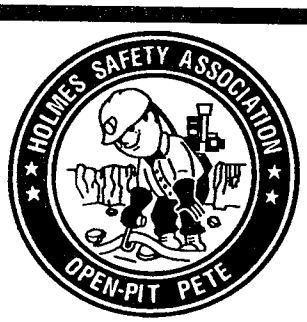
BULLETIN

January 1992



January 1992

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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

NAME	CHAPTER NUMBER	LOCATION
Barrett Aggregate	9473	Dexter, MI
Southern Columbia Sand & Grave	9474	Elizaville, NY
Barb Tipple	9475	New Concord, OH
Miric Pit	9476	Cadiz, OH
Polen II	9477	Barnesville, OH
Stanby Safety Services, Inc.	9478	Cortez, CO
Jim Stephens, Inc.	9479	Cortez, CO
Creative Safety Management	9480	Albuquerque, NM
High Splint #1	9481	Lynch, KY
Number 37 Mine	9482	Lynch, KY
Loadouts & Cave Branch	9483	Lynch, KY
Corbin Prep Plant	9484	Lynch, KY
Noble County Auger #1	9485	Belmont, OH
Commercial Rock Products	9486	Pagosa Springs, CO
Meadows and Leonard Mine #1	9487	Windber, PA
No Broken Bones	9488	Memphis, TN
B & F Engineering, Inc.	9489	Hot Springs, AR
Lenig Tunnel	9490	Shamokin, PA
Pioneer Ready Mix, Inc.	9491	Bozeman, MT
Broken Hill Mining Company	9492	Pikeville, KY
Sarah Ashley Mining Co ., Inc .	9493	Pikeville, KY
Chad Processing, Inc.	9494	Pikeville, KY
White Cloud Mining Co., Inc.	9495	Pikeville, KY
Tri-County Concrete	9496	Roosevelt, UT
Vernal Mill	9497	Vernal, UT
Vernal Pit	9498	Vernal, UT
Delta Safety Network	9499	West Helena, AR
Smith Pit	9500	Star City, AR
Lone Mt. #2	9501	Las Vegas, NV
Lone Mt. #1	9502	Las Vegas, NV
Jack Pot/patsy Group	9503	Nelson, NV
Leavitt Ready Mix - Moapa Pit	9504	Moapa, NV
Georgia Pacific Mine	9505	Las Vegas, NV
Indian Creek Materials	9506	Fairbury, IL
Nashville Gravel	9507	Nashville, AR
Pennsylvania Coal Company, Inc.	9508	Stoystown, PA
Coal Operators & Associates	9509	Pikeville, KY
Bull Run No. 1	9510	Beaver Dam, KY
Kennecott Ridgeway Mining Co.	9511	Ridgeway, SC
Tjs Mining, Inc.	9512	Indiana, PA
Roxcoal, Inc.	9513	Berlin, PA
J.T. Express, Ltd.	9514	Imlay City, MI
Safety III	9515	Ada, OK
Safety II	9516	Ada, OK
Safety I	9517	Sulphur, OK
Candice Sterusky	9518	Phoenix, AZ
Anderson Brothers Const. Co.	9519	Brainerd, MN
Indian Nation Chapter	9520	Wilburton, OK
Upper Potomac River Commission	9521	Westernport, MD
Bartolec Pit	9522	Coshocton, OH

Holmes Safety Association
Monthly safety topic

Asphyxiation

GENERAL INFORMATION: A 42-year-old logger with 5 years of experience was asphyxiated by engine exhaust when his vehicle became stuck in a mud hole during the previous night.

The mine is an underground coal mine and has one active longwall panel development section using a continuous mining machine, shuttle cars, and belt haulage. The mine produces 650 tons per shift, with 52 employees working one production shift and one maintenance shift 5 days a week.

DESCRIPTION OF ACCIDENT: The victim, a contractor, was performing lithologic logging of exploration boreholes being drilled on mine property north of the mine portals.

About 6:00 p.m., the drillers had completed their final hole of the day and were preparing to leave the property. The company geologist was in charge of the exploration proceedings and had remained to oversee operations. The victim was in the process of logging a drill hole with the logging tool at a depth of 500 feet. The tool was being withdrawn from the hole at a rate of 25 to 30 feet per minute.

Due to recent heavy rains in the area, the access roads were extremely muddy. The geologist had remained on site to ensure safe withdrawal of all persons from the property. The victim wished to complete the logging of the hole that evening and, therefore, requested that everyone proceed home without him. He assured them he would be okay. The geologist and the others left the area by the most direct route to the main highway shortly after 6:00 p.m.

On the following morning about 11:50 a.m., the geologist and geologist helper met the dozer operator in the drilling site area. The dozer operator said he had been in the canyon near the previous evening's drill site and saw the victim's Ford van stuck in a mudhole. This was on a different road than that used by the others the night before. He added that the rear doors of the van were open and a generator inside the van was running, but there was no sign of the victim.

The geologist instructed the dozer operator to return to the area of the van by one route while she and the geologist helper traversed a separate route to begin a search for the victim.

About 12:30 p.m., the geologist and helper arrived at the van and discussed how deeply it was stuck in the mudhole, even taking pictures of it. While looking the van over, they observed the victim sitting inside the front passenger compartment. He did not respond to their calls, and they began pounding on the window. At this time they thought they observed the victim breathing abnormally and very labored.

As the passenger doors were locked, the geologist climbed in the open back doors, but could still not access the area where the victim was seated. She noticed the heavy smell of exhaust fumes in the rear compartment, even though the doors were open, and turned the generator off. The dozer operator then broke the right passenger window with a hammer and opened the sliding side door to reach the victim. Finding no vital signs, the geologist and helper administered CPR while the dozer operator went for help.

An ambulance arrived about 1:20 p.m., and transported the victim to the medical center where he was pronounced dead on arrival due to asphyxiation.

CONCLUSION: After becoming stuck in a mudhole, the victim probably elected to spend the night in the front compartment of his van. He attempted to stay warm by operating an electric heater powered by a gasoline generator in the rear of the van. The rear doors of the van were left open in an apparent attempt to evacuate the leaking exhaust fumes, but since the van was steeply inclined uphill, some of the exhaust fumes remained inside the rear compartment. Poisonous gases were introduced into the sealed front compartment, where he was sleeping, from the contaminated rear compartment by the blower fan of the electric heater. The victim succumbed to the poisonous effects of the exhaust fumes during the night.

The following physical factors were involved:

1. Due to recent heavy rains, certain access roads to the drill site area were extremely muddy.

2. The most direct road to the paved highway was over high ground and was easily passable. The lower road on which the victim had tried to exit was extremely muddy and had been earlier determined by the geologist to be impassable. She stated that she had cautioned the victim against traveling the lower road even though his van was a 4-wheel drive vehicle. The victim was using a 1979 Ford 350 quadravan equipped for logging boreholes.

3. Earlier in the day, the victim, the geologist, and the drilling crews had discovered a female bear fatally injured in a fall from a tree, leaving an orphaned cub. This was near the location where the victim was eventually found. The entire crew had expressed concern over the well-being of the cub and had discussed actions to ensure its survival.

4. The victim had been working in this area for several weeks and was familiar with the access roads to the drill sites.

5. Prior to leaving the area, the geologist had cautioned the victim against traveling to the area where the bear cub had been observed because the roads were impassable due to mud and ruts.

6. After logging the strata of the borehole he was examining, the victim apparently attempted to leave the area via the lower impassable road rather than the higher road used by the other personnel. The victim either accidentally took the wrong road or intentionally tried it, perhaps attempting to observe the bear cub.

7. The length of the mudhole in

which the victim's van was stuck was about 50 feet. He had driven about 2/3 of the way across the mudhole to where the road turned uphill. At this point, the van became mired in mud up to the frame and was hopelessly stuck.

8. The victim probably elected to spend the night in the van rather than walk out of the remote area and, after sunset when the temperature dropped, decided to warm the van with a pre-installed electric heater. The van was divided between the front and rear compartments by a solid wall with windows. An electric heater was mounted in the wall separation on the passenger side and directly adjacent to the seat in which the victim was found seated. The heater was equipped with a blower fan which drew air from the rear compartment of the van. A gasoline-powered generator was located in the rear compartment and the exhaust was vented to the outside. A leak was found in the exhaust system where it exited the side of the van.

9. The front of the van was raised at a steep angle due to the rear wheels being sunken in the mudhole.

10. All windows in the front compartment of the van were tightly closed and the doors were locked. Although the rear doors were wide open, the geologist stated that when she entered the rear compartment to turn off the generator, the smell of engine exhaust was very strong.

11. After discovering the victim, the geologist and geologist helper attempted to revive him by performing CPR until medical assistance arrived, a time period of about 45 minutes.

Breathing apparatus wins 'R&D 100' Award

The Bureau of Mines has earned an "R&D 100" Award for 1991 for its SR-100 self-contained self-rescuer. The annual award, sponsored by *Research and Development* magazine, honors 100 of the world's most innovative and technologically significant achievements for the year. It's the Bureau's 28th award since it began participating in the program in 1978.

The device is a closed-circuit breathing apparatus that provides complete respiratory protection for a user escaping from a toxic atmosphere. The SR-100 was developed by the Bureau's Pittsburgh Research Center and CSE Corporation of Monroeville, Pennsylvania, for use in underground mines. It also has potential as a rescue device for other industrial environments, including the cement industry, tunneling, municipal sewer and utility construction projects, and other areas where a self-contained breathing device may be needed in emergency situations.

The technological advantage offered by the SR-100 is its capacity to contain a relatively large quantity of oxygen in a small, lightweight package. The apparatus can be easily worn because of its small size and weight. It can also provide full respiratory protection in a matter of seconds. In an environment that can quickly become unbreathable, these advantages become lifesavers.

John Kovac, U.S. Bureau of Mines.

Safety comes first at Conesville preparation plant

On June 18, employees at the coal-washing facility completed 4 years without a lost-time accident

By Dave Waitkus

According to Dave Leppla, it's no accident that the Conesville Coal Preparation Company recently reached 4 years without a lost-time injury.

appreciative of the group that cooperates and works with you. It's not something a plant manager can do. It takes a total team effort."

Harvey Prince, a mobile equipment operator at the Conesville coal preparation plant, descends a flight of metal stairs from a safety platform at the plant' refuse loading area. The platform and stairs were the result of employee suggestions.

"It's something to be real proud of," says Leppla, plant manager at the American Electric Power Service Corp. (AEP) Fuel Supply coal-washing facility. "By the same token, you have to be

Conesville prep plant workers reached their latest safety milestone June 18. The 47 employees at the plant have received an AEP Fuel Supply Safety Award in each of the past 4 years.

Rick Shuck, scalemaster at the Conesville preparation plant, communicates from the scalemaster house with one of the many coal truck drivers.

"It takes a lot of effort to keep a positive attitude toward safety at all times," Leppla continues. "Everyone has other things on their minds and it sometimes becomes difficult to keep your mind on doing your job safely."

"The nice thing is that the word has gotten back to the workers here that AEP is very safety conscious. They know how serious everyone is about safety, from upper management right on down."

Leppla and Steve Wilson, safety/operations supervisor at the prep plant, agree that employee suggestions—the "ergonomic" approach—and productive safety meetings have been keys to achieving such lofty goals.

"Our ergonomic program is a big part of our safety committee work," says Wilson. "Safety works its way into nearly all of our talks."

