The Holmes Safety Association BULLETIN

August 1997

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Mine fire preparedness
Dumping procedures
Skin cancer
Bee stings

HSA Bulletin *August 1997*

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

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

THIS MONTH'S COVER: Still another excellent photo from Jim Sniegowski of Powley Sand and Gravel of Spring Bay, Illinois. [If you have a potential cover photo (this is Jim's 3rd), please send an 8" x 10" print to the editor, Fred Bigio, MSHA, 4015 Wilson Blvd., Arlington, VA 22203-1954]

KEEP US IN CIRCULATION
PASS US ALONG

Underground mine fire preparedness

By William J. Wiehagen, Industrial engineer, Ronald S. Conti, Fire prevention engineer, Charles Vaught, Research sociologist, Richard S. Fowkes, Research physicist, and Michael J. Brnich, Jr., Mining engineer National Institute for Occupational Safety and Health, Pittsburgh Research Center, Pittsburgh, PA.

Part 3 of 4: underground fire-fighting experiences and workers' perceptions of training and readiness for fire-fighting

This is the third in a series of four articles that discuss underground fire-fighting preparedness. As with the first two articles, it is based on interviews with 214 miners conducted at 7 underground coal mines (referred to as Mines "A" through "G") by researchers of the National Institute for Occupational Safety and Health's (NIOSH) Pittsburgh Research Center [Vaught et al. 1996]. In the first article, the authors presented an overview of the study conducted by NIOSH on mine fire response preparedness and provided a general perspective on underground mine fires. The second article discussed miners' preparedness to evacuate a fire and their experience with incipient fires. In this article, we describe miners' experience in fighting underground mine fires and present their perceptions of training and readiness for fire-fighting.

Miners' experiences in fighting underground mine fires

Figure 1 presents the percentages of workers who reported having direct experience in fighting underground mine fires at some point during their mining careers. The most consistent part of this picture is captured by the finding that, across all seven mines, about 70% of those interviewed had, at some time during their career, fought a fire underground. This suggests that small fires are a constant, i.e., they will always occur. Many miners were involved in more than one firefighting incident; the percentages are reported in Report of Investigations (RI) 9584 [Vaught et al. 1996]. The reader should note that, because of the nature of the questions, summary data for fire response do not distinguish the fire experiences of miners while employed at a particular mine site from previous experiences working at other sites.

Figure 1 also summarizes the results of follow-up questions concerning these small fires. Note that 19% of the workers were involved in episodes in which apparatus were donned to help fight the fire, and 14% were involved in incidents in which ventilation changes were made (to either clear the smoke or help fight the fire). In terms of their perception of the way in which the fire was handled, 30% of miners reported (in hindsight) being involved in at least one event in which they felt that the fire could have been handled differently (i.e., better), and 45% were involved in fighting a fire (or fires) that they felt could have gotten out of control.

Miners were asked a series of questions about their experiences in

Figure 1.—Percentage of miners with direct experience in underground fire fighting

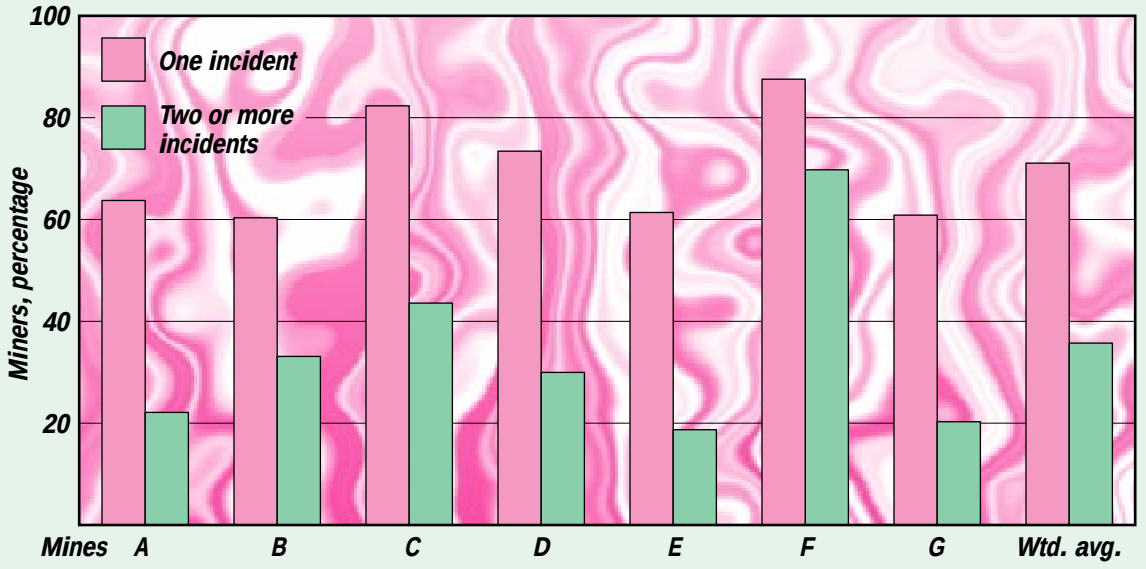
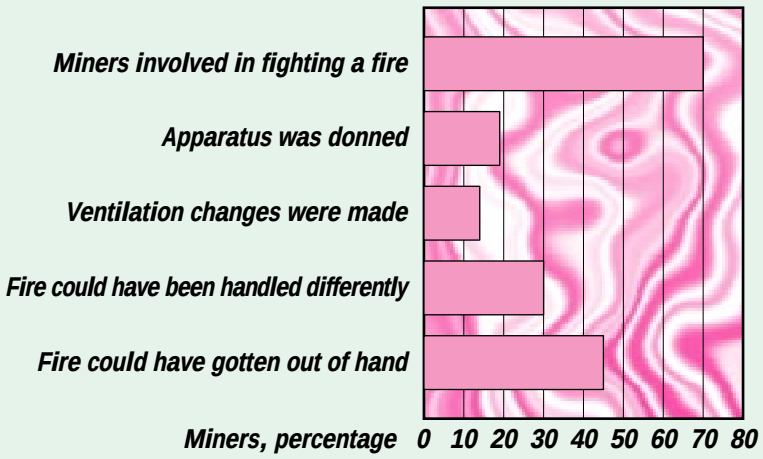


Figure 2.—Miners involved in fighting fires



the use of fire-fighting equipment and materials (such as rock dust). The four bar charts in figure 2 summarize for each mine visited ("A" through "G") the percentage of miners who reported having hands-on experience in the use of rock dust, fire extinguishers, fire hoses, and fire suppression systems on equipment. The extent of these workers' experience was differentiated as to whether they had used the equipment underground to fight fires, used them underground for some other purpose, and/or used them at all. In the case of rock dust use, however, it appeared relevant to ask miners only whether they had ever employed it to put out a fire underground. Looking across the four bar charts and across mines, with regard to fighting fires underground, over one-half of the miners interviewed had hands-on experience using rock dust to put out a fire. Although rock dust served as a successful extinguisher for many miners, there were some instances where it was not. As one miner noted:

"I was on third shift rock dusting, and we was coming back up the track, and we hit smoke...When we hit that smoke, we put our self-rescuers on to go through the smoke. [The motorman] just put the motor in low tram, and we rode the motor and rock duster through it. And when we got through it, we got to the fire up there. We found it, located it, and we got on the good side; we had good air. We took our self-rescuers off then, and we had about half a tank of rock dust left… I went in there and started shooting rock dust on the fire, you know, trying to contain it, and it was done too far gone."

When fire extinguishers had been employed inside the mine, it was almost always to fight a fire. Forty percent of the respondents had used fire extinguishers to perform this task. About 30% of the workers had used water hoses, and less than 10% had activated a fire suppression system. As a group, workers were most likely to report having hands-on experience in the use of water hoses in general (over 80%). Individuals were also most likely to have used hoses underground (about 75%). Because water hoses are utilized in the mine for such tasks as washing down equipment and wetting roadways, this is not an unexpected finding. About 75% of all respondents had hands-on experience in the use of fire extinguishers, although only about one-half of these miners had used extinguishers underground to fight a fire. As mentioned above, most of the extinguishers discharged inside the mine were used on a fire:

