BULLETIN

HOLMES SAFETY ASSOCIATION

E PLURIBUS UNUM

SAFETY EFFICIENCY

MINERAL INDUSTRIES

HOLMES SAFETY ASSOCIATION

MR. JACK SAFETY

September 1991

HOLMES SAFETY ASSOCIATION

OPEN-PIT PETE

September 1991

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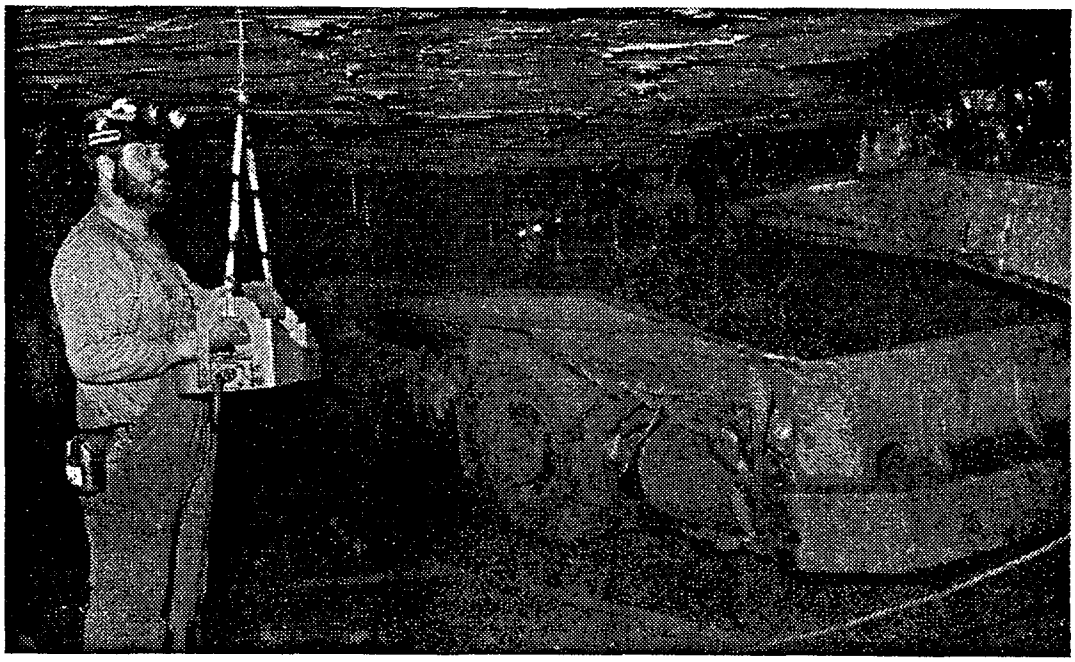
KEEP US IN CIRCULATION

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

CHAPTER NAME	CHAPTER NUMBER	LOCATION
Fire Master	9275	Winnemucca, NV
Fire Master	9276	Rock Springs, WY
Fire Master	9277	Phoenix, AZ
Fire Master	9278	Gillette, WY
Fire Master	9279	Elko, NV
Fire Master	9280	Bevlah, ND
Fire Master	9281	Bismark, ND
Fire Master	9282	Salt Lake City, UT
Fire Master	9283	Billings, MT
H. A. Manosh Corp.	9284	Morrisville, VT
F. J. Mine	9285	Earlton, NY
Schultz Const., Inc.	9286	Round Lk, NY
G & L Construction	9287	Coxsackie, NY
David B. Seward Sand & Gravel	9288	Oneonta, NY
Lee Mike	9289	Hazardster, KY
Wolverine Coal Co., Inc.	9290	Lebanon, VA
Big Dog Coal Co., Inc.	9291	Cleburn Va, VA
Halls Arkansas Oilstones, Inc.	9292	Pearcy, AR
City of Johnstown	9293	Johnstown, NY
Delany Development	9294	Mayfield, NY
Fulton County Highway	9295	Johnstown, NY
Twin Cities Sand	9296	Johnstown, NY
Mclaughlin Pit and Mine	9297	Watertown, SD
American Tel-A-Com, Corp.	9298	Murry, UT
United Cable and Telephone	9299	Murry, UT
Daytona Trucking, Inc.	9300	Marmet, WV
O & G New York, Inc.	9301	Dover Plains, NY
Palumbo Sand & Gravel	9302	Dover Plains, NY
Nicholas Domain Sand & Gravel	9303	Bethel, CT
Peritt & Vickers, Inc.	9304	Emmett, AR
Konitz Contracting, Inc.	9305	Lewistown, MT
Lee West Coal Co., Inc	9306	Hillier, KY
Unit #1	9307	Winner, SD
Williams Welding Service	9308	Oak Hill, WV
Schogan Companies	9309	Yuma, AZ
W. L. Dunn	9310	Cochran, PA
H and H Coal Co.	9311	Ermine, KY
Nelson Sand & Gravel Pit #2	9312	Franklin Grove, IL
Center Pit & Plant No. 3	9313	Bloomfield, NE
Cardinal No. 1	9314	Mortons Gap, KY
T-M Development, Co.	9315	Belleville, MI
Wynot Sand & Gravel	9316	Wynot, NE
Quachita Gravel Plant	9317	Malvern, AR
Paul Bradt General Contracting	9318	Northville, NY
Scotia Sand and Stone	9319	Scotia, NY
Herba Sand and Gravel	9320	Gloversville, NY
Casino Creek Concrete	9321	Lewistown, MT
S.D. Ireland Concrete	9322	So. Burlington, VT
Cormen's Safety Shop	9323	Pittsfield, MA
Bushika Sand and Gravel	9324	Cheshire, MA
Apac-McClinton-Anchor Division	9325	Fayetteville, AR
Apac-McClinton-Anchor Division	9326	Fayetteville, AR

Remote controlled equipment can be safer, but...



The increase in remote controlled mining equipment during the past few years is revolutionizing the coal industry. As a result of this technology, coal mine safety has been improved significantly. Remote controlled equipment is currently being used to perform some of the most hazardous tasks associated with coal mining. These tasks can now be accomplished with the operators of the equipment positioned at safe locations away from the potential hazards. Remote control continuous miners, roof bolters, scoops, mobile roof supports and haulage systems are increasing at a rapid pace. In addition to the safety advantages that are being realized with remote controlled mining equipment, production improvements are also evident.

However, several serious and fatal accidents provide proof that several new and unique hazards have been introduced with remote controlled equipment. Nearly all of these accidents could have been avoided if the operators of the equipment had been positioned in an operator's compartment onboard the machines. Within the past 6 months, two Kentucky coal miners have perished while operating remote controlled mining equipment. One accident occurred in November of 1990 during pillar extraction with a remote controlled continuous miner. Two Virginia coal miners were killed during 1990 while operating remote controlled continuous miners.

There may be a temptation to jump to the conclusion that the victims of these accidents were totally responsible for their own deaths. At first glance, we may be tempted to conclude that these victims placed themselves in an unsafe location and then suffered the tragic consequences. This line of thinking provides an easy route around a complex problem. However, in reality, it represents a gross over-simplification. We must learn the lessons of our failures, or we are destined to repeat them in the future.

The introduction of new or modified equipment requires careful attention to additional effective training

methods. These training efforts should be focused primarily on the identification of all potential hazards, and the development and implementation of proper work procedures to avoid accidents. If this objective is met, production improvements are certain to occur.

It is not coincidental that the operators of the remote controlled equipment have been the victims in the overwhelming majority of this type of accident. All persons who operate remote control equipment must be thoroughly familiar with the operating controls and their limitations. During operation of any remote control machine, all persons, including the operator, should position themselves in an area that affords maximum protection from unsupported roof and the planned or unexpected movement of the equipment. All persons should remain in or outby the machine, unless they can position themselves in an area that provides a safe route of retreat. If it is necessary to perform tasks beside the machine, the operator should cease operation of the machine until the tasks are completed and all persons are in the clear. All persons should take precautions to avoid placing themselves at potential pinch points. When remote control machines are being trammed from place to place, it might be advantageous and safer to operate the remote control machine from within the operator's compartment utilizing the onboard controls.

Reprinted from Kentucky Department of Mines and Minerals Bulletin, Volume 1, 1991.

Unique safety program rewards employees with purchasing power

Points for safety records at Gold Field's Mesquite Mine are turned into dollars that fuel buying power in an unusual reward program that has hit the $120,000 mark in less than 3 years.

The cooperating retail partner, Imperial Stores, is planning to recognize the individual who passes the $100,000 milestone purchase with a $300 reward.

The program began in June, 1988, when employees at the gold mine, 7 miles east of Glamis, were offered the chance to accumulate points based on safety records and redeem them for their choice of products from several retail stores in the area or the company warehouse.

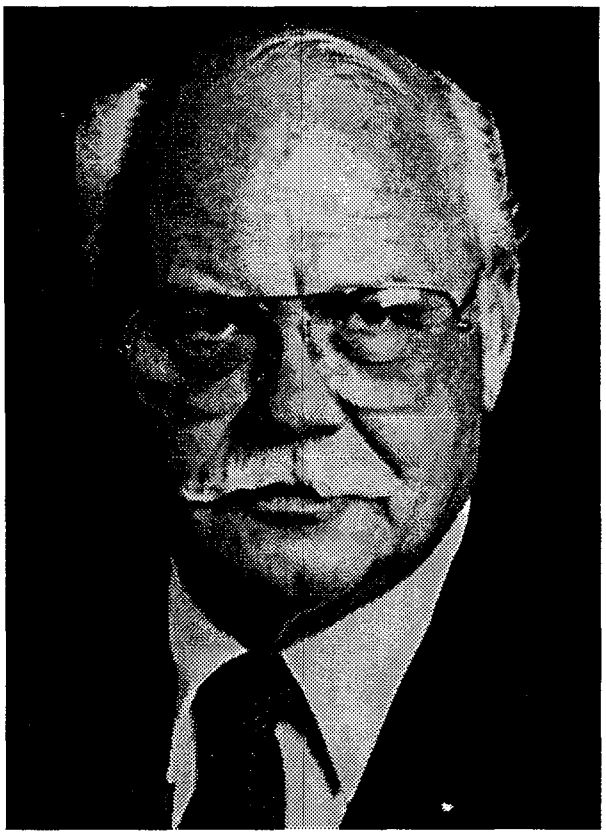
Awards are based on annual and quarterly safety achievements. Each point equals $1 in purchasing power from Imperial Stores, and hourly and salaried employees can accumulate 50 "individual award" points in a year. Production and maintenance personnel are also eligible for 25 points a quarter in a "crew award" and 200 points a year in a "team award" if there are no lost-time accidents on the employees' crew or team.

Mesquite Mine manager Bob Filer said the program was designed to give employees something tangible to enjoy and help them appreciate the special effort that went into the reward. It also demonstrates the economic benefits to local business of a major industrial operation.