"Steve spends a lot of time communicating with the employees and taking suggestions," adds Leppla. "The employees know if they have a problem, it will be taken care of. Steve also travels to the mines to pick up new ideas."

Wilson says several programs and

Conesville has devised an extensive system for safely handling the 300 coal trucks that move on and off the property during each delivery day. No more than 10 trucks are allowed to advance to the scales/dumping area at one time. The others must wait in designated zones along the haul road.

improvements can be pointed to as features of the plant's safety achievement.

Perhaps the most significant change came at the plant's refuse discharge area where a metal slip-proof platform and stairs were installed to provide easier access for refuse truck operators.

"Our drivers don't even have to use their truck ladders except for the first time in the morning," explains Wilson. "We have effectively eliminated 60 to 70 trips up and down those ladders each 24-hour period. These drivers work in all kinds of weather, and this has been a big asset to them."

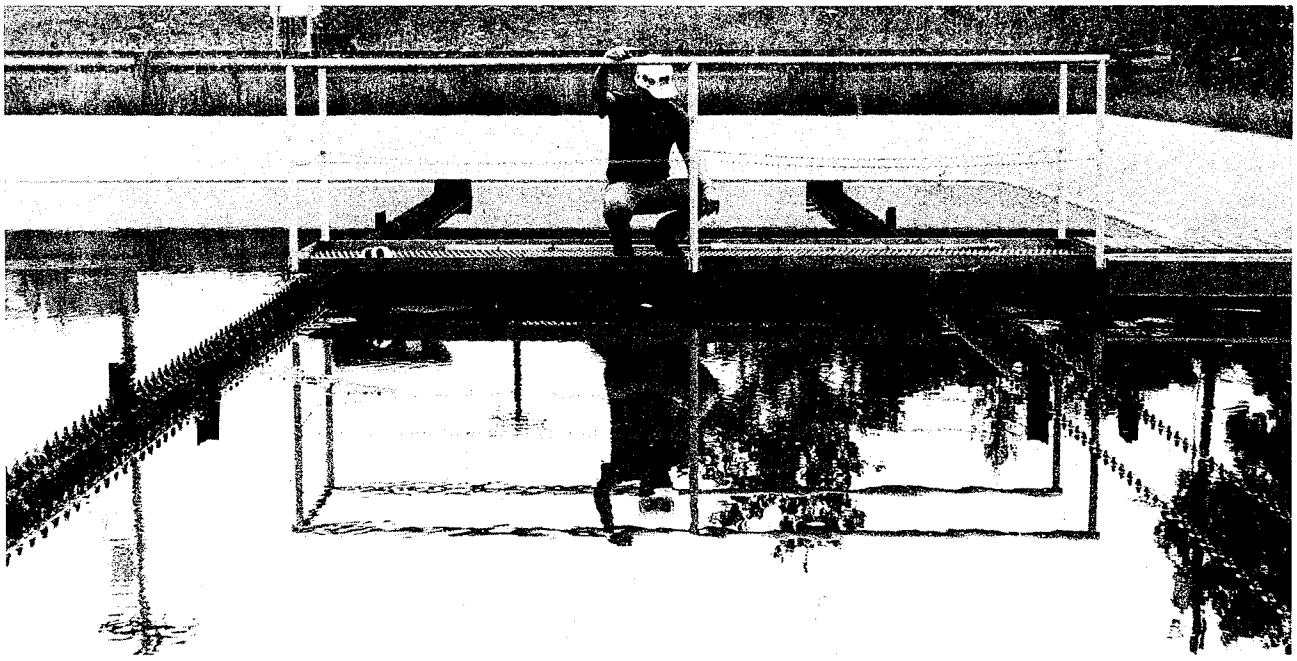
During a typical day, one driver operates two of the 85-ton trucks. After unloading one truck, the driver parks it under the discharge area and moves to the other truck.

The platform, which evolved from suggestions from the plant's mine safety committee and employees, was put into use approximately 2 years ago and has been a tremendous success.

Another major safety concern is the plant's coal unloading area. Leppla reports that approximately 300 coal trucks unload coal per day. These trucks share the haul road with the plant's refuse trucks in all types of weather, making the situation even more difficult. In order to handle the truck traffic, a number of programs have been implemented.

"First, all truck drivers must be hazard trained before they can come on the property," says Wilson. "One of the first things we tell them is that the refuse trucks have the right-of-way."

In order to control the flow of trucks, Wilson and scalemaster Rick Shuck have established safe "waiting points" along the haul road, as well as "No Parking" zones. In order to alleviate congestion, only 10 trucks are permitted to enter the scales/dumping area at



Steve Wilson, operations/safety supervisor at the Conesville preparation plant, shows how lab technicians now have a metal "no-slip" catwalk across the plant's acid mine drainage pond. The catwalk allows the technicians to take water samples in a safe manner at prime locations.

one time. Of those 10, three can dump coal in designated zones at the same time.

"We have a good communications system," Wilson emphasizes. "The dozer operators have CB radios to communicate with the truck traffic. We also have control room and mine radio systems. We can communicate with nearly everyone at all times."

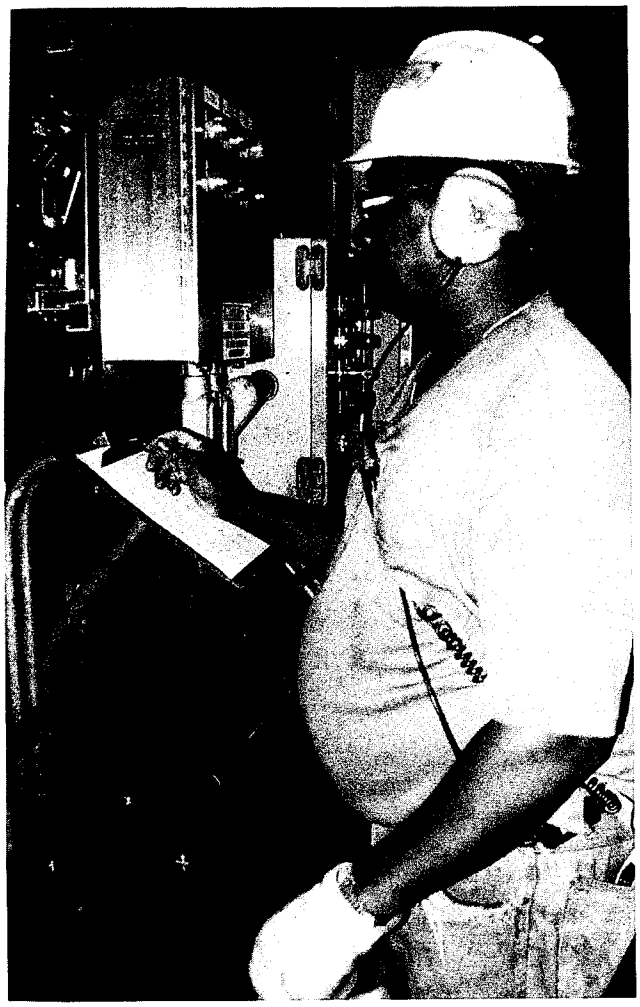
Wilson adds that a traffic light system is also being installed on the haul road to better regulate the trucks. The major concern again is the location of the refuse trucks. If a refuse truck has dumped its load and is returning to the haul road, the light will flash caution yellow to warn the coal truck drivers.

Another safety feature at the plant is a metal no-slip catwalk that extends across the plant's acid mine drainage settling pond.

Wilson says lab technicians constantly take water samples from the pond. Previously, they had to put themselves into an awkward position at the edge of the pond to draw the proper sample. The catwalk allows them to safely take samples from any major point across the center of the pond.

Other new safety features at the prep plant include: a ladder and guard that were installed for easy access to the plant's roof; working platforms on various conveyors to lessen strain on employees; fire suppression systems on the refuse haulers and other mobile equipment; an escape ladder for the filter press area; and the installation of a ventilation fan in the employee lunchroom to improve air circulation.

Wilson has also implemented the "Take Two" program he borrowed from



Andy Avery, a stationary equipment operator at the plant, has hearing protection that doubles as a receiver for communicating with refuse truck drivers

Central Ohio Coal Company. The basis of Take Two, he explains, is for employees to stop and think about each task before it is performed.

On August 1, representatives of the Holmes Safety Association honored Conesville prep plant employees for working 4 years without a lost-time injury. Ron Keaton, manager of the Mine Safety and Health Administration's District 3, presented Conesville workers with a 6-foot trophy on behalf of the Holmes Safety Association.

Representing AEP at the ceremony were Hugh H. "Luke" Lucas, vice president of mining operations, and John

O'Green, safety and health director.

Accepting the award for Conesville, in addition to Leppla and Wilson, were Clyde Parks, an electrician who represented the plant's United Mine Workers of America (UMWA) safety committee, and Alan Horner, a laborer who serves on the plant's UMWA mine committee.

"Everyone here thinks about safety," Wilson concludes. "It's a total team effort. "

Reprinted from the August 1991 issue of the AEP ***Coal Courier.***

Conesville employees receive safety award

On August 1, a special meeting of the Mid-Ohio District Council of the Holmes Safety Association was held to present an award to the employees of the Conesville Coal Preparation Company for their sincere dedication in providing a safe work place. The employees worked 48 months without a lost-time accident (06-18-87 through 06-19-91). This accounts for 324,689 hours worked without a lost-time accident.

Employees of the Conesville Preparation Plant are listed alphabetically: Almack, Martha ; Avery, Andrew; Beaber, Robert; Brown, Roger; Celeschi, John; Colburn, Thomas; Custer, Dennis; DeVault, David; Dobson, Gregory; Ferri, Dominic; Filkill, Dean; Fitch, Edward; Foster, James; Foster, Lewis; Grier, Patricia;Hahn, Jamie; Horner, Alan; Jasper, Ralph; Joseph, Jr. George; King, Jeffrey; Kowalewski, Richard; Krebs, Kenneth; Lambert, Russell; Leppla, H. David; Lowery, Joseph; McFarland, George; Magers, Jeffrey; Mason, Steven; Miller, Randy; Miller, Alan; Morin, George; Norris, Richard;Parks, Clyde; Parsons, Michael; Porth, Robert; Prince, Richard; Priode, Dwight; Roberts, Jack; Roberts, Mark; Rosser, Larry; Savage, Wayne; Shuck, Richard; Toler, Bethel; Wesney, Raymond; West, Richard; Williams, Mark; Wilson, Steven; Yacapraro, Jr., Joseph.

Those present representing MSHA were Ronald L. Keaton, District Manager, District 3, Irmadell Pugh, Program Analyst, District 3, Robert Crumrine, Subdistrict Manager, St. Clairsville, Ohio, Jack Cologie, Supervisory CMS&H Inspector, James Myer, E & T Specialist, and Robert Grissett, CMS&H Inspector, New Lexington, Ohio Field Office.

Those representing the Ohio Division of Mines were Paul Kidney, Chief, and James Hoblick, Inspector and President of the Mid-Ohio District Council.

John O'Green, Safety and Health Director, and Hugh Lucas, Vice President of Mining Operations, represented the American Electric Power Company, owner of the Conesville Plant.

From the Mid-Ohio District Council of the Holmes Safety Association.

ASARCO holds safety awards dinner

ASARCO's Tennessee Mines Division held a Safety Awards Dinner at the Hyatt Regency on September 14, 1991. The dinner was held to honor 265 employees for working from 10 to almost 40 years without a lost time accident. Over 400 employees and their spouses attended the gala event.

