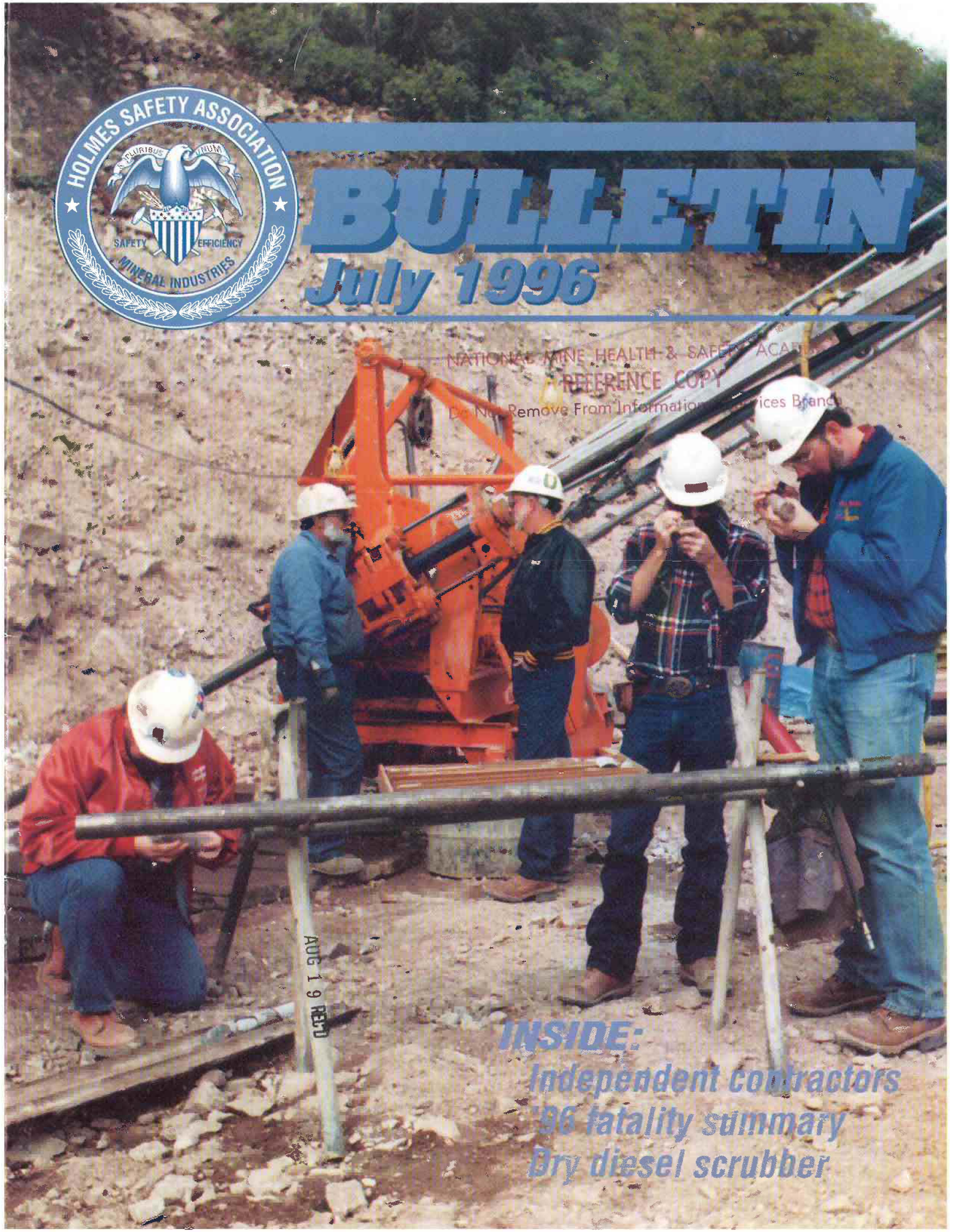


BULLETIN

July 1996

INSIDE:

- Independent contractors
- '96 fatality summary
- Dry diesel scrubber

HSA Bulletin *July 1996*

contents:

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

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

THIS MONTH'S COVER: Once again, thanks to H.L. Boling of Phelps Dodge Morenci, Inc., for this photo of "geologists undertaking geologic mapping, walking over the outcroppings, noting rock types, ore minerals and the thickness and orientation of veins and faults. Exploration drilling then confirms the location of the ore body."

KEEP US IN CIRCULATION
PASS US ALONG

Independent contractor employment and accident trends in metal/nonmetal mining

By Barbara Fotta, Training research specialist, and Lynn Rethi, Research methodologist, U.S. Department of Energy, Pittsburgh Research Center, Pittsburgh, PA.

Within the Mine Safety and Health Administration's (MSHA's) classification of metal/nonmetal (M/NM) mining, the number of independent contractor[1] employees has increased significantly in recent years. In 1985 independent contractor employee hours reported to MSHA accounted for 4.5% of all M/NM mining employee hours (excluding office workers); by 1994 that proportion had doubled to 9.0%. As a result, these workers now account for an increasingly significant proportion of fatal and nonfatal mining accidents. According to MSHA's statistics, annually computed fatality incidence rates (the number of fatalities per 200,000 employee hours) for independent contractors working in M/NM mining are consistently higher than those for operator employees. Over the five-year period from 1990 through 1994, 53 independent contractor employees were fatally injured while working on M/NM mine property (See Table 1). More than one third of these fatalities (36%) were due to accidents involving powered haulage; 21% were machinery accidents; and 11% percent were falling material accidents. Combined, these three accident classifications accounted for 68% of all independent contractor fatalities occurring on M/NM mine property during these years. Clearly, current efforts to increase the safety of the mining workforce must also address the safety of the independent contractor employee.

This report is a preliminary attempt to identify trends in the employment and safety of independent contractor workers by identifying which segments of M/NM mining are experiencing the greatest increases in the number of independent contractor employees and by examining changes in the rates and types of accidents in which these employees are involved. The employment and accident data used in this report were obtained from the MSHA database.

Table 1.—Independent contractor metal/nonmetal fatalities, 1990-1994

Accident type	Number	Percent	Cumulative percent
Powered haulage	19	36	36
Machinery	11	21	57
Falling material	6	11	68
Slips/falls	6	11	79
Electrical	5	9	88
Explosives	3	6	94
Other	3	6	100
TOTAL	53	100	100

Independent contractor metal/nonmetal data

Independent contractors are required to report employee activity to MSHA separately for coal and metal/nonmetal mining. MSHA differentiates M/NM mining into four distinct segments based on the type of material being mined: (1) metal (e.g., iron ore, copper, gold, etc.), (2) nonmetal (e.g., salt, phosphate rock, clay), (3) stone (e.g., limestone, lime), and (4) sand and gravel. Sand and gravel mining is strictly a surface operation (including dredging), while metal, nonmetal, and stone mining may include underground mining, surface mining and mill operations. Independent contractor hours are reported for the particular type of operation for which the hours were worked (i.e., underground, surface area of underground, strip mine, mill, etc.), not by the type of material being mined or processed. However, for each independent contractor accident reported to MSHA, information is obtained regarding both the type of operation where the accident occurred as well as the type of material being mined or processed. This additional information makes it possible to determine what proportion of independent contractor accidents occurred at metal, nonmetal, stone, or sand and gravel mines or mills.

In the following sections, independent contractor employee hours, accidents and fatalities are reported within the four major mining locations which include underground locations, surface locations at underground mines, surface mining, and mills. Also reported are the proportion of accidents occurring at metal, nonmetal, stone, or sand and gravel operations. Overall, the data is presented as a comparison of employment and accidents for two time periods occurring at the

Table 2.—Number and proportion of employee-hours, accidents, and fatalities accounted for by independent contractors working in metal/nonmetal mining

Mining location	Years	Employee-hours		Accidents[1]		Fatalities	
		Number[2]	Percent of all hours	Number and *rate*[3]	Percent of accidents	Number and *rate*[3]	Percent of fatalities
Underground mines	1985-87	2.9	0.7	172 *11.68*	0.8	0 *0*	0
	1992-94	8.0	2.5	527 *13.11*	2.9	0 *0*	0
Surface area of underground mines	1985-87	7.3	13.3	78 *2.13*	5.1	4 *0.11*	18.2
	1992-94	16.1	34.4	161 *2.00*	12.3	5 *0.06*	55.6
Surface mines	1985-87	23.7	6.9	303 *2.56*	6.1	7 *0.06*	14.6
	1992-94	42.6	15.4	476 *2.23*	11.5	19 *0.09*	45.2
Preparation plants	1985-87	9.3	8.7	260 *5.60*	11.2	1 *0.02*	6.3
	1992-94	17.9	19.1	270 *3.02*	12.6	7 *0.08*	53.8

[1] *Accidents include injuries resulting in either permanent disabilities or lost workdays or both, but excludes injuries resulting only in days of restricted work activity.*
[2] *Employee-hours are reported in millions of hours.*
[3] *Rates (in italic) are computed as the number of accidents or fatalities per 200,000 employee-hours.*

beginning and the end of a ten-year span from 1985 to 1994. Because the number of incidents involving independent contractors in certain accident categories during any one year may be small, three-year totals are presented; the first three years (1985-87) of the ten-year period are compared with the last three years (1992-94).

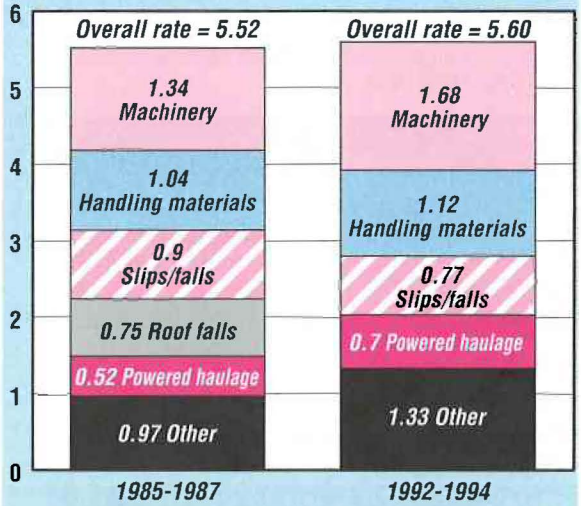
Underground locations of metal/nonmetal mines

In underground M/NM mining, independent contractor employee hours increased by only 7% (from 2.7 to 2.9 million hours) from 1985-87 to 1992-94 (See Table 2). These hours represented 3.7% of all underground M/NM mining employee hours in 1985-87 and most recently account for about 4.4% of all underground employee hours. Comparing these two time periods, independent contractor fatality rates have decreased significantly from .37 to .07 fatalities per 200,000 employee hours, while the lost day accident rate has increased slightly from 5.52 to 5.60.

Separate rates computed for the most frequently occurring accidents during both time periods (See Figure 1) show a rise in the rate of occurrence of machinery, handling materials, and powered haulage accidents. On the other hand, the rate of accidents due to slips and falls has decreased slightly, and the rate of occurrence of roof fall accidents has dropped to less than 0.5 (included in '*Other*').

Although the majority of independent contractor underground accidents occur at metal mines, recent increases in the number of accidents occurring at nonmetal and stone underground mines suggest these two industries are increasing their use of independent contractors. In the period including 1985 through 1987, 93% of independent contractor lost day accidents occurred at underground metal mines; the remaining 7% occurred

Figure 1.—Independent contractor lost-day accident rates at underground metal/nonmetal mines*



* *Accidents per 200,000 employee-hours exposure*

at nonmetal mines. More recently, 1992 through 1994, 78% of the lost day accidents occurred at metal underground mines (primarily copper, lead/zinc and gold); 18% at nonmetal underground mines (primarily salt); and 4% at stone mines (primarily limestone).

Surface locations of underground metal/nonmetal mines

At surface locations of underground M/NM mines, employee hours of independent contractor workers increased by 53% from 1985-87 to 1992-94. These hours now account for 15.5% of the total number of hours reported for the surface areas of underground M/NM mines (See Table 2). Despite an increase of about one million employee hours during 1992-94, no fatalities occurred during this time period and the lost day accident rate decreased substantially from 3.91 (1985-87) to 2.96 (1992-94).

Contributing to this decrease in the accident rate were significant declines in the rates of accidents involving machinery, hand tools, and powered haulage (See Figure 2). The occurrence of accidents involving machinery and hand tools declined to rates of 0.21 and 0.28, respectively, during 1992-94 (included in '*Other*'). On the other hand, the rate of lost day accidents due to handling materials increased while the rate of occurrence of accidents due to slips and falls remained relatively unchanged.

