

Review of the Program to Control Respirable Coal Mine Dust in the United States



Report of the Coal Mine Respirable Dust Task Group

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Executive Summary

In May 1991, Secretary of Labor Lynn Martin directed the Mine Safety and Health Administration (MSHA) to conduct a thorough review of the program to control respirable coal mine dust and to develop recommendations for how the program could be improved. This request followed Secretary Martin's April 1991 announcement of widespread tampering with respirable dust samples taken by mine operators at nearly 850 underground coal mines. These dust samples are an essential part of MSHA's program to protect miners from coal workers' pneumoconiosis, more commonly known as "black lung."

In response to the Secretary's directive, Assistant Secretary for Mine Safety and Health William Tattersall established an interagency task group to study and recommend improvements to the coal mine respirable dust control program. The Coal Mine Respirable Dust Task Group, hereafter referred to as the "Task Group," was directed to consider all aspects of the current program including expanding the role of the individual miner in the sampling program; to examine the feasibility of MSHA conducting all sampling; and to consider the development of new or improved monitoring technology, including technology to continuously monitor the mine environment.

In developing this report, the Task Group has:

- Met with industry, labor, other interested parties, MSHA experts, and representatives from the Bureau of Mines and the National Institute for Occupational Safety and Health;
- Explored the changes that have occurred in the mining industry since the establishment of the current enforcement program;
- Examined the role of industry, labor, and government in the dust enforcement program;
- Designed and implemented a short-term spot inspection and monitoring program to determine the level of current compliance with all aspects of the dust regulations, and

initiated development of a data base to facilitate continued improvements in the dust enforcement program;

- Examined current and potential future technologies for instrumentation for dust measurement, control, and monitoring.

The Task Group's major conclusions and recommendations are outlined below.

MAJOR CONCLUSIONS AND RECOMMENDATIONS

The Task Group reached the following major conclusions and proposed appropriate recommendations based on its review of the current respirable dust program, the role of the miner, monitoring and dust control technologies, and analyses of data compiled in the spot inspection program:

Respirable Dust Exposures - There have been significant reductions in respirable dust levels since 1969. While average dust levels are now below 2.0 mg/m³, some mining operations continue to have environmental dust levels above the applicable standard.

Respirable Dust Monitoring - Continuous monitoring of the mine environment and parameters used to control dust offers the best solution for improving the dust enforcement program. Therefore, the Task Group recommends an accelerated research program to develop a fixed-site monitor capable of providing continuous information on dust levels to the miner, mine operator, and to MSHA if necessary. A research program should also be accelerated to develop a personal sampling device capable of providing both a short-term personal exposure measurement as well as a full-shift measurement. A parallel program to develop instrumentation for continuously monitoring the parameters used to control respirable dust should also be undertaken.

Collection of Samples - MSHA should not take over the operator sampling program. While there has been abuse in the current program, the majority of operators do not engage in such conduct, and MSHA's assumption of total responsibility for sampling could impact negatively on other Agency safety and health activities. Therefore, the

present operator sampling program should continue pending reassessment when mine-worthy continuous monitoring equipment is available. However, improvements are needed to enhance the integrity of the operators' program. The Task Group recommends that MSHA minimize the submission of unrepresentative operator samples by: 1) redefining "normal production shift"; 2) instituting a program for monitoring operator sampling procedures; and 3) requiring operators to have in place security measures to safeguard the integrity of the entire sampling process. Also, MSHA should review violations issued for operators' failure to sample for possible special penalty assessment.

Tamper-Resistant Sampling - No tamper-proof sampling system is currently feasible, although steps can be taken to improve the tamper resistance of the existing system. The Task Group therefore recommends that MSHA require the use of more tamper-resistant cassettes.

MSHA Enforcement - MSHA is not conducting the prescribed number of respirable dust sampling inspections, nor is MSHA adequately monitoring operator abatement of dust violations. The Task Group therefore recommends that MSHA institute one-day spot inspections on a permanent basis, and make compliance determinations based on single samples as well as on multiple sample results.

Dust Control Plans - Dust control plans submitted by mine operators for approval by MSHA can be improved to better reflect the controls that are being used. Also, MSHA's approval procedures fail to address variable production levels and their interaction with dust control parameters such as ventilation, water, etc. Therefore, the Task Group recommends that MSHA develop uniform plan approval guidelines that incorporate minimum acceptable dust control parameters for each method of mining. Operators should be required to verify the adequacy of dust control plans submitted to the Agency for approval.

Education and Training - The current certification program for persons conducting sampling and maintenance and calibration of the sampling equipment, and the training and retraining required of these persons by MSHA regulations can be improved. The Task Group therefore recommends that MSHA update the current dust sampling and

maintenance certification examination; institute a formal decertification process; and require periodic retraining and consider periodic recertification. MSHA should also update Part 48 training and retraining requirements to increase miners' knowledge of respirable coal mine dust hazards, sampling procedures, and control techniques.

Role of the Miner - Miners or their representatives should be encouraged to report to MSHA any irregularities in the sampling process and to participate in reviewing and providing input into dust control plans proposed by the operator.

Introduction

On April 4, 1991, Secretary of Labor Lynn Martin announced the issuance of 4,710 citations by the Mine Safety and Health Administration of the U. S. Department of Labor (MSHA) to over 500 companies for tampering with respirable coal mine dust samples at nearly 850 coal mines. These citations resulted in the proposal of civil penalties against mine operators totaling some \$6.5 million. Concerned about the widespread tampering and its impact on the integrity of the program to control respirable coal mine dust, the Secretary directed MSHA to thoroughly review the program and make recommendations for improving it.

In response to the Secretary's directive, William J. Tattersall, Assistant Secretary for Mine Safety and Health, established the Coal Mine Respirable Dust Task Group (hereafter referred to as the "Task Group") to review relevant information and to study and recommend improvements to the Agency's respirable dust control program (See Appendix A). While the tampering issue prompted the establishment of the Task Group, the areas examined by the Task Group go far beyond this issue. The Task Group was specifically instructed to consider expanding the role of the individual miner in the sampling program; to examine the feasibility of MSHA conducting all sampling; and, in conjunction with the Bureau of Mines of the U. S. Department of the Interior and with the National Institute for Occupational Safety and Health of the U. S. Department of Health and Human Services (NIOSH), to consider the development of new or improved monitoring technology, including technology to continuously monitor the mine environment.

Although the respirable coal mine dust program applies to both underground and surface mines, the primary focus of this review was on underground operations. That is the area where the highest exposures associated with respirable coal mine dust occur. While many of the matters reviewed by the Task Group have application to surface coal mines and facilities, a determination was made by the Agency that those operations would not be addressed in this report.

In conducting its review of the respirable dust program, the Task Group conferred with MSHA officials involved in the program, as well as with representatives of other government agencies (See Appendix B), including the Bureau of Mines and NIOSH. The Task Group

also met with representatives from the mining community and other interested parties. The primary objective of these discussions was to solicit the parties' views on the respirable dust control program, with specific focus on the monitoring and control of miners' exposure, education and training, and dust control technology. The respective roles of the government, mine operator, and mine worker in achieving and maintaining a healthful working environment were all discussed. The Task Group used the information gathered during these meetings to help identify areas for examination.

The Task Group also reviewed the changes in the respirable dust control program since passage of the Federal Coal Mine Health and Safety Act of 1969 (Coal Act); appraised current and possible future instrumentation technologies for dust measurement, monitoring, and control; examined different sampling strategies; reviewed published literature and Bureau of Mines research; and analyzed Agency Management Information System (MIS) data.

To facilitate a comprehensive review of all aspects of the respirable dust program, the Task Group established six "expert" teams (See Appendix C), comprised of representatives of MSHA, the Bureau of Mines, NIOSH, and the Occupational Safety and Health Administration (OSHA). The Task Group designated a number of technical issues for detailed study by the individual expert teams and directed the teams to prepare written reports on their findings and recommendations, which were used by the Task Group in its deliberations.

In addition, because the disclosure of widespread operator tampering in the dust program raised concerns about the validity of existing information on miner exposure, the Task Group developed a short-term respirable dust spot inspection program and a monitoring inspection program to supplement existing data. The spot inspection program was designed to measure dust levels to which miners were exposed, to determine what dust controls were in use and their effectiveness, and to assess how much miners and operators knew about the dust program. This information was obtained by MSHA inspectors through in-mine dust sampling, measurement of dust controls, and interviews of mine personnel. The monitoring program was designed to evaluate the operator's sampling program through MSHA observation of the operator's sampling and dust control practices. The spot inspection program was completed on October 31, 1991, and resulted in the inspection of some 615 underground coal

mines.¹ Under the monitoring inspection program, which ended in late December 1991, 680 underground mines were monitored.

Given the extensive amount of information generated by the spot and monitoring inspection programs, the Task Group has not completed a detailed analysis of all data for this report. The Task Group used available spot and monitoring inspection program information in the Group's assessment of the respirable dust program. The Task Group also used these data, in addition to data and information derived from other sources, in developing the Group's conclusions and recommendations for program improvement.

¹ In October 1991, 33 mine operators and 42 individuals agreed to plead guilty to federal criminal charges involving tampering with respirable coal mine dust samples through the services of an independent contractor. In response to the disclosure of this additional misconduct, the Assistant Secretary announced that the respirable dust spot inspection program would be continued indefinitely. In addition, other measures were implemented to address potential fraud by independent contractors performing respirable dust services for mine operators.

Background

Coal mine dust is produced when material is extracted from the coal seam by drilling, blasting, and cutting, and during loading and transporting of that material from the mine. Respirable coal mine dust consists of very small particles that can be inhaled and deposited in the lungs, and that presents a health hazard if not adequately controlled. Long-term exposure to excessive levels of respirable coal mine dust can cause the potentially disabling respiratory disease coal workers' pneumoconiosis, commonly known as "black lung".

The Coal Act established provisions that were intended to: 1) prevent disabling respiratory diseases such as pneumoconiosis; 2) provide for early detection of the disease; 3) protect those miners with evidence of the disease; and 4) compensate miners disabled from the disease and the survivors of miners whose deaths resulted from the disease.² The 1969 Coal Act established the first comprehensive dust standards for coal mines in the United States. These standards were based upon studies conducted in Great Britain, and were intended to protect the health of miners by imposing strict limits on the amount of respirable coal mine dust allowed in the air that miners breath. Mine operators also were required to take accurate dust samples at periodic intervals to measure the amount of respirable dust in the mine atmosphere where miners work or travel. The Coal Act also required that citations be issued whenever respirable dust samples collected either by an operator or by federal mine inspectors showed noncompliance with the dust standard. The Coal Act was amended by the Federal Mine Safety and Health Act of 1977 (Mine Act), but the respirable dust provisions remained essentially unchanged.³

The Mine Act stresses that respirable dust must be sufficiently controlled to permit coal miners to work over a lifetime (35 years) without becoming disabled by pneumoconiosis or any other occupational lung disease. The Mine Act provides that, as of December 30, 1972:

² Federal Coal Mine Health and Safety Act of 1969, 30 U.S.C. 801 et. seq.