*Reprinted from **California Mining**, California Mining Association, 1121 L St., Suite 909, Sacramento, CA 95814.*

National Safety Council to present "Distinguished Service to Safety Award"

The president of the National Safety Council, T.C. Gilchrest, in a speech to the Southwest Safety Congress, held in Phoenix recently, announced that William Fellows, coordinator for the Arizona State Mine Inspector's office, would receive the highest individual honor the National Safety Council can bestow on a safety professional. This award is in recognition of Fellows' outstanding contributions to occupational safety and health in his community, the mining industry and the council. Fellows has worked in the mining community 35 years, beginning with Phelps-Dodge in Bisbee, Arizona, and for the last 18 years, with the Arizona State Mine Inspector's office where he coordinated the mandatory health and safety education for over 19,000 miners who work in the 600 mines throughout Arizona. Mandatory training for miners was enacted through passage of the Federal Mine Safety and Health Act of 1977.



William G. Fellows

Fellows wrote the proposal on how the Arizona State Mine Inspector's office could administer this training law for, and on be half of, the Federal government and has been administrating the program since 1978.

Fellows lectures throughout the country to State Grant Educational and Training Congresses on new and innovative training methods while serving as a special consultant to mining interests and community college systems. He also teaches on a national basis.

Fellows, a State employee, has lived in Phoenix for the last 18 years and has been active in community affairs, performing such tasks as Referee for Juvenile Court, Superior Court, Cochise County; Scoutmaster for the Boy Scouts of America; Chairman of the Committee on Auto Accident Reduction for State Employees in Arizona; and is a member of the American Society of Safety Engineers.

The National Safety Council will bestow this honor upon Fellows at its 1991 Congress in New Orleans, Louisiana, in October. For information contact the National Safety Council or Bill Fellows, Arizona Mine Inspector's Office at (602) 542-5971.

Holmes Safety Association Monthly Safety Topic

Fatal fall/slide of material accident

GENERAL INFORMATION: A 26-year-old lead driller with nearly 7 years of mining experience was fatally injured while drilling a blast hole at an open pit bench when the ground collapsed beneath him. A 6 x 8 foot hole opened, allowing the victim to fall 75 feet to the bottom of an old raise. The victim was then covered with 15 feet of rock.

The mine is presently mining several low-grade, heap-leachable, gold and silver deposits.

DESCRIPTION OF ACCIDENT: The victim reported for work at the usual starting time of 6:00 a.m. After the morning meeting with the drilling supervisor, the victim and three other drillers proceeded to the 4840 bench floor to continue the drill pattern on the 4820 bench.

After drilling approximately 10 feet, the victim's drill steel broke through the surface rock which was covered with about 4 feet of overburden. The ground collapsed under him and the opening funneled out allowing him to fall 75 feet down the old finger raise and covering him with approximately 15 feet of rock. At 10:10 a.m., a sampler saw the victim's drill suddenly tip to one side. He thought something had happened and ran over to the drill. When he got to the drill, he saw a large hole at the rear of the drill where the drill operator normally stands. The sampler tried to look into the opening to see if he could see the victim, but visibility was impaired due to dust. The sampler ran to the drill the supervisor was operating and told him something had happened to the victim. The supervisor and the sampler ran to the victim's drill and looked into the opening, but could not see the victim. When it was apparent the victim wasn't in the area, the supervisor went to the drill pick-up and used the radio to summon help and an ambulance. The supervisor then shut down the victim's drill and instructed the other drillers to shut down. A loader was called to the site to help stabilize the drill and prevent it from falling farther into the opening. Another miner, who had observed the drill mast tip, arrived at the site at this time. He called the mine office to alert the safety director and the surface mine rescue crew. He then assisted in securing the area and helped chain the drill to the loader. At about 10:45 a.m., the safety director arrived on site and, together with the surface mine rescue team, took charge of the accident site. A decision was made to rappel down the center of the opening far enough to see if the victim could be located in the portion of the opening that could not be seen from the surface. The safety director was rigged into a harness and, using a belay and rappel line that was

anchored to a crane, rappelled down approximately 8 to 10 feet down the center of the opening. Unable to locate the victim, he ascended to the surface and informed the general manager what he had observed. The safety director made a second trip down the opening to assess the condition of the area. The general manager also rappelled into the opening to assess the situation and the condition of the opening. It was decided that because of unstable ground in the opening, it would be unsafe to continue further without first supporting the bad ground and to summon a trained underground mine rescue team. A call was made to another mine to ask their rescue team to help in the recovery. While waiting for the rescue team to arrive, employees used a dozer to clear rock from the portals of the 300 and 350 levels of the old underground mine. The portals were located on the face and toe of the 4820 bench wall. Upon clearing the 300 level portal, the general manager, the process superintendent, and the safety manager, entered the 300 level with a trained search dog in an attempt to locate the victim. At approximately 150 feet, the access was blocked by a cave-in. The search dog did not pick up a scent of the victim in the 300 level or at the cave-in area. By the time the 300 level area check was completed, the mine rescue team had arrived at approximately 5:30 p.m. The search, rescue and recovery work was transferred to them.

The mine rescue team entered the 300 and 350 levels of the mine to check for possible access to the victim. Because of cave-ins and rock falls, it was determined that the best access would be from the surface down the opening at the drill. The drill was removed from the opening prior to the start of recovery work. The rescue team determined that the opening was probably an old raise from the 350 level to the 300 level. The raise required extensive ground support and removal of loose rock to provide safe access to the bottom of the raise. After nearly 2 days of work removing 15 feet of rock, the victim was located and removed from the raise at 8:15 p.m.

Three nurses were standing by during the recovery. A nurse, the county coroner, and county sheriff checked the victim for vital signs—none were found. The victim was then taken by company ambulance to the funeral home.

CONCLUSION: The cause of the accident was drilling over old underground workings resulting in the collapse of the 4840 bench floor where the victim was standing.

Factors contributing to the accident were the failure to check available mine maps to determine the relationship of the 4840 bench to old underground workings, and evaluate if hazards to drillers and others working on the bench were created by those workings. Additional holes drilled into underground voids were routinely skipped for blasting, without considering potential hazards. Also, areas where open holes or subsidence occurred were not checked against old maps or considered for hazards, but were simply backfilled.

Mine escapeways

Throughout mining history, fires and explosions have claimed many lives. Many of these lives were lost not from the direct effects of the fire or explosion, but from the aftereffects of smoke-filled mine entries and from the confusion and fear following a disaster.

For example, a fire occurred in an Idaho silver mine in 1972, claiming 91 lives. All of the deaths were due to the inhalation of carbon monoxide and smoke. Another 82 persons, however, were rescued. Although many factors contributed to the severity of the disaster, the first one listed in an official report was "the emergency escapeway system from the mine was not adequate for rapid evacuation."

Another fire occurred in a West Virginia coal mine in 1972 when a continuous mining machine came in contact with a bare trolley wire. As a result, flames quickly spread to the coal seam. Several miners died from smoke inhalation despite the existence of adequate escapeways.

In contrast, a fire in a large metal mine in South Dakota in 1975 resulted in no loss of life, even though several errors were made. Evacuation of the mine was successful because of good planning and well-maintained escapeways.

For many years, few mining operations bothered to establish an escapeway system. We will never know how many lives could have been saved if escapeways had been in general use throughout mining history.

A great deal of emphasis is now being placed on preventing fires and explosions. Until mining systems can be devised to eliminate these disasters, we must remain prepared for them. Persons working in a mine today must be provided a suitable escapeway for use in an emergency.

Having an escape route from a fire is not merely a mining problem. At home, work, or school, and in a building, mall, restaurant or sports facility, we are all subject to the effects of a fire. All of these facilities need a safe route of escape, as witnessed by the many cases of fire deaths throughout history. In 1975, 165 people died after fire struck a Kentucky nightclub near Cincinnati, Ohio.

This article considers the special problems encountered by persons working in the confines of an underground mine. Just as public buildings and schools are required to have fire doors and exits, mines are required to have escapeways.

Escapeways

Bearing in mind that an escapeway is a special mine entry designed for the travel of persons, including disabled persons, what is needed for a good escapeway? There must be no obstructions to travel, so the escapeway must be:

1. Free of water holes which would impede passage. Small amounts of water in a high seam may cause only the discomfort of wet feet or clothing, but in low seams this would be a more severe problem as travel is slower in these areas.

Height of travelway (inches)	Feet per minute	Body position
Below 30	24	Crawling
30-36	50	Creeping on knees
36-42	75	Duckwalking
42-48	100	Extreme body bend
48-60	200	Slight body bend
60-72	275	Head bend
Over 72	300	Upright

Speed of travel in escapeways.These figures represent ideal travel conditions.

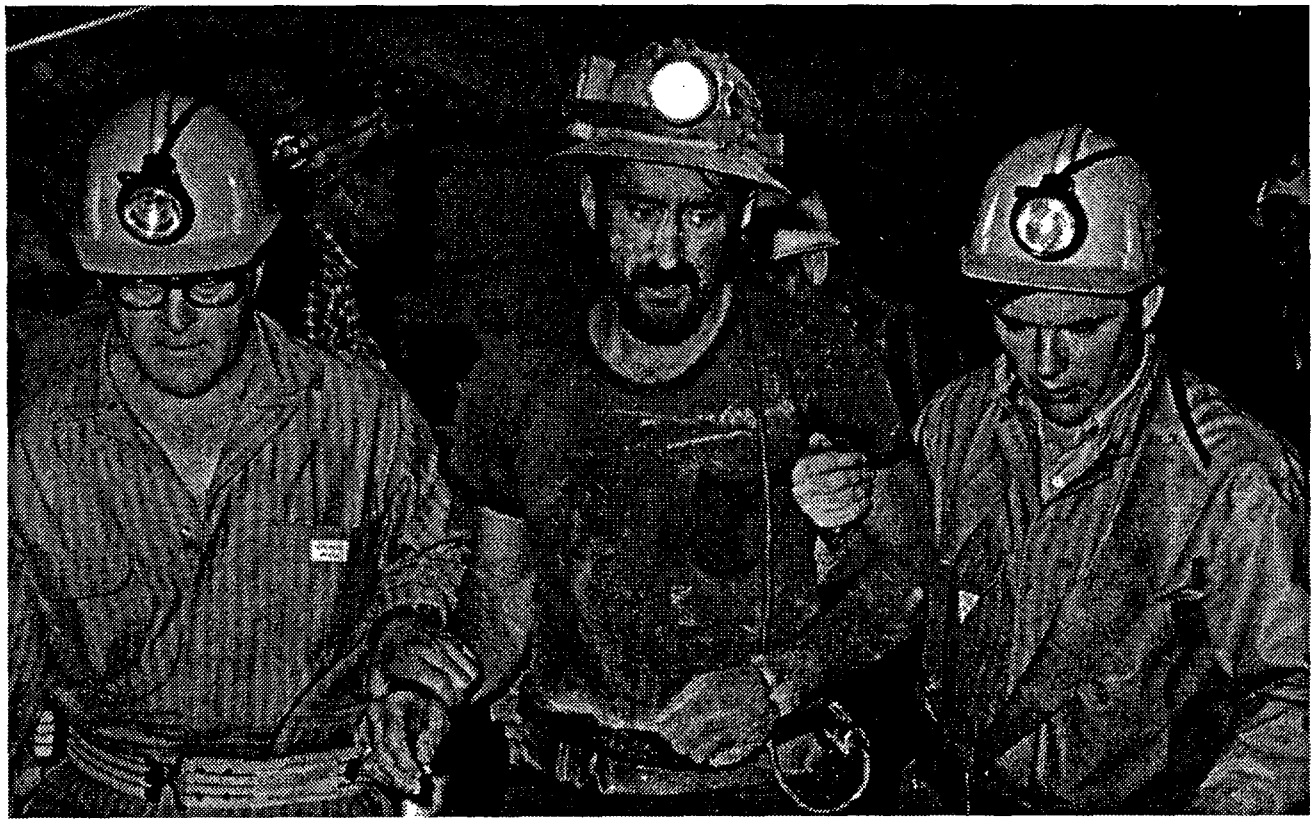
Large water holes may not only create slow travel and additional fatigue, but may also create fear and even panic in an emergency. In addition, it may be necessary to carry a disabled person. Carrying a disabled person when conditions are favorable is difficult; carrying a disabled person through large water holes is almost impossible

2. Free from falls of roof (back) or ribs. Aside from making travel difficult, such debris could cause injury. Persons in an emergency tend to be less cautious and could easily trip and fall.