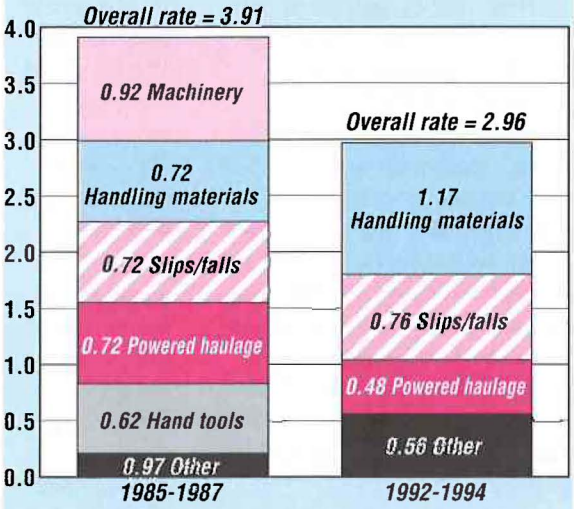
Although from 1985-87, 92% of the accidents occurred at metal underground mines, during 1992-94 only 47% occurred at metal mines, while 44% were reported at nonmetal mines, and 9% at stone mines.

Surface metal/nonmetal mines

Comparing the two time periods, employee hours of independent contractors working at surface M/NM mines have increased by about 75% over the past ten years. With an increase of 23 million employee hours, surface M/NM mining operations have experienced the greatest increase in the absolute number of independent contractor employees hours. The 53.4 million employee hours reported during 1992-94 accounts for 10% of all employee hours reported for surface M/NM mines (See Table 2). However, independent contractors also accounted for 29% of the fatalities (21 out of a total of 73) which occurred at surface M/NM mines during 1992-94. Eleven of these 21 fatalities occurred at stone mines, five at sand and gravel operations, three at metal mines and the remaining two fatalities occurred at nonmetal surface mines. Although the fatality rate for independent contractors has decreased from .13 (1985-87) to .08 (1992-94), it still exceeds the rate for direct employees of surface mine operators. On the other hand, independent contractors comprised only 6% of the accidents occurring at M/NM surface mines. Additionally, the overall lost day accident rate for independent contractors at surface mines has decreased from 2.13 (1985-87) to 1.87 (1992-94).

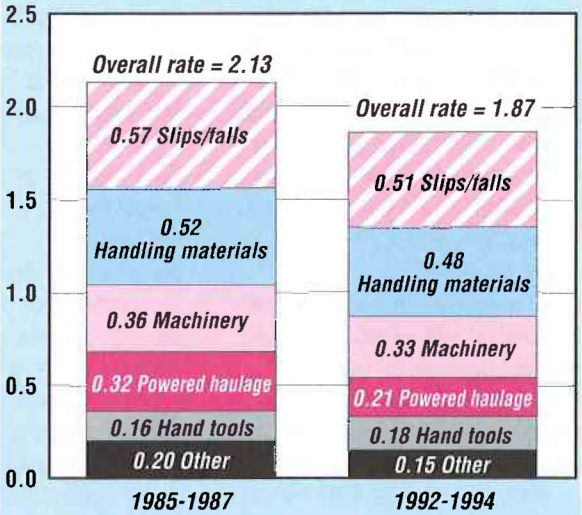
Separate rates computed for the five major types of accidents show a substantial decrease in the rate of powered haulage accidents and slight decreases for accidents due to

Figure 2.—Independent contractor lost-day accident rates* at surface locations of underground metal/nonmetal mines



* Accidents per 200,000 employee-hours exposure

Figure 3.—Independent contractor lost-day accident rates* at surface metal/nonmetal mines



* Accidents per 200,000 employee-hours exposure

slips and falls, handling materials, and machinery accidents (See Figure 3).

From 1992-94, only 6% of these independent contractor accidents occurred at sand and gravel operations and 8% at nonmetal (primarily phosphate rock) surface mines. Most of the accidents (59%) were reported at metal surface mines (primarily gold and copper mines) while about a fourth of the accidents (27%) occurred at stone mines (primarily limestone mines). The differences in proportions of accidents occurring within these four subgroups did not vary by more than 5% (plus or minus)from 1985-87 to 1992-94.

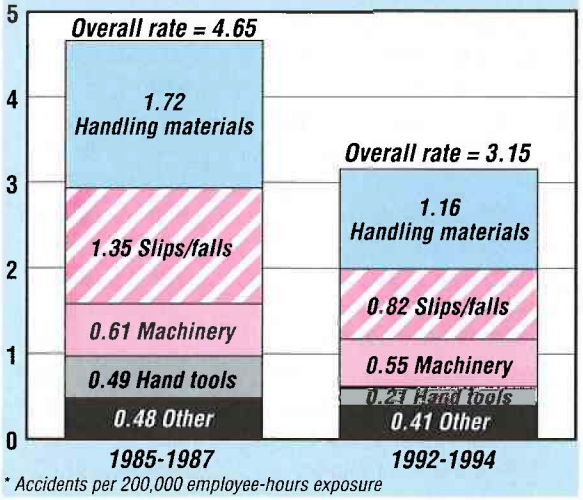
Metal/nonmetal mills

At metal, nonmetal and stone mills, employee hours for independent contractor workers increased by 74% from 1985-87 to 1992-94. With 26.8 million employee hours and 421 lost day accidents reported during 1992-94, independent contractors now account for 6% of all mill employee hours and 6.7% of the accidents (See Table 2). Of the 27 fatalities occurring at M/NM mill operations from 1992-94, 26% (seven of 27 fatalities) involved independent contractor employees. Despite the relatively high proportion of fatalities accounted for by independent contractor workers at mills, the fatality rate has decreased from .08 (1985-87) to .05 (1992-94). Similarly, although the overall accident rate for independent contract workers at mills is higher than the accident rate for direct employees of mills, a comparison of the two time periods shows a decrease from 4.65 during 1985-87 to 3.15 more recently.

This decrease in the overall lost day accident rate reflects declines in the rates of the major types of accidents particularly those due to handling materials, slips or falls, and the use of hand tools (See Figure 4).

From 1985 through 1987, 61% of independent contractor mill accidents occurred at metal mills; 32% at stone mills; and 7% at nonmetal mills. During 1992-94, 43% of independent contractor lost day accidents were reported at stone mills (primarily limestone and cement mills); 41% occurred at metal mills (primarily gold, copper, and alumina); and 15% at nonmetal mills (clay and phosphate rock).

Figure 4.—Independent contractor lost-day accident rates* at metal/nonmetal mills



* Accidents per 200,000 employee-hours exposure

Discussion

The number of independent contractor employee hours in metal/nonmetal mining reported to MSHA has increased by 70% (50.4 million hours to 85.9 million hours) when comparing the three-year period from 1985 to 1987 to the period from 1992 to 1994. The largest increases in the numbers of independent contractor employee hours are being reported at surface mines and mills. Fatality rates for independent contractors at both of these locations are higher than those observed for the direct employees of operators. However, improvement at both of these locations is evidenced by the fact that both the fatality and accident rates reported for independent contractors during the years 1992-94 are lower than those computed for the years 1985-87.

Independent contractor employees will continue to be a growing segment of the mining workforce. Specific accident and injury data provides safety practitioners with information that can be used in safety intervention strategies. For example, most independent contractor fatal accidents were classified as either powered haulage or machinery accidents. These may be accident classifications on which safety practitioners want to focus. To further enhance safety interventions, a more detailed profile of independent contractors working in M/NM mining is necessary. Additional areas of investigation might include the following: (1) an assessment of risk and exposure to hazards based on job classification and type of mine, and (2) conducting evaluations of the training provided to independent contractor workers.

[1] *Title 30 CFR, part 45, section 2c defines an independent contractor as: "any person, partnership, corporation,... that contracts to perform services or construction at a mine." Mine operators employ independent contractors for a variety of production and support services. A sample of occupations include truck drivers, security guards, supervisors, technicians, equipment operators, mechanics, drillers and blasters, and construction workers. Although independent contractors are required to report annual hours worked on mine property to MSHA, they are not required to obtain an MSHA identification number. Consequently, the possibility exists that the number of independent contractor employee-hours and accidents, while working on mine property, may be under reported.*

Progress seen in slowing accidents at small mines

By J. Davitt McAteer, Assistant Secretary of Labor for Mine Safety and Health

As one of the first major initiatives after my appointment as head of MSHA, the agency hosted a small mine summit at the National Mine Health and Safety Academy in Beckley, West Virginia.

From the summit, we hoped to develop a blueprint for improving the chances of saving lives, reducing injuries and reducing health problems among workers at small mines. Approximately 200 people attended. More than 30 speakers provided a broad spectrum of views.

As an outgrowth of this summit, I made a decision to place a high-level official at the head of a small mines safety program. Jesse P. Cole became coordinator of the small mines program, working from the Academy in Beckley. In addition, seven MSHA specialists working in several MSHA districts have been assigned to the small mines unit, but remain in their field locations in order to work directly with the local small mines.

The strongest common thread expressed throughout the summit was that of training. There was agreement among all segments that improvements in this area could play a significant role in reducing serious injuries and fatalities.

As a first step, a study and analysis of accident data from small mines was conducted: Accident reports and related data on fatal and nonfatal accidents were gathered for the five-year period of 1990-1994. Because of their concentration of small mines, the survey concentrated on three states, Kentucky, Virginia, and West Virginia. It also concentrated on the smallest mines, employing fewer than 20 miners, because these mines seem to have the greatest need and desire for training assistance.

From this information, graphs and charts were created illustrating the "who, what, and where" of on-the-job injuries and fatalities at small mines in the three states, both underground and surface.

These statistics were made available to state mine agency personnel as well as MSHA officials in each state.

Next, small mines program personnel began presenting the information to mine operators, miners, mine trainers and contract trainers, pointing out the type of accidents that have been injuring and killing employees at small mines, along with the occupations and activities affected, They have presented the findings also to large groups in the mining community during Holmes Safety Association Meetings and similar events.

Starting April 1, the group began using the Mine Emergency Unit's command vehicle as a mobile classroom. Training specialists from the small mine group, along with district personnel, are conducting presentations at selected small mines for the mining crews.

By bringing this information directly to the miners affected, MSHA hopes to instill a new level of awareness that will help significantly reduce serious accidents and fatalities at small mines.

Our experience has been positive. At one of the first mines visited, the superintendent called the local MSHA field office and reported that the program had such an impact on the miners, 'They continued to discuss the accident prevention material throughout the remainder of their work shift."

Another mine manager was impressed enough with the program that he asked for it to be presented at the company s other operations. And, additional requests have been coming in as word gets around.

For the five years from 1990 through 1994, an average of 13 fatalities per year occurred at small mines in Kentucky, Virginia and West Virginia. In 1995, four fatalities occurred at small mines in the three states. It is still too early to read a positive trend, but we are hopeful that the combined efforts of mine operators, miners, State mine agencies and MSHA are making a difference in small mine safety.

Reprinted from the June-August 1996 edition of ***The Coal Chronicle****.*

Managing the transfer of training:

How to make learning pay off in performance

By John Cheeseman, Education Specialist at Canada's Ontario Natural Resources Safety Association

This is part one of two. In Part two of "Managing the Transfer of Training," John Cheeseman will tackle strategies to employ after the trainee returns to work. He will offer 8 tips to ensure the new knowledge and skills the employee has learned aren't lost after he or she leaves the classroom. Watch for Part two in the August issue of the **Bulletin**.

It's a year since your firm decided to upgrade the accident investigation skills of all supervisors and health and safety committee members Training was delivered according to plan, taking into account the specific needs of your operation. Posttraining reaction forms indicated participants were happy with the program. The trainers were pleased with the outcome and even provided documentation that each individual satisfied the required learning objectives But as time passes, the quality of the accident reports is less than you expected. Accident descriptions are often superficial. Basic and underlying causes are rarely identified. Preventive action, in most cases, continues to be "safety contacts"—pep talks with workers about renewing their commitment to safety. Recommendations for corrective action still tend to be "quick fixes" instead of longer-term solutions such as ergonomics, system safety and total quality management. Your review of the training content indicates that all of these issues and concerns were addressed, but for some reason, are not being put into practice.

Does this sound familiar? The company concluded that skills could be upgraded and the accident investigation program improved through training. A course was carefully developed and delivered with apparent success. But, as time passed, it became evident that the training failed to pay off in improved performance. The operation was a success, but the patient died!

Organizations continue to rely on training as the most popular strategy to improve workplace performance. Everyone agrees that an effectively trained, highly productive workforce is a fundamental element of every successful business organization. But many companies are realizing that training by itself is not enough to get the results they are looking for The performance improvements expected from training only happen when newly-learned skills and knowledge are applied and allowed to develop in the workplace. This is what is known as the "transfer of training".