³ Federal Mine Safety and Health Act of 1977, 30 U.S.C. 801 et. seq.

each operator shall continuously maintain the average concentration of respirable dust in the mine atmosphere during each shift to which each miner in the active workings of such mine is exposed at or below 2.0 milligrams of respirable dust per cubic meter of air [2.0 mg/m³].⁴

This standard is further reduced when the respirable dust contains more than 5 percent quartz since this presents an additional respiratory hazard that can cause silicosis.⁵ In addition, miners who have evidence of the development of pneumoconiosis, and who have elected to work in a low-dust environment, cannot be exposed to dust levels above 1.0 mg/m³.⁶ Their standard can be further reduced if the work environment contains more than 10 percent quartz dust.

To sample the mine environment, the operator uses a small battery-powered pump that draws mine air through a filter that removes the respirable coal mine dust. Each filter is precisely preweighed by the manufacturer before it is sealed in a plastic housing. After exposure to the mine environment over the period of a full work shift (eight hours or less), the filters are sent to a government laboratory where they are again precisely weighed under controlled conditions. The difference between the weight of the filter before and after sampling is used to calculate the concentration of dust, in mg/m³, to which miners have been exposed. If the concentration of dust measured exceeds the applicable standard, the operator is issued a citation and must take action to lower mine dust levels.

In 1970, federal regulations were issued that initiated a comprehensive dust sampling program for U. S. coal mines.⁷ These regulations set forth specific operator sampling requirements. The operator was required to take samples on "high risk" occupations (defined as the miner exposed to the highest respirable dust concentration) at specified frequencies to determine compliance with the applicable dust standard. All other occupations were assumed

⁴ 30 U.S.C. 842(b)(2).

⁵ 30 U.S.C. 845.

⁶ 30 C.F.R. Part 90.

⁷ 35 FR 5544 (April 3, 1970).

to be in compliance when the high risk occupation was in compliance. Additionally, each miner was sampled individually at different intervals. These individual sample results were not used for compliance determinations but were provided to NIOSH for medical research purposes. The operator was also required to submit a ventilation system and methane and dust control plan for government approval that specified the operator's dust control measures. If an operator was found to be out of compliance with the applicable dust standard, he/she was required to take corrective action and to sample every production shift to demonstrate that the amount of dust had been lowered to an acceptable level.

Also in 1970, a federal government dust sampling program was established providing for full-shift sampling by inspectors at each underground coal mine at specified intervals. Federal mine inspectors were also to check the overall effectiveness of the operator's sampling and dust control program during other inspections. Currently, MSHA collects approximately 27,000 samples annually.

In 1980, federal regulations governing operator sampling were revised. These revised regulations remain in effect.⁸ Like the 1970 regulations, the current regulations continue to rely on sampling the occupation that has the highest dust exposure, requiring each operator to periodically sample the mine environment. Because these regulations require fewer personal samples to be taken by the operator, the number of operator samples collected dropped from approximately 500,000 samples annually to fewer than 100,000.

The revised regulations also provide for sampling equipment to be properly maintained and calibrated. Additionally, operators' sampling personnel are required to demonstrate a certain level of competence by passing a test administered by MSHA.

During the development of the 1980 regulatory revisions to the operator sampling requirements, comments were received that indicated a lack of confidence in MSHA relying on operator samples to make compliance determinations. In response to these concerns, MSHA published a proposed regulation in 1980 that would have provided miners' representatives the right to observe each phase of the operator dust sampling process. The proposal was intended to promote better cooperation between mine operators and miners in order to

⁸ 45 FR 23990 (April 8, 1980).

improve the effectiveness of the program. In 1985 the Agency decided not to finalize regulations to provide miners' representatives the right to observe operator sampling, stating that compliance with the 1980 revisions to the sampling program had resulted in greater confidence in the overall dust program.⁹

Other federal agencies play roles in monitoring and controlling respirable dust in the mine environment. Both the Coal Act and the Mine Act authorized the Bureau of Mines to conduct research "to develop new or improved means and methods of reducing concentrations of respirable dust in the mine atmosphere of active workings of the coal mine." Research and development by the Bureau of Mines has contributed significantly to reducing mine dust levels through the development of improved methods for dust measurement and control.

One such Bureau of Mines accomplishment was the development of a more tamper-resistant filter cassette in 1978. The prototype filter cassette included features designed specifically to safeguard the integrity of the sample. Although the new filter cassette was designed to reduce the chance of dust loss from the collection filter due to reverse flushing, impact, or cassette opening, it did not include a total volume indicator as requested by MSHA, nor was the necessary testing conducted. Attempts to develop a reliable total volume indicator (that records the total volume of air that has passed through the cassette) were unsuccessful. As a result, the Agency did not require the use of these new filter cassettes at that time. However, following the disclosure of widespread tampering in 1991, Secretary Martin announced that MSHA would require tamper-resistant cassettes. Accordingly, the Agency has considered the original plus other new designs to make filter cassettes more tamper-resistant. These designs incorporate newer technology but achieve the same results as the 1979 version of the cassette. A more tamper-resistant cassette is expected to be commercially available within the next six months.

The Bureau of Mines has also been involved in the development of direct reading coal mine dust instruments, which improve the monitoring of respirable dust levels in coal mines by providing the user with information on current dust conditions. Such instruments have the potential to indicate the need for corrective action and provide immediate feedback on the

⁹ 50 FR 17450 (April 29, 1985).

effectiveness of newly introduced control measures. Since the early 1970's, MSHA has supported the development of such devices.¹⁰ Continuous monitoring of the environment was achieved using light-scattering technology to detect respirable dust. In 1981, a prototype fixed-site, machine-mounted, continuous respirable dust monitor employing light-scattering technology was developed under a Bureau of Mines contract. The prototype device, however, was never field tested to assess its performance and operational characteristics under a wide range of environmental conditions. In the early 1980's, Bureau of Mines research on the fixed-site respirable dust monitor was suspended.

At a hearing before the Subcommittee on Mining and Natural Resources of the U. S. House of Representatives in June 1991, representatives of the Bureau of Mines testified that advances in electronics and sensing technology make the renewal of research to develop and implement a mine-worthy, fixed-site, continuous respirable dust monitor feasible. Currently, three technologies offer the potential for continuous monitoring of respirable dust levels -- light-scattering, beta attenuation, and tapered-element microbalance techniques.

Additionally, MSHA and the Bureau of Mines are currently evaluating the effectiveness of an improved version of the hand-held, instantaneous-reading dust monitor known as a MINI-RAM (Miniature Instantaneous-Readout Aerosol Monitor). This instrument was developed in 1982 by GCA Corporation under a Bureau of Mines research contract, but was never utilized because of its unreliability in the mine environment. The device's short-term measurement capability has the potential to identify dust sources, to determine when full-shift sampling should be conducted, and to provide immediate feedback on the effectiveness of modifications to dust controls.

Both the Coal and the Mine Act also mandated a Coal Workers' X-ray Surveillance Program, which is administered by NIOSH. The primary objective of the program is to screen miners for pneumoconiosis. Miners who show signs of pneumoconiosis on their chest x-rays are offered the option to participate in MSHA's Part 90 program, and work in an area of the mine with lower dust levels. All working underground coal miners are eligible to participate

¹⁰ In 1980, MSHA demonstrated that technology was available to continuously monitor respirable dust levels in underground coal mine environments.

in the screening program. Miners employed since 1970 must have a chest x-ray when they are hired and again three years later. Working coal miners may volunteer for subsequent x-rays at approximately five year intervals. The chest x-rays are taken at no cost to the miners. NIOSH is also required to develop information on the incidence and prevalence of pneumoconiosis and other respiratory ailments of miners, and to evaluate the effectiveness of the current respirable dust standard.

Review of the Current Respirable Dust Program

In order to critically evaluate the respirable dust control program, the Task Group first identified the key elements of an effective health protection program. This provided an analytical framework against which the current program could be assessed. Based on generally-accepted industrial hygiene principles, the following elements for an effective health protection program were adopted: 1) monitoring of the work environment; 2) control of worker exposure; 3) education and training of miners; and 4) medical surveillance.

The Task Group then conducted a comprehensive review of the current respirable dust control program, which included an analysis of the issues referred to in the directive from the Assistant Secretary and those areas identified by outside interest groups. Based on this review, the Task Group identified specific areas in the program where improvements may be warranted. A discussion of the Task Group's analysis follows.

Monitoring of the Work Environment

There are two objectives in monitoring the workplace. The first objective is to measure the level of a particular contaminant to which workers may be exposed, and the second is to determine the effectiveness of any control measures in place. To serve these purposes, samples must provide a representative measure of the work environment.

Current Program

While the current respirable dust control program provides for monitoring by MSHA and the mine operator, the operator has primary responsibility for demonstrating that all miners work in an environment that is free of excessive levels of respirable dust. A brief description of the key elements of the program follows:

1. Operator Sampling Program

Each mine operator is required to collect a prescribed number of full-shift respirable dust samples on a bimonthly basis and submit them to MSHA for processing and analysis to determine compliance with the respirable dust standard. Bimonthly sampling conducted by mine operators provides a periodic evaluation of the quality of mine air and of the effectiveness of the operator's dust control system on the days the samples are taken. These samples are required to be collected by certified persons -- individuals who have passed a written examination administered by MSHA.¹¹ Since proper use of sampling equipment is essential to the integrity of the sampling process, the certification requirement is intended to provide reasonable assurance that the person conducting sampling is competent to perform the task. After samples have been collected, certified persons are required to fill out the dust data card provided by the manufacturer with each filter cassette. They identify the mine, describe the type of sample taken, report the production level during sampling, and include their signature and certification number.¹²

The sampling device is required to be operated "portal to portal". This means that the pump is operated from the time the miner enters the mine until he or she leaves the mine, for a period of 8 hours or less. Sampling must also be conducted with approved sampling equipment that is properly calibrated and maintained by persons certified to perform that task. The equipment must be examined by a certified person prior to the beginning of the sampling shift, at least once during the second hour of sampling, and again during the last hour, to verify that the equipment continues to function at the necessary flow rate and otherwise is operating properly. Sampling devices are also required to be calibrated before being placed into service and thereafter at intervals not to exceed 200 hours of operating time.¹³

Underground coal mine operators are required to collect and submit two different types of respirable dust samples: designated occupation samples and designated area samples. A designated occupation is the work position that has been determined to have the greatest

¹¹ 30 CFR 70.2(c); 70.202(a) and (b).

