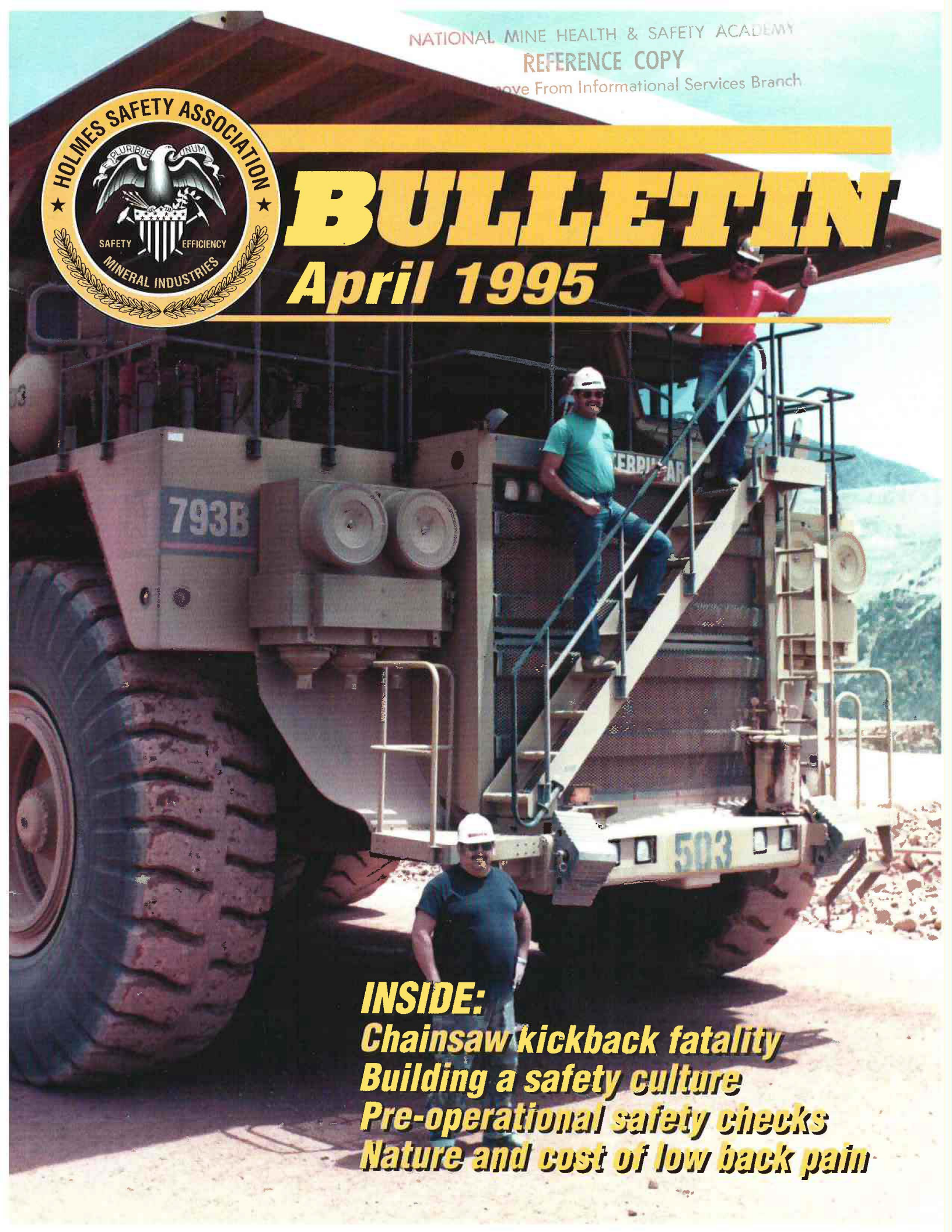


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# **BULLETIN**

## **April 1995**



***INSIDE:***  
***Chainsaw kickback fatality***  
***Building a safety culture***  
***Pre-operational safety checks***  
***Nature and cost of low back pain***



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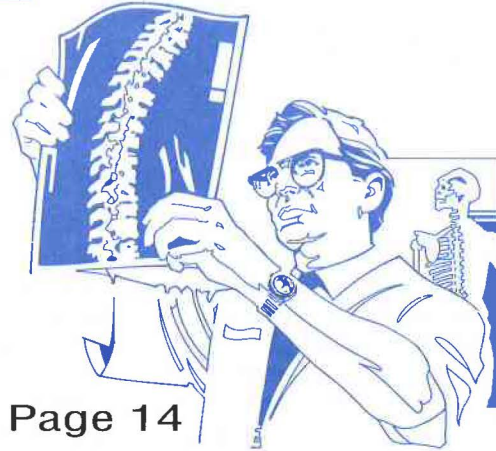
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Cover photo of the Joy 14CM10 continuous miner courtesy of Joy Technologies Inc. We welcome **any** materials that you submit to the Holmes Safety Association Bulletin. We especially need color photographs (8" x 10" or larger—color negatives are acceptable) for our covers. We cannot guarantee that they will be published, but if they are, we will list the contributor(s).

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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 "HSA Bulletin" articles are those of the authors and should not be interpreted as representing official policy of the Mine Safety and Health Administration.

**KEEP US IN CIRCULATION—PASS US ALONG**



# Holmes Safety Association monthly safety topic



## Fatal falling/sliding material accident

**GENERAL INFORMATION:** A 37 year old production operator, with 10 years of mining experience, was fatally injured attempting to clear a plugged screw conveyor and hopper. The rapid pressure of material breaking loose from the inside wall of the tower, forced open inspection doors, struck the victim, propelled him through handrails, and he fell 36 feet to the concrete pad below. The open pit mining and milling operation employed a total of 101.

**DESCRIPTION OF ACCIDENT:** The victim began his normal 12-hour shift at 7 PM. His normal duties included routine checks to observe possible problems in the production sections of the plant. The victim was assigned to the preheater section of the plant. He performed routine checks and repairs to equipment throughout the preheater area during the first ten hours of the shift without incident. Many of the production operator's assignments were coordinated by the control room operator who radioed when visual control monitors and instruments indicated problems in the process system.

At 5:15 AM, the control room operator noted an audible alarm on the screw that removed residual build up from the bottom of the main water spray tower. The alarm indicated the screw had stopped due to a mechanical or electrical overload. The control room operator contacted the victim and directed him to the screw platform to assess the problem. The victim radioed the control room operator that the screw had become plugged with material.

The shift supervisor radioed the victim to get more information about the problem. The victim replied, "We're buried. It's plugged." He said he would work on the problem.

At 5:20 AM, the production operator was at the clinker transfer belt when he heard the radio call that the main spray tower screw had stopped. He went towards the burner floor and when he reached a point above the main spray tower screw platform, he observed the victim standing on the east side of the platform next to the screw. He also observed that a door on the east side of the screw trap enclosure was open and that some of the material had been removed from the top of the screw.

At 5:35 AM, he then left the area and went to the control room where he heard the control room operator tell the shift supervisor that the main draft on the main spray tower system was lost. The shift supervisor then attempted to contact the victim several times on the radio but failed to get a response. He then headed for the screw conveyor platform.

When the shift supervisor arrived he could not see the victim. Assuming that the victim might have gone for tools or to the motor control room, the shift supervisor assessed the material build up in the screw enclosure and the damage that had occurred in the screw housing. He also replaced a clean out door on the east side of the lower spray tower enclosure. He again attempted to contact the victim via radio but, as before, received no reply.

The production operator joined the shift supervisor at the screw

platform and assessed damage to the screw conveyor housing and planned to shut down and begin repairs. The production operator then walked to the east side of the screw to observe the damage. The shift supervisor walked to the west side and when he looked over the protective handrail, he saw the victim lying on the concrete pad below.

When the shift supervisor reached the victim he checked him for a pulse but detected none. There appeared to be massive head injuries with profuse bleeding from the mouth. CPR was administered at that time.

A paramedic team arrived at 5:54 AM and performed emergency first aid on the victim. The county coroner arrived later and pronounced the victim dead at 6:50 AM. The cause of death was determined to have been blunt force trauma.

**CONCLUSION:** The direct cause of the accident was the failure to ensure that a build up of material on the spray tower walls was clear before removing the doors on the clean-out openings.

Although an outward surge of material of the magnitude encountered during the accident had not occurred in the past, a concise program for safe clean-out had not been established. A written work procedure was not in effect or a training program established. In addition, signs warning of the hazard and indicating the protective action required for cover removal were not posted.



## ***Behavior-based safety: model shift beyond the failures of attitude-based programs***

John H. Hidley, M.D. & Thomas R. Krause, Ph.D.

The 1980s witnessed the arrival and development of the behavior-based model of safety management. This approach represents a truly new model for accident prevention. Safety professionals familiar with quality principles see the crucial role behavior plays in achieving the step-change to continuous improvement in safety.

However, managers less immersed in these new developments remain confused about behavior-based safety. Use of the term "behavior-based safety" to re-label traditional attitude-based models and practices (that are not behavior-based) furthers this confusion. Calling something behavior-based does not make it so—attitude-based approaches remain as outmoded and counterproductive as ever. Yet, well-meaning people unfamiliar with the new model can be misled by names. And even people who are familiar with the new model can lapse into traditional ways of thinking and become confused (see sidebar: A Misguided Pep Talk).

### ***Model: safety is personal***

When the traditional model of safety management discusses behavior, it refers to things that go on within the individual. (The reference to psychological "behavior," Error #7 in the Misguided Pep Talk, is one example.) Emphasis on the personal or individual is a fatal confusion, one the continuous improvement model does not tolerate. In quality this mistake shows up as the tendency of

management to see every defect as a special cause event.

In safety, this misconception creates a misguided model that wastes time and resources on initiatives designed to raise "individual safety consciousness." This state of heightened awareness is supposed to occur via:

- proper training;
- reflection on experience, which, in turn, should produce positive safety attitudes and commitment (Pep Talk Errors 2, 4, 6, & 9); attention to the job and awareness (Errors 1, 3, & 8); and a heightened sense of personal responsibility. (Errors 5 & 9).

To achieve these objectives management attempts to provide leadership (Error 6), motivate (Error 8) and sustain these attitudes in the employees.

### ***What's wrong with this picture?***

This picture shows nothing new and is filled with counterproductivity. It represents a step backward into traditional safety management techniques. Awareness, learning, experience, commitment, attention, personal responsibility, and management initiative — the same old mix used in safety for several decades. Yet, none of these is a behavior-based strategy. Rather, each appeals to feelings that occur within individuals.