The guest speaker was Don Farley, Secretary Emeritus of the Holmes Safety Association and currently the Chief of the Safety and Health Technology Branch of the National Mine Health and Safety Academy at Beckley, West Virginia. Farley presented his views on the role of the Mine Safety and Health Administration in achieving a safer and healthier workplace. He praised the attendees for their "truly remarkable safety accomplishments."

Among the special guests for the evening were Tom Osborne, Executive Vice President for ASARCO, Frank McAllister, Vice President of ASARCO, Bryon G. Brumbaugh and Rick Maxwell of ASARCO's Safety Department, Ron Goins of the Tennessee Department of Labor, Division of Mines, and J. L. Bales, Manager of ASARCO's Eastern Mining Department.

D.H. Walter, Manager of the Tennessee Mines Division (TMD), detailed the recent improvements to the TMD Safety Program, and voiced continuing commitment to improving the Safety Program. He thanked the employees and supervisors of Tennessee for their dedication to safety.

The Tennessee Mines Division operates 4 underground zinc mines and two mills in Knox and Jefferson Counties, and employs approximately 550 persons. The division is the largest zinc producer in the continental United States.

***Standard Banner**, Jefferson City, Tennessee, Thursday, October 10, 1991.*

The coal miner

By Jimmy "Jabo" W. Ball

I'm a coal miner
Whose occupation there is no finer
They say we are a special breed
Working to fulfill our family need

We have bolters, miners, and shuttlecars too
To help provide the work we do
We go back and forth and from side to side
On this equipment we ride

It is dark, damp, and low too
This place we work myself and my crew
We laugh and joke and have our fun
But all in all we get our work done

Some work by day, some work by night
All work done by limited light
We are extra careful in the work we do
By guided hand we make it through

We try to run the black gold
By laws we control
Not too high and not too wide
By Federal and State Laws we abide

Company rules and guidelines too
Keep safe the job we do
Inspectors are always coming in
Every 90 days their inspections begin

Some are Jewell Smokeless, some are Dominion
Some call us other names, but that is their opinion
We're not union, we're not scabs
We're just hard working moms and dads.

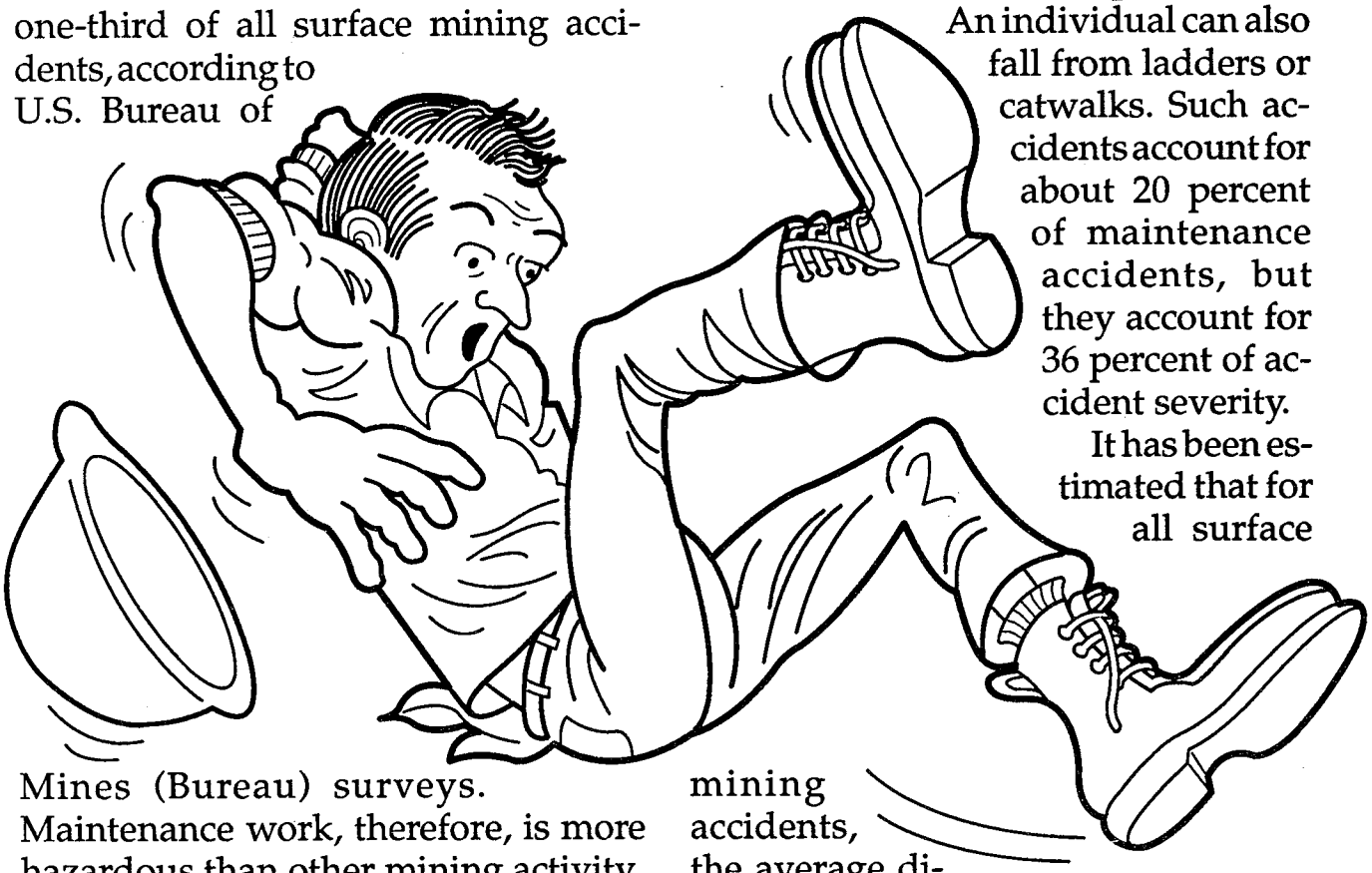
Jimmy W. Ball
P.O. Box 1244
Richlands, Virginia 24641

Maintenance

Avoiding slip-and-fall accidents

By Nicholas P. Chironis

Accidents that occur during equipment maintenance constitute more than one-third of all surface mining accidents, according to U.S. Bureau of Mines (Bureau) surveys. Maintenance work, therefore, is more hazardous than other mining activity.



During 1986, for example, the Bureau estimates that there were 27,864 maintenance workers in the surface mining industry. Although these workers accounted for only 6.7 percent of all hours worked, they were involved in 16.8 percent of all surface mining accidents. Based on these figures, maintenance is 2.5 times more hazardous than other activities.

A large part of the maintenance worker's job is performed on large mining equipment in the presence of fluids, fuels, lubricants and dust and debris—all of which put the maintenance worker at risk of slips and falls. An individual can also fall from ladders or catwalks. Such accidents account for about 20 percent of maintenance accidents, but they account for 36 percent of accident severity.

It has been estimated that for all surface mining accidents, the average direct cost to the mine operator in production losses and in increased insurance rates is $14,000 per case. For severe accidents, the cost is much higher. The average work time lost for a surface mining accident is 18.5 days. But the average time lost in a slip-and-fall accident is 33 days, with costs estimated at $25,200.

Who or what to blame?

As to the cause of the accidents, the bureau notes that two diametrically opposed schools of thought seem to

Table I—Listing of antecedent events, codes, and frequency noted in accident narratives

Event	*Code*	*Frequency*
Slipped on surface	20	170
Slipped off machine	40	170
Unknown	65	141
Slipped on spill	25	129
Stepped off machine	41	116
Tripped on uneven surface	22	104
Unexpected energy release	60	97
Slipped on machine	42	90
Inadequate workstand	50	89
Slipped on work surface	26	82
Slipped on debris	24	73
Carried object	73	62
Slipped on step	32	55
Slipped on stairs	30	53
Jumped	47	51
Fell from ladder	16	50
Slipped on ladder	11	48
Stepped off structure—other than machine	33	39
Ladder slipped or fell	12	38
Access system not used	66	38
Unmarked hazard	21	35
Falling or raising object	71	34
Other structural failure	54	32
Knee gave way	70	27
Work boots not cleaned	61	25
Stepped on machine access	43	22
Stepped off ladder	17	12
Slipped on catwalk	44	12
Slipped on deck	45	9
No guardrail	51	9
Carrying object using ladder	14	7
Tripped on grating	23	6
Portable stairs moved	31	6
Guardrail structural failure	52	6
Clothes caught on object	63	6
Ladder structural failure	10	5
Inadequate access design	55	4
Bumped head	72	3
Handrail not used	13	2
Handrail did not arrest	15	2
No escape route	46	2
No toe rail	53	2
Total structural failure	64	1

The Bureau of Mines listing of types of accidents and their frequencies was compiled from accident records obtained from MSHA's data base.

prevail. One school faults foolish, careless or negligent people for the cause of 90 percent of all accidents.

The other viewpoint puts the blame on poorly designed products (vehicles, machines, auxiliary components, etc.). The belief is that such products should be designed so that even untrained or careless people will be protected from their own errors and negligence.

Both viewpoints seem to be sup-

Table II—Antecedent events associated with direct and indirect worker behavior

Event	*Code*	*Frequency*
Direct:		
Jumped	47	51
Access system not used	66	38
Work boots not cleaned	61	25
Carried object using ladder	14	7
Handrail not used	13	2
Total		123
Indirect:		
Slipped on spill	25	129
Slipped on debris	24	173
Unmarked hazard	21	35
Total		237

Table III—Slip-and-fall accident location, proportion of total work time in location, and relative risk

Location	*Frequency*	*Pct. total accidents*	*Pct. total work time*	*Ratio*
Access systems:				
Ladders	160	11.6	1.9	6.1
Stairs/steps	114	8.3	3.5	2.4
Walkways	12	0.9	5.4	0.17
Surfaces	252	18.2	38.9	0.47
Machines and all else	843	61.0	51.0	1.20

Table II shows the frequency of direct and indirect high risk behavior. The frequency of slip-and-fall accidents per maintenance area is given in Table III.

ported by an MSHA study of ladder falls from off-highway trucks. The study concluded that "safe ladder systems are needed to prevent men from falling; however, insufficient training and unsafe work practices appear to be the major causes of injuries associated with haul truck ladder systems." Unsafe work habits were defined as (1) missing a step, (2) carrying articles, (3) jumping from the ladder, (4) catching clothing or ring on a step or handrail, (5) not using a handrail, (6) jumping from a moving truck and (7) facing away from the ladder while using it.

Cutting the accident rate

By studying access systems of mobile mine equipment for new (1988) and older (pre-1988) front-end loaders and trucks, as well as accident records obtained from MSHA's data base through use of the Bureau's Accident Data Analysis program, the Bureau produced a complete listing of types of accidents and frequencies (Table I).

In many of the accidents, the individual involved took major risks. Risky behaviors included descending a ladder facing outward, jumping from a machine and simply not using an access system even when one was available (Table II). A substantial portion of the access system elements (ladders, steps, stairs and walkways) were involved in the accidents (Table III).

Given these statistics, the following question arises: What strategies should be taken by a mine operator to improve slip-and-fall safety? The first priority is to improve the quality of access system elements. The second priority should be to change the subjective risk perception of the maintenance workers. The strategy includes stricter adherence to safety rules and the implementation of formal training programs that will teach workers to recognize hazards and to change their behavior.