Incomplete transfer continues to be a problem despite growing attention being paid to this very important issue. Research over the past 40 years confirms that 20 to 80 percent of skills and knowledge acquired from training fail to translate into application and long-term retention. This is supported by the work of two American professors, Dr. Mary Broad and Dr. John Newstrom. They conservatively estimate that no more than 50 percent of all training content is still being applied a year after training delivery. As a result, North American companies continue to experience a startling waste of investment in human resource development.

Tracking precise expenditures and attaching accurate dollar values to this problem may well be impossible. The latest industry report from *Training* magazine indicates that U.S. corporations spend in excess of $50 billion annually on formal training. Broad and Newstrom contend that this represents a direct dollar loss of over $25 billion each year. North of the border, a recent study by the Conference Board of Canada found that companies are spending approximately $800 to $1000 per employee on training annually. Whether this is interpreted as a direct dollar loss, or as a failure to realize half of their potential gain, one observation is indisputable. Companies on both sides of the border are not getting full value for their investments in training.

Research has identified common transfer barriers such as:

- lack of reinforcement on the job from managers and supervisors;
- limited opportunities to apply new learning;
- other interferences in the workplace (e.g., workload, lack of resources, etc.);
- poor organizational climate;
- trainees' perception that training is irrelevant;
- trainees' discomfort with change;
- poorly designed or delivered training; and
- pressure from peers to resist change.

Two conclusions can be drawn. First, more of the barriers come into play after training has been delivered. Second, managers are

in the best position to help minimize or eliminate most of these barriers. Some emerging management strategies are enabling organizations to get better value for their investments in training. By implementing the following strategies, performance improvements in health and safety, productivity, quality, and efficiency can easily be gained.

Stage one: Before training begins

1. **Determine Precise Training Needs:** The first strategy for managers to consider is a careful determination of precise training needs, defined as the skills and knowledge required by employees to perform job tasks safely and efficiently. Needs analysis is the mechanism to determine what problems can be solved by training, what type of training is required, what it will look like and which employees are appropriate candidates for training. Managers, by virtue of their knowledge of how organizational systems interrelate, can make a valuable contribution to this important process .

2. **Conduct A Workplace Environmental Assessment:** No, this has nothing to do with industrial hygiene. Instead, it entails a careful search for potential barriers that may inhibit the transfer of training. Be on the look-out for those barriers:

- in the training program itself,
- with trainees,
- with immediate supervisors,
- in the trainees' specific workplace, and
- with the organizational climate, e.g., value placed on training.

Surveys, interviews, job observations and document searches provide this type of information minimizing potential barriers before training means the application of new learning will be smoother and more rewarding for employees.

3. **Review Potential Training Programs:** Working with trainers and supervisors, managers should periodically conduct a comprehensive review of training programs to verify that the material is current and relevant to the needs of the organization. Ensure that courses are based on sound instructional design principles, and incorporate a variety of learning activities, teaching methods and media to support the instructional process. Determine whether or not learning exercises require trainees to think and act as if they were actually confronting problems or performing tasks in the workplace. The more the training resembles the real world, the higher the probability that skills and knowledge will transfer to the workplace.

4. **Develop Effective Instructors: This is an area that needs special** attention from management. Too often the sole criteria for selecting trainers is a long history of practical work experience. Experience is not enough to make a good instructor. Trainers have an enormous responsibility for organizing (often developing) materials, facilitating the learning

process and conducting evaluations. As well, they are expected to be acutely aware of the educational implications of adult learning principles. With the assistance of management resources, special train-the-trainer courses can be made available to fine-tune the delivery skills of your training staff.

5. **Carefully Select Who Will Attend Training:** Plan ahead. Select employees on a "need to know" rather than a "nice to know" basis. Be certain these are the individuals who will be applying the training. That is the only justification for them attending the training session. Last minute replacements are less motivated than others and benefit the least from training.

6. **Win Support from Supervisors:** Supervisory support is a key variable in the transfer process. Employees rely heavily on supervisors for encouragement, support, feedback and guidance. An orientation meeting is an excellent opportunity for managers to bring supervisors "up to speed" on the content and purpose of the training initiative. Unless supervisors are convinced of the value of the training, it is unlikely they will support and encourage the transfer of newly learned skills and knowledge.

7. **Prepare Trainees In Advance:** This is an opportunity for managers to "prep" employees prior to training and address any questions and concerns they may have. Adults, in general, are highly motivated to learn in areas that have a direct application to their immediate needs. Managers can help employees identify that connection by explaining why the training is important and where it should be applied. This helps promote a state of "learner readiness". If a meeting is impossible, the next best thing is an advance letter. Promote the upcoming event and explain why the training is significant and worthwhile.

8. **Distribute Pre-Course Material:** Insist that your training department or whoever is conducting the session distribute precourse material to each participant. Some familiarity with the subject matter also promotes readiness. It stimulates the formulation of questions and gets participants thinking about issues and concerns surrounding the subject matter.

Stage two: During the training session

1. **Demonstrate Management Commitment To Training:** Managers should plan to "kick off" the proceedings with a few inspirational words emphasizing the value the organization places on employee development. Never underestimate the importance your presence can have at training sessions. It supports the process of building positive expectations and productive relationships.

2. **Provide Adequate Training Facilities:** Providing proper facilities is another way to demonstrate management commitment. Learning is easier when the physical conditions of the training room ensure comfort and privacy. Off-site facilities are usually more productive environments for learning because unwanted distractions are minimized. Interruptions interfere with the learning process and communicate a negative message about your commitment to training.

3. **Provide Adequate Resources For the Trainer:** Instructors have special needs that must be met. A mechanic cannot perform effectively without proper tools and managers have a responsibility to ensure that trainers have access to such things as flipcharts, slide projectors, VCRs, current videos, photocopy machines, up-to-date statistics, and other training materials.

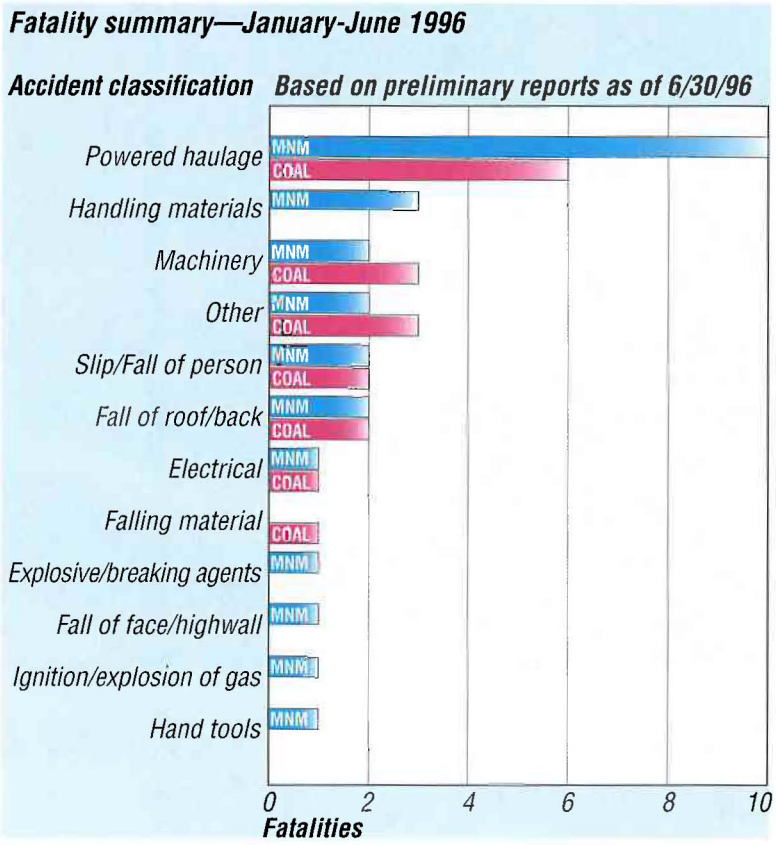
4. **Insist On Documentation:** The effective transfer of training is impossible if trainees fail to master course content. Learning is no guarantee that performance improvements will follow; but it is a prerequisite. Because of the cost of training and the critical relationship between learning and performance, it is not unreasonable for managers to insist on documented evidence that learning objectives have been met. This makes trainers more accountable for providing quality instruction and conducting meaningful evaluations.

5. **Offer Recognition:** Everyone needs recognition and appreciation to boost their confidence and self-esteem. Managers should plan to be part of the closing stages of the training course and distribute certificates of achievement to the participants. Ensure the certificate is a document employees will be proud to hang on their office wall or work area, rather than tape to the inside of their coverall locker. It demonstrates that the company supports each individual and is sincere about the application of new skills and knowledge.

Reprinted from Canada's Ontario Natural Resources Safety Association's March/April 1996 issue of ***Health & Safety RESOURCE.***

Fatality summary—January-June 1996

This article is the second in a series updating the status of fatalities occurring in both coal and metal/nonmetal mines from January through June, 1996. Based on preliminary accident reports, as of June 30, 1996, forty-four fatalities have occurred at coal and metal/nonmetal mining operations. During this period, coal experienced 18 fatalities and metal/nonmetal had 26 fatalities. Powered haulage fatalities in both coal and metal/nonmetal were the most frequent accident classification, causing 36 percent of the fatal injuries.



Below is a summary of coal and metal/nonmetal statistics:

Coal Mining

Six of the fatalities were classified as powered haulage. Machinery and the "other" category accounted for three fatalities each. Seven coal fatalities occurred in West Virginia, and six occurred in Kentucky. Thirteen fatalities occurred underground and five occurred on the surface.

Metal/Nonmetal Mining

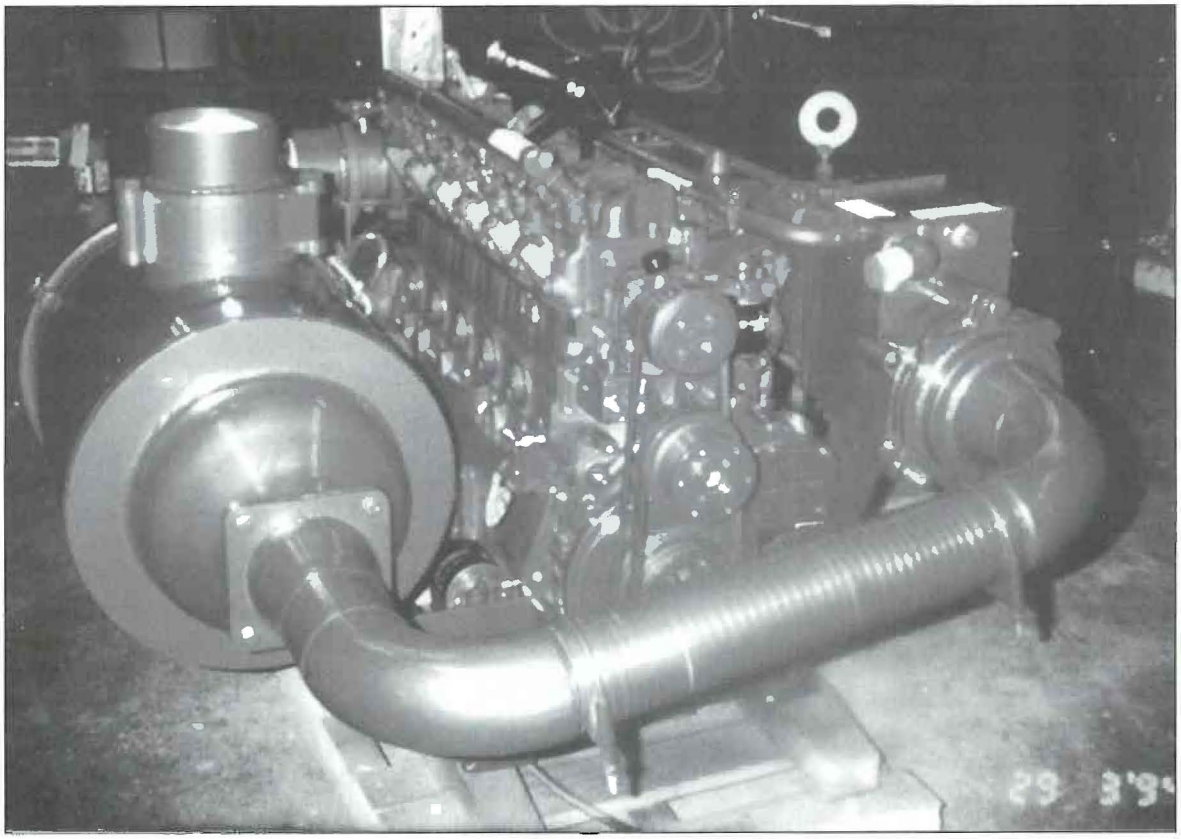
Ten of the fatalities were classified as powered haulage and three were handling materials. Machinery, drowning, and slip and fall of person accidents accounted for two fatalities each. Eight fatalities occurred at sand and gravel operations and six occurred at limestone operations. There were 21 fatalities at surface operations and 5 fatalities at underground operations.

