BULLETIN

HOLMES SAFETY ASSOCIATION

December 1994

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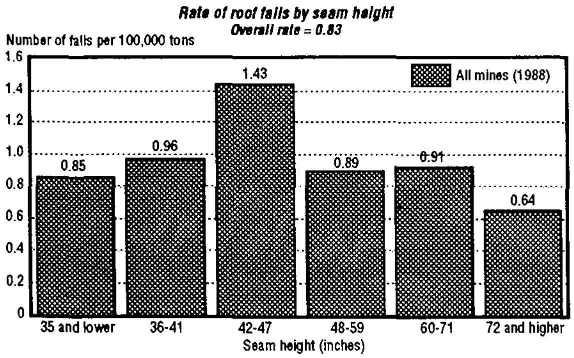

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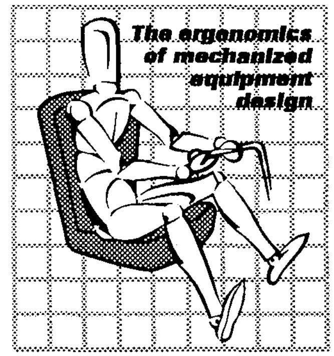

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Please note: The views and conclusions expressed in HSA Bulletin articles are those of the authors and should not be interpreted as representing official policy of the Mine Safety and Health Administration.

KEEP US IN CIRCULATION

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

WELCOME NEW MEMBERS

NAME	CHAPTER NO.	LOCATION
L.W. Hall Co., Inc.	10956	Oak Run, CA
Tim Hannigan Co.	10957	Gauley Bridge, WV
Thurman Oil & Mining, Inc.	10958	Fairbanks, AK
Gold Star Mining	10960	Fairbanks, AK
Kiewit Pacific Co.	10961	Vancouver, WA
Campbell's Creek No. 4	10962	Chapmanville, WV
Pinkerton Security Services	10963	Elcentro Imperial, CA
Modular Mining/Clock	10964	Tucson, AZ
Sunchiek Mines Co.	10965	Mesa, AZ
Imcor	10966	handler, AZ
W.S.S.I./Irwin	10967	Scottsdale, AZ
Talon Environmental	10968	Aztec, NM
Martin No. 1	10969	Mannington, WV
Ceredo Ponds	10970	Ceredo, WV
Cinder Cone Cind-r-lite	10971	Las Vegas, NV
Shell Electric	10972	Gloversville, NY
Casey Mining Ltd. No. 1	10973	Kingston, NY
Casey Mining Ltd. No. 2	10974	Kingston, NY
Cableskill Stone Products Inc	10975	Hancock, NY
Brechbuhlen Scales, Inc.	10976	Nitro, WV
Quincy Dock	10977	Belle, WV
Dynasty Resources, Inc.	10978	Sidney, KY
Burnrite Coal Company	10979	Atlas, PA
A & J Trucking	10980	Jodie, WV
Dicalite Miners	10981	Burney, CA

NAME	CHAPTER NO.	LOCATION
Continental C.B. Mine	10982	Fresno, OH
E.P. Bender Coal Co., Inc.	10983	Carrolltown, PA
Rocky Canyon Plant	10984	Santa Maria, CA
Viborg Sand & Gravel	10985	Paso Robles, CA
#11 Notomine	10986	Marmet, WV
Van Alstyne Trucking	10987	Hague, NY
Martin Lake Construction, Inc.	10988	Tatum, TX
Grand Prairie Crew No. 1	10989	Grand Prairie, TX
Grand Prairie Crew No. 2	10990	Grand Prairie, TX
Grand Prairie Crew No. 3	10991	Grand Prairie, TX
Grand Prairie Crew No. 4	10992	Grand Prairie, TX
Phoenix Limestone Co.	10993	Bedford, IN
Qualified Operators, Inc.	10994	Philipsburg, PA
Santa Margarita	10995	Atascadero, CA
Garofano Consulting	10996	West Rutland, VT
Crossmans Sand & Gravel	10997	Mendon, VT
Casella Construction, Inc.	10998	Rutland, VT
J.P. Carrara & Sons, Inc.	10999	N. Clarendon, VT
Trudo Construction Co., Inc.	11000	Castleton, VT
Elnicki Aggregate, Inc.	11001	West Rutland, VT
L.F. Carter	11002	Pittsford, VT
Division of Apprenticeship	11003	St. Paul, MN
Bryant Farms Gravel Mine	11004	Claverack, NY
Nixon Fork Mine	11005	McGrath, AK

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 while attempting to clear a plugged screw conveyor and hopper. Material broke loose from the inside wall of the tower, forced its way through the open inspection doors, struck the victim and forced him through the handrails of the platform and caused him to fall 36 feet to the concrete pad below. The victim had nine years and five weeks' experience as a production operator at this facility.

DESCRIPTION OF ACCIDENT: The victim, a production operator, began his normal 12-hour shift at 7 p.m. His normal duties included routine checks to observe possible problems in the production sections of the plant. When problems were found, corrective actions were taken. Production operators rotated work duties on a regular basis to allow for changes in routine workloads. Many of their assignments were coordinated by the control room operator who radioed when visual control monitors and instruments indicated problems in the process system.

On the day of the accident the victim was assigned to the preheater section of the plant. He performed routine checks and conducted repairs and maintenance to equipment throughout the preheater area during the first 10 hours of the shift without incident.

At 5:15 a.m., 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 immediately contacted the victim via a portable radio which the victim carried on his belt and directed him to the screw platform to assess the problem. The victim went to the area and, upon arrival, radioed the control room operator that the screw had become plugged with material. The shift supervisor was at the control room when the control room operator received the radio message. The shift supervisor radioed the victim to get more information about the problem. The victim replied, "We're buried. It's plugged." He indicated that he was going to work on the problem.

The production operator was at the clinker transfer belt approximately 100 yards south of the victim. At 5:20 a.m., he heard the radio call that the main spray tower screw had stopped. The production operator proceeded from the area of the clinker belt towards the burner floor. 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. The production operator 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 a.m., the production operator 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. The production operator told the shift supervisor that he would help with the problem after he had completed his prior work report and the shift supervisor immediately left the control room and 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 gone 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 received no reply.

The production operator, having finished his report, joined the shift supervisor at the screw platform. The two of them assessed damage to the screw conveyor housing, and discussed a plan 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.

The shift supervisor called to the production operator and they both started down the stairway to the pad below which was located at ground level. As he was descending the stairs, the shift supervisor radioed to the control room operator in the control room informing him of the situation and instructing him to call emergency services.

A paramedic team arrived at 5:54 a.m. and performed emergency first aid on the victim. The county coroner arrived later and pronounced the victim dead at 6:50 a.m.

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. HSA

A review of recent data concerning accidents caused by falls of unsupported roof

By Robert H. Peters[1] and Barbara Fotta[2]

Introduction

Virtually everyone who works in a coal mine has been told that it is very dangerous to go under unsupported roof and knows that mine safety regulations prohibit this behavior. Nevertheless, information obtained through accident investigations and interviews with coal miners indicates that there are individuals in the coal mining work force who, in certain circumstances, do not hesitate to go under unsupported roof. During the past 8 years, 53 coal miners lost their lives because the victim traveled inby roof supports and the roof fell on them. How were these miners different from other miners? How were their mines different from mines where people have not been killed by falls of unsupported roof? This paper addresses these and other questions by showing how these 53 miners compare to other groups of miners in terms of their experience, age, and certain characteristics of the mine where they were employed.

Findings

Characteristics of the employee

Table 1 shows the median, mean, minimum and maximum values for the age and experience levels of three categories of miners.[3] The first category consists of the 53 miners killed by a roof fall while under unsupported roof during the period 1986-1993. The second category consists of the 189 people who were killed by some type of underground mining accident other than a fall of unsupported roof during the period 1986-91.[4] The third category of miners is the underground coal mining workforce. Estimates of workforce characteristics are based on survey data obtained from 622 coal mining operations during 1986 (Butani and Bartholomew, 1988). Estimates are based only on underground employees. Employees who work at the surface of underground operations were excluded.

Age. Both the mean and median of the ages of miners killed by falls of unsupported roof are a little lower than the corresponding values for miners killed by some other type of accident.[5] Likewise, the estimated average age of the entire workforce is a little higher than the average age of miners killed by falls of unsupported roof (38 versus 35.3 years).

Experience in job. The median number of years experience that Group 1 miners had in the job that they were performing when they were killed was 4 years. The corresponding values for Groups 2 and 3 are, respectively, 4 years and 3 years. The mean values for Groups 1 and 2 are nearly identical.

Total mining experience. Both the mean and median number of years of total mining experience for miners killed by falls of unsupported roof are a little lower than the corresponding values for miners killed by some other type of accident. The estimated median years of total mining

Experience at current mine
Median values

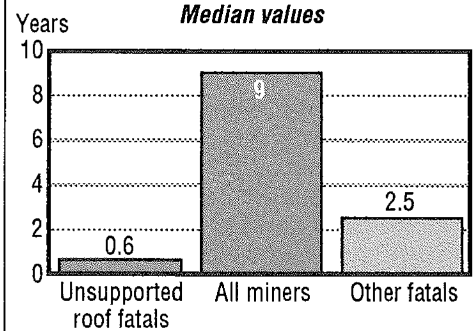


Table 1. Comparison of miner characteristics.

Miner characteristic		GROUP 1. Miners killed by roof falls while under unsupported roof (N = 53)	GROUP 2. Fatalities NOT due to falls of unsupported roof (N = 189)	GROUP 3. Estimates of coal mining workforce from 1986 survey
Age (years)	Median	35.0	37.0	NA[1]
	Mean	35.3	38.5	38
	Min-Max	20-60	19-62	NA
Experience in job (years)	Median	4.0	4.0	3
	Mean	5.7	5.9	NA
	Min-Max	0.01-24	0.02-30	NA
Total mining experience (years)	Median	12.0	13.9	11
	Mean	12.8	14.3	NA
	Min-Max	0.3-28	0.12-44	NA
Experience at this mine (years)	Median	0.6	2.5	9
	Mean	2.1	5.5	NA
	Min-Max	0.02-19	0.02-38	NA

[1] Not available

experience of the entire workforce is a little lower than the corresponding value for miners killed by falls of unsupported roof (11 versus 12 years). Thus, it does not appear that miners who have been killed by falls of unsupported roof differ very much from other miners in terms of their total mining experience or their job experience.

Experience at this mine. There are very sizable differences between the groups in terms of the amount of experience the individuals had working at the mine where they were employed. The median number of years experience miners had working at their mine before they were killed by a fall of unsupported roof was only 0.6 years. This means that about half of these victims had been working at the mine for less than 8 months when they were killed. This value (0.6) is about one fourth of that for miners killed in other types of accidents (2.5) and less than one tenth of the corresponding value for the remainder of the underground workforce (9 years)! Similarly, the mean value for Group 1 is substantially lower than the mean for Group 2.

The differences between Groups 2 and 3 may reflect the victim's lack of familiarity with the new mine—the physical characteristics of the mine, the equipment, the habits of coworkers, or various factors associated with management. Prior research strongly suggests that lack of familiarity is a significant contributor to injuries among underground coal miners (Goodman & Garber, 1988). Perhaps the new employee tries to win the approval of supervisors by showing them that he is willing to take shortcuts or risks in order to appear more productive. Or, perhaps he tries to gain the respect of his co-workers by showing them that he is not afraid to perform risky behaviors.

The factors mentioned above also might explain some of the differences between Group 1 and Group 3. The differences between Group 1 and Group 3 may also reflect the fact that there can be substantial differences in the stability of the roof from one mine to another. Miners who are used to working where falls of unsupported roof happen very rarely may develop the habit of doing certain things under

Table 2. Comparison of mine characteristics.

Mine characteristic		GROUP 1. Mines with roof fall fatalities under unsupported roof (N = 52)	GROUP 2. Mines with fatalities **NOT** due to falls of unsupported roof (N = 155)	GROUP 3. All mines operating in 1988 (N = 1,841)
Annual production (tons)	Median	72,896	335,151	63,279
	Mean	230,146	687,028	221,298
	Min-Max	3,362-1,980,072	2,245-3,296,794	NA[1]
Annual employee hours	Median	26, 867	121,071	20,666
	Mean	78,338	234,785	72,186
	Min-Max	1,200-780,926	1,783-1,485,845	NA
Seam height (inches)	Median	42	54	42
	Mean	50.7	58.6	49.3
	Min-Max	26-120	24-144	NA
Lost-time injury rate (per 200,000 hours)	Median	15.3	14.0	14.0
	Mean	17.5	17.8	21.4
	Min-Max	0-90.4	0-46.3	NA
Productivity (tons per employee hour)	Median	2.4	2.7	2.6
	Mean	3.0	3.0	2.9
	Min-Max	0.8-6.9	0.7-7.8	NA

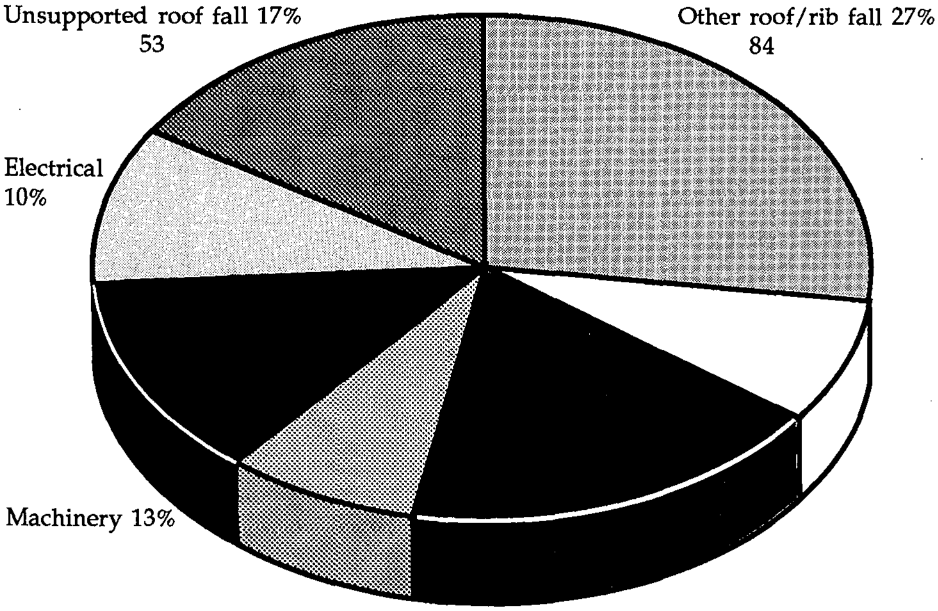
[1] Not available

unsupported roof. If these miners should go to work at a different mine where falls of unsupported roof are more common, it may take some time for them to change their old habits. Once they are firmly established, habits can be very difficult to change. Unfortunately, miners may be killed by a roof fall before they even have a chance to realize that their old habits are much more dangerous in their new work environment. Therefore, it is very important that all newly employed experienced mine workers be reminded of the importance of never going under unsupported roof. This is especially important for miners who have recently worked at mines where roof conditions were stable. Such individuals may have developed a complacent attitude about going under unsupported roof.