Mark your calendar for TRAM 19

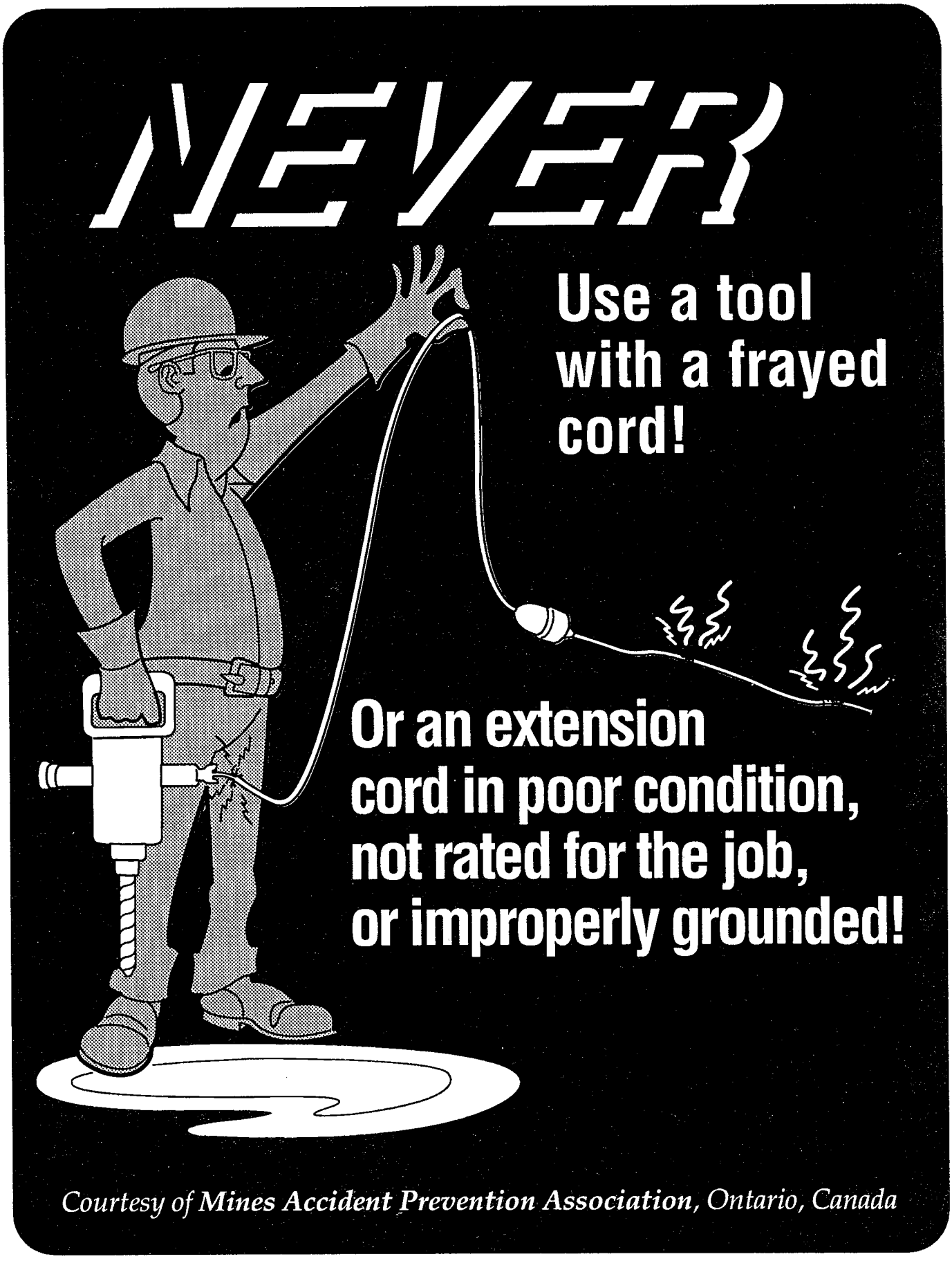
The 1992 Training Resources Applied to Mining (TRAM) Conference will be held on August 24-26, at Wilson Lodge in Oglebay Park, Wheeling, West Virginia.

This year's Program Chairman is David E. Braden of ARCO. Dave will be assisted by Richard Wells of Peabody. Three tracks are being planned.

TRAM is a conference by and for mine trainers. Suggestions for presenters and topics are always welcome. If you have ideas for TRAM presentations, contact Program Chairman, David Braden, in Denver at (303) 293-4850 or Conference Director, Michael Klishis, in West Virginia at (304) 293-4211. Exhibitors should contact the Exhibits Chairman, Jim Simms, of Joy Technologies at (814) 432-1414.

Winning safety slogan selected

We received a great response to our 1992 slogan campaign—97 responses from HSA members in November. The slogan committee had a difficult task in selecting our winner—Ms. Penny Traver, from Standish, Michigan. The winning slogan is **"Safety Begins with You in '92."** The first runner-up is Don Willis from Lexington, Kentucky.


NEVER
Use a tool with a frayed cord!
Or an extension cord in poor condition, not rated for the job, or improperly grounded!
Courtesy of Mines Accident Prevention Association, Ontario, Canada

Creating the safety culture

Is safety an afterthought at your company, or part of its routine life? Some safety leaders offer their advice on weaving safety into the fabric of your firm.

By Stephen G. Minter

Are you the safety cop, the sole person in your company charged with making sure that employees work safely and that "the numbers stay low?" Have you ever wondered what you can do to help other managers and employees see that creating a safe workplace is in everybody's self-interest? Are you looking for a way to stop having safety be "your" concern and start being "our" concern?

If so, you're not alone. Increasingly, safety managers see their function not as policing compliance by employees and supervisors with safety rules, but as a management resource dedicated to helping all members of the company create and cultivate a safe and healthy workplace.

In an era of leaner organizations and work performed with less supervision, no company can afford to have every employee individually watched by a safety manager, notes Michael Topf, president, Topf Organization, a safety consulting firm based in Rosemont, Pennsylvania.

"Ultimately, safety is really everybody's responsibility. The culture that we ideally would want to create is that if you had 500 people, be they laborers, technicians, or chemists, and you had line, middle, and upper management, each individual in that organization would come to the realization that their own safety is their own responsibility. The safety of their coworkers and the company, as well as the community and the environment, is their individual and collective responsibility," he explains.

While many companies profess that safety is their "number one" priority, it's often an empty slogan. Topf said an essential task in changing a company's culture is to first determine what the real attitudes and practices are regarding safety. Topf's firm surveys top management, middle management, and line employees to find out what the actual commitment to safety is, and what messages employees are receiving about safety. Often, there are gaps. A plant manager may say he is committed to safety, notes Topf, but when he asks operators, "They say, 'Hey, it sounds good, but when push comes to shove, all they want is to get pounds out the door.'"

To deal with that, Topf carefully solicits from top management why they want to see safety improved. Those reasons—high costs, employee morale, trouble with OSHA or EPA, etc.—are used to build the foundation for a new culture. "The foundation is built on the declarations and the commitments of key management. Once we're clear

about the commitments and what culture you want, we build those into your whole management process. We speak your words, not our own," he said.

Some companies get a management commitment to safety out of necessity. When Eleuthere Irenee du Pont constructed his first black powder mill along the banks of the Brandywine River, he built his home right on the factory site. "He put himself and his family at some risk, so they were very mindful of safety," says Lee Schaller, safety and occupational health fellow at Du Pont. Since that time, a concern for safety has become institutionalized in Du Pont and managers are exposed to the necessity for safe operations throughout their careers.

At other firms, the commitment to safety comes out of basic values that the founders bring to their enterprises. At Johnson & Johnson (J&J), New Brunswick, New Jersey, the founders created a company, in corporate safety director John Thirion's words, that had an "inseparable concept that quality of life wasn't just what we sold, it's what we are." In the 1940s, the company established a four-part credo, including a vow that the workplace will be "clean, orderly, and safe."

Drawing upon that credo, J & J chief executives have committed the giant healthcare firm to safety excellence. Indeed, current Chairman and CEO Ralph Larsen has established two strikingly ambitious goals for the company's 83,000 employees—to achieve an injury-free workplace and to become the safest company in the world.

Management commitment to safety is necessary in order for it to be effective, says Du Pont's Schaller, because safety operates on two planes. One, he says, involves the physical environment—the design of plants, processes, and machinery, and the safeguards such as barriers and inter-locks that are installed. The second, and more critical, is the human factor—the standards that management demands and that individual employees believe in.

"There are many ways in even the best-designed facility that people can hurt themselves and hurt others," he explained. "They must really buy into this idea that safety is important and it takes precedence over other demands that are placed on people, such as productivity and quality. It doesn't have to be at odds with those other parameters of performance, but it can't be compromised."

Buying in

If you're not working for a company with a longstanding tradition of safety, don't despair. It's possible to convince top management that safety deserves their full support. In fact, says safety consultant Ray Boylston, today's business conditions present a golden opportunity.

"Today, we have a better opportunity to sell this kind of safety program than at any time since the Industrial Revolution," maintains Boylston, senior vice president of ELB and Associates Inc., Chapel Hill, North Carolina, and an instructor at the University of North Carolina. "Injury and illness costs are higher than they've ever been. The regulatory emphasis on fines and penalties is greater than it has ever been.

Principles of safety success

In order for an organization to be committed to safety, it must clearly spell out what its goals and expectations are. At DuPont, these 10 safety principles have guided the firm's managers and employees for many years. "If you accept these principles and really live them," says Lee Schaller, safety and occupational health fellow at DuPont, "I'm convinced you're going to have continually improving safety performance."

1) All injuries and occupational illnesses are preventable.
"We haven't prevented them all," admits Schaller, "but we're unwilling to accept that any of them could not have been prevented."

2) Management through all levels is responsible for preventing injuries and illnesses.
Safety is the responsibility of line management.

3) Safety is a condition of employment.
"If you want to work at DuPont," explains Schaller, "you have to accept your safety responsibility. If you can't, it's better for you and the company if you don't work here."

4) Employees have to be trained to work safely.
Many hazards are not obvious, Schaller points out. "You can't rely on just your natural instincts in the work environment," he cautions.

5) Safety and occupational health audits must be conducted.
Audits help management stay aware of safety conditions and demonstrate its interest in safety to employees.

6) All deficiencies must be corrected.
"You cannot recognize a deficiency and not do something about it. That sends the wrong message and, obviously, leaves the deficiency that poses a hazard," Schaller explains.

7) You have to react to incidents, not just injuries.
"If you wait for an injury, you're going to have an injury," Schaller emphasizes. Far better, he says, to address problems before injuries occur.

8) Off-the-job safety is as important as on-the-job.
Both in terms of the pain and suffering that employees experience and the costs to the company in terms of absenteeism and medical expenses, notes Schaller, there is no difference between injuries that occur at home and at the plant.

9) It's good business to prevent injuries and illnesses.
Poor safety performance not only drives up workers' compensation costs, but adversely impacts productivity, quality, employee and community relations, and other key factors affecting profitability.

10) People are the most important element of the safety and occupational health program.
"The work environment is important, but it's the human factor working within that work environment that makes the difference," stresses Schaller.

Liability problems and the penalties from criminal prosecution are greater than they've ever been before."

Boylston says safety professionals need to assess what the costs of injuries and illness are to the company. They also need to determine what potential disasters could befall the company and what their consequences would be. Armed with that information, he said, "you come up with a pretty strong justification that you should manage safety and health better."