Submitted by John V. Forte, MSHA Academy, Beckley, WV

Capsule news...

Coal production and consumption will hit all-time record levels by year-end, each exceeding 1 billion tons, according to National Mine Association's short-term coal forecast. Production in 1996 is expected to increase by 2.4% to a record 1.046 billion tons from 1995's estimated 1.021 billion tons. Production in the Westwill grow nearly 5% to 504 million tons, topping the 500 million ton level for the first time. Production in the East will show only a small improvement over 1995 levels to total approximately 542 million tons. Total coal consumption—for domestic use and for export—is expected to grow to 1.050 billion tons by year-end, up from 1.033 billion tons in 1995. Coal for electricity generation remains the only domestic market to show an increase, as coal use for coking and industrial purposes continues to be essentially flat. More than 80% of U.S. coal production is consumed by utilities and non-utility generators to produce power.

Reprinted from the March 1996 issue of ***COAL PEOPLE MAGAZINE****, Vol. 20, No. 7, copyright 1996 by Al Skinner, Editor/Publisher.*



Test package at West Virginia University—the Deutz MWM 916-6 engine.

Cyprus Amax develops a practical dry diesel scrubber

New emissions management system virtually eliminates particulate matter

By Steve Fiscor, Intertec Publishing Corp.; Managing editor of ***Coal****, the publication which serves the North American coal-mining industry.*

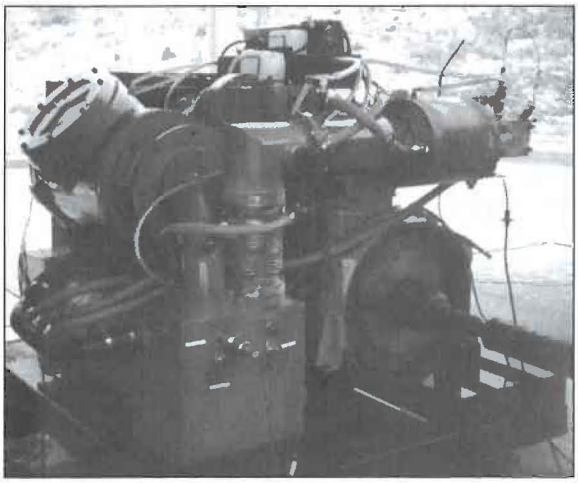
Underground diesel engines have gained popularity in the United States, especially in coal operations with longwalls. These engines provide the power needed during longwall moves and when hauling supplies to the various mechanized mining units. However, they also have inherent problems, particularly with the exhaust scrubbing devices.

Two concerns must be addressed when considering underground diesel scrubbers: the environment and safety. Environmental concerns focus on the diesel engines' exhaust emissions, which pose potential health risks to the miners sharing the common environment. Safety concerns involve aspects that pose a fire or ignition hazard from CH_4, coal dust, or spilled fuels.

Cyprus Amax has the largest diesel population in U.S. underground coal and, including the company's mineral operations, perhaps the largest in U.S. underground mining. While some coal companies are bringing diesels on-line, Cyprus Amax Coal Co. has been developing a new dry scrubbing system for its diesel engines.

"We wanted to develop not only a more practical scrubber," according to W. Mark Hart, vice president, Cyprus Amax Coal Co., "we also wanted a system that would enhance the working environment for our personnel."

Norbert Paas, a diesel emissions specialist, owns Paas Technologies, Inc., and has been developing dry scrubbing systems since the mid-1980s. During 1990, Hart took an interest in Paas' system and invited mining



equipment manufacturers, including Brookville and Goodman, to join in development and certification efforts.

From 1991-1993, the U.S. government's Mine Safety and Health Administration (MSHA) tested and certified the system and Paas was awarded a patent. Six machines have been placed in five Cyprus Amax Coal operations.

"This is a promising example of new technology being applied for underground diesel emissions control," said George Dvorznak, chief of the mechanical safety division, MSHA Certification and Approval Center. He was directly involved with testing and certification of the Diesel Scrubbing Technology (DST) Management System.

In the United States, underground diesels in coal have a history of over 25 years. Initially, during the late-1960s and early-1970s, diesels were used underground primarily in western mines where the relatively thick seams allowed high profile equipment. Only a handful were operating in the East. During the late-1970s and early-1980s, about 90% of the mines west of the Mississippi River were employing diesels underground. Only a few existed in the East.

A number of states had had very restrictive regulations on use of diesel engines in underground coal mines, i.e., Virginia, Illinois, Alabama, Pennsylvania, and West Virginia. The national mineworkers' union had an influential role in that legislation. Its antipathy stemmed from the dieselization of railroads that began in the 1940s and consequent loss of a major coal market and jobs.

Today, all of those states have diesels in some form operating underground, except West Virginia, Pennsylvania, and Ohio. Changes in the East began with Alabama, followed by Virginia; during the early 1980s, Illinois opened its mines to diesels underground mainly because lower-profile (height) diesel engines attained certification.

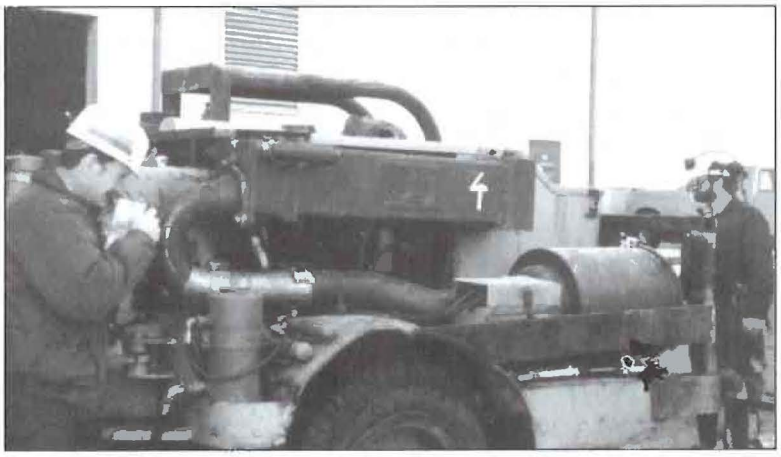
During the mid-1980s, the percentage of diesel populations underground in the East essentially equaled that of the West. Underground diesels have seen an increase of about 200 units/yr. As of 1994, an estimated 2,500 diesels are operating in U.S. underground coal mines.

Cyprus Amax's new system

During late 1992, the first prototype, retrofitted to an Eimco 975 mantrip, was placed at the Shoshone mine. The Wyoming mine, with steep gradients, is one of Cyprus Amax's more difficult operations. This was the first water-jacketed, manifold-and-catalyst scrubber installed on a Caterpillar (Cat) 3304 diesel engine underground. "This was a light-duty vehicle and the mine just wanted to get some hours on the system," said Paas.

After some minor engineering design changes and almost one year later, a second system was placed at Cyprus Amax's Twentymile mine, near Oak Creek, Colo. It was installed on an Eimco 913 scoop, selected for its duty cycles. "The scoop had a more erratic duty cycle, with more power spikes, compared to the first system—which was primarily steady state," explained Paas. The system has remained the same except for some refinements to engineering design.

A few months later, another system was installed on an Eimco 975 flat-bed truck, with a Cat 3304

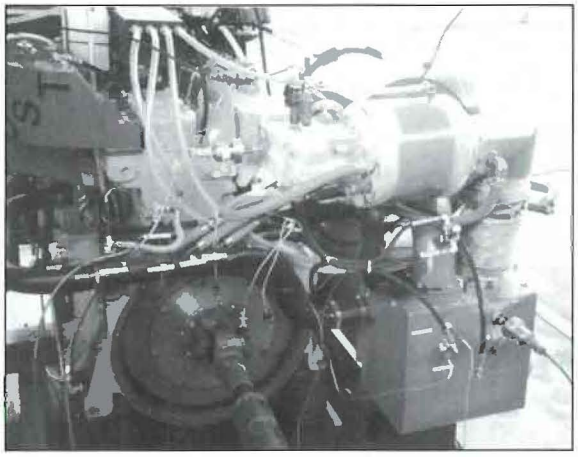


◀

Top—Latest certification application, configuration B, for Caterpillar 3306 PCNA engine.

Bottom, Cyprus-Amax Shoshone mine 975 truck—outby machine—first prototype.

◀



Latest certification application, configuration A, for Caterpillar 3306 PCNA engine.

engine, at the Empire mine near Craig, Colo. At the same time, Cyprus installed another Cat 3304 system at the Plateau mine in Utah. "The Cat 3304-based systems have seen a lot of outby operating time, but unlike the Deutz MWM 916-6 based system, have not been MSHA certified yet," said Paas.

The next system was installed on a Wagner ST5-25X longwall shield-hauler at the "Twentymile" operation. The design concept for this system was changed radically. The fundamentally re-engineered design moved from a direct engine mount to a modular scheme, where the components can be placed anywhere on the machine. This prototype was the basis for MSHA certification applications and for 'inby' (potential explosive atmosphere environment) Cat 6-cylinder diesel engines, which is near completion.

In May 1994, Cyprus Amax began extensive emissions testing of a system on a Deutz MWM 916-6 diesel engine at West Virginia University (WVU). Cyprus Amax hopes to place the system at either the Cumberland or Emerald mine in Pennsylvania. WVU is one of the few U.S. universities with underground diesel lab-testing facilities.

"Lab tests supplement in-mine testing by offering a wide range of duty cycles," explained Paas. "Field testing does not allow for certain variables to be isolated, and lab tests provide ideal conditions."

A seventh system was installed on a Jeffrey Ramcar in October 1994 at the Wabash mine in southern Illinois. It is inby-certified, replacing the water scrubbing system with a DST system on a Deutz MWM 916-6.

Water-jacket catalyst?

"The DST system combines several advanced, proven technologies that are extremely effective in reducing gaseous and particulate emissions from diesel exhaust," said Dvorznak.

The four components consist of:

- A specially formulated, water-jacketed oxidation catalyst;
- A tube-and-shell heat exchanger;
- A disposable, low-cost particulate filter; and
- An on-board cleaning system.

Also included are the required flame- and spark-arrestors and safety shutdown devices. They are requirements for the system to be considered flame/explosion-proof by government regulatory agencies.

After an initial investment of $35K/machine, the filters cost $50, compared to a ceramic trap that costs about $5,000. The filters have a targeted price of $40.

"This is the only surface temperature-controlled catalyst that provides surface temperatures below the MSHA-required 302° F, simultaneously maintaining the 400° F internal-level needed for catalyst performance," said Paas. It removes most of the CO and unburned hydrocarbons which give diesel smoke the smell associated with diesel-powered equipment.

The heat exchanger is a simple, yet effective, two-pass, tube-and-shell heat exchanger. It is designed to be compact with minimal back pressure.

While developing the heat exchanger, the designers focused on finding a stabilization rate of the unpreventible sooting process inside the tubes. Since manual cleaning was out of the question, an on-board internal cleaning system was created.

Once the exhaust system reaches a certain back-pressure, the on-board cleaning system is activated by the operator (or automatically). This is done while the engine is operating, and restores the heat exchanger to "as new" condition. The filter safely captures dislodged soot.

"The design objectives for the filter," explained Paas, "were to provide a low-cost, truly disposable, large-capacity filter." The filter had to function under all operating conditions from prolonged idle to long periods of full power. The designers also wanted the filter to remove at least 95% of the total particulate matter, with the filter lasting a full week.

"We have achieved filter life of several weeks in actual mining operations," according to Paas. "Particulate reductions >99% and CO reductions of up to 96% have been measured in the field." All of the components are made from nontoxic materials that will not give off noxious fumes when heated and that have ignition temperatures which are at least twice as high as the operating temperatures. There is no risk of fire from the filter material.

Environmental concerns

Potential health risks from diesel particulate matter have been studied by many organizations. The prior focus has been the chemical composition of the particulates, and the carcinogenic potential of each of the many chemicals that adhere to the carbon particle. The general consensus was that the individual chemicals, which are part of the soluble organic fraction, would be responsible for the carcinogenic potential. More recent studies, however, have identified the size and shape of the particle to be the cause for the carcinogenic behavior of the diesel particulates, with the chemical composition being only a minor contributor.