3. Free from bad roof. Bad roof (or back) must be corrected in all areas of a mine where persons work or travel. Loose rock could be made to fall by dislodging a roof support or a hanging piece of rock.

4. Well marked to indicate route of travel. An escapeway may make many turns through the miles of entries in a large mine. Persons may become confused and lose valuable time. Reflectors and directional signs are a vital part of an escapeway.

5. Separated from the other entries. This often prevents the smoke produced by a fire from spreading into the escapeway.



One of the 2 survivors of the silver mine fire of 1972—the Sunshine Mine disaster in Kellogg, Idaho, in which 92 miners lost their lives

Other escape facilities

Escapeways must not only allow miners to travel through the mine entries, but also allow them to reach the opening surface. There are three different types of surface openings into mines. These include drifts (adits), slopes and shafts. In drift and slope openings, it is possible to walk out without special equipment. In some slope mines, travel is helped by a motorized tow rope or ski lift. In certain emergency situations, it is possible to use all or part of the mine transportation system. In these cases, persons travel in mine cars, special mantrip cars, mine jeeps (jitneys), or ride on conveyor belts. In some slopes, they may ride a special mantrip car pulled by a hoist.

In mines with shafts, additional conveyances may be required. Some shafts are equipped with ladders or stairways. Travel in shafts using ladders or stairways is slow, and if disabled persons are involved, travel can be even more difficult. The most effective shaft conveyances are hoists or elevators. The elevator in a mine shaft may be like those in buildings, either controlled automatically or operated by an attendant. In many mines, the shaft used to transport persons into and out of the mine also serves as an escape shaft. In some cases, it is possible to use a crane which raises or lowers a special capsule. Only a small number of persons can be transported at a time in this manner.

Federal regulations

There have been many escapeway regulations adopted in recent years adding to the protection afforded to miners. Some of the Federal Regulations are common to both coal and noncoal mines. Some examples are:

Each mine must have two escapeways to the surface. Two escapeways improve the chances of having a safe exit.

Each mine must have the location of escapeways shown on mine maps posted where miners can study them. These maps must reflect any changes made in the location of escapeways. This is done to keep each miner abreast of the escape system.

Each mine must have plans to fight fires and handle emergencies. Each worker has specific duties and responsibilities in emergency situations. These plans provide for an orderly evacuation of those workers underground.

Coal regulations

Coal mines generally have a greater potential for fires. In fact, they have a constant source of fuel: coal in the form of solid coal, coal lumps, and dust.

Liberal applications of rock dust (powdered limestone) are required to prevent the spread of fires and explosions; but mining operations continually are exposing new face areas. Examples of coal mine regulations include:

1. The two escapeways, distinctly separate from each other, must lead from each working section to the surface. They must follow the most direct, practicable route.

2. Each escapeway must receive a thorough examination each week and the results of this examination must be recorded.

All miners must participate in practice drills where they travel through all

or part of the escapeways in order to become familiar with them.

One of the escapeways must be located in an intake (fresh air) entry. In mines and working sections opened on or after March 30, 1970, the escapeway required to be in intake air must be separated from the belt and trolley haulage entries of the mine. These entries contain additional fire hazards.

In mines where the coalbed is less than 5 feet high, the escapeway should be maintained to the height of the coalbed. In coal beds 5 feet or higher, the escapeway should be at least 5 feet high. These heights exclude any necessary roof support. In either case, the travelway should be maintained to a width of at least 6 feet. This provides optimum clearance for travel, even for a person who must be transported on a stretcher.

In addition to the escapeway drill, each mine must have practice fire drills. The escapeway drills satisfy the requirements for practice use of the escapeways during fire drills.

Metal and nonmetal regulations

Additional regulations for non-coal mines include several dealing with operators of underground hoists. It is essential that the underground hoist operator be able to function during an emergency. An independent supply of air must be provided for this person. He or she must also be provided with a 1-hour self-contained breathing apparatus for his or her exit from the mine.

Warning systems

One of the keys to rapid evacuation from a mine in an emergency situation is an effective warning system. Maintaining communication from the surface to each point of the mine where miners are located is the ideal situation. Present mine telephone systems can be used effectively if not damaged by a fire or explosion.

In some metal and nonmetal mines, a common warning system is the use of stench (ethyl mercaptan-freon mixture). Stench is a gas with a strong odor. It can be released in the mine through the ventilation system or through compressed air lines. Problems arise when ventilation air moves slowly or the miners are not using compressed air.

Research is being done to develop new and more effective ways of warning miners of emergencies.

Use of escapeways

Each emergency situation must be

Members of one of the many mine rescue teams at the Idaho mine fire in 1972.

quickly evaluated. Decisions must be made as to what action to take. The choice of escapeways is one decision that must be made as soon as possible. The location, size, and type of fire or other emergency are factors to be considered. The value of the practice drills becomes apparent at this time. Each person should know his duties, the location of necessary equipment, and the routes of the escapeways. Some important things to consider if an emergency arises are:

1. Good leadership. The supervisor in charge should gather the group and begin the evacuation or fire fighting, if necessary. This leadership is vital to prevent indecision or panic.

2. Communication. If the mine communication system is operative, it should be used. Calls should be made to inform others of the group's plans and progress along the way.

3. Staying together as a group. A long piece of rope, if available, could be used to keep all the group members together.

4. Tests for gases. Devices for testing mine gases should be carried and used.

5. Self-rescuers. The miner should not take chances with carbon monoxide. He should use his self-rescuer!

Escape plans

The most likely places for fires to start are at the face, along belt conveyors, in haulageways, and at other places where power wires and machinery are located. At some mines, provisions are made to short circuit the ventilating air if fires occur. This is done in some mines by opening doors to allow air to pass from the intake to return entries. In others, doors are closed across certain entries to stop airflow. Most mines are quite complex and the escapeways may extend for miles. The choices of escape routes may vary greatly.

Related rescue measures

Check-in and check-out system

A major mine disaster occurred around 1900 in which several hundred miners lost their lives. There was an accurate count of the number of mules lost in the disaster; but the number of persons killed was not accurately de-

termined. There was no check-in and check-out system.

Now each mine must have a check-in and check-out system. When entering the mine, the miner generally places a small brass tag bearing his name on a board marked "IN." The miner also has an identical tag attached to his mine belt. Upon leaving the mine, he removes the check from the "IN" board and places it on the "OUT" board. Some mines have other types of systems, such as time clocks. This regulation applies to all people who go underground. In the event of an emergency, this procedure accounts for those individuals in the mine.

Self-rescuers

One of the most dangerous gases produced by a fire is carbon monoxide. Many fire deaths are attributed to inhalation of carbon monoxide. Each miner must have available a self-rescue device for use in emergencies. The self-rescuer provides protection against high percentages of carbon monoxide for one hour. It is vitally important that the self-rescuer be worn when escaping from a fire. Many lives have been lost needlessly because of failure to use it properly. This was the case in the 1972 Kellogg, Idaho, silver mine fire.

In coal mines, the mine operator must provide a self-contained self-rescue device for each miner who goes underground. Devices must be made available for visitors authorized to enter the mine. This device contains a supply of oxygen which must be adequate to protect a person for one hour or longer.

Refuge chambers

In non-coal mines, refuge chambers are required where two escapeways cannot be guaranteed. They are similar to bomb shelters in buildings. The chambers must be fire-resistant, large enough to accomodate the miners, and gas-tight. They must also be provided with compressed airlines, waterlines and a communication system. The secretary of labor, or an authorized representative, may require the erection of emergency shelters in coal mines.

The refuge chambers or shelters would be used in an emergency if the escapeways could not be traveled.

In the Idaho silver mine disaster, a portion of the mine was developed with only one escapeway and no refuge chambers.

Barricades

It is possible that the fire or other emergency situation may destroy the escapeway system and block access to any refuge chambers. As a last resort, the miners may have to build a barricade. The barricade must be airtight to prevent noxious or poisonous gases from entering it; and the miner must know where to build it, as well as how to build it.

The only air for breathing will be in the space behind the barricade so several things must be considered. The first consideration is how to prevent bad air from getting in while the barricade is being built. This can be done by "short-circuiting" the air. Short circuiting may be done by making openings in the ventilation controls which are directing the air into the area. Another

thing to remember is to avoid building the barricade in areas that contain caved or backfilled ground. The space blocked off must contain enough good air for miners to breathe until rescue crews arrive. This may be a few hours, or a few days. The largest possible area that can be sealed off with the least work is a good rule. Areas where water may accumulate or certain gases could build up must be avoided. If possible, an area where airlines or waterlines exist should be used.

Mine rescue system

The Bureau of Mines has sponsored the development of a system to rescue trapped miners. With this system, trapped miners can be located and a hole drilled from the surface to reach them. These holes can be drilled to depths of up to 1,500 feet.

When miners are trapped underground, special equipment is rushed to the area immediately. Three explosions are made at the surface to alert the trapped miners that the equipment has arrived. The miners are to respond by pounding on something solid. This pounding signal will be picked up by special equipment. When the rescuers on the surface locate the signal, they set off five explosions to inform the miners. Two holes are then drilled to reach the trapped miners. The first is a small hole to supply oxygen, food, first aid and communication. The second hole is large enough for a rescue capsule. Each miner should wear, in his safety hat, a decal which explains the system.

Summary

Fires and other emergency situations are apt to occur at many different locations. It is imperative that plans be made to ensure the safety of miners who may be affected by such events. Mining personnel face these and additional problems when fires occur underground. The chances of survival can be greatly enhanced by the maintenance of good escapeways and escape facilities.