Beyond these direct savings in workers' compensation and medical costs, says Schaller, are other benefits that derive from a strong safety program. "The discipline which has to be developed within an organization in order to have good safety performance is going to pay off in a lot of ways that are not directly related to safety—quality, for example. Safety is a consequence of doing things right. So is quality."

For organizations such as Johnson & Johnson that are committed to total employee involvement, says Thirion, safety serves as an "ideal place" to "establish trust between all levels of employees." By addressing real safety issues in an "adult-to-adult" fashion, he continues, companies build the trust and desire to excel in their employees that leads to superior performance.

"We know that safety is a clearcut barometer of organizational excellence," says Thirion. "You cannot have an excellent organization that has a lot of accidents. It's a [contradiction of terms]."

If safety has such value, however, why is it frequently so difficult to convince top management of its benefits? One reason, according to Schaller, is that safety is a long-term investment. "It doesn't take a lot of capital outlay, but it does require a commitment of time and attention on the part of all levels of management and, ultimately, every employee before you start to get a return," he notes, adding: "It's tough to come by, and easy to lose."

Building blocks

In integrating safety into its corporate culture, a guiding principle at Du Pont has been that safety is a line management responsibility rather than the responsibility of a safety manager. "You have to couple the responsibility for safety with the authority to act," warns Schaller. "In an industrial enterprise, it is really the line organization that has the authority to act to make the decisions that will affect safety."

Helping to symbolize this management accountability for safety is Du Pont's longstanding requirement that every lost workday injury be reported to headquarters within 24 hours. A brief summary of the accident is immediately sent to CEO Edward Willard. The head of that business is responsible for being able to explain the circumstances surrounding the injury.

"Now, we don't have that many in the course of a year, so each one is a significant event. If the senior vice president of a major business in the company has to know, it's reasonable that the plant manager on whose site the injury occurred is going to be extremely well informed of it and so will the area superintendent in which the incident occurred," says Schaller. The result, he says, is that the importance that Du

Pont places on safety is focused up and down the organizational ladder.

With the line organization responsible for implementing the safety program, says Schaller, safety professionals take on the role of consultants. Plants are encouraged, he says, to regard their safety and health professionals "as people who can help the line organization to achieve their safety objectives, not the people who scramble around trying to scrounge up the resources and time to achieve it."

In such an organization, continues Schaller, safety professionals are judged not in terms of the results of the safety program, but rather on how responsive and competent they are in addressing the line organization's needs. Their job is to address technical issues, develop program ideas and structures, and conduct training.

Gradual process

Corporate culture may be defined as the common set of attitudes and customs that members of a company share. They are the norms to which employees conform. If everyone wears a blue suit and gets to the office by 8 a.m., that is the way that people will likely behave. Those same signals about what is acceptable in a company in regards to safety must be carefully defined and practiced if a corporate culture that values safety is to be created.

"The ideal would be if people were at a point where they knew what was required, they knew the risks that were at hand, and they began to take responsibility and take care of themselves," Topf says. In his view, that is accomplished not by creating more safety rules, but by raising employees' awareness of the risks they face and their responsibility for behaving safely.

That's not to say, cautions Topf, that safety becomes the sole responsibility of employees. The company remains responsible for providing a safe work environment and for informing employees of the inherent dangers and risks of their jobs. The company must also ensure that managers and supervisors understand that they need to manage safety just as they manage other aspects of their job, and that they will be held accountable for safety performance within their areas.

Supervisors must act as a proper role model within their areas. If they won't wear safety glasses, for example, they send a clear message to employees that safety glasses are not necessary and that they won't be held accountable if they imitate the same unsafe behavior.

Boylston, who worked 22 years at Du Pont before leaving to run North Carolina's state OSHA program, emphasizes that culture is created by involvement. At Du Pont, he notes, employees are involved in safety training from day one. Supervisors throughout their careers are involved in safety committees and managing safety.

"Companies have problems because safety is something separate from normal day-to-day activity," says Boylston, who advocates setting up central safety committees and task groups to involve supervisors and employees in safety issues. These committees, he says, help line management by developing and sharing expertise on specific safety topics.

"Safety must be included as part of the daily routine," said Topf. "When supervisors issue orders, they must make sure that safety is included. If people are injured in their area and these people were not complying with safety rules or were allowed to use unsafe equipment and the foreman permitted it because of production reasons, that is not acceptable."

Since 1982, Johnson & Johnson has eliminated 93 percent of its lost-time injuries. One way that Thirion is addressing safety improvement is by employing ideas and techniques developed in the quality field. One example is his shift in focus from lost-time injuries to actual plant conditions and employee behaviors.

"We have 8,000 supervisors and approximately 100 lost-time accidents in a year for 83,000 people. What that tells you in a nutshell is that the average supervisor can go two working lifetimes and, on the basis of pure luck, not have a lost-time accident and think he was managing safely. Our whole thrust is to drive the focus way downward, not just to the lesser injuries, even beyond the unsafe acts and the resulting conditions, to looking at positive behaviors and rewarding and recognizing people for the things they do right."

Thirion has developed a plan called the Safety Outreach System, which emphasizes asking employees what their safety concerns are and then responding to those problems. "You start asking every employee, every visitor, every contractor, 'What worries you the most about your safety? What hazards do you see here in the workplace? Where is the next accident going to occur? To whom? What can we do to prevent it?' What I do is create the most time-real safety agenda that any management can have," he asserts.

Since this process uncovers real safety concerns, Thirion says safety meetings must address them. "We're in a world-class competitive environment. It's an insult to every person in this environment to waste people's time with meaningless safety meetings when there are so many real issues that do need addressing," he maintains. By the same token, in addressing employees' actual safety concerns, management builds trust in its workforce and encourages the desire to do more to improve safety.

Thirion says a preoccupation with lost-time injuries is counterproductive because it focuses attention on the results of accidents rather than on their causes. "Once the accident is unrolling itself, once all the right events and conditions are in line for the scenario, how hurt somebody gets is purely a matter of luck. I can have a wrecking ball either swing past my head, scratch my nose, or hit me in the ear and kill me. It's the same accident," he said.

"If you treat every first aid case like a potential fatality, then you start to make safety matter to your people and you start to be able to do something about it," Thirion says. "I can walk out and talk to three people in 10 minutes and get three safety concerns to work on or I can wait for 40 years for the next lost-time accident."

Signs of change

In assessing culture change, Topf

said he looks for quantitative changes such as reduced injury rates, but he adds that such measures alone are not enough. He also looks for changes in attitudes and behaviors. Use of personal protective equipment may improve. Where people might formerly have come to safety meetings and fallen asleep, they now participate and ask questions. At one company, Topf recalls, the number of phone calls to the maintenance department reporting observed hazards dramatically increased. Moreover, the employees were offering suggestions for dealing with the hazards.

How far will employees go in exhibiting this culture change and taking ownership of their own safety? J & J's Thirion says that depends on management.

"Empowerment is determined by participative management. As a management moves from being essentially autocratic to participatory, the employees move along with it," he explained. They take a predictable path from indifference through awareness, concern, involvement, and eventually ownership. "How far you are in your management style transition is exactly how far they will be in their employee style transition."

Laboratory tests subsidence abatement technology

Subsidence affects more surface land area than any other type of abandoned mine land problem. It also causes direct damage to property, creating significant financial loss, and presents a danger to public health, safety, and general welfare. Backfilling, or stowing, is the most common method used to stabilize mine voids, thus reducing subsidence and protecting surface structures. Little documented information is available, however, on the capability of the various backfilling methods to completely fill a mine void or to provide long-term structural strength. The Bureau of Mine's Pittsburgh Research Center designed and constructed a full-scale test laboratory to analyze the effectiveness of subsidence abatement techniques under controlled conditions.

Experiments were completed to evaluate remote pneumatic backfilling equipment, including a prototype "AirJet" style injector and four collapsible elbow and nozzle combinations for conventional pneumatic stowing equipment. The results showed that remote pneumatic stowing is a viable method for backfilling abandoned mine voids. The airjet style systems do not have the severe equipment wear problem usually associated with conventional pneumatic stowing. Additionally, the collapsible elbow demonstrated a significant improvement in horizontal trajectory and void-filling capacity.

Jeffrey Walker, U.S. Bureau of Mines.

Holmes Safety Association Monthly safety topic

Fatal electrical accident

GENERAL INFORMATION: A 51-year-old electrician, with 24 years of mining experience, was electrocuted while attempting to remove a 200 amp high voltage fuse from a circuit that he apparently thought was safely deenergized.

Copper/molybdenum ore was being extracted from an open pit mine. The mining and milling operations were located at the 5800-foot level.

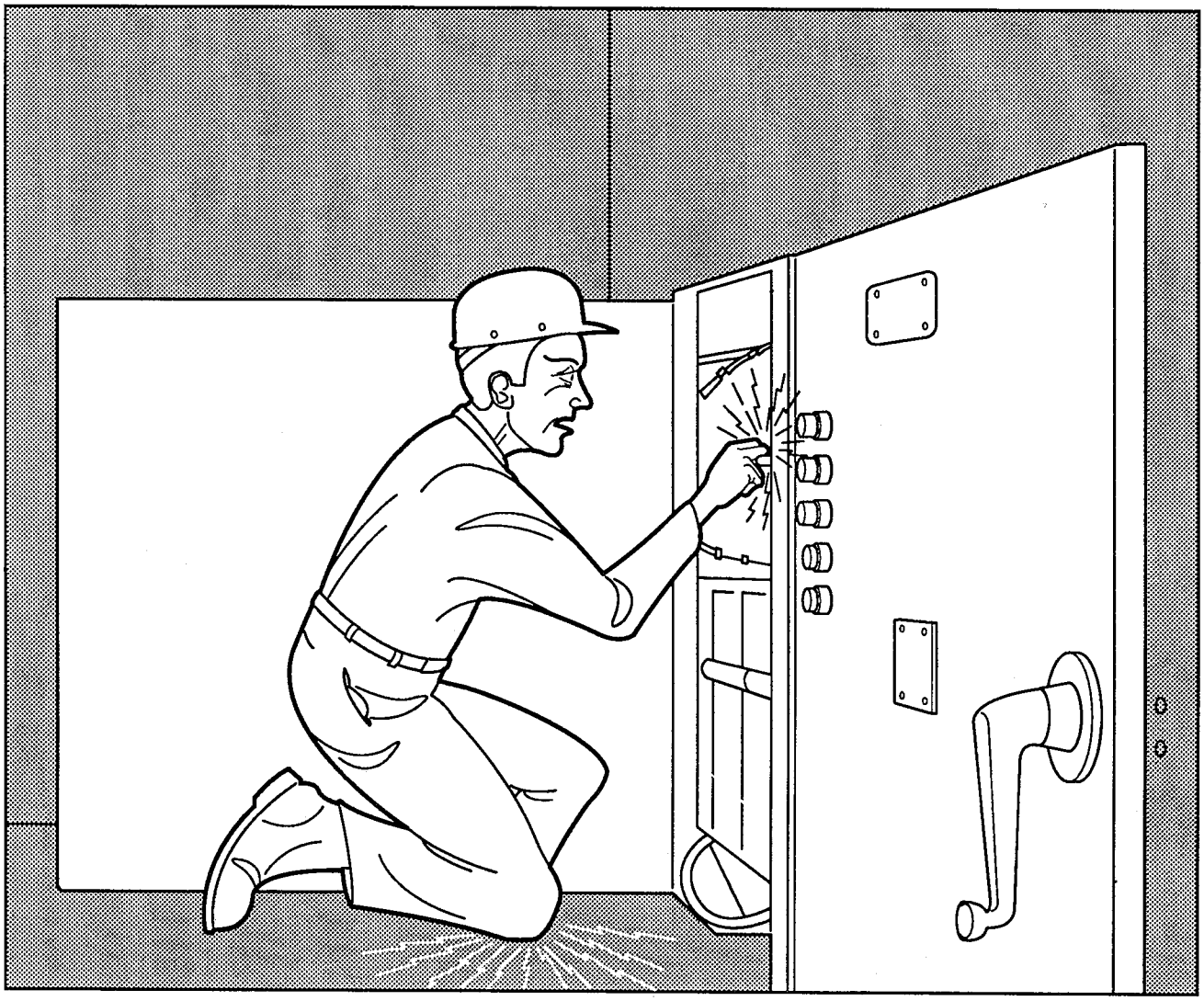
DESCRIPTION OF ACCIDENT: The victim reported for work at his normal starting time of 6:00 a.m. at the electric shop for the mine. The victim regularly received work assignments from the supervisor at the electric shop and was briefed by other workers going off shift. The last contact the victim had with his supervisor was the previous day. The victim was notified of electrical problems throughout the shift and would respond to them on a priority basis.

