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Comparison of Small Mines and Small Businesses: Health and Safety Barriers and Intervention Strategies

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CIP

CONTENTS

ILLUSTRATIONS

TABLE

COMPARISON OF SMALL MINES AND SMALL BUSINESSES: HEALTH AND SAFETY BARRIERS AND INTERVENTION STRATEGIES

By Lynn L. Rethi[1] and Kristine L. Burns[2]

ABSTRACT

This U.S. Bureau of Mines report summarizes common obstacles found when attempting to implement health and safety strategies in small mines and small businesses in general industry. Recently, the U.S. Mine Safety and Health Administration focused much of its attention on addressing health and safety issues at small mines. Some of the more innovative interventions practiced by small businesses in general industry are discussed for consideration of their applicability to the mining industry. The most effective intervention strategy that was developed for small businesses is the Occupational Safety and Health Administration Consultative Program. The details of this program and other intervention strategies used by small mines and small businesses are presented.

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INTRODUCTION

The trend of small mines experiencing a higher fatality incidence rate (FIR) than larger operations is parallelled by small businesses in general industry. Both small entities are often compared to larger operations within their standard industrial classification (SIC). Likewise, literature indicates that many of the obstacles to implementing health and safety strategies into small mines are similar to those obstacles present in small businesses. Small mines and small businesses have attempted to address these health and safety concerns. Some of the innovative interventions implemented in small businesses suggest their application may be equally effective in small mines. This report will focus on the barriers to health and safety and intervention strategies in both small mines and small businesses and offer recommendations based upon those proactive intervention strategies being used by small businesses in general industry.

A small mine is defined in this report as a mine that employs 50 or fewer people. Small mines have historically experienced a higher FIR than larger mines throughout the mining industry. This trend has been documented as far back as the 1980's. In July 1982, a study in the safety of U.S. underground coal mines was completed by the Committee on Underground Coal Mine Safety; the results of the study were published in a report entitled "Toward Safer Underground Coal Mines" (*1*).[3] One of the findings of the study was that there was a strong correlation between mine size and fatal injuries. The Committee found that the FIR in mines with 50 or fewer employees was nearly 3 times that of larger mines.

A more recent study conducted in 1994, "Statistical Profile of Accidents at Small Underground Coal Mines" (*2*) which analyzed statistics from 1989 to 1991, found that the trends are still similar to those cited in "Toward Safer Underground Coal Mines" (*1*). This study (*2*) also reinforces that FIR's are consistently higher at small mines than at large mines. In fact, the difference between the rates at large mines and small mines has become even more extreme (*2*). Tisdale (*3*) reported that "in 1992, small underground coal mines, with fewer than 20 employees, had a fatal incidence rate of about 6 times that of larger mines, and those with more than 20 but fewer than 50 employees had a rate about 4 times that of larger mines."

FIR's continue to be one dependent measure that has historically been used to "benchmark" how one company compares to another. Both fatalities and fatality frequencies have been used to characterize small mines.

The realization of smaller operations having a significantly higher fatality and injury rate is not unique to the mining industry. Small worksites in general industry employ nearly 60% of the Nation's work force (*4*). Based on estimates published in the "County Business Patterns" section of "Occupational Safety and Health" (*5*), 94.8% of the business establishments in the United States employ less than 50 people. As with the small mines, these "small businesses" are experiencing higher fatality and injury rates when compared to larger operations within their industrial code. This pattern of small businesses having higher incidence rates is not confined to the United States. A study entitled "Work-Related Injuries and Illnesses: Small Employers" (*6*) states that in Alberta, Canada, small employers (39 or fewer employees) represented an average of 37% of the estimated person years and 96% of all worker compensation claims.

When comparing small mines to small businesses, both appear to be experiencing similar problems when attempting to address health and safety concerns within their organizational operations. Both entities, in their respective industry, have identified definite "roadblocks" to implementing a health and safety program to address their specific needs. These common obstacles parallel those documented in 1982 when the U.S. Mine Safety and Health Administration (MSHA) conducted a study to identify factors that possibly contribute to disabling injuries in all underground coal mines (*7*). The study identified training, quality of management-labor relations, and available resources as key elements that correlated with disabling injury rates in underground coal mines.

As part of its goal to improve the health and safety of the Nation's miners, the U.S. Bureau of Mines has compiled some of the more innovative attempts used by small businesses in general industry for consideration of their applicability to the mining industry.

[3]Italic numbers in parentheses refer to items in the list of references at the end of this report.

SMALL BUSINESSES

BACKGROUND AND BARRIERS

Although the majority of businesses throughout the world are small businesses, there are few empirical studies evaluating safety and health strategies being used within this group. However, the fact that small businesses are constantly struggling to address health and safety concerns is well documented.

Several factors have been identified that are believed to exacerbate safety and health in all small businesses throughout general industry. Some of the more recurring factors are management and employee attitude, lack of awareness and knowledge of support services, limited capital and time to invest in safety, lack of proper supervision and poor communication. Obviously, these factors vastly overlap. For example, a small business manager may not be able to adequately supervise his or her employees because of multiple jobs being conducted at various geographic locations. This lack of supervision quite possibly could be eliminated if the small business had more financial resources that would enable a representative of management to frequently travel to satellite locations.