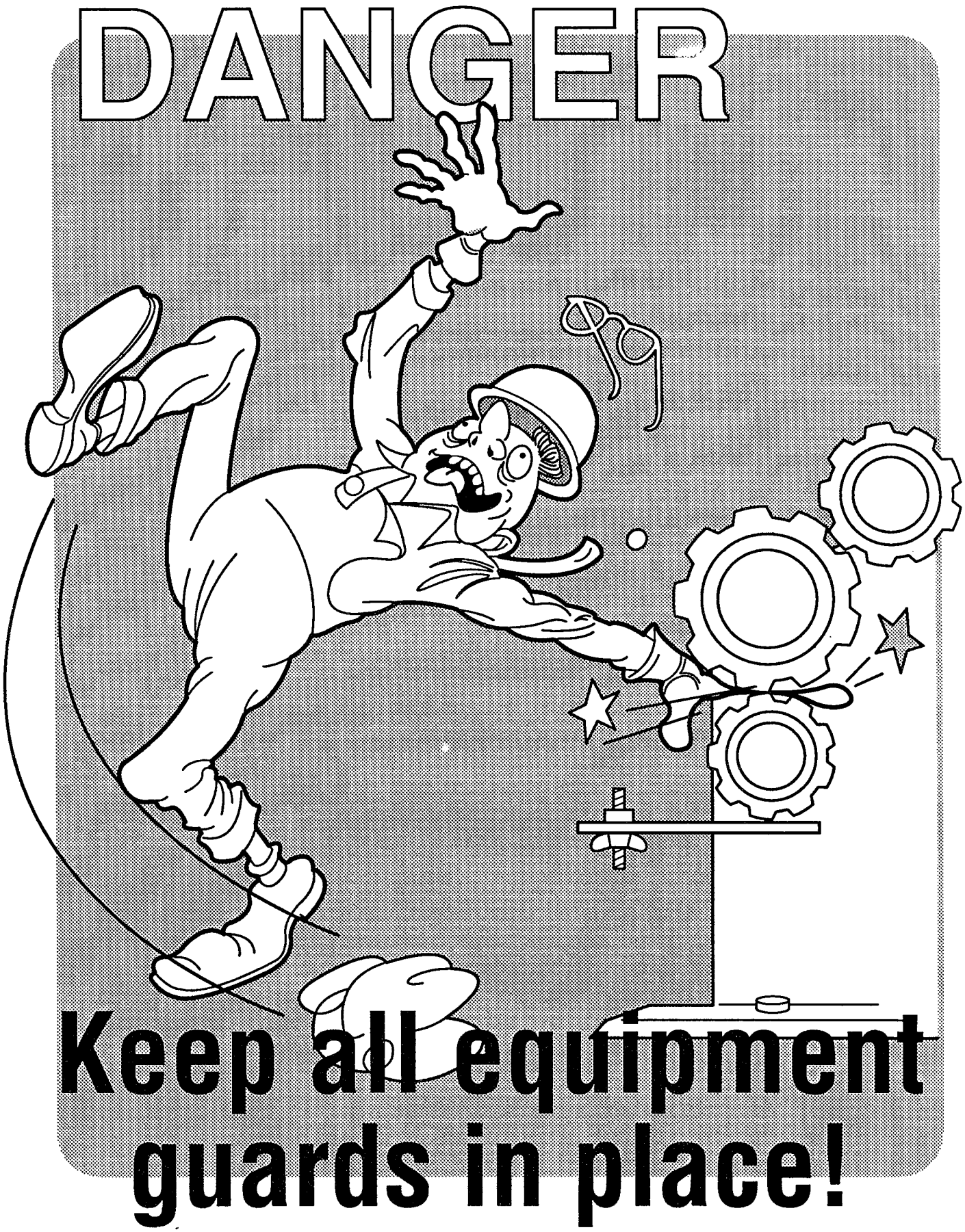
A thorough knowledge of escapeways is vital to the safety of every person who enters an underground mine. Practice drills will help persons underground to gain that vital knowledge. In addition, drills will greatly reduce the probability that fear and confusion will occur during an emergency. Drills will also facilitate a timely, quick, and safe retreat from the mine.

When escapeways cannot be used, however, the backup use of refuge chambers is important. If chambers are unavailable or inaccessible, miners should know how to erect airtight barricades.

Improved methods of rescuing trapped miners have greatly enhanced the possibility of survival. Occasionally, their survival will rest on their ability to build a suitable barricade.

It is hoped that fires and other emergencies can be eliminated from mining. In order to ensure their health and safety, miners must always be prepared for any emergency.

Mine Escapeways, U.S. Department of Labor, Mine Safety and Health Administration.



Courtesy of the ***Mines Accident Prevention Association,*** *Ontario, Canada*

Carpal tunnel syndrome

By Gene E. Autio, MSHA M/NM

Carpal tunnel syndrome (CTS) is one of the occupational diseases generally termed as a cumulative trauma disorder. Overuse of the hands and wrists can cause numbness, tingling, pins-and-needles feelings, weakness, and even pain in the fingers and hands. Eventually the pain can extend up into the wrist and arm. The condition is caused by compression of the median nerve. The median nerve passes through an opening in the wrist joint, called the carpal tunnel, on its way from the forearm to the hand. The median nerve is surrounded by ligaments and bones as it and the flexor tendons of the fingers pass through the carpal tunnel. The tunnel is normally large enough to allow easy movement of the nerve and tendons as the wrist moves. If something happens to cause the size of the tunnel to decrease, the movements of the tendons and nerves are restricted. Flexation of the wrist and pressure on the palm of the hand when using a hand tool such as a screwdriver, wrench or a drill, can cause the size of the carpal tunnel to decrease and cause compression on the median nerve. Vibration from tools and equipment can also increase the chances of developing CTS. If the median nerve is compressed and irritated too often, carpal tunnel syndrome can result.

The early symptoms can be intermittent and vague. There may be numbness, tingling, and pain in the fingers except for the little fingers. Many times the symptoms occur and can be more severe at night, away from the job. As a result, people may not associate the symptoms with their job. CTS is not specifically an occupational disease. Some other diseases and conditions that may increase the chances of developing CTS are wrist fracture, arthritis, diabetes, and hypothyroidism. Still, most health professionals believe that use of the hands and tools by themselves, or in association with other factors, may lead to the development of CTS.

It is important to get a proper diagnosis and treatment before any nerve damage becomes permanent. A doctor specializing in this area should be consulted. Severe cases may require surgery, which is not always successful. Less severe cases may be treated with rest, possibly a wrist brace, and changes in the job to prevent reoccurrence.

Ergonomic design can be used to lessen or eliminate work conditions that are believed to be factors in the development of CTS. Ergonomics can be defined as fitting or designing a job, a machine or a tool to the worker, as opposed to making the worker adjust to the job, machine or tool.

The number of cases of CTS in the United States is believed to be underreported and the actual number of people suffering from CTS is not known. CTS can be difficult to diagnose, and some people do not want their employers to know that they have CTS for fear of being moved to another job or even losing their job. The num-

ber of cases of CTS that are reported to MSHA has increased in the last 3 years. Some of the job categories reporting CTS are baggers, mechanics, repairman, equipment operators, and drillers. Since 1984, the following number of CTS cases have been reported to MSHA Metal and Nonmetal Mine Safety and Health: 8 in 1984; 5 in 1985; 11 in 1986; 8 in 1987; 32 in 1988; 48 in 1989; and 70 in 1990.

As with all illnesses, early diagnosis and treatment of CTS is crucial. The best procedure is the elimination or reduction of the conditions that cause or increase the chances of developing CTS, so that medical treatment is not necessary.

Safety or health?

By Douglas K. Martin, Arizona State Mine Inspector

Which comes first, ***safety*** or ***health***? What do we teach in our safety training classes or our weekly safety meetings? We have safety engineers and other safety professionals concerned with the "health and safety" of our employees, but how much emphasis do we place on each aspect?

Day after day is spent developing programs on hazard recognition, task training, job safety analysis and other safety-related aspects of our industry. However, most of us seem to largely ignore the other half of our job, health education, or at best only give it lip service.

During first aid classes, the video tape will list the major controllable causes of heart attack—smoking, diet, weight, exercise, stress; and even notes that merely reading this list will not be meaningful. "You must do something about these causes to prevent heart attacks," intones the tape's moderator. But how much good does it actually do? Has anyone really quit smoking as a result of one of these lectures? Has anyone changed his or her eating habits or begun exercising more? Do they now cook with low fat vegetable oils rather than grease or butter? Have we impressed upon them effectively enough the importance of forming good health habits?

It can be argued what an employee does on his or her own time is their business, and the rest of us can butt out! However, if an employee takes illegal drugs or drinks too much alcohol before coming on the job, employers have every right and responsibility to test them and even dismiss the employee because they are a hazard to themselves and others around them.

The only time an employee with bad eating habits might be a hazard to others is if he had a heart attack while driving a large haulage truck, lost control and caused a collision. This may sound extreme, but, given this scenario, it has been determined that the driver of a haulage truck at one Arizona copper mine *was* dead of a heart attack **before** the "accident." Luckily, no one else was injured, that time.

Intelligent managers agree that pre-

ventive maintenance on all our expensive mining equipment is essential, and saves uncounted millions of dollars in repair and down-time costs. Are we successful in stressing what "preventive maintenance" might do for our even more valuable employees?

Some insurance companies recognize the value of good health practices by charging lower premiums for nonsmokers. A few employers have encouraged their people to quit smoking by offering cash incentives. A healthy employee lowers company overhead by reducing time off for sickness, for medical bills, and for hiring and training replacements. An added bonus of a healthy employee is having a happier, more productive employee.

The vice president of one small Arizona mining operation offered $500 to an equipment maintenance supervisor if he would quit smoking for 6 months. The employee quit and after 2 years is still off cigarettes. While this is impossible for everyone to do, it does illustrate one effective method, "economic incentive." Call it bribery, if you will, but it works. Not only does the employee save the $1.50 per day ($90 per month, $1,080 per year), but a small cash bonus to boot works wonders. At the same time, incentives for other health-related areas like diet and exercise could be explored.

Hazard recognition, task training, job safety analysis, safe production seminars, and other "safety first" programs should never take a back seat in training sessions, but neither should attention to better health. Is there any difference in an employee lost to sickness or one lost to an accident? Becoming health conscious will not only provide exceptional benefits to both the employer and employee, but also improve the safety program. ***"Treat the whole person."***

Alertness prevents *hurtness!*

There is no end to the things that flash through our minds during the performance of daily tasks. Some pass quickly; others we become absorbed in. Our concern should be with the problem of becoming lost in thought which is entirely unrelated to what we're doing—*not having our mind on what we're doing*. Perhaps one answer is for each of us to make a deeper personal analysis of our current work, and become fully aware of the potential danger to ourselves and others through failure to "Keep our mind on what we're doing!" Think: ***Alertness prevents hurtness!***

Depression on the job

With the medical bill for mental health and chemical dependency problems skyrocketing, you'd expect that companies would have studied these problems ad nauseam. You'd be wrong.