This picture also clearly reflects attempts to re-package traditional remedies and sell them as new strategies. Not only is this not the proactive, behavior-based approach;

it is the very opposite—the reactive attitude-based approach.

### ***What is safety-related behavior?***

When advocates of the traditional model of safety management discuss behavior, they refer to socially acceptable actions and ideals about how they wish people felt and acted (Pep Talk Errors 1, 5, 8, & 9), which is why so much time is spent addressing attitudes (Errors 2, 4, & 9). Attention is actually focused on the social setting (which is the proper setting for annual fund drives and other types of cheer-leading activity). Such an approach is inadequate when managing continuous improvement projects of any kind, including safety.

Contrary to this vague, socially oriented meaning of behavior, the new model considers behavior to be a scientific, technical term. The behavior-based approach focuses strictly on observable, measurable actions critical to safety at a particular facility. This task-oriented view of behavior treats safety-related behaviors as critical work-related skills.

These critical, safety-related behaviors are discovered via applied behavioral analysis of data, including a comprehensive review of a site's incident reports. Using this analysis a facility develops an inventory of critical behaviors, which typically contains a cluster of 15–20 behaviors that are implicated as the final common pathway in most of the accidents at the site. Behaviors that emerge from such analyses often



include:

- 3-point contact on all ladders, stairs, and catwalks;
- body position in relation to task;
- wearing personal protective equipment.

These behaviors are critical regardless of people's attitudes.

To see how "irrelevant" attitudes are to results, consider the following scenario. A plant manager receives progress reports on safety initiatives used in two departments. One department uses the attitude-based approach, the other, the behavior-based approach.

"What kind of results is the attitude-based safety initiative generating?" the plant manager asks.

"Well," the operations manager replies, "our supervisors have been talking up safety at crew meetings. If you ask our people, they will say that safety is their responsibility. I think we're beginning to make believers out of them."

In response, the plant manager repeats his/her request for results data.

In contrast, consider the typical report on a behavior-based safety effort:

"What kind of results is the behavior-based safety initiative producing?" the plant manager asks.

"Employees have developed their inventory of critical behaviors and have trained behavioral observers for each workgroup," the operations manager reports. "Observers have established the department's baseline percent safe ratings. Over the past three months, all crews are up to at least 85% safe from their original baseline rating of 55% safe on performance of 3-point contact. Progress is also good—up to 75% safe—on wearing personal protective equipment. However, percent safe ratings for body position in relation to task remain a concern, showing no improvement over the baseline rating. Crews are developing action plans to address this area."

When a plant manager such

detailed tracking data, s/he does not ask, "Well, the workgroup safety data sounds good, but how are employee attitudes?" Why? Because when plant performance of critical safety-related behaviors improves, managers are not concerned about "safety attitude." When it comes to safety, behavioral performance is the true bottom line.

Furthermore, behavior-based managers do not worry about attitude because attitude follows performance. When a workgroup demonstrates progress, as measured

by peer observation on the basis of a behavioral inventory developed from hard data and endorsed by consensus, their safety attitude also improves.

At an industrial site, a combined group of managers and veteran hourly employees are typically the best source of knowledge about safety-related behaviors. Once this group understands the concept in practice, it appreciates the strict safety-related focus of the behavioral approach. Employees often serve with distinction on the steering

### ***A misguided pep talk***

Consider the following pep talk given by a manager who mistakenly thought he was encouraging his supervisors to use the new behavior-based model. The way this well-meaning manager lapses into outmoded attitude-based errors provides a textbook case of confusion about behavior-based safety. The errors are numbered for further discussion in this article.

#### ***Operations manager to his supervisors:***

***We have good employees here, and***

***Error 1.*** if we can just get them to be more aware of safety, then they will behave more safely.

***Error 2.*** We need to get at the attitudes that underlie the behavior of our employees. Only then will we begin to see our injury rate come down.

#### ***No one comes to work wanting to get hurt, but***

***Error 3.*** sometimes some of our employees take safety for granted; they go to sleep psychologically, and then an injury happens.

#### ***We want them to have a***

***Error 4.*** more "proactive attitude."

***Error 5.*** We want a "behavioral" approach to safety where each employee assumes total responsibility for his or her own safety, and for the safety of their co-workers.

#### ***To make this happen***

***Error 6.*** you supervisors must be leaders and commit yourselves to this goal.

***Error 7.*** People's psychological "behavior" is the key, so

***Error 8.*** wake them up, get them paying attention,

***Error 9.*** get them responsible and committed, and then they will behave safely.

#### ***If this pep talk rings true for you, read on.***

Not only is this manager off-track; he's dead wrong. Each numbered statement here repeats at least one piece of counterproductive, outmoded thinking. Even though he is using some of the language of behavior-based safety, he is really relying on the Old Model of attitude-based safety. Some of his wording may be new, but his approach is no different in practice from that of his predecessors of twenty years ago.



committees, which conduct behavioral reviews of accident reports to produce an inventory of measurable critical behaviors. Their contribution is a key example of employee involvement in the behavior-based safety process.

### **Behavior-based does not mean personal**

Focusing safety efforts on individuals may seem a reasonable approach. After all, when an injury occurs, a person is hurt, and it is a person who benefits from accident prevention. However, focusing on the person is not the way to achieve continuous improvement. The traditional model mistakenly assumes that because safety efforts are for individuals, the most effective approach must be personal. This can be termed the "personal fallacy."

This fallacy parallels the erroneous conclusion that because individuals suffer in highway accidents, highway safety can be improved by prompting people to change their attitudes, feelings or consciousness. In fact, however, when on the expressway, drivers do not think about other drivers' attitudes, only about whether they will signal lane changes and observe principles of safe driving. The personal fallacy argues that because individuals suffer or benefit from safety practices, responsibility for those sufferings and benefits must "lie within" the individuals. This belief confuses cause and effect. Responsible feelings are not the cause of improved safety (Errors 5 & 9).

The proof: People can feel responsible for safety, yet not improve their safety performance. Or, employees may have cynical feelings and attitudes about safety, yet perform their jobs with admirable levels of safe behavior. Programs that focus on attitude do not work in the long term. At best, they heighten the sense of responsibility for a short time and, therefore, must be continually revised.

Not surprisingly, advisers who endorse approaches based on this fallacy recommend hiring external consultants to conduct training to prod people to develop and maintain insight into the importance of safety. In a well-functioning safety process (not a program), individuals increasingly feel responsible for safety. These feelings are the result, not the cause, of an effective behavior-based safety initiative.

An approach that focuses on the person is no longer valid. Its uses are limited and its drawbacks numerous (i.e., punishment, disciplinary action, investigation, incentives, and the many motivational schemes). Despite evidence to the contrary, those who advocate the personal approach to safety continue to believe that the problem is within the individual: She/he does not have sufficient sense of responsibility, correct safety beliefs, proper respect for safety, etc.

The definitive sign that this approach is fallacious occurs when it misfires. Consider the problems associated with the "personal fallacy" as embodied in top-down initiatives, incentive schemes, punitive accident investigations, and motivational programs:

- At best, these measures provide only a temporary fix.
- Focusing on the person often creates resistance—either in the person receiving negative attention or from the person passed over for positive citation from management.
- The personal approach in injury investigation fosters adversarial conflicts within the culture.
- Focusing on the person invariably creates a cycle of increased energy (fear or excitement), followed by letdown and withdrawal.
- The personal approach eventually creates indifference or cynicism about management's genuine commitment to safety because it diverts attention and resources away from real issues. Among management, it fosters the view that injured

employees are defective humans who are not serious about their own safety and would rather blame the company or "work" the system.

### **The new model: behavior means action**

The new model focuses on the one area that people (properly fit for their jobs) can directly control — their task-related actions. According to this approach, effectiveness lies in the realm of task-related action or behavior; therefore, expanding the individual's sphere of action is the key to improving safety.

Consequently, a facility should install a systematic methodology to identify, measure, and alter antecedents and consequences in order to maximize safe behaviors and minimize at-risk behaviors. People can thus expand their control over the critical behaviors. Employee committees use the methodology to drive continuous improvement in safety performance and cultural safety standards, thus increasing their actual effectiveness and their sense of involvement and responsibility for safety.

Note which comes first (cause) and which is the result (effect). By controlling their behavior, people act responsibly; as a result of this consistency of performance (behavior) they develop a sense (attitude) of increased responsibility and involvement. Responsibility follows from action. Under the new model's analysis of safety, behavior is the key variable. By focusing directly on behavior, the model avoids counterproductive appeals to awareness, attitudes, feelings.

The personal fallacy really is an indirect way of prompting people to improve performance. In fact, it is responsible for much that is frustrating and ineffective in traditional safety management, which does not specify behaviors.

- No scientific inventory of critical behaviors. Identification of behaviors critical to good safety



performance is left up to the scrimmage between opinion and controversy.

**CONTRAST:** In the behavior-based model, the behaviors that truly make a difference are systematically identified and operationally defined.

- No valid measurement. No effective technology in place systematically samples and measures behavior.

**CONTRAST:** The level of safe or at-risk behaviors performed is measured as a percent safe rating. Individuals can use this feedback to improve performance. It also provides an ongoing measure of the level of workplace safety.

- No proactive data collections. No system collects and analyzes safety data before injuries occur. In a classic reactive pattern, accidents steer the safety effort.

**CONTRAST:** Safety data are analyzed to prevent accidents.

- No answer for barriers. Invariably, cultural barriers to safety (unidentified antecedents and consequences) pressure people to routinely perform at-risk behaviors. The attitude-based model offers no systematic way to identify and remedy these barriers. Instead, it seeks to simply "inspire" a safer organizational culture.

**CONTRAST:** In the behavior-based model, a computerized data base is built regarding these issues. Workgroups use this data to solve problems.

- Subjective and unfair. Typically, the "behavioral" focus of the traditional model has been inconsistent, unjust, half-hearted, and negative or punitive.

**CONTRAST:** Behavior is viewed impartially and impersonally. The ongoing focus is behavior (not individuals), and feedback on behavior is positive and constructive.

Attempts to achieve results with the attitude-based model are hindered by the frustrating struggle against its inherent limitations. Management's role is a fantastic,

impossible mix of drill sergeant, traffic cop and cheer leader. (No wonder supervisors and managers suffer burn-out in such a system.) In the new model, management does not boss, it empowers.