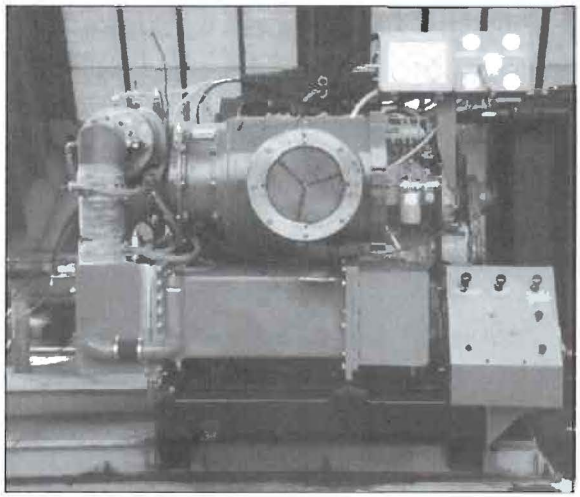
Whichever school of thought one subscribes to, this system provides a viable solution. Total particulate matter, considered to be the culprit in the most recent studies, is reduced dramatically under all operating modes. The soluble organic fraction, and associated individual chemical constituents, is first reduced at the catalyst and then captured in the filter.

Extensive testing of the DST system on precombustion chamber engines has proven to reduce particulate matter by >95%, CO by 80-96%, and unburned hydrocarbons by 70-90%.

The catalyst removes unburned hydrocarbons and dries the soot for better filter performance. Rapid exhaust cooling, inside the heat exchanger, encourages soot particles to agglomerate, making them easier to capture in the filter.

The filter captures >95% of all particulate matter under all operating conditions. Sulfates from the fuel's sulphur content adhere to the carbon core of the diesel particulates and also are captured in the filter.

Diesel engines used with the DST system are MSHA certified. They are derated to less than the MSHA allowable limit for undiluted CO and are further derated for high altitudes.



◀ *Latest certification application, configuration A, for Caterpillar 3306 PCNA engine.*

The DST system is well-suited for applications where the engine operates under light loads or idles for long periods of time, or where the duty cycle switches between light and heavy loads.

In surface applications where heavy loads are common for extended periods of time, ceramic filters have been successful. However, when the loads are more frequently light, highly cyclical, or when long durations of heavy loads are not encountered frequently, the ceramic trap technology is severely limited. Even with catalytic coatings, fuel additives, external or internal heaters, these limits are present.

Water-filled scrubbers are problematic—difficult to maintain and sometimes impossible to clean thoroughly. The DST system does not use water which eliminates 20-30 min./shift downtime. Flushing the system is simple, and can be performed while the machine is running. Due to the elimination of the possibility of the scrubber running dry, unscheduled scrubber-induced shutdowns are also avoided.

"Another attribute of the system is the fact that it can operate consistently at any gradient," according to Dvorznak. "Because the water-bath system has been eliminated, the scrubber is not dependent on any orientation."

The DST system is inherently safe and does not rely on sensors and floats. It has several safety features that include three safety shutdown sensors for:

- Exhaust gas pressure
- Exhaust gas temperature
- Coolant temperature

The system also uses a set of redundant flame arrestors.

Components are designed from nontoxic materials, will not give off harmful gases when heated, and will not burn under any operating conditions. "It should be stressed that even though this unit is certified for inby use," said Dvorznak, "it has more potential applications on outby machines because it largely eliminates the particulate matter."

"We are extremely proud of all the people who helped us reach our achievements to date," added Hart. Cyprus Amax plans to install approximately 100 systems during the next three years.

Acknowledgments:

George Dvorznak, chief of mechanical safety division, Mine Safety and Health Administration; Ron Eberhart, Goodman; Technologies; and Dalph McNeil, Brookville Mining Equipment (fabricators); W. Mark Hart, vice president Empire, Shoshone, Twentymile Business Unit, Cyprus Amax Coal Co.; and Norbert Paas, Paas Technologies, Inc.

Reprinted, with updates, from the June 1995 issue of Maclean Hunter Publishing Company's ***Engineering and Mining Journal,*** *Features section: Pg. WW54.*

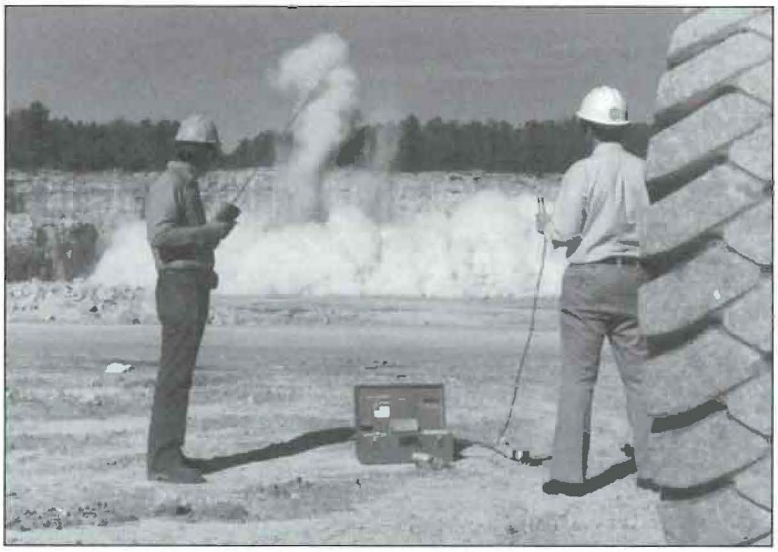
14

Size selection of blast hole drilling equipment...

Bigger is not always better

By Jim Ludwiczak, Blasting and Mining Consultants, Inc., 1801 Bonnie Castle Drive, Owensboro, KY 42301 502-683-7222

It has been well-known that even the best blasting "magician" can not completely correct for poorly drilled, mismatched, or misplaced blast holes. Basically, if the drilling methods are poor and the drilling equipment is not the best for the job, then the results of the blast will be equally as poor. The problems of poorly-drilled holes and misplaced holes are usually easily discovered and corrected. In most cases, the problem is a "human" one and can be resolved with management's oversight. However, if the drilling equipment is badly mismatched, the problem may not be as easy to resolve.



In recent years (mostly as a result of more stringent surface blasting regulations) another "Grinch" has developed to plague the drilling and blasting industry (not that we need any more). This Grinch is especially irritating to surface coal mining operations that are unfortunate enough to be operating next to residential areas. This new Grinch is in the form of problems associated with engineering blasting rounds for deep and large diameter blast holes located within hundreds of feet of occupied dwellings.

For sake of argument and to more clearly show my point, I would like to use a "worse case scenario" of the type of operation in which the Grinch thrives. This scenario is actually not a fabricated operation or condition. There are many surface mining operations of this type in operation and more on the way.

The example operation is a surface coal mine using a large yardage dragline to remove approximately 100 feet of sandstone and shale overburden to get to the coal. The 12 inch diameter blast holes drills are well suited for the depth of the overburden and for the type of equipment used to remove the blasted overburden. At least that is what they felt when they purchased the equipment and successfully opened the mine some years ago. Now, the mine is in a situation where the blasting is being conducted within a few hundred feet of occupied dwellings and even a small town. The mining operation is now also saddled with the most stringent regulations and limitations governing blasting close to occupied structures.

Assume that presently, the blasting design calls for the need of 3000 pounds of explosives per each blasthole. The blasting is taking place 1,000 feet (and moving closer) away from the closest occupied structure. The scale distance equation limits the maximum pounds of explosives to be detonated per delay of 329 pounds. If they were to use the scale distance equation (to design the blast) they would have to "delay deck" load each 3,000 pound hole with less than 329 pounds per deck, or about 9 decks per hole. The delay deck loading of deep and large diameter blast holes can be very tedious. For a 12 inch diameter blast hole, each foot holds over 45 pounds of explosives and heavy anfos up to 60 pounds. Obviously, when using large diameter holes the smaller the charges, the more difficult to engineer and load the shot. Even though the blasting is compli-

cated, this method is very common and has been successful for many operations.

If the operator finds that the scale distance equations are too stringent, he can choose to ignore these equations and monitor each shot with a seismograph. In recent years, the development of blasting seismographs has evolved to such a level that the use of seismographs is quickly becoming the "preferred" method. The use of many delay decks is troublesome, complicated, time consuming, and expensive. Monitoring with a seismograph allows more flexibility to the blast designs, while at the same time keeping a continuous record of the ground vibration levels at the closest structures (also make sure that there are good preblasting surveys of these structures).

Whatever method is selected by the operator, the blasting will be much more complicated. The close distance to occupied dwellings will also cause an increase in complaints and claims.

To help solve some of the associated problems, some operators have started using smaller diameter drills in place of the larger ones. This is because the smaller diameters (6 inch and less) better distribute the powder column throughout the blasthole (6 inch is about 10 pounds per foot). The smaller drills use different drill patterns and blast designs, but have proven to be very successful.

The blast design using the smaller diameter holes lowered the vibrations levels and complaints. When compared to the results of the blasts by delay deck-loading the large diameter holes, the smaller holes produced better breakage, especially on top of the shot (better powder distribution). However, more holes had to be drilled to blast the same size pit and the drilling was a little slower.

There is really no single solution to this type of blasting problem. About the only way to avoid this type of situation is to take a good look at the mining area **before** the drill purchases are made. Just because a particular size drill is best for a piece of equipment, or overburden depth, does not mean that it is best suited for an effective and legal blasting program. To help avoid this Grinch, management should also seek the advice and participation of the blasting personnel when the decisions are being made as to drill equipment purchases.

MSHA academy marks 20th anniversary

HSA membership are encouraged to attend

This August marks the 20th anniversary of the National Mine Health and Safety Academy (Academy) in Beckley, West Virginia. To commemorate the Academy's 20 years of service to the Nation's miners through education and training, and to rededicate the Academy to excellence in the 21st century, we are planning to host an anniversary celebration at the Academy on Friday, August 16 at 10:00 am. The senior U.S. Senator from West Virginia, Robert C. Byrd, has agreed to deliver the keynote address. We would be most pleased if you (our readers) could attend this celebration.

We have seen many changes at the Academy during the past 20 years, all of which reflect our dedication to promoting miners' safety and health. Not only are mine health and safety training courses taught at the Academy, but we also distribute education and training materials, and conduct hands-on fire fighting and fire suppression training at the Mine Simulation Laboratory. The Academy's facilities are used by miners, mine operators and their representatives, state, national, and international mine safety organizations, and members of academia, as well as Mine Safety and Health Administration personnel. As we move into the 21st century, our library materials, currently being centralized, modernized, and expanded at the Academy, will also help us to promote miners' health and safety by providing easy and rapid access to the most complete and up-to-date body of mine safety and health information in the world.

The following is a tentative schedule:

10:00–11:30 am—Formal program in the auditorium

11:30 am–12:00 Noon—Lunch period (cafeteria style-cash basis)

12:00–4:00 pm—Demonstrations and exhibits

For further information please contact Richard Wood at the National Mine Academy at (304) 256-3240.

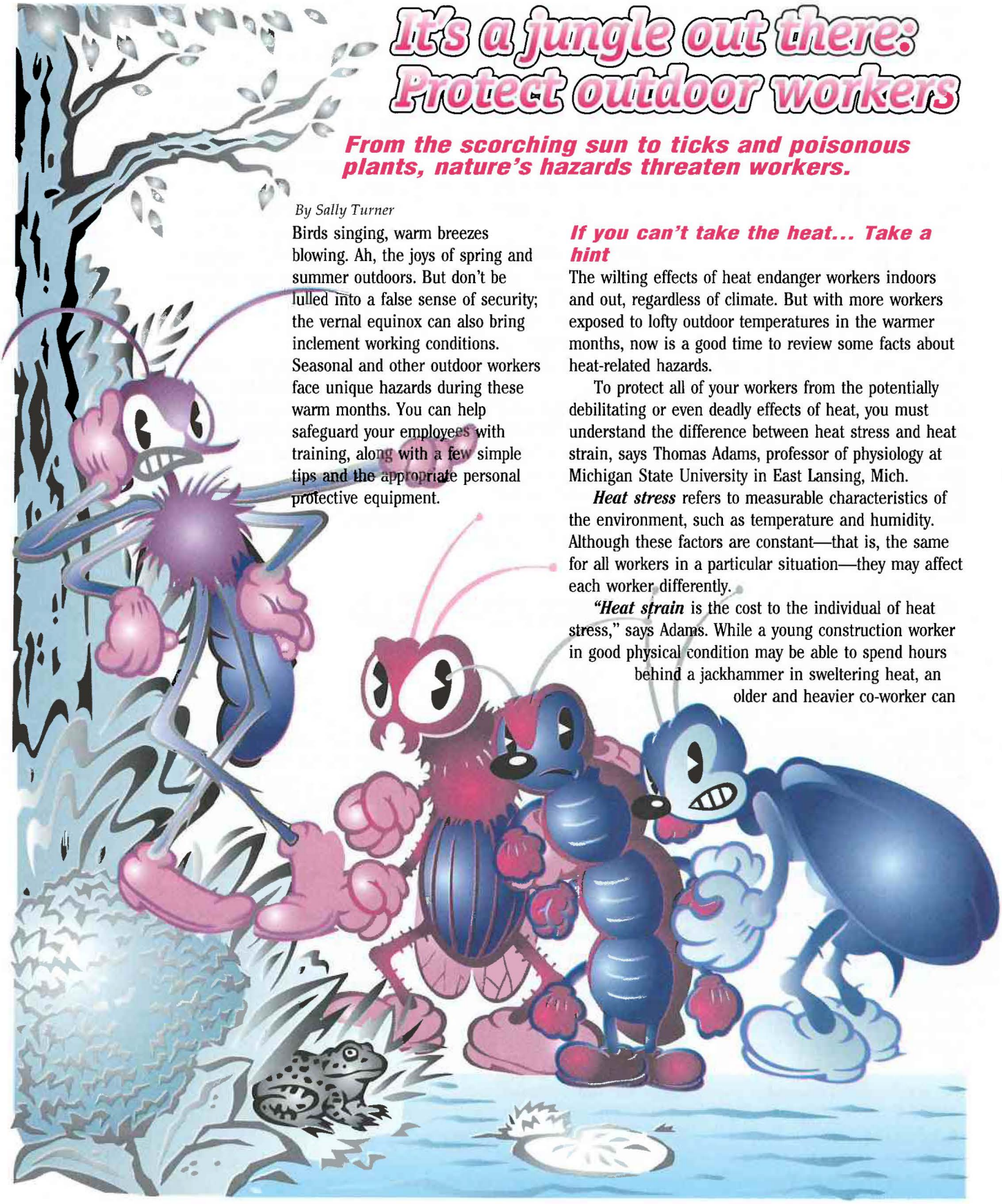
Submitted by John V. Forte, National Mine Academy, Beckley, WV