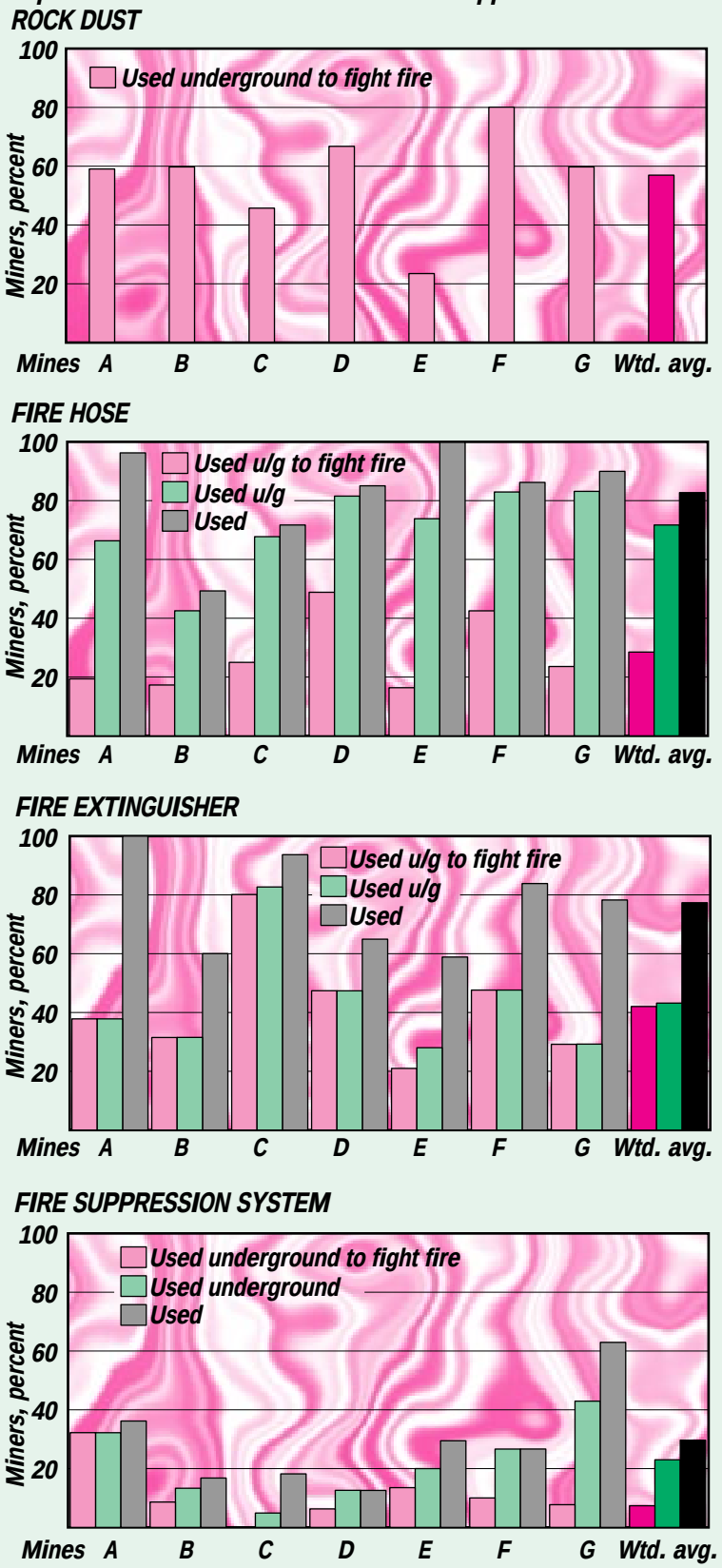
"I guess the [shuttle car] cable caught on fire. So, anyway, the cable was burning. All the cable on the roll, probably about four blocks of cable on the roll, was burning, and the shuttle car tire was on fire, too...Now, like I said, I went back in for the fire extinguisher. I shoot the fire extinguisher off; but it never helped."

In general, machine-mounted fire suppression systems had the lowest percentage (less than 30% overall) of use, both in fire response and general use (e.g., in training). The only exceptions were for miners at Mine G, where more than 69% of the workers had activated a fire suppression system. In terms of the differences among mines with regard to workers' use of fire-fighting equipment, note that for Mine A 100% of the miners had used a fire extinguisher and almost 100% of them had used a water hose. These individuals were also most likely to describe their fire-fighting training as a hands-on approach.

Workers' perceptions of training and readiness for fire-fighting

Miners were asked to describe their training to fight underground mine fires in terms of whether this instruction was conducted primarily through the use of lectures (being told what to do), discussion (talking about it), or a hands-on approach (practicing with fire-fighting equipment). Many miners reported that their training consisted of a combination of two of the three approaches (e.g., discussion and lecture). The percentages of miners reporting each of the three types of training are depicted for each mine in figure 3. Workers from Mines B, C, D, and F described their training as consisting primarily of lecture and discussion. Conversely, more miners at Mines A

Figure 3.—Percentage of miners reporting hands-on experience with various means of fire suppression

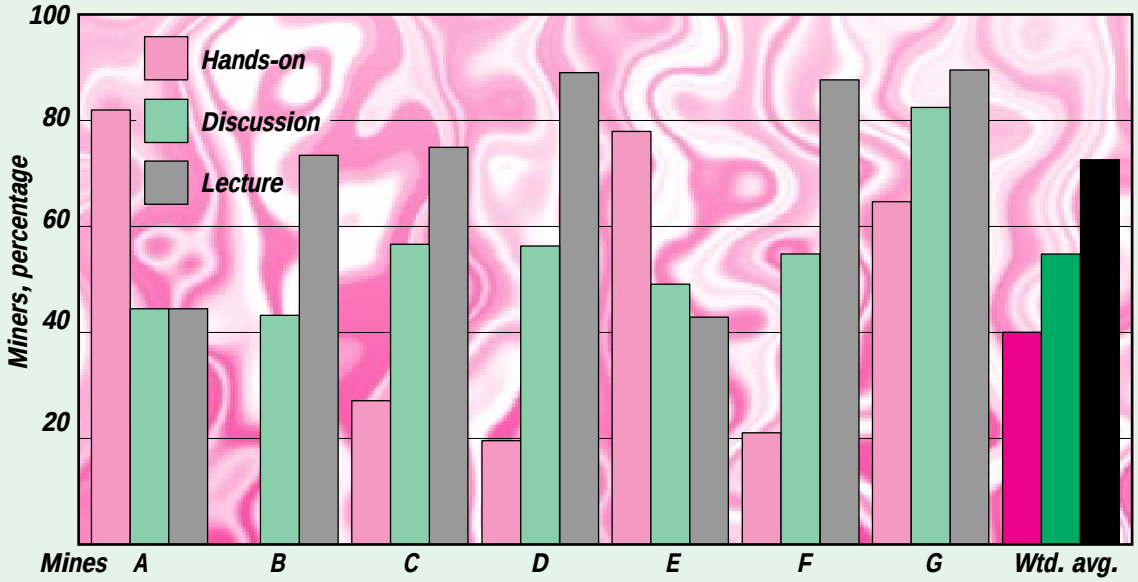


and E described their training as a hands-on approach. At Mine G, this approach was often in combination with lecture and/or discussion. Miners were asked if they felt that they had an acceptable level of fire-fighting skills. Figure 4 indicates the percentage of miners at each mine who believed that they possessed an acceptable level of such skills. At four of the mines—C, D, E, and F—about 70% of the workers felt that they had an acceptable level of skills. The highest percentages were found at Mines A and G, two operations where fairly high percentages of miners reported a hands-on approach to training. Conversely, only 57% of miners from Mine B felt that they had an acceptable level of fire-fighting skills; this was also the only mine where none of the miners described their firefighting training as a hands-on approach. In describing his level of fire-fighting skill, one miner commented:

"I think I know when to fight a fire, and I believe I know how big a fire I can put out just by looking at it, and if I can't put it out, then we're gonna get people down here to do it… If it's bad enough [that] I can't put it out, management will be immediately made aware that we have a problem with this area."

Mitchell [1990] indicates that many miners may not be as knowledgeable in fighting fires as they think they are. For example, handheld or portable fire extinguishers are often the most common equipment used to fight a fire. However, these contain only a small amount of the fire suppression agent; a lack of knowledge in their use makes them of little utility and even dangerous, because misuse on oil and other fluid fires can spread the fire. In fact, as common as they are, few miners have learned how to activate and apply the agent onto a fire. Dry-powder chemical and foam generator systems are used, but fires can reignite on

Figure 4.—Mine-specific training in underground fire-fighting

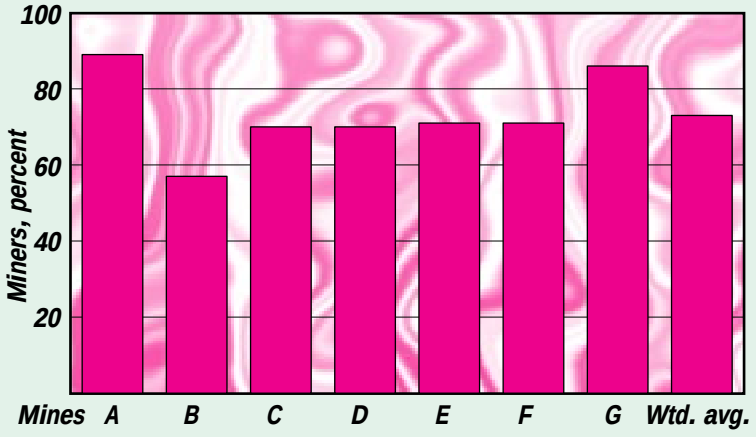


belting when these extinguishing agents have been applied. Mitchell also points out that "the best facilities and equipment can never compensate for poor preparation." Thus, training is needed and "the most important facts to teach and learn are how to lead and how to follow. Too often the Section Foreman is not the only one telling the crew what is best to do, what route to take." According to Mitchell, fire drills should be unannounced. They should involve a simulated fire or explosion specific to conditions in the section and should reinforce the training and identify any weaknesses in the emergency plan. The principal obstacle to overcome when this training is given is that the miners do not experience smoke (because the chance for injury is too great if smoke is added). He also notes that there are logistical problems if, for example, 7 miners had the opportunity to don their self-contained self-rescuers (SCSR's) during these drills; in that case, replacement miners would be needed if produtction is not to be interrupted. Another topic discussed by Mitchell concerning fire response is the use of check curtains (when, where, how, and why) to control smoke. Mitchell also advises that when miners are well trained, are equipped with SCSR's, and have access to escapeways that are adequately identified and maintained, barricading will not be necessary. However, he advises that miners should still have some training in barricading techniques.

Miners' perceptions of their work crew as a fire-fighting unit

Miners were questioned as to whether they had specific duties in case a fire occurred on their section. The percentages of miners who responded affirmatively varied from lows of 31% to 33% for Mines G and C to highs of 80% to 94% for Mines B and D, respectively. Traditionally, many miners have been instructed (via lecture and discussion) in the performance of specific roles if a fire occurs. There appears to be a slight movement from these cultural traditions, typified by the responses of

Figure 5.—Percentage of miners who feel they have an acceptable level of fire-fighting skills



miners from Mines G and C, to a more practical, problem-based solution that relies heavily on the leadership, skills, and experience of the supervisor and veteran crew members. Obviously, there are both advantages and disadvantages to preassigning specific duties in case of an incipient fire. An important question might be whether or not miners actually put these preset protocols into place when fire does occur. Complicating this further, the frequency of job changes, shift, and crew scheduling, as well as multiple skills and duties, can result in miners performing many tasks over a short period. This could result in confusion and difficulties if miners were preassigned specific duties based on traditional occupational classifications.