Attitude

Among the five roadblocks that small businesses encounter when attempting to implement health and safety programs is attitude. There are several aspects associated with attitude. The main focus is on the attitude of management; however, employee attitude is also of concern. The majority of small business managers do not consider health and safety to be a high priority (*8-9*). Most feel that the daily operation of their business must receive the highest priority and, consequently, most of their time and resources, leaving little left over for health and safety. As one study indicated, "Owners were too preoccupied with the myriad of immediate day-to-day demands associated with running a small business to consider workplace health a significant issue" (*8*). Another common attitude among small business managers is that their place of work is not hazardous and thus does not warrant attention being given to health and safety concerns. A study of relatively high-risk small businesses was conducted on workplace perception of health and safety. It was determined that over one-half of these businesses perceived a low level of significance with regard to health and safety even though all of these businesses were high risk (*8*). Small business management also seems to have the collective attitude that health and safety is intrinsic to expertise (*9*). Numerous studies have shown that this is not the case, thus a costly and erroneous assumption of management is made. Finally, employee attitude may be compromised. In Alberta, Canada, 24 division staff members representing 7 different branches within the Alberta Occupational Health and Safety Division participated in a workshop designed to increase effective communication among the division staff regarding "potential strategic approaches to a significant occupational health and safety problem area" (*10*). "Participants stressed that it may be difficult for small employers to influence the attitudes and behavior of their workers because their workers are often geographically dispersed" (*10*).

Awareness

Another area that poses difficulties to small businesses is the awareness of both small business management and employees. There are two areas of awareness that are directly related to management, whereas only one area is directly related to the employees. Lack of awareness or knowledge of services offered by both government and the private sector plagues small businesses. Although not abundant, there are services and resources that small businesses do not take advantage of simply because management is unaware that such services exist. These services include both regulatory and nonregulatory aspects. This unawareness is due, in part, to lack of communication, which is another one of the five "problem areas" discussed in the "Communication" section. Similarly, small business managers are unaware of the possible consequences if health and safety concerns are not addressed (*8*). They don't realize the ramifications these consequences may have on their business. Depending on the degree of occupational injury or loss, a business may be responsible for not only the medical and compensation cost but also legal liability. One study cited that "it is commonly believed that managers and workers in small businesses have very little if any knowledge of their general legal liability or rights, or of regulations" (*9-11*). Employees of small businesses are unaware of the many health and safety risks that they incur since most of them perform a multitude of tasks or jobs and thus do not have the time and/or are not provided with the resources necessary to become familiar with the appropriate health and safety measures that should be taken.

Resources

Resources and awareness are closely intertwined in that if management is unaware of resources available, the full potential of the organization may not be realized. Eakin (*9*) stated that "perhaps the most commonly cited constraint for small businesses is their financial and manpower limitations, each creating a distinct set of problems." With regard to health and safety, financial limitations are usually more damaging since the result is usually an abandonment of existing health and safety programs or a complete disregard of future investment in health and safety. A common theme is that small businesses focus on meeting payroll and often suffer the consequence that they have little or no financial resources available for addressing health and safety issues. One study reports that there is a vast difference between the actual cost of health and safety services and the fee that small businesses are capable and willing to pay for these services. The study concluded that to provide health and safety services to small businesses, the cost of the services must be subsidized by at least 70% to 80%. Even this estimate may be conservative since all of the small businesses who participated in this study had requested these services, thus resulting in an inherent bias (*5*).

Supervision

Small businesses are also hindered by the responsibility of management to supervise employees. This supervision is often compromised because of geographic location and social relationships. A small business with one or two supervisory personnel will have a difficult time monitoring the activities of workers in five or six different locations. This represents both a physical and financial constraint that small businesses have not been able to overcome. Social relationships also interfere with supervision. In the findings of "Occupational Health and Safety in Small Businesses: A Sociological Perspective," the "Perceptions of Control and Authority" section stated that "many owners felt that they did not have the authority to intervene in certain (aspects) of their employees' health related behaviors for a variety of reasons including the nature of the social relationship between owners and employees" (*9*). Those managers who have relationships with their employees, other than professional, outside of the workplace or managers who frequently work in a hands-on capacity, side by side with their employees, often have difficulty expressing and enforcing health and safety policies.

Communication

The last identified problem area is communication. This area is unique in that it presents a problem for both small businesses and various health and safety agencies. The small businesses may have communication problems within their business, as indirectly discussed earlier in the "Awareness" section. The focus of the communication problem to be discussed here is the lack of adequate communication between small business management and health and safety agencies. Several of these agencies have expressed that small businesses are "hard to reach" (*8*). This entails both locating small businesses in need of their services and finding a practical and effective means of communicating with the small business management. The appropriate means of communication will vary, depending upon the business. Possibilities include written correspondence (which will often go unread or become buried under other piles of correspondence), telephone contact (which is often difficult if the manager spends a great deal of time in the field and there is no secretary), and face-to-face contact (which is often expensive for the health and safety agency). Again, all of these means of communication depend upon the organization and structure of the small business and also upon the patience and persistence of the health and safety agency since interruptions and cancellations will be frequent occurrences at small businesses. Additionally, participants in an Alberta, Canada workshop pointed out that "division staff (especially field officers) need more internal training on the problems of the small employer in order to gain a better appreciation of the operation and organization of small businesses" (*10*) and "the organizational model that staff have in mind when dealing with large corporations may not be applicable to smaller establishments" (*10*). This particular workshop acknowledged the importance of communication at all levels.