### ***The person in the new model***

The person exists in the new model as a "professional." The model respects the individual more than the attitude-based approach. In fact, because it respects the power of attitude, this model does not attempt clumsy or ham-handed approaches to attitude modification.

Attitudes, beliefs, awareness are closely related to concepts such as hope, anticipation and enjoyment. Although these concepts are personally defined, it does not follow that an individual can control these feelings, much less someone else's.

In fact, the sources of feelings are not accessible to the individual either (personal fallacy). A supervisor can order him/herself or employees to be punctual, yet cannot order anyone to value punctuality. One can promise to attend an event, yet cannot promise to enjoy it. Anyone who believes s/he can command, order or promise in such ways is guilty of believing in the personal fallacy: "Now hear this: after our next safety workshop, you will be aware of safety."

Behavior-based safety management is not confused about such issues. It treats individuals well by not establishing unrealistic expectations. It does not prompt people to manipulate their feelings, beliefs and awareness, nor does it abuse the limits of people's powers of attention, alertness, focus, commitment, etc. Hyper-vigilance is no virtue, even if it applies to safety.

Calls for "constant safety awareness" and "permanently heightened attention to safety" are in truth, loose talk (Pep Talk Errors 1, 3, & 8). No productive person truly lives and works in that manner. For example,

an individual Secret Service agent can only guard the President for short periods. The same holds true for any professional watchers, sentries and guards. By falling into the personal fallacy, the traditional model has proven to be inadequate in meeting the complex challenge of managing continuous improvement in safety.

### ***Behavior meets the challenge of safety***

Effective safety management presents a uniquely complex set of organizational challenges. The human stakes of health and well-being, the necessary interface with productivity and related factors combine to make safety a volatile issue, which can create adversarial tensions within an organization. Employees blame management because managers ignore conditions; in turn, employees are blamed for "their" injuries. Both sides are caught in the personal fallacy.

Even where this counterproductive fault-finding is avoided, organizations often experience frustrating re-runs of the accident cycle: 1) low safety performance triggers 2) increased attention to safety until 3) performance improves; consequently, 4) resources are moved elsewhere and another period of 1) deteriorating safety performance. In organizations where safety efforts have broken free of this cycle, safety performance level often plateaus.

Considering the range of these challenges, it is clear why many organizations familiar only with traditional, attitude-based safety programs ponder whether continuous improvement in safety is achievable. Found in this quandary are fundamental questions about human relations, accountability, and long-term commitment of resources. The answer is not greater awareness or a heightened sense of safety responsibility. Rather, the answer is operationally defined critical behaviors—specific at-risk, task-related



behaviors, which are the final common pathway of most incidents. Specific task-related safe behaviors are the cause of excellent performance.

Managing continuous improvement requires a process approach. Managing the complex organizational challenges of safety for continuous improvement requires a behavior-based, rather than attitude-based, process. Signature features of a behavior-based approach to safety are:

- operational definitions of critical, spite specific at-risk behaviors;
- ongoing, systematic observation of workforce critical behaviors;
- regular charted data and verbal

feedback about those observations;

- employee involvement in problem solving and action planning, on the basis of the observation data;
- subsequent observation and feedback on new measures.

Sound safety attitudes and a high level of individual safety responsibility are a wonderful benefit of an effective safety process. They are not, however, its cause.

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## Former coal miner wants everyone to see heart of the industry

WEST FRANKFORT, IL—Few people travel 600 feet down into the earth and experience the inky blackness of a coal mine.

But if Chris Ledvina has his way, thousands of tourists every year will take that trip into the heart of the Old Ben No. 25 mine after it becomes part of the National Museum of Coal Mining.

Plans for the museum moved ahead as its board of directors—many of whom are third-, fourth- or fifth-generation coal miners—toured Old Ben No. 25, about three miles east of West Frankfort.

"We want this to look as good as any world class museum you've ever seen," said Ledvina, who spent years working in Southern Illinois coal mines.

It might seem surprising that Ledvina's passion for the industry continues to grow despite the fact that a mining accident in Old Ben No. 26 landed him in a wheelchair, unable to work as a coal miner. "Me

and a rock didn't get along," he said of the accident.

Afterward, Ledvina returned to school, moved to the Chicago area and now teaches at the college level. But even though he's on the tenure track, he plans on quitting to work full time on establishing the National Museum of Coal Mining.

The main portion of the museum will be in the hoist house of the historic Orient No. 2 mine near the West Frankfort exit of Interstate 57. Ledvina said there couldn't be a better site. The Orient mine still holds the world's single shift hoisting record of 15,700 tons and is the only 1920s vintage coal mine still standing in North America.

Coal mining companies plan to donate equipment totaling about \$92 million. In addition to a model mine, plans call for a gift shop, a library, a Wall of Honors and historical archives to be established before the museum's scheduled opening in June 1996.

Mark Ballard of Marion, president of the museum board, said he hopes that companies from the area will take interest in the project because the board would like to give business to local contractors. The board members said they want the facility to be used for education and research as well as for tourism. Universities and community colleges, in addition to mine rescue teams, will be encouraged to use museum materials.

To get up and running the project will need about \$1.7 million in donations. In addition, one of the conditions of the donation of Old Ben No. 25 is that the National Museum completes the reclamation of about 60 acres of gob pile, land on which mine waste has collected. That reclamation will take about two years.

*Reprinted from the February 1995 issue of Acquire's COAL TODAY.*



## Chainsaw kickback fatality

A 28-year-old cutter with 12 years experience was killed recently when his chainsaw kicked back and severed major blood vessels in his neck. He had just felled and limbed a 74-foot white pine. There was no witness as to whether the cutter was cutting or walking with a running saw. However, it was determined that the saw kicked back from a nearby pair of 2-inch balsam saplings growing close together. After receiving the injury, he stumbled about 30 feet before collapsing in dense undergrowth.

When the skidder operator came looking for the cutter, he inadvertently drove over the already dead body. He saw the body only after he backed up and turned the skidder around.

The investigation revealed several

maintenance problems with the victim's chainsaw: the bolt securing one end of the chain brake was missing; depth gauges had been filed too low; and the chain was loose.

### **Lessons that can be learned from a preliminary review of this fatality include:**

- Maintain your saw according to the manufacturer's instructions—with particular attention to the brake, proper sharpening of the chain, setting of the depth gauges and adjustment of chain tension.
- When walking any distance, either use the chain brake or shut off the saw, and carry the saw with the bar aimed behind you.
- Whenever visibility is obstructed, skidder operators should visually locate all of their cutters before

entering their work area.

### **Other points to remember are:**

- Make sure the upper part of the chainsaw bar (the "kickback zone") does not touch anything while you are cutting.
- Make sure you have good balance and solid footing before you begin any cut, and stand at a slight angle off to the left of the work.
- Wrap your left thumb under the forward handle of the saw and try to keep the left arm straight (so that the saw will pivot up and away from you in a kickback).
- Start every cut at full operating speed.

*Reprinted from the January/February 1995 issue of Ontario, [Canada's] Natural Resources Safety Association's Health & Safety RESOURCE.*

## Not what they were looking for

A recent study by the Addiction Research Foundation (ARF) found that sleep disorders were the single most common factor that contributed to workplace accidents. The study, entitled "The Role of Drugs in Workplace Accidents: Is Drug Testing Appropriate?", is based on a 1992 survey of 882 working people in Ontario. It examined their drug and alcohol use, lifestyles, workplace environments and accident history. Researchers found that the subjects had been involved in 54 workplace accidents that resulted in injuries serious enough to require medical attention. They did indeed find that

illicit drug use contributes to accidents (drug use was associated with 11% of respondents, but 20% of accidents). But sleep disorders topped the list, being associated with 55% of respondents and 78% of accidents. Shift work was associated with 42% of accidents, alcohol problems with 39% and boring work with 29%.

These somewhat unexpected results raise some interesting questions. In your workplace, do accident investigations ever consider whether the persons involved were tired? Has the importance of being well-rested ever been the topic of a safety

meeting? How much research went into the design of the shift work schedule? Can your EAP (Employee Assistance Program) access help for the up to 30% of workers who suffer from sleep disorders? It may be time to treat these questions more seriously than we have in the past. If this study is accurate, tiredness may be an underlying cause of more accidents than we might have thought.

*Reprinted from the November/December 1994 issue of Ontario [Canada's] Natural Resources Safety Association's Health & Safety RESOURCE.*

### **July 3, 1926; Pettebone Colliery No. 6 (Anthracite), Kingston, PA; 7 killed**

On the morning of July 3, a squeeze along the robbing line of a pillar section caused the men to be withdrawn to another part of the section. When the fall came at about 9:00 pm,

an accumulation of gas was forced into the area where the men were working, and the gas was ignited by matches, smoking, or a reflective

flame safety lamp. Seven men were killed and 8 others injured.

*Reprinted from Bureau of Mines Bulletin 586.*



## Building a safety culture

The Joseph A. Holmes Safety Association and the Holmes Safety Association (HSA) will hold their annual business meeting at the Radisson Hotel in St. Paul, MN, on June 27-29, 1995. The agenda includes timely safety and health topics which should be of great interest to participants. Make your reservations *today*.

Lodging at the Radisson will be \$69 single or \$79 double. Children

under 18 stay free. Make your own reservations directly with the Radisson by calling 612-292-1900. All reservations should be guaranteed either by advanced deposit of one night's lodging or by credit card. We have reserved a block of 150 rooms which will be held until May 1. Be sure to indicate you are attending the HSA Meeting. Transportation to hotel is via Airport Express (at lower level of air

terminal) at a cost of \$11.50/RT.

A meeting registration fee of \$55 per person will be required. Registrations are due by April 30, 1995. Registration fees received after April 30 will be \$70. Guests and spouses not attending the conference meeting but who will attend the Wednesday lunch and riverboat ride and the Thursday evening banquet will be required to pay a \$40 fee to cover costs.