Miners were asked to rate, on a scale of 1 to 5, their confidence in their crew's ability to extinguish fires on their section:

"I think if it's extinguishable, we can put it out. [We could not handle] a fire that had been burning long enough that the ribs and stuffhad also caught fire… "

A mean confidence rating was computed for each mine by averaging the ratings of individual respondents. The resultant means range from a low of 3.9 for Mine F to a high of 4.6 for Mine A (the operation at which most miners had hands-on training).

Perspective

There is perhaps little difference during the incipient phase between a fire that goes unreported and one that results in a mine being sealed. It is simply that the latter either was not detected quickly enough or was not responded to properly. To achieve enhanced mine fire preparedness, mining companies will need to sharpen their strategy with regard to available technology and equipment while investing increased time and effort in their human resources. If this is done, the number of reportable incidents will likely decline even further and there should be even less chance of another disaster or permanent mine sealing.

The final article of this four-part series offers suggestions to improve mine fire-fighting preparedness.

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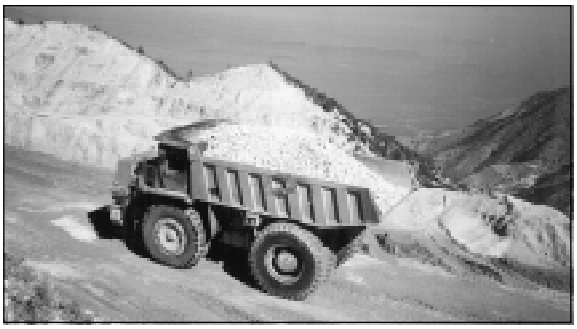

Best practices for surface mine, powered truck haulage: dumping procedures

In 1996, coal and metal/nonmetal mine operators, surface haulage equipment manufacturers, and trade associations, along with representatives from the Mine Safety and Health Administration(MSHA) and the National Institute for Occupational Health, began working on preparing "best practices" for haulage trucks. The goal of the group was to identify best practices, proven methods, and innovative procedures to reduce surface haulage accidents. These best practices were developed with the truck driver as the audience. The best practices are a check list of "did you" questions or short but complete phrases about procedures. The intent of the group was to present the best practices in several different media forms, such as safety talk notes and laminated pocket cards or small brochures that can be carried in the pocket.

The draft best practices developed by the group have been well received by persons associated with coal and metal/nonmetal mines. They are also being reviewed by MSHA's surface haulage training volunteers before they are finalized for presentation to the mining community. Because of the importance of disseminating this

information as widely as possible, MSHA is presenting the information in several formats, including this publication. As they are developed, other best practices will appear in future issues.

Best practices go beyond preaching safety. Best practices provide the truck driver with useful information on how to safely operate the truck and make that driver an active member of the mine safety team. The following best practices give the driver a starting kit of the best tools some of the safest mine companies in the U.S. can think of to keep you, the driver, safe. Be aware, however, that there are differences at your specific mine that can prevent using some of the best practices listed here.

Powered truck haulage at surface mines; Best practices for dumping procedures

✔ You are the most valuable part of the truck. Operate defensively and stay alert.

✔ Your truck has a tremendous amount of power; operate it with respect.

✔ Learn all the audible and visual signals to be used in your mine and identify who has the responsibility to give them.

✔ Know the operating specifications of the truck; they are found in the operators manual. If the truck does not have one, get one from your supervisor. Your life could depend on it. Operating specs typically cover:

- stopping distance for your truck
- maximum grade and speed
- gear/speed/grade information
- appropriate use of retarder
- fire suppression and other emergency equipment and procedures
- secondary (emergency) brakes and secondary (emergency) steering operation
- operating procedures under varying weather and road conditions gage readings indicating vehicle systems within specified ranges

✔ Always do a complete walk around the truck before reboarding. This will give you a chance to inspect the truck and note any obstacles around the truck before starting out.

✔ Always conduct a safety check of the truck and test the systems before driving. Use a buddy system to test lights. If your shift starts with a loaded truck that is in use, take the first unloaded opportunity to walk around and inspect the truck. As a responsible driver, you do not have to operate unsafe equipment or drive in unsafe conditions.

✔ Buckle up and stay buckled. The safest place to be in a runaway haultruck is in the cab. It's impossible to jump clear.

✔ Before moving, or putting the truck in gear, put your mind in gear. It is impossible to see all areas around a large truck. Communicate to those around the truck that you are preparing to move it. This is especially true if the truck has been idle. Some mines use one horn blast before starting engine, two horn blasts prior to moving forward, and

These two photos were provided by VISTA, 525 Milwaukee Ave., P.O. Box 247, Burlington, WI 53105-0247 1-800-942-2886

three blasts before backing-up.

✔ Pay attention to your machine and your surroundings. Look out for animals, people, truck speed, other vehicles, changing road surfaces, odd sounds, slumping or sloughing slopes, highwall and haul road conditions, downed or low wires, lighting or visibility problems, and unusual response of vehicle controls. Tell your supervisor so the problem can be fixed. Be aware of changes in conditions—weather, traffic, visibility, haul route, or other work in progress. Alert others.

✔ Always set the parking brakes, place all controls in "off" or "shutdown", and turn the wheels into the hill or use chocks when leaving the truck cab for any reason. When using wheel chocks, always place them on the driver's entry side. This also gives you a handy visual to pick up the chocks before returning to the cab.

✔ Talk with each other before, during and after field repairs or maintenance to avoid any miscommunications and unexpected movements.

✔ Some mines use flagged and lighted "buggy whips" on smaller support vehicles for better visibility around large equipment. Others may use strobe lights. Look out for these, and any other warning devices your mine uses.

Dumping procedures

✔ Cross windrows at an angle, one wheel first to reduce jarring the load, the truck, and yourself.

✔ Be sure the dump area is checked for cracks along the top edge, over-steep slopes, or sunken or soft areas which indicate an unstable edge. The weight of your truck near an unstable edge can be enough to break it loose, taking you with it.

✔ Never dump over the edge of an unstable dump slope.

✔ Most mines use mid-axle height as a minimum for berm construction.

✔ When possible, approach the dump site from left to right and make sure the dumping berm is in place (contact the supervisor if it is not). This also gives you better visibility to look over the area for obstacles or unstable conditions along the dump edge and slope. Keep at least one truck width away from the edge berm.

✔ Area lights provide the ability to see around the dump point at night. Report loss of night time area lights. Don't dump in areas where there is inadequate lighting.

✔ Check that the dumping area is level or sloping slightly up towards the edge. A slight upslope to the edge will help you keep the truck under control by backing uphill. It will also

drain water away from the edge to help keep the dump edge dry and stable.

✔ If more than 1 truck is dumping at a time, keep at least 2 truck widths apart to spread the weight and to avoid hitting another truck if a tip-over occurs.

✔ Rain, melting snow, freeze/thaw and other weather effects can weaken the dump area. Be aware that these conditions can lead to unstable slopes.

✔ Make your turn to back up at least one truck width away from the dumping berm to avoid overloading the dump edge and taking you over.

✔ Back up almost perpendicular to the dumping berm so the left rear tire approaches the berm first. This improves your dumping position and can help keep your truck from penetrating or going through the berm.

✔ Back up slowly and come to a gradual stop at the dump point to avoid loading the rear axle and causing the edge of the dump to break away.

✔ Don't use or expect the berms or bumper blocks to stop the truck. Stop just before the berm. This avoids accidentally breaking through the berm and going over the edge.

✔ If other people or equipment operators are nearby, wait to dump your load. Raising the truck bed can cause materials to fall off and can injure or kill those around the truck.

✔ Shift the truck into neutral and set the appropriate brake when dumping. This avoids accidental movement either forward or backward while you are focusing on dumping. Do not use the retarder as a dump brake.

✔ Be alert for the presence of material stuck in the bed when hauling wet or damp materials. Materials stuck in the bed can cause truck stability problems.

✔ Before leaving the dump area, lower the truck bed completely. Lowering the truck bed provides better truck stability, reduces damage to equipment, and reduces the likelihood of electrocution by overhead power lines.

✔ When pulling out, turn left whenever possible. This will give you better vision over the area you're turning toward.

Stockpiles

A stockpile is a temporary pile of ore or other material which will be used later. Stockpiles are especially hazardous when there are activities at the top edge and the toe. Loading out material at the toe causes sloughing which can cover the loader. It can also over-steepen the slope, making the top edge of the pile unstable for trucks which may be dumping at the top. Always dump in an area where there are no activities immediately below and never dump over an over-steepened slope. If possible, dumping should be done at least one truck length away from the edge and materials pushed by dozer to final position—**look around.**

Spoil piles

Spoil piles are usually permanently-placed waste materials or spoils. Because of changing dumped materials, there can be soft spots, weak and loose materials, and steep slopes which may cause unstable piles. Of special concern are dumps that are constructed by trucks end-dumping over the dump edge to form angle-of-repose slopes. Careful inspection of the dump edge for sloughs and cracks along the edge should be done before approaching the dump. Look for minimum suggested mid-axle height dumping berms. Remember also, too much moisture can weaken the pile—***BE CAREFUL.***

Bins and hoppers

Bins and hoppers are engineered structures for storing or channeling materials. They have a specific dump point with features such as overhead obstructions, chutes, gratings, stopping blocks, and guide rails. Look over the area before pulling in to dump to check for any damage to any of these features. Dumping at these areas is very repetitive and special efforts are needed to maintain driver awareness.—***STAY ALERT.***

Submitted by Doris Cash of MSHA's Office of Metal/Nonmetal Mine Health and Safety

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Home

The Sunshine State is the testing ground for a new computerized photo-voltaic (PV) residential water heater. The Florida Solar Energy Center in Cocoa has begun a one-year trial of the National Institute for Standards and Technology-built device that uses computer technology to maximize the conversion of sunlight into electricity. A microprocessor reacts to light intensity changes and kicks in the appropriate electrical resistive elements for maximum energy conversion from sunrise to sunset. Unlike previously proposed PV cells for residential homes, it does not require the use of storage batteries to provide energy and does not need an expensive electronic inverter to convert dc current produced by the PV cells into ac current required for household appliances.