INTERVENTION STRATEGIES

There have been attempts to address the problems identified by introducing safety and health education interventions to small businesses in general industry. Proven intervention strategies discussed in the following sections include consultative programs and formal associations. These approaches are available to large businesses as well; however, these services may benefit small businesses to a greater extent.

Consultative Programs

OSHA Consultative Program

In a 1981 study of six industrialized nations, Heath (*12-13*) found that the United States was the only country using enforcement as its primary method of combating occupational health and safety problems. He found that personnel in other countries concentrated more on disseminating information and providing technical assistance and consultation; these countries believe that a mixture of information, education, training, consultation, and enforcement produce better results than enforcement alone. Today, in the United States, the Occupational Safety and Health Administration (OSHA) Consultative (OSHCON) program is used in conjunction with OSHA's existing enforcement branch. This philosophy parallels the finding of a study conducted in Alberta, Canada, which stated that "the consensus was that inspectors should focus on consultation with the small employer regarding ways to overcome occupational health and safety problems and that enforcement should be a secondary consideration" (*10*).

The OSHCON program provides a unique service of "assisting" businesses through consultative initiatives. The OSHCON program originated from the OSHA Act of 1970. Funding did not become available to implement the program until the mid to late 1970's. Today, the OSHCON program exists in all 50 States and 5 U.S. territories. Identification and documentation of existing hazards present in the workplace is the first priority of the OSHCON program. A secondary priority is the evaluation of those hazards and the development of policies and procedures to address unsafe conditions. A third priority is to train and educate the work force in general health and safety topics. The OSHCON program also works with employers to develop specific programs, such as the Hazard Communication Standard in hopes that the employer will become self-reliant.

Any business may contact its respective OSHA Consultative office to request assistance with specific health and safety concerns. The OSHCON program focuses on assistance and cooperation between the employer and the agency as opposed to the traditional enforcement of regulations. More and more studies are indicating that consultation services may provide a more effective means of improving safety and health. One of these studies indicated that "the consultation program alone was found to reduce significantly the number of health and safety hazards found for as long as one year from the initial hazard survey" (*12*).

The typical consultation involves initial contact being established and site evaluation(s) being completed. Initial contact is usually established by businesses contacting their local OSHCON program office. The businesses explain their safety and health concerns to an OSHCON program representative who documents the information that will be used to prioritize the request. Once the business has been scheduled for a site evaluation, an OSHCON program representative will use an opening conference to define the scope of the problem and to determine the most appropriate type of evaluation for that business. This evaluation may consist of specific surveys, comprehensive surveys, correction assistance, program assistance, or training and education. Specific examples of these evaluations include lead monitoring, wall-to-wall surveys (safety inspections of entire facility), and hazard communication, among others. During the evaluation, the OSHCON program representative must be provided the opportunity to speak with the workers. The evaluation is followed by the OSHCON program recommending corrective measures that the employers can implement to address their concerns. After the employer has had an appropriate amount of time to implement the recommendations, the OSHCON program representative revisits the site and conducts another evaluation to determine the effectiveness of the measures that were taken. Once an OSHCON program representative has been assigned to a particular business, he or she is responsible for all phases of the program up to and including the final evaluation. This process ensures consistency yet provides an opportunity for the representative to elicit expertise from other OSHCON program staff members. A business that follows the recommendations of the OSHCON program and implements the appropriate safeguards is exempt from an OSHA inspection for a period of 1 year.

OSHCON programs can be staffed through a variety of sources. States with approved plans or universities with qualified staff may directly institute OSHCON programs. Private consultants may also provide these services to businesses in general industry. These consultation programs receive up to 90% of their funding from Federal OSHA and the rest from the individual (host) State. The individual OSHCON programs are staffed with safety engineers and industrial hygienists who are highly qualified to assist businesses requesting their services.

Some businesses have found that the OSHCON program can be disadvantageous. OSHCON programs prioritize requests for services with regard to the degree of hazards associated with each request and the size of the business, which subsequently determines the order in which those businesses receive services. Small businesses in high-hazard industries receive first consideration;

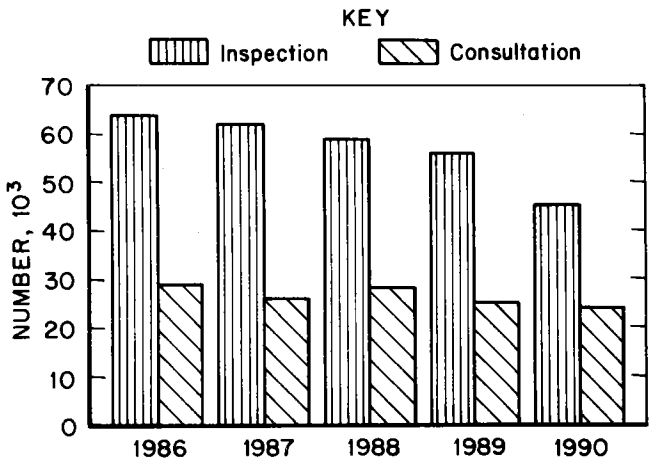
however, no one is turned down. As one OSHCON program director stated, "We just tell them that if they have more than 150 employees or are not a high hazard business, they may be on our waiting list forever" (*14*). Another potential disadvantage of the OSHCON program is that if recommendations to correct a serious hazard have been made to a business requesting assistance but not implemented, or if only partially implemented, OSHCON program representatives may contact the OSHA enforcement agency regarding the matter. Another consideration is that the business may incur costs associated with implementing the recommendations of the OSHCON program representative. There also exists the disadvantage for possible work interruptions while the site or process evaluation is being conducted by the OSHCON program staff. The OSHCON program will not respond to a request from a business during an ongoing inspection by the OSHA enforcement agency. However, the OSHCON program may offer assistance in correcting a citation issued by OSHA. The OSHCON program is also obligated to react to imminent danger or serious hazards found during their site survey. The most extreme reaction would be to close down the affected segment of the business and require that the business correct the condition before resuming production.