When newly employed people are first assigned to work near face areas, they should be closely monitored to ensure that they are not exposing themselves to unsupported roof during the course of performing certain activities associated with their job. If they are, corrective actions need to be taken immediately (see Peters (1991) for a discussion of several strategies for changing unsafe employee behaviors). If the individual persists in the behavior, it may be necessary to reassign them to a job where they are not required to work in close proximity to areas of unsupported roof.

Distance beyond the last row of bolts. The Mine Safety and Health Administration's (MSHA) reports on fatal accidents involving miners killed while under unsupported roof were reviewed to determine how far beyond the last row of supports the victim was at the time they were

Underground coal fatalities by accident type (1986-1993)



killed. Most of the victims were found within 4 feet of the last row of supports. Thus, it is important that miners realize that it is NOT safe to go even a short distance beyond the last row of roof supports.

Characteristics of the mine

Table 2 shows characteristics of underground coal mines that fall into three categories. These categories correspond to the ones in Table 1. The 52 mines in Group 1 are operations where one or more miners were killed by a roof fall while under unsupported roof during the period 1986-1993. All of the 155 mines in Group 2 are operations where one or more miners were killed by some type of underground mining accident other than a fall of unsupported roof during the period 1986-91. Group 3 consists of all mines operating in 1988. The statistics for Group 3 mines are based on data from 1988 because that year is near the middle of the time period 1986-91. Many of the mines in Groups 1 and 2 were not in operation during the entire period for 1986-91. The average of the annual figures that each mine reported for its production, employment, and lost-time injuries for each of the years during 1986-91 that it was in operation was used to estimate the "typical" levels of production, employment, and lost-time injuries for each of these mines. The figures for employment, and lost-time injuries reflect underground units only. Surface workers at underground mines are excluded from the analyses.

Group 1 versus Group 3 mines. Mines where a fatality occurred due to a fall of unsupported roof produced an average of 8,848 more tons of coal per year than mines where there were no fatalities. Similarly, the median of the annual tons of coal produced for Group 1 mines is 72,896, which is 9,617 tons more than the median for Group 3 mines. There is a similar difference with respect to the mean and median values for annual number of hours worked by underground employees. In comparison to Group 3, the workforce at mines in Group 1 appears to be a little larger. The median of the rates of lost-time injuries per 200,000 hours worked by underground employees is a little higher for Group 1 mines than for Group 3 mines (15.3 versus 14.0). The median number of tons produced per hour of underground labor is slightly lower for Group 1 mines than for Group 3 mines (2.4 versus 2.6). Finally, there is no difference in terms of the median seam heights for Group 1 and 3 mines. The median for both groups is 42 inches. In terms of the parameters listed in Table 2, it appears that mines where fatalities occurred under unsupported roof are fairly similar to mines that did not have any fatal accidents.

Group 2 mines versus Groups 1 and 3. The group of mines that experienced fatalities caused by accidents *other than* falls of unsupported roof (Group 2) appear to be different from the mines in Groups 1 and 3 in two respects. Group 2 mines are larger, and operate in higher seams. The injury rate and productivity rate for Group 2 mines is about the same as for the other two groups.

A more in-depth look at seam height

The seam height in many mines is so low that workers crawl most of the time when they need to move around. For various reasons, low seam height may influence miners' propensity to go under unsupported roof. In comparison to walking, it takes considerably more time and effort for mine workers to move from place to place when they must crawl. Therefore, in low-seam mines, it may be more tempting for

Table 3. Percent of employee hours and fatal accidents under unsupported roof, by seam height.

Seam height (inches)	Employee-hours worked throughout all mines operating in 1988 (percent)	Mines with fatal accidents under unsupported roof (percent) N = 52	Ratio of column 3 to column 2
35 and lower	5.6	21.2	3.8
36-41	9.7	26.9	2.8
42-47	5.9	11.5	1.9
48-59	23.3	11.5	0.5
60-71	19.2	7.7	0.4
72 and higher	36.3	21.2	0.6

Table 4. Rate of roof falls[1] reported to MSHA for all mines operating during 1988 and for mines with a fatality under unsupported roof, by seam height.

Seam height (inches)	Roof fall rates throughout all mines operating in 1988	Roof fall rates for mines with a fatality under unsupported roof[2]
35 and lower	0.85 n=390	2.76 n=8
36-41	0.96 n=447	0.0 n=11
42-47	1.43 n=185	0.92 n=3
48-59	0.89 n=185	1.54 n=4
60-71	0.91 n=189	2.10 n=4
72 and higher	0.64 n=282	0.98 n=11
Overall	0.83 N=1,841	1.11 n=41

[1] *Roof fall rates were computed as the number of roof falls per 100,000 short tons of coal produced.*

[2] *roof fall rates reflect what the mine reported to MSHA during the year preceding the fatality.*

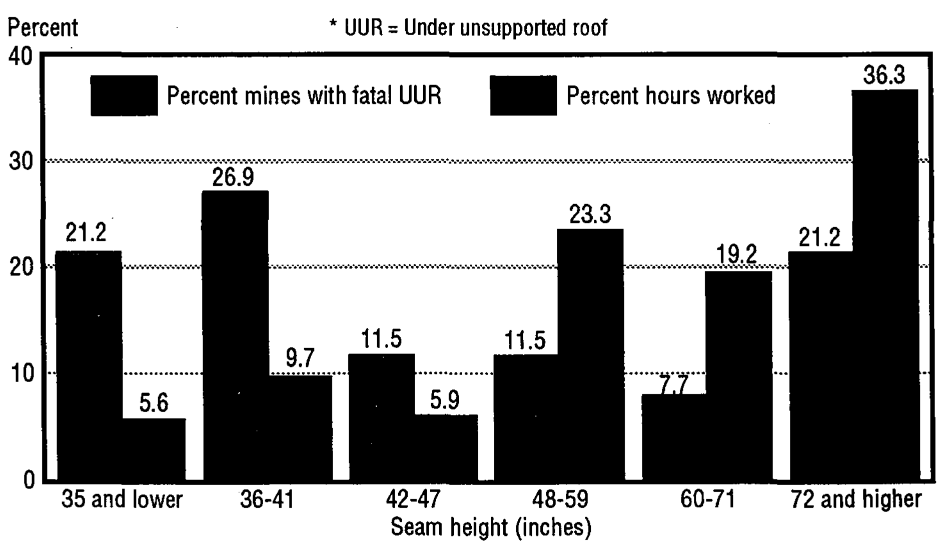
employees to take shortcuts through areas that have not yet been bolted, e.g., an unbolted crosscut. Low seam height also makes it more difficult for miners to get a good view of the roof in front of them. Bureau researchers recently asked miners from a low seam mine to describe recent incidents in which they had unintentionally gone under unsupported roof (Peters and Randolph, 1992). Some of them noted that it is easier to go under unsupported roof unintentionally in a low seam mine because (1) it is more difficult to look at the roof from a crawling position than from a standing position, and (2) when operating equipment, such as a scoop, it is sometimes difficult to see whether the roof ahead is bolted or not without getting off the equipment to get a better view. A comparison of interview data collected from miners at both low seam and high seam mines suggests that people unintentionally go under unsupported roof more frequently in low seam mines than in high seam mines (Peters and Randolph, 1992).

Is the rate of fatal accidents from falls of unsupported roof actually higher at low seam mines? The data in Table 3 was compiled to address this question. The second column of Table 3 breaks down employee hours worked in underground coal mines during 1988 into 6 categories based on seam height (column 2). Of the total hours employees spent working in underground coal mines, 5.6% was in mines with seams less than 36 inches high, 9.7% was in mines with seams of between 36 and 41 inches, etc. The third column in Table 3 shows the percent of all the accidents in which miners have been killed by falls of unsupported roof during 1986-93 that occurred at mines within each of the same 6 categories of seam height. Of the total fatal accidents from falls of unsupported roof, 21.2% occurred at mines with seams less than 36 inches high, 26.9% occurred at mines with seams between 36 and 41 inches, etc. The fourth column in Table 3 shows the ratio of the numbers in the third column to the numbers in the second column. These ratios show that, relative to the percentage of employee hours, a disproportionate number of fatal accidents from falls of unsupported roof occur in seam heights less than 48 inches and particularly in seam heights less than 42 inches.

This data appears to fit with the assertion that miners are more likely to go under unsupported roof in low seam mines. However, these variations in fatality rate by seam height might also reflect non-behavioral factors, such as differences in the stability of the roof. Another scenario that could explain the pattern of data in Table 3 would be: Miners are spending the same proportion of time under unsupported roof in both low seam and high seam mines, but roof falls occur more frequently in low seam mines. The data in Table 4 was compiled to examine this issue. Table 4 shows the rate of roof falls reported to MSHA by mines in each of the six categories of seam height.[5] The rate of roof falls (both injury and non-injury) per 100,000 tons of coal produced was computed for mines operating within each seam height category to see whether a disproportionate number of roof falls occur in lower seam height mines.[6]

In the lowest three categories of seam height, rates of roof falls increase as seam height increases to a high of 1.43 roof falls per 100,000 tons for mines with seam heights of 42-47 inches. Rates then decline to about 0.90 for mines with seam heights between 48-71 inches. Finally, seams heights of 6 feet (72 inches) or higher have the lowest rate (0.64). Thus, a trend of decreasing roof fall rates with increasing seam height is not evident. On the contrary, up to a height of 48" the rate of roof falls steadily increases. Thus, using rates of roof falls reported to MSHA as a measure of roof stability, it does not appear that roof falls happen

Mines with a fatality UUR*, and total hours worked underground by seam height



more frequently in low seam mines. This suggests that the substantially higher fatality rates in lower seam mines cannot be adequately explained by differences in the frequency of roof falls, but rather, reflects differences in worker behavior.[7]

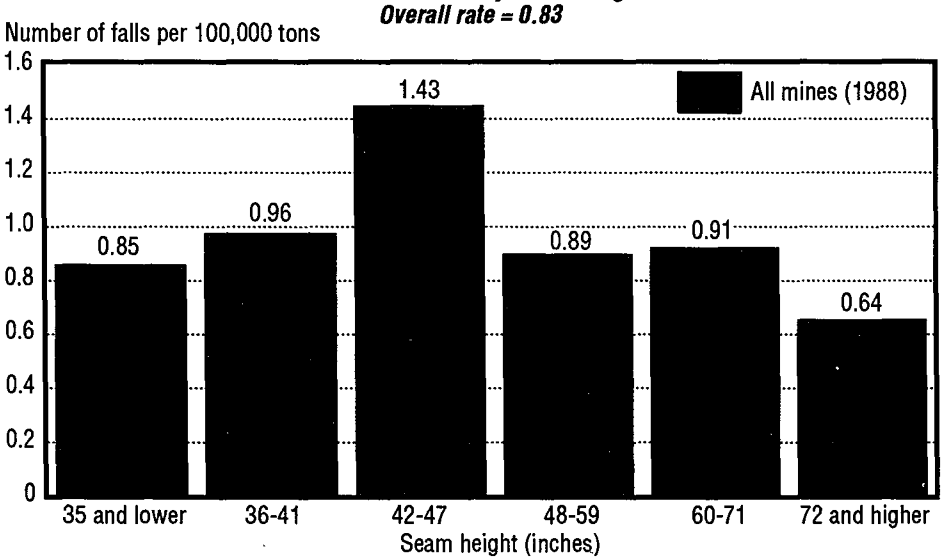
Perceived roof stability

In interviews about the causes of roof fall fatalities, miners and mine inspectors have occasionally remarked, "It's not the 'bad' roof that kills people, it's the 'good' roof" (Peters and Randolph, 1992). In other words, people who work in mines with very stable roof conditions may eventually stop worrying about avoiding unsupported roof because roof falls happen so infrequently. When a fall of unsupported roof eventually happens, it is more likely that someone will be beneath it in mines where people perceive the roof as 'good' than in mines where people perceive it as 'bad'. Is there empirical support for this proposition?

To address this question, rates of roof fall accidents (both injury and non-injury) were computed for the year prior to the year of the fatality for 41 of the 52 mines in which miners were killed by falls of unsupported roof during 1986-93. Data for the remaining 11 of the 52 mines was not available because these mines were not in operation during the previous year. The overall rate of roof falls for these 41 mines was 1.11 per 100,000 short tons of coal produced. The overall rate of roof falls for all underground coal mines in 1988 was 0.83. The direction of this difference in rates is opposite that suggested by the proposition, "It's not the 'bad' roof that kills people, it's the 'good' roof."