¹² 30 CFR 70.209(c).

¹³ 30 CFR 70.204(b) and 70.205(b).

respirable dust concentration.¹⁴ The designated occupation concept is based on the reasoning that if the environment of those whose exposure is the greatest complies with the standard, then the environment of all other employees in the work group will comply.¹⁵ The regulations identify the designated occupation in each of the ten common mining systems. MSHA has the authority to substitute other occupations if samples show that a different occupation is exposed to the highest dust concentration.

During each bimonthly period, mine operators are required to collect and submit five designated occupation samples for each mining unit. The samples must be collected on consecutive production shifts or on production shifts on consecutive calendar days. MSHA then analyzes these samples and makes a compliance determination by comparing the average concentration to the applicable dust standard. An operator who is found to be in violation is issued a citation and must take steps to reduce the dust level. After corrections have been made, the operator must collect five additional samples within a time limit specified by MSHA to demonstrate that the mining unit is in compliance.

The operator is also required to collect samples from each designated area. These designated areas are potentially dusty locations in the mine, other than the area where coal is being extracted. These locations are strategically selected so that the environment where miners normally work or travel is monitored for compliance with the applicable dust standard. The operator's approved ventilation system and methane and dust control plan is required to identify the specific locations in the mine where area samples are to be taken.^{16 17} Operators are required to collect and submit one sample from each designated area during each bimonthly period. If any of these samples exceeds the applicable respirable dust standard, MSHA notifies the operator of this finding. The operator is then required to submit addi-

¹⁴ 30 CFR 70.2(f).

¹⁵ Roach, S.A. Sampling Air for Particulates. *The Industrial Environment -- its Evaluation and Control*, U. S. Department of Health, Education and Welfare, 1973, p. 150.

¹⁶ A "ventilation system and methane and dust control plan" required by regulation for each underground coal mine contains a substantial amount of information which is not related specifically to dust control. Many mine operators submit a separate "dust control plan" specifying the dust control parameters to be used in their mine. References in this report to the "dust control plan" mean that portion of a ventilation plan that addresses dust control, whether or not it is a separate plan.

¹⁷ 30 CFR 75.316.

tional samples collected on five consecutive production shifts or days from that designated area within 15 days. MSHA will then make a compliance determination based upon the average of those five samples. In the event of a violation, the citation and abatement sequence described above is followed.

In addition, mine operators are required to collect and submit a bimonthly sample from every "Part 90" miner they employ. If any of these samples exceed the applicable standard of 1.0 mg/m³, the operator is required to submit additional samples collected on five consecutive production shifts or days, which are used by MSHA to make a compliance determination.

Operators must transmit all samples collected to MSHA within 24 hours after the end of the sampling shift, to expedite compliance determinations and minimize periods of miner overexposure. Each sample transmitted to MSHA must be accompanied by a properly completed dust data card.

While not specified in the regulations, operators are permitted by practice to note on the dust data card any reason why they believe the samples transmitted are not valid and should not be used by MSHA to determine compliance. These reasons may include malfunction of the sampling equipment, unintentional failure to comply with proper sampling procedures, contamination of the sample by foreign substances, or collection of the sample in the wrong location. Generally, such samples are voided by MSHA and the operator is required to submit a substitute sample within that bimonthly sampling period.

MSHA may also determine that an operator sample is invalid for many of the same reasons as may be indicated by an operator. MSHA will also void operator samples for technical and administrative reasons, such as samples submitted in excess of the number required, or designated occupation samples if they were not taken during a "normal production shift." "Normal production shift" is defined as "a production shift during which the amount of material produced . . . is at least 50 percent of the average production for the last set of 5 valid samples . . ." ¹⁸ However, if the dust sample shows a dust concentration in excess of 2.5 mg/m³, the sample will not be voided based on low production levels. ¹⁹

¹⁸ 30 CFR 70.2(k)(1); 70.207(a) and (d).

¹⁹ 30 CFR 70.207(d).

MSHA also examines both operator and MSHA samples for the presence of so-called "oversize particles," which are defined as dust particles greater than 10 microns in size. If the sample contains a certain number of oversize particles, MSHA will void it. This procedure is designed to screen out samples that may have been improperly collected. MSHA also examines operator samples that show no or low weight gain.

After MSHA has processed the samples, the operator is provided with a respirable dust sample data report, which contains the results of every sample submitted. The operator is required to post this report on the mine bulletin board for a period of 31 days to provide miners ready access to current information on respirable dust conditions in the mine. Operators are also required to report to MSHA in writing any change in the operating status of the mine, mining unit, or designated area that affects the sampling requirements, within three working days after the change occurs.

2. MSHA Sampling Program

MSHA's policy for dust sampling provides for inspection personnel to conduct dust sampling inspections annually at underground coal mines.²⁰ During these inspections, MSHA collects samples from at least five different occupations at each mining unit, from selected designated areas, and from each Part 90 miner. Depending on the concentration of dust measured, sampling can be terminated after the first day or continue for up to five days before a compliance/noncompliance determination can be made.²¹ The results of these inspections are used to assess the operator's efforts in maintaining the level of dust at or below the applicable dust standard. The samples taken during these inspections also allow MSHA to determine the designated occupation and the designated areas that the operator must sample. MSHA sample results are used for compliance determinations, and provide a means to verify that the dust levels measured by MSHA are consistent with those measured during operator

²⁰ *Coal Mine Health Inspection Procedures*, MSHA Handbook Series, Handbook Number 89-V-1 (February 1989).

²¹ As part of the Task Group's review, a respirable dust spot inspection program was initiated to assess the dust concentrations in some 600 underground coal mines. Unlike the program which has been in place since 1981, the spot inspection program called for only one day of sampling. Under this program, inspectors were authorized to make a noncompliance determination based on the average of sample results from five occupations, which is equal to or greater than 2.1 mg/m³ or on the result of a single sample which is equal to or greater than 2.5 mg/m³.

sampling. MSHA samples may also be used to lower the applicable dust standard if excessive levels of quartz are shown to be present. During other regular inspections throughout the year, MSHA inspectors collect no samples, but check whether the operator is complying with the provisions of the approved dust control plan. Appropriate enforcement is taken when an operator is in violation of the plan.

Issues

The objective of the current sampling program is to monitor the coal mine environment to provide reasonable assurance that miners are not overexposed to respirable dust. Agency data indicate that there have been significant reductions in respirable dust levels since 1969. At that time, the average dust concentration in underground coal mines was reported to be approximately 6.5 mg/m³.²² At the present time, results from the MSHA spot inspections, which were conducted at the request of the Task Group, indicate that average dust levels for the occupations sampled were all below 2 mg/m³ (See Appendix D). This may suggest that overexposures are no longer a problem. However, a closer examination of the inspection results indicates that there is still a basis for concern, since approximately 29 percent of the mining sections sampled were found to be in violation of the applicable dust standard. The Task Group has identified specific aspects of the current program's design that have the potential to negatively affect the validity of sampling results. These program design vulnerabilities also affect the validity of the spot inspection sampling results. The Task Group has also identified areas where MSHA's enforcement activities related to monitoring could be improved. These issues are described below.

1. Potential for Unrepresentative Samples

To effectively monitor the mine environment to which miners are exposed, respirable dust samples that are "representative", in that they reflect typical dust conditions, are essential to the success of the respirable coal mine dust program. As evidenced by recent findings of operator tampering, some operators may physically alter the weight of dust collected on the filter, or collect samples in low-dust areas of the mine or even outside of the mine. These

²² *Report to the Congress*, Comptroller General of the United States, General Accounting Office (December 31, 1975), p. 5.

disclosures correspond with the concerns expressed by critics of the operator sampling program that the system, which is controlled by mine operators, remains susceptible to tampering.²³

The current program also permits the operator to submit legitimate samples that may not be representative of normal dust conditions in the mine environment.²⁴ For example, the level of coal production has a significant impact on dust generation and, consequently, on respirable dust levels. The regulations, however, provide that samples will be valid when collected during periods when the mining unit's production level is at least 50 percent of the average of the level reported during collection of the last five bimonthly samples. The intent of this provision was to recognize the fluctuations inherent in the mining cycle. However, a mine's "normal production" level for sampling purposes and the actual normal production level may diverge greatly over the course of several sampling cycles.

Moreover, this provision makes the respirable dust program susceptible to intentionally reduced production during sampling periods. This may be particularly true as operators introduce mining systems with the potential for high rates of production such as high production longwall mining units. These systems often generate a corresponding increase in the volume of respirable dust and their control approaches the limits of effectiveness of current dust control technology. Existing MSHA technical information indicates that some reduction in production levels occurs during sampling periods.²⁵

The fact that sampling is controlled by the mine operator also allows the operator to determine when and under what conditions samples will be collected during each bimonthly period. This permits the operator to conduct sampling during those periods in the mining cycle when conditions are anticipated to result in lower dust levels in the mine environment. For example, the operator may choose to sample during periods when the volume of air on

²³ In addition to the recent criminal convictions referenced in this report, there have been eight other occasions since 1980 where the federal government has prosecuted individuals or corporations for fraud in the respirable dust program.

²⁴ *Report to Congress, op. cit.*, p. 19.

²⁵ Denk, J. M. *et al.*, *Longwall Ventilation and Environmental Dust Control Investigation of the Jim Walter Resources No. 4 Mine*. Mine Safety and Health Administration, Investigative Report Nos. P338-V242 and DD-4145, 1990.

the section is greatest or when ventilation controls are operating at optimal efficiency. Accordingly, these sample results may not be representative of typical exposure levels.

The recent disclosure of dust fraud, involving a major independent contractor found to have artificially created respirable dust samples for 33 coal companies, has highlighted the vulnerability of the current monitoring system to unrepresentative samples. It should be noted that these were mine operations employing fewer than 50 miners. Furthermore, data from the spot inspection program shows a significant difference between MSHA and operator sample results at these operations. This same degree of disparity between MSHA and operator results did not exist at larger mines.