"Companies in general have paid very little attention to the mental health of workers," asserts E. Carroll Curtis, M.D., corporate medical director for Westinghouse Electric Corp., Pittsburgh. "We don't even know how often major mental health problems occur in the workforce. That's particularly true of the white-collar workforce."

Like other major corporations, Westinghouse sponsors employee assistance programs (EAP), which over the past decade have become increasingly comprehensive. Though the company had always felt that its investment in EAPs was beneficial, it had little data to back up its decisions.

Curtis, in conjunction with colleagues at the University of Pittsburgh School of Medicine, decided to try to get abetter picture of the psychological health of Westinghouse. With a grant from the National Institute of Mental Health, a study was conducted involving 1,870 Westinghouse managers and professionals. Eighty percent of the employees were male; over half had graduate-level education.

Mental health professionals conducted 2-hour interviews with the employees, primarily at their homes, to find out the prevalence of alcoholism and major depression, and the relationship of home and work stress to these problems.

Before starting the study, Curtis recalled, the research team had been warned that they were unlikely to find many mental health problems among this group of well-educated, stably employed people. Instead, the study found that 23 percent of the men and 36 percent of the women had suffered from major depression, about twice what would have been expected based on general population studies. In addition, the study found a higher than expected rate of alcohol abuse among the women employees—8.6 percent compared to general population rates of 4.2 to 4.8 percent.

The Westinghouse study also refuted warnings that the allegedly nonverbal engineers being studied would clam up in front of interviewers. "It worked out precisely the opposite," Curtis recalled. "The biggest problem the interviewers had, after completing the questioning, was getting away." Employees found it so refreshing, Curtis explained, that it had the unanticipated benefit of providing some therapeutic value.

Historically, Westinghouse has been viewed as a people-oriented employer with a very loyal workforce, Curtis pointed out. So, why the high rates of depression? Curtis said a number of factors were at work. One, the company had announced layoffs among its white-collar workforce the same month the interviews began. Second, he said the Westinghouse study was very carefully conceived and conducted, making it more sensitive than previous stud-

ies performed in the community at large. But perhaps most importantly, according to Curtis, is that the study reflected changes in the American workforce in the 1980s—a period when employment became less stable and work and family life became increasingly intermingled.

Curtis said conclusions about cause and effect could not be drawn from the study. " If somebody is having trouble at work and they become depressed, did the trouble at work give rise to the depression or did the depression give rise to the trouble at work? We can't tell that from our study," he said, adding that there was a "good prospect" that a follow-up study would be conducted.

Help for 'gatekeepers'

One "strong association" the study was able to draw was between negative work events, particularly conflicts with a supervisor, and episodes of depression. In order for Westinghouse to sensitize its corporate culture toward problems of mental health, said Curtis, it was important for the company physicians and nurses to be more aware of mental health issues that affect workers, and better prepared to recognize psychological problems in order to refer troubled employees to mental health professionals.

Curtis said there is still considerable stigma attached to mental health problems, but he contends that one of the reasons mental health and chemical dependency costs are rising is that people are becoming more willing to seek help.

"I don't mind the costs going up if people are getting the help that they need," he said. "Medical costs are like a balloon. If you squeeze it in one place, then it bulges out in another." If workers have mental health problems and don't seek treatment Curtis said, they are likely to develop physical problems such as ulcers or high blood pressure. "You're going to pay for it one way or the other," he said.

Strains and sprains

Your evening jog is going well. Suddenly, your foot lands on a small rock and you collapse. What happened? It's a sprain if a ligament that links the ankle bones together has stretched or torn. But, if a muscle or tendon is affected, it's a strain. You can help avoid the pain and annoyance of these injuries by knowing about strains and sprains. If an accident does happen, you can prevent it from getting worse and help it to heal sooner by using basic first aid hints.

Why strains happen

Muscles and tendons need to be warm to work well. When you haven't warmed them up—let's say before shoveling snow or bowling, you can strain them. Strains are not as serious as sprains. Strains also happen if your muscles aren't used to an activity. If

you play baseball once a year at the company picnic and neglect to get into shape beforehand, you may end up with a strained shoulder. Using your body in the wrong way can also cause strains. A common cause of back strains is lifting a heavy box without bending the knees.

Why sprains happen

Joints allow us to bend, twist, or turn. When a joint is forced to go much further than usual, you have a sprain. Ankles, wrists, knees, and fingers can sprain easily. Sprains are common in sports. Sudden twisting as in baseball, tremendous force and pressure as in football, or falls as in ski accidents, are all causes of sprains. You don't need to be an athlete to suffer a sprain. Just walking and twisting an ankle, or tripping, falling, or landing hard on a joint can result in a sprain.

Sprain/strain symptoms

A sprain may be instantly very painful. The joint swells quickly and turns black and blue. You may not know whether or not you have broken a bone unless x-rays are taken. Strains may be painful several hours after the injury. The injured area may be tender and swollen and may turn black and blue. Often, you will have a smaller range of motion in the area.

First aid helps heal

Stop using the injured part immediately. Don't walk on it, carry with it, or move it at all. Raise injured part above the level of the heart, letting it rest on pillows or blankets.

For a strain, use an elastic bandage to firmly (not tightly) wrap the injury. Put ice in a towel or bag and apply to the injury for 30 minutes. This will lessen the pain and keep swelling down. For the next 15 minutes, remove both the ice and the wrap to allow blood into the area. Repeat ice and wrap, on and off, as your doctor or physical therapist recommends.

For a sprain, treat it as if there are broken bones, since you may not be able to tell until an x-ray is taken. Splint the area using a pillow, towel, or blanket. Then, apply ice in a towel or bag to the injury, and speak to a doctor to see if you need an x-ray.

After 48 hours

Now, you can promote healing by using wet heat, such as whirlpool, bath, or wet towel. If it is a mild strain, gentle exercise will help you feel less stiff. But, if pain is sharp, stop immediately. See a doctor or physical therapist if: sprain is moderate or severe; pain is very strong or lasts more than 24 hours; swelling doesn't lessen after 24 hours.

Easy prevention

1. Warm up for any physical activity, from painting walls to ice skating. Stretch gently and begin slowly with easy movements.
2. Get in shape and wear proper equipment for your activity.
3. Gradually slow down, then stretch when your activity is finished.

Sports injuries memorandum, April 3, 1991, U.S. Department of Labor.

Holmes Safety Association Monthly Safety Topic

Fatal explosives

GENERAL INFORMATION: A 48-year-old surface mechanic, with 27 years of mining experience, was killed and a co-worker seriously injured when the two workers attempted to destroy deteriorating explosives stored in a surface magazine.

The mine involved is being developed by the room and pillar method. Coal is extracted by continuous mining machines. Mining height varies from 30 to 36 inches. Explosives are stored and used at this mine primarily to excavate overcast sites for ventilation currents.

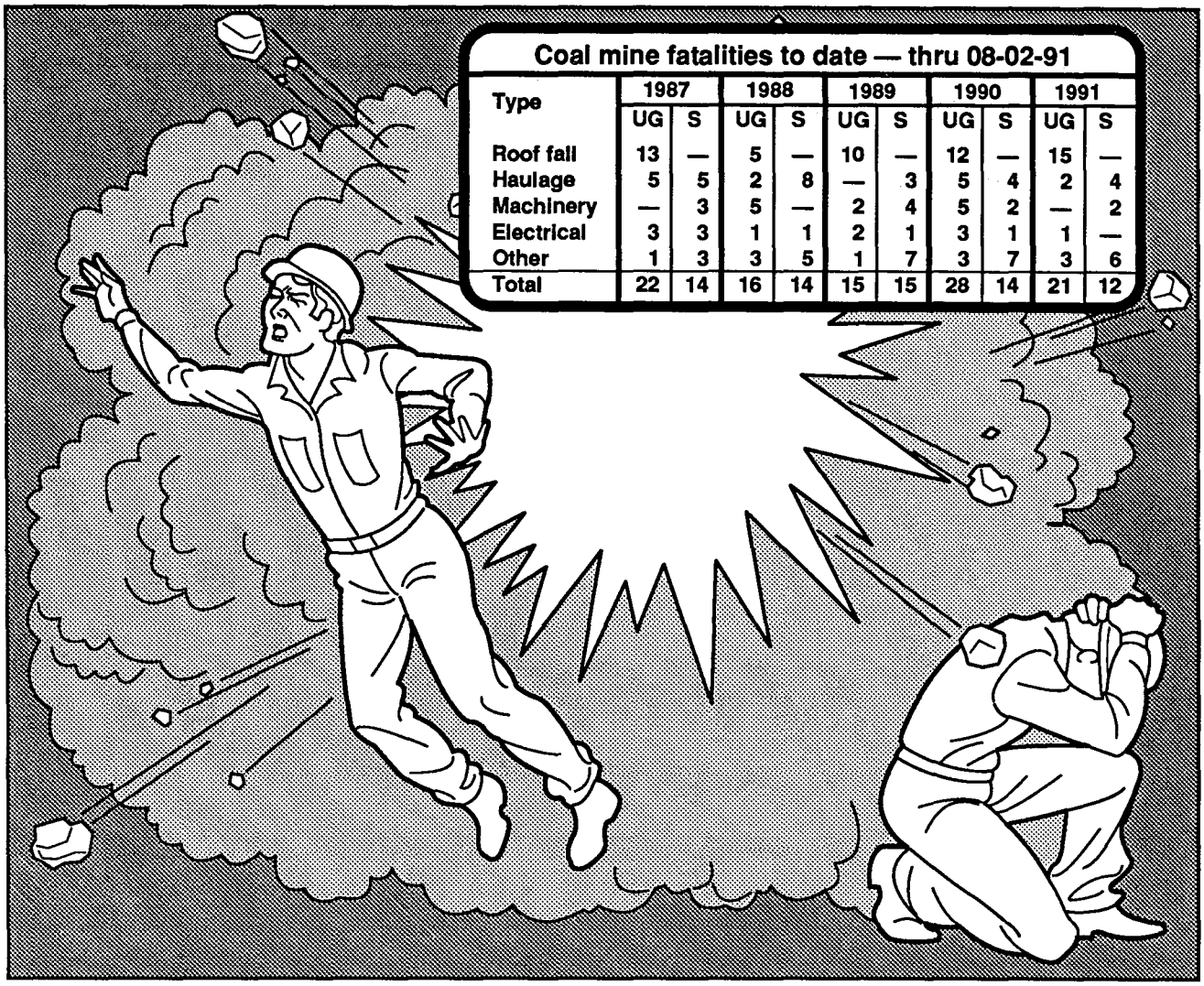
A total of 15 persons are employed on three production shifts per day, 5 days per week. Daily production averages 1,500 tons of coal.