Finally, the 41 mines in which miners have been killed by falls of unsupported roof during 1986-93 were partitioned into six categories on the basis of seam height, and rates of roof fall accidents (both injury and non-injury) were computed for each separate category (see column 3 of Table 4). Overall, these rates are highly variable and show no obvious trend. One rather interesting finding is that only 3 of the 19 mines operating in seam heights of less than 42 inches reported any roof falls during the year prior to the fatality, i.e., only 15.8% of these 19 mines reported at least one roof fall.[8] Thus, if one looks only at the data on fatalities that have occurred in mines below 42 inches, it appears that there is some support for the argument, "It's the 'good' roof that kills people." However, one must be cautious in drawing any conclusions from the data in the last column of Table 4 because the number of mines in some seam height categories is quite small (particularly in the 42-71 inches range). These rates may be unstable in that the addition of another mine (value) could significantly alter the rate for the category.

Rate of roof falls by seam height
Overall rate = 0.83



Conclusions

Some of the more salient findings from this analysis of accidents caused by falls of unsupported roof include:

1. The rate of fatalities from falls of unsupported roof is higher at low seam mines than it is at high seam mines.
2. The overall rate of roof falls reported to MSHA is somewhat higher for mines where a fatality has occurred under unsupported roof than for mines that have not experienced such a tragedy.
3. Most miners killed by falls of unsupported roof are found within 4 feet of the last row of roof supports.
4. As a group, miners killed by falls of unsupported roof are similar to other miners in the workforce, except that the average length of time they had been employed at the mine was much shorter. This suggests that it is important to closely monitor newly employed people to make sure that they are avoiding unsupported roof at all times.
5. Miners have been killed by unsupported roof in a wide variety of mines since 1986, and what is "typical" (or the median) for this group of unfortunate mining operations looks very similar to what is typical at the many mines where fatalities did not occur.

In spite of this last finding, it may be tempting for mine workers to assume that mines where people are killed by falls of unsupported roof are somehow different from the mine where they work. This is part of how people rationalize that horrible events "could not happen to me." Miners may imagine that their mine is somehow different from mines in which people get killed. In some instances there are valid reasons to hold such beliefs. However, in other instances this is a false illusion. Trusting areas of unsupported roof not to fall is one of those instances.

The Bureau of Mines has been conducting research to learn more about why miners go under unsupported roof and what types of actions might help to eliminate this behavior. The strategies that have been suggested include: (1) ask miners for ideas about how to keep people from going under unsupported roof, (2) modify equipment and work procedures to eliminate situations which tempt miners to go under unsupported roof, (3) offer incentives for eliminating the precursors of going under unsupported roof, (4) increase fear of the harm that roof falls can cause, and (5) formulate and enforce a policy on how to handle individuals who persist in going under unsupported roof. For further information about why miners go under unsupported roof and how to stop them; see Peters (1991), Peters and Randolph (1992), Peters (1993), and Mallett, Vaught, and Peters (1992).

MSHA has a program devoted to preventing roof fall accidents called REAP (Roof Evaluation and Accident Prevention). Several very useful types of information are available through the REAP program including: safety posters, videotaped interviews with miners who have survived serious roof fall accidents, reports and videotapes that summarize each year's fatal roof fall accidents, and materials for conducting training exercises with miners. HSA

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[1] Research Psychologist, Pittsburgh Research Center, U.S. Bureau of Mines, Pittsburgh, PA
[2] Research Methodologist, Pittsburgh Research Center, U.S. Bureau of Mines, Pittsburgh, PA
[3] The median is the middle value in a set of numbers arranged in order of magnitude, i.e., the 50th percentile value.
[4] 1991 was the most recent year for which complete data was available.
[5] It is important to remember that the groups being compared are complete populations rather than samples from a population Therefore, it is not appropriate to perform t-tests on the data.
[6] Mine operators are required to report to MSHA any of the following types of roof or rib falls: (1) falls that cause death or injury, (2) falls that cause entrapment of an individual for more than thirty minutes, (3) any unplanned roof falls at or above the anchorage zone in active workings where roof bolts are in use, (4) any unplanned roof or rib fall in active workings that impairs ventilation or impedes passage. Of the 15, 983 groundfall accidents reported to MSHA in 1991, 72% were non-injury incidents.
[7] A roof fall rate based on the amount of exposed roof and rib (some surface area measurement) might be the most appropriate measure to use. However, because such information is not available, the amount of production probably more closely approximates this area than any other measure readily available.
[8] It is important to remember that the comparisons that have been made are based on the assumption that mines are accurately reporting roof fall accidents to MSHA. Unfortunately, there is currently no way to determine how often mines fail to report roof falls that MSHA defines as "reportable" accidents. If there were a tendency for low seam mines to be significantly more likely to fail to report roof fall accidents than high seam mines, then the conclusion that worker behavior is a more important contributor to fatal roof fall accidents in low seam mines than in high seam mines might not be accurate.
[9] As a basis of comparison, 24% of the 837 mines operating in seams of less than 42 inches in 1988 reported at least one roof fall.

From a paper delivered by the author at the 25th Annual Institute on Mining Health, Safety, and Research, August 29-31, 1994, at Virginia Polytechnic Institute and State University at Blacksburg, VA.

Accident Report

Don't take blasting caps for granted!

There has been an alarming trend developing recently involving carelessness in the handling of blasting caps. Fortunately, in the accidents and incidents described below, there has not been a serious injury—yet.

Most recently, a worker was standing in the basket of a boom lift ANFO loader, scaling the back. A piece of loose top fell, striking the detonator container that was attached to the side of the basket. The container fell to the ground and the detonators went off at impact. Fortunately, no one was nearby.

On three separate occasions blasting caps have been found in the frames of vehicles that were being serviced or repaired. In one, the cap was detonated by sand-blasting of the frame. It blew a hole in the frame, but was fortunately pointing away from the sandblaster. In another, welding of the frame detonated the cap, causing cuts to the welder's face. His eyes were spared because of his welding goggles.

In a similar situation, three workers were cutting a piece of steel with a torch outside the mill door. A blasting cap was hidden in the grass and detonated when the steel on top of it became sufficiently hot, cutting all three workers.

On at least two occasions blasting caps have been found in pockets at the laundry. (Would you want them in your home laundry where your family could be exposed?)

Blasting caps have been detonated by being run over by a train in a drift, by a clam mucking the bottom of a shaft, and by coming into contact with a hot manifold while being transported (30 of them caused some pretty bad shrapnel wounds to the worker's leg).

A report which analyzes these and other accidents involving detonators with recommendations for prevention is available from the ONRSA's Resource Center. It would make an excellent topic for a crew safety meeting. HSA

*Reprinted from the May/June 1994 issue of the Ontario [Canada] Natural Resources Safety Association's **Health & Safety Resource.***

Media and methods for training handtool safety

By Larry D. McClain, Pennsylvania Electric Company,
O & HRD Generation Training,
Maintenance Training Supervisor

Shouldn't all maintenance personnel know how to properly use their tools? After all it's their job. What's the consequences of not knowing something like the proper and safe use of tools upon the larger organization, the company? Has that ever been conveyed to the mechanic or even considered? If you haven't yet addressed these concerns, why wait for an accident to occur, medical expenses to mount, or the liability lawsuit?

It has been said "that you can't do business today like you did it yesterday, and expect to be in business tomorrow." Today, "productivity" is a buzzword in every office. It's been defined in some organizations not as working harder and longer hours but as working smarter. Working smarter means maximizing the use of available resources, whether its management programs, economics, equipment, or manpower. This doesn't occur overnight; it may require a change in the corporate culture. It means involvement from every aspect of the business by individuals not previously provided such opportunities. Working smarter then contributes to improved employee performance and overall productivity.

But then how does handtool safety training relate to productivity? One way is that all efforts directed toward heightening employees' safety consciousness are beneficial. A safe maintenance man is a smart employee. I have been involved in maintenance training for over 14 years and in that time I have observed numerous trainee reactions to various training programs. In this time I have learned that tool safety and use topic reactions, more times than not, initially reflect the trainee's experience level or attitude toward the learning process. The less experienced trainees and the trainees whose outlook upon training is that every learning experience afforded is valuable, view the topic with interest and motivation. While they may only possess this narrow limited personal view, it is sufficient motivation for those individuals. The more experienced trainees, however, may not be so motivated due to their perception of the basic, elementary nature of the topic. This creates a training challenge, to address the subject in a manner that is interesting, meaningful, satisfies specific learning objectives, and, from a broader organizational view, contributes toward satisfying the business need(s) that led to the inception of the training program. Using the right tool for the job is not the entire picture. Using the right tool as it was designed to be used, safely avoiding injury to the user and others working in the immediate vicinity, and not damaging or destroying expensive equipment is a more complete view.

Screwdrivers are not chisels! Hammers are not gasket cutters or bearing drivers! There are right tools for specific applications. Many maintenance people are impulsive by nature; they use what is available the best they can to get the job done. While these abilities are characteristics of competent maintenance workers, they often involve shortcut and dangerous techniques learned through their own past experiences. These techniques may include misusing tools and equipment or not using the proper tools for the job at all.

They have done the job so many times that these personalized procedures may have become routine for them and even acceptable to others while posing real safety hazards. Tool safety training may not be a single, stand-alone course. It may be appropriate to include it in numerous courses. One learning objective of any maintenance training program should include the selection and proper use of the appropriate tool for the job.

This places responsibilities upon the employer. The company must make the necessary tools available to the workforce and commit to, not just superficially discuss, providing meaningful job performance based training. Just as having a swimming pool doesn't make confident swimmers, or buying an automobile doesn't make a good driver, simply supplying an employee a toolbox does not make him/her a mechanic.

No matter what the job an individual is employed to perform, we all have toolboxes. Our toolboxes may contain tools much different than a mechanic but it contains the resources needed to allow us to perform our job. It may be the computer used in your office, the equipment you used to produce your latest training materials, or the new audio-visual equipment you just purchased. If you'll think of the tools in your toolbox, chances are you can remember when and how you learned to use them. The point is that no matter how routine using the tools in our toolboxes may become, some form of training enabled you to become the productive worker you are today. We may have been afforded the opportunity to personally attend a training program, learned by studying tutorial materials, or maybe some self-study course work to learn the skills to do our jobs.

Likewise, various forms of training are available today which address the topic of handtool safety. In today's business world the old accepted instructor-led type of training may not be the most beneficial or cost effective means of providing this training. But before we continue, let's agree upon an appropriate definition of training. To a non-training professional, training is commonly described in terms such as the length of a course (1 or 2 days, 3 weeks, or 4 months). But training professionals know that the length of a given program is only a minor detail to be determined by the extent and nature of the learned outcomes of that program along with numerous other business elements. Training professionals think of training as a scientific, systematic management tool. If this tool is to be used effectively, its parts must be fully understood and put to use properly. Needs analysis, job and task analysis, objective and evaluation design, courseware development, scheduling, presentation, and evaluation are all components of any sound training experience.

Training, specifically maintenance training, involves the psychomotor domain of learning. This learning addresses "motor skills" which must be performed, actually physically carried out by the trainee. This is not to be confused with either the cognitive or affective domains of learning which involve the learning of knowledge facts or the development of our personal feelings, value systems, and attitudes respectively. "Motor skill" training provides proven results when the training program directly includes the job tasks the trainee is required to perform. This may be done in a laboratory exercise and actual hands-on training or by one of several simulation means. No matter which delivery technique is employed, it must provide the relevant practice necessary to link the subject matter presentation to the evaluation process.

Training programs and/or materials may be developed by your own training organization to address handtool safety. Many suppliers of tools have information, training aids, or other training related materials available which address their specific tools, their use, as well as safety considerations. Publishers also have texts available concerning this topic which may be useful when developing your own training programs. However, today's economics may not afford us the necessary manpower or resources to fully develop our own materials. Numerous resources are available from training service suppliers in various delivery system formats which may be of value to the situation.

There are training service suppliers which will provide maintenance training for your organization, some of which you may already use and have a working relationship. Their services include instructor led programs which may be presented either at their off-site training facility or can be delivered at your site. Many such programs are job performance based and include actual hands-on experience for the trainees. Along with an instructor, trainee manuals, job aids, lab exercises, and evaluations may also be incorporated into such programs and services.

Other training service providers market entire libraries of videotape-based training programs. Some videotape programs are for viewing and discussion purposes only. Others provide a more complete training experience by supplying trainee manuals which require written responses to questions asked concerning the tape contents. While these products may serve some organization's objectives, other companies which utilize videotape recordings support them with an actual instructor. This instructor can then expand upon the content, provide immediate feedback to the trainee's inquiries, and evaluate exercises which allow the trainee to demonstrate mastery of the skills addressed. Another advantage of videotapes is that they permit the consistent demonstration of a skill or procedure from class to class, where instructors may vary the same procedure due to personal preferences, techniques, or particular groups of trainees.

Print-based materials are also available to address this topic of handtool safety training. These materials include only written lessons to be read and studied carefully. Upon completion of a lesson, the trainee completes a written evaluation which is scored either in-house by some designated individual or returned to the supplier for scoring. Results are available to both the trainee and the company and can be used to track the trainee's progress. This format may be advantageous because physically gathering a number of employees at a common location on the same day and time is difficult. Being self-paced, it possesses the capability of accommodating rotating shift work schedules of the trainee. However, guaranteeing learning outcomes through performance evaluations is not often included in this format of training.

