediately or issue a new respirator until repairs can be made. And remember to record all inspections and actions taken as a result of each inspection.

Work area surveillance

Monitoring your workplace is an ongoing process that ensures continued worker safety. Even minor adjustments—such as changes in temperature or humidity—can result in a change in the concentration of a chemical and the effectiveness of the chosen respiratory protection.

Program inspection and evolution

A thorough annual inspection and evaluation of your program helps you maintain effective protection and implement improvements immediately.

You may find it helpful to include employees in the process for valuable, first-hand information. Their insight on how your established procedures work on the front line could be invaluable to the success of the program.

OSHA's respiratory standard is strict. And your adherence to 29 CFR 1910.134 is vital to the safety of your employees. For more information, guides such as Lab Safety Supply's *Respiratory Protection Program*, may help.

*Article provided by **Lab Safety Supply, Inc.**, Janesville, WI.*

REMINDER: The Winter Alert is still in effect!

- *Rockdust*
- *Preshift and onshift checks*
- *Check for methane frequently*
- *Keep equipment maintained*
- *Check the roof—especially near mine entrances*
- *Check ventilation often*
- *NEVER smoke underground!*

The last word...

"You were enjoying your breakfast until you picked up the morning paper, read the list of the 10 richest people in town and found that your bookkeeper is one of them."

"The jawbone of an ass is still a dangerous weapon."

"A friend asks only for your time not your money."

"What's vice today may be virtue tomorrow."

"A pound of pluck is worth a ton of luck."

"Keep your feet on the ground even though friends flatter you."

"Wise men learn more from fools, than fools from the wise."

"He who hurries cannot walk with dignity."

"On Thanksgiving Day all over America, families sit down to dinner at the same moment—halftime."

"Man is the only animal that can remain on friendly terms with the victims he intends to eat until he eats them."

"Fox hunting is the unspeakable in pursuit of the inedible."

NOTICE: We welcome any materials that you submit to the Holmes Safety Association 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 1994 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
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