DESCRIPTION OF ACCIDENT: The day shift began their normal duties at approximately 7:00 a.m. At about 2:20 p.m., the mine superintendent assigned the victim and another mechanic the task of disposing of deteriorated explosives that were stored in the surface explosives magazine. This was a task that the two miners had performed without incident on numerous occasions in the past. At about 2:30 p.m., the two mechanics left the outside shop to begin disposal of the explosives.

At about 2:45 p.m., the chief electrician, who was in the outside shop observed an explosion in the vicinity of the explosives magazine. The electrician, the mine superintendent, and another miner ran to the area of the explosion. The superintendent, upon realizing what had occurred, returned to the shop and summoned other employees to help. He also called the rescue squad. Upon arriving at the explosion site, the electrician, who is also an emergency medical technician (EMT), began administering first aid to the injured mechanic, who was lying near the remains of a detonator magazine. As other employees arrived to help, the electrician and another miner, who was also a trained EMT, went to examine the victim who was lying on the ground approximately 20 feet from the injured mechanic. The examination of the victim failed to reveal any vital signs. The injured mechanic and the victim were moved to the mine office and, upon arrival of the rescue squad, were transported to the nearest hospital where the victim was pronounced dead on arrival.

The force of the explosion created a crater 13' x 9' x 2' and caused damage to several private homes in the area.

CONCLUSION: The employees were in the process of burning the explosives within 18 feet of the detonator (cap) magazine. The detonator maga-



Coal mine fatalities to date — thru 08-02-91

Type	1987		1988		1989		1990		1991	
	UG	S	UG	S	UG	S	UG	S	UG	S
Roof fall	13	—	5	—	10	—	12	—	15	—
Haulage	5	5	2	8	—	3	5	4	2	4
Machinery	—	3	5	—	2	4	5	2	—	2
Electrical	3	3	1	1	2	1	3	1	1	—
Other	1	3	3	5	1	7	3	7	3	6
Total	22	14	16	14	15	15	28	14	21	12

zine was destroyed by the explosion scattering the detonators over the accident site. Evidence from the accident site and testimony from employees indicated that a fire had been started and, as they had on previous occasions, these employees had used petroleum naphtha to start fires to burn the explosives. A lidless half-filled can of petroleum naphtha was found on the ground approximately 20 feet from the crater. An old naphtha can and a hydraulic oil can that was damaged was also found near the accident site. Company officials and employees indicated that these employees had burned other explosives at this same location on numerous occasions. Testimony from company officials indicated that other explosives had deteriorated from this same group of explosives and that these two men had also disposed of them by burning. A record from the explosives magazine was found lying on the ground near the magazine indicating that 6-1/2 cases of explosives were in the magazine. After the explosion, the magazine contained 2-1/2 cases. Approximately 34 sticks of explosives were found scattered near the accident site.

This accident and resulting fatality occurred when the two employees remained in the area while burning deteriorated explosives. The method of disposal of these explosives contributed greatly to the accident.

Safety topic—First aid

By Preston T. White

An accident can be defined as "an unplanned, unwanted occurrence." Some accidents occur and no one gets injured. When someone is injured, we need to be ready to administer emergency medical treatment—-first aid. This covers everything from applying a band-aid to treating a person for a broken back.

When someone is injured you must act fast. Everyone **must** know where the first aid materials are kept. A well-equipped first aid station should contain the following:

1. One stretcher
2. One broken-back board (if a splint-stretcher combination is used, it will satisfy the requirements of both 1 & 2)
3. Twenty-four triangular bandages (15 if a splint-stretcher combination is used)
4. Eight 4-inch bandage compresses
5. Eight 2-inch bandage compresses
6. Twelve 1-inch adhesive compresses
7. One foille
8. Two cloth blankets
9. One rubber blanket or equivalent substitute.
10. Two tourniquets
11. One dozen ammonia ampules or a 1-ounce bottle of aromatic spirits of ammonia.
12. The necessary complements of arm and leg splints or two each inflatable plastic arm and leg splints
13. All first aid supplies should be stored in suitable, sanitary, dust-tight,

moisture-proof containers and such supplies should be accessible to the miners.

While one person goes after the first aid supplies, you need to do a *primary assessment* of the injured person. Some of the items you should check for in a primary assessment are:

1. Determine that the area is safe to treat the injured
2. Open the airway
3. Check breathing
4. Control bleeding

Mouth-to-mouth ventilation

1. Open the airway

A. Kneel at the victim's side with your knee nearest the victim's head opposite the victim's shoulder

B. Use the head-tilt/chin-lift maneuver

2. Pinch the nose closed. Inhale deeply and place your mouth over the victim's mouth, making sure of a tight seal. Give two (2) full breaths. Watch for the chest to rise after each breath (be careful not to over-inflate a small person's lungs)

3. Keep the victim's head extended at all times

4. Remove your mouth between breaths and let the victim exhale

5. Feel and listen for the return flow of air and look for fall of victim's chest

Control of bleeding

A. Bleeding from artery—bright red in color and spurting

B. Bleeding from vein—dark red in color with a steady flow

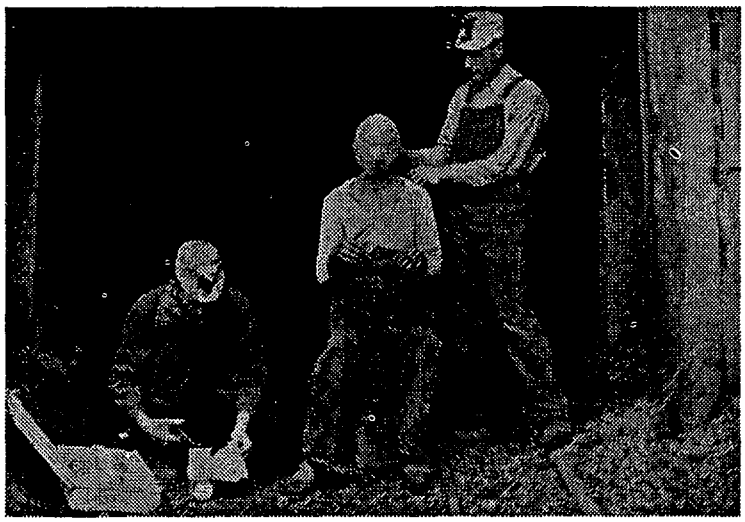
C. Bleeding from capillaries—steady ooze of blood.

Use the following methods to control bleeding:

1. Use direct pressure with a sterile bandage if available
2. Elevation
3. Pressure points
4. Cold compresses
5. Tourniquet, if necessary (use as a last resort)

Once these items have been checked and taken care of, you can then do a *secondary survey.* This consists of a complete examination of the injured for non-life-threatening injuries.

If you desire more information on first aid, you can obtain a copy of MSHA's *Safety Manual No. 3* or *First Aid Book* from the National Mine Health and Safety Academy, Beckley, West Virginia.



Getting wrapped up in an early Bureau of Mines-sponsored first aid class

Stress: It's not all in your mind

By Barbara A. Brehm, Ed.D., Smith College, Northampton, MA

Current research continues to implicate stress as a risk factor for everything from acne to cancer. No longer is someone with a tension headache told, "Don't worry, it's nothing serious. It's all in your mind."

This research touches all of us, because we all experience stress in some way. The trick is to get rid of excess stress, and learn to try to control our response to the source of stresses with which we live.

1. What is stress? Stress usually involves your *perception* of a *situation or event* that requires some sort of response from you. Stress can be mild—putting out the dog if it barks; or severe—coping with the consequences of crashing your car into a telephone pole.

Exposure to heat, cold, exercise, loud noise, and pain is stressful. Loss of a loved one, financial problems, arguments with co-workers, and moving to a new town are emotionally stressful. Most of us are most concerned with emotional stress.

When you feel stressed, your body reacts by eliciting a "fight or flight" response. You prepare physiologically to confront or run away from the threat. Your heart beats faster and harder, your breathing gets faster and shallower, and your muscles tense for action. Blood rushes to your head to give your brain plenty of oxygen. Your pupils get larger, and your hearing sharper. Blood leaves your extremities, and your hands and feet often feel cold and sweaty. Many biochemical changes occur to mobilize energy as you gear up for action.

2. Is this reaction harmful? Not as a single episode. The problems come when you experience this fight or flight response over and over, without getting a chance to relax and recover. Chronic stress arousal may gradually take its toll on your mental and physical health.

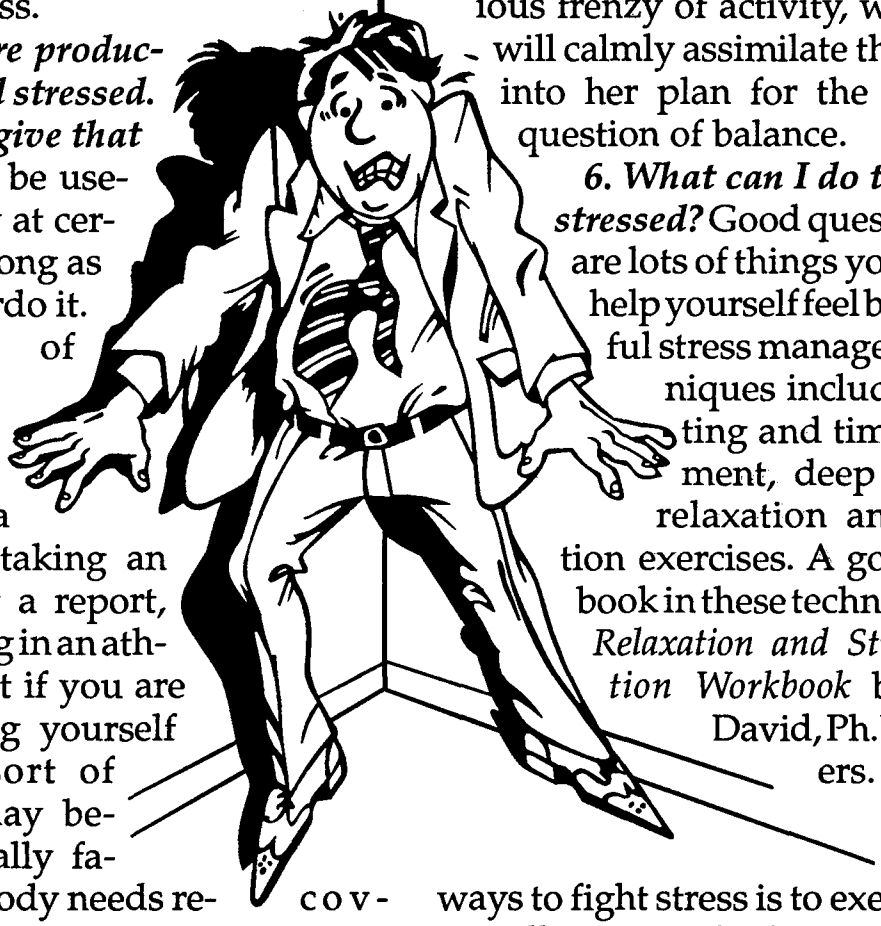
It is possible that chronic elevation in blood pressure leads to injury of the arterial walls, and atherosclerosis. Chronic stress is also associated with high cholesterol and triglycerides, muscle tension problems—especially pain in the jaw, head, neck and shoulders—migraine headaches, indigestion, ulcers, colitis, constipation, diarrhea, insomnia and fatigue. Chronic stress weakens your immune response, and you become more likely to get sick. Stress sometimes leads to inappropriate coping, including drug and alcohol abuse, consumption of too much caffeine, and violent behavior. Depression, anxiety, phobias, resentment and hostility top the list of stress-related mental health problems. Since these symptoms may have causes other than stress, you should check with your physician if you are concerned.