One of the most recent training program formats to become available is that of interactive video training. This format incorporates the use of a laser video disc player interfaced to a personal computer with a touchscreen monitor. This system combines live video and audio with the capabilities of the computer to present the training. The touchscreen monitor permits active participation by the trainee throughout the learning experience. Trainees' evaluation and progress records are stored automatically by the computer. This system presents the subject matter, provides relevant practice through computer simulations, and administers the evaluation instrument associated with the given training program. Just a few years ago, these systems were thought of as "star wars," pie-in-the-sky training tools. As technology has advanced, these systems are no longer cost prohibitive for industry and in fact have been shown to be cost effective when compared to some instructor led programs. If your organization is considering programs, compare commercially available off-the-shelf materials to attempting in-house custom development.

Finally, yet another often overlooked valuable training tool associated with handtool safety is the reports which must be completed after an accident occurs. They may be company required documentation which describe the accident or insurance reports which are required by your carrier. Insurance carriers may require a full description of the accident, its cause(s), specific action required to be taken to avoid repeating occurrences of the same, as well as placement of responsibility for correction and follow up. Often these accidents must be classified as the result of an unsafe act or a mechanical defect. Either determination possesses training implications. These documents could be reviewed, with discretion, in actual training programs which address the use of the same or similar tools involved with the accident. These implications provide the necessary analysis data to justify including the handtool safety training topic in any maintenance training program in each of our organizations.

Heightening the employee's safety consciousness by providing handtool safety training opportunities is but one aspect of productivity improvement. The resulting consequences of any accident also affects productivity. Injuries resulting from handtool accidents most often involve cuts, burns, bruises, and sprains, but may become lost-time accidents keeping the employee off their job. While the nature of the majority of handtool accidents is minor, limited or light duty job assignments are often required. This detracts from the individual's performance as well as the overall department's productivity. Even if other employees are assigned the injured individual's job tasks, the efficiency and quality of their work may not be equivalent in quantity or quality as compared to the experienced employee. Productivity is then affected when trained, qualified employees are, for any reason, not performing their job. Accidents which occur result from failure to inspect, unsafe use, misuse, or abuse of tools and may be minimized through effective training efforts.

It's your decision to determine which of the handtool safety training methods or media which we discussed best meets your organization's training needs. One of my objectives was to re-establish the importance of including this topic in our training curriculums. I sincerely hope that our review of this topic as well as a look at some of the various training methods and materials available was beneficial to you. HSA

Consol's hand and finger program

By Bruce W. Blakemore, Instructor, Consolidation Coal Company, Morgantown, West Virginia

Abstract

Consol's Hand and Finger Program was developed and implemented to help protect our employees from hand and finger injuries. These types of injuries occurred all too often, therefore, the [need for its development].

After development and prior to implementation, our program was presented to our Senior Vice President, Operational Vice Presidents, and the Regional Managers. They approved the program and gave it their support. We developed an introduction video segment by our Senior Vice President and Regional Manager of Safety. The Operational Vice Presidents concluded our program with a video message.

The program encompassed risk, prevention, and perceptions as it relates to our hands and fingers.

Why do hand and finger accidents occur? What is Consol doing to protect [its employees'] hands and fingers? How can we avoid hand and finger traps that result in injuries? What can you do to prevent hand and finger injuries? These were some of the questions our program addressed.

Metacarpal gloves save hands and fingers by preventing injury or reducing the severity of injuries. Consol remains committed to zero accidents! Our hand and finger program is one of the means of achieving our goal of zero accidents.

Introduction

Consol's Hand and Finger Program was developed as a result of hand and finger injuries that were occurring in... the West Virginia [area]. The program began in the fall of 1990. Consol remains committed to the goal of zero accidents and this program is one of the avenues... to reach this goal.

I would like to [note] something we deal with everyday, especially in our occupations, but tend to forget—that is, RISK. Not only do we deal with this in our jobs, but in our personal lives as well.

Not only do we work in a high risk industry, but we greatly increase our odds of having something happen to us because we take chances—WE GAMBLE. We are all gamblers, whether it be travelling at 65 MPH in a 55 MPH zone or running a yellow light. We take a chance that it can't happen to ME. We make a choice to take a chance—we gamble, sometimes we WIN, sometimes we lose.

Prevention

The objective of this program is to identify specifically what is causing hand/finger injuries, create interest in accident prevention, and encourage commitment to improved safety performance.

We can do this by:

1. Identifying hand traps
2. Identifying unsafe acts
3. Through continued use of the Safety Action Program
4. And through greater awareness of how to prevent hand and finger injuries.

Off hand injuries

Your chance of having a hand or finger injury is greater than you think. Over 25% of all industrial accidents (20% mining) involve injuries to the hand or fingers, and many more injuries occur off the job. Ninety percent of us are right handed, and of those injured, 50% of those injuries occur to the opposite hand that is doing the work. So, let's take a look at hand and finger injuries in the northern West Virginia Region.

Why do hand and finger accidents occur?

1. Distractions: Some jobs require close attention. Accidents happen when people take their minds off of what they are doing, sometimes just for an instant.

2. Shortcuts: People get hurt when they do not follow proper procedures. They reach into an operating machine or they do not perform adequate lockouts of equipment. They do not use the right tools. The company's philosophy is: "Our work is never so urgent or important that we cannot take time to do it safely."

3. Impatience: it is not difficult to work quickly and safely at the same time. But, many injuries happen when people take risks because they are in too much of a hurry.

What we see isn't always what it is!

Some injuries happen to people who did not recognize the hazards. Most hand injuries happen to people who knew better. They knew the right way to work safely, but they still were injured. Let's take another look at those statistics in another light.

We can't calculate how many chances you take or how many near misses you've had this month. But, if we could stop everyone from taking a chance, we wouldn't have to worry about the rest of the pyramid—by eliminating chances there wouldn't be any near misses, recordables, etc.

Perceptions

Let's first look at the problem of recognizing hand and finger hazards. One of the problems in recognizing the hazards is how you perceive a situation—what you see isn't always what it is.

The classic example is of two facing silhouettes. The intervening space, in white, assumes the shape of a vase but is rarely noticed. Most of us would see just one image and not the other—but that other image that we did not perceive could be a hazard which could cause a hand or finger injury. We must see the "WHOLE PICTURE" if we want to prevent hand and finger injuries.

What consol is doing to protect workers hands and fingers

By increasing awareness of how to prevent hand and finger injuries—in other words, through preventive measures such as the development of the metacarpal glove.

Even though a glove cannot prevent hand injuries, it can lessen the severity of the accident.

This resulted from an employee suggestion on how to prevent hand and finger injuries.

Ways to avoid hand and finger injuries

But more important, we must recognize places and things that cause hand and finger injuries and eliminate them. In order for us (meaning you and the management here at your mine) to gain more awareness around our jobs, we are asking you to write down five hand traps that are in your work area and give them to your safety department.

Six ways to avoid hand injuries

1. Use your head *not* your hands to locate hazards.
2. Use the right tools and the right gloves to do the job.
3. Watch where both hands go.
4. Know where your hands have been and where they are going.
5. Cutting corners cuts hands.
6. Metacarpal gloves save hands and fingers.

Responsibility for preventing hand and finger injuries

Safety programs will continue to be established throughout the company [similar to] the one we just presented. In the final analysis, each employee must recognize his/her individual safety responsibility. You are expected to perform your work in the safest possible manner with due regard to the safety of yourself and all of your co-workers.

Safety is an integral and inseparable part of producing coal, and this attitude should be a part of our thinking on the job and off. HSA

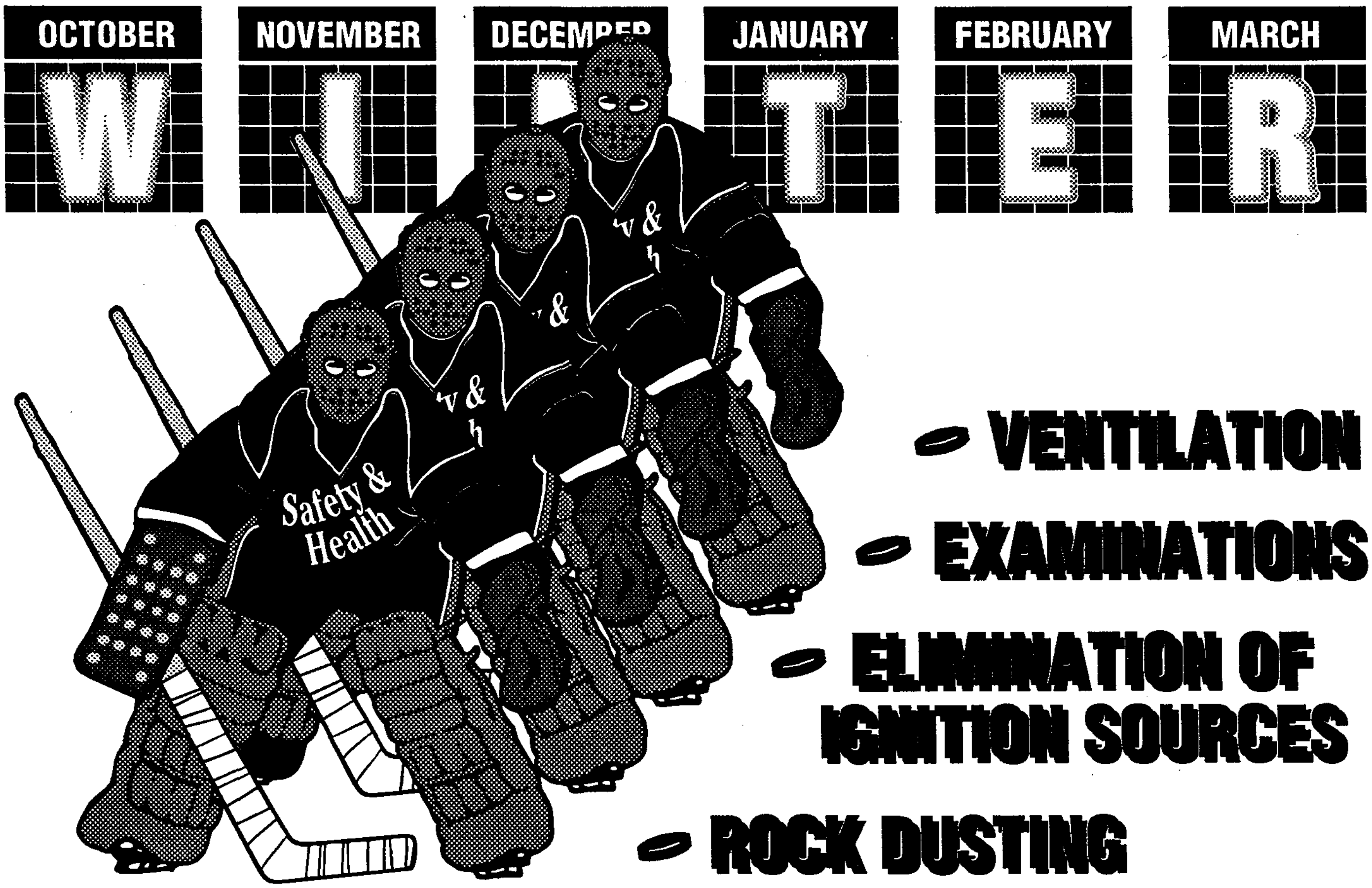
May 23, 1900; Cumnock Mine, Cumnock, N.C.; 23 killed

At 4:30 in the afternoon an explosion in the east heading of the mine cost the lives of 22 miners and the superintendent. The explosion is thought to have been caused by a broken gauze in a safety lamp. Between 40 and 50 men were in the mine at the time. Five were brought out alive from the east heading, while none of the men in the other parts of the mine were injured. All of the bodies were horribly burned, and they were recovered during the night as the mine was not damaged very much. A survivor, brought up from the east heading and resuscitated, said he heard a report like a dynamite shot and the next instant the firedamp exploded. The superintendent, who came from Pennsylvania 2 years before, was in the east heading and was killed. Twenty men were killed outright, and 3 others died after being rescued. It was thought that the gas accumulated and that one of the flame safety lamps with which the men worked became overheated or was hit, breaking the glass and gauze. Coal was mined by pick and blasted by battery. Dynamite was used because it will not explode gas. Pennsylvania men own the property; extensive improvements were made since the explosion in December 1895, and the mines had been thought safe.

The mine was not operated afterward. HSA

From the News and Observer, Raleigh, N.C., May 23, 24, 26, 1900.

WINTER ALERT
Four lines of defense



✔ A drop in barometric pressure can increase release of methane in underground coal mines. Always maintain adequate mine ventilation and make frequent checks for methane and proper air flow.

✔ Make frequent visual and sound checks of the mine roof during each shift. NEVER travel under unsupported roof.

✔ Control coal dust with frequent and liberal applications of rock dust. Maintain water sprays and other coal dust suppression devices in good working condition.

✔ Maintain and examine mine ventilation systems to ensure abandoned areas are adequately ventilated and bleeder systems are functioning properly.

✔ Know your mine's ventilation plan and escapeways. Properly maintain methane detection devices. Communicate changing mine conditions to one another during each shift and to the oncoming shift.