The most beneficial feature of the OSHCON programs is that there is no direct cost to the business for the consultative services. Another benefit to the business requesting assistance is confidentiality. This includes identification not being used without proper consent of the business. Additionally, the results of the evaluation are reported only to the employer, and the consultation will not trigger an inspection since the details of the consultation are not shared with the regulatory enforcement agency. However, serious hazards that are not fully corrected may be reported to OSHA.

Robert P. Soule, chairman of the Safety Sciences Department at Indiana University of Pennsylvania, Indiana, PA, graciously provided the data that he compiled. These data depict some of the benefits of the OSHCON program and are presented in figures 1 and 2. It is important to note that the enforcement branch of OSHA has, as a major function, the duty to inspect the workplace. Therefore, the term "inspection" refers to the enforcement of OSHA mandates.

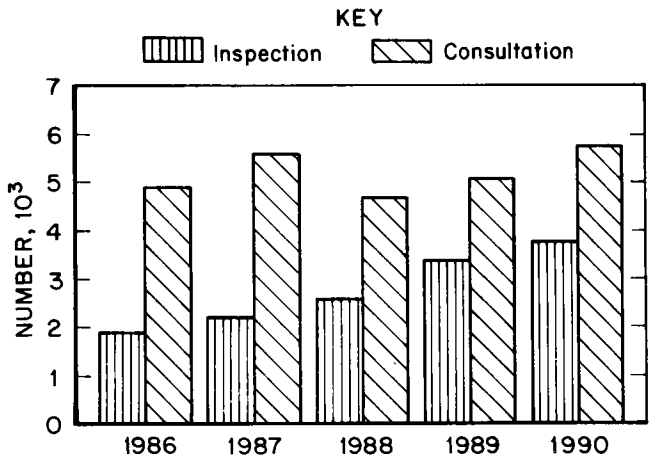
As depicted by figure 1, the number of OSHA inspections has steadily declined over the 5-year period. The number of consultation visits has remained relatively constant. Overall, the number of inspections is twice the number of consultations. This information is important since it is needed to make comparisons between the number of violations and hazards found per visit, as represented in figure 2. As seen in figure 2, the number of violations and hazards found during OSHA inspections has steadily increased over the 5-year period. It is clear from the figure that the number of hazards and violations identified during consultative visits far exceeds those found during inspections. One possible explanation for this is that "the hazards that were corrected were not limited to serious hazards that were required to be corrected" (*12*).

Figure 1



Enforcement and consultant activity during 1986 to 1991.

Figure 2



Violations-hazards per inspection-visit during 1986 to 1991.

Table 1 represents fiscal year 1990 and indicates the effectiveness of the consultation program versus enforcement. Although the number of consultative visits was only about one-half the number of inspections, the number of hazards identified by consultants was only 25% lower than the number of violations found by inspectors. The Federal cost per inspection is more than twice as much for enforcement than for consultation; however, the number of hazards identified per consultant was more than three times those found by inspectors. Along these same lines, the Federal cost per hazard was more than 3-1/2 times greater for enforcement than for consultation.

Table 1.—Relative effectiveness of enforcement and consultation in fiscal year 1990

Activity	Enforcement	Consultation
Number of site inspections	45,511	22,799
Number of violations (hazards) found	172,663	129,427
Number of consultative inspections	1,200	265
Federal cost (thousands)	$118,704	$24,980
Federal cost per inspection (visit)	$2,608	$1,096
Hazards found per inspector (consultant)	144	488
Federal cost per hazard	$687	$193
Exemptions granted	66	340

Findings of Study by City of Houston

A study conducted by the City of Houston, Department of Health and Human Services, Occupational Health, identified several shortcomings of existing OSHA enforcement policies (*15*). After conducting the survey, it was found that less than 0.5% of the employers had a copy of the OSHA regulations relevant to their industry. Without these regulatory guidelines, businesses may not be aware of specific safety and health mandatory safeguards and may have a higher rate of exposure to potential hazards. Another finding of the study concluded that employees of small businesses are less likely to contact OSHA in regard to a safety concern because small businesses are usually nonunionized and employees have less job security and less anonymity. In reality, without employee involvement, a small business may seldom be visited by OSHA inspectors. Of those businesses surveyed, less than 3% of those inspected have had experience with private industrial hygiene consultants or OSHA enforcement representatives. Perhaps the most favorable finding was that more than 93% of the businesses contacted by the City of Houston greatfully accepted the services of the OSHCON program. It was found that by offering this service, the employers and employees were left with a feeling of cooperation and a high willingness to contact the agency for additional assistance should the need arise.