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PERSPECTIVES

This article represents the views of a guest columnist writing for "Mine Safety and Health News" and not necessarily the views of this publication. In addition, the views expressed herein are those of the author and do not necessarily represent the views of any other organization.

An opportunity to get ahead of the accident curve

By Steve Minshall, CIH, CSP

Right about now, many people are looking for answers to the rising number of fatalities in the metal/nonmetal mining industry.

MSHA statistics have defined the problem as viewed with 20/20 hindsight: more fatalities occur on Fridays, and in December and May. Front end loaders are involved in many accidents and people in the "baby boomer" category represent a large proportion of those killed.

Additional viewpoints are posited that training (or the lack thereof), high production rates, new and unfamiliar equipment technologies, lack of supervision, inexperienced miners, and the high energy transfer ratio from powered haulage to the human body are also factors in the fatalities.

Perhaps this is so, but who knows for sure? What can you do about these things?

Training might be an answer but considering that the nature of the accidents has been so diverse, choosing the correct training subjects would be difficult. We might consider that the person who lost a finger or hand in a powered belt accident just did not realize the extreme forces with which he was dealing. And, if so, was this really because someone had not said to him, "Don't stick your hand in a pinch point"? Factors more powerful than just training motivate people to take, or not to take, risks.

Decreasing production might be another answer. Where should you start? Someone would have to make a tough decision to shut down the crushing operation or the mill, or perhaps conclude that driving haul trucks only four hours a day is the right thing to do. What if you were actually able to do these things and stay in business and accidents still occurred?

Lax supervision might be the problem. It can be, but are we helping the situation by making such a generalized statement? If such a statement is to be made and believed, specific, unacceptable behaviors must be outlined. And, specific expectations must be communicated. We tend to get what we expect and what we accept.

Inexperience has been implicated in the accident trend and it can lead to risk taking because new people may not have yet recognized the hazards. Yet, we will always have some inexperienced people working for us.

A careful examination of MSHA statistics reveals that it is miners with an average of 10 years experience who are being killed. Ten years? This does not sound like inexperience—more like complacency. And if it is complacency, what specifically do you do about that?

If new technology is the problem, maybe it should be placed on hiatus and only old, familiar equipment used. But, surely old equipment has been responsible for as many accidents as the new. Maybe lack of training is a key in the issue of new technology, but high tech equipment has not been an issue in every accident.

It is a fact that a human body interacting with an 80-ton haul truck is likely to lose out. And, it is hard to disagree that a belt traveling at 600 feet per minute can yank an arm into a pinch point faster than anyone can react. So something has to be done about all this, right? We should apply efforts in all these areas and, maybe, just maybe, we will hit on the one thing or combination of things that makes a difference. The pressure is there for us to "do something" and we need a quick fix to this mounting problem.

Or do we?

Perhaps we should take a different, longer term view, look at the accidents that have occurred, find a common thread where possible and focus our efforts on the issues our analysis reveals. What different approach might we take? How about a behavior-based one?

The potential for success

I can almost hear a collective gasp coming from some. Behavior, did he say? He must mean that the injured or killed were at fault and blame must be placed on them. Nothing could be further from the truth. In fact, to blame employees for being injured is counterproductive. (*Geller, 1996*)

Some people give behavior-based safety a bum rap. They immediately start thinking about the negative connotations, such as blame, associated with the word "behavior" that most of us became familiar with

as we grew up. (*Geller, 1996*) Quite often our parents admonished us about our "bad" behavior or told us to be on our "best" behavior while out in public. We formed our impressions of what "behavior" meant from the way our parents, teachers, coaches and friends used the word.

Others who are critical of the behavior-based approach to safety can relate examples of where such an approach failed to correct a specific problem. Or they describe a situation in which behavior could not have been a factor in an accident, all the while they are describing behaviors that clearly lead to the final common pathway to an incident in which someone was injured or killed. Some say that the relevance of unsafe acts in the occurrence and outcome of accidents has been debated for decades and that no further discussion on the issue is needed.

Tying your shoe is a behavior!

Let's stop for a moment and define behavior to rid ourselves of these negative images. In this application, behavior means "an observable act without attributing positive or negative aspects to the action." (*Geller, 1996; Killimet*) Tying your shoe is a behavior, as is using a pipe wrench to remove a bolt. Central to the theme of behavior-based safety is that behaviors, well-defined according to behavioral science principles, can be observed and so can be measured.

What we can measure, we can analyze. We can then design appropriate intervention strategies to both correct the at-risk behaviors that we don't want and foster the safe behaviors we do want. (*Killimet*)

Let me discuss the theory of unsafe acts/unsafe conditions in the causation of accidents. Heinrich in 1931, gave us the "domino theory." He said that a sequence of factors came together to result in an injury and that most often it was either an unsafe act or an unsafe condition that allowed the accident to occur.

According to the theory, if you remove either the unsafe act or the unsafe condition, the accident cannot occur. (*Petersen*) Many people have used this theory for years, even decades. Some have focused more on unsafe acts. Others have primarily taken the position that unsafe conditions are the major causes of accidents, hence, government regulations came into being that targeted engineering controls, enforcement and education (read that as "training") as the solution to industrial accidents.

These approaches to safety have largely gotten us where we are today. In the history of American industry, the need to correct many unsafe conditions is indisputable and the implementation of engineering controls has no doubt been a factor in the overall improving safety trend. No reason to debate that.

But we are stumbling, caught in the reactive safety cycle. We are struggling to find a way to produce further improvement in our safety statistics, but we keep trying the same old things. We need a methodology to move us ahead.

This brings me back to behavior-

Figure 1

Activator	Behavior	Consequence	Assessment
Lack of training	Failure to wear seat belt while driving a haul truck ↓	Injured in an accident	later/uncertain/neg.
Seat belt tucked away	↓	MSHA citation	later/uncertain/neg.
Hurrying	↓	Takes less time	soon/certain/positive
Feel safe in a big truck	↓	More comfortable	soon/certain/positive
Time of Day	↓	Disciplinary action	later/uncertain/neg.

Figure 2

Activator	Behavior	Consequence
Belts clean, serviceable	Wearing seat belts while driving a haul truck ↓	Supv. gives positive feedback for use
Seat belts readily accessible	↓	Positive feedback for belt use via radio
Modeling by supervisors	↓	Pride in "doing the right thing"
Provide safety training	↓	Positive feedback from peers

based safety. Is Heinrich's domino theory, postulated in 1931, what we mean when we use the term "behavior-based safety" today?

No. Heinrich's theory brought safety a long way, but it is the behavioral science research and concepts developed by B.F. Skinner that underlie what we know as behavior-based safety. (*Geller, 1996; Krause, et. al.*) Why is it important to make that distinction? Because we need to understand that the debate that has occurred over the last several decades about the role of unsafe acts and unsafe conditions in accident causation centered around Heinrich's theory and not the behavior-based safety process. In fact, I would venture to say that most people had not heard of behavior-based safety until the mid to late 1980s when the first consulting firm began its assault on the status quo approach to safety. I know that is the case for me. Behavior-based safety and Heinrich's early domino theory are not one in the same.

You may be wondering at this point, "What is behavior-based safety? Is it a quick fix to the almost textbook safety cycle we are in? Does it work for everyone and, more importantly, will it work in the mining industry?"

My view of behavior-based safety is this: It is a proactive, preventive method to systematically look at the upstream variables (behaviors) that underlie the majority of injury incidents. It is commonly held that unsafe acts (or at-risk behaviors) form the final common pathway to an injury incident 80 to 95% of the time. (Krause, et. al.) Defining and measuring (counting) those at-risk behaviors and determining where the problems actually lie, presents a far larger opportunity to intervene before an incident has occurred. In large part this is because statistically far more at-risk behaviors exist in comparison to outcomes of at-risk behaviors such as near-hits, first aid cases, reportable accidents, lost time accidents and fatalities. (Geller, 1996)

Understanding the role of behavior in safety means having to understand what controls behavior in human beings. Again, Skinner did the pioneering research in this area. But it has been Krause and also Geller who have most recently used the results of that research to describe what is known as ABC analysis or the ABC Model;

- A for activator (or antecedent),
- B for behavior and
- C for consequence.

An activator is what triggers a behavior and a consequence is what results from the behavior. One of the dearest examples of this is a telephone rings (activator), you answer the phone (behavior) to determine who is on the line (consequence).

Most people would have thought that it was the ringing phone that controlled our behavior. Skinner, however, showed that it is the consequence that is the more powerful predictor of behavior. If, for example, the phone rings several times and each time you pick it up no one is there, you soon stop answering the phone. Since the consequence is weak or missing, the behavior stops. It is still true, however, that the activator helps to direct the behavior. (*Krause, et. al.; Geller, 1996*)

Knowing that consequences control behavior is not enough, though. Some consequences are more powerful than others; this has been described variously by Krause and Geller.

According to these experts, those consequences that are soon, certain and positive (or sizable) are most powerful. (*Krause, et. al.; Geller, 1996*) Unfortunately, as Geller points out in his book, The Psychology of Safety, "...safe behaviors are usually not reinforced by soon, sizable, and certain consequences. In fact, safe behaviors are often punished by soon and certain negative consequences, including inconvenience, and comfort, and slower goal attainment." (*Geller, p. 113, 1996*)

Using the ABC method of behavioral analysis on a workplace situation helps make the concept clearer. Let's take a look at an example from mining using the model Krause (*Krause, et. al.*) has described (see Figure 1).

In this example you can see that the consequences that are most powerful are soon, certain and positive. And, they favor the at-risk behavior. At the same time, this analysis helps point us in directions of positive intervention in order to obtain the safe behavior we want. For example see Figure 2.

Is doing this kind of behavioral analysis all there is to behavior-based safety? No, it takes more effort, but this description begins to let you know some of the basics.

Where do you start?

One approach, presented by Krause (*Krause, et. al.*) is to review past accident reports and from them develop an inventory of at-risk behaviors that contributed to the injuries.