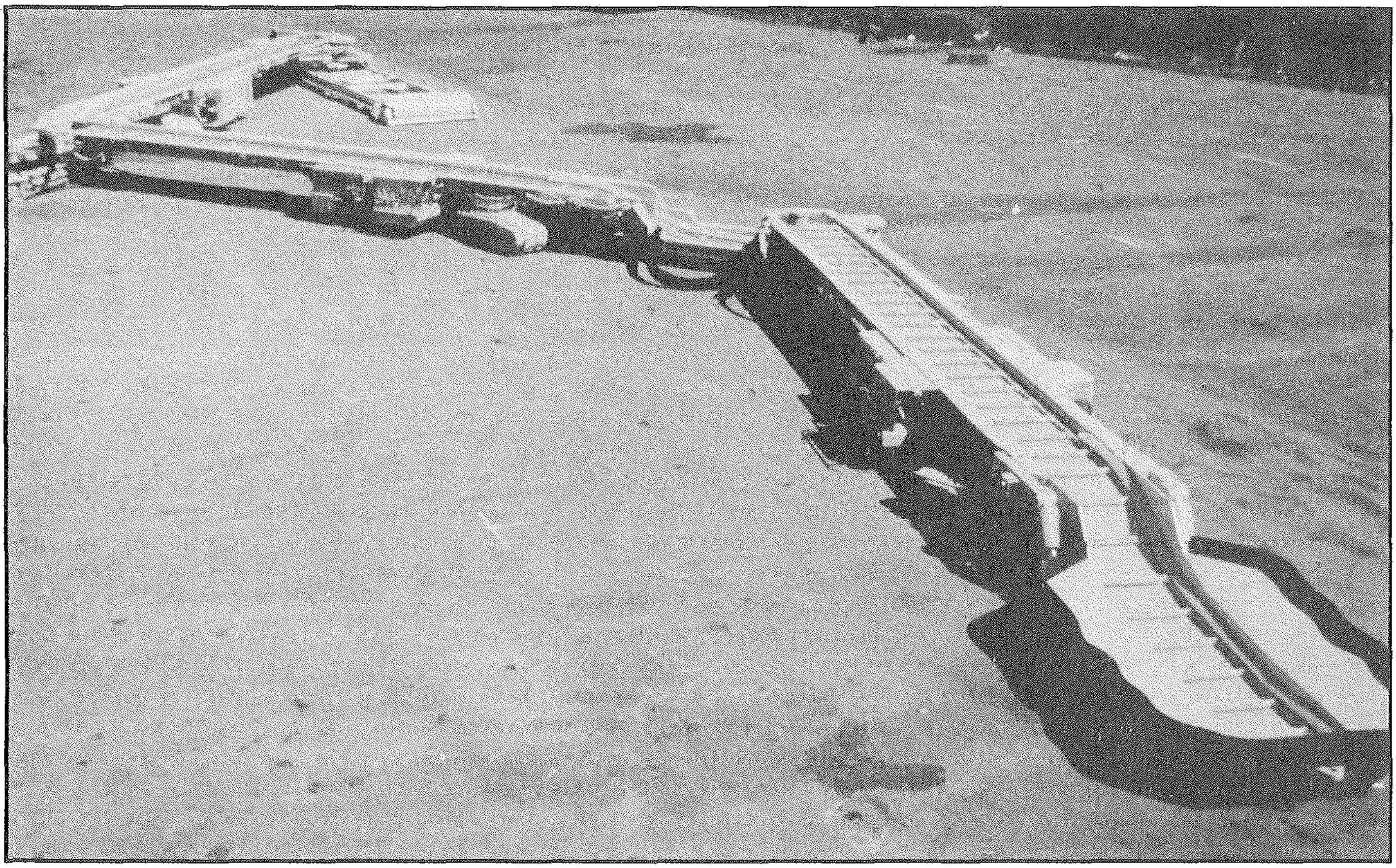
✔ NEVER smoke in an underground coal mine!

STAY ALERT! STAY ALIVE!

Continuous haulage proves a success at Continuous Mining, Inc.

Another success story from the eastern coalfields

By Gary D. Jessey, Associate Editor, COAL TODAY



Ideally, continuous mining should mean the coal is extracted from the seam by the continuous miner and removed without delays until the miner has to reset.

In practice, however, the miner has to stop while shuttle cars, ram cars, or scoops get into position to receive the coal. Valuable time and production are wasted.

About four years ago, a coal company in West Virginia, known as Continuous Mining Incorporated, decided to go with a new innovation, the continuous haulage mining system. This system consists of conveyor bridges from the miner to the beltline. Taylor Norman, the superintendent at the time, presented the idea to management who told him to go ahead, but if it didn't work, it was his problem.

Taylor looked at several different systems then chose the Fairchild Haul-Mark Continuous Haulage system.

"Under the mixture of conditions at the mine, with dips, rolls, soft bottom, low and high coal, the Fairchild Haul-Mark system was the only way to go. We have mined entry widths as narrow as 17 feet and our cross cuts were true 90 degrees. No other system could make those true 90 degree turns with those width factors." Taylor said his seam varied from 34-58 inches.

"Naturally, whenever you install something new, it takes a while to get it going right. We had been sweating through the first month when management suggested going back to buggies. I told them, 'Give me a little more time.' They did and after another two weeks, we hit our peak."

"The manufacturer of our drum miner said we would cut more coal than the Haul-Mark system could handle. They said, 'It couldn't be done.' That worried me for a while. I even thought about installing side boards, but it never happened the way they said it would. The Fairchild haulage was able to handle anything the miner dished out and then some."

I asked Taylor about maintenance. "It's better than buggies. We never lost over an hour at a time. We never replaced an electric motor, not the first one, in nearly four years. I estimate availability to be 97% plus. We use preventive maintenance, replacing parts when they are near their wear limit. Our cost per ton plummeted from as much as $0.25 per ton to $0.065 per ton. When we got the bridges, we knew nothing about them. All it takes is common sense and good coordination. I can take a man who has never operated a Haul-Mark system and, in one shift, have him trained on the last bridge."

Taylor continued to compliment the haulage system noting less down-time, low operating cost, ease in training personnel, and better visibility and communication between men.' The Fairchild Haul-Mark is a true low-vein continuous haulage system."

When asked about production, Taylor said they averaged around a quarter of a million tons per year from this low seam mine. He added, "MSHA likes the system because it's safer and can operate in the narrow entries required by today's regulations."

I could tell Taylor loved that system, but a little over six months ago, he was transferred as superintendent of another company mine in Kentucky that uses buggies. "If I had my druthers, I'd use a Fairchild bridge system. Even though we're a high-capacity, mid-seam mine, I'd like to have the Haul-Mark system. We'd run more coal than our present arrangement."

I asked a final question, "What would you do to improve it?" Taylor thought quietly for a moment, then said, "I don't see a thing that could be done to improve it."

From there, in Kentucky, I traveled to the mine in West Virginia where Taylor had set up the continuous haulage system. It was called Continuous Mining Company—an apt term. His brother, Howard Norman, is now the superintendent. He is as positive about the system as Taylor.

"We have spent more in one year on shuttle cars than three years with continuous haulage. There's no comparison. I've been around both and I'd rather have a Fairchild Haul-Mark."

Howard took me in for a tour. The mine conditions were quite varied with dips and rolls and soft bottom. I had arrived at the right time. They just started cutting a 90 degree cross cut. The miner trammed forward, turned the corner and the Haul-Mark, with its 180 degree pivoting crawlers, followed easily. The four bridge operators were close enough to communicate both verbally and visually.

As the miner began its cut, we timed it. A 20' x 40' cut in about 42" of coal took 16 minutes. The coal was conveyed from the bridge to the belt line smoothly and efficiently. In addition to its narrow frame, the crawler units are another great feature. They are able to turn 90 degrees in either direction to position the bridges, literally anywhere. It took the right angle turn easily.

Howard pointed out another feature of the Haul-Mark—its low ground bearing pressure of 15 psi. Although we were in a dry section that day, this is an important feature in a soft bottom area.

Riding out in the man-trip, Howard commented, "The bridge system has the power to move the miner or roof bolter, if necessary, in bad conditions."

It was easy to see why both Howard and his brother, Taylor, two safety conscious superintendents, are sold on this true continuous haulage system: safety, production, maintenance, and ease of operation.

I spoke with Gary Bennett, General Manager of Cumberland River Coal Company in Mingo County, West Virginia, the holding complex for the coal reserves. He remarked, "Without the Fairchild system, we would not be competitive with the low seam of coal we are mining. We are very happy with it and hope to go with two haulage units in the near future." Both he and the company president, Gerald Peacock, are sold on the Fairchild haulage system.

Continuous mining has proved a success at Continuous Mining Incorporated, thanks to the Fairchild Haul-Mark Continuous Haulage System. HSA

Reprinted from the July 1994 issue of Acquire's COAL TODAY.

Microbial conversion of coal to methane

The nature of coal mining is such that it leaves a portion of the coal underground. Each year of mining in the United States leaves the equivalent of 3 quadrillion Btu's of coal underground. This energy quality equals the current U.S. hydroelectric capacity, or approaches the total U.S. nuclear production of 4.92 quadrillion Btu's. At the current average price for natural gas, the value of this resource approaches $1.8 billion per year. In addition, the last 50 years of U.S. coal mining has left about 168 quadrillion Btu's of unrecovered coal in abandoned mines.

Bureau of Mines (USBM) researchers believe that biological conversion of coal to methane may provide an economical means of extracting energy from an otherwise lost resource. Arctech, a biotechnology company, previously discovered strains of bacteria that can convert lignite and other low-rank coals directly to methane. Higher-ranked bituminous coals, however, are more frequently mined by underground methods. The USBM and Arctech cooperated in the collection of mine water samples from higher-ranked coals. These samples were examined for bacteria that can convert higher-rank bituminous coals to methane. This project has examined mine waters from two active and seven abandoned mine sites. Waters were tested for the presence of microorganisms capable of producing methane. Thus far, samples from three of the abandoned mines have been shown to produce significant quantities of methane.

A mine inundation and explosion accident was explored under this project. A small mine in West Virginia had accidentally mined into an adjacent, flooded abandoned mine. Of particular interest was that a methane explosion occurred immediately following the inundation and that neither the old nor the new mine had a history of methane. Water samples taken from the old mine showed dissolved methane levels of O.18% in the head space above the water. Low levels of methane below the detection limits of thermistor-type methane monitors are in fact common in many non-gassy coal mines. It therefore is possible that the observed methane was residual absorbed gas from the abandoned mine. Anaerobic water samples were collected from the point of encroachment into the old mine and assayed for methane production. After 18 days of incubation, two separate samples yielded 6.7% and 1.6% methane, while controls showed no methane, proving that methanogens are present in the samples. The source of substrate for the methane, however, remains uncertain. A more detailed analysis is currently underway.

The biological conversion of coal to methane in abandoned mines offers clean energy from the Nation's large coal reserves. The process would also leave the ash and sulfur underground. Production of gas from an abandoned mine would occur over many decades, during which gas producers would maintain the old mining site. From a technical standpoint, bioextraction of methane from coal uses small quantities of energy since the reaction takes place at near ambient temperatures as opposed to conventional high temperature gasification processes. Finally, biogasification of coal is environmentally helpful and meets the President's plans for increased use of natural gas while also using the Nation's abundant coal reserves. HSA

For additional information, please contact: Jon C. Volkwein, USBM, Pittsburgh Research Center P.O. Box 18070, Pittsburgh, Pennsylvania 15236-0070, Telephone: 412-892-6689.

Reprinted from the July 1994 issue of Acquire's COAL TODAY.

MSHA names first coordinator of safety in nation's small coal mines

The Labor Department's Mine Safety and Health Administration (MSHA) has named its first coordinator of safety and health in the nation's small underground coal mines. Jesse Cole, a longtime MSHA official and currently agency district manager in the eastern Kentucky area, will assume duties on Sept. 18, 1994.

"The increased level of safety and health problems at small underground coal mines is of great concern to this agency," said J. Davitt McAteer, assistant secretary of labor for mine safety and health. "The new small mines safety coordinator will focus directly on the problems that confront the operators and miners at small mines across the country."

McAteer created the new position based, in part, on recommendations resulting from MSHA's Small Mine Summit which he convened in April. The Small Mine Summit examined the increased safety hazards at the nation's small underground coal mines, those employing 50 or fewer miners. Recent statistics reveal that small underground coal mines with fewer than 50 employees had a fatality rate about four times that of larger mines. Additionally, mines with fewer than 20 employees had a fatality rate that was six times that of larger coal mines

A panel of mine safety experts from MSHA and other coal mining states considered presentations from many facets of the mining industry and made key recommendations to McAteer on actions to address the problem at small mines. McAteer pledged at the time that "MSHA has committed to the appointment of a small mines coordinator to see that the recommendations (of the panel) are carried out."

As coordinator of small mine safety, Cole, a resident of Beckley, W.Va., will serve as MSHA's expert on all matters related to small mine safety and enforcement programs Cole will work with MSHA district managers and state mining agencies to direct the agency's overall enforcement, training and technical assistance efforts to the nation's small coal mines

In addition, Cole will also coordinate MSHA's mine emergency response activities and serve as on-site coordinator for all rescue and recovery operations in the event of a coal mine emergency.

Cole began his mining career in 1957 working in coal mines with his father. In 1969, he joined the U.S. Bureau of Mines (a part of the agency which would later evolve into MSHA) and taught many of the Federal coal mine inspectors hired following the 1968 Farmington mine disaster. After serving in increasingly responsible positions with MSHA, in September of 1990, Cole was named to his current position of district manager in MSHA's district office in Pikeville, Ky.