OSHA Consultative Program With Educational Component

One study by Martyny and others has documented the impact of an OSHCON program implemented in conjunction with an educational component (*12*). A study of 19 businesses showed that a formal training program designed to provide a general knowledge of occupational safety and health, in addition to the OSHCON program, increased the general knowledge level of occupational safety and health. It was also found that a formal education and training program, in conjunction with consultation, resulted in an increase in the knowledge level of individuals directing the safety and health programs within the small businesses. As stated in the study, "Two factors were found to be significantly different between the initial and final consultation surveys: (1) a substantially larger percentage of clients had obtained material safety data sheets (MSDS) ($P < 0.05$); and (2) a significantly higher percentage of businesses provided employee training ($P < 0.05$). Both of these factors were heavily affected by the consultation program as a whole."

Cost Effectiveness

In general, consultative services that are provided at no charge are obviously beneficial to the employer, but are they cost-effective for the providing agency and the industry? A pilot study was conducted in Colorado to determine the cost-effectiveness of providing industrial hygiene services free of charge to small businesses (*12*). The study focused on 48 businesses with an average size of 21 employees. Thorough facility-wide industrial hygiene and safety surveys were conducted at these businesses. The businesses were provided with a detailed report that included recommended corrective actions. As Martyny and others (*12*) reported:

> The effectiveness of the program in terms of getting health and safety hazards corrected was a relative success with 68% of all hazards identified being abated. Evaluation of the program relative to satisfaction with services rendered revealed that over 85% of the clients served were very pleased with the consultation service. Only half of the businesses served would have been willing to pay a reasonable fee for the services rendered (and) if small businesses are to receive industrial hygiene or safety services, those services must be free or at least subsidized by 70% to 80%.

Other Approaches by OSHA

Voluntary Programs

In addition to the OSHCON program, OSHA also has made available three voluntary programs (Star, Praise, and Try) that are part of a nationwide effort to promote increased safety and health in small businesses (*16*). These programs are offered not only to single employers at one location, but also to several employers at one site, a group of employers who form a pool, or a single employer with various locations. As with OSHCON programs, these programs do not replace the traditional OSHA enforcement policies; however, businesses participating in the programs will be exempt from regularly scheduled OSHA inspections. To be eligible to participate in these programs, the business must have an existing safety and/or health policy. If an applicant is accepted into one of the three programs, periodic reviews and evaluations of the business will be conducted by an OSHA representative. The three programs each have specific qualifications based on certain aspects of the firm's safety and health. Also, the degree of involvement by OSHA varies among the programs. Businesses can obtain more information on these programs by contacting the OSHA Office of Policy Analysis in Washington, DC.

OSHA Handbook for Small Businesses

Another approach taken by OSHA in an attempt to reach the small businesses throughout general industry is the development of the OSHA "Handbook for Small Businesses." The handbook is comprised of seven specific areas relating to the characteristics of a proactive health and safety policy. Categories include leadership; responsibility; hazard identification and control; employee and supervisor training; safety and health record keeping; first-aid and medical assistance; and employee awareness, acceptance, and participation. Analogous to this effort, OSHA has also made six courses available to employers through its training institute. The courses include Competent Person Course, Basic Instructor Course in Occupational Safety, OSHA Guide to Occupational Safety and Health for the Construction Industry, Basic Guide to Voluntary Compliance in Safety and Health, OSHA Guide to Voluntary Compliance in the Safety Area, and OSHA Guide to Voluntary Compliance in the Health Area.

Forming Associations

Small businesses who form organizations that act as a central location to disseminate information is another intervention strategy that may be used to heighten awareness to safety and health issues. For example, the Contractors' Safety Council was formed in Texas to train contract workers in proper safety procedures. Currently, this organization "will be adding safety programs, developing a broad consulting service and working to standardize the warning systems used in the local industries, among other projects" (*17*). These types of organizations are typically formed by businesses within a common industry or location where there isn't an existing organization that can service their needs.

In many industries, there is evidence that a universal need exists for such associations to be formed. Even when a limited number of organizations exists, the small companies may not have access to the critical information that these associations provide. For instance, in the meat and meat products industry, "of the approximately 15,000 companies covered by SIC 201 (meat and meat products), only about 10% are affiliated with one of the three major trade associations (and) there are a considerable number of small companies employing from 10 to 50 people that may not have ready access to information concerning safety" (*18*). In this particular industry, the injury frequency rate doubled in a 10-year period, and in past years the rate has been almost three times higher than the rate for all manufacturing.

However, recent trends indicate that a growing number of small businesses are beginning to form pools in an attempt to negotiate discounts for various services. These services are not limited to specific health and safety concerns. Some of the additional services include reduced employee membership fees at health clubs and community centers, reduced health insurance rates via group health insurance, securing employee assistance programs, and providing opportunities for participation in wellness programs. According to Chenoweth (*19*), "one of the most publicized examples of pooling for health insurance coverage started in 1982 when a group of small businesses in Cleveland, OH, formed a large pool called the Council of Smaller Enterprises (COSE). The council consists of 9,000 firms representing 54,000 employees and 120,000 dependents." Another example of the effectiveness of small companies banding together is for liability coverage. According to Robert Brian of Conning & Company, "you have more small and medium-sized companies banding together, forming these facilities where there are many of the same types of risks, to get the benefits of size that they can't get as individuals" (*20*).