It's a jungle out there: Protect outdoor workers

From the scorching sun to ticks and poisonous plants, nature's hazards threaten workers.

By Sally Turner

Birds singing, warm breezes blowing. Ah, the joys of spring and summer outdoors. But don't be lulled into a false sense of security; the vernal equinox can also bring inclement working conditions. Seasonal and other outdoor workers face unique hazards during these warm months. You can help safeguard your employees with training, along with a few simple tips and the appropriate personal protective equipment.



If you can't take the heat... Take a hint

The wilting effects of heat endanger workers indoors and out, regardless of climate. But with more workers exposed to lofty outdoor temperatures in the warmer months, now is a good time to review some facts about heat-related hazards.

To protect all of your workers from the potentially debilitating or even deadly effects of heat, you must understand the difference between heat stress and heat strain, says Thomas Adams, professor of physiology at Michigan State University in East Lansing, Mich.

Heat stress refers to measurable characteristics of the environment, such as temperature and humidity. Although these factors are constant—that is, the same for all workers in a particular situation—they may affect each worker differently.

"Heat strain is the cost to the individual of heat stress," says Adams. While a young construction worker in good physical condition may be able to spend hours behind a jackhammer in sweltering heat, an older and heavier co-worker can

succumb to heat strain without lifting a finger, in the same or even lower temperatures.

Be aware of factors that increase heat *stress*:

- Elevated air temperatures and humidity
- Absence of a breeze or wind
- Exposure to direct sunlight
- Vigorous work or exercise
- Work around hot machinery

More important, know which workers are likeliest to suffer heat strain in the above situations. The following factors boost the chances that an employee will have problems:

- Obesity or overweight.
- Poor physical condition. Any worker who is new to a heat-stressing job should have a physical examination to determine whether his or her cardiovascular, kidney, respiratory and sweat-gland functions are adequate for the circumstances.
- Advanced age.
- Lack of experience with heat-stressing work. The bodies of workers who are used to heat stress have often acclimated to the heat, so they're better able to cope with the stress.
- Alcohol consumption. Alcohol causes dehydration, which compromises the body's ability to fight heat stress.
- Certain medications. "Antihistamines are particularly dangerous," says Adams. "A person who worked in a heat-stress setting for a long time and did very well took antihistamines and died." His physician forgot to tell him to avoid heat stress while on the medication, because some antihistamines suppress sweat gland activity. Employees should ask their doctors about the effects of any medicines during heat strain.
- Inadequate information. Anyone who works in severe heat should know the warning signs of heat strain and how to cope with heat-related stress and strain.
- Gender. Some evidence indicates that women tolerate heat stresses better than men, Adams says.

Keep out cancer-causing rays

Another hazard that faces all outdoor workers is ultraviolet radiation caused by exposure to the sun's rays. The American Cancer Society predicts that doctors will diagnose more than 700,000 new cases of skin cancer in the United States this year, most caused by overexposure to the sun.

Of the three major types of skin cancer, basal cell carcinoma is the most common. About half a million new cases are diagnosed each year in the United States, says Ken Springer, regional supervisor for the division of safety and hygiene at the Ohio Bureau of Workers' Compensation. The more ultraviolet exposure a worker has, the greater his or her chances of getting basal cell carcinoma. Fortunately, although it is the most common type of skin cancer, basal cell carcinoma grows slowly and usually is not life-threatening, the American Cancer Society reports.

Squamous cell carcinoma also results from too much sun exposure. Unlike basal cell carcinoma, it can spread to other parts of the body; but the cure rate is high when the cancer is detected early, says Springer.

Malignant melanoma, the deadliest type of skin cancer, affects about 32,000 new patients and kills about 6,700 people in the United States each year. Diagnosed early, however, melanoma is easily cured, reports the American Cancer Society. Mounting evidence links melanoma to ultraviolet exposure, says Dr. Boris Lushniak, a dermatologist with the National Institute for Occupational Safety and Health.

Protect workers with sunscreen and information

Outdoor workers can't hide from the sun altogether, but they can and should take precautions to minimize their exposure.

Springer encourages employers to provide sunscreen to workers as part of standard personal protective equipment and to make it accessible so that people will use it. He suggests that employers mount large dispensers of sunscreen near the exit doors workers use to go to their outdoor workstations.

"If they're on a tractor, mount it right in the tractor, so that it's always right there and available," says Springer. Sunscreens protect through a chemical reaction, so it is best to apply sunscreen 15 to 20 minutes before exposure.

Decipher the mysterious SPF

Fifteen is the magic number when it comes to SPF, or sun protective factor. Sunscreen with an SPF of 15 will protect a person from sunburn 15 times longer than it would normally take that person's skin to redden. "You need to know the minimum time it takes your skin to redden in the sun," Springer notes.

If it takes 20 minutes before your skin normally reddens, then with SPF 15 sunscreen, you could safely work five hours in the sun. Remember, however, that more sunscreen applied after five hours will ***not*** protect you from sunburn.

In addition to sunscreen, PPE should include long-sleeved shirts and pants made of tightly woven fabrics such as cotton. Hats are another essential PPE component. Springer advises managers to steer workers away from the traditional baseball cap that leaves the ears, the back of the neck and the bridge of the nose exposed to the sun. A wider brim or even a Foreign Legion-style cap is a much safer choice.

When heatstroke strikes, act quickly

Heatstroke (also known as sunstroke) is the often fatal condition that occurs when a person's normal temperature-regulating mechanisms become overloaded and shut down, says Thomas Adams, professor of physiology at Michigan State University in East Lansing, Mich. He cautions people not to rely on complicated calculations, measurements of body or environmental temperatures, or personal protective equipment. "I put a lot of faith in people knowing the early warning signs and acting appropriately."

Help your [co-]workers avoid becoming the casualties of heatstroke. Look for these warning signs:

- **Visible sweating**—Visible sweat on the skin's surface is a sure indication that a person is not in good physical condition, says Adams. "People say, 'I sweat all the time,' and I say, 'OK, all the time you're at stage one of heatstroke, which is like ignoring the red light on the dashboard of your car.' It would be just as inappropriate to say, 'Oh, that red light's on all the time; I never worry about it.' Your engine's not going to last very long."
- **Increased heart rate**—A normal response to strenuous work even in cold weather is an increased heart rate. If in hot weather, however, you feel a pounding pulse during only moderate work, slow down, go to a cooler spot and rest.
- **Clumsiness or confusion**—If a worker misplaces frequently used tools, seems confused or clumsier than normal and finds that routine chores require more concentration, he or she has progressed further toward severe heat strain and is at risk on the job.
- **Unexplained irritability**—Tempers flare and people are more easily frustrated than usual. If workers "don't seem to be themselves," get them to cool off and rest.
- **"Feeling kind of funny"**—Heat strain often feels similar to mild or moderately severe flu-like symptoms, such as lightheadedness, nausea, fever or chills, clammy or shaking hands and an unsteady gait.

Heat exhaustion can lead to these serious physiological disorders:

- **Heat syncope**—In the first stage of heat exhaustion (not stroke), a worker may faint or have blurred vision or reduced peripheral visual fields, see spots, hear ringing in the ears, or experience odd tastes or smells, tingling in the tongue and face, nausea, weakness or disorientation. To avoid this condition, be physically fit, rest in a cool place for 10 minutes of each work hour and keep body fluids and electrolytes in a normal range (see below).
- **Loss of body water and salts**—If these are not replaced, a worker will feel fatigue, nausea, muscle cramps and dizziness, and could suffer from vomiting, circulatory failure and death. People who work in the heat must learn to use electrolyte replacement fluids rather than just plain water. Consult a physician to determine the best solution for you. Don't depend on salt tablets or soft drinks. To avoid this condition, drink small amounts of fluid frequently. If you urinate throughout the day at about the same rate as other times of year or while not working, you are probably getting the right amount and mix of water and electrolytes. Quenched thirst is not a reliable indicator of adequate hydration.
- **Thermoregulatory failure or heatstroke**—The victim may be panicky, confused, manic, delirious, unconscious or have convulsions. To reverse this condition, get emergency medical help. Meanwhile, loosen or remove clothing, flood the victim's skin with tepid (not cold) water and fan his or her body vigorously. Insist that the victim be hospitalized. Without advanced medical care, a worker may die from tissue damage within 24 to 72 hours of heatstroke, even if his or her body temperature is reduced.

Workers are subject to exercise-induced heat stress year-round, regardless of the weather. Take precautions for yourself and keep an informed eye on your co-workers. If you can't take the heat, take these hints and take care of yourself.

Springer's office developed a 45-minute slide presentation to teach awareness and prevention of skin cancer. For information, contact Springer at (614) 575-1190.

Watch out for sun sensitivities

Certain medications and other substances can make a person more sensitive to sun exposure. Antibiotics such as tetracycline can cause a person to sunburn more easily, Springer says. Outdoor workers should ask their physicians about any medications they take.

Skin sense

Summertime—a time to shed those heavy winter clothes, head outdoors and cure the "cabin fever" of the winter. The first few days of enjoyment are often followed by red skin, but, as any devoted sun worshiper can explain, that's the price of a healthy summer glow. It is also a small deposit on a much bigger account, skin cancer.

It is estimated that one million new skin cancers will be diagnosed in 1996. Half of all new cancers will be on the skin, and roughly 7300 people will die from melanoma (skin cancer) this year. One in five Americans will develop some variety of skin cancer, and the chance of malignancy is predicted to be one in seventy five by the year 2000.

All people, regardless of race or skin tone, are susceptible to cancers of the skin. Those with fair complexions, blondes or red heads, those with blue, green, or gray eyes are at greater risk than others, as are any persons those received excessive sun exposure prior to age twenty, and those with a family history of skin cancer.

The best way to fight skin cancer is early detection. A thorough examination, regularly performed, can find a mole or other surface irregularity. Be especially careful of moles that are asymmetrical (one half appears different from the other), irregular in shape, varied in color, or are larger than the diameter of a pencil eraser. Skin spots which become crusty, or appear to grow, change, or bleed should be examined by a dermatologist.

Prevention of skin damage is the best way to avoid the risk of skin cancer. Avoid sun exposure between the hours of 10:00 a.m. and 4:00 p.m.. Use a sun screen with both UVA and UVB protection as well as an SPF rating of 15 or more. Apply it regularly, normally once every two or three hours, more often if exposed to water. Wear protective clothing, a broad brimmed hat, and protective sunglasses. Stay in the shade as much as possible. Avoid reflective surfaces, such as water, which can reflect as much as eighty five percent of the damaging rays back at you.

Unlike our pioneer ancestors (who appear to have had very few skin cancer problems), we believe that fewer clothes and browned skin is a sign of health. As we live longer lives, we want to keep what looks we have as long as possible. Care—and protection—of our "birthday suits" will help insure we reach that goal. After all, that is an irreplaceable part of our wardrobe!