The small mines coordinator and staff will operate from MSHA's National Mine Health and Safety Academy in Beckley, W. Va. HSA

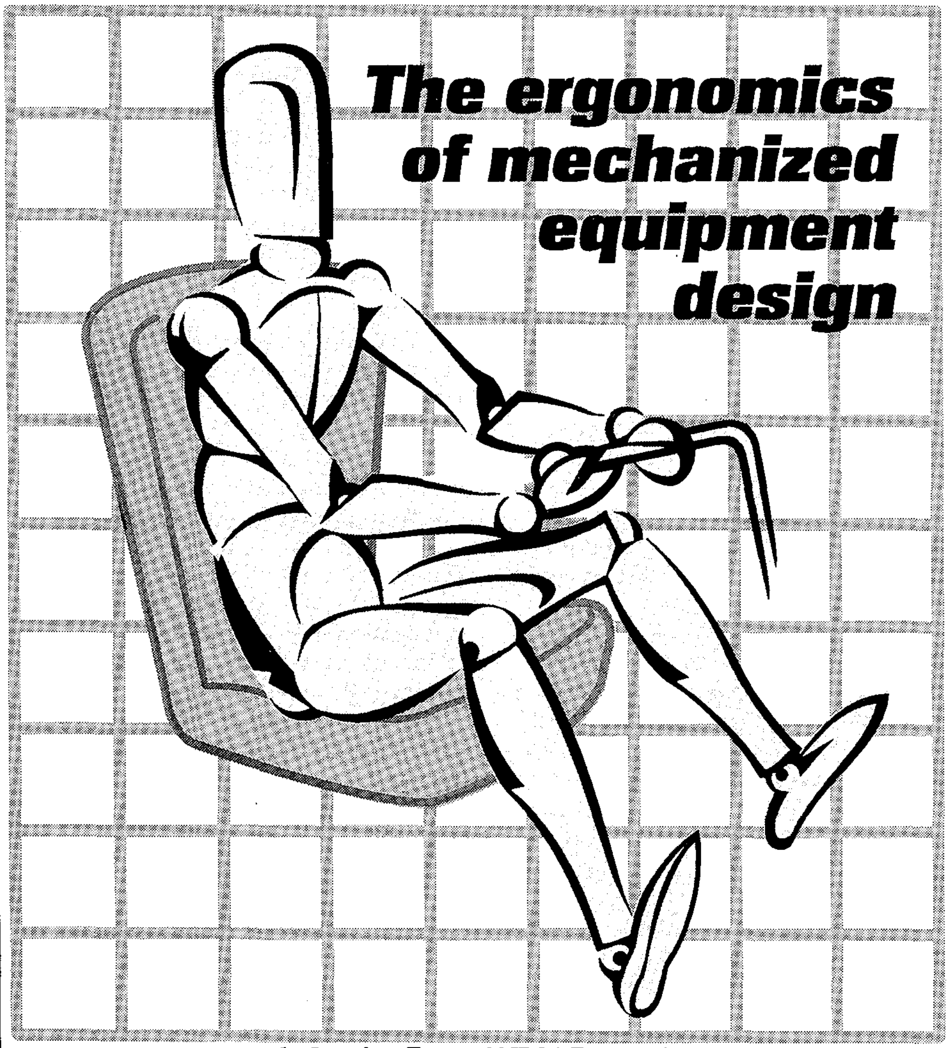
U.S. Department of Labor,
Office of Information and Public Affairs,
Philadelphia, Pa., Sept. 8, 1994.

April 21, 1912; Coil Mine, Madisonville, Ky.; 5 Killed

The mine was opened by 2 shafts 290 feet deep and because it was a new mine the workings were no more than 600 feet from the main shaft. The mine was gassy and the fan at the bottom of the airshaft was shut down when no one was in the mine. No work was done on that day, but about 6:50 p.m., 5 men were lowered to load the coal that had been shot the night before. At 7:05 p.m. the explosion severely damaged the mine and the shafts and killed the men. One was blown out of the mine. The foreman had started the fan but did not wait for the air to clear before starting to inspect the workings with an open light. HSA

From Bureau of Mines report, by E. B. Sutton

The ergonomics of mechanized equipment design



by Jonathan Tyson, ONRSA Ergonomist

In the past 15 or so years, there has been a tremendous change in the way ore is mined and trees are harvested. Manual methods using jackleg drills and chainsaws are rapidly being replaced with mechanized methods—jumbos for drilling and rock bolting and feller-bunchers for harvesting and stacking trees. While it is true that this move towards mechanization has, for the most part, reduced the overall physical demands on many workers, it has created a number of its own health and safety concerns.

Two common concerns related to the use of mechanized equipment in mining are brake system failures and fires on Load-Haul-Dump (LHD) equipment. Since these problems can have sudden and possibly catastrophic results, mining companies have put a great deal of effort into controlling these risks. This is usually accomplished by retrofitting the mechanized equipment after it has been purchased to make up for shortfalls in the original design. As you will see later, individual mining companies can still find it difficult to persuade some equipment manufacturers to improve their designs.

In the wood harvesting industries, slips and falls from equipment are one of the most common causes of operator injury. In order to reduce these injuries, a number of forest products and pulp and paper companies have established policies and procedures that require all equipment to be audited before purchase to ensure minimum safety standards. When contacted, several companies stated that the distributors or manufacturers of wood harvesting equipment are usually willing to make minor changes to the equipment at little or no cost to the purchaser.

Slips and falls, fires and brake failures are obvious safety issues. Less obvious but perhaps ultimately more serious concerns are those related to the design of the operator's compartment and how it affects both operator well-being and productivity. Past studies of both mining and wood harvesting equipment have often shown a lack of good ergonomic design in operator compartments. That is, the compartments did not meet established ergonomics criteria for items such as space, control design and layout, display and gauge design, and seating design.

The poor ergonomic design of operator compartments has contributed to back, neck and shoulder injuries, slips and falls, cumulative trauma disorders of the hand and wrist, and (due to poor visibility from the compartments) tragic accidents. In the U.S. from 1972 to 1979, 25 miners were killed as a result of accidents where inadequate visibility from the operator's cab was considered a main cause. More recently and closer to home [Canada], the Coroner's Jury from the inquest into the death of an LHD operator at an Ontario mine found that poor visibility from the operator's compartment was a contributing factor to the accident.

During the past 10 years, there have been some significant ergonomic improvements to the operator compartments of wood harvesting equipment. Unfortunately, the same cannot be said for LHDs. There are several possible explanations for this discrepancy.

First and foremost, the level of awareness of ergonomics seems to be quite high among both the manufacturers and users of wood harvesting equipment. This increased awareness may be due to evaluations of wood harvesting equipment in the 1970s and 1980s by the Forest Engineering Research Institute of Canada (FERIC). A common finding was that the productivity of the equipment was lessened by a lack of good ergonomic design and standardization of the operator controls. FERIC also did specific studies on the ergonomics of skidders, feller-bunchers and delimbers. Some common ergonomic concerns noted were: step and grab rail heights which were too high, a general lack of seat adjustability, cabs that were narrow and not high enough, sub-optimal control design, and there was a general lack of standardization of controls between similar machines.

There were exceptions to the rule. Some of the newer machines evaluated had well designed operator compartments which met most of the ergonomics criteria listed on checklists developed by both FERIC and research groups in Sweden.

As a result of this work and concerns raised by equipment users and their representative associations (such as the Canadian Pulp and Paper Association), a Canadian Standards Association Committee was formed to develop a standard for mobile forestry machines. The standard will address issues such as safety, maintainability, ergonomic design of operator compartments and standardization of controls. Originally formed in 1990, the work of the committee was delayed due to a lack of funding. Only recently has the committee been able to resume its work and they hope to have an initial document (CSAM680) published by the end of 1994.

A second reason for forestry's greater ergonomic progress is that it is easier to make changes to the size and layout of operator cabs on wood harvesting equipment because the wood lot environment does not place as many limitations on the height or width of cabs as does the underground mining environment.

Finally, feller-bunchers and harvesters are replaced more often than LHDs. According to one manufacturer, a feller-buncher may have a useful life span of five to six years before it is replaced or refitted to perform other duties. As such, a wood harvesting company replaces its equipment on a relatively regular basis, whereas a mine may run the same LHD for 20 years or more. Wood harvesting companies have thus been able to benefit from much improved ergonomics in their operator compartments. Often, this improvement has been driven by European parent companies who must adhere to strict ergonomic design criteria which have been regulated or built into new European standards. European manufacturers of LHDs must also adhere to these standards, and a review of recent literature from a Finnish manufacturer seems to show significantly improved ergonomic design of the operator's compartment. However, since there is infrequent turnover of LHD equipment in mining, very few mining companies have had the opportunity to take advantage of these improved designs. A similar review of literature on an LHD made in the U.S. indicates a much lower level of ergonomic design in the operator's compartment.

Less frequent replacement also means less equipment purchased. This reduces the amount of "consumer pressure" that individual mining companies can exert on manufacturers to improve their designs.

It is up to the consumer to demand that mechanized equipment meet certain criteria, not only from a productivity and performance point of view, but also from a maintainability, safety and ergonomic point of view. The Williams Mine seems to have gone a long way in this regard. A paper presented at ONRSA's 1994 *Mining Health and Safety Conference* (available from our Resource Library) describes their determined (and initially futile) efforts to obtain the co-operation of equipment manufacturers. That determination is demonstrated by the fact that they shipped new LHDs out of province to be stripped and essentially rebuilt from the frame up. Since then, they have had more success pressuring a supplier to provide LHDs with modified exhaust and engine cooling systems that improve the operator's working conditions.

It is only through such consumer pressure that manufacturers will make changes to their designs. Individual companies and industry associations need to set minimum safety, ergonomic, productivity and maintainability design standards and then seek out the equipment manufacturers who best meet these requirements.

In the near future, a significant overhaul of the Canadian standard (CSAM424.2-M90) for underground mining equipment is required. The impetus for this overhaul should come from the Ontario Mining Association, in conjunction with the Mining Association of Canada and individual mining companies. The ergonomic criteria that should be included in the standard are readily available from the International Standards Organization (ISO), the European Standards Association (CEN) and the Society for Automotive Engineers.

It should be noted that tools currently exist to evaluate the ergonomics of operator compartments. For wood harvesting equipment, FERIC has published a checklist that can be used to evaluate the ergonomics of operator compartments. Similar checklists have been published by the British Columbia Research Corporation and by the National Institute of Occupational Health in Sweden. While not specifically designed for mining equipment, if applied carefully, these checklists could be used to evaluate the operator compartments of a variety of underground and surface mining equipment. Information on how to obtain copies of these checklists is available by contacting the author.

In conclusion, in order to minimize accidents and injuries related to mechanized equipment and to maximize productivity, the match between the operator and the operator compartment must be optimized. This optimization will only be achieved when manufacturers of mechanized equipment design operator compartments to meet both the physical and psychological needs of the operators, i.e., design using ergonomic criteria. Users of mechanized equipment need to insist that ergonomics is included in operator compartment designs from the very beginning. Initially, the cost of equipment may increase; but these increased costs will be more than offset by higher productivity, lower rates of operator injury and discomfort, and reduced maintenance time. HSA

Reprinted from the September/October 1994 issue of the Ontario [Canada] ***Health & Safety Resource.***

Holmes Safety Association Monthly safety topic

Fatal machinery accident

GENERAL INFORMATION: A 54-year old mechanic, with 17 years of mining experience, was fatally injured when the left front tire he was installing on a pan scraper fell and pinned him to the ground.

The mine produces coal from the Middle Kittanning and Lower Freeport coal seams. Each seam averages 18 to 28 inches in thickness. The mine consists of seven open pits and one preparation plant. The mine employs 33 miners on two production shifts 5 days a week and produces 680 tons of coal daily. Dozers, drills, front-end loaders, pan/scraper, rock trucks, and draglines are used during mining operations. Haulage trucks transport the coal to the preparation plant to be processed.

DESCRIPTION OF ACCIDENT: The victim arrived at the 009 pit area with the company service truck at 5:50 a.m. to replenish the anti-freeze in the Lima 2400 dragline coolant system. The victim and the foreman discussed the completion of repairs to the Wabco 333 FT pan scraper braking system. These repairs had been started on June 29, 1994, as a result of a citation issued because of inadequate brakes.

The dozer operator began his shift at 6:00 a.m. and was instructed by the foreman to finish grading a roadway and then assist the victim with the repairs to the scraper. The victim and the dozer operator met at the scraper at approximately 6:30 a.m. and completed connecting several brake oil lines. The victim started the scraper engine and checked the repairs to the brake system. Satisfied with the repairs, the victim turned off the engine and exited the machine. He moved the service truck next to the scraper and then positioned the boom crane hoist rope directly over the tire/rim assembly, which was lying flat on the ground. A Ford F-7000 series truck chassis was being used as a service/maintenance-type vehicle. An Auto Crane Company 8005 H hydraulic operated crane equipped with a remote control (umbilical cord) was mounted to the truck. The boom measured 13 feet with a 30 degree angle and was rated to provide a lift capacity of 4,135 to 4,840 pounds. The tire/rim assembly measured 93 inches diameter by 36 inches tread width with an estimated total weight of 3,018 pounds (the tire manufacturer's size rating is 35.5 x 39 with an E-3 tread rating). He connected the hook from the crane hoist rope to the rim and raised the tire into the upright position. He then disconnected the hook and obtained two 3/8-inch chains from the service truck. The victim and the dozer operator attached one end of each chain together and wrapped them around the circumference of the tire. He connected the other ends of the two chains together, and attached the crane hoist rope hook at this point using the remote control to operate the hoist. Excess slack was removed from the connected chains until about 10 inches of chain was left over the top of the tire. The tire was raised and moved into position near the left wheel hub. According to the dozer operator, the victim noticed the top of the chain was close to, but away from, the outer edge of the left front fender. The victim handed the crane remote control to the dozer operator, who was standing to the right of the raised tire. He stepped in front of the raised tire, placed his two hands on the tire assembly and pushed the tire towards the hub, trying to align the rim with the hub. The dozer operator heard the sound of metal against metal as the top of the chain struck against the fender. The combined action of the victim pushing the tire assembly and contact of the chain against the fender caused the tire to be dislodged from the lifting chain. The victim tried to run; but the tire struck him knocking him to the ground, coming to rest on his lower back and legs.