In addition, other aspects of the monitoring system may allow the submission of unrepresentative samples. They include:

- Limiting the sampling duration to 480 minutes does not measure the actual dust levels to which miners on extended shifts are exposed. Experience indicates that some miners regularly work shifts longer than eight hours in duration.
- The tamper-resistant characteristics of the current sampling equipment are minimal, and interfering with its operation has been relatively easy.
- The security measures to safeguard the integrity of the entire sampling process vary as evidenced by the disclosure of sample tampering.
- The location of samples cannot be accurately verified, and the sampler can be worn or placed in a cleaner environment than it is supposed to sample. This is true even when MSHA inspectors collect samples, because inspectors do not normally remain with the sampling equipment during the entire sampling shift.
- MSHA does not have an effective program to examine samples that show unusually low weight gain given the mining method and the production levels reported.

The potential for unrepresentative samples has resulted in an ongoing debate within the mining community over the concept of operator sampling. The recent revelations concerning fraud in the operator sampling program have heightened the concern over whether operators should be given the responsibility to gather and submit samples upon which MSHA makes compliance determinations. Critics of the operator sampling program contend that there is simply too great an incentive to manipulate the program, and that a lack of adequate MSHA oversight makes it far too easy for some operators or miners to do so. These critics urge that MSHA assume responsibility for the collection of all samples of the mine environment used for compliance determinations.

2. Failure of Operator to Collect Required Number of Samples

Although the current operator sampling program is significantly less burdensome than the program implemented in 1970, some operators do not sample every bimonthly period or fail to submit the required number of bimonthly samples. For example, in fiscal year 1991, MSHA issued approximately 1,700 citations to mine operators for failing to sample at all or to take the required number of samples. Over 50 percent of these citations were issued for failing to comply with the requirement of submitting one valid sample from designated areas or from Part 90 miners during the two-month period.

In addition, there have been instances where operators failed to submit samples but were not cited because of differences in MSHA's interpretation of when sampling is required. The current regulations require operators to submit samples each bimonthly period. This has been interpreted by some MSHA personnel to mean that the operator has approximately sixty days to submit the required number of samples. Under this interpretation if the operator ceases production during the last week of the bimonthly period, samples would not have to be taken at that operation during the sampling cycle. Other MSHA personnel believe that the standard requires samples to be taken if the operator was in production at any time during the bimonthly cycle and had a reasonable opportunity to conduct sampling. Under this view, the operator who ceased production during the last week of the cycle could be in violation of the sampling requirement.

Also, the level of penalties assessed for failing to take the required number of respirable dust samples provides little incentive for an operator to comply with the sampling requirements.

For example, in fiscal year 1991, the average penalty assessment against operators for failing to sample was \$59. This is significantly below the national average of \$218 assessed for violations of the dust standard. These penalties are in contrast to the reported \$150 to \$300 that operators are charged by independent contractors to provide sampling services for each mining unit during a bimonthly cycle.

3. Sampling Scheme is Unresponsive to Sample Results Showing Overexposure

The current MSHA inspection program, which involves averaging the results of multiple samples taken over a one to five day period, does not provide for compliance determinations to be made based on individual sample results that exceed the applicable standard. This is not consistent with the practices of other enforcement agencies, such as the Occupational Safety and Health Administration of the U. S. Department of Labor, that make use of single-sample measurements to make compliance determinations.

For example, if the combined average concentration of the initial five occupation samples is below the applicable dust standard, but one or more individual samples exceed this standard, current MSHA policy does not provide for enforcement action to be taken, but only requires MSHA to conduct additional sampling. Even if one or more single-sample measurements significantly exceed the applicable standard (2.5 mg/m³ or higher), the current sampling scheme will not permit the inspector to find a violation or to require the operator to take corrective action. This is because the combined average concentration of the samples is at or below the applicable dust standard. In fact, under the current sampling scheme, one or more occupations could be exposed to these high dust levels for up to four consecutive shifts and no enforcement action would be taken, even though at these high levels there is reasonable basis to conclude, based on valid statistical methods, that the 2.0 mg/m³ dust standard has been exceeded during individual shifts.

Data from the spot inspection program, which used single-sample measurements in addition to the combined average of multiple sample results for compliance determinations, show that there are a significant number of instances where the dust concentration of a single sample exceeds the applicable standard. Specifically, the data showed that 24 percent (187 units) of the 781 mining units inspected in 615 underground coal mines were in violation of the applicable standard based on the results of a single sample, while 8 percent (63 units) were

in violation of the applicable standard based on the average of all occupations sampled on the mining unit.

4. Voiding of Valid Samples

MSHA allows operators to indicate on the dust data card the reason why a particular sample should not be used for a compliance determination. While this was intended to give operators some flexibility in the event of equipment failure or other unanticipated occurrence, valid samples may be voided because the MSHA processing facility is unable to validate the information. For example, if an operator notes on the dust data card that the pump malfunctioned during the sampling shift, or that the sample was taken in the wrong location, these samples would be voided regardless of the concentration indicated.

Control of Worker Exposure

Fundamental to an effective occupational health protection strategy is the control of the contaminant in the environment to which workers are exposed. In the case of occupational lung disease, the objective of such controls is to reduce the concentration of contaminant that a worker breathes. Effective control methods must be devised, implemented, and maintained, as well as evaluated at regular intervals, to provide reasonable assurance that they continue to function as intended.

Monitoring of the work environment provides an indication of how effective the existing dust control measures are, but monitoring alone does not control dust levels. Accordingly, the primary focus of the coal mine respirable dust program is on controlling the level of dust to which miners are exposed through the application of appropriate dust control measures. These measures should be stipulated in the operator's approved dust control plan. The implementation of dust control measures that sample results have shown to be effective under typical mining conditions, and the maintenance of those controls in proper working order, provides reasonable assurance that no miner will be overexposed. Because present respirable dust monitoring technology is designed to be used for periodic sampling, operator compliance with an effective dust control plan is currently the only practical means of reasonably assuring, on a continuous basis, that miners are not being overexposed.

The clear intent of the Mine Act is that environmental controls should be the primary means of limiting miners' exposure. "Environmental controls" are methods that control the level of dust in the environment by either reducing dust generation or by suppressing, diluting, or capturing the dust. Personal protective equipment or administrative controls should not be used in lieu of environmental controls. While the Mine Act provides that an operator "make available" approved respirators to miners during periods of noncompliance, when miners may be overexposed, the Act specifically prohibits the use of respirators as a substitute for environmental controls in the active working areas of the mine.²⁶ Administrative controls or "work practices", which restrict the amount of time that miners spend in high-dust areas, can result in lower personal exposures. However, these types of controls do not achieve the

²⁶ 30 U.S.C. 842(h).

intent of the Act, which was to maintain dust levels in a miner's normal work environment at or below specified limits. In general industrial hygiene practice, the concept of environmental controls is recognized as the best approach to controlling exposure.

Current Program

To control dust in the mine environment, operators are required by regulation to develop respirable dust control plans and submit them to MSHA for approval.²⁷ These plans provide detailed requirements for the protection of miners by specifying engineering controls, such as the quantity and the velocity of the air current used to ventilate the active working areas in a mine; the number, type, and location of water sprays; and the pressure and quantity of water delivered by the sprays. Additional environmental control methods may be specified, such as the use of dust scrubbers -- devices that collect mine air and filter out dust particles. The plan will generally also contain specific procedures for maintenance of dust control equipment. Once approved, these dust control parameters are to be employed on a continuous basis, and can be measured and checked by the mine operator prior to and during the work shift, thereby reasonably assuring that respirable dust levels are being adequately controlled, without waiting for an analysis of a dust sample. Additionally, the operator's plan will indicate the "designated areas" where the operator is required to collect dust samples.

MSHA conducts sampling during its annual respirable dust inspections for several reasons, among them to verify that mine operators are adequately controlling dust. Under current policy, MSHA collects these samples under typical mining conditions while the plan parameters are in place. An operator is given the option of adjusting the parameters in place to the minimum levels specified in the plan before MSHA begins taking samples. If an operator chooses not to make these adjustments, and compliance is demonstrated through the samples, MSHA inspection procedures require the operator to incorporate the parameters that were in place during sampling in the dust control plan. During regular safety and health inspections, MSHA inspectors do not collect dust samples, but they are required to confirm that the plan is being complied with and that all required controls are in place and operating.

²⁷ 30 CFR 75.316.

This is accomplished through visual observation and physical measurement of such factors as air quantity and velocity.

Under the regulations, the ventilation system and methane and dust control plans must be reviewed for continued effectiveness by the operator and by MSHA every six months. MSHA may grant an operator temporary approval of a proposed dust control plan until MSHA has had the opportunity to conduct sampling to verify that the plan is adequate.

MSHA may determine that an approved dust control plan is no longer adequate based on MSHA samples showing noncompliance when the controls in the existing plan are in place. In such case, MSHA will notify the operator that the plan must be revised to address identified problems. MSHA may also make a determination that a plan is no longer adequate based on operator samples showing noncompliance, and will so notify the operator. If the operator fails to revise the plan, MSHA has the authority to revoke its approval of the operator's plan. Because operators cannot mine without an MSHA approved plan, revocation of approval can essentially stop mining operations for a limited period of time.

Issues

In order for a dust control plan to be effective in maintaining dust levels in the work environment within the permissible limit, two things must occur: the plan must be designed to address typical mining conditions; and the plan must be complied with at all times. The following discussion reviews certain aspects of the current program that do not promote the development of quality plans, can fail to provide reasonable assurance that operators are complying with their plans on a continuous basis, and tend to undermine the statutory primacy of environmental controls.

1. Quality of Dust Control Plans

The Task Group has identified four major factors that can adversely affect the quality of dust control plans. They are: insufficient detail and specificity; improper consideration of production; lack of plan upgrading following abatement of citations; and infrequency of MSHA sampling. These factors are discussed below.

Agency experience and a review of a representative number of dust control plans indicate that respirable dust control plans lack specificity or do not incorporate all the control measures in place at the mine. For example, the review of dust control plans for three major underground coal mines listed the air quantity in the mining section to be 18,000 cubic feet per minute. The actual quantities measured by MSHA inspectors at these mines during the recent spot inspections varied from 40,000 to over 120,000 cubic feet per minute. Under these circumstances, it would be impossible to assess the adequacy of the air volume specified in the plan. In addition, a lack of specificity in some plans makes it difficult for MSHA to determine during regular safety and health (nonsampling) inspections whether the operator is complying with the mine's respirable dust control plan. Several plans indicated that mining equipment was to be provided with water sprays. However, the plan did not specify the location of such sprays or the water pressure at the spray nozzles. This lack of specificity results in part from the fact that there are few existing Agency guidelines for respirable dust control plan review and evaluation.