In order for small businesses to be able to focus on a comprehensive approach to safety and health, it is necessary for these small businesses to receive support from private sectors. It was stated that this private sector support should be directed toward trade and professional organizations (*16*). This was one of three approaches

recommended by OSHA to elicit participation and cooperation in voluntary health and safety efforts. Formation of associations by small businesses with similar concerns provides an opportunity to share information and interventions that have an application to their specific industry. This cost-effective approach is a means to provide relevant information.

Another way small businesses can benefit from formal associations is to receive permission to take an existing safety and health program and adapt it to their specific needs. One program developed by Reilly Industries was adapted from the Synthetic Organic Chemical Manufacturers' Association's (SOCMA's) Chemical Operator Certificate Training Program (*21*). Within the first year, of the 51 production supervisors, foremen, and chemical operators who were participating in this program, 75% have completed the first phase. Those who completed phase 1 will now begin phase 2, and a different group of 100 chemical operators will begin phase 1. This approach is a recent endeavor, and the effectiveness and benefits have not yet been evaluated.

In conjunction with forming associations, "information transfer" is also effective in improving the awareness of health and safety concerns (*8, 22*). Eakin (*8*) stated that "the dissemination of technical information on hazard identification and control, information clearing houses, and hazardous materials labeling programs are examples of mechanisms for "transferring" health information from those who know to those who do not." This dissemination of information must be accessible to all of the appropriate firms, thus confirming the need for the formation of associations to both obtain and provide the information. In particular, small companies must be capable of acquiring the necessary materials and information to aid them in addressing their health and safety concerns.

The intervention strategies that have been discussed have all proven to be effective in a wide variety of small businesses in general industry. Their innovative implementation has resulted in an overall improvement of health and safety within small businesses.

SMALL MINES

BACKGROUND AND BARRIERS

Throughout the mining industry today, small underground coal mines account for approximately 85% of all underground coal mining operations. In 1991, there were approximately 1,300 small underground coal mines in the United States. All but 100 were located in a 4-State region (Kentucky, West Virginia, Pennsylvania, and Virginia). In 1984, small underground coal mine production was approximately 53% of the market share, whereas from the years 1986 through 1991, small underground coal mines produced only about 26% of the total tonnage of coal mined. During this same period of 1986 through 1991, small underground coal mines also represented about 25% of the total number of employee hours worked and had a work force averaging 27,000 employees per year. As production decreased, the percentage of fatalities in small mines continued to increase.

Small mines having FIR's higher than those of larger mining operations is not a recent discovery. Accident data today suggest that the nonfatal days lost (NFDL) rates are similar for small and large mines; however, the FIR is out of proportion. For example, in 1991, small mines experienced an FIR of 0.10 and an NFDL rate of 10.90, whereas large mines had an FIR of 0.02 and an NFDL rate of 11.76 (*23*). As these numbers appear to indicate, "There is a strong correlation between mine size and fatalities in underground coal mines," as was noted by the Committee on Underground Coal Mine Safety (*1*). This correlation was substantiated again in 1994 by Peters and Fotta (*2*).

Further, the Committee on Underground Coal Mine Safety (*1*) reported that between 1978 and 1980, mines with 50 or fewer employees had an FIR 3 times that of mines with over 250 employees. During recent years, workers at small mines continue to experience a greater risk of fatal injury compared with those working at larger mines. By contrast, less than one-half of all mine deaths occurred at small mines just 10 years ago. Additionally, the number of deaths at small mines doubled between 1989 and 1991. This latter figure represents an FIR that is four times the overall mining industry rate.

There are small mines that have effectively addressed safety and health concerns faced by traditionally small mines. An example is the Banner Coal Mining Co. that today operates two small mines in West Virginia. The company points to its major accomplishment over the years, which is its safety record. The company, which once operated more than 20 different coal mines, has been in existence for 16 years. During that time, the company has produced more than 10 million metric tons of coal with only one disabling injury. Joe Phillips, president of Banner, said "We're offended by all the talk from Washington about the poor safety job being done by the small coal operator" (*24*). He continued to say that "It's the same as with anything else. There are those who are totally committed and those to whom it is just a job. The critics

should focus a little more on those who are doing the job with a commitment to doing it safely" (*24*).

Numerous studies have identified several obstacles faced by the small mining community when attempting to implement health and safety strategies (*1, 7, 24-32*). These include inadequate training, lack of resources, poor management-labor relations, and limited communication as key elements that positively correlated with high-disabling-injury rates in underground coal mines. It is evident that the small mining community is adversely affected by problem areas that are similar to those experienced by small businesses in general industry.

Training

"Factors Associated With Disabling Injuries in Underground Coal Mines" examined the adequacy of training in both high-incidence- and low-incidence-rate mines (*7*). After interviewing miners at 11 different high-incidence-rate mines, it was reported that the "miners believed that the instructor did not present materials specifically tailored to their individual needs. Training consisted primarily of the instructor reading the information, a technique that discouraged student/instructor interaction" (*7*). It was also felt that the topics discussed were both repetitive and not pertinent to the specific jobs and tasks being performed. Additionally, the miners stated that management did not take appropriate measures to evaluate the effectiveness of the training in relationship to job performance. As reported by the Department of Mineral Engineering at The Pennsylvania State University, University Park, PA, "The full benefits of the statutory training requirements has been lost at most small underground coal mines even though there is an industry-wide recognition that good training programs are associated with operations that enjoy the highest productivity and lowest cost in the industry" (*28*).