### AGENDA

#### Tuesday, June 27

- 9:30 am Registration
- 1:00 pm Electrical Safety Workshop
- 4:00 pm HSA and JAHSA Executive Board Meetings

#### Wednesday, June 28

- 8:00 am Registration and Refreshments
- 8:30 am Welcome
- 9:00 am MSHA Policy Directions  
J. Davitt McAteer, Assistant Secretary—MSHA
- 9:30 am Management Perspective
- 10:00 am Labor Perspective

### Concurrent workshops— Four tracks

1. Culture building
2. Nuts and bolts safety
3. Health
4. Innovations in safety and training

### Time Trk Title

- |          |    |                          |
|----------|----|--------------------------|
| 10:00 am | 1. | Designing the culture    |
|          | 2. | Mine traffic managemnt   |
|          | 3. | Industrial hygiene panel |
|          | 4. | Power safety step        |
| 11:45 am |    | Lunch at hotel           |
| 1:00 pm  | 1. | Making the culture wrk   |
|          | 2. | Stockpiling hazards      |
|          | 3. | Substance abuse          |
|          | 4. | Public outreach          |

- |         |    |  |
|---------|----|--|
| 2:30 pm | 1. | Maintaining the culture                |
|         | 2. | Blasting safety                        |
|         | 3. | Ergonomics                             |
|         | 4. | Back care strategies                   |
| 4:00 pm |    | Dinner on your own                     |
| 6:30 pm |    | Riverboat Ride—Dixieland Band—Cash Bar |

#### Thursday, June 29

- 8:00 am Vendors Workshops
- 10:30 am Tour of Bureau of Mines Research Center
- 1:30 pm Lunch on your own
- 3:00 pm HSA and JAHSA Gen Mtgs
- 6:00 pm Social—Cash bar
- 6:30 pm Banquet  
Speaker awards,  
Scholarships, Prizes

 Cut out and mail the completed registration form to Al Simonson (address below)

Complete and mail the registration form at right, with your check, to:

**Al Simonson**

Safety and Health Coordinator  
South Central Technical College—  
Mankato Campus  
1920 Lee Blvd.  
North Mankato, MN 56003  
Telephone: 507-389-7320

Checks must be made payable to:  
**Holmes Safety Association**

Meeting Registration Fee of \$ \_\_\_\_ is enclosed for \_\_\_\_ persons @ \$55 per person, \$70 after April 30, 1995. A guest fee of \$ \_\_\_\_ is enclosed for \_\_\_\_ persons @ \$40 per person.

Number of persons that will be attending the following sessions is indicated (mark one in each group

### REGISTRATION FORM

Name(s): \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone (include area code): \_\_\_\_\_

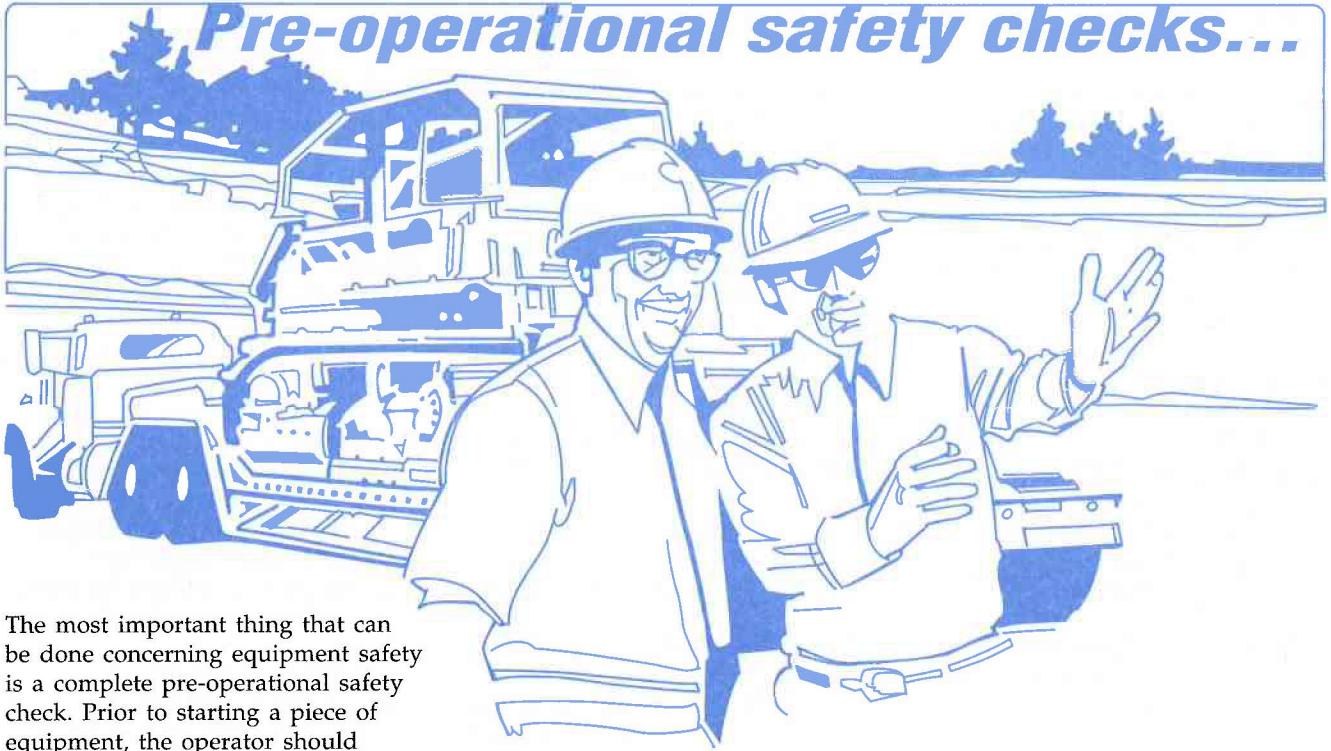
for each person):

- Electrical Safety Workshop
- Designing the Culture
- Making the Culture Work
- Mine Traffic Management
- Stockpiling
- Industrial Hygiene Panel
- Substance Abuse
- Power Safety Step

- Public Outreach
- Maintaining the Culture
- Blasting Safety
- Ergonomics
- Back Care Strategy
- Riverboat Ride
- Tour Bureau of Mines



## Pre-operational safety checks...



The most important thing that can be done concerning equipment safety is a complete pre-operational safety check. Prior to starting a piece of equipment, the operator should perform an adequate pre-operational check. This is true at both surface and underground mines.

Mining companies spend millions of dollars each year to improve safety. They employ safety managers and company safety inspectors in an attempt to improve safety. These are certainly important persons, and their work is applauded. However, we need to transform every equipment operator into a safety inspector. Just think how this would improve equipment safety in the mining industry.

Many companies have been requiring preoperational safety checks for several years. They provide a check list each operator completes at the start of each shift. They have learned that this not only has enhanced safety, but it has saved them a tremendous amount of money and at the same time elevated production levels. Companies that presently require pre-operational safety checks have fewer accidents, and receive almost zero citations and closure orders.

It is difficult to understand why someone would be opposed to pre-operational safety checks. There are absolutely no negative effects resulting from checking equipment before it is operated. It only takes a few moments at the start of each shift. If everyone is as committed to safety as they claim, they will demand that this be done at the start of each shift. If a machine breaks down and it is in everyone's way, it may take the rest of the shift just to move it. Even worse, if the malfunction results in an accident, there will be state and Federal inspectors conducting an extensive investigation that may last for days, and may not have a very good conclusion. How would you like to get into a jet airplane and wonder if the crew performed a pre-operational safety check before taking you up about 30,000 feet in the air? That is not a very pleasant thought and neither is a huge piece of strip mine equipment traveling down a ramp with malfunctioning brakes, or a shuttle car

romping down an entry that can not be stopped.

At mines across the country, inspectors can provide information on training to mine management and equipment operators concerning pre-operational safety checks. At underground mines, inspectors can do the same thing. If you need help starting a new program or improving an existing one, ask your inspector to assist you. They are there to help you, and this is a service you should draw from.

It will take the cooperation from everyone to make safety programs like this work. We all need to work together and accomplish an accident free mining industry. With cooperation, we can achieve this, but it requires an effort from everyone, including you.

*John L. Franklin*

*Reprinted and adapted from the Volume IV, 1994 issue of Kentucky's Department of Mines and Minerals Bulletin.*



## ***MSHA commemorates twenty-fifth anniversary of Coal Act***

The Mine Safety and Health Administration will commemorate the twenty-fifth anniversary of the Federal Coal Mine Health and Safety Act of 1969, with a program and reception in Washington on March 30. The event will bring together persons involved in passing the legislation, as well as government officials and current representatives of industry, labor, and community groups.

Enacted in the wake of a Farmington, West Virginia explosion that killed 78 miners and amid mounting concern about black lung disease, the Coal Act was a breakthrough in mine safety and health regulation. The Act established a series of standards designed to

improve working conditions, including a limit on dust concentrations, and gave federal regulators effective tools for enforcement.

Safety and health in the mines have improved dramatically since the Coal Act was passed. In 1968, for example, 311 coal miners were killed in mining accidents. By 1994, the number had dropped to 44—still too many, but a strong sign that the legislation was working. The incidence of black lung disease, meanwhile, has decreased by more than two-thirds. (MSHA began to administer the Coal Act in 1977, when it was expanded to cover metal and non-metal mines and enforcement authority was transferred from the Interior Department.)

In a recent public message noting the Coal Act's anniversary, President Clinton observed:

*The law has been an overwhelming success, saving thousands of lives and reminding us of the great achievements possible when the public and private sectors work together for the common good. As we celebrate the twenty-fifth anniversary of this historic legislation, I encourage laborers, managers, manufacturers, mining associations and schools, and federal officials to rededicate themselves to the noble principles on which this law was based: the protection of those who toil for our country's greater prosperity.*

## ***MSHA holds mine emergency conference***

An MSHA-sponsored conference on the future of mine emergency preparedness drew more than 250 people to the National Mine Health and Safety Academy in Beckley, West Virginia, on January 26-28, 1995.

Panel presentations provided industry and labor perspectives on the status of mine-rescue teams, described state efforts to respond to emergencies, and examined developments in training and technology. Government and industry representatives from Australia, Canada, Poland, the Ukraine, and South Africa also shared their experiences.

Conference participants then joined discussion groups to address



***Former MSHA employee, Frank Derenge, with a portrait he made of his father—a survivor of the 1915 Layland mine disaster. He has graciously lent this to the MSHA Academy for a temporary exhibit.***

particular issues, including rescue-team financing and regulatory requirements. Representatives from each group offered reports when participants reconvened.