MSHA policy regarding the minimum production level for plan evaluation can result in dust control plans that are inadequate. For example, by policy MSHA may approve a plan if sample results show compliance when production is at levels as low as 60 percent of the average production over the last 30 production shifts.²⁸ However, this does not provide reasonable assurance that the plan would be effective at actual production, which would exceed the 60 percent level during the mining cycle. To illustrate, if MSHA samples show dust concentrations of 1.8 mg/m³ at 60 percent production levels, MSHA may approve the plan. Whether this plan would be effective at higher production levels is questionable. It should be noted that MSHA determines the requisite production level based on information obtained informally from the operator. There is no requirement that records be kept in a form that would permit their use for determining the appropriate production level for any particular mining unit. The production information MSHA regulations specify to be submitted by mine operators on a quarterly basis is not useful since the data are submitted on a mine-wide basis. Moreover, this information could reflect the amount of clean coal that

²⁸ The 60 percent average production limit should not be confused with the 50 percent limit which is the minimum production level for a valid operator bimonthly respirable dust sample. By policy, MSHA requires that an operator produce at least 60 percent of average production when the Agency samples to determine plan adequacy.

has been mined that is lower than the tonnage of total material produced required for sampling purposes.

Because of the dynamic nature of mining, conditions can change significantly from one day to another. These changes in mining conditions can directly impact on dust generation and on the effectiveness of the measures in place to control respirable dust. Consequently, the adequacy of the dust control plan needs regular evaluation to determine whether it continues to be effective in maintaining respirable dust levels in the work environment at or below prescribed levels, or whether the plan may need to be updated.

While the purpose of operator sampling is to demonstrate compliance with the applicable dust standard and to verify that the control measures in place continue to be adequate, MSHA does not routinely rely on operator sample results in assessing the adequacy of operators' dust control plans. As described earlier, when an operator is cited for exceeding the applicable dust standard based on results of the bimonthly samples, the mine operator must take appropriate corrective action to abate the violation. This may simply involve complying with all the parameters stipulated in the plan, or an operator may elect to employ enhanced dust control measures beyond those in the plan to bring the dust levels within acceptable limits. For example, the operator may increase the volume of air delivered to the affected area. However, MSHA does not routinely require the operator to include the additional control measures taken to achieve compliance in the dust control plan. This is due to the fact that the Agency does not routinely monitor the operator's abatement actions and therefore does not know whether the dust standard was exceeded because the operator failed to comply with the existing plan or because the plan was inadequate.

Instead, MSHA has assumed primary responsibility for evaluating the effectiveness of the operators' plans through its own collection of samples. Although current MSHA policy requires the Agency to collect samples at each producing underground mining section annually, MSHA currently conducts fewer than the prescribed number of respirable dust evaluations. For example, in fiscal year 1991, only 58 percent of the 2099 mining sections that were in operation for at least 181 days during the fiscal year were adequately sampled by MSHA.

The duration of annual MSHA sampling is from one to five days. Because mining conditions and resulting dust levels can fluctuate over a given period of time, even five days of sampling may not be sufficient to enable evaluation of the plan under typical mining conditions. Additionally, MSHA sometimes is not able to sample immediately to evaluate a plan that has been submitted, and may approve the plan on a temporary basis until MSHA can sample. A plan may be implemented, although on a temporary basis, which may not maintain dust levels at or below acceptable levels.

2. Compliance with Dust Control Plans

The aim of any well-designed dust control plan is to maintain the environment free of excessive levels of respirable dust. However, failure to comply with the plan's requirements on a continuous basis will defeat the purpose of the dust control plan and may needlessly expose miners to higher dust levels. A review of the citations issued during the spot inspection program, in which MSHA inspectors conducted several checks of the dust control parameters during the course of each sampling shift, revealed that 21 percent of the 781 mining units sampled were not complying with the minimum requirements of the dust control plan. Operators were cited accordingly for these violations.

Under the Mine Act, one of the primary methods of protecting miners is to require operators to conduct periodic examinations of the workplace to identify hazards. Historically, these examinations have been limited to the identification of safety-related conditions. There is no provision requiring the operator to monitor dust control parameters on a regular basis as part of the required daily examinations.

During regular safety and health inspections, MSHA inspectors are required to determine whether the operator is complying with the provisions of the dust control plan. This is accomplished by visual observation and measurements of control parameters such as pressure of the water sprays, quantity and velocity of the air currents, etc. As indicated above, the lack of plan specificity could make it difficult for the inspector to determine whether the plan parameters are in fact being followed.

Given the importance of effective dust control, some form of continuous monitoring of dust control parameters would be highly desirable. The technology currently exists for the

monitoring of such parameters as water pressure and flow rate, but has yet to be integrated into a system that can be implemented in underground mines.

3. Primacy of Dust Controls

The Mine Act intends that mine operators maintain dust levels in the work environment at or below the applicable standard through the use of environmental controls. Primary reliance on environmental controls minimizes the chance that individual workers may inadvertently be overexposed to respirable dust. Another method of avoiding overexposure is the use of administrative controls, which is the practice of rotating work assignments to spread the exposure to the contaminant among a sufficiently large number of employees to avoid an overexposure to any single individual. Plans at some mines using longwall mining systems include administrative controls even though additional feasible environmental controls could be implemented. Reliance on administrative controls in these circumstances presents the same type of problem as reliance on respirators for miner protection. Both methods depend on the ability of the workers to follow specified procedures if the control is to be effective.

Operators are required to provide miners with approved respirators as an interim protection measure during periods of noncompliance, but are not required to compel their use. Approved respirators offering the highest level of protection that are suitable for the mining conditions and environmental dust levels should be made available. For example, respirators of the powered air-purifying type offer greater protection than more traditional disposable air-purifying types, where size and weight of the respirator is inconsequential.

In order for any respirator to function effectively, it must be properly selected, fitted to the miner, and maintained. However, there are no current Agency directives to guide inspectors in evaluating the effectiveness of operator utilization and maintenance of such equipment, so that inspectors may determine whether an adequate degree of protection is afforded to the miner.

Education and Training

Education and training are an important part of any effort to prevent occupational lung disease, and are essential if all parties, including the worker, are to participate constructively in achieving a work environment reasonably free of health hazards. The goal of education and training is to provide an opportunity for all parties to become fully cognizant of the nature of the hazard in the environment and of the purpose, proper use, maintenance, and limitations of available protective measures.

Current Program

As discussed earlier, the collection of operator samples, as well as the calibration and maintenance of sampling equipment, must be performed by a certified person. An individual may be certified to perform either sampling, or maintenance and calibration. Individuals usually obtain certification to perform both tasks. To become certified, a person must pass an MSHA examination. This requirement is designed to provide a certain minimum level of competence, thereby safeguarding the integrity of the sampling process. Individuals may be certified on a temporary basis prior to passing the required examination if they have received instruction from MSHA on the appropriate subject. The temporary certification is withdrawn if the person does not successfully complete the appropriate MSHA examination within six months.

The regulations at 30 CFR Part 48 require new underground miners to complete 40 hours of comprehensive training before beginning employment, and to receive eight hours of annual refresher training. Operators are required to develop a plan for the training of their miners that is approved by MSHA. The regulations outline the safety and health topics to be covered during this training and include instruction on the purpose of taking dust measurements and on any health control plan in effect at the mine. The health provisions of the Act as well as any mandatory health provisions related to the miner's tasks must also be explained.

Issues

The Task Group has identified two major areas of concern involving the certification of persons to conduct sampling and the training of miners.

1. Certification Process

There are potential vulnerabilities associated with the initial certification process. No formal classroom training is required prior to taking the examination, and MSHA publishes the certification examinations as well as the answers to the exam questions. Accordingly, a person who has passed the examination may not actually possess the necessary level of knowledge and competence intended by the regulations. Such a lack of requisite knowledge is evidenced by the results of interviews of certified dust samplers during the recent spot inspection program. Some 34 percent of the samplers interviewed did not know how often a dust pump must be calibrated under the regulations.

In addition, some of the examination questions are no longer relevant. The examination currently administered has not been revised in ten years, and contains obsolete material, including references to sampling equipment that is no longer being used. Although certified persons perform an important function in providing a healthful environment and should be aware of the magnitude of this responsibility, there are no questions that test their knowledge of ethical or legal obligations. This has become a particularly sensitive issue in light of recent disclosures of widespread operator dust sample tampering.

Once a person has been certified, the integrity of the program depends on that person continuing to fulfill the regulatory requirements in a competent and honest manner. Certified persons who do not comply with the regulations or who otherwise fail to carry out their responsibilities should no longer be certified. However, there is no ongoing process in place to assess the quality of the certification program under existing regulations and procedures. Certifications are valid indefinitely, and no refresher training is required to maintain certification. Moreover, the Agency has no formal criteria defining the type of conduct that may warrant decertification action. Although MSHA has initiated decertification proceedings on an ad hoc basis against a small number of individuals, the lack of formal procedures for decertification may inhibit prompt Agency action.

2. Training of Mining Personnel

Interviews conducted during the recent spot inspection program indicate that miners are not fully knowledgeable about certain aspects of the dust program. For example, during these interviews, 30 percent of the miners interviewed did not know the parameters included in the mine's dust control plan, although this is a topic specifically required to be covered by the operator in the Part 48 training. Miners whose occupations were sampled were asked what they were required to do with the sampling pump when they changed jobs. Thirty-three percent of the miners interviewed responded incorrectly to this question. Other spot inspection data indicate a lack of miner knowledge of hazards associated with respirable coal dust and of the dust control plan parameters, and a failure of personnel to follow correct sampling procedures.

Medical Surveillance

The primary objective of medical surveillance is to evaluate the health condition of individual workers, with emphasis on specific "target organs" most likely affected by actual environmental exposures. Medical surveillance provides for assessing the health status of the workforce, and for early detection of the development of disease so that appropriate steps can be taken to prevent further progression of the disease. The results also provide some indication of whether the workplace control measures are effectively protecting the health of workers, and whether the exposure standards are providing the expected level of protection.

Current Program

The Mine Act does not assign to MSHA any specific medical surveillance responsibilities. The Act does charge NIOSH with the administration of the Coal Workers' Health Surveillance Program, also called the X-ray Surveillance Program, to identify underground miners who show signs of pneumoconiosis.²⁹

NIOSH is also required to develop information on the incidence and prevalence of pneumoconiosis and other respiratory ailments of miners. The x-ray program provides NIOSH with the means for monitoring the incidence of pneumoconiosis under the current respirable dust standard. As part of NIOSH's ongoing effort to assess the adequacy of the current respirable dust standard, MSHA provides to NIOSH the results of respirable dust measurements made by the operator and MSHA inspectors.