During the early part of the shift (8:00-8:30 a.m.), the foreman, a witness to the accident, reported that the high voltage (three-phase, 4160 volt) trailing cable to the rotary drill operating at the pit, had blown or faulted. Furthermore, the probable fault had evidently tripped the 4160 volt overcurrent protection located at the breaker station. The foreman immediately proceeded to the No. 1 "iron horse"—a portable high voltage distribution facility, located near the pit. Entering the iron horse, he opened (disengaged) the No. 4 high voltage vacuum contactor carriage and disconnected the trailing cable from one of the two No. 4 couplers. He then requested the assistance of an electrician as soon as possible.

The victim responded to the trouble call and proceeded to the No. 1 iron horse. After the feeder breaker was reset, the foreman reenergized each of the trailing cables that operated two shovels, which were also powered from the No. 1 iron horse. The victim then proceeded to test the trailing cable and determined it had an internal failure. He then returned to his earlier work activities at the shop.

The foreman, following normal operating procedures, made arrangements for his crew to replace the entire faulty trailing cable with a good spare. The new spare cable was connected to the drill, while the other end was extended to the No. 1 iron horse and left disconnected.

At about 12:00 noon, the foreman returned to the No. 1 iron horse with the equipment operator. Together, they connected the trailing cable for the drill to the coupler identified as "4A" at the No. 1 iron horse. The coupler was powered from the 4160 volt, No. 4 contactor



in the iron horse. The foreman closed the No. 4 contactor carriage and verified that power was available by observing the indicating lights on the cubicle door. He then pushed the start button to energize the contactor and thus provided 4160 volts of power to the cable. Power to the drill was verified; however, the cable was connected incorrectly because the motor rotated in the wrong direction.

The foreman pushed the stop button to deenergize; and then opened the No. 4 contactor carriage which disconnects it from the high voltage buss. He and the equipment operator changed the trailing cable from coupler "4A" to "4" in order to change motor rotation direction. When they attempted to close the No. 4 carriage contactor to the energized position, it would not close. Several unsuccessful attempts were made to close the contactor.

The foreman then decided to disconnect and change the drill trailing cable from the No. 4 coupler to the No. 1 coupler, which was not in use. The two men again went through the routine procedure of moving the trailing cable coupler from No. 4 to No. 1. The foreman proceeded to close the No. 1 contactor carriage and observed the

light indicating that power was available. However, when he pushed the start button, nothing happened. He noticed that the indicator lights on the compartment door revealed there was "insufficient power" available. At that time he again requested that the victim return to the No. 1 iron horse to solve the problem.

The foreman returned to the iron horse and discussed the problem with the victim. At approximately 12:40 p.m., the victim himself tried several times to close the No. 4 contactor carriage but without any success. The victim then showed the foreman a blown 200 amp line fuse in the No. 1 compartment on the contactor carriage, which confirmed the earlier condition of "insufficient power" available. With no spare fuse at hand, the victim told the foreman that he could take a fuse out of the No. 4 compartment. The victim then tried a few more times to close the No. 4 contactor carriage; again he was unsuccessful. It is most likely that he assumed that the carriage was safely disengaged, as also did the foreman. At about 12:45 p.m., the victim knelt down, with the foreman nearby, reached into the contactor and grabbed the fuse ejector handle for the right-hand 200 amp fuse.He pulled it down, with his right hand, to eject the fuse for removal. Evidently this caused inadvertent movement of the contactor carriage in a backward direction (away from the victim) which began engaging the 4160 volt primary disconnect fingers with the energized line buss. This placed the victim in the direct path of one phase of the 4160 volt circuit or 2300 volts and the iron horse metal floor that was part of the safety ground system.

At that instance fire and arcing started to occur and the foreman stated that it appeared as if the victim was then pulled into the contactor carriage. The victim was not wearing or using dielectric insulated tools or equipment. It was surmised that the victim fell forward into the carriage contacting the middle line fuse at his throat area. This connected the victim phase-to-phase across the 4160 volts. The foreman's first inclination was to grab the victim. However, he quickly ran to the pick-up truck to call for help on the radio. When he arrived at the pick-up, which was just outside the No. 1 iron horse, he overheard the shovel operator's report on the radio that they had just lost power. The foreman then cut in and issued a "red alert" over the radio and help immediately started arriving. Several employees arrived at the No. 1 iron horse who helped remove the victim from inside and immediately started administering CPR. A pulse could not be detected on the victim and he was not breathing. CPR was conducted by company employees until an ambulance and the fire department arrived, at which time paramedics took over. Two attempts were made to revive the victim but, because of the extensive throat damage, it was very difficult maintaining his airway. Efforts to resuscitate the victim continued in the ambulance and at the emergency room where the victim was pronounced dead at 2:00 p.m.

CONCLUSION: The most probable reason this occurred was due to the racking mechanisms being jammed,

which in turn restricted operation of the safety shutter barrier from positioning between the energized buss and the primary disconnect fingers on the carriage when it was in the disengaged position. This allowed the carriage to be somewhat free and easy to move in the cubicle. The victim and the foreman knew the racking mechanism was not working properly. Furthermore, it was possible to look inside the cubicle to observe the position of the safety shutter. However, apparently this was not done, or the unsafe condition could have been discovered.

Investigation revealed that the jamming or binding condition that existed with the racking mechanisms was likely caused when a bolt head on the racking drive shaft gear and a bolt head on the shutter slide support bracket caught against each other.Investigation revealed important facts that address the unsafe work practice used by the victim, and the operator's negligence.

The direct cause of the accident was a malfunction of the racking mechanism and the safety shutter barrier at the No. 4 cubicle, No. 1 iron horse, which allowed the victim to contact an energized high voltage source while attempting to remove a fuse.

Factors contributing to the accident were as follows:

1. The victim did not deenergize and lockout the 4160 volt main power at the No. 1 iron horse.

2. The victim was wearing cotton gloves. He did not use electrical hot line tools or equipment.

3. The victim was aware the racking mechanisms were malfunctioning in the No. 4 compartment and did not recognize the existing potential danger.

4. The supervisor was also aware of the racking mechanism malfunction. Furthermore, the supervisor was aware of company lock-out procedures and did not insure it was being followed by the victim.

5. The operator's written lock-out procedures were not clear or concise in regard to the iron horse switchgear. Additionally, no written instructions were posted at the No. 1 iron horse for employees to review concerning locking-out and deenergizing.

6. The operator had reason to know that problems had previously existed in the No. 4 compartment at the No. 1 iron horse. Two previous electrical maintenance log entries addressed racking mechanism problems—corrective action had been taken under supervision, as revealed at a later date.

7. A serious electrical burn accident occurred nearly 3 months before when electrical troubleshooting was being performed without the use of hot-line tools or equipment. The electrician was off work for 50 days.

8. The operator had been cited previously for using improper lock-out procedures.

9. Reportedly there was a lack of regular routine maintenance performed on the high voltage contactor and associated equipment at the iron horses.

Injection injuries harm hands

High-pressure injection injuries seem minor at first, but they can result in permanent disability if not treated immediately and properly.

By Murray Flotre, M.D.

What a great day! The sun was shining brightly, and there wasn't a breath of wind. A perfect day to paint the fence. Bill Adamson decided to borrow his neighbor's paint sprayer rather than spend the whole day painting. That way he could finish the job by mid-afternoon and still have time for a round of golf.

About an hour into the painting session, the nozzle of the paint sprayer clogged. Bill's neighbor had warned him that this might happen and told Bill how to correct the problem: "Just keep your finger on the trigger, and work the obstruction loose with a finger on your other hand. It works every time."

Bill tried it. The sprayer unclogged quite easily, but Bill managed to shoot some of the paint into the tip of his left index finger. Since the wound was very small, and not particularly painful, Bill just put some iodine ointment and a bandage over the fingertip and carried on with his painting. By the time he finished painting and started to clean up to go golfing, Bill's finger began to swell; and it had become quite painful. Instead of golfing, Bill went to the doctor on call in his local medical clinic. The doctor gave him a prescription for a broad-spectrum antibiotic. The doctor told Bill to come back if the problem worsened. Bill spent that night in fitful sleep; the pain woke him every half-hour.

The next morning Bill's left hand was grossly swollen, red and very painful. The index finger was quite large and discolored. Bill's doctor sent him to a plastic surgeon in a nearby city. He was taken into emergency surgery. The surgeon opened Bill's left index finger and the palm of his left hand. During the operation the surgeon removed paint particles, along with a large amount of dead and dying muscle, and fatty tissue.

Progress following the surgery was slow. Bill was left with some weakness and stiffness in his left hand due to fibrosis (fibrous tissue buildup) and loss of muscle. The surgeon told Bill he was lucky he did not lose his left index finger. Lucky? Bill is not so sure.

Use care with equipment

Both industry and farms use high-pressure equipment, which includes hydraulic equipment, paint sprayers, and diesel-injection engines. Use has increased during the last few years.

The home handyman, such as Bill, also makes much use of this type of equipment. High-pressure equipment has made it easier to carry out various tasks.