Displays at the Conference were devoted to past rescue efforts (among them the Sunshine Silver and Porter Tunnel operations), current training activities, and women in mine rescue. A display on the early history of mine safety featured the 1915 Layland, West Virginia disaster, among whose survivors was the father of former MSHA staffer Frank Derenge—a future story will highlight the Layland disaster.

MSHA expects to release a report on the conference later this spring.



# Holmes Safety Association monthly safety topic



## Fatal powered haulage accident

**GENERAL INFORMATION:** A 59 year old roof bolter, with 30 years of mining experience—18 months in this job, was killed in a powered haulage accident. The victim was attempting to reposition his scoop away from the belt conveyor, when the scoop rolled or was trammed back down the grade, and the victim was crushed as he was caught between the deck frame of the scoop and the belt structure.

The operation is an underground coal mine employing 10 miners on two coal-producing shifts and produces about 350 tons of coal daily.

**DESCRIPTION OF ACCIDENT:** The day-shift section foreman entered the mine with the day-shift crew about 7 AM, and started making his belt examination. Upon arriving on the section, the crew made routine operations checks. The day-shift section foreman was still en route to the section as normal coal production began.

Normal production continued without incident until 8:30 AM, when a mechanical failure occurred on the continuous-mining machine, and coal production ceased for the day shift.

The continuous-mining machine operator notified the section foreman that a bearing was down in the rippers and that the section feeder was also down and needed repairs.

The day-shift section foreman and the continuous mining machine operator assigned general section maintenance duties to the shuttle-car operator and the victim. The victim and the shuttle-car operator worked on the section, performing routine

section maintenance, as day-shift section foreman and the continuous mining machine operator worked at repairing the continuous-mining machine. About 3 PM, the victim and the shuttle-car operator were instructed to go to the surface and take the two scoops out as they went.

The shuttle-car operator operated the No. 2 scoop, and the victim operated the No. 1 scoop. He stated that he had operated the No. 2 scoop during the shift, and the batteries were getting low. Realizing this, he decided to go out in front of the No. 1 scoop, thus allowing the victim to push his scoop on any grades that they would encounter.

The shuttle-car operator stated that he trammed the No. 2 scoop without any assistance from the victim until he reached the last small grade at which time the victim began to push the scoop. Both vehicles were being trammed battery-end first toward the outside; therefore, the victim's scoop was pushing, using the bumper against the scoop bucket of the shuttle-car operator's vehicle. This also put both operators toward the belt and belt structure.

The shuttle-car operator stated that as they approached the top of the grade, the victim's scoop began to spin and that the victim shouted to him to hold his position or go on to the top on his own because he had to reposition his scoop in order to be able to push again. Evidence at the accident scene indicated that when the victim's scoop began to spin, the scoop slid toward the belt, thus placing the scoop deck near the belt and belt structure.

The shuttle-car operator stated

that both scoops were stopped near the top of the grade when the victim told him about repositioning his scoop and that his scoop was unable to tram under its own power. He stated that as he tried to tram again, he heard the No. 1 scoop moving down the grade and it appeared the scoop went under the belt and structure and out into the roadway again at the bottom of the grade.

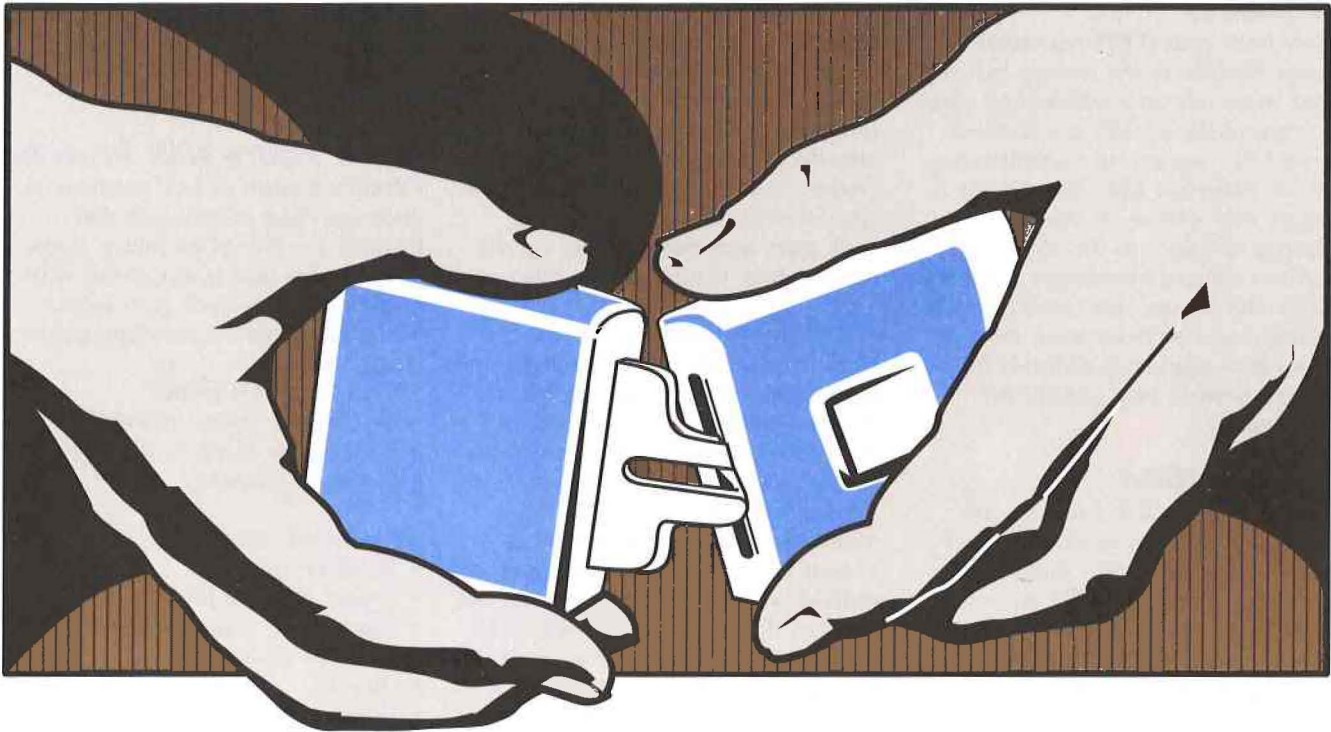
The shuttle-car operator realized that the victim could be hurt and he immediately parked his scoop against the coal rib and crawled to the No. 1 scoop. He found the victim lying on the mine floor between the scoop center section. He observed that the victim had received severe head and upper-body injuries and he could not detect any vital signs. He contacted the outside communications man and requested assistance.

When help arrived, they examined the victim and found no vital signs. They removed the victim from the accident scene and transported him to the surface, where the rescue ambulance service was waiting. The victim was transported to the hospital where he was pronounced dead upon arrival by the attending physician.

**CONCLUSION:** The accident and resultant fatality occurred because the victim failed to recognize the machine's actual position in relation to the proximity of the belt conveyor prior to reversing his direction of travel. A contributing factor was management's failure to maintain the automatic emergency parking brake on the No. 1 Model 482 S&S scoop.



# *Seat belts...*



***KEEP*** you in position to control your vehicle...

***KEEP*** you out of the windshield...

***KEEP*** you in the cab...

***KEEP*** you from being thrown about...

***Buckle up and stay buckled up  
because SEAT BELTS CAN...***

***KEEP YOU ALIVE!***



## Nature and cost of low back pain

By Sean Gallagher<sup>1</sup> and Christopher A. Hamrick<sup>2</sup>

### Abstract

Low back pain (LBP) represents a huge expense to the mining industry and to society as a whole. Any effort to control the problems associated with LBP requires an understanding of the nature of LBP. This review paper was written by the U.S. Bureau of Mines to describe the current state of knowledge regarding LBP—the causes, risk factors for LBP, effectiveness of treatments, recovery from back pain, and methods that can be used to help control the problem.

### Introduction

Low back pain (LBP) is very common in Western countries and is a major cause of worker disability, limitation of activity, and economic loss. Many studies have indicated that up to 80% of the general population are affected by LBP at some time during their lives (26, 35).<sup>3</sup> Furthermore, it is estimated that approximately one in seven Americans are currently experiencing LBP (25). The cost of back injuries in the United States in 1989 was variously estimated to be anywhere from \$27 to \$56 billion (38). These costs have undoubtedly risen by a substantial amount since that time.

Few need to be reminded of the magnitude of the back pain problem in the mining industry. Back injuries consistently rank as the leading cause of lost workdays, account for up to 40% of worker compensation payments, and cost the industry tens of millions of dollars every year (20). In underground coal mines alone, back injuries cost the industry in excess of \$30 million in 1991. The average cost of a back injury that year was over \$8,000.<sup>4</sup>

As part of its mission to enhance the safety and efficiency of mining, this review paper was written by the U.S. Bureau of Mines to describe the current state of knowledge regarding LBP—the causes, risk factors for LBP, effectiveness of treatments, recovery from back pain, and methods that can be used to help control the problem.

### Cause of LBP

While a great deal of knowledge has been accumulated regarding LBP in the past couple of decades, doctors and scientists still cannot explain the exact mechanisms causing pain in the majority of patients with LBP. Many experts believe that LBP is caused by changes in the spine as an individual ages. It is thought that the changes that occur as one gets older may lower the resistance of the spine to heavy workloads. Consequently, heavy loads on the spine trigger the onset of low back symptoms (26-27, 34, 41).

### Typical LBP history

LBP typically begins fairly early in life (usually in one's twenties). Back pain during this period is typified by a mild and diffuse pain of relatively short duration, which is followed by a return to full activity. In one's thirties, there are often more frequent attacks of LBP, which are relieved by rest and followed by relatively pain-free periods. Back pain typically peaks in the forties; episodes of sciatica (radiating back pain) are more frequent, and there is often residual pain between attacks. Improvement is frequently seen in the fifties. This period is characterized by less severe pain, which appears to be arthritic in nature (morning stiffness) and is largely

relieved by activity during the day. The sixties often bring substantial relief from pain for the LBP patient (41).

### Back injury risk factors

Effective control of LBP requires an understanding of activities that increase the risk of an injury. Some of the major factors associated with increased risk of back pain follow:

- Manual materials handling (especially lifting).
- Twisting of the trunk.
- Bending the trunk forward.
- Bending the trunk to the side.
- Excessive reaching.
- Falls.
- Prolonged sitting.
- Sedentary jobs.
- Highly physical jobs.
- Exposure to whole-body vibration.
- Cigarette smoking.
- Obesity.
- Extreme tallness.