He advocates listing the behaviors in general categories such as body use, personal protective equipment, tool use, or procedure. These are just examples and you might come up with others.

These general categories, however, need to have specific behavioral definitions written for them. For example, "body use" might be further refined to include the terms placement, line of fire and visibility.

The key is to start to define the at-risk behaviors at your location, the ones that are predictors of later, downstream accidents, and intervene with positive consequences that encourage safe behaviors.

I hope you can see how this

leads to a reduction in the number of injuries occurring on a mine site.

Hourly workers trained in observation

In the next step, after these categories are adequately defined in behavioral terms, hourly employees are trained to conduct observations of co-workers performing normal tasks. They look for at-risk as well as safe behaviors. Part of the observer training includes how to give feedback in a nonthreatening way to the person being observed.

The observations are recorded and tallied as percent safe and percent at-risk. No names are recorded and strict rules are followed that do not allow the observation process to be used in any disciplinary action. (*Krause, et. al.; Geller, 1996*)

When the observation results are charted and displayed, additional opportunity is provided for feedback on how well the workforce is doing. Other employees can then be involved in problem solving sessions to address concerns that have been highlighted by the observation process. This is a means of having a positive effect on the culture of an organization. You cannot mandate a change in culture; you can achieve the change you desire by focusing on observable behaviors, providing positive feedback and involving all employees in the process. (*Krause, et. al.*)

Hourly employees are involved in this process from the outset. They establish the rules of participation, observation and feedback. They become the eyes and ears that are so sorely needed in an effective safety process.

Everyone knows supervisors cannot be everywhere; too few supervisors exist to allow that. But think of the multiplied benefit when, for example, 50 or more hourly employees in a plant of 150 have been trained in how to observe for safe and at-risk behaviors and can give immediate feedback to correct a dangerous situation or provide encouragement to continue a safe behavior.

This is a powerful approach and one you may not be able to fully appreciate until you have spoken with employees who have done it or until you have done it yourself. I have spent hours talking with people who have taken this approach to heart and who truly believe in it. The most amazing thing happens when you talk with these people. They can talk almost endlessly about their experience with the process. They are intimately familiar with the challenges and the solutions they worked out. They have learned or enhanced skills they have not previously used to any large extent. They are nearly evangelical in their support of the process they helped design and implement.

Compare that to a conversation about a safety program with an employee who has not been involved in a successful behavior-based safety process. My experience has been that it will often be a short conversation that is lacking in detail and enthusiasm.

Why is behavior-based safety successful?

Behavior-based safety is based on behavioral science principles. It involves the people who need to be involved, the workers. It stresses the positive, recognizing that negative reinforcement or punishment can work but generally produces a short term result and may produce unexpected or unwanted results. (*Krause, et. al.; Geller, 1996; McSween*) It recognizes that while attitudes are important they are internal to people and cannot be easily changed by slogans or exhortations. (*Krause, et. al.; Geller, 1996*) Behavior-based safety uses the knowledge that you can "act people into thinking differently". (*Geller, 1997*)

Will behavior-based safety be successful for everyone? Perhaps not, and for a variety of reasons. The biggest hurdle to overcome is resistance to change. It rapidly shows up when an initiative like this is proposed and people are asked to move out of their comfort zone. If resistance to change is not anticipated and managed, your efforts at behavior-based safety will be severely hampered and may fail miserably.

Resistance can show up as a lack of cooperation from key management personnel or employees who decline to participate in the process. The good news is that you can anticipate such resistance and develop a strategy to help overcome it.

Krause has suggested a nine-step strategy for managing individual resistance to change. His approach includes such things as

- communicating clearly;
- ensuring an understanding of what needs to be changed and why;
- talking with people about the process;
- seeking cooperation not blind obedience;
- being realistic in your time expectations for implementation; and;
- negotiating where negotiation is possible. (*Krause, et. al.*)

Have mining companies successfully used the behavior-based safety process? Yes, particularly in metal mining.

I spoke at length with two miners from a metal mining operation in southern Georgia. Their teams read about behavior-based safety and implemented the process without the help of an outside consultant. The conversation with these men was enthusiastic, and they were obviously proud of their mine's safety accomplishments. Other mining companies have enjoyed similar successes.

I know some will scoff and say, "But they still have accidents, they haven't totally eliminated all injuries." True, but I do not believe in the

maxim that says all injuries are preventable (heresy, perhaps). In fact, as Dr. Scott Geller points out, cognitive failures (or "brain cramps"), which are "sudden, unexpected mental lapses", may cause injuries. If you buy that, Geller further states, "then it's illogical to presume that all injuries are preventable." (*Geller, p. 47, 1996*) Accepting this rationale is part of changing our mindset about how to successfully approach improvement in safety.

In summary, I do not see behavior-based safety as one more tool in my safety toolbox. I see it as a process that complements, not supplants, ongoing activities aimed at improving the physical environment and the management aspects of the workplace.

I see it as an opportunity to get ahead, as much as possible, of the accident curve. It provides employees the chance to become actively involved in the safety process and exert a measure of self-determination they might not have experienced before.

It is not a process aimed at blaming anyone. Behavior-based safety applies tried and true scientific principles aimed at defining behaviors, both safe and at-risk, with the intent of reducing or eliminating the at-risk ones while fostering growth of safe behaviors.

The behavior-based safety approach may not be the right approach for everyone, especially if other aspects of the safety process are sorely lacking, if trust levels between management and labor are low, or if the only way you know to approach safety is with a compliance mentality.

The behavior-based safety approach requires commitment and hard work in laying the foundation for this process to thrive. It requires involving employees in the entire process and providing them with the communication tools they need to succeed. In my view, the effort, cost and commitment are justified by the results. Everyone concerned about safety should believe that.

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Scientists to test machine that could stop mine subsidence

A machine that could help end the problem of mine subsidence is scheduled to begin field trials in Illinois in two weeks.

The 15-ton machine injects a mixture of flyash and other coal combustion wastes into closed mine shafts, creating a rigid filler that should prevent underground mines from collapsing, say its creators, Edwin Thomasson and Eric Powell of Southern Illinois University at Carbondale.

According to an AP report, the machine is designed to fill areas up to 300 feet in circumference from a single hole drilled into the mine, something existing mine-filling machines are not able to do, said Thomasson, the project manager.

"Previous work in this area didn't have the range that this technology has," he said.

There is another bonus: The machine uses flyash and other byproducts of coal combustion for the filler. If successful, the method would help coal users dispose of the material.

The field tests will be conducted at the closed Peabody Coal Co. Mine No. 10 near Pawnee, about 10 miles south of Springfield.

Researchers will test two methods for inserting the mixture. In the first trial, which begins March 17, a toothpaste-like mixture will be blasted into bore holes at 600 to 700 pounds of pressure per square inch, instantly filling crevices up to 300 feet away.

In the second test, which begins March 24, a lowpressure method will be used to deposit a cone of dryer flyash mixture from the floor up to the mine roof. High pressure air will then be used to blow the compound out onto nearby walls, where it will dry into a rigid filler.

The tests are designed to pump 10,000 tons of flyash into a void measuring 20 feet wide by 7 feet high. The machines can pump up to 600 tons a day.

"If the weather cooperates and Murphy's Law stays out of our way, we expect to have some good results," Thomasson said.

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Best practices for surface mines, POWERED TRUCK HAULAGE:

In 1996, coal and metal/nonmetal mine operators, surface haulage equipment manufacturers, and trade associations, along with representatives from the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Health, began working on preparing best practices for haulage trucks. These best practices were developed with the truck driver as the audience. The draft best practices developed by the group have been well received by persons associated with coal and metal/nonmetal mines. They are also being reviewed by MSHA's surface haulage training volunteers before they are finalized for presentation to the mining community. Because of the importance of disseminating this information as widely as possible, MSHA is presenting the information in several formats, including this publication.

Cab inspection

Ingress-Egress. Steps, platforms, walkways, handrails, handholds, guardrails, skid resistant material, etc., are designed to provide safe ingress and egress to the machine's operating station and areas where maintenance is performed.

• Keep these areas clear and clean to minimize accumulation of material that can cause a person to slip or fall.

• Check daily for defects including loose, bent, fractured or missing parts.

• Personal items or supplies are not to be hand carried while climbing or descending an access system. Place the items on the machine within reach from the ground or cab. If this is not possible, use a rope or other means to transport items.

• Door latches must be in working order.

• Doors must be able to open from inside and outside.

Seats—operator and, if provided, a passenger seat. Inspect the following items or conditions on a regular basis:

• The seat suspension system for proper operation. Any excessive looseness, binding, broken or missing parts must be repaired before use.

• Fore and aft adjustment, weight compensators and other adjustable components.

• Seat must be adjusted to insure that the operator can perform all control functions satisfactorily. Especially, consider the ease of operation of the primary controls such as steering, brakes, transmission and directional controls.

• Seat restraining bolts are to be checked at least monthly to insure that they are in place and properly tightened.

• Check the seat belts for cuts, worn areas, cleanliness, chemical damage, or deterioration from the sun or other elements.

• Insure that the seat belt is securely anchored.

• Check the belt label to ensure it complies with SAE J386 standard.

Machine instructions and Warnings.

• The operator's manual should be in the operator's compartment or located in an area where it is readily accessible to the operator on request.

• The operator must be completely familiar with the contents, especially as they relate to safety concerns, inspection instructions, operation of controls and the machine's operating limitations.

• Decals, labels, plates, safety signs, warnings, and instructions are provided for specific critical points to safely operate the machine. Have these items replaced if they are damaged, missing or unreadable.

• Safety warnings are provided by the manufacturer to warn of possible loss of control. They are generally both visual and audible. Blinking lights, buzzers, horns, voice messages, etc., are some of the many ways to warn operators of machine problems.

• Stop the machine as quickly as possible if any of the warnings are activated.

• Never operate a machine when these devices are activated until it is determined safe to do so by an authorized person.

• Other warnings are provided to indicate potential mechanical system malfunctions that could be very costly or lead to a serious safety problem.