Issues

The primary concern in this area is the diminishing participation of eligible miners in the X-ray Surveillance Program. According to NIOSH, coal miner participation rates have

²⁹ 30 U.S.C. 843.

decreased since 1970 from 50 percent of eligible coal miners to approximately 32 percent.³⁰ Some reasons for the low miner participation rate may be the belief that participation in this program could affect miners' future black lung benefits, or that medical results will not be kept confidential. This low rate hampers the government's efforts to identify miners with early x-ray evidence of pneumoconiosis, which in its early stages is asymptomatic, and afford them an opportunity to work in an area of the mine where the lower levels of dust will not cause further progression of the disease. The low miner participation rate also results in an incomplete picture of the state of miners' respiratory health, and hinders an accurate assessment of the overall effectiveness of the dust control program.

NIOSH also uses operator and MSHA data on dust levels to assess the adequacy of the current respirable dust standard. For reasons discussed above, these data may not be representative of miners' actual dust exposure.

³⁰ Wagner, G.R. and E.A. Spieler. *Is the U.S. Coal Miner Chest X-ray Surveillance Program Succeeding in Controlling Lung Disease?* Proceedings of the VIIth International Pneumoconiosis Conference, August 23-26, 1988, Pittsburgh, Pennsylvania, p. 804.

Review of the Role of the Miner in the Respirable Dust Program

It is impossible for MSHA to monitor an operator's activities on a continuing basis. Therefore, miners must be actively involved in insuring that their health is protected through proper work practices and compliance with applicable laws. Their active involvement should increase their confidence in the effectiveness of the dust control program.

Current Program

Under the current operator sampling program, coal mine operators are required to sample specific miner occupations every two months. Operators are required to place the sampling device on the miner whose occupation is being sampled, or place the sampling device within a specified distance of the normal work position for the entire shift. Although the certified dust sampler, rather than the miner, is responsible for checking the sampling unit during the second hour of operation and at the end of the shift, the miner is in a position to monitor those checks and report any irregularities to mine management or to MSHA, as appropriate. Additionally, the miner can verify that the sampling unit is operating properly and at the proper flow rate during the entire sampling shift. Operators are required to post the results of sampling, thereby affording miners the opportunity to review them.

During the collection of samples by MSHA, the miners' representative has the right, under Section 103(f) of the Act, to travel with the inspector during the inspection and observe MSHA sampling.³¹ The miners' representative may also accompany the MSHA inspector while the inspector verifies operator compliance with the dust control parameters. Miners may also observe whether the operator is complying with the requirements of the dust control plan when MSHA is not on site, and may alert management of any problems, or notify MSHA if necessary. The right to contact MSHA is protected by Section 105(c) of the Act, which provides that no person shall discharge or otherwise discriminate against miners because of the exercise of their rights under the Act, including the making of complaints

³¹ 30 U.S.C. 813(f).

related to safety or health hazards. Miners who are discriminated against may file a complaint with MSHA alleging such discrimination. After MSHA has investigated the allegation, the Agency may initiate legal action to obtain appropriate relief, including reinstatement of the miner to the position from which he or she has been discharged.³²

Issues

The miner whose occupation is being sampled can observe the operation of the sampling unit during most of the sampling shift, and is in a position to notice irregularities in the process. To enable miners to recognize when proper sampling procedures have not been followed, they must be familiar with proper sampling procedures. As more fully discussed under the Education and Training section, some miners lack this necessary knowledge. However, even if miners have been properly instructed, their involvement ends once the sampling unit is removed at the end of the sampling shift. Additionally, there are limited opportunities for input by miners regarding the contents of the operator's dust control plan.

³² 30 U.S.C. 815(c).

Recommendations

The Task Group has concluded that new technology for continuous monitoring of the mine environment and of the parameters used to control dust offers the potential to improve the integrity of the enforcement program and to further improve miner protection from excessive levels of respirable coal mine dust. A detailed discussion of the potential for this new technology is contained in Appendices E and F. Because the Task Group does not recommend that MSHA take over the operator sampling program, for reasons discussed below, the present operator sampling program should remain in place until continuous monitoring equipment is available. The Task Group's review of the existing respirable dust control program revealed that both the design of the existing program and MSHA's ongoing enforcement activities could be strengthened.

Accordingly, the Task Group has formulated long-term recommendations that focus on the development and implementation of new and improved technology, along with recommendations for improving the existing respirable dust control program.

Improvements in the Current Respirable Dust Program

Because the estimated time frame for the introduction of continuous fixed-site monitors into mines is three to five years or longer, the Task Group recommends that the Agency initiate improvements to the existing program. The degree to which these recommendations are adopted and implemented should be based on the progress of research to develop the fixed-site continuous monitor.

The Task Group's review of the existing respirable dust control program focused on the four elements identified as basic to an effective health protection program. The recommendations to improve the program are structured accordingly.

Monitoring of the Work Environment

The Task Group has identified four areas where monitoring of the work environment could be improved while utilizing current technology: 1) minimizing the likelihood that unrepresentative samples will be collected or submitted; 2) collecting the required number of operator samples; 3) ensuring that the sampling scheme is responsive to sampling results showing overexposure; and 4) minimizing the voiding of representative samples. These matters are discussed below.

1. Unrepresentative Samples

The Task Group has been charged with addressing the issue of whether the Agency or the operator should be responsible for conducting compliance sampling. This issue arises directly from the concern over unrepresentative samples. Some in the mining community, particularly labor interests, argue that this concern would be addressed in large measure if MSHA were to assume total responsibility for the collection of dust samples. Under this approach, an operator would not be able to adjust or select the mining conditions under which samples are collected, or the location where samples are taken. The opportunity for tampering with samples would also be minimized because of MSHA's presence at the mine site.

However, the Task Group does not recommend that the Agency assume this responsibility. While there has been abuse in the current program, the majority of operators do not engage in such conduct. When there is such abuse, the Agency has demonstrated its commitment to strong civil and criminal enforcement action. Moreover, an operator sampling program is consistent with the Mine Act, which contemplated that the operator will have responsibility for the collection of respirable dust samples used by MSHA in making compliance determinations.³³

From a practical standpoint, MSHA's assumption of total responsibility for sampling could impact negatively on other Agency safety and health activity. Currently, operators are required to sample each operating mining unit every bimonthly period. In order for MSHA

³³ 30 U.S.C. 842(a).

to conduct all sampling, the Agency would need to redirect significant resources or obtain additional resources to match this sampling frequency, or the number of samples collected would have to be significantly reduced. Also, the future adoption of a program based on continuous fixed-site monitoring would significantly reduce the need for either the operator or MSHA to conduct periodic sampling. Consequently, the near-term expenditure of resources to develop and implement a full-scale MSHA sampling program using current technology may not be a practical option.

The Task Group believes that the existing operator sampling program can provide adequate assurance that miners will not be exposed to unhealthful levels of respirable coal mine dust until continuous monitoring is feasible, if appropriate improvements are made in the program. To increase confidence in the existing program, the potential for the submission of unrepresentative operator samples must be minimized. Accordingly, the Task Group recommends:

- MSHA should redefine "normal production shift" to reflect actual production during normal work cycles. The Agency should also develop a means to verify actual production levels of individual mining units.
- Efforts are currently underway to develop a dust cassette that inhibits removal of dust from the filter. MSHA should require the use of the new cassette when it becomes available. MSHA should also consider requiring the use of other equipment to make the entire sampling process as tamper-resistant as possible, including enhancement of the integrity of the pump and sampling head assembly.
- MSHA should continue to examine samples that show no weight gain, and should also develop a screening system to identify samples with dust levels that are unusually low given the mining method and the production level reported.
- Current regulations limit the duration of sampling to the entire shift or eight hours, whichever is less. As a result, miners who work nontraditional shifts of more than eight hours are not being adequately monitored under the existing regulations. MSHA is currently addressing this issue for substances other than respirable dust in its rulemaking on Air Quality, Chemical Substances, and Respiratory Protection Stan-

dards.³⁴ Once MSHA determines how it will address miner exposure to other contaminants during novel work shifts in the final regulation on Air Quality, the Agency should implement a similar approach for respirable coal mine dust.

- To minimize the potential for operators to select sampling periods that do not reflect normal mining conditions and to determine whether operators are complying with dust sampling procedures, MSHA should institute a formalized program for monitoring the conditions under which operator sampling is performed. MSHA should require operators to provide the Agency with advance notice of their sampling schedule.
- MSHA should require operators to have in place security measures to safeguard the integrity of the entire sampling process.

2. Failure of Operator to Collect the Required Number of Samples

MSHA records show that a significant number of mine operators have failed to collect samples as frequently as the regulations require. This hampers MSHA's ability to determine whether operators are complying with the applicable dust standard and whether the operator's dust control practices continue to be effective. In some cases there may be legitimate reasons why an operator has not submitted samples, such as a bimonthly period when production is unpredictably intermittent and there has been insufficient time for sample collection. However, there is no Agency policy setting forth the circumstances under which operators should be cited for failing to sample. It is clear that the level of civil penalties assessed against operators who fail to conduct bimonthly sampling does not serve as an adequate deterrent. Accordingly, the Task Group recommends:

- The Agency should examine its current policy regarding the collection of samples during a bimonthly period, and should review all violations for failure to sample for special assessment or for increased gravity and negligence evaluations.

3. Sampling Scheme is Unresponsive to Sample Results Showing Overexposure

The current MSHA inspection program is not designed to respond to individual samples showing overexposure. Existing spot inspection data show a significant number of instances where the dust concentration over a single shift exceeds the applicable standard. Outside of

³⁴ 54 FR 35760 (August 29, 1989).

the recent spot inspection program, MSHA historically did not issue citations based on single sample results. Providing for the option of making a compliance determination based on either a single sample or the combined average of multiple samples will afford a greater degree of health protection to the miner, as intended by the Coal Act as it will result in operators taking more immediate corrective action. Accordingly, the Task Group recommends:

- MSHA should institute a program that utilizes Agency single-sample measurements in addition to the average of multiple sample results for compliance determinations. Also, while making no specific recommendation, the Task Group suggests that the Agency study the appropriateness of making single-sample compliance determinations based on samples submitted by the operator during bimonthly periods.
- MSHA should revise its policy to eliminate the present multiple-shift respirable dust inspection program and institute a program that provides for more frequent one-day respirable dust spot inspections.