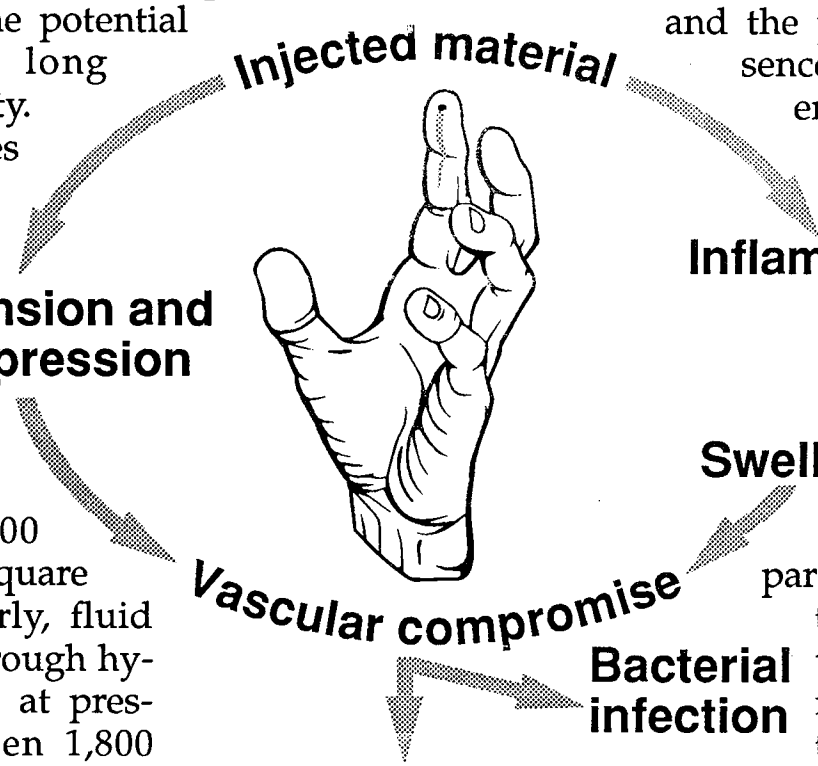
Unfortunately, this type of equipment produces a very specific kind of

injury. On the surface, these injuries appear as small puncture wounds. If not treated aggressively by a surgeon trained to deal with such problems, they have the potential to produce long term disability.

The nozzles of paint and grease guns emit a fine stream of liquid at a pressure of 600 to 12,000 pounds per square inch. Similarly, fluid circulates through hydraulic lines at pressures between 1,800 and 2,200 pounds per square inch. Fine jets of fluid, driven by such high pressure, travel at velocities of up to 600 feet per second. This closely resembles the muzzle velocity of a rifle.

Protective clothing, such as gloves or coveralls, often does not provide enough of an effective barrier against such fluid jets. It is not difficult, therefore, to understand why human skin is so easily penetrated. The area of injury does not even have to be in close contact with the source of fluid. Penetration has been reported with distances of up to 4 inches between the source of fluid and the injured area.

Once the skin is broken, the fluid reacts as fluid does anywhere. It travels along lines of least resistance. In the human body this means that it runs along the various tissue planes. Its spread depends on the pressure of the fluid injected, the viscosity (thickness) of the fluid, the amount injected, and the presence or absence of tissue strong enough to stop it.



Identify the injury

Since the hand is the most common body part to be injured, this article will use the hand as a model for symptoms, physical signs, and treatment. Other parts of the body, however, can be affected and would be treated in a similar manner.

At the time of fluid penetration, the person may notice only a slight stinging sensation. A small puncture wound may be the only mark at the site of entry. In fact the injury may seem so trivial that it is almost forgotten.

However, within hours the affected area can become severely swollen and painful. The time between injection and painful swelling depends upon the type of material injected. Paint causes a very rapid response. Oil and hydraulic fluid often take much longer to make their presence felt.

If a doctor examines the injured area before the onset of pain and swelling, the potentially serious nature of the

injury may not be appreciated. This can, unfortunately, lead to a delay in getting proper treatment. The longer the swelling continues, the more internal damage will occur.

The end result is tissue necrosis (tissue death). The severity of long-term loss of function depends upon which, and how much, vital tissues (such as muscle, nerves, and blood vessels) are damaged.

Paint and paint thinners or solvents cause the worst immediate damage due to their ability to dissolve fat and the intense inflammatory reaction they cause. Grease, fuel, and hydraulic fluid often cause little or no problem for as many as 3 or 4 days. These fluids, however, often go on to form little cysts that continue to burst to the surface for months after the incident. This results in the formation of fibrous tissue, which causes stiffness and loss of flexibility. All injection injuries have the potential to result in amputation of the affected area, particularly fingers.

Treat injuries properly

Immediate medical treatment should include elevation of the affected area. Cool, moist compresses should cover the injection site. The victim should receive a tetanus shot if one has not been given within 5 years of the accident. A broad-spectrum antibiotic should be started. The patient should then see a surgeon familiar with hand surgery, such as a plastic surgeon or orthopedic surgeon. This surgeon will probably order an X-ray of the affected area to show how far the injected substance has spread from the injection site. The next step is exploratory surgery of the affected area. The surgeon will remove as much of the injected substance as possible, along with all necrotic (dead) tissue. The area should be left open to drain. Intravenous antibiotics will usually continue until all signs of infection subside. The surgeon may use steroids to reduce persistent inflammation. The hand will be splinted in a position of function (the position the hand is in while holding a glass), which will make rehabilitation easier.

The most important factor that affects the severity of damage, and ultimately whether there will be long-term loss of function, is the length of time between the injection and the exploratory surgery. If an employee sustains a high-pressure injection injury, it is of the utmost importance that both the victim and the first physician to see the victim realize the potentially serious nature of this type of injury. Obviously, proper use of high-pressure equipment can prevent most of this type of injury.

The management of the John Deere Implement Co. is concerned enough about high-pressure injection injuries that the company has set up an "oil injection injury hotline." The telephone numbers for this hotline are: Monday through Friday, 8:00 a.m. to 4:30 p.m. CST, (309) 765-2773; all other times, (309) 765-4292.

Murray Flotre, M.D., is a family physician who often treats injured workers. His work has fostered a special interest in occupational and emergency medicine.

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Another look at the Sunshine Mine Disaster

By Robert E. Launhardt, Safety and Environmental Director, Sunshine Mine

Having been employed at the Sunshine Mine since 1954 and having been in the mine on May 2, 1972, I certainly take seriously the lessons taught me by that disaster.

There are several fundamental factors in the Sunshine Mine fire disaster that have failed to get the attention they deserve. A major part of the problem, in my opinion, was that the years of litigation following the fire prevented a full and free exchange of information between the U.S. Bureau of Mines, the Idaho State Mine Inspector's Office, various manufacturers and suppliers of materials used in the mine, and the staff and management of the mine itself. What follows is my opinion. I would gladly discuss it with any and all who might want to explore further into the rationale.

Ventilation system design

Applying 20/20 hindsight, it can be said without hesitation that a poorly designed ventilation system caused a mine fire, that would otherwise have cost no lives, to become a major mine fire disaster. The fact the fire started where it did has never been disputed. A ventilation control bulkhead separating the main exhaust airway from worked out stopes failed due to combustion. When it failed, it subjected both intake airways to a deluge of extremely poisonous smoke and gas. The bulkhead was on the discharge side of two large exhaust fans located in the interior of the mine. The pressure differential across the bulkhead was the direct result of the approximate 15 inches of water gauge across the two fans. When the bulkhead failed, a short circuit back to the intake of the fans occurred, carrying the fire gases back through worked out areas of the mine in a manner that filled both intake airways with smoke and gas. Had those fans been on the downwind side of the burning bulkhead, the smoke would all have coursed out of the mine.

The lesson that was **not** learned was the extreme danger to human lives that can result from improper location of ventilation fans within a mine. The deep metal mines do not lend themselves to having all ventilation fans on the surface, due to the design limitations of state-of-the-art ventilation fans. However, as the post fire design and installation has proved, a ventilation system can work to enhance rather than jeopardize the safety of personnel in a mine at the time of a fire. Unfortunately, such design will not occur until the industry recognizes the extreme hazard of an improperly designed system.

Warren Andrews, a very capable ventilation engineer and member of the MSHA Technical Support Group at the Denver Federal Center could provide you with a wealth of information. Mr. Andrews is very familiar with the Sunshine Mine ventilation system, both as it exists now, and as it existed prior to the May 1972 fire disaster.

In your September 1991 article, you quote the U.S. Bureau of Mines official report that "the emergency escapeway system from the mine was not adequate for rapid evacuation." That is correct. Had the system allowed evacuation to the surface from all parts of the mine within about 5 minutes, the 91 men may not have died. But the reality is that no deep, complex mine such as those found throughout the Silver Valley in North Idaho has the capability of rapid evacuation. However, with a properly designed ventilation system, such as that now in use in the Sunshine Mine, crews can evacuate safely, in smoke-free ventilation air.

Polyurethane foam

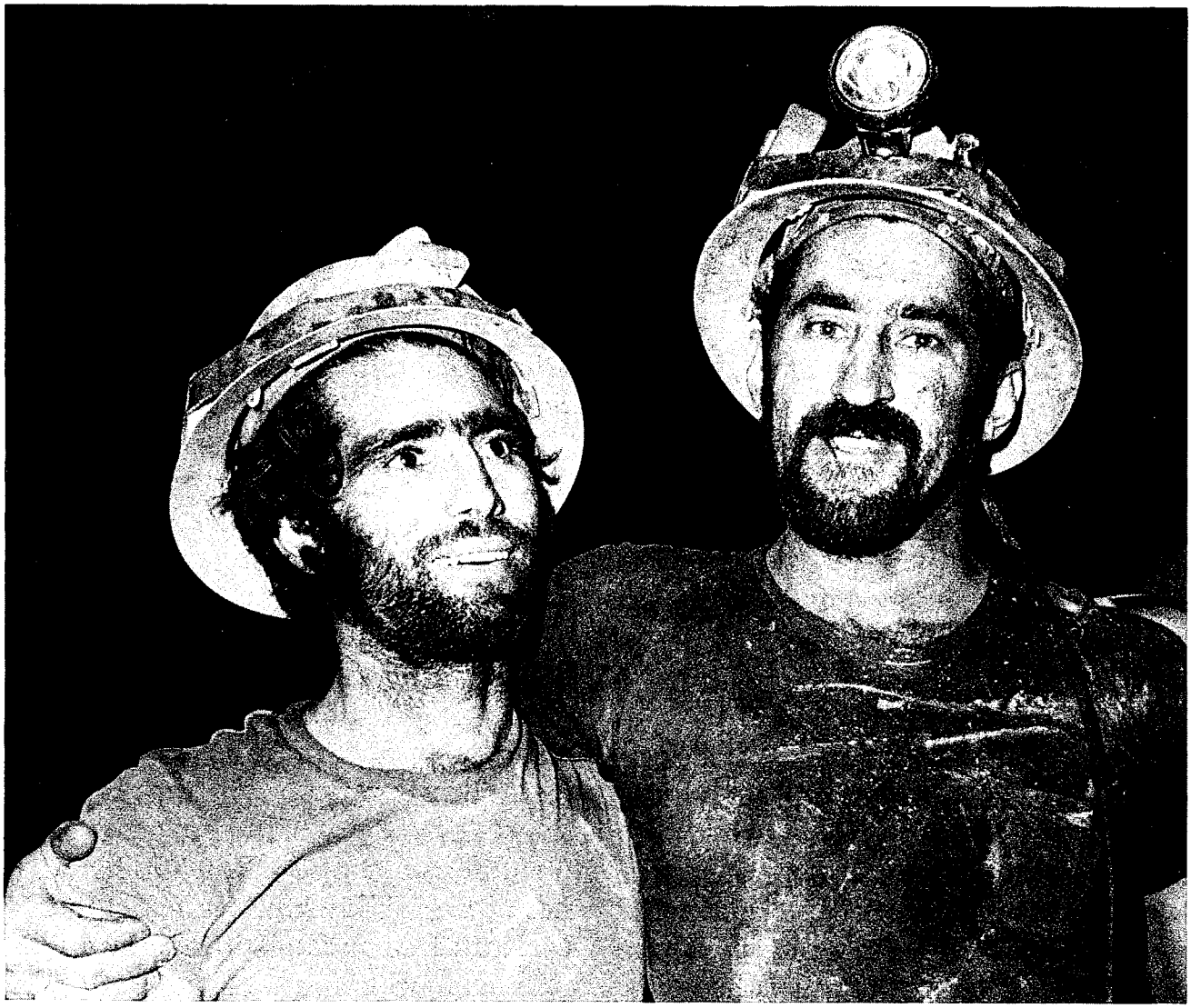
Mine disasters similar to the Sunshine Mine's 1972 fire, in which large quantities of polyurethane foam were involved in the initial conflagration, resulted in a total ban of that product in underground mines in western Europe and England before the end of the 1960s. While the so-called "approved" high density polyurethane foam can be used safely in certain configurations in an undergound setting, the type of application involved in the Sunshine Mine fire is extremely dangerous from the standpoint of fire hazards. For reasons known only to the enforcement agencies, polyurethane is still allowed and used in mines, railroad tunnels, etc. in the United States.