• Never operate a machine with safety warnings disabled or deactivated, until it is determined safe to do so by an authorized person.

• External alarms i.e., back up alarms, horns, are provided to attract attention to the machine. Since their primary purpose is to prevent injury to persons outside the machine, the machine must not be operated until they are functional.

• Visibility enhancement devices are provided on many machines to aid the operator in insuring that personnel and equipment are clear of the machine being operated. Check your windshield and other glass for cracks that could impair your visibility.

• Keep mirrors adjusted to provide the desired visibility especially to the rear vicinity of the machine.

• Keep all glazing sufficiently clean so operating visibility is not impaired. Any damage to glazing or mirrors should be replaced or repaired.

• Emergency exits should be readily accessible. Items must not be stored in such a manner as to inhibit access to the normal or emergency exit.

• Secure loose items in the cab. Do not allow items to interfere with the operation of foot or hand controls.

• The manufacturer's operator's manual must always be considered to be the primary source of information for safe operation of any machine.

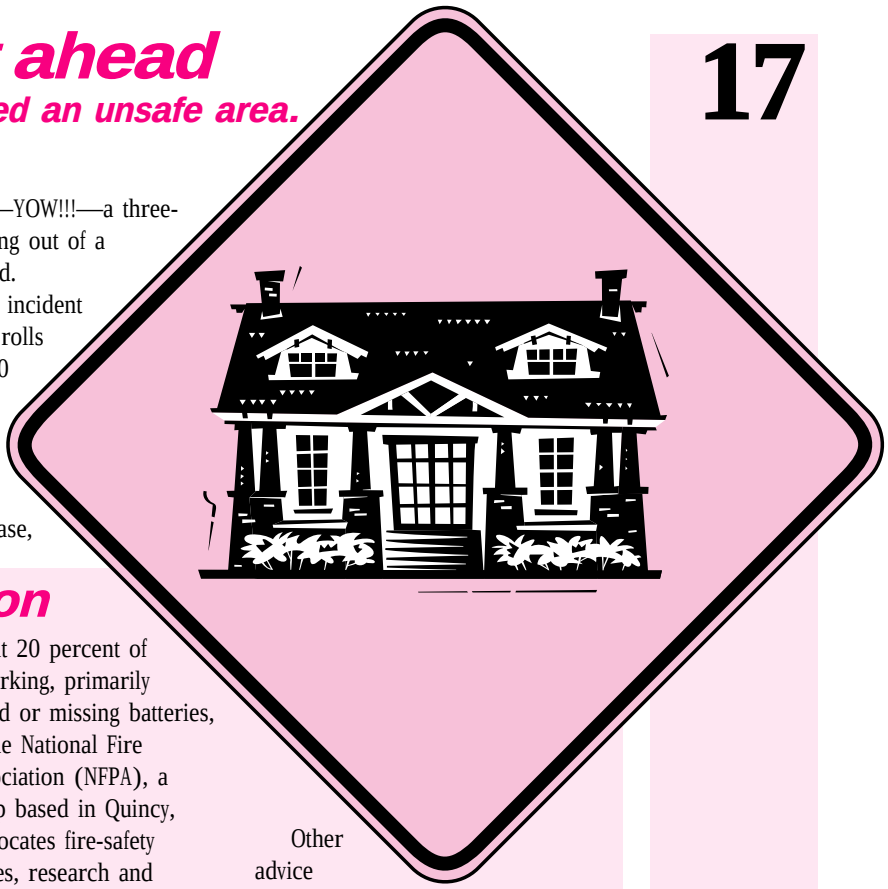
• Any malfunction, defect or improper operation is to be checked by an authorized person to correct the problem

Submitted by: Doris Cash, MSHA Office of Metal/Nonmetal Mine Safety & Health

Danger zone just ahead

Welcome Home. You have entered an unsafe area.

By Sandra Evans



I was uncrating my mother's bureau, shipped from St. Louis, using crowbar and hammer to pry apart plywood held together with three-inch nails. Out flooded a mountain of those pesky packing peanuts, scattering over the laundry room floor, covering dismantled plywood. After catching my breath, I stepped back in to assault the mess. In stocking feet. Onto the packing peanuts. Onto—YOW!!!—a three-inch nail sticking out of a strip of plywood.

That recent incident put me on the rolls of the nearly 20 million Americans a year seriously injured at home. In my case,

An ounce of prevention

Safety experts have long lists of recommendations for making a house safer. The advice may seem daunting at first, because the steps take more time and care than just installing devices such as a smoke detector or carbon monoxide detector. But most remedies aren't costly.

To prevent falls, for example, experts recommend that homeowners keep stairwells uncluttered and well lit (some suggest motion-sensitive lights), install handrails on both sides of staircases, put nonskid surfaces on steps, secure loose rugs to the floor, install grab bars in bathtubs and showers, wipe up spills that make floors slippery, don't walk around the house in socks, and keep electrical cords out of the way.

To prevent fire injuries and deaths, don't just install a smoke detector and think you're protected. Each home needs a fire escape plan, because people have only a few minutes to get outside after the alarm sounds. And check the battery regularly (at least once a month) or get one that wires into the electrical system.

Although more than 90 percent of homes now have smoke detectors, about 20 percent of them aren't working, primarily because of dead or missing batteries, according to the National Fire Protection Association (NFPA), a nonprofit group based in Quincy, Mass., that advocates fire-safety standards, codes, research and education association. Each home should have a fire extinguisher in a handy spot, and more elaborate firefighting systems are becoming available.

Arson is the surprising No. 3 cause of household fires, after cooking and heating equipment, according to the NFPA, which recommends locking up gasoline cans in outside sheds and keeping the outside of houses well lit.

A home's heating and electrical systems can became dangerous with age. "The home needs a tune-up just like a car does," with heating systems checked regularly and any electrical malfunction repaired quickly, said Lori Tietz of the National Safety Council. "You can't ignore the aging process of a home."

Homes with children need a special added layer of safety precautions, such as locking up medicines and poisons, installing child gates on stairs and securing windows so children won't fall out of them.

Other advice includes storing things in easy reach, un-plugging small appliances, keeping knives organized in a spot separate from other utensils, using a cordless phone so children can be watched during a conversation, and keeping flashlights and a first-aid kit handy.

Psychologist E. Scott Geller of Virginia Tech recommends a room-by-room safety audit of the home and completing a safety analysis of each job before performing it, whether it's mowing the lawn, climbing a ladder, or moving furniture.

But the most important change in a household may be one of attitude—becoming more aware of potential hazards so they can be avoided.

In "a lot of what happens in the home, we are victims of our own haste and inattentiveness," said Tietz. "In the home, we are left to our own devices."

Sandra Evans

I had to bundle up my kid, get a tetanus shot and a prescription for antibiotics at a walk-in clinic open on weekends, and then spent the next two weeks limping.

Home. It sounds so cozy and secure. But the casualty figures make it look more like a battlefield. About 7.3 million Americans (or one in 36) were disabled for at least one day last year in household accidents. That's more than the number disabled in workplace accidents and car crashes combined (though more injuries from car accidents are fatal).

"The home is not the safe haven everyone wants it to be," said Lori Tietz, a spokeswoman for the National Safety Council (NSC), located in Itasca, Ill., a nonprofit group that compiled those figures. "We have been lulled into the idea of Home Sweet Home," she said, but in terms of accidental injuries, "the home is the most dangerous place to be."

Falls are the No. 1 cause of injury in the home, by far. But the home also holds serious hazards of fire, suffocation, poisoning, choking, wounds, and a wide variety of dangers from even the most mundane of household items.

Like jewelry. Those seemingly benign accessories sent nearly 55,000 Americans to the emergency room in 1994, according to U.S. Consumer Product Safety Commission (CPSC) records.

The jewelry-related visits involved cuts to ears and eyes, kids swallowing earrings or putting beads up their noses, and injuries when rings got caught on something. These types of injuries were more common than accidents involving chain saws (41,000) or razor blades (38,000).

"We are dealing with so many things, everything from curling irons to… toasters to washers and dryers," said Tietz. "We expose ourselves to a myriad of things [in the home]. It's a huge order for us to keep up on it."

While laws tell us we have to work safely and drive safely, we can behave as stupidly as we want in our own home. Some experts say it is less that our houses are unsafe but more that we behave unsafely in them (like uncrating bureaus in stocking feet).

"We are much more cautious in the workplace than we are in the home," said E. Scott Geller, a psychology professor at Virginia Tech in Blacksburg who specializes in safety and health issues. "We have the work culture, and we have the home culture. In the home, we're ready to take greater risks."

Geller pointed out that workers are routinely required to wear hard hats, ear protection, steel-toed shoes, and other safety gear to do jobs with even minimal safety risks. Before any

job, a safety analysis is supposed to be done and safety precautions taken. But at home, people mow their lawns wearing tennis shoes, which give them no protection from wayward lawn-mower blades.

Homeowners climb up on ladders without tying them off at the top. They use chain saws with no eye or head protection.

"The more we are familiar with something, the less risky it feels. People just don't feel that the home we are so familiar with is dangerous," said Geller, author of the new book "Working Safe: How to Help People Actively Care for Health and Safety" (Chilton Book Co., Radnor, Pa.; 288 pp.; $19.95 soft cover).

"We do things for convenience, for comfort, for efficiency," he added. "Personal protection equipment is uncomfortable. Tying off a ladder takes time."

The CPSC samples hospitals and estimates how many emergency room visits a year are associated with consumer products found in the home, one method the agency uses in spotting trends and problem areas.

The NSC analyzed this and other data to pinpoint some of the top hazards:

• Nearly 2 million people in 1994 wound up in the emergency room for injuries at home involving stairs, ramps, landings and floors, mainly a reflection of falls.

Falls, for decades the home accident that killed the most people, accounted for 7,300 of the 26,400 accidental deaths in the home in 1995. Poisoning deaths, which include unintentional drug overdoses, for the first time outpaced the deaths from falls in l995.