As can be seen, a wide variety of activities are associated with back injuries (from prolonged sitting to heavy lifting). The following sections give some additional detail with regard to these risk factors.

### Specific risk factors for LBP

#### Manual Materials Handling.—

According to a study performed by Bigos (7), manual handling tasks are associated with almost two-thirds of all low back compensation claims. Lifting is a particular concern, being associated with 49% of low back compensation cases (43). Studies have shown that lifting is especially hazardous if the object workers have to lift is excessive, i.e., greater than 15.9 kg (35 lb) in weight (13, 30, 42). Perhaps more important than the actual weight of an object is the moment that is imposed on the low





back. An example illustrates this point by posing the question: Which is more stressful on the low back, 15 kg (33 lb) of feathers or 15 kg (33 lb) of lead? In this example, 15 kg (33 lb) of feathers actually makes the load experienced by the spine greater. This is because the 15 kg (33 lb) of feathers must be packaged in a bulky container, which causes the worker to hold the object further away from his or her body (creating a larger moment). This increases low back stress. Fifteen kilograms (thirty three pounds) of lead, on the other hand, makes for a compact load that can be carried quite close to the body, which will decrease the stress on the low back. Many other aspects of manually lifting a load have been shown to be potential hazards to the musculoskeletal system. These include horizontal and vertical location of the load, shape and size of the load, lifting frequency, load stability, couplings, duration of lifting, workplace geometry, asymmetric lifting, environmental issues, etc. (21).

**Body Motions.**—Twisting of the trunk is associated with a significant

proportion of low back compensation cases (approximately 18%). Bending the trunk forward is also associated with such cases, but to a somewhat lesser degree (12% of cases).<sup>5</sup> More recent studies have also shown that the more quickly one twists the trunk or bends the trunk to the side, the higher the back injury risk (32). Other studies have demonstrated that excessive reaching (for example, reaching over obstacles or handling bulky objects) is associated with higher back injury rates (3, 48). Falls are responsible for only about 10% of compensation cases (7), but these cases tend to be somewhat more severe and costly (7, 47).

**Environmental Factors.**—Workers who are required to sit for prolonged periods of time have a higher risk of back pain (31). This may be due in part to the fact that the spine is almost fully bent forward in a relaxed sitting posture (4). It appears that jobs with low physical demands (sedentary jobs) and jobs possessing high physical demands both have somewhat higher incidences of LBP (36). A moderate amount of physical work is related to lowest back injury

rates. Exposure to whole-body vibration (such as that experienced by shuttle car drivers) has also been implicated as a risk factor (9, 19). Another environmental factor that has received a great deal of attention recently is that of job satisfaction. Several studies have recently reported that an employee's satisfaction with his or her job, working environment, and/or first line supervisor is related to LBP (6, 45). One reason for this relationship may be that workers who enjoy their jobs are willing to work through minor bouts of back pain, while persons who do not like their job will use the same type of pain as a chance to get away from an undesirable situation.

**Personal Factors.**—A recent study has demonstrated that smokers have an increased risk of LBP (17). In fact, this study showed a dose-response relationship between cigarette smoking and LBP. What this means is that the more a person smokes, the greater is his or her risk of LBP. The reasons for a smoker's increased LBP risk are probably due to two factors: (1) Smokers develop a deep cough, which places increased stress on the low back, and (2) smoking decreases blood circulation to the spine, which prevents essential nutrients from being delivered, causing tissues to be increasingly vulnerable to injury. Other personal risk factors involve body size. Back pain appears to be about twice as common in the 20% most obese (17). Furthermore, exceptionally tall individuals seem to have a higher incidence of LBP (3). Certain types of LBP (especially those cases involving intervertebral disk problems) seem to have a genetic component, as well (39).

### **Multiple risk factors**

Although the exact relationship is not known, it is believed that the various personal and task risk factors listed above interact with one another (21). That is, several risk factors may be present at the same



time, which may increase the chances of a worker experiencing a back injury (14). Thus, in a general sense, the greater the number of risk factors an individual has, the greater the likelihood will be that an individual will experience an episode of LBP.

As an example, let's look at a truck driver, whom we'll call Charlie. In his everyday job, Charlie may be exposed to a large number of back injury risk factors. As a truck driver, Charlie typically has to remain seated for prolonged periods of time and is exposed to whole-body vibration when driving. Charlie is a two-pack a day smoker and is also very obese, both of which may increase the likelihood of experiencing LBP. Furthermore, Charlie has to do heavy lifting to unload his truck. In the unloading process, Charlie is forced to bend and twist to get some of the loads off of the truck. One can easily see that Charlie has a large number of risk factors that increase the likelihood that he will experience an injury to his lower back.

Contrast Charlie's situation with that of Frank. Frank works in an office. While he sits at his desk a fair amount of the time, he's often called upon to do other jobs that require him to be up and around the office. Frank is rarely required to do any heavy lifting, but is called upon to do light lifting every so often. Frank is a nonsmoker and takes pride in keeping himself in shape. Compared to Charlie, it should be fairly obvious that Frank has fewer risk factors for LBP and would be less likely to experience an injury. The authors want to make it clear that it is possible that Frank might experience a back injury, while Charlie may remain injury-free. However, the probability is that we would expect Charlie to be the one to most likely experience bouts of LBP and disability.

Looking at these two cases brings up another point. Let's suppose that both Charlie and Frank are experiencing a moderate amount

of back pain. Frank may well be able to go to work and tolerate his LBP and still be able to do his job effectively. However, the same amount of back pain might be disabling for Charlie, because the pain may well prevent him from being able to perform the tasks that are required in his job. So not only does Charlie's job increase the chances that he will experience a back injury, it also increases the chances that his back pain will result in lost time.

### **Treatment of LBP Choice and effectiveness of treatment**

The majority of individuals who experience LBP cope with their pain without seeking any sort of medical treatment. While a large number of therapies have been attempted to combat LBP, most studies have demonstrated relatively little difference in the effectiveness of various therapies (49). One therapy that clearly fares worse than others is extended bed rest (49). It is clear that a few days of bed rest may be necessary during episodes of acute LBP; however, it is important that the patient be mobilized as soon as possible.

### **Manipulation**

One difference that was noted in a large, carefully controlled study was that patients who received "chiropractic-type" rotational manipulation of the spine reported more immediate relief than that of the control group. However, over the long run there was no difference in pain relief between those receiving spine manipulation and those who did not (24).

### **Exercise**

There is some support for the use of exercises to decrease the degree of incapacity and increase the mobility of the spine that typically accompanies LBP. Furthermore, endurance training of the back muscles appears

to have some benefits in patients with postural LBP. Finally, exercise appears to have a significant effect in decreasing stress, improving the patient's attitude, and allowing better sleep; exercise may provide a positive alternative to prolonged use of medication in the chronic LBP patient.

### **Back schools**

Back schools appear to reduce sick leave, improve work status, decrease pain intensity or duration, and increase the activity level of patients. The "self-care" approach taught at back schools generally consists of enhanced knowledge of the anatomy and physiology of the back, better body mechanics and work techniques, and improved muscle strength and flexibility. Back schools have been used for patients with chronic pain, short-term (acute) pain, and as a preventive technique for industrial workers. Of the three groups, back schools appear to provide most help to patients with acute pain.<sup>6</sup>

### **Surgery**

Surgery is only helpful in a very small segment (1% to 2%) of back pain cases. Successful surgery is reliant upon careful selection of the patient. The successful surgical patient must have unremitting sciatica (back pain that radiates down the leg), and even then, only 5% to 10% of such patients should be candidates for surgery. The unfortunate fact is that surgery often only provides short-term benefits to the patient. Comparisons of surgical and nonsurgical patients indicate that surgical patients do somewhat better after 1 year, but after 4 years have passed, surgical and nonsurgical groups fare about the same (18).

### **Recovery from LBP Return to work**

A study of compensation cases in 22 States for 1982 indicated that the average duration of a lost time back



injury was 14 scheduled workdays (48). However, data from the U.S. Mine Safety and Health Administration records of mining accidents in 1990 indicated that the average days lost for a back injury was more than three times as long as that mentioned in the previous study—an average of 43 days lost! Table 1 illustrates the percentage of compensation cases returning to work, by time (44). This table illustrates that almost two-thirds of patients returned to work within 2 weeks and four out of five returned within 6 weeks. However, after 6 weeks, the return to work was much slower. Seven percent of compensation cases lasted longer than 1 year.

**Table 1.—Low back compensation cases returning to work, by time (44)**

Week	Percent workers returning
1	42
2	62
6	79
12	87
24	89
52	93

**Probability of returning to work**

Data show quite clearly that there is a limited time to get workers back on the job once they have experienced a back injury. Table 2 illustrates the probability of a worker returning to active employment after various durations of being off work, based on data collected in two different studies (33, 40). This table shows that if a worker is off 6 months with a back injury, the chances are even that he or she will return to productive employment. If the worker is off for 1 year, there is only a one in four chance that the worker will return to work. But if the worker is off for 2 years, the chances are very slim that the worker will ever return to the active work force.

**Table 2.—Probability of worker returning to work for low back compensation cases, percent**

	McGill (33)	Rosen (40)
Off work over 6 months ..	50	35-55
Off work over 1 year .....	25	10-25
Off work over 2 years .....	0	2-3

**Deterrents to returning to work**

There are several factors that may act as barriers to the worker returning to work. Malingering by the worker is sometimes observed, but studies generally find that malingering is less prevalent than is generally believed. More likely deterrent factors associated with workers are psychological disability (anxiety and depression associated with chronic pain) (5) or illness behavior (a magnified or abnormal response to illness) (50-51). Management may also prevent an early return to work through policies that it may put in place. Often management does not provide followup or encouragement for the injured worker. Providing modified, alternative, or part-time work to an injured employee may help facilitate his or her early return (16). Other deterrents to a quick return to work may include specific contract rules, extended treatment by the medical practitioner (15), or situations where legal proceedings result.

**Control of LBP**

There are three traditional approaches to the control of back pain that will be considered here. These are (in order of effectiveness) job design (ergonomics), worker selection and job placement, and education and training. These will be discussed briefly below; however, a more extended treatment of job design is given in a companion paper in this proceedings (23).