The crane remote control was knocked out of the dozer operator's hand by the falling tire. He recovered the remote control, lowered the crane boom and attached the hoist rope hook to the tire rim. He raised the tire off the victim and lowered it to the ground next to the wheel hub. The dozer operator checked the victim's condition and determined he was breathing. He also spoke to the victim and received a verbal response. The dozer operator called the base station on the service truck radio and informed the base radio operator what had happened and requested medical help. He returned to the victim and told him that he was going for additional help. The dozer operator ran to the work area of a dragline and dozer which was approximately 500 feet away and informed the job foreman/dozer operator of the accident. They went to the scene of the accident and moved the service truck out of the way. The job foreman/dozer operator left to obtain first-aid materials. When he returned with the first-aid materials, they attended to the victim until the emergency vehicle and the ambulance arrived at 8:07 a.m. A Med-Star Life Flight helicopter arrived on the scene at 8:29 a.m. The victim was transported to the hospital where he died at 11:35 p.m.

CONCLUSION: The accident occurred because the mine operator failed to provide a proper means or device suitable for lifting and holding large diameter tire/rim assemblies for mounting and removal purposes. A contributing factor was the mine operator's failure to have established safe work procedures for the installation/removal of tire/rim assemblies associated with the types of mobile equipment being used at this mine.

HSA

When cold and water meet, hypothermia is close behind

And it plays no favorites. Careless rescuers often can become victims.

As cold weather approaches, it's time to remember the special concerns that drop in along with falling temperatures.

We will look at the way cold affects a patient's ability to respond to instructions and how it affects the rescuer, individually and as part of a team.

Hypothermia is a very important and often-overlooked piece of the emergency response puzzle. The human body operates most effectively in a very narrow temperature range. In some cases, the body will function well outside of its normal range, enabling many people to last through conditions they would not normally survive.

We will not discuss the body's temperature as it relates to the thermometer. Few ambulance units around the country carry the proper hypothermia thermometers, and rectal temperatures are tough to obtain in the field or in the heat of a rescue. Let's concentrate on how our patients become hypothermic, how we as rescuers can become hypothermic, and how cold temperatures influence the overall mission.

Light switches

Hypothermia is a general cooling of the body core. It is important to know that it is possible to become hypothermic slowly. This type, chronic hypothermia, is also referred to as "subacute" in ordinarily healthy people. Hypothermia that develops quickly is known as acute hypothermia.

The two forms can be compared to electric light switches. Chronic hypothermia is like slowly turning off the light over the dining room table with the dimmer switch. In chronic hypothermia, the body becomes "dirty," as the decrease in circulation does not allow oxygen and nutrients in and does not allow CO_2 and waste products out. This causes damage at the cellular level and is very difficult to manage.

Acute hypothermia is like turning off a normal light switch—the light is on one moment and off the next. Relatively speaking, the body is "turned off' in a clean slate. There may be oxygen and nutrients in the cells that, if given the chance, can be used to resuscitate the body.

How do people become hypothermic? Most often, they are not prepared for the environment. As much as 50% of the body's generated heat can be lost through the head if it is not properly covered in 40°F weather.

The rate of general body cooling significantly increases from wind and/or water exposure. The body can easily lose heat 25 times faster when wet or immersed than when it is dry. This is unfortunate since fires, inclement weather and most rescues involve water. Water is among the most difficult elements nature has to insulate against effectively. More subtle contributors to hypothermia are respiration (cold air is introduced directly into the lungs because victims tend to breath through their mouths instead of their noses), drugs and alcohol, or a chronic medical condition that impairs respiration or circulation.

Perspiration and respiration also contribute to heat loss and dehydration. Dehydration then contributes to hypothermia by causing the blood to thicken, impairing the body's ability to oxygenate and reheat the cells as it passes through the core.

Chronic hypothermia decreases the patient's ability to aid in his or her rescue. A hypothermic, conscious person can be uncooperative, agitated or even angry, apparently unwilling to assist you. An altered mental state is one of the first signs of hypothermia. The change may be subtle. The patient may appear apathetic, disinterested and uncoordinated, or make inappropriate remarks.

Many rescuers have been frustrated by victims who will not cooperate because they cannot comprehend instructions.

Another obstacle to overcome is the

victim's inability to perform fine motor skills. When asked to grasp or hold an object, the victim won't hold with his or her hands but may hook with an elbow. This is an indicator that assistance is necessary.

Also, many rescue leaders experience frustration when crew members fall victim to the cold. Otherwise energetic and efficient team members cannot function effectively after continued exposure to the cold during a rescue if not properly prepared.

An irritable heart

Acute hypothermia, sometimes called immersion hypothermia, is frequently caused by sudden immersion into water colder than 70°F. This patient often seems to have suffered cardiac arrest and appears to be cold and dead. However, there are documented cases where this type of victim has survived, a phenomenon we call "Cold Water Near Drowning."

Hope is not lost until the patient has been rewarmed and is dead. In a near drowning with submersion time of 60 minutes or less, every effort should be made to resuscitate the patient.

Near drowning patients benefit most from gentle handling. This single fact can't be overemphasized. A cold heart is an irritable heart. Every effort should be made to prevent fibrillation. Handling and treatment of the patient should be part of a rescue team's plan. How will the patient be gently removed from the water's edge to the waiting ambulance? How will the patient be carried up the incline to the roadway? The job is not done until the patient is in the ambulance. Cardiopulmonary resuscitation, endotracheal intubation, drug therapy and other treatment should be performed in accordance with the local standard of care. Know the standard in your community.

A less common, but still important, form of acute hypothermia is suffered by the patient who has been immersed in or covered with supercooled solvents or gasoline. These products have a much lower freezing point than water and can produce profound body cooling. The patient should be removed from the hazard, cleansed in warm water between 104° and 108°F and rewarmed as soon as possible.

Cold comfort

Chronic hypothermia is among the most overlooked problems in the rescue field. Although rescue personnel are normally physically fit and in good health, they have a strong sense of duty and are reluctant to admit to being cold.

Everyone from the incident commander to the firefighter on the line is at risk. As with a patient, this condition often manifests itself as apathy, fatigue, poor decision-making or agitation. Consider the engineer who has a difficult time handling a hose cap on the pump panel or the incident commander who is slow to make a simple decision.

Any member of the rescue team can become hypothermic if he or she does not prepare for the elements. For example, standard structural firefighting gloves offer protection from heat and minor injury. When wet, they contribute to the loss of dexterity that may decrease the rescuer's effectiveness. Loss of dexterity increases the amount of time needed to accomplish a job. It may also cause injury to the rescuer or further harm to the patient.

Most rescue clothing is inherently warm, until it is soaking wet. Watch for the firefighter who stops shivering without being warmed. Exhausting work leads to fatigue, dehydration and shortage of energy, all of which contribute to hypothermia. All of these factors should be addressed by a comprehensive plan and active rehabilitative sector.

Be prepared

Now that we have refreshed ourselves on hypothermia, we should discuss real solutions to the problem. When dealing with victims of acute hypothermia, always approach the rescue with the knowledge that a team member may have to be committed to the water. Consider the rescue a job well done if you do not have to send a rescuer into the water, but always think ahead to alternative options. Even a mildly hypothermic patient might not have the mental ability or the manual strength and dexterity to assist in his or her own rescue.

Let's face this cold weather season prepared to take care of our own. First, take a new look at your response area. If there are water and/or ice hazards, equip your team with the proper training and equipment. Don't ask members of the rescue team to act, and act they will, without the proper tools for the job. As individuals and managers, prepare for the weather by following these simple rules:

1) Be prepared to stay warm and dry for longer than your tour of duty.
2) Have access to nutritious food that contains carbohydrates for quick energy during strenuous work. Eat small amounts often.
3) Keep fluid intake up. Carry a small water container in your coat pocket.
4) Keep dry clothes nearby (dry gloves, hat, socks as a minimum). Dress in layers.
5) Stay sheltered from the wind. Use personal wind barriers and shelter the work area from the wind whenever possible.
6) Do not overexert yourself. Don't stay in the game until you are injured. Know your limits and the limits of your teammates. As a team, make it OK to ask for rest.
7) Stay fit and well-rested.
8) Learn to recognize hypothermia in its early stages. Expend your energy toward prevention through planning. Stay ahead of the game and stay warm.
9) Use all the resources at your disposal. Know your community's standard of care as it relates to not only hypothermia but frostbite and other cold-related injuries. Once prepared, you will recognize these conditions and be more effective as a rescue community. HSA

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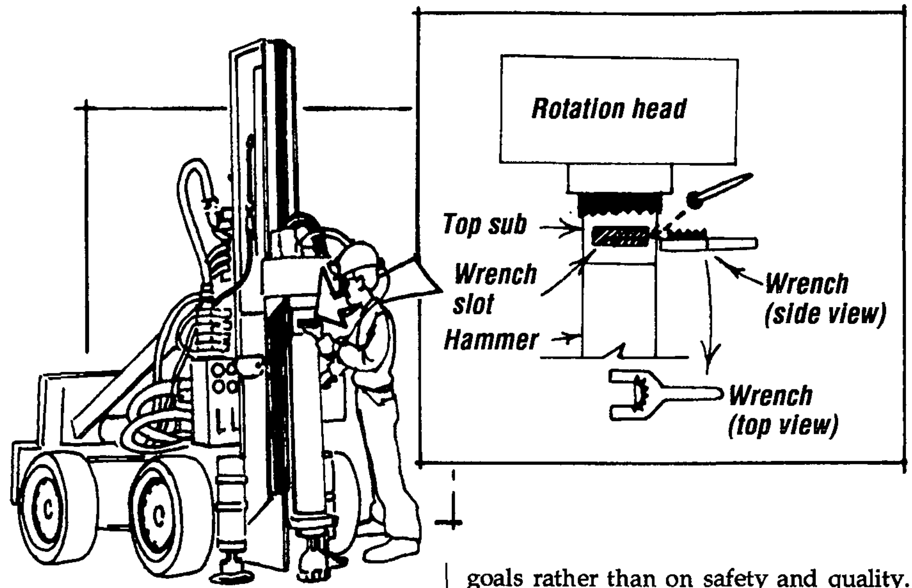
Work, Kathy, RN and Kushner, Jon, EMT-P; MedDIVE (Dive Rescue International; Fort Collins, Colo. 1992)

Michael Bielmaier, NREMT-P, is director of education at Dive Rescue International, a Fort Collins, Colo., company that instructs more than 10,000 water-rescue professionals each year. He is a member of the Larimer County (Colo.) dive rescue team and a contributing author of the textbook MedDIVE, a guide to emergency treatment of diving injuries. Before joining Dive Rescue, Bielmaier was operations manager of EmergiCare Paramedics, Rapid City, S.D., and a member of the Rapid City Fire Department.

Reprinted from the November/December 1993 issue of ***Industrial Fire Chief.***

Accident Report

Eight-inch spike punctures worker's chest



An in-the-hole driller narrowly escaped death after an eight-inch Ardox nail was driven into his chest for nearly its full length.

The victim had completed drilling a hole and had removed the rods. He attempted to remove the drill bit from the hammer using a spline wrench. The top of the drill hammer was badly worn and the wrench kept slipping on it. The victim therefore jammed a nail between the hammer and the wrench to get a tighter fit. When torque was applied to the drill string, the nail was forcefully ejected and entered the victim's chest. It pierced his lung but fortunately missed his heart and major arteries.

The immediate causes of this accident are obviously using improper tools for the job (the nail) and using defective tools or equipment (the worn drill hammer).

The underlying causes, in Loss Control terms, are "improper motivation" and "inadequate tools or equipment." In everyday terms, they might be called "good enough" and "make do." The maintenance department thought that the drill hammer was "good enough" to send underground. The worker thought it was "good enough" to use. When it turned out that it wasn't, he thought he could "make do" with what was readily at hand (the nail) to rectify the problem.

There are many reasons why such attitudes might exist in our workplaces: perhaps they are recognized but tolerated by management; perhaps there's too much pressure to get the job done quickly; perhaps incentive systems are based solely on production goals rather than on safety and quality.

Whatever the reasons, it is important that everyone, from CEO to worker, realizes that in the long run short cuts cost rather than save; and that "good enough" never really is. Safety, quality, and productivity are inseparable—they all result from doing the job right, first time, every time. HSA

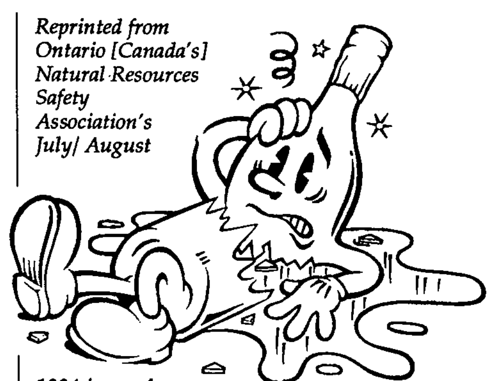
*Reprinted from Ontario [Canada's] Natural Resource Safety Association's July/August 1994 issue of **Health & Safety Resource.***

Good news and bad news about booze

Which do you want first? OK, the bad news. Alcohol prematurely ages your brain. A U.S. study found that in alcoholic men there was up to a 20% decrease in the rate of brain metabolism—the way sugar was used by the brain—compared to nonalcoholics. Alcoholics in their early '30s had brains that resembled those of 50-year olds.

Now for the good news. Another U.S. study found that persons who have one to three drinks a day cut their risk of heart attack in half compared to non-drinkers. Alcohol apparently increases the amount of HDL cholesterol in the blood. HDL is the good cholesterol that prevents LDL (bad) cholesterol from building up as plaque in your arteries. Drinking more than three drinks a day does not reduce the risk any further.

Whether the benefits of alcohol outweigh the risks (which include liver disease as well as aged brains) is something you should obviously talk over with your doctor. Moderation, as in most things, is probably the key. HSA



*Reprinted from Ontario [Canada's] Natural Resources Safety Association's July/ August 1994 issue of **Health & Safety Resource.***

Seminar on improving safety at small underground mines to be held in Charleston, West Virginia

On Wednesday, December 7th, the U.S. Bureau of Mines will be conducting a free technology Transfer Seminar at the Ramada Inn in South Charleston, WV. Registration will begin at 8:00 am. The seminar will run from 8:30 am to 3:00 pm.