• Bicycle accidents sent more than 600,000 people to emergency rooms. And 472,000 serious home injuries involved knives. Those two categories may seem unsurprising, but what about the 145,000 serious injuries that involve clothing? CPSC records show that many of these resulted from people tripping or slipping on clothes, especially shoes and shoelaces.

Maybe by now you just want to crawl into bed and pull the covers over your head. But wait. That's even more dangerous than wearing clothes.

An estimated 400,000 disabling injuries involve beds, mattresses and pillows. The bed injuries usually involve people falling out of bed or falling onto a headboard or bed frame.

And don't think the living room is safe. An additional 410,000 injuries are associated with chairs, sofas, and sofa beds, largely because people fall off them. Other injuries, such as pulled muscles and strained backs, are caused when people try to move large pieces of furniture.

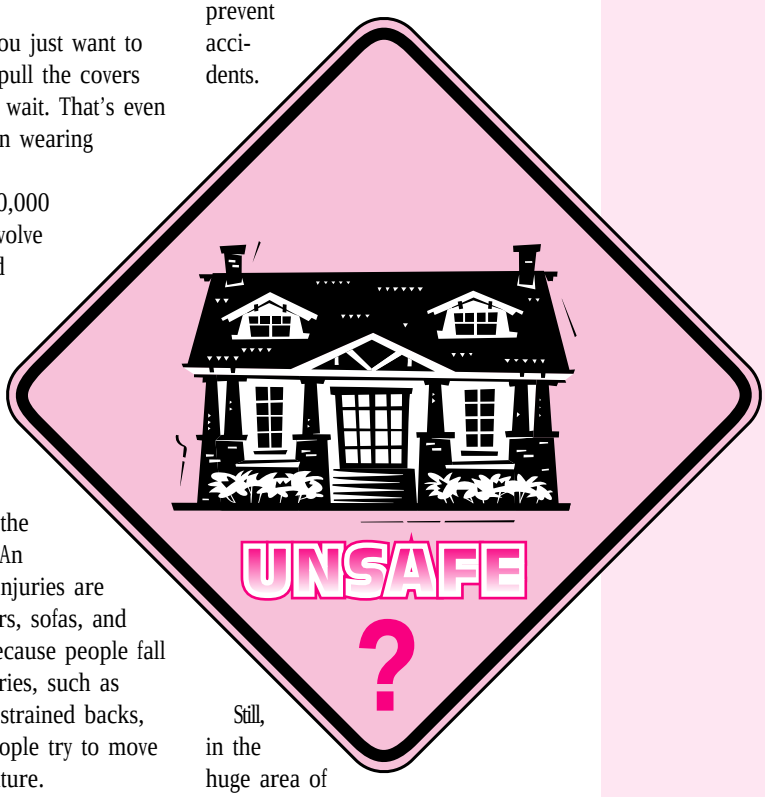
When I put that nail through my foot, I joined more than 200,000 people hurting themselves with nails and carpet tacks. And 238,000 others went to emergency rooms with injuries involving cans.

Even pet supplies hold hazards (26,000 injuries the last time this category was recorded, in 1992), as do washers and dryers (20,000 injuries) and telephones (17,000).

The CPSC has to pick and choose which of the 15,000 consumer products it monitors design changes to, new standards for, or extending safety precautions to more products (such as child-resistant packaging).

The agency is working on more than two dozen projects aimed at reducing consumer injuries, such as establishing mandatory standards for bike helmets and carbon monoxide detectors.

In recent years, the agency has negotiated design changes to prevent the cords on window blinds from hanging children and has gotten clothes manufacturers to take drawstrings out of kids' clothes to prevent accidents.



Still, in the huge area of falls, "it's a difficult problem not addressable by the agency," because by and large the falls are not a result of product design flaws, said Ronald L. Medford, the CPSC's hazard identification and reduction specialist.

Stephen Farrell, merchandise manager for *The Safety Zone*, a mail-order company created in 1989 in Weehawken, N.J., that specializes in home safety products, said the average homeowner is much more safety conscious now than 10 years ago, especially regarding children.

"It's the mundane accidents we're not prepared for," like falls and knife cuts, he said. "You can't buy a product to solve that problem. You have to be cognizant."

Sandra Evans is a Washington Home contributing writer.

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SKIN CANCER
An undeclared epidemic

Skin cancer is the most prevalent of all cancers. Estimates vary on its occurrence but it is estimated that approximately 700,000 Americans develop skin cancer every year.

Sun avoidance is the best defense against skin cancer.

The principal cause of skin cancer is almost universally accepted by medical experts to be overexposure to sunlight, especially when it results in sunburn and blistering. Other less important factors would include: repeated medical and industrial x-ray exposure; scarring from diseases or burns; occupational exposure to such compounds as coal and arsenic, and family history.

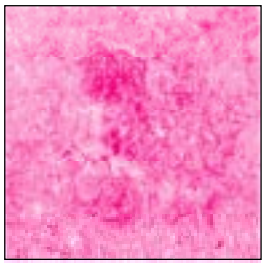
Prevention is a matter of guarding the skin against the known causes. Since the sun and its ultraviolet rays would seem to be the main culprit, the most effective preventive method is sun avoidance. Limit the exposure of the skin to harmful rays by covering up and using sunscreens with at least a 15 SPF rating.

Early detection is the surest way to a cure.

It is a simple routine to inspect your body for any skin changes (see pages 5 & 6 for suggested procedures). Actinic keratosis and each of the skin cancers depicted in the following pages can be readily detected. If any growth, moles, sore, or discoloration appears suddenly or begins to change, see your dermatologist.

Precancerous skin conditions

In addition to the types of skin cancers illustrated here, be alert for a precancerous lesion called actinic keratosis. These small scaly spots are most commonly found on the face and back of the hands in fair-skinned individuals who have had significant sun exposure. If they are not treated, some of them may become skin cancer, requiring more extensive treatment. If they are diagnosed in the early stages, actinic lesions can be removed by cryotherapy (freezing), by applying a topical form of chemotherapy or by other outpatient procedures.



Actinic lesions

There are three forms of skin cancer:

Basal cell carcinoma

This tumor of the skin usually appears as a small, fleshy bump or nodule on the head, neck and hands. Occasionally these nodules may appear on the trunk of the body, usually as flat growths. Basal cel1 carcinomas seldom occur in dark-skinned persons; they are the most common skin cancers found in Caucasians. It has been found that people who have this cancer frequently have light hair, eyes and complexions, and they don't tan easily. These tumors don't spread quickly. It may take many months or years for one to reach a diameter of one half inch. Untreated. the cancer will begin to bleed, crust over, then repeat the cycle.

Basal cell carcinoma

Although this type of cancer rarely metastasizes (spreads to other parts of the body), it can extend below the skin to the bone and cause considerable local damage.

Squamous cell carcinoma

These tumors may appear as nodules or as red, scaly patches. Squamous cell carcinoma is the second most common skin cancer found in Caucasians. It typically is found on the rim of the ear, the face, the lips and mouth. It is rarely found on dark-skinned persons. This cancer will develop into large masses. Unlike basal cell carcinoma, it can metastasize. It is estimated that there are 2,300 deaths from nonmelanoma skin cancers every year.

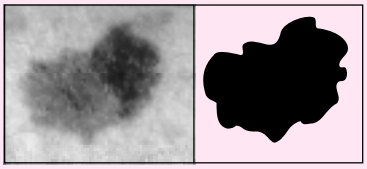
Squamous cell carcinoma

The cure rate for both basal cell and squamous cell carcinoma is 95 percent, when properly treated.

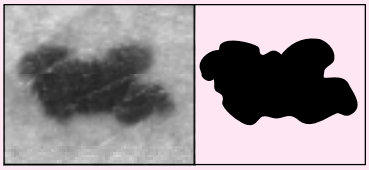
Malignant melanoma

It is projected that this most virulent of all skin cancers develops on the skin of 32,000 Americans annually. And every year an estimated 6,800 Americans will die from melanoma. It is important to note that the death rate is at last declining, because patients are seeking help earlier. Melanoma, like its less aggressive cousins, basal cell and squamous cell carcinomas, is almost always curable in its early stages.

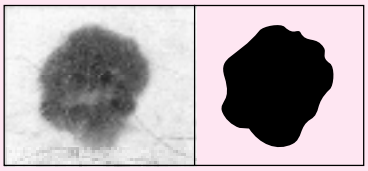
The ABCDs of Melanoma



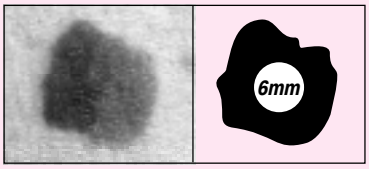
Asymmetry—One half doesn't match the other half.



Border irregularity—The edges are ragged, notched, or blurred.



Color—The pigmentation is not uniform. Shades of tan, brown, and black are present. Dashes of red, white, and blue add to the mottled appearance.



Diameter—greater than six millimeters (about the size of a pencil eraser). Any growth of a mole should be of concern.

Melanoma has its beginnings in melanocytes, the skin cells that produce the dark protective pigment called melanin. It is melanin that is responsible for suntanned skin, acting as partial protection against sun. Melanoma cells usually continue to produce melanin, which accounts for the cancers appearing in mixed shades of tan, brown and black. Melanoma has a tendency to spread, making it essential to treat.

Melanoma may suddenly appear without warning but it may also begin in or near a mole or other dark spot in the skin. For that reason it is important that we know the location and appearance of the moles on our bodies so any change will be noticed.

Excessive exposure to the sun, as with the other skin cancers, is accepted as a cause of melanoma, especially among light-skinned people. Heredity may play a part, and also atypical moles, which may run in families, can serve as markers, identifying the person as being at higher risk for developing melanoma there or elsewhere in the skin.

Dark brown or black skin is not a guarantee against melanoma. Black people can develop this cancer, especially on the palms of the hands, soles of the feet, under nails, or in the mouth.