Submitted by:
Robert C. Peterson, PE
Safety/Engineering
Lone Star Industries, Inc.,
Cement & Construction Materials Grp.
Maryneal Plant, P.O. Box 1639
Sweetwater, Texas 79556
(915) 288-4221

A group of plants known as furocoumarins have a similar effect. These include celery, lemons and limes among others, says dermatologist Lushniak. A bartender who cuts limes at an outdoor bar and serves drinks all afternoon in the sun could end up with a "nasty rash, like a bad sunburn."

Gloves or barrier creams with sunscreen provide good protection, Lushniak says. Call a tanning parlor for a list of medications and other substances that interact with ultraviolet radiation. Some states require tanning parlors, which Lushniak does not endorse, to provide such information.

Sunglasses: More than a fashion statement

Your eyes are vulnerable to the sun's dangers as well. Chronic exposure to intense ultraviolet radiation damages the lens and can eventually lead to cataracts, says Springer. It can even damage the retina.

Springer recommends sunglasses with "special purpose" lenses, which block out 99 percent of all ultraviolet radiation. Glasses with "cosmetic" and "general purpose" lens designations do not provide adequate protection for outdoor workers and don't necessarily cost less. Look for a design that protects the eyes from the side and top as well as the front.

Things that sting and bite

Forestry, agriculture, landscaping, [mining,] and road maintenance workers in particular should be aware of the risks posed by stinging insects, spiders, ticks and snakes. Stinging insects accounted for the largest number of workers compensation claims in Ohio last year, Springer says.

Even workers who are not allergic to bee or wasp stings can develop secondary infections from them. An attack by a swarm of stinging insects can be lethal if a person receives enough poison. Workers who are allergic to bee stings can experience anaphylactic shock and sometimes die after a single sting.

Tick bites can cause Lyme disease or Rocky Mountain spotted fever, both potentially fatal. Don't let the names fool you; although both diseases are named for specific locales, their incidence is widespread. North Carolina accounted for the greatest number of cases of Rocky Mountain spotted fever in the United States; there were 88 deaths in 1994.

The bites of poisonous spiders such as the black widow and brown recluse rarely kill healthy adults but can cause severe illness and tissue damage. Likewise, rattlesnake bites can also cause a great deal of pain,

says Springer. Coral snakes, found primarily in the tropics and the southern United States, release a neurotoxin that can paralyze the victim's respiratory system and possibly cause death.

PPE for workers who may be exposed to such perils includes:

- Insecticides and tick repellent;
- Heavy jeans and boots that cover the ankles and can protect against snake bites;
- A first-aid kit that contains two or three epinephrine pens—self-administered shots of adrenaline to counter the potentially fatal effects of a bee sting to an allergic worker; and
- Long-sleeved shirts, gloves and hats that can keep ticks from lodging on a worker.

Additionally, remind your workers not to reach into cool, dark places where spiders live; under or behind rocks where snakes often lie; or anywhere they can't see. Be aware of the potential for stinging-insect nests and don't send workers out alone in areas where nests may exist. The buddy system can save lives when workers are overcome by swarming insects. Instruct employees to examine their entire bodies with a mirror or with someone else's help, so they can look for ticks after each day in the field. Chances are, a worker won't notice the actual bite.

Plants can make your skin crawl... Or itch

The same workers at risk for bites and stings are likely to encounter poisonous plants in their work.

Poison ivy and other poisonous plants can cause contact dermatitis, which, although not deadly, can be costly in terms of medical expense and time off from work, says dermatologist Lushniak.

To protect your workers from poisonous plants, you can try to destroy them ahead of time. But be forewarned, the plant's oleoresin (which contains the poison), when burned, can be inhaled with disastrous and even fatal effects. So, if you plan to burn out the poisonous plants, make sure that workers are protected from inhaling the smoke and particulate matter released.

Lushniak recommends the use of gloves and clothing made of tightly woven fabric to prevent contact. Clothing should be washed in soap and water after any possible contact, because the oleoresin stays active. "You can get poison ivy from unwashed coveralls or even machinery," he says.

The effectiveness of barrier creams—thick, waxy or oily creams applied to the skin's surface—is questionable, says Lushniak.

If workers know they have contacted a poisonous plant, have them scrub the area as soon as possible with soap and water. Don't be misled by the absence of symptoms; they typically don't appear immediately after contact .

Chemical exposure Poses hazards to skin, other organs

Construction workers and others who work with cement are at risk for cement dermatitis. Chromium in the cement can cause an allergic reaction, Lushniak says. Barrier creams may provide some protection, but the best course is to keep cement off the skin's surface. If workers get any on their skin, make sure they wash it off as soon as possible.

Agriculture workers often face serious health threats from pesticides and herbicides, says Steve Lenhart, an industrial hygienist for NIOSH's Health Hazard Evaluations and Technical Assistance Branch in Cincinnati. The greatest risk of contamination occurs when workers mix and transfer the pesticide from a holding tank to the tractor tank.

Make sure that your employees wear safety shields to protect their eyes and skin from splashes, and encourage them to have a spare set of clothing in case one set gets saturated, Lenhart says. He urges managers to make water available for workers to rinse wherever a spill occurs. Equipment repair workers should wear neoprene gloves, and supervisors should ensure that workers inspect gloves for holes or tears and decontaminate them after each use. Chemical resistant foot protection is also important. Pesticides and insecticides can soak through leather boots and shoes.

Instruct your workers to be aware of wind direction and the locations of other workers when they spray chemicals. Be sure to follow... [M]SHA standards for respiratory protection. Among other things, these standards require you to select a respirator that is appropriate for the individual who will wear it and for the situation in which that worker will use it.

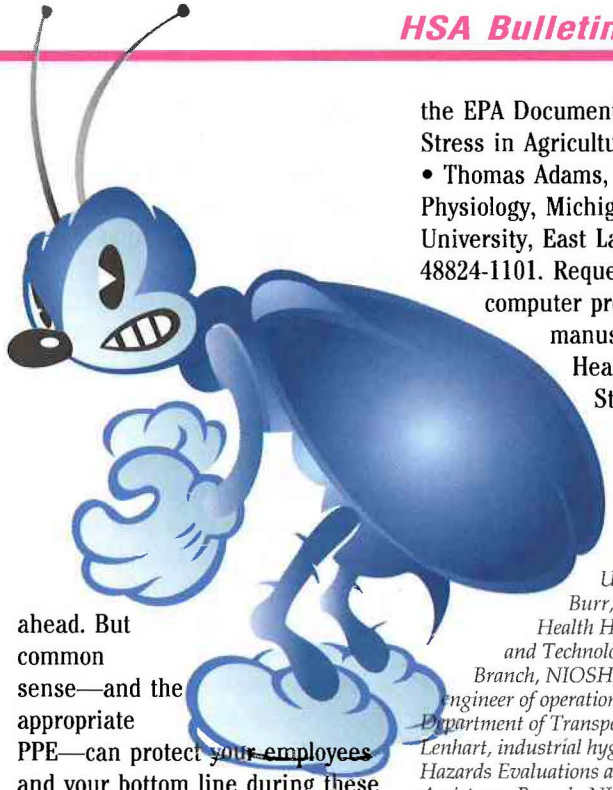
With the vast array of hazardous chemicals typically present in

many outdoor jobs, it's not easy to keep track of the risks or how to respond when a worker is exposed. Jim Klafeta, engineer of operations for the Illinois Department of Transportation, District 1, finds invaluable help from the Hazardous Materials Information Network. Each maintenance yard in his Chicago-area district has a computer loaded with the "Hazmin" software system, which lists each product's supplier, manufacturer, safety precautions for use and storage, how to respond if an employee is exposed and other crucial details. The information also is stored in a hard-copy manual.

Klafeta recalls losing an employee several years ago, prior to the availability of such information. The worker was hit by a car while he painted stripes on the road. The paint, which contained the thinning agent toluene, infected a serious cut on his leg and he eventually died from the poison in his bloodstream. IDOT now uses only water-based paints.

Common sense and PPE save lives, improve productivity

Countless other hazards will jeopardize the lives and well-being of outdoor workers in the months ahead. But common sense—and the appropriate PPE—can protect your employees and your bottom line during these busy months. Be alert to the unique risks your employees face and encourage safe work practices to ensure their productivity now and in the future.



For more information on heat stress and strain, contact these resources:

- The National Institute for Occupational Safety and Health, (800) 35-NIOSH. Request Document 86112, "Working in Hot Environments."
- The Environmental Protection Agency, (703) 305-7666. Request the EPA Document "Guide to Heat Stress in Agriculture."
- Thomas Adams, Department of Physiology, Michigan State University, East Lansing, MI 48824-1101. Request a copy of the computer program and manuscript "Human Heat Stress and Strain."

Sources: Thomas Adams, professor of physiology Michigan State University; Greg Burr, industrial hygienist, Health Hazards Evaluations and Technological Assistance Branch, NIOSH; James Klafeta, engineer of operations, Illinois Department of Transportation; Steve Lenhart, industrial hygienist, Health Hazards Evaluations and Technological Assistance Branch, NIOSH; Dr. Boris Lushniak, dermatologist, Medical Section, Health Hazards Evaluations and Technological Assistance Branch, NIOSH; Dr. Aubrey Miller, medical officer, Health Hazards Evaluations and Technological Assistance Branch, NIOSH; Ken Springer, regional supervisor, Southeast Region, Division of Safety and Hygiene, State of Ohio; William Wagner, director of technical affairs, ACGIH.

*Reprinted with permission from the April 1996 issue of **Safety + Health** magazine—a publication of the National Safety Council, 1121 Spring Lake Drive, Itasca, IL 601433201.*

Safety reminder

Hazardous agents can put a miner's family at risk

When the subject of hazardous materials arises, it's popular to tell workers "what you don't know *can* hurt you". But now it seems that what you don't know about hazardous materials can hurt your family as well. A recent study by the National Institute for Occupational Safety and Health (NIOSH) in the U.S. looked into cases in 28 different countries where families had been exposed to toxic substances and infectious agents apparently linked to the workplace of one of the family members. The study was the subject of a report recently in *ACGIH Today*, the journal of the American Conference of Governmental Industrial Hygienists.

Among more than a dozen health effects the study identified were:

- asbestosis and mesothelioma

(lung and skin diseases) from asbestos;
- chloracne and other effects from chlorinated hydrocarbons;
- neurological effects from mercury;
- liver angiosarcoma (tumors) from arsenic;
- status epilepticus (a series of epileptic attacks) from chemical exposure.

Of course, there are sources for exposure to hazardous materials within the home, but this study focused on contaminants the worker unknowingly transports home from work.

A number of preventive measures can help reduce risk to the family of a worker who is exposed to hazardous materials. First, every effort should be made to reduce that exposure in the workplace as much as possible.

Workers who must work with hazardous materials should be able to change their clothes and shower before going home. If possible, work clothes should be laundered at work or by someone contracted by the employer to do that work safely. The worker's street clothes should be stored in a separate area of the workplace to avoid contamination.

If the worker must take work clothes home, they should be laundered separately from the family's regular washing.

In Canada, some of these preventive measures for specific hazardous agents may be identified in the Material Safety Data Sheet (MSDS) for that chemical. MSDSs are required for any controlled substance under the Workplace Hazardous Materials Information System (WHMIS), and the sheets must be updated at least every three years.

Under WHMIS, employers have a responsibility to inform and train their employees about the preventive measures that will ensure their safety when exposed to hazardous materials. Employees, in turn, have a duty to learn and apply that information. The new NIOSH study gives workers even more incentive to make sure they get the proper training and use it. Not only is their own health at stake; the lives of their families may be at risk too.

Cheryl Suzio, Chairperson of the HSA Scholarship Committee presents replica checks to Gene Rek and to Nancy Dorset.

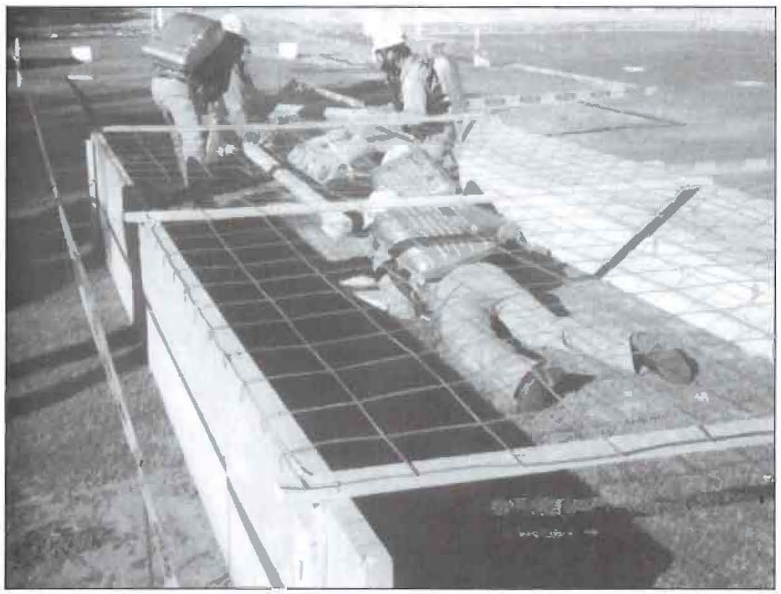
HSA Scholarships awarded

The two winners of Joseph A. Holmes Scholarships are Gene Rek and Nancy Dorset.