The report also states that the costs associated with training are beyond the means of small operations (*28*). Another study that addressed specifically tailored training programs for small mines found that many of the training programs failed to address the hazards that miners are exposed to in their everyday working environment (*25*). The study also noted that "many small mining companies are ill-equipped with qualified trainers and materials to provide effective training programs that meet the requirements of federal regulations" (*25*).

Resources

As was the case with small businesses, resources are severely limited in the small mining community. Lack of resources includes both financial constraints and shortage of time. Numerous studies indicate that lack of financial resources directly impacts the degree to which safety and health programs are implemented at small mines (*1, 24-29*). More specifically, one study suggested that limited capital directly affected the ability of the small mines to support the more extensive safety programs utilized by larger mines (*29*). In an article on Banner, Phillips said "In comparing small operations to the larger ones a major problem facing smaller operations is lack of capital" (*24*). This lack of resources is not limited to small mines in the United States. Other countries are experiencing similar financial constraints in both small mines and small processing plants. With regard to shortage of time, the majority of management personnel at small mines have a multitude of daily tasks to perform. Typically, these managers work long hours and do not have the available financial resources to hire additional personnel. Consequently, management is continually faced with a shortage of time. Very often, matters dealing with safety and health are compromised to allow management to dedicate their time to production matters.

Management-Labor Relations

Management and labor relations is another area in which small mines experience difficulties similar to those in small businesses. As determined by the Committee on Underground Coal Mine Safety (*1*), "The best safety program in the world, developed by the most committed management, will work only if it has the wholehearted support and active cooperation of those who actually mine the coal." The committee also found that the degree of cooperation between management and labor was directly related to injury rates. The organizational structure of a company can also dictate the degree of cooperation between management and labor. For example, a study by Pfeifer and others (*30*) found that the absence of a unionized effort at small mines may hinder joint efforts of management and labor. This study identified the lack of employee involvement in decision making processes as a major problem in mines with high-incidence rates. In the summary and findings of The President's Commission on Coal (*31*), numerous recommendations focused on enhancing labor-management relations. These efforts are necessary to combat the historic hostility and controversy that continues to exist between labor and management in many small mines. Inversely, organizational structures that allow management and labor to develop a highly interfaced working relationship have documented positive safety and production results (*33*).

Communication

As in small businesses in general industry, lack of effective communication is a major concern in small mines. One study stated that "small businesses are so great in number that communicating the "gospel of safety" to them is impractical by using the promotional method of attack that has been so widely and effectively used with employers of larger companies" (*32*). This study, which conducted interviews at various small mines, also reported that "most of the interviewees contended that if there is effective communication and understanding between management and employees, even without (safety) committees, any necessary actions will be taken to provide the safest working conditions for the employees" (*32*). Therefore, management must take an initiative to obtain and disseminate the vast amount of information available from manufacturers, suppliers, government agencies, associations and various technical literature.

Other

Other more specific obstacles have been identified by the Commission on Engineering and Technical Systems and the Committee on Underground Coal Mine Safety (*1*). First, the mining equipment in small mines is characteristically of lesser quality, sometimes second hand, and frequently not well maintained. Second, the physical condition of employees may be less conducive to safe work performance. In fact, small mine operators sometimes employ workers that large companies will not accept because of the individual's physical limitations, skill level, problem-solving capabilities, or unsatisfactory level of general education. Small mines also frequently find themselves in geologically poorer coal reserves, such that roof conditions, seam heights, etc., cause mining tasks to be more difficult. These specific factors are extensions of the major problem areas previously presented.

INTERVENTION STRATEGIES

Intervention strategies are sometimes difficult to implement in small mines since many of the small mines have a lifespan of just a few years and investment in safety and training is not always well defined on the part of the owners-operators or the public agencies. Confounding the issue is the fact that serious injuries are relatively rare events for individual small mine sites. Public attention to mine safety, in general, is reactive; therefore, a continuing need exists to develop a better set of dependent measures for small mines that can work proactively to prevent serious lost-time injuries. Federal and State agencies, as well as some operators, have begun to take a proactive approach in addressing the health and safety issues present in small mines.

Small Mine Training Initiative

Based on the number of small mines and their higher FIR, several intervention strategies have recently been instituted to address these concerns. The MSHA's Small Mine Training Initiative (SMTI) is one program that focuses on small mines throughout a four-State region (Pennsylvania, West Virginia, Virginia, and Kentucky) and is the latest undertaking to address safety and health issues at small mines. The purpose of this pilot program is to assist small mine operators in reducing mining accidents and injuries and to improve their compliance record. Small mines are either selected from the Joint Mine Assistance Program (JMAP) or by mutual agreement between districts and SMTI representatives based on the mine's NFDL rate and citation history. SMTI representatives work closely with the mine by introducing training programs, safety incentives, and loss-control techniques in an attempt to reduce accident and citation trends. This program forms a cooperative effort between operator and SMTI representative to jointly address safety issues. The effectiveness of this program is being monitored and will be evaluated as it matures.

Joint Mine Assistance Program

Another program is the JMAP, which was developed as a four-State initiative encompassing MSHA's joint program with the West Virginia Division of Energy, Kentucky, Pennsylvania, and Virginia. Efforts concentrate on offering assistance in developing an action plan to correct safety problems in mines with fewer than 50 employees. This program focuses on trend analyses of a specific minesite and evaluates history trends as they relate to injuries and violations. Representatives of the regulatory agency meet with management and develop an action plan to address those health and safety concerns identified in the analysis.