3. Should I try to get rid of all the stress in my life? Of course not! For one thing, that's impossible. Besides, we wouldn't want to live without it. In order to banish stress from our lives, we'd have to give up holidays, traveling and falling in love. Excitement is a form of *eustress*, good stress. Stress challenges and stimulates us; it encourages us to grow. An ability to respond

quickly to dangerous situations can save your life or the life of someone you love. You need that adrenaline rush to grab your child from the path of an oncoming car.

On the other hand, too much stress, and especially too much negative stress, leads to *distress* and often illness.

4. I am more productive when I feel stressed. Why should I give that up? Stress can be useful in this way at certain times, as long as you don't overdo it. That sense of arousal helps us perform at our peak while giving a presentation, taking an exam, writing a report, or participating in an athletic event. But if you are always putting yourself under this sort of stress, you may become chronically fatigued. Your body needs recovery time. True creativity requires a fresh vision that just won't come from a foggy brain.



5. How do I know if I have too much stress? You are "overstressed" if you feel stress having a negative impact on your life. People experiencing any of the physical or mental symptoms listed above often benefit from stress management practices. If stress is getting in the way of your productivity, your enjoyment of your family, friends, and recreational activities, or your sense of well-being, you might discover new energy, creativity and joy as you learn to relax.

Stress sources and responses differ from person to person. A new deadline might send Rita into an anxious frenzy of activity, while Linda will calmly assimilate the new task into her plan for the day. It's a question of balance.

6. What can I do to feels less stressed? Good question! There are lots of things you can do to help yourself feel better. Helpful stress management techniques include goal setting and time management, deep breathing, relaxation and meditation exercises. A good how-to book in these techniques is *The Relaxation and Stress Reduction Workbook* by Martha David, Ph.D., and others.

One of the best ways to fight stress is to exercise. Exercise allows your body to carry out the fight or flight response and return naturally to a relaxed state. Exercise also encourages self-awareness and self-esteem as you develop discipline and an improved body-mind connection. Spending some time renewing yourself is one of the best ways to feel less stressed.

From the Phelps-Dodge-Morenci Employee Newsletter, February 1991.

Back injuries require integration of aggressive and passive treatment

Low-back injuries account for one-third of all compensation needs, a total of $4.6 billion annually

By Gijs van Oort, PhD, Maureen Frederick, MS, PT, Donna Pinto, RN, and Daniel Ragone, MD.

It is fair to say that low-back injuries are the Achilles heel of our health-care system. Although few people die of this condition, and it is not contagious, it has significantly affected workers' compensation claims, employee morale and company profits.

The facts are staggering: 28 percent of the U.S. industrial population will experience disabling low-back pain at some time during their lives, while 8 percent of the working population will be disabled in any given year. Although low-back injuries account for one out of every five compensable injuries, they demand one-third of all compensation needs, a staggering total of $4.6 billion annually.

The cost of low-back injuries is directly related to the length of absence from the job: 74.2 percent of workers with reported low-back injuries are returning to work within 1 month; yet 7.4 percent of workers with spinal disorders stay out for more than 6 months. These cases are responsible for 75.6 percent of the overall compensation and medical costs related to lower-back injuries.

Kelsey found that of the patients who were out of work for 6 months, 50 percent returned to work; of those who stayed out for 1 year, only 25 percent returned to work. Those who were out for more than 2 years had a zero return-to-work rate.

Present treatment

Given the discouraging prognosis following long-term absence from the job, the present approach to low-back rehabilitation is one of aggressive care, with the objective of having the patient back to work in about 4 to 6 weeks. Consequently, the medical care immediately following the incident is critical.

Experts have tried to understand the reasons for the much lower return-to-work rate when recovery exceeds several months. Malingerers, although existing among this population, make up only a small portion. More often, a patient's attitude changes when an immediate cure is not available. Initially, he may have verbalized complaints to justify his new condition and to gain the understanding of people in his environment. When no results are apparent for a considerable time, these complaints can become a part of the normal thinking pattern.

The treatment of lower-back problems has evolved in a fashion similar to that of cardiovascular rehabilitation. While a heart attack at one time was treated with 6 weeks of bed rest frequently followed by a lifelong disability status, now a patient can be up and around—yet under care—within 48 hours of the event.

For lower-back injuries the following components have been, and fre-

quently still are, a standard regimen:
• Bed rest—with or without authorization to get out of bed even to use the bathroom;
• Thermotherapy—a local application of deep heat using diathermy, ultrasound, infrared rays, warm compresses, heating pads or hydrotherapy;
• Cryotherapy—cold packs for local application of ice or iced water with ice wrappings or compresses;
• Traction—intermittent or continuous longitudinal elongation of the spine, either mechanical or manual;
• Massage—deep or superficial manipulation of the soft tissues according to defined techniques;
• Manipulation—high-velocity, low-amplitude movement of the vertebra beyond its physiological range but within its anatomical range;
• Ultrasound—deep-heating agent using sound waves to increase the tissue temperature to a depth of 5 cm or more;
• Electrical stimulation—high-voltage, low-amperage direct current used to decrease synovitis, edema, pain and muscle guarding;
• Spinal orthosis—rigid orthopedic braces, custom-made for long-term use, to provide support to the lumbar and cervical area by immobilization.

Integrated treatment

A conservative approach, consisting of one or several of the above methods, is usually effective for the first 2 weeks of treatment. Since the causes of many low-back injuries lie in daily work activities, however, the lasting effects of any of these treatments are minimal. Consequently, a treatment that involves the patient both passively and actively has a greater chance of returning the patient to work and keeping him there. Long-term passive care, on the contrary, has developed a "revolving-door" patient situation, with 6 weeks of hot pack, then 6 weeks of ultrasound, for example. Additionally, the inactivity incurred during the treatment creates further weakening of the muscles and increases the chances of re-injury.

An aggressive rehabilitation program is focused around an individualized, structured exercise program, geared to create improved stamina, flexibility, strength and work readiness. The program should start immediately after, or in conjunction with, the passive treatments. A team approach, with physician, physical therapist, rehabilitation specialist and insurance carrier working together, helps ensure effective treatment.

The role of exercise in the treatment of low-back injuries has long been questioned. Yet many researchers have identified various deconditioning symptoms, especially weakening of trunk muscles, in patients with low-back problems. Chaffin et al. reported that workers with reduced isometric lifting strength had increased episodes of low-back pain. In a study evaluating the protective effects of strengthening exercises in fire fighters, Cady et al. found that with increasing fitness levels, a significant protective effect for back injuries was gained.

Further evidence was given by De Vries et al. in a study that compared electromygraphic signals of back-supporting muscles during prolonged postural stress conditions in two groups of people: one group with low-back inju-

ries, and one of apparently healthy individuals. His data suggest that muscular deficiency is a major contributor to low-back injury.

Jackson and Brown list the following arguments for prescribing exercise to patients with low-back injuries:

- to decrease pain;
- to strengthen muscles;
- to decrease mechanical stress to spinal structures;
- to improve fitness level to prevent injury;
- to stabilize hypermobile segments;
- to improve posture;
- to improve mobility.

They base these statements on their extensive review of the literature, from which they further conclude that the strength of the trunk extensor muscles is often reduced with chronic back pain; and muscular insufficiency—in the form of decreased endurance—is a contributing factor in low-back pain where there is no known cause. Adequate strength of the trunk muscles is necessary for a full return to function and work. Muscle strength may also be related to the degree of incapacity of a back patient, if not the degree of pain.

Rehabilitation components

To achieve a return-to-work, a rehabilitation program should include treatment, conditioning, education and orientation, and job analysis and modification.

A conditioning program should include several elements:

Walking on a track or treadmill without incline at speeds varying from 2.5 to 3.5 mph.

Swimming in a pool under well-heated conditions—80 to 86 degrees F. Since swimming is a non-weight bearing activity, conditioning can be accomplished without the pain often incurred by walking. The back stroke is recommended during the initial rehabilitation phase, as is the use of snorkel and mask, to prevent significant trunk rotations which put undue stresses on the injured muscles or muscle sustem. For non-swimmers, a pool-walking program can be implemented.

Bicycling on a stationary bicycle is another non-weightbearing exercise that can be effective if proper body posture is maintained. The traditional position of a 10-speed racing bike is not advisable without appropriate strengthening of the back muscles or reversal of the handlebars.

The aerobic component should last 35 to 40 minutes, and be done three to five times a week. Aerobics classes are not recommended unless a clear assessment of the patient's readiness warrants this. Issues such as vertical impact on the spine, extreme ranges of motion and the intensity of these classes require close scrutiny before a back patient should participate. The same considerations are applicable to rope-jumping and jogging, or any other activity that jars the spinal column.

Flexibility exercises should be based on each patient's need. At the patient's initial evaluation, flexibility deficits are noted and a specific program is outlined. The importance of proper flexibility cannot be overstated, given the fact that flexibility is joint-specific, and repeatedly activated muscles require regular stretching throughout the workday. Currently, flexibility and strength-

ening exercises for low-back injuries include posterior pelvic tilt trunk rotations; hyper-extension exercises as recommended by McKenzie; and hamstring stretching.

Strengthening exercises with weight machines that work individual muscle groups are essential. Isokinetic conditioning machines, which force patients to work against a fixed resistance, can also be helpful. The objective of strength training is to develop proportional strength gains in all major groups, especially those involved in the functioning and support of the back region. Partial situps can also be helpful in achieving this goal.

During the course of such a strengthening program, a patient progresses through gradually increasing weight resistance and numbers of repetitions to perform on a daily basis. Progress should be noted daily on an exercise recording card. This information can be made available to an employer or insurance carrier when a back-to-work decision must be made.

The *work-simulation* component should be started with a job site analysis for each patient, either on-site or through conversation with the insurance specialist. Information is needed about the types of activity the tasks require, the work environment, the number of breaks, and about any physical demands.

Once an adequate level of conditioning has been reached, the patient is introduced to work-simulation tasks. These tasks are conducted under the physical therapist's supervision, using increasing levels of resistance up to a level required for the job. At all times, proper forms and techniques are demonstrated and emphasized.