Rek is a safety engineer at ALCOA's Sandow Mine in Rockdale, Tex. He is enrolled in the safety program at Texas Technical College where he commutes 160 miles to attend classes. Rek has earned 42 semester hours toward completion of the program. He plans to take a leave of absence to go to school full time, and the scholarship will help defray his expenses.

Dorset was a coal miner at Consolidation Coal Co.'s Arkwright No. 1 mine in Osage, W.Va. She is a member of the Cave Rescue Team and a certified instructor. Her specialties are wilderness medicine, patient care, and overall rescue and research management. She was a member of MSHA's team testing the MSA prototype of the SCSR. Dorset has served as a representative to the National Safety Council, a Miner's representative, and a Safety Committee member for UMWA Local 5429. She is attending West Virginia University where her major field of study is mining engineering. She is preparing to graduate, and believes a Ph.D. and a teaching/research position at a mining college are within her reach.

Reprinted from the June 14, 1996 edition of Legal Publication Services Mine Safety and Health News.



Americans assist Mexico in second mine rescue contest

Gilbert Miera, Deputy State Mine Inspector from Silver City, N. Mex., and Whitey Jacobson Safety Specialist from MSHA's Dallas, Tex., District office, traveled to Frisnello, Mexico on March 30th, to assist the Mexican Mining Industry in their Second Annual Mine Rescue Contest. The competition was sponsored by the Penoles Group headquartered in Toran, Mexico.

The Penolas Group operates 9 mineral mines and a coal mine throughout Mexico. Minerals include gold, silver, and zinc along with other metal byproducts being refined at some of the operations. The Mine in Frisnello has been mining since the middle 1500s. Monthly production amounts to 25 tons of silver—gold is a by product. The mine is opened by a decline and vertical shaft about 2,300 feet deep. They mine about 92,000

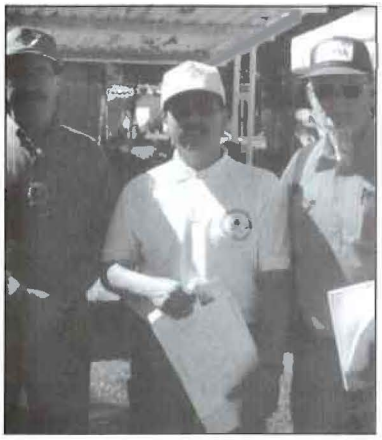
metric tons of ore a month. The mine operates around-the-clock 7 days a week.

The mine rescue contest was held April 1-2, 1996. The Benchmans competition, first aid competition, and written examinations were held on Monday. The field competition was held on Tuesday. Sixteen teams participated in the program.

The winning team was scheduled to compete in the Carlsbad, N. Mex. contest held this past April 18-19. The company withdrew from the Carlsbad contest because of a massive ground fall that resulted in the death of 2 miners at one of the company's mines. All of their mine rescue personnel are mining engineers and were needed to investigate the accident.

They plan to invite mine rescue teams from the U.S. to participate in the 1997 contest to make this an international event.

Whitey Jacobson, E & T Specialist, South Central District Office, Dallas, Tex.



Upper left, rescue team members crawl under simulated hazard as part of the rescue problem. At right above, is the statue dedicated to the miners of Frisnello, Mexico. Lower left, left-to-right are: Gilbert Miera, Deputy State Mine Inspector from Silver City, N. Mex., an unidentified contest official, and Whitey Jacobson Safety Specialist from MSHA's Dallas, Tex., District office. At lower right a rescue team works their way through the mine rescue problem.

THE LAST WORD...

A timid person is frightened before a danger, a coward during the time, and a courageous person afterwards.—Jean Paul Richter

When I was young I observed that nine out of every ten things I did were failures, so I did ten times more work.—George Bernard Shaw

The expectations of life depend upon diligence; the mechanic that would perfect his work must first sharpen his tools.—Confucius

Constant success shows us but one side of the world; adversity brings out the reverse of the picture.—Charles Caleb Colton

No man is more unhappy than the one who is never in adversity; the greatest affliction of life is never to be afflicted.—Anonymous

We triumph without glory when we conquer without danger.—Corneille

Prosperity is not without many fears and distastes; adversity not without many comforts and hopes.—Francis Bacon

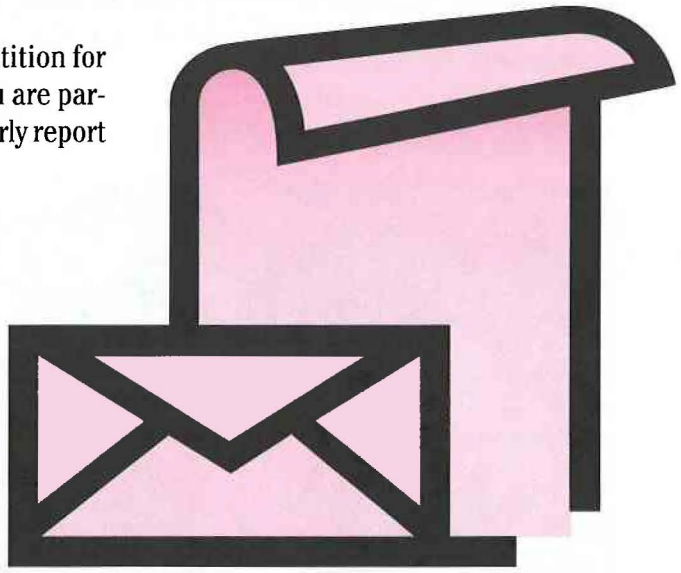
The most dangerous thing in the world is to try to leap a chasm in two jumps.
—William Lloyd George

NOTICE: We welcome any materials that you submit to the Holmes Safety Association Bulletin. We **DESPERATELY** need color photographs suitable for use on the front cover of the ***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 1996 is underway—please remember that if you are participating this year, you need to mail your quarterly report to:

Mine Safety & Health Administration
Educational Policy and Development
Holmes Safety Association Bulletin
P.O. Box 4187
Falls Church, Virginia 22044-0187

Please address all editorial comments to the editor, Fred Bigio, at the above address. Phone: (703) 235-1400



Holmes Safety Association Officers and Executive Committee 1995-1996

Officer	Name	Representing	State
President	John Shutack	Federal	VA
First Vice President	Steve Walker	Supplier	WV
Second Vice President	Fred Bowman	State	IL
Third Vice President	Gary Moore	Management	NM
Fourth Vice President	Roger Carlson	Labor	MN
Secretary-Treasurer	Robert Glatter	Federal	VA

Name	Representing	State
Barry Ryan	Federal	WV
Timothy Thompson	Federal	WV
Bruce Dial	Federal	WV
Jerry Johnson	Federal	WV
Jim Myer	Federal	OH
Robert Crumrine	Federal	OH
John Collins	Federal	OH
Michael Lawless	Federal	WV
Claude Narramore	Federal	VA
Vern Gomez	Federal	VA
Marvin Nichols	Federal	VA
Jesse Cole	Federal	WV
Rexford Music	Federal	KY
Leland Payne	Federal	KY
Joseph Pavlovich	Federal	KY
Ron Deaton	Federal	KY
Jon Montgomery	Federal	NY
Joseph Garcia	Federal	PA
Don Conrad	Federal	PA
Donna Schorr	Federal	PA
James Petrie	Federal	PA
Bob Randolph	Federal	PA
Fred Hanson	Federal	CA
Doyle Fink	Federal	TX
Martin Rosta	Federal	AL
Dave Couillard	Federal	MN
James Salois	Federal	MN
Larry Ramey	Federal	CO
Judy Tate	Federal	OK
Whitey Jacobson	Federal	TX
Lonnie Gore	Mgmt.	WV
Ernest Marcum	Mgmt.	WV
Roger Ball	Mgmt.	WV
Adele Abrams	Mgmt.	DC

Name	Representing	State
H.L. Boling	Mgmt.	AZ
Chuck Gessner	Mgmt.	AZ
Kevin Myers	Mgmt.	KY
Kyle Dotson	Mgmt.	AZ
Cheryl Suzio	Mgmt.	CT
John DeMichiei	Mgmt.	PA
Richard Radakovich	Mgmt.	PA
Ronald Corl	Mgmt.	PA
Jim Sells	Mgmt.	PA
Myron Nehrebecki	Mgmt.	PA
Steven Reyba	Mgmt.	PA
Andrew Hewitson	Mgmt.	PA
Clifford Forrest	Mgmt.	PA
Jon Merrifield	Mgmt.	OH
James Tompkins	Mgmt.	OH
Mark Wharton	Mgmt.	CO
Joseph Vendetti	Mgmt.	WY
William Craig	Mgmt.	WY
Richard Burns	Mgmt.	WY
Penny Traver	Mgmt.	MI
Nancy Staley	Mgmt.	MI
William Vance	Mgmt.	NM
Gary Cook	Mgmt.	NM
Joseph Lamonica	Mgmt.	DC
Rick Wells	Mgmt.	KY
Richie Phillips	Mgmt.	KY
Nelson Mueller	Mgmt.	TX
George Krug	Mgmt	MA
Lloyd Armstrong	Mgmt.	MN
Greg Oster	Mgmt.	MN
Frank Salas	Labor	AZ
Henry Townsend	Contractor	TX
Larry Russell	Contractor	TX
Joseph Main	UMWA	DC

Name	Representing	State
Robert Scaramozzino	UMWA	DC
Jeff Duncan	UMWA	PA
Lex Prodan	UMWA	PA
Larry Frisbie	State	WA
Sam Vancil	State	IL
Ben Hart	State	FL
Lee Graham	State	KS
John Franklin	State	KY
Al Simonson	State	MN
Tom Gregorich	State	MN
Desi Apodaca	State	NM
Doug Conaway	State	WV
Tony Grbac	State	WV
Douglas Martin	State	AZ
Thomas Ward, Jr.	State	PA
Joseph Sbaffoni	State	PA
William Garay	State	PA
Paul Hummel	State	PA
Ron Cunningham	State	OK
Phillip Johnson	State	KY
Glen Rasco	State	GA
Jerry Duncan	Supplier	WV
Steve Lipe	Supplier	AZ
Wayne Peterson	Insurance	MN
William Hoover	Emeritus	AZ
Vern Demich	Emeritus	PA
Harry Thompson	Emeritus	PA
Richard Machesky	Emeritus	PA
Bill Powell	Emeritus	TX
Ford B. Ford	Emeritus	VA
Ronald Keaton	Emeritus	WV
Irmadell Pugh	Emeritus	WV
Alex Bacho	Emeritus	MD

This month's cover: A JOY 4LS longwall shearer, courtesy of Joy Technologies, Inc. We welcome ***any*** *materials that you submit to the Holmes Safety Association* ***Bulletin****. We especially need color photographs (8" x 10" or larger—color negatives are acceptable) for our covers. We cannot guarantee that they will be published, but if they are, we will list the contributor(s).*

Because of the recent federal shutdown, we did not publish the January issue of the Bulletin. We regret any inconvenience.

U.S. Department of Labor
MSHA, Holmes Safety Association
P.O. Box 4187
Falls Church, VA 22044-0187

BULK RATE
POSTAGE & FEES PAID
DOL
PERMIT NO. G-59

84807 OA
NATIONAL MINE S & H ACADEMY
INFORMATIONAL SERVICES BRANCH
P O BOX 1166
BECKLEY, WV 25802

JOIN and GROW with us

Mark your calendar NOW!

Upcoming events:

- *Aug. 14, Small Mines H&S Seminar, PSU, State College, PA*
- *Aug. 16, MSHA Academy 20th Anniversary, National Mine Academy, Beckley, WV*
- *Aug. 21-22, Ky. Steering Comte./Ky. Holmes Safety Assoc., Holiday Inn N., Lexington, KY*
- *Aug. 22-24, Nevada Mining Association Convention, Harvey's Lake Tahoe, Lake Tahoe, NV*
- *Aug. 26-28, 27th Annual Institute on Mining Health, Safety, & Research, Virginia Tech Campus, Blacksburg, VA*