4. Voiding of Valid Samples

The voiding of samples at the request of the operator raises the possibility that some valid representative samples may not be considered by MSHA in making compliance determinations. This is due to the fact that in many cases MSHA is unable to verify the information supporting the request. Therefore, the Task Group recommends:

- MSHA should review its existing policy regarding the voiding of samples to minimize the potential for invalidating representative respirable dust samples.

Control of Worker Exposure

Providing and maintaining a work environment free of excessive levels of respirable dust is essential for long-term health protection. The Task Group has identified three areas where improvements would strengthen the control of worker exposure. They involve quality of dust control plans, compliance with plans, and primacy of controls.

1. Quality of Plans

Dust control plans demonstrated to be effective under typical mining conditions are essential to preventing overexposures. However, plans may be approved when the production achieved during plan verification is significantly lower than normal production, raising doubts about the plan's adequacy at higher production levels. Additionally, MSHA sampling for plan verification may not be of sufficient duration, given other fluctuating variables that affect dust levels, to enable an accurate assessment of plan effectiveness.

Although periodic MSHA sampling is essential to verify the adequacy of the operator's efforts to control respirable dust levels, the Agency has not sampled every mining unit annually in accordance with current inspection procedures. The Task Group also concluded that, in some cases, dust control plans lack specificity or do not reflect the measures that are actually being used in the mine to control respirable dust.

Finally, while operators are required to take appropriate action to correct a violation of the dust standard and to sample for the purpose of demonstrating compliance, the Agency does not routinely require the operator to include those measures that were taken to abate the violation in a revised dust control plan. This is true even when operators must employ enhanced control measures beyond what is called for in the plan to achieve compliance. Consequently, compliance with the plan does not guarantee that miners will not be overexposed. Accordingly, the Task Group recommends:

- MSHA should develop uniform plan approval guidelines that incorporate minimum acceptable dust control parameters for each method of mining.
- MSHA should rescind its policy of making determinations of plan adequacy when production levels are as low as 60 percent of the mine's average, and only approve plans that are demonstrated to be effective at typical production levels.
- MSHA should revise its policy to require coal mine operators to provide verification of the adequacy of dust control plans submitted to the Agency for approval, demonstrating that the plan will be effective under typical mining conditions. One method for an operator to accomplish this is through sampling over an extended period of time, to increase the likelihood that verification samples reflect typical dust levels. The Agency should also require a responsible mine official to verify that the plan's supporting data are accurate and reflect representative mining conditions.

- MSHA should revise its policy and review dust control plans whenever noncompliance is demonstrated with the applicable dust standard, and require the operator to incorporate in the plan those control measures that are determined to be necessary to achieve and maintain compliance.

2. Compliance with Plans

Once an effective dust control plan has been designed, its continued implementation is vital to preventing overexposure. However, recently obtained spot inspection data show that some operators are not complying with their plans on a continuous basis, and there are no systematic procedures in place requiring operators to routinely monitor the status of the dust control measures. Accordingly, the Task Group recommends:

- MSHA should increase its monitoring of operator dust control practices during respirable dust spot and regular inspections to ensure compliance with the mine's dust control plan.
- MSHA should require coal mine operators to make periodic on-shift examinations to verify that the plan parameters are in place and functioning as intended.

3. Primacy of Controls

The most effective dust control strategy to minimize the potential for miner overexposure to respirable dust is the application and use of environmental control methods. Control of the work environment gives reasonable assurance that all miners in the area will be adequately protected. This is consistent with the Act, and may serve to encourage the development of new dust control technology. However, the Task Group has concluded, based on its review of selected dust control plans, that there is a growing trend toward the use of administrative controls when additional feasible environmental controls could be implemented, primarily at mines employing longwall mining systems. While administrative controls may be attractive to mine operators because they may be easier and less costly to apply and maintain in the short term than environmental controls, they have the potential to be less reliable.

Currently, operators are required to make available approved respirators to miners during periods of noncompliance, although miners are not required to wear them. While current MSHA policy requires inspectors to consider the use of respirators in determining the gravity

of violations of the applicable dust standard, the Agency has no guidelines for evaluating the effectiveness of an operator's respirator practices.

Accordingly, the Task Group recommends:

- MSHA consider ways to improve the effectiveness of its existing policy that operators implement all feasible environmental controls before resorting to administrative controls.
- Approved respirators, such as the powered air purifying type, can be effectively used as an interim method of protecting miners when properly selected, used, and maintained. Therefore, MSHA should consider developing policy setting forth guidelines for evaluating the effectiveness of operator respirator programs, to give reasonable assurance miners are protected when such personal protective devices are used, while preserving the primacy of engineering controls.

Education and Training

The Task Group recognizes that education and training is an important part of any effective health protection strategy to prevent occupational lung disease. In order to strengthen the current program, the Task Group has identified two key areas where significant improvements could be realized: the certification process for operator sampling personnel and the training of miners under Part 48 of MSHA's regulations.

1. Certification Process

The current certification process is inadequate. The examination is outdated, and MSHA does not require classroom training as a prerequisite to certification. Moreover, the current certification process places no emphasis on the legal obligations of certified persons. Certifications are valid indefinitely, and no refresher training is required to maintain certification. As a result, persons who have been certified may not possess the necessary level of knowledge and competence intended by the regulations. Additionally, the Agency has no formal procedures defining the type of conduct that may warrant decertification action. Lack of formal decertification procedures may inhibit prompt Agency action in those instances when MSHA has reason to believe that an individual has failed to perform the necessary duties competently or responsibly. Accordingly, the Task Group recommends:

- MSHA should update the current dust sampling and maintenance certification examination. MSHA should also discontinue the practice of publishing the examination questions and answers. Lastly, consideration should be given to revising the regulations to require classroom training as a prerequisite to taking the certification examination.
- MSHA should establish written criteria defining conduct that may result in the revocation of certification, and should institute a formal decertification process.
- MSHA should determine the feasibility of suspending all current certifications and requiring recertification, using new and improved procedures, at specified intervals. Periodic retraining should be required.

2. Training of Mining Personnel

MSHA regulations require training of both new and experienced miners. However, spot inspection data indicate that miners are not fully knowledgeable about the respirable dust control program in effect at the mine. Accordingly, the Task Group recommends:

- MSHA should review, and revise as appropriate, Part 48 training and retraining requirements to increase miners' knowledge of the health hazards of respirable coal mine dust, the importance of effective dust sampling and control, and the miners' role in the sampling process. Miners should also receive instruction in correct sampling procedures, so that they will recognize when proper procedures are not followed. Part of this MSHA review should include an evaluation of actual operator training plans and the quality of the operator training.
- MSHA should develop a program to assist operators and miners in providing and maintaining a healthful work environment. The program should be patterned after the Job Safety Analysis Program (JSA), using the same concepts and elements of the JSA, as appropriate. Implementation of the program should incorporate input from all segments of the mining industry.

Medical Surveillance

During the recent hearings before the Subcommittee on Appropriations regarding tampering with coal mine dust samples, Dr. J. Donald Millar, Director of NIOSH, indicated that medical surveillance was essential to preventing coal-related occupational lung diseases. Efforts must be made to detect those miners who are developing the disease so that they can be spared further exposure to coal mine dust and further progression of disease. While mechanisms exist under the existing program to address these issues, the Task Group found that participation by miners in the NIOSH X-ray Surveillance Program historically has been low. This matter should be addressed by emphasizing to miners the need for them to fully participate in this essential program. Therefore, the Task Group recommends:

- MSHA should emphasize the importance of miner participation in the X-ray Surveillance Program in Part 48 Training. The Agency should also consider establishing a health outreach program to convey this message to the mining community.

Role of the Miner in the Respirable Dust Program

One important means of improving the dust sampling program is to encourage increased involvement of miners in the process. The miner should be familiar with the hazard of overexposure to respirable dust, appropriate sampling procedures, and engineering controls required by the dust control plan. Accordingly, the Task Group recommends:

- MSHA should stress the importance of the miner's role in recognizing and reporting to MSHA any irregularities in the sampling process, or any unhealthful work practices.
- MSHA should encourage miners or their representatives to participate in reviewing and providing input into dust control plans proposed by the operator.

Long-Term Program Improvements

Technology is at the threshold where fixed-site dust monitors and dust control parameter monitors can be developed. Monitors strategically located in the work place or mounted on the mining equipment would permit the environment of the mine and the parameters essential to the control of dust to be continuously monitored. Information provided by continuous monitoring devices would provide real time data that can be used by mine personnel to achieve control of hazardous dust levels. The information can also be transmitted to a central data gathering site for processing. Although the development of monitors is feasible with existing state-of-the-art technology, a commitment of resources will be required in the area of research to develop, evaluate and integrate this instrumentation into the mine environment.

The Task Group recommends the following actions to achieve the goal of continuous monitoring of the mine environment:

- An accelerated research program to evaluate existing state-of-the-art technologies having the potential to be used in the development of a fixed-site underground coal mine dust monitor. Applicable technologies to be considered are light scattering, tapered element oscillating microbalances and beta sensing gauges. The ultimate goal is to have an instrument that can be used as a fixed-site monitor that will provide continuous information to the miner and mine operator on the status of dust resulting from the mining process as well as information on the status of compliance with respect to the applicable respirable dust standard. The monitor is also expected to have the capability of cutting power to mining equipment whenever applicable dust standards are demonstrated to be exceeded. Application of a fixed-site monitor to MSHA's dust enforcement program is expected to be similar to that of the current methane monitor.
- An accelerated research program to develop instrumentation for continuously monitoring the parameters (ventilating air quantity, water consumption, entry velocities, etc.) used to control dust.
- A research program to develop a device for measuring full-shift personal respirable dust exposures and for use as a hand-held detector for determining the efficacy of methods used to control dust. This would be a device similar to the MINIRAM, an

instantaneous dust measuring instrument that uses the principle of light scattering to measure the amount of dust in the environment. However, unlike the MINIRAM, the instrument developed should provide a direct measure of the mass of dust to which an individual is exposed. The device should be capable of providing both a short term measurement (five to ten minutes) as well as a determination of the average full shift respirable dust exposure. In designing the instrument, primary consideration should be given to minimizing weight and size and optimizing resistance to tampering.

Longwall mining systems currently represent the state of the art in underground coal mining methods. However, this technology brings with it higher levels of respirable dust, new dust sources, and the need to identify new concepts for controlling dust from these sources. Accordingly, the Task Group recommends:

- MSHA should encourage the development of new or improved dust control technology, with special emphasis on dust control methods for high-production longwall mining units and other mining operations experiencing difficulty in maintaining consistent compliance.