The topics to be discussed include: (1) preventing back injuries through job redesign, (2) easy to construct materials handling devices, (3) ground control during pillar extraction, (4) training exercise on machine guarding requirements, (5) hazards associated with roof bolting, (6) assessing safety in extended cut mining sections, and (7) developing safety programs for small mines. Attendees will receive a proceedings containing the papers prepared for the seminar. For further information regarding the seminar, contact: Jacquie Jansky at the U.S. Bureau of Mines (412) 892-6615. HSA

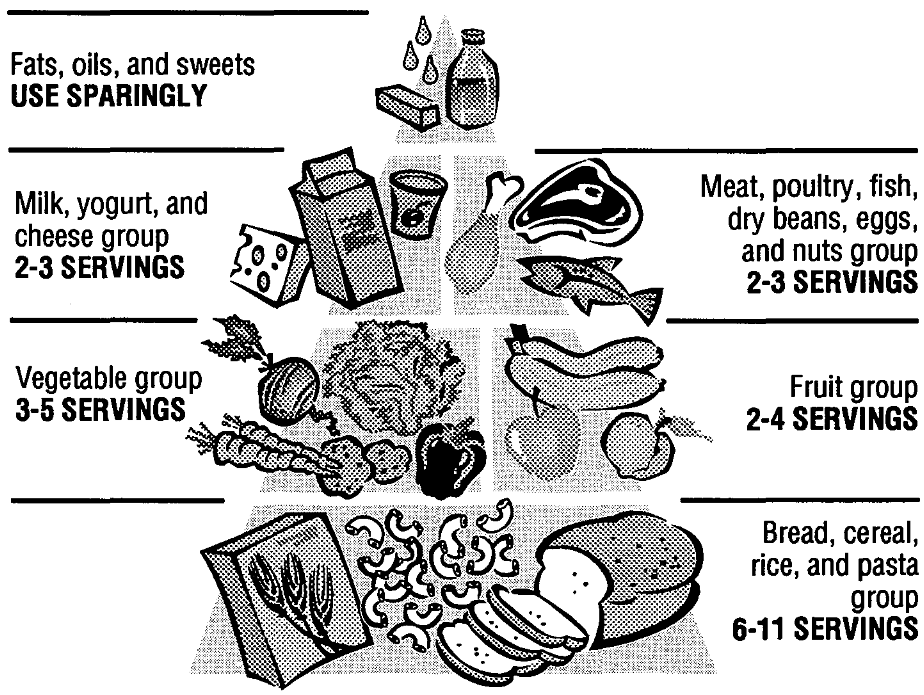
New food pyramid

Remember the four basic food groups essential for a healthy diet? Don't worry if you can't--they're obsolete now. The U.S. Department of Agriculture has created a new food pyramid designed to help us understand the essential foods we need to eat to get the U.S. recommended daily allowance of essential nutrients.

As experts have increased their knowledge of the impact of nutrition on human health, the food groups have shifted and changed. Years of research indicate that a healthy diet should be low in fat and sodium, moderate in protein, and high in fiber and complex carbohydrates. One does not necessarily have to decrease the amount of food consumed during the day, as long as the types of food eaten are monitored. The original four food groups have increased to six.

Arranged in a pyramid shape, the food groups at the bottom of the pyramid should be consumed the most. The bottom tier is also the largest group of foods. The higher the group sits on the pyramid, the less one has to eat from that group. This does not mean, however, that these foods are not as good for you as those on the bottom. It simply means that fewer servings are required to obtain the nutrients they supply.

Each category of the pyramid is broken down into a range of servings. The number of servings an individual should consume depends upon the person's age, sex, size, and level of physical activity. An older woman who does not get much exercise, for example, should eat the smaller number of recommended servings from each group. A teenage male athlete, on the other hand, should consume the larger number of servings.



There is no need to eat an item from each food group at every meal. The important point is to get all of the recommended nutrients in one day. There is no harm, therefore, in having a meal composed of nothing but grains and vegetables, as long as foods from the other categories are eaten at some point during the day. Remember that foods in one group cannot replace those in another, and that no one group is more important than another. You need foods from all the groups to have a balanced diet. HSA

Reprinted from the Spring 1994 issue of Silver Spring, Maryland's Holy Cross Hospital's Cross Currents.

Do I use the ice pack or the heating pad?

You've pulled a muscle in your leg, or that lower back pain is back yet again. What's the first thing you do? Get the heating pad, or crawl into a nice hot bath? Wrong! Apply the ice.

According to the University of California at Berkeley *Wellness Letter*, "Icing is simply the most effective, safest and cheapest form of treatment." Ice acts as a local anesthetic by reducing the impulses of pain receptors. Cooling limits tissue damage and speeds healing by reducing blood flow, muscle spasm and inflammation in the affected tissues.

Ice should be applied as soon as possible after the injury and every two waking hours for the next two or three days. Use soft cooling packs, a bag of frozen peas or something else that conforms to your body shape. To prevent damage to skin and nerves, the ice or ice pack should not be placed directly on bare skin, and the application should never exceed 20 minutes. This is especially important for elbows and knees where nerves are closer to the surface.

Does this mean that you should toss away the old heating pad? Not really. Heat can still play a useful role by increasing blood flow to the affected area. This is harmful immediately after the injury; but after icing has reduced the swelling, the increased blood flow promotes healing by helping to remove waste products from the injured area. Heat also eases pain, relaxes muscles and reduces joint stiffness. Applications should be for 20 to 30 minutes, two or three times a day, and should not be too hot (don't use the high setting on the heating pad). HSA

*Reprinted from the September/October 1994 issue of the Ontario [Canada] **Health & Safety Resource**.*

Home hearing protection tips

If you work in a noisy environment, you may be aware of the importance of on the job hearing protection. But, what many workers fail to realize is that safe noise exposure limits don't stop when they punch out of work. The best way to protect your hearing on the job is to follow your company's hearing conservation program and to *use* the hearing protectors your employer provides. To protect your hearing off the job, recognize potential hazards and use ear plugs or muffs when operating loud appliances or tools. "Hear care" means protecting your hearing for life.

Home hearing hazards

Many common household appliances expose you to excessive noise: vacuum cleaners, dishwashers, garbage disposals, trash compactors, even a noisy blender or mixer. The home workshop can also contain hearing hazards: saws, drills, and other power equipment. Tools like lawn mowers, leaf or snow blowers, and hedge trimmers can also expose you to excess noise. Keep a pair of ear plugs at home and use them when operating noisy tools or appliances.

Recreational hearing hazards

Perhaps the most common recreational hearing hazard is listening to overly loud music. The problem is compounded if you listen to loud music through earphones. To protect your hearing, turn down the volume. Recreational vehicles—motor boats, snowmobiles, motorcycles—can have very loud engines. When operating these vehicles, be sure to wear ear plugs or muffs. And while hearing loss does result from excess noise exposure over a period of time, a single exposure to a very loud noise—like gunfire—can cause permanent hearing loss. *Always* use hearing protectors while hunting or target shooting.

Hear today... and tomorrow

The best way to protect against hearing loss in the future is to protect your hearing today and every day. Follow your company's hearing conservation program, and use hearing protection for off-the-job hearing hazards, too. When purchasing new appliances, tools, or equipment, select noise-reduced models. A little safety sense can help save one of your most valuable senses—your hearing. HSA

*Reprinted from the 1988 edition of Parlay International's **Personal Safety & Health**.*

Possible link between silica and cancers

The June issue of the *Journal of Occupational Medicine* reports that a Finnish study of 811 silicosis cases discovered a link between silica and both lung and skin cancers. The patients suffering from diseases related to silica exposure had a cancer rate 1.7 times greater than the general population. Mining and quarrying, with their exposure to silica in rock, were among the occupations with the higher rates.

Researchers claim that there is a direct causal link between silicosis and lung cancer, and suggest that the excess skin cancers may be the result of an immune system that has been depressed by silicosis, thereby reducing the body's defenses to UV radiation. HSA

*Reprinted from the September/October 1994 issue of the Ontario [Canada] **Health & Safety Resource**.*

Outstanding safety achievements recognized with Sentinels of Safety awards

Fifty-nine mining operations under the jurisdiction of the Mine Safety and Health Administration (MSHA), North Central District, were recently recognized for working all of 1993 without experiencing a single day lost because of an injury. Each operation received a Sentinels of Safety Certificate of Achievement in Safety.

Award winners:

Illinois:

Vulcan Materials, Midwest Division: Kankakee Main and Fine Grind; Decatur Plant; Crystal Lake

Material Service Corporation: Indian Point Quarry; Central Illinois Stone; Fairmount Quarry; Dundee Sand and Gravel; Morris Sand and Gravel

Ozark-Mahoning Company: Minerva No. 1 Mine; Denton Mine
Meyer Material Company, West Pit
American Colloid Company, Inc.
Feltes Sand and Gravel Company, Elburn Pit
Road Materials Corporation, East Dundee Pit
Joliet Sand and Gravel Company, Rockdale Quarry
Wedron Silica Company, Wedron Plant
Charleston Stone Company
Elmer Larson, Inc., Sears Limestone Quarry and Mill

Indiana:

United States Gypsum Company, Shoals Mine
Martin Marietta Aggregates, Kentucky Avenue Mine and Mill
Vulcan Materials Company, Lafayette Quarry
U.S. Aggregates, Inc.
Lehigh Portland Cement Company, Mitchell Plant
Evansville Materials, Inc., Rockport Plant
Irving Brothers Gravel Company, Inc.
Mulzer Crushed Stone, Inc., Cape Sandy #1
Stoneco, Inc., Ft. Wayne Plant
Liter's Quarry of Indiana, Inc., Cooper's Lane

Iowa:

Schildberg Construction Company, Inc.: Plant #2; Plant #5; Stripping; Stripping #2
Wendling Quarries, Inc.: Portable Crushing Plant #1; Marion Quarry #1; Moscow Quarry
Kaser Corporation: Durham Mine and Mill; Sully Mine and Mill
Northern Gravel Company Plant and Dredge
United States Gypsum Company, Sperry Mine
K. H. Buttler Construction, Portable Crusher #1
The River Products Company, Inc., Conklin Quarry and Mill

Michigan:

Londontown, Inc., London Aggregate
National Gypsum Company, Tawas Quarry
United States Gypsum Company, Alabaster Quarry
Holloway Sand and Gravel Company, Inc., Pioneer #2
Lafarge Corporation, Great Lakes Region, Alpena Plant

Minnesota:

William Mueller and Sons, Inc., Mueller Pit and Mill
Unimin Corporation, Kasota Pit and Plant
Hansen Gravel, Inc.
Edward Kraemer and Sons, Inc., Burnsville Quarry

Ohio:

Mecco, Inc.
The Belden Brick Company, Sugarcreek Operations
Baker Sand, Inc., Baker Pit and Mill
J.P. Sand and Gravel Company
Van Wey Sand and Gravel, Inc.
Rupp Construction, Inc.
The France Stone Company, Flat Rock Stone Quarry
Union Aggregates Company

Wisconsin:

Flambeau Mining Company, Flambeau Mine

The purpose of the annual Sentinels of Safety Award Program is to recognize achievement of outstanding safety records, to stimulate greater interest in safety, and to encourage development of more effective accident prevention programs in the mining industry. The program is co-sponsored by MSHA and the American Mining Congress. HSA

THE LAST WORD...

"Whenever you find humor, you find pathos close by his side." — Edwin Percy Whipple

"Good humor isn't a trait of character, it is an art which requires practice."— David Seabury

"There are very few good judges of humor, and they don't agree."— Josh Billings

"Men will confess to treason, murder, arson, false teeth, or a wig. How many of them will own up to a lack of humor?"— Frank Moore Colby

"If I had no sense of humor, I would long ago have committed suicide."— Mahatma Gandhi

"If I studied all my life, I couldn't think up half the number of funny things passed in one session of congress."— Will Rogers

"A man isn't poor if he can still laugh."— Raymond Hitchcock

"Judge of a jest when you have done laughing."— William Lloyd

"Jesting is often only indigence of intellect."— Jean de La Bruyère

"Many a true word is spoken in jest."— English Proverb

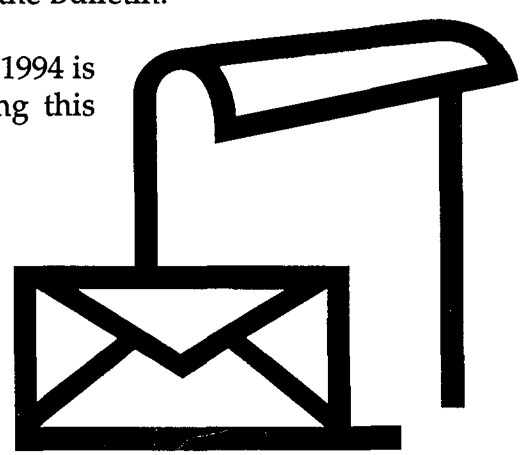
"Jests that give pains are no jests."— Miguel de Cervantes

"The jest loses its point when he who makes it is the first to laugh."— Johann von Schiller

"The most conservative persons I ever met are college undergraduates. The radicals are the men past middle life."— Woodrow Wilson

NOTICE: We welcome any materials that you submit to the Holmes Safety Association Bulletin. We cannot guarantee that they will be published, but if they are, we will list the contributor(s). Please let us know what you would like to see more of, or less of, in the Bulletin.

REMINDER: The District Council Safety Competition for 1994 is underway—please remember that if you are participating this year, you need to mail your quarterly report to:



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