Other warning signs include: changes in the surface of a mole; scaliness, oozing, bleeding or the appearance of a bump or nodule; spread of pigment from the border into surrounding skin; and change in sensation including itchiness, tenderness, or pain.

How skin cancer is treated

If a laboratory test reveals that an area of the skin is cancerous, the dermatologist has an array of procedures to choose from, dependent on the needs of the individual patient. In the treatment of any of the skin cancers, early detection and removal is the best defense.

Fortunately, skin cancers are relatively easy to detect and most can be cured. Even malignant melanoma, if caught in its early stages, can be treated successfully.

Dermatologists recommend that one helpful way to guard against melanoma/skin cancer is to do periodic self-examinations. Get familiar with your skin and your own pattern of moles, freckles and "beauty marks." Be alert to changes in the number, size, and shape and color of pigmented areas. If any changes are noticed, call your dermatologist.

*Reprinted from **Skin Cancer** published by the American Academy of Dermatology, 1988; Revised 1994. American Academy of Dermatology, 930 N. Meacham Rd., P.O. Box 4014, Schaumburg, IL 60168-4014*

Periodic self-examination

Prevention of melanoma/skin cancer is obviously the most desirable weapon against this disease. But if a lesion should develop, it is almost totally curable if caught in the early stages. To aid in early recognition of any new or developing lesion, periodic selfexaminations are helpful. The following is a suggested method of self-examination that will ensure that no area of the body is neglected. To perform vour self-examination you will need a full length mirror, a hand mirror and a brightly lit room.

1 Examine body front and back in mirror then right and left sides, arms raised.

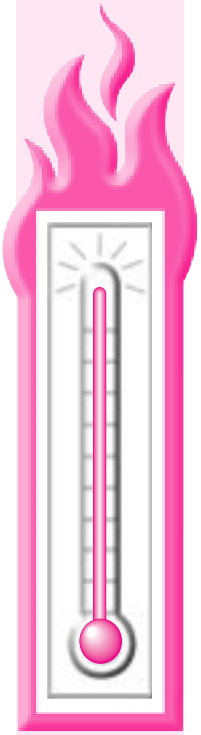
2 Bend elbows, look carefully at forearms back of upper arms and palms.

3 Next, look at backs of legs and feet, spaces between toes, and soles.

4 Examine back of neck and scalp with a hand mirror. Part hair to lift.

5 Finally, check back and buttocks with a hand mirror.

Surviving the summer when it sizzles



Although most of us can survive hot summers simply by taking it easy on those sizzling days, for some the hot, hazy weather poses a serious health risk. "The combination of heat, humidity, and poor air quality, especially during July and August, put the very young, the very old, and [even] athletes at risk," says John Howell, MD, chair of Georgetown [University Hospital's] Department of Emergency Medicine.

You can prevent heat illness by drinking large amounts of fluids, avoiding alcohol, and limiting physical activity during the hottest times of the day. The serious athlete should work out in the morning and drink plenty of liquids before and right after exercising. Infants should be dressed in one layer of light clothing when exposed to heat.

Symptoms of heat illness include dizziness, difficulty in breathing and lack of sweating. Serious heat illness—heat stroke—is marked by confusion and difficulty in thinking. "Most minor forms of heat illness can be treated with fluids and rest in a cool place," says Howell. "The more serious types, however, require a trip to the emergency department."

Other summertime health problems:

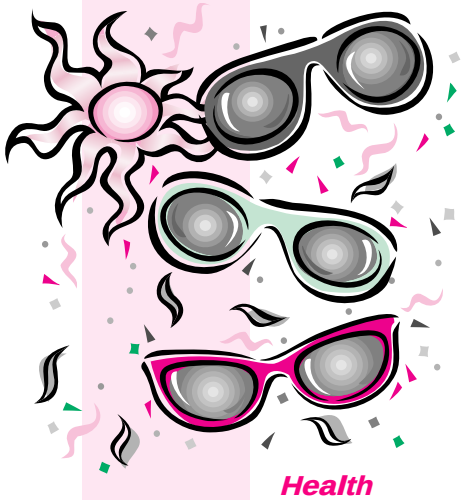
Breathing poor air quality in the summer increases the health risks for some. Stay inside in an air-conditioned area as much as possible if you have a long-standing breathing problem such as asthma, emphysema or chronic bronchitis. Take prescribed medication as directed. Do errands early in the day.

Sunburn. Limit time in the sun and always use a sun block product rated at least SPF 15. Check its expiration date. If you do stay out too long in the sun, treat a sun burn with cool compresses and topical anesthetics and antihistamine creams combined with pain relievers taken orally, such as ibuprofen.

Bug bites and stings. Prevent bites and stings by wearing dark clothing, avoiding colognes and perfumes, and using insect repellent that contains DEET. Treat local bug bites and stings with cool compresses, oral antihistamines, and pain medication. See your doctor or go to an emergency room immediately if there is shortness of breath, throat swelling, dizziness, or a rash all over your body. These symptoms may indicate a life-threatening reaction.

Reprinted from the Summer 1996 issue of Washington, DC's Georgetown University Medical Center's ***Healthy Decisions***

Protect your eyes



With sunny days already here and trips to the beach already happening, make sure you keep your sunglasses in easy reach. Medical studies have linked the formation of cataracts and other eye diseases to over-exposure to the ultraviolet light from the sun's rays.

"We recommend glasses that block 100 percent of the ultraviolet rays," says Howard Cupples, MD, of Georgetown [University's School of Medicine's] Department of Ophthalmology. "Regular reading glasses block about 10 percent of light, and all sunglasses must have a blocking of 60 percent."

Your sunglasses should have a mark on them telling you the percentage of ultraviolet protection. Both over-the-counter and prescription glasses should be marked.

Reprinted from the Summer 1997 edition of Georgetown University's ***Healthy Decisions***

Health

A **'gentler' test for heart disease** is being developed at Penn State University. Some heart disease even in early stages, can impair a heart cell's ability to contract and relax. Current tests for single heart cell contractions are tedious and as likely to destroy a cell's membrane and cause cell injury as they are to indicate disease. These techniques use hard contact between a sensor and a cell removed by a biopsy. In contrast, the Penn State method relies on a laser and a high speed camera to illuminate and capture the contractions of a heart cell—also removed via biopsy—in soft contact with a gellike fluid. This optical technology then portrays, in real-time the cell's movements on a microcomputer. The system has already been tested on a synthetic heart cell. Researchers will next test the procedure on a rat's heart cell. The project is being funded by the Whittaker Foundation.

Reprinted from the February 21, 1996 edition of ***Industry.Net Report****, a publication of Automation News Network by the Franklin McKee Corp.*

Safety reminder

Bee stings one of summer's hazards

After months of treacherous driving conditions, cold and flu viruses passed among coworkers, and back aches caused by too much shovelling, it's always a relief to see summer on the way.

But the gentler seasons bring their own share of health and safety risks. One of those hazards, especially for anyone who works outdoors, is bee stings.

A small percentage of people can have severe allergic reactions to bee stings. But even for those who are not allergic, the experience is not pleasant, and it's worth taking steps to avoid it.

Avoiding a bee sting

Bees are not naturally aggressive. They're simply trying to go about their work of honeymaking. To avoid attracting them, try not to resemble their next job site. Avoid wearing fragrances and bright colours. Wear a hat and shoes for protection. Be careful with foods, especially cans and bottles of pop or juice. Bees can climb in looking for pollen and be frightened into stinging the drinker when the can moves.

If a bee does land, resist the instinct to jump and flap. Stand still so the bee won't be startled. Try blowing gently on the bee to encourage it to move along.

Bees carry their barbed stingers at the base of their abdomens. When they sting, they force the tip of this stinger through the victim's skin, and leave the stinger and poison sack behind. The longer it stays in the skin, the more venom is injected.

Treating a bee sting

Victims of bee stings are usually advised not to pull the stinger out with fingers or tweezers since that could inject more venom. Instead, they are told to try to scrape it out with something like a credit card. However, a study published in the medical journal 'The Lancet' in August 1996 found that the way a stinger was removed made no difference to the size of the weal caused by the sting. The study suggested the priority is simply to get the stinger out, whatever way works best.

There are several ways to limit the pain and itching caused by a sting: a paste of meat tenderizer and water, baking soda and water, antiperspirant, or lotions like calamine are worth trying. Ice or cold water applied for 10 to 30 minutes after the sting can help ease the pain and swelling too.

For most people, the pain from a bee sting will last a few hours. However, someone who is allergic may have swelling that spans two joints, swelling or hives elsewhere on the body, headache, dizziness, vomiting, hoarseness, or difficulty breathing. Anyone with these symptoms should receive medical care quickly. For a few people who are highly allergic, a bee sting can be fatal.

Reprinted from the Ontario Natural Resources Satety Association's May/June issue of ***Health & Safety RESOURCE***

Health

A wir**eless heart monitor** is under development at Georgia Tech. The Vital Signs Monitor (VSM) uses high-frequency microwaves to detect heart beat and respiration rate from distances of up to 400 ft. The device works similar to a radar gun used by police to detect speeders. Aimed at a person, the VSM emits signals that bounce off the chest, measuring the movement of the chest wall. The results are then converted—like an EKG—into wave readouts for analysis. But while an EKG requires electrodes to be placed on the chest, the VSM requires no physical contact with the subject. About the size of a paperback book, Georgia Tech researchers estimate that the portable VSM unit could be mass produced for as little as $200. The device could also find usage in hospital burn units, where it would allow medical personnel to monitor a victim's vital signs without touching the body.

Reprinted from the March 13, 1996 issue of ***Industry.Net Report*** *by Automation News Network*

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

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- *Aug. 7-11, WVMRA Annual Meeting, Greenbriar Hotel, White Sulphur Springs, WV*
- *Aug. 25-27, 28th Annual Institute on Mine Health, Safety, & Research, University Park Hotel, Salt Lake City, UT*
- *Aug. 28-30, WV Coal Assoc. Annual Fall Meeting, Lakeview Resort, Morgantown, WV*
- *Sep. 10-12, Bluefield Coal Show, Bluefield, WV*