**Job design (ergonomics)**

Ergonomics is a science that strives to improve job design so that job or task demands do not exceed the

physical capabilities of the worker. This approach has become quite popular in general industry over the past couple of decades, and a scattering of ergonomic committees have been created in the mining industry over the past several years (37). Studies have indicated that the proper design of jobs can reduce up to one-third of all low back compensation by reducing the onset of painful episodes, allowing the worker to stay on the job longer and permitting the worker to return to the job more quickly (43).

The job design approach begins with the evaluation of existing jobs to identify risk factors that may lead to back injury. As identified previously, back injury risk factors may include manual handling tasks; body movements such as bending, twisting, and reaching; excessive loads; prolonged sitting; prolonged work in static postures; and exposure to whole-body vibration. Job redesign consists of reducing the risk factors associated with the job. For example, exposure to excessive loads may be reduced by providing the worker with mechanical aids. Improving the layout of the workplace may also help to reduce unnecessary bending and twisting. Appropriate packaging of objects (to ensure that object weights match worker capabilities) will also reduce exposure to excessive loads. In addition, proper seat design (providing an adjustable seat with good lumbar support and vibration damping) can reduce the stress on the low back (28, 46).

Management is sometimes reluctant to redesign jobs because of the costs involved. However, many companies have learned that devoting capital to job redesign is indeed a sound business investment.<sup>7</sup> Reduced compensation costs and increases in worker productivity will return the cost of the initial investment over time. Determining the payback period will help persuade management of the cost effectiveness of redesigning jobs.



## **Worker selection and job placement**

### **Medical examination**

It has been estimated that a maximum of 1 in 12 young (first hire age) workers susceptible to low back problems may be identified by performing a careful examination and obtaining a thorough medical history (41). The effectiveness of this approach for older workers may be somewhat higher (41). However, it should be pointed out that there is no guarantee that the workers screened out through this process will ever experience a bout of LBP. Use of X-rays in the examination process has been controversial, with the majority of physicians recommending that routine pre-placement X-rays not be used (2).

### **Strength and fitness testing**

Studies have indicated that the chance of a musculo-skeletal injury is up to three times higher when the lifting requirements of a job approach or exceed a worker's isometric lifting capacity (12, 29). However, it is important to note that if strength testing is used to place workers in jobs, there is a risk of possible legal problems involving discriminatory hiring practices. To prevent such accusations, it is crucial that the strength tests used to select workers match the job demands as closely as possible.

In recent years, a large number of sophisticated strength testing devices have appeared on the market. However, thus far, there are no data regarding the effectiveness of these devices in reducing LBP.

## **Education and training**

### **Training in safe lifting**

Teaching workers the proper method of lifting would appear to be a useful way to prevent back problems. However, the studies examining the effectiveness of this approach have failed to demonstrate that training has any effect on LBP (8, 15, 43, 52). There may be several reasons why these studies have shown no

effect. For one thing, the quality of training in industry is typically lacking. Presentations are generally poor, the content of programs uneven, and there is usually no followup associated with training programs. Furthermore, workers tend not to comply with safe lifting recommendations, unless a program of performance feedback is provided (1). Safe lifting is not a natural way to lift, requires more energy to perform, and is generally harder to do (22). Uninjured workers are particularly hard to motivate. A better approach may be to concentrate training efforts on workers with a history of LBP, rather than attempting to train the entire work force.

### **Strength and fitness training**

Some research appears to support the notion that improving worker fitness decreases the chances of worker compensation claims (10). Table 3 shows the results of a study examining the fitness of 1,652 Los Angeles firefighters. The firefighters were divided into three fitness categories based on strength, flexibility, heart rate and blood pressure, and physical work capacity. This study demonstrated that the most fit workers had fewer back-related compensation claims, the least fit had the highest number of claims, and those in between had a moderate number of claims. In a separate study (11), compensation costs were compared between workers with the greatest and least flexibility, strength, and physical work capacity. This study showed that workers with the greatest flexibility, strength, and work capacity had much lower compensation costs compared to those with the least flexibility, strength, and work capacity. The authors concluded that physical fitness and conditioning may have some preventive effect with regard to back disorders.

**Table 3.—Low back compensation claims for Los Angeles firefighters, by level of fitness (10)**

	Most fit	Middle fit	Least fit
Number of firefighters ...	266	1,127	259
Low back compensation claims, % .....	0.77	3.19	7.14

## **Summary**

The economic costs of LBP are overshadowed only by the pain and disability experienced by the sufferer. Despite significant advances in knowledge of the low back, the exact causes of LBP remain largely unknown. We do know that there are several risk factors that increase the chances of experiencing LBP. These include lifting, bending and twisting of the trunk, prolonged sitting, exposure to whole-body vibration, and smoking. The best methods for controlling LBP in the workplace is to reduce the worker's exposure to these risk factors. If a back injury does occur, there is a limited amount of time to get the worker back on the job. The longer the worker is off the job, the greater the chances are that the worker will not return. Three main approaches have been used to control LBP: job design (ergonomics), worker selection and job placement, and education and training. Of these, job design appears to offer the greatest ability to reduce the occurrence of LBP; however, most effective back injury control efforts use a combination of the approaches listed above.

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<sup>1</sup>Research physiologist.

<sup>2</sup>Industrial engineer.

<sup>3</sup>Italic numbers in parentheses refer to items in the list of references at the end of this paper.

<sup>4</sup>Unpublished data prepared by C.A. Hamrick in 1994; available upon request from S. Gallagher; BuMines, Pittsburgh, PA.

<sup>5</sup>Private communication from Stover H. Snook, Liberty Mutual Insurance Co., Aug. 1989.

<sup>6</sup>See footnote 5.

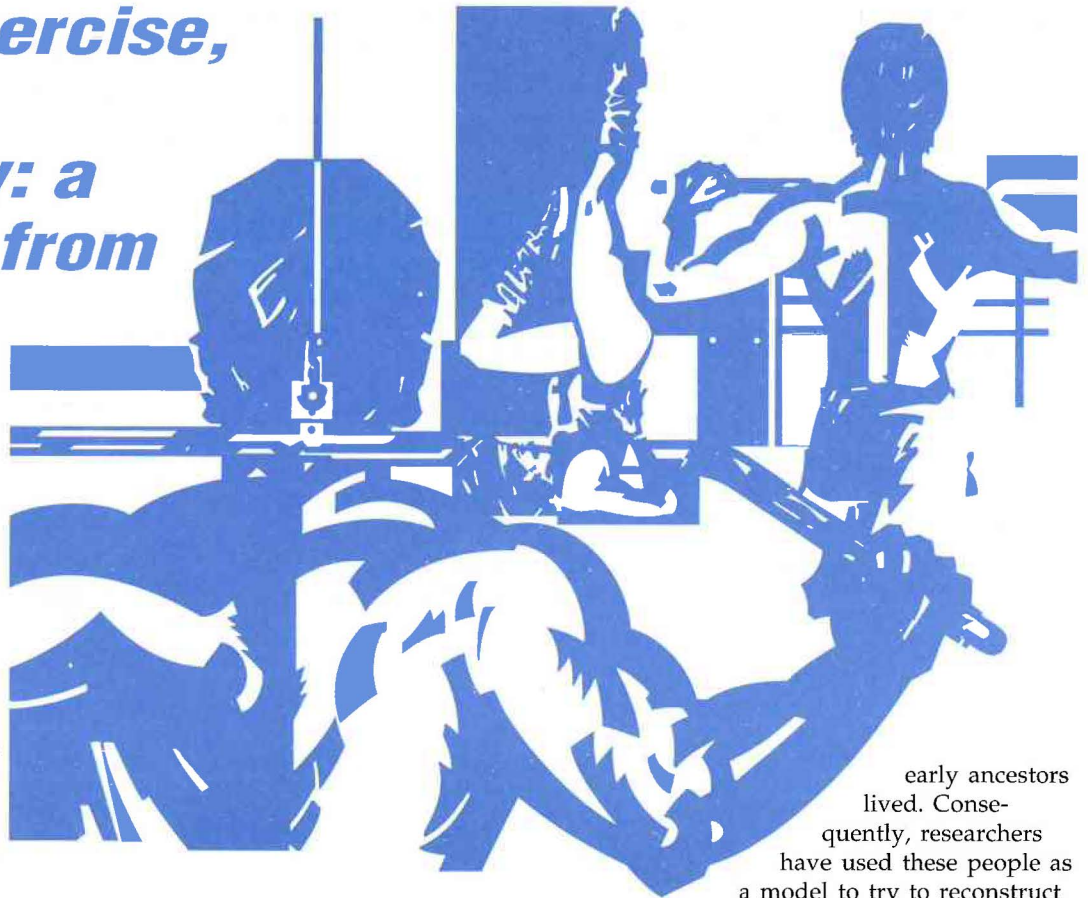
<sup>7</sup>Ibid.

Reprinted from the 1994 Bureau of Mines' publication: *Improving Safety at Small Underground Mines*; compiled by Robert H. Peters.



## *Eat, exercise, and be healthy: a lesson from our ances- tors*

Long before fast-food restaurants became a part of our lives, our ancestors hunted wild animals for meat and gathered berries, nuts, and plants to provide a well-rounded and healthy diet. These "hunter-gatherers," as they were called, lived long before the beginning of agriculture and the domestication of animals. Perhaps most interesting for today's health conscious people, these early societies of humans did not have anywhere near the amount of the so-called "diseases of civilization" such as cancer, heart disease, stroke, diabetes, and high blood pressure that cause 75% of all deaths in America today. It is commonly thought that the reason our ancestors did not get these diseases is because they did not live long enough. It is true that these early people often did die of infections or accidents. But those that survived these early assaults lived long lives—comparable in length to the longevity of people today. So why didn't they get age-related diseases such as heart disease and high blood pressure? Scientists believe that diet and exercise had a lot to do with it.



A question you might ask right now is how can we know anything about people who lived so long ago? First, the bones of some of these early people have been found and analyzed by scientists. Bones reveal how much calcium a person consumed in his or her diet, for instance, or how strong this person was. Also, there are people today who live as hunter-gatherers in the jungles of Africa and Indonesia, and in the Arctic. Though they are sometimes referred to as "primitive" people, they actually have a very sophisticated knowledge about plants, animals, and other things in their environment. (Modern scientists are now trying to learn as much as they can about the medicinal use of plants from the medicine men and women in these tribes.) It is thought that today's hunter-gatherer tribes live very much the way that our

early ancestors lived. Consequently, researchers have used these people as a model to try to reconstruct the lifestyles of our earliest ancestors.