Appendices

APPENDIX A - Task Group Members

The Coal Mine Respirable Task Group members include:

Robert G. Peluso

Chairperson, Chief, Pittsburgh Safety and Health Technology Center, MSHA

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Thomas F. Tomb

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George E. Niewiadomski

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Richard W. Metzler

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Mary Katherine Alejandro

Counsel for Coal Standards and Legal Advice, Division of Mine Safety and Health,
Office of the Solicitor

Edward Zimowski

Industrial Hygienist, Salt Lake City Technical Center, OSHA

Fred Siskind

Economist, Office of the Assistant Secretary for Policy

Task Group Facilitator:

John P. Seiler

Supervisory Electronics Engineer, Technical Support, MSHA

APPENDIX B - Meetings With Interested Parties

During the course of its evaluation of the Coal Mine Respirable Dust Program, the Task Group met with the following interested parties:

MSHA District Managers
MSHA Health Specialists
The U. S. Bureau of Mines
The National Institute for Occupational Safety and Health

Bituminous Coal Operators Association
National Coal Association
The American Mining Congress
National Independent Coal Operators Association

United Mine Workers of America
Occupational Safety and Health Center

Monitoring Instruments for the Environment, Inc.
Gelman
Mine Safety Appliances Company
Rupprecht and Patashnick Company, Inc.

APPENDIX C - Listing of Expert Teams

The Task Group established six teams of experts, composed of representatives from MSHA, OSHA, NIOSH, and the Bureau of Mines to examine and prepare reports on a variety of technical issues. A brief description of each team's mission follows:

Audit Team

The mission of the Audit Team was to organize and implement the respirable dust spot inspection and monitoring inspection programs. The team was charged with producing program instructions and providing training to MSHA personnel who were responsible for conducting the programs in the districts.

Dust Control Plan Criteria and Improved Approval Methodology Team

The mission of the Dust Control Plan Criteria and Improved Approval Methodology Team was to examine the current MSHA dust control plan process in terms of adequacy, format, content, approval, evaluation, monitoring and revocation. Its objectives included defining dust control plan criteria and formulating approval methodology; recommending policies pertaining to enforcement activities; reviewing and analyzing the respirable dust spot inspection and monitoring program data relative to dust control plan parameters and sample results; recommending necessary regulatory changes; defining training needs in terms of the dust control plan; and identifying both current and future research needs.

Sampling Strategies and Innovative Concepts Team

The mission of the Sampling Strategies and Innovative Concepts Team was to evaluate and recommend changes in sampling and monitoring procedures. The team's objectives included: the review of present MSHA sampling requirements, audit procedures, and citation policies; the development of recommendations to improve operator accountability for miner safety and health and operator sampling procedures in order to better evaluate miner exposure to respirable coal mine dust; the development of recommendations to improve miner accountability for both MSHA and operator sampling; and the development of recommendations to improve MSHA inspection procedures to better evaluate miner exposure to respirable coal mine dust.

Education and Training Team

The mission of the Education and Training Team was to evaluate and recommend enhancements to MSHA's training and certification programs, to develop new training programs in order to increase miner awareness of the health hazards associated with respirable coal mine dust, and, through training, improve the quality of coal dust sampling and control.

Instrumentation Team

The mission of the Instrumentation Team was to provide technical guidance for the development of technology to monitor dust in the mining environment. The team was to evaluate current aerosol measurement technologies and identify necessary long term research that could be applied to monitoring respirable dust in the mining environment in terms of both hand-held and fixed-site instruments operating as continuous or shift average monitors. The team was also to evaluate technologies that could be applied to measure worker exposure to dust considering personal monitors that provide both shift average and continuous measurements of dust exposures sufficiently accurate for compliance purposes.

Statistical Team

The mission of the Statistical Team was to utilize data obtained through the coal mine operator's respirable dust sampling program, the respirable dust spot inspection and monitoring inspection programs, and MSHA's routine dust sampling inspections to help evaluate the effectiveness of the operator's and MSHA's sampling programs in monitoring underground respirable dust exposures and compliance. The statistical team was responsible for developing a computerized data base to provide data in a format suitable for statistical analysis.

APPENDIX D - Underground Coal Mine Dust Exposure Levels

OCCUPATION	1969 ³⁵ mg/m ³	1991 ³⁶ mg/m ³
Cutting Machine Helper	8.4	0.8
Continuous Miner Operator	7.7	1.5
Loading Machine Operator	7.1	1.3
Cutting Machine Operator	6.9	1.9
Coal Drill Operator	6.7	1.3
Continuous Miner Helper	6.5	1.3
Loading Machine Helper	6.0	1.4
Shot Firer	5.9	*
Timberman	4.7	*
Roof Bolter Operator	4.6	1.2
Beltman	3.7	0.9
Section Foreman	3.2	0.8
Scoop Car Operator	*	0.9
Supply Man	3.0	1.0
Shuttle Car Operator	2.7	0.9
Boomboy	2.4	*
Mechanic	2.1	0.6
Longwall Operator (tail)	*	1.7
Longwall Operator (head)	*	1.5
Longwall Jack Setter	*	1.4

* Indicates that the studies did not include these occupations

³⁵ Wheeler, H.P., Jr. *The Working Environment: Statement of the Steps and Rationale for Action taken by the Department of the Interior. Papers and Proceedings of the National Conference on Medicine and the Federal Coal Mine Safety and Health Act of 1969. June 15-18, 1970, pp. 28-34.*

³⁶ Respirable Dust Spot Inspection Program.

APPENDIX E - Review Of Monitoring Technologies

In addition to evaluating the current respirable dust control program, the Task Group was directed to consider the development of new or improved monitoring technology, including technology to continuously monitor the mine environment. The Task Group conducted an extensive evaluation of current state-of-the-art aerosol measurement technologies and identified the long-term research necessary for effective monitoring of respirable dust in the mining environment. Information on available hand-held and fixed-site instruments was reviewed to determine if these devices could be used as continuous or shift-average monitors. The Task Group also studied available information on technologies that could be used in the development of a new personal dust monitor.

This review indicated that, given the current state of technology, monitors can be developed to provide mine personnel with current information on the status of environmental dust levels. However, additional research is needed to complete development of such monitors, to evaluate the effectiveness of these devices, and to integrate this instrumentation successfully into the mine environment.

Approximately ten years ago, MSHA developed a continuous light-scattering respirable dust monitor for use in underground mines. The Agency determined at that time that this technology could be used to monitor the effectiveness of dust controls. Current fixed-site light-scattering monitors are used in the United Kingdom to monitor dust levels in the return airways. These monitors incorporate a standard gravimetric system that verifies the accuracy of the light-scattering measurement. This combination of measurement methods allows the recording of a multiple shift dust profile while collecting a physical dust sample. However, this instrument is presently not suitable for machine mounting and has inherent maintenance problems when used over a long term. Other technological issues that remain to be addressed are: accounting for the presence of water drops; rendering the sensing mechanism and the monitor sufficiently durable for intended use in mine environments; and designing the equipment to be tamper-resistant.

Recent disclosures of tampering have highlighted questions about the integrity of the measurement obtained by the current sampling unit and the need to make the system more tamper-resistant. Equipment modifications to reduce potential tampering could be addressed within the year. Although the current unit can be made more tamper-resistant, elimination of all possibility of tampering is not considered practical or feasible at this time.

Technology is currently available for the development of a short-term, direct-reading personal sampler that would allow continuous feedback to miners on the environmental dust levels. Such an instrument could be developed employing a combination of light-scattering technology and standard gravimetric methods. The light-scattering device would provide a direct reading, while the gravimetric method would provide the time-weighted average results required for compliance purposes.

Recent advances in electronic signal processing and sensing technologies make the development and implementation of a mine-worthy, continuous personal and fixed-site monitor feasible within the next three to five years.

The development of the personal and fixed-site continuous monitoring devices offer the potential to significantly improve monitoring of the work environment and control of worker exposure. Such instruments will allow the continuous measurement as opposed to periodic measurement of dust concentrations under the existing program. Furthermore, worker exposure to excessive levels of dust would be minimized because mine personnel would be aware of the actual dust conditions in their work environment at all times, and appropriate action could be taken immediately to avert possible overexposure. The focus of dust control could consequently be shifted away from the stipulation of specific measures in the operator's dust control plan.

The vulnerabilities associated with unrepresentative samples would be addressed in large measure by the introduction of continuous monitoring of the work environment. Under continuous dust monitoring, occasions for altering production, selecting optimal conditions for sampling, improperly voiding samples, or failing to sample would no longer exist to any appreciable degree. Such an approach would minimize the potential for tampering because the devices would be located at fixed sites, operate continuously, and be in clear view of miners. Although the identification of the occupation to be sampled would no longer be necessary, the proper number and location of fixed-site monitors would need to be determined.

The status of technology that could be applied to continuously monitor the parameters that are used to control dust was also evaluated. Such parameters include ventilation, the quantity and pressure of the water supplied to control dust and mine entry air velocities. Technology for monitoring water pressure and quantity exist; therefore research for further development of equipment to monitor these parameters is not required. However, questions remain concerning the ability to successfully monitor other parameters, such as the ventilation airflow rate.

APPENDIX F - Status of Dust Control Technology

Since the passage of the Coal Act, the primary method used by mine operators to control dust at underground mining operations has been through the proper application of ventilation and water. Over the last twenty years, the Bureau of Mines has conducted extensive research on new technologies for the control of dust at mining operations, and has improved the application of ventilation and water for this purpose. Examples of the technologies developed include: integral scrubbers on continuous mining equipment; improvement of the coal cutting process, both at continuous and longwall mining operations; and improvement of the use of water to create and direct air currents, and to remove dust from the environment.

Current technology, when properly applied, is sufficient to control the dust generated by conventional and continuous mining methods. However, the control of dust generated by longwall mining systems continues to be a problem. Approximately 25 percent of the longwall mining operations are out of compliance with the applicable dust standard at any one time.

The problem of respirable dust control at operations employing longwall mining methods could present a major limitation on the application and production potential of this advanced mining technique. This is particularly evident from operator bimonthly sampling data that show that the average longwall production per shift has increased over 25 percent during the past five years from 2300 tons in 1987 to over 2900 tons in 1991. Also, the proportion of underground coal produced by longwall mining techniques has doubled over the past eight years. If the coal mining industry is to meet projected production gains through the use of longwall mining systems, new and improved methods of dust control must be developed and implemented.