Other

There are other specific programs, although not aimed directly toward small mines, that promote safety and health within the mining industry. Federal and State accident prevention and reduction programs that have been implemented are designed to motivate a change, but usually lack the resources for an empirical evaluation. These programs are designed to educate and motivate, but

their impact is seldom evaluated. Some of the higher profile programs are:

- Accident Analysis and Problem Identification (AAPI).—The purpose of this program is to provide industry with a methodology to conduct an accident investigation to identify contributing factors and to develop sound recommendations for preventing similar accidents.
- Repeat Violation Reduction Program (RVRP).—The intent of this program is to identify a pattern of violations and to assist the operator in implementing a strategy to abate serious hazards found at an operation. A key component of the program is to improve cooperation between the inspectors, labor, and operators in an effort to correct both the violations and the system that led to the violation.
- Roof Evaluation-Accident Prevention (REAP).—This program focuses on increasing health and safety awareness in mining. Through the use of training materials and poster distribution, miners are alerted to the hazards associated with roof falls and their consequences.

These and other individual State and Federal programs (such as Virginia's Topic-of-the-Month Program and Kentucky's SHARK Program) impact the safety of mines. However, most of these programs have focused their efforts on providing health and safety training to mine operators (including, small operators) to assist in time-based compliance with 30 CFR 48 instead of competency-based safety incentives. Some of the intervention strategies mentioned are relatively new endeavors and thus have not been fully evaluated. It is expected that the effectiveness of these programs will continue to be evaluated. Trends and patterns may become prevalent and suggested areas for future concentration may emerge.

SUMMARY

Several obstacles to implementing health and safety strategies are common to both small businesses in general industry and small mines. The three obstacles that are most prevalent in both industries are poor management-labor relations, limited resources, and poor communication. Regulatory agencies have attempted to combat these problems through enforcement. This process has proven beneficial; however, enforcement alone does not facilitate a cooperative attitude between the regulatory agency and the industry. In order for a loss prevention or loss-control program to achieve adequate results, cooperation is a necessity. Numerous studies have indicated that the use of a consultative program in conjunction with enforcement can dramatically increase cooperation, thus resulting in substantial health and safety benefits.

For the past 20 years, small businesses in general industry have attempted to take a proactive approach to health and safety. Early on, an attempt was made to identify and document roadblocks to implementing health and safety programs within small businesses. Not only have small businesses examined other businesses within their own SIC, but they have also explored other industries in an attempt to identify possible treatments. These efforts resulted in the development of a support network consisting of Federal and State agencies, educational institutions, trade associations, and other professional organizations. All of these endeavors served as vital aspects in the development of consultative programs. These consultative programs are, perhaps, the most effective and significant intervention strategies that have been developed. These programs have been institutionalized to the point where their effects can be evaluated. Several studies suggest that small businesses have made substantial progress in addressing safety and health issues as a direct result of the OSHCON program's impact on small businesses. Perhaps the most obvious aspect of the OSHCON program's success is the number of businesses requesting assistance. Many of the studies indicated that a backlog exists for businesses awaiting the services offered by the OSHCON program.

Similarly, small mines have taken the initiative to identify the problems associated with implementing health and safety programs. Federal and State agencies have begun to implement several programs aimed at improving health and safety at small mines. These agencies have only recently begun to evaluate the effectiveness of the programs and to identify areas where more specialized intervention strategies should be implemented. These efforts have had an impact on the small mining community; however, the implementation of proven intervention strategies, such as the ones utilized by small businesses, could greatly benefit small mines.

RECOMMENDATIONS

The vast majority of the literature suggests that small businesses in general industry are more advanced than small mines in implementing effective health and safety strategies. In order for small mines to achieve similar results, interventions being used with small businesses should be examined and those that are applicable should be implemented. Based on the review of the literature and the available empirical evidence, the recommendations are:

1. Form a committee to examine the practicality of consultative services being made available to small mines. Committee members should include members of industry, Federal and State regulatory officials, safety and health officials, and representatives of the OSHCON program. A consultative program that parallels the OSHCON program may be desirable. Future research efforts could focus on the impact and effectiveness of this approach. As indicated by previous studies, subsidization is vital to the success of such a program. Sources of funding may include Federal and State grants, financial support from industry, professional organizations, and educational institutions.

2. Implement methods to improve communications throughout the small mining community. Such efforts may include the formation of associations, clearinghouses, and consultative networks.

3. Develop formal training programs to improve management-labor relations and organizational communication. This could be achieved through a joint effort of State agencies and educational institutions.

These recommendations parallel those presented in "Toward Safer Underground Coal Mines," which was published by the Committee on Underground Coal Mine Safety in 1982 (*1*). Although some small mines have effectively addressed health and safety issues within their organization, as a whole, there has not been a dramatic improvement in health and safety at small mines over the last decade. Many well-established roadblocks still hinder safety and health efforts at small mines; the continued existence of these barriers only reinforces the need for innovative intervention strategies. Intervention strategies, such as those presented in this report, used to address safety in general industry's small businesses and those proposed by the Committee on Underground Coal Mine Safety (*1*), could have a positive impact on the health and safety of small mines.

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