### ***Men and women: equal opportunity for exercise***

How did they live? Well, first, they got much more exercise than the average person today. Basically, they needed to engage in relatively heavy and consistent physical activity in order to eat. The men of these early tribes hunted animals. The hunt would require walking or jogging for hours in order to track animals. But the women were no slouches either when it came to physical exercise. It appears, based on our knowledge of hunter-gatherer tribes today, that the primary responsibility of women was to gather plant foods, nuts, berries, and fruits. In one African hunter-gatherer tribe existing today, the women routinely walk between 2 and 12 miles a day 3 times per week



to gather food. If a 12-mile walk seems impressive it's even more impressive when you consider that these women are also carrying 15 to 35 pounds of plant food back on their return trip. And they often are also carrying babies and small children on their backs for a good part of the trip! Gathering food doesn't mean lazily picking a piece of fruit within reach off a tree. These women often have to climb the tree to get the fruit. Or they dig out potato-like tubers and roots buried several feet in the ground. It puts those of us who drive a car to a fast-food restaurant to shame!

### **A meat and potatoes type of people**

Just what did our ancestors eat? Though today we are told to eat foods from four basic groups (meat and fish, vegetables and fruits, milk and milk products, and breads and cereals), our ancestors derived their nutrients from the first two groups: meat/fish and vegetables/fruits. Even today, most hunter-gatherer tribes do not rely on milk or milk products, and breads and cereals were not available until the beginning of agriculture. But these two food groups supplied our ancestors with a good, healthy diet. In fact, if you compare the average American diet today to the diet of our ancestors, we are the losers.

Our ancestors consumed more calcium (for good strong bones) and fiber (to prevent colon cancer and lower cholesterol) than we do today. Their intake of sodium, a mineral which can elevate blood pressure in certain people, was far lower than the intake of the average American. Their overall fat intake was about half of ours today. Furthermore, they consumed more of the "better" polyunsaturated fat compared to the "bad" saturated fat than we do.

They did not drink alcohol and they consumed much more vitamin C or ascorbic acid than the average American today. Interestingly, their

cholesterol intake was higher than ours. This is because even though the mainstay of their diet was plant foods, their consumption of meat was greater than our consumption today. (Meat is the most common source for dietary cholesterol.) However, our ancestors ate wild game, which has a much lower fat content than that of our domesticated animals today. Furthermore, wild game has a higher proportion of polyunsaturated fat compared to saturated fat; the opposite is true of meat from domesticated animals, such as beef.

No one is suggesting that we start hunting our meat or gathering our plants and vegetables over hill and dale. But we can integrate some of these ancestral lessons into our "civilized" lives today. Our first suggestion is to increase the amount of fruits and vegetables in your diet. In *CardiSense*® Volume IV, Number 2 of 1994, we gave a "plant oriented" diet plan for our readers. Because the fat content of our meat today is so different from the meat that our ancestors ate, cutting out meat completely from your diet and substituting alternative plant sources of protein is an excellent dietary recommendation.

If you can't become a vegetarian, eating "free-range" chickens as your source of protein is a good alternative. Free-range animals live more like the wild animals that our ancestors ate. Rather than being raised in crowded conditions, they are allowed to move around more and are fed a healthier diet. And they've got some healthy statistics to show for it.

### **A free-range chicken in every pot**

The inescapable fact that eating fat makes you fat has caused many of us to rethink our basic dietary choices. And we are fighting back with our forks. The interest in organically grown, free-range poultry is a natural outgrowth of our shifting

eating habits, and one that deserves to be discussed in a little more detail.

Unlike their cooped-up counterparts, free-range poultry are fed a wholesome diet of organic grains and vitamins without the hormones, antibiotics, tranquilizers, and growth stimulants that are added to the usual diet of the feathered set. With access to outdoor space, fresh air, water, and sunshine, these free-roaming poultry develop more muscle and less fat—as much as 20% less fat than their caged counterparts according to poultry farmers.

Because of the more healthful, natural conditions under which these chickens live, their growth cycle takes a full 10 weeks versus 6 or 7 for traditionally raised poultry. According to experts, this longer time to reach maturity translates into a big flavor bonus for consumers. While some chefs describe the flavor of free-range poultry as full-bodied, similar to that of traditional wild game such as duck, squab, or quail, others describe it as fresher and moister than supermarket chickens.

Good taste has its price. Heartsmarter, free-range poultry cost more than the chickens we're all used to buying at the supermarket. A national price check revealed prices ranging from \$1.79 to \$2.39 per pound. But serving for serving, these more tasty and healthy poultry still cost less than an equivalent portion of meat or fish.

In summary, the health lessons we can learn from our ancestors are to exercise regularly, eat plenty of fruits and vegetables, and if you do eat meat, eat a low-fat variety.

*Reprinted from the 1995 Volume 5, Number 1 issue of Marion Merrell Dow, Inc.'s CardiSense® magazine.*



## **WARNING: A lack of social relationships may be hazardous to your health**



There are many established risk factors for heart disease, including a high-fat diet and lack of regular exercise. But new evidence implicates lack of a social network as yet another risk factor.

A recently published 9-year study of over 6,000 people found that people who lacked social and community ties were more likely to die compared to those with more extensive contacts. How did they define these social ties in the study? Social activities ranged from intimate social relationships, such as with a spouse, to church involvement and volunteer activities. The study showed that those men who engaged in more active social relationships were less likely to die. Passive or solitary activities such as reading or watching television were more likely to be associated with a higher rate of death. For women in this study, these solitary activities were even more strongly associated with mortality.

### **How does a social network improve health?**

A person who has the assistance of others during illness may come out of it healthier than someone who does not. It could be that life is less stressful for people who can call on others for help. Various studies have suggested that relationships are associated with a general resistance to disease-producing agents and processes.

### **Social support and friendship: It literally "does your heart good"**

Researchers have suggested that excessive beating of the heart and excessive increases in blood pressure in response to stressful situations may contribute to the development of heart disease and high blood pressure. This theory suggests that heart disease may come about in part as the result of an accumulation of thousands of these episodes of increased blood pressure and heart rate produced in response to stress. One recent study suggests that social support can subdue this "overreacting" response.

This study involved people who were subjected to verbal attack in a heated discussion. In one group, a person was present who *supported* the person being attacked. In the other, a person was present but said nothing and offered no *support*. The results showed that people with support had much smaller rises in their blood pressure and heart rate during the attack than the people with no support.

### **"Do good" and do your health good**

One of the most dependable ways to

get involved with people is to do volunteer work. Not only will you have the opportunity to do something good for someone else and to get involved in issues larger than your own, but you will also be put in contact with a special group of people—other caring people who just might turn into very good friends.

### **If you can read this article, you can volunteer**

Where to volunteer? Just the fact that you're reading this newsletter means you could teach reading skills to children or adults. Contact LITERACY VOLUNTEERS OF AMERICA. Call your local listing or contact the national office at (315) 445-8000.

Want to help seniors? The NATIONAL SENIOR SERVICE CORP. (formerly known as the Senior Companion Program) is a federally funded program that enlists senior citizens to help care for other seniors who need companionship and help with shopping, trips to doctors, and other daily events. The program even offers a stipend to senior volunteers with an income lower than \$9,200. The program is in operation nationally. To contact the main office, call (212) 466-4471.

Volunteer at your local hospital or for the Meals on Wheels Program, where you can get involved delivering meals to housebound seniors. To volunteer for the Meals on Wheels program, contact your local Office of Aging.

*Reprinted from the Volume 5, Number 1 issue of Marion Merrell Dow, Inc.'s Cardisense®*





*This may be your*  
***last issue!***

***We are requesting your assistance in completing a survey form to update the Holmes Safety Association Bulletin mailing list. We are giving you the opportunity to continue receiving this Bulletin. Please take the time to fill out this form and mail it back to us as soon as possible. If you do not fill out this form, the July 1995 issue will be your last!***

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# ***THE LAST WORD...***

**"He that lives upon hope will die fasting." Benjamin Franklin**

**"Hope is the parent of faith." Cyrus A. Bartol**

**"A misty morning does not signify a cloudy day." Ancient Proverb**

**"Hope is the only universal liar who never loses his reputation for veracity." Robert Green Ingersoll**

**"We should not expect something for nothing but we all do, and we call it hope." —Ed Howe**

**"Hope is the struggle of the soul, breaking loose from what is perishable, and attesting her eternity." —Herman Melville**

**"To the sick, while there is life there is hope." —Cicero**

**"As machines get to be more and more like men, men will come to be more like machines." —Joseph Wood Krutch**

**"To me, there is something superbly symbolic in the fact that an astronaut, sent up as assistant to a series of computers, found that he worked more accurately and more intelligently than they. Inside the capsule, man is still in charge." —Adlai E Stevenson**

**NOTICE:** We welcome any materials that you submit to the Holmes Safety Association Bulletin. *We desperately need vertical format color photos for our cover.* 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 1995 is underway—please remember that if you are participating this year, you need to mail your quarterly report to:

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Holmes Safety Association Bulletin  
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# **Joseph A. Holmes Safety Association Awards Criteria**

## **Type "A" Award – For Acts of Heroism**

The award is a medal with a Medal of Honor Certificate.

## **Type "A" Award – For Acts of Heroic Assistance**

The award is a Certificate of Honor.

## **Type B-1 Award – For Individual Workers**

(40 years continuous work experience without injury that resulted in lost workdays)

The award is a Certificate of Honor, a Gold Pin, and a Gold Decal.

## **Type B-2 Award – For Individual Officials**

(For record of the group working under their supervision)

The award is a Certificate of Honor.

## **Type C Award – For Safety Records**

(For all segments of the mineral extractive industries meeting adopted criteria)

The award is a Certificate of Honor.

## **Other Awards – For Individual Workers**

(For 10, 20, or 30 years without injury resulting in lost workdays)

The awards are 30 years - Silver Pin and Decal, 20 years - Bronze Pin and Decal, 10 years - Decal bearing insignia.

## **Special Award – For Small Operators**

(Mine operators with 25 employees or less with outstanding safety records)

The award is a Certificate of Honor.

For information contact: Secretary-Treasurer, Joseph A. Holmes  
Safety Association (703) 235-8264



U.S. Department of Labor  
MSHA, Holmes Safety Association  
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