Because of the comprehensiveness of this aggressive approach and the relatively high goals set for the course of treatment, a team of professionals is needed. Every other week a team meeting with the physician, physical therapist and rehabilitation specialist should be scheduled. During this, the progress of the patient and possible readjustments in goals are discussed. Discharge planning also takes place, and recommendations are made to the personal physician.

The occurrence of low-back injuries has become epidemic in our society. Despite the fact that medicine continually develops new and better assessment and treatment tools, the treatment of low-back injuries to date is not any more clear cut than it was 10 years ago. We know that lifestyle habits can contribute to the incidence of these injuries, so treatment should include improving lifestyle habits.

In today's management of the back patient, both passive treatment and aggressive treatment are needed. The rehabilitation program should not only return the patient to work but also create awareness about prevention of future episodes.

Reprinted from the January 1990 issue of ***Occupational Health & Safety*** *magazine.*

Retsof's Anzalone given "Hero Award"

Daniel J. Anzalone, Jr., mine production foreman at Akzo Salt Inc.'s Retsof Mine, was recently honored with a "Hero Award" by the Holmes Safety Association. It was presented by Assistant Secretary of Labor, William J. Tattersall, at an awards banquet held at Pipestem State Resort Park, Pipestem, West Virginia. This prestigious award is given to recognize those individuals who have willingly risked their own lives in saving or attempting to save the life of another.

Anzalone was presented the award for the part he played in saving the life of fellow employee Russell Schneider during a roof fall at the Retsof Mine on November 19, 1990. According to a report released by the Mine Safety and Health Administration, Anzalone, risking personal danger, stayed at the scene to remove the slabs of salt that had covered Schneider. The report determined that, had Anzalone not taken immediate action, Schneider would have died.

In summing up the significance of the Holmes Hero Award, the agency referred to a biblical quote: "No greater love hath any man than to lay down his life for a friend."

Valley Camp takes first in rescue contest

The Valley Camp Coal Company's Donaldson Division Team captured first place in a mine rescue contest held June 1. The contest, sponsored by the Holmes Safety Association and Kanahwa Valley District Council, was held on the Cannelton Little League baseball field.

The Valley Camp team members include: Frank Foster, captain; Rick Waugh; Blaine Hall; Tim Browning; Gary Hastings; Gilbert Young; Ron Sedlock; and Jack Campbell, trainer.

Cannelton Industries' Kanawha Division Team of Jack Hatfield, captain; Jimmy Nottingham; Dave Prelaz; Roy Truman; Jim Thompson; John Whitt; Jeff Kukura; Robert Osborne; and James Adkins, trainer, placed second in the contest.

Third place went to Leivasy Mining Corporation's Lady H Mine Team of Luther Spence, Jr., captain; Gary Trout; Thomas Drew; Dana Hackworth; Barry Mullins; Dave Morris; Michael Groves; and John Ashcraft, trainer.

Beth Energy's Mine No. 84 Team placed fourth. Team members include: Brad Debush, captain; Dave Carroll; Tom Olinger; Fred Eimer; Bruce Carson; Mike Reese; Ken Wiley; Frank Femia; and Ron Bizick, trainer.

Organizers say special appreciation is due to: Gauley Sales Inc.; Raleigh Mine Supply; Quality Engineering; Valley Emergency Medical Services; Holmes Safety Association; Valley Coal Camp Company, Donaldson Division; Cannelton Industries Inc., Kanawha Division; Beth Energy Mines Inc.; Leivasy Mining Corp.; West Virginia Department of Energy; The Montgomery Herald; UMWA Local Union 8843; the Upper Kanawha Valley Little League Association; and the Mine Safety and Health Administration.

Protective clothing

by Doris Ann Cash, Mining Engineer, Office of Technical Support

Special clothing may be necessary to protect workers against hazardous substances or conditions. For example, gloves, aprons, boots, coveralls, or other appropriate clothing that is chemically resistant or flame-proofed should be worn where there is danger of splashes or other injurious contacts with hazardous materials. Protective clothing prevents the absorption of toxic substances through the skin, as well as preventing damage to the skin.

The type of protective clothing that is needed depends on the nature of the hazards encountered, the duration and frequency of exposure to the hazard, site characteristics, and the tasks that the worker must perform while the clothing is being worn. There is no all-purpose protective clothing. However, manufacturers offer a wide selection of garments designed to protect against specific hazards. Clothing is available to protect against acids, alkalis, moisture, oils, temperature extremes, and other chemical and physical agents.

To determine whether protective clothing is needed and if so, what type, the chemicals used on site and the mining or mill process used must be reviewed to identify the physical and chemical hazards that may be encountered. Both the worker who must wear protective clothing and the person responsible for ordering the clothing should familiarize themselves with the appropriate Material Safety Data Sheets to determine what level of protection is appropriate. The skin notations in the ACGIH TLV Booklet, the NIOSH/OSHA Pocket Guide to Chemical Hazards, manufacturer's guides, and process flow sheets may also provide useful information. The pH of the mill circuit or mining process under consideration should also be known. Both high pH (alkaline) and low pH (acid) materials will damage the skin and increase the rate of chemical uptake. In unique situations where exposure to a hazardous substance can occur through multiple routes of entry and cause death, serious illness or injury, or impair the ability to escape, totally-encapsulating chemical protective suits may be necessary.

Once the tasks the worker will be performing are known, the accidents that could occur can be anticipated. Protective clothing can then be selected to prevent injury to the body parts most likely to be affected during the extent of time the protective clothing will be needed. For example, workers at a cement kiln may need several types of protective clothing. An encapsulating, heat-resistant suit with appropriate face shield would be worn on the occasions when an air-lance is used to break up dust jams to prevent both thermal and chemical burns from the hot, alkali dust. Chemical resistant boots, gloves, and suits would need to be available in plant areas where wet spills could occur. When chemical resistance is required, material must be selected that will provide protection for the length of time the protective clothing will be worn. In the case of the cement plant, a worker who normally spends up to 4

hours a day in areas where wet spills are common would need protective clothing made of material resistant for 4 hours to both alkali water and any other chemicals present. Remember that "impermeable" and "impervious" are misnomers. One material will have a longer breakthrough time than another for a specific chemical. However, there is no material that is a barrier to all chemical exposure.

Proper procedures must also be established for the cleaning or disposal of protective clothing. While it is often possible to clean or dispose of contaminated clothing locally, some applications will cause the clothing to become hazardous to store or process. Protocols for hazardous waste disposal or decontamination should be followed carefully to prevent further contamination. Those items of protective clothing that can be reused will have longer lives if they are cleaned properly. If an item is visibly worn or damaged, it will not provide adequate protection and should be replaced. The chemicals which gradually permeate protective clothing will degradate the material and allow the chemicals to seep through to the skin. A record of use or schedule for replacement will help prevent injury due to the degraded material offering inadequate protection.

It is critical that workers be supplied with properly fitted protective clothing. The hazards associated with ill-fitting clothing include entanglement, trips, falls, and limitation of function. Workers who perform a variety of tasks while wearing protective clothing should be able to do all of them safely.

Reliance on protective clothing has one inherent fault. Nothing has been done to reduce or eliminate the hazard itself. If the clothing or equipment fails, the worker is immediately exposed to the hazard. That is why protective clothing or equipment should be relied on only when it is not possible to remove the hazard, or in cases of short exposures to hazardous materials or substances, such as unplanned spills.

September 15-21, 1991 proclaimed 'National Farm Safety Week'

Because we count on farmers and ranchers for so much, both as individuals and as a nation, it is fitting that we observe National Farm Safety Week—a public awareness campaign aimed at promoting farm health and safety.

Over the years much has been done to improve the safety of agricultural production. Advances in science and technology and increased attention to avoiding safety risks have made farms and ranches safer places to work.

Unfortunately, however, while important strides have been made in reducing the risks of farming and ranching, agricultural production remains one of our most hazardous industries.

Most accidents on the nation's farms and ranches can be prevented by simple, sensible measures. Children should be kept away from hazardous machinery and all family members and employees should be trained in safety procedures and first aid.

I hereby proclaim the week of September 15-21, 1991, as National Farm

Safety Week. I urge all who live and work on our nation's farms and ranches to make the preservation of personal health and safety a part of their daily activities. I also urge them to protect their children, not only by instruction in safety habits, but also by setting an example of carefulness and by avoiding needless risks.

George Bush, President of the United States

President's message...

The committee responsible for making the arrangements for the annual national meeting for 1992 met on July 23, in the Pennsylvania Department of Deep Mine Safety Conference room. Since I am a member of that committee, I thought it would be appropriate to give a report on the meeting.

Members present were Dan Breedon, John Shutack, Bob Glatter, Donna Schorr, Harry Tuggle, John Jansky, Paul Hammel, T. J. Ward, and yours truly.

An extensive agenda was presented by Bob Glatter, the National secretary. It was a well thought out agenda and shows that our new secretary is taking his additional responsibilities seriously. Good job Bob, keep it up.

The agenda was too extensive to complete in one day, so we had to defer the remaining four items until our October meeting. Some of the items discussed were as follows:

The committee authorized the development and purchase of stickers related to substance abuse.

It was decided to solicit articles for the Bulletin by asking each member of the executive committee to submit an article on a rotational basis. A letter explaining the details for committee members will be forthcoming.

The committee strongly supports the promotion of programs related to substance abuse, job safety analysis, safety around abandoned mines, buckle-up program, and enhanced participation.

Unanimous approval was given to Bob Glatter's suggestion that a special award for Ival Van Horne be presented to his widow.

Bob was authorized to add to his list of promotional items; coffee mugs, Swiss army knives, and T-shirts. This is one of the very limited methods HSA has of enhancing its financial position. I'm sure the councils where these items are available would be happy to receive your purchase order.

A proposal was made to develop two new stickers, "Mike Miner" and "Larry Longwall," to replace the outdated "Jack Safety" sticker. The secretary will arrange to have the art work done and submit it to the committee for their approval.

Last, but not least, was the approval of a $100 saving bond to be awarded to the individual who comes up with the best safety slogan for the 1992 HSA decal. Details for this program should appear in next month's Bulletin.

Ronald L. Keaton, President

The last word...

"A bore is a person who talks when you want him to listen."

"Watching some TV shows makes a person wonder what the networks rejected."

"Things could be worse. Suppose daytime soap operas run on Saturdays and Sundays, too."

"The quickest way to lose your shirt is to put too much on the cuff."

"'In this great free country, everybody has a chance to amount to something and thus earn the hate or envy of all the others who had the same chance but didn't use it."

"We grow a little every time we do not take advantage of somebody's weakness."

"Those who spend today boasting about the wonderful things they will do tomorrow probably spent yesterday doing the same thing."

"Some people have lousy memories—they never forget anything."

"There's no sense in advertising your troubles. There's no market for them."

"Perseverance is a virtue, but sticking to your guns when you're out of bullets is pigheaded."

NOTICE: We welcome any materials that you submit to the Holmes Safety 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 1991 is underway – please remember that if you are participating this year, you need to mail you quarterly report to:

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Holmes Safety Bulletin
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