The most recent major tragedy involving polyurethane foam in a mine fire occurred in South Africa in September 1986. One-hundred seventy-three miners died in a fire that occurred in an intake airway deep within a mine, an airway insulated from the high ambient rock temperatures by a layer of polyurethane foam. I can still remember the statement of the mine superintendent in an interview I heard over the radio as I drove through Toronto on September 16. He said, "They told us it wouldn't burn!" Well, that's the same thing they told us. Let the history of what has happened dictate who is wrong.

Again returning to the matter of the Sunshine Mine disaster, eyewitnesses observed personnel without self-rescuers in a state of collapse in as little as 5 minutes after the first smell of smoke. The short-circuiting of the mine's ventilation made escape impossible.

On page 9 of your September 1991 issue is a picture of Ron Flory. His own testimony is very convincing about the degree of toxicity of the fire gases early on after its inception. Ron and his partner, Tom Wilkinson, were helped to reach an area on the 4800 level supplied with a small amount of ventilation air unaffected by the short-circuit in the balance of the active mine workings. The miners who helped Ron and Tom attempted to help additional personnel back to the area of safety. They died in the effort.

Several hours later, Ron and Tom decided to attempt an exit. They walked hundreds of feet from their area of safety to the No. 10 shaft station, stepping over bodies as they walked. They tried to call a cage with a cage call. There was no answer. They tried then to phone the hoistman. There was no answer. They then decided to return to their area of safety. They again travelled many hundreds of feet, again stepping



From the left, Tom Wilkinson and Ron Flory, moments after their rescue from the Sunshine Mine on May 8, 1972.

over their fallen comrades, and reached their waiting post from which they were rescued nearly a week later.

One fact that stands out in my mind is that the condition of the fire gases had changed remarkably over what it was initially, or Ron and Tom's story would never have been told. Burning polyurethane foam emits copious amounts of carbon monoxide, to say nothing of hydrogen cyanide. The burning foam caused the extreme early fire conditions. After it was consumed, wood was left burning, and the fire gases were much less toxic.

I urge you to research the facts of the Sunshine Mine fire. I also urge you to research the reasoning that resulted in the banning of polyurethane foam in England and Europe in underground mines. But most of all, I urge you to share the dangers of a ventilation sytem with internal mine fans that might result in short circuiting of smoke products.

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Pennsylvania state mine rescue contest
Results from August 24, 1991

The Pennsylvania Bituminous Safety Association held it's 28th Annual State Mine Rescue and Benchman Contest at the Greene County Fairgrounds, on Saturday, August 24, 1991.

The Association is the parent body for the Central-North Central Mine Rescue Safety Association and the Southwestern Safety Association. The President is Robert Newhouse, Mine Safety and Health Administration; 1st Vice President, William Garay, Pennsylvania Department of Environmental Resources; 2nd Vice President, Thomas Shoemaker, U.M.W.A.; 3rd Vice President, Jim Moretti, National Mine Service Co.; Secretary, Donald Conrad, MSHA; and Treasurer, Richard Flack, R & P Coal Co.

There were 17 rescue teams participating in the contest. Sixteen of the teams represented the bituminous coal producing counties of Pennsylvania and the following companies: The Helen Mining Company, Teams 1 and 2; Helvetia Coal Company, Helvetia Mine Rescue Team; Cypress Emerald Resources Corp., Blue and White Teams; U.S. Steel Mining Company, Cumberland and Maple Creek Mine Rescue Teams; Keystone Coal Mining Corp., Teams 1 and 2; Tunnelton Mining Company, Tunnelton Mine Rescue Team; BethEnergy Inc., 84 Mine Rescue Team; Consolidated Coal Co., Dillworth Mine Rescue Team; Consol PA Coal Co., Bailey Mine Rescue Team; Greenwich Collieries, Teams 1 and 2; and the Commonwealth of Pennsylvania, Uniontown Mine Rescue Station No. 1 Team. In addition, the Peabody Coal Company's Federal No. 2 Mine Rescue Team was in the contest as a noncompetitive team.

The mine rescue teams demonstrated their expertise in rescue and recovery operations in four simulated mines. The teams were in full mine rescue apparel, using oxygen as they explored and rescued miners and recovered the mine. In addition, there was a benchman contest in which one member from each team demonstrated his or her skill in the use, care, and maintenance of the self-contained breathing apparatus.

The mine rescue teams and benchmen were judged by personnel from the Mine Safety and Health Administration and the Pennsylvania Department of Deep Mine Safety.

This was the 28th Pennsylvania State Mine Rescue Contest, and the program was dedicated to the late Stephen McCann. Steve was the financial chairman from 1961 to 1991 and a active supporter of the Association.

In memory of Mr. McCann, the Association had designated that the First Place Mine Rescue Trophy be named the Stephen McCann Memorial Trophy.

Steve McCann was also recognized by the Association with a presentation of a plaque to the family in remembrance of Steve's outstanding dedica-

tion to mine rescue. The Honorable William Deweese, Majority Leader of the Pennsylvania House of Representatives and a long time friend of Mr. McCann, commented on Steve's work with the Association and the mining industry in Pennsylvania and presented the plaque to the McCann family.

Dr. Robert Grayson, Dean of the College of Mining, West Virginia University was the featured speaker at the awards ceremony.

The four teams and four benchmen with the least number of discounts were awarded trophies presented by National Mine Service Co., Mine Safety Appliance Co., Pennsylvania Coal Association, CSE Mine Service Co., and the Pennsylvania Bituminous Safety Association. Individual trophies were presented by the U.M.W.A. to the first place team members.

The following were the winning teams and bench persons:

MINE RESCUE

First Place–Consolidation Coal Company, Dillworth Mine Rescue Team
Second Place–Greenwich Collieries, Greenwich #1 Team
Third Place–Cyprus Emerald Resources Corp., Emerald Mine White Team
Fourth Place–U.S. Steel Mining Company, Inc., Maple Creek Mine Rescue Team

BENCH

First Place–U.S. Steel Mining Company, Bill McLaughlin, Cumberland No. 1 Team
Second Place–Helvetia Coal Company, Filbert Jobe, Helvetia Team
Third Place–Greenwich Collieries, Ron Murphy, Greenwich No. 2 Team
Fourth Place–U.S. Steel Mining Company, Robert Williams, Cumberland No. 1 Team

From a press release issued by the Pennsylvania Bituminous Safety Association.

President's message...

The three steps to achieving acceptable safety records at any coal mine are:

First: When planning a mine the initial thought should be, "How can we perform each task in a manner that is completely safe and healthful?" The mining methods and each job should be designed in a manner that will not require a miner to ever be placed in an unsafe or unhealthful position. This can be accomplished by a strategic examination of each job to be performed.

In order to meet the desired objective, the first action should be to compile a list of the jobs required to be done. The planners should have a clear understanding of what is expected to be accomplished, thus enabling them to develop a plan that is commensurate with safe and healthful work procedures.

Once the jobs list is compiled, the planners should dissect each job and decide on the proper method of completing that job so that the safety and health of the miner assigned to the job is guaranteed. This can be accomplished by 1) separating the job into its basic steps, 2) identifying the hazards associated with each step, and 3) controlling the hazard.

This procedure is appropriately named "Job Safety Analysis (JSA)" and over the last 30 or 40 years many programs have evolved from this proce-

dure. There are many names applied to these accident prevention programs, such as WISE, SWI, etc., but what a program is called does not change the basic procedure.

As stated in a memo from Dick Brechbiel, Director, Educational Policy and Development, to both Coal and Metal/Nonmetal Administrators, "JSA addresses causes of accidents that are the result of poor judgement, overfamiliarity, and lapses of attention. We can still see these "intangibles" causing accidents. Miners are: going under unsupported roof; not blocking equipment while making repairs; working on equipment that is still energized; leaving equipment running and unattended; not making pre-shift examinations of equipment; using equipment beyond its design capabilities; placing themselves in hazardous positions; not wearing safety belts and lines where there is a danger of falling; and not wearing seat belts while operating mobile equipment."

If a job is designed so that no one is required to go under unsupported roof and there is never any reason to go in that area of a mine, then we would eliminate many roof fall fatalities every year. There is an old proverb that says: "A good leader always makes it easy for people to do the right thing and difficult for them to do the wrong thing." Every job designed for miners should make it easy to do the right thing. This is the first step to implementing a successful accident prevention program.

Furthermore we have the technology available that, if used, would eliminate some of the fatalities. For example: the equipment that is left running while unattended could be made to shut off automatically. Every lawn mower sold in this country today has this feature.

Second: The second step to a safe work place is a teaching process. Once a safe job description is established, the individual it belongs to has to understand it. In order to accomplish that, guidance and direction is absolutely imperative. If a job description doesn't fit, then it needs to be corrected, or if the person doing the job doesn't understand, corrections need to be made.

The result of each job analysis should be a system or method of doing the job in a safe, hazard free manner. If a violation or hazard is discovered then a breach of the system has occurred. In that case, the Repeat Violation Reduction Program (RVRP) should be implemented in order to find the root cause of the violations. Once that information is obtained, it should be used to correct any deficiency that exists.

The RVRP procedure constitutes the teaching/learning process. If one can learn what caused the system to fail, then the information necessary to make the proper alteration is available.

Third: The third step to an acceptable safety record is to persuade everyone who works at a mine that nothing less than the best will be accepted. If anyone working at a mine sees someone doing something in an unsafe manner, they should tell the one committing the unsafe act that its not acceptable at that mine. If the idea that "we just don't do things that way at this mine" permeates the entire mine population, then an outstanding safety record can be achieved. Everyone has to be convinced that the safest way to do a job is the only way that is acceptable.

Ronald L. Keaton, President
Holmes Safety Association

The last word...

"People who fly into a rage always make a bad landing." *Will Rogers*

"When people cease to complain, they cease to think." *Napoleon*

"Never answer an angry word in kind. It's the second word that makes the quarrel." *Anonymous*

"Man is the only animal that blushes. Or needs to." *Mark Twain*

"Nothing is more terrible than ignorance in action." *Goethe*

"Wise men talk because they have something to say; fools because they would like to say something ." *Plato*

"Family harmony takes much understanding, patience, and at least two TV sets."

"There are three ways to get something done: do it yourself, hire someone to do it, or forbid your kids to do it."

"Adversity is never pleasant, but sometimes it's possible to learn lessons from it that might not be learned in any other way."

"There is nothing that will turn fact into fiction faster than word of mouth."

"The smallest good deed is better than the largest good intention."

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 1991 is underway – please remember that if you are participating this year, you need to mail your quarterly report to:

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