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MINE SAFETY AND HEALTH

Tampering Scandal Led to Improved Sampling Devices

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February 25, 1993

The Honorable Richard H. Lehman
Chairman, Subcommittee on Energy and Mineral Resources
Committee on Natural Resources
House of Representatives

Dear Mr. Chairman:

This report was prepared in response to a request by the Chairman, Subcommittee on Mining and Natural Resources, Committee on Interior and Insular Affairs, House of Representatives. It addresses questions related to the program administered by the Mine Safety and Health Administration (MSHA) to protect the health and safety of underground coal miners.[1] Specifically, the Chairman asked us to review MSHA's actions concerning the development and use of tamper-resistant devices, particularly cassettes and pumps, for collecting coal dust samples in its respirable coal dust control program. The request followed the Secretary of Labor's announcement in April 1991 that MSHA found that coal mine operators had tampered with coal dust samples submitted for analysis.

Most of the Chairman's questions focused on the chronology of the testing, development, and use of tamper-resistant cassettes and pumps from the 1975 tampering scandal until 1991, when another scandal was found and coal mine operators were required to use tamper-resistant cassettes. The Chairman was particularly interested in why MSHA did not mandate the use of tamper-resistant cassettes before 1992 and whether MSHA would require mine operators to use a tamper-resistant pump when one was developed. Also, he asked us to determine whether technology exists, other than that now used in MSHA's respirable coal dust control program, that would provide superior coal dust sampling data.

To answer these questions we reviewed pertinent legislation, regulations, and policies and obtained related documentation from MSHA, the Bureau of Mines, and NIOSH. We also obtained information from officials at the United Mine Workers of America and the private firm that manufactures the sampling devices used in MSHA's respirable coal dust program. (See app. I for a more complete discussion of our scope and methodology.)

[1]MSHA, an agency in the Department of Labor, is responsible for enforcing federal laws concerning mine safety and health. The Bureau of Mines in the Department of the Interior and the National Institute for Occupational Safety and Health (NIOSH) in the Department of Health and Human Services have responsibility, respectively, for research and testing activities related to mine safety and health.

Background

The Federal Mine Safety and Health Act of 1977 was enacted to protect the health and safety of the nation's miners. The act requires the Secretary of Labor to assess whether mine operators conform to federal safety and health standards by having MSHA monitor and conduct periodic inspections of all mines. In addition, mine operators are to collect and maintain health and safety information, periodically submit the data to MSHA, and have it available for review during on-site inspections.

MSHA's respirable coal dust control program requires mine operators to collect periodic coal dust samples from the mines. To collect samples, miners wear personal sampling devices while performing specific tasks in each section of the mine. These personal sampling devices consist of a sampling pump that collects respirable dust from the air in sealed, preweighed filter cassettes. Mine operators subsequently submit the cassettes to MSHA for analysis. The dust collected on the filters show whether an operator is complying with MSHA's respirable dust standard to protect miners from lung disease. (See app. II for more details on these devices.) As part of their on-site inspections, MSHA inspectors also collect samples using these pumps and cassettes.

The personal sampling device measures a time-weighted average dust concentration and assesses a worker's exposure to respirable mine dust. Federal coal dust standards, enforced by MSHA, provide that mine operators must control dust conditions so that miners breathe no more than an average of 2.0 milligrams of dust concentration per cubic meter of air during each 8-hour shift. The standards require that this average comes from samples mine operators collect every 2 months on five consecutive 8-hour shifts.

A scandal involving tampering with coal dust samples occurred in the mid-1970s, but court actions resulted in no convictions. Between January 1980 and January 1991 eight operators of coal companies were convicted for tampering with coal dust samples or related violations. In April 1991, MSHA charged 850 operators of coal mines of tampering with about 4,700 coal dust samples. The operators removed coal dust from the cassette filters to decrease the weight of the samples. In this manner, the samples would meet MSHA's established standards. As a result of this tampering problem, the Secretary of Labor directed MSHA to conduct a review of the respirable coal dust control program. MSHA then established an interagency task group to study and recommend improvements to its respirable coal dust control program.

Results in Brief

MSHA became aware of the need for tamper-resistant cassettes in its respirable coal dust control program in 1975 after coal mine operators tampered with required coal dust samples they collected in their mines. The Bureau of Mines, which is responsible for mine safety and health research, awarded contracts for the development of tamper-resistant cassettes in 1975, but testing of a prototype in 1978 found problems. However, between 1978 and 1991 MSHA, the Bureau of Mines, and NIOSH agreed not to pursue developing a tamper-resistant cassette in part, because the urgency for it decreased after the tampering scandal ended. Also, they believed there were higher funding priorities. In 1991, a cassette manufacturer privately developed a tamper-resistant cassette. At that time the Secretary of Labor required coal mine operators to begin using tamper-resistant cassettes in 1992.

MSHA considered tamper-resistant pumps for its program in the 1970s, but the Bureau of Mines did not allocate funding for such research and development. In 1992, the same manufacturer that modified the cassette also developed a tamper-resistant pump. Subsequently, MSHA purchased 500 pumps for its inspectors to use when taking coal dust samples. MSHA began using these pumps in January 1993, but it has no plan to require coal mine operators to immediately purchase and use this pump. According to MSHA, the mine operators will purchase the improved pumps as they replace those currently used, because only the tamper-resistant pumps are now being produced.

Over the years research has been conducted on alternative monitoring devices to improve the technology used to collect and measure respirable coal dust samples—primarily, fixed-site, continuous monitoring systems. To date, these efforts have been unsuccessful, and MSHA officials believe such technology is years away.

Tampering Scandal Raised Need for Tamper-Resistant Cassette

MSHA officials told us that before the Secretary of Labor's 1991 announcement of massive tampering with coal dust samples, no incentive existed for the coal industry to independently improve the tamper resistance of cassettes. Although the Bureau of Mines had tried in the mid-1970s to develop a tamper-resistant cassette, it was unsuccessful. In 1978, the Bureau of Mines, MSHA, and NIOSH agreed not to pursue developing a tamper-resistant cassette, in part, because they believed the urgency for such a cassette had decreased and there were other funding priorities.

As a result of the 1975 tampering scandal, the Bureau of Mines, at MSHA's request, contracted with two private firms to develop prototype models of a tamper-resistant cassette. However, neither firm was able to develop a successful cassette.

One contractor went out of business before developing the prototype. The other developed a prototype, but it did not meet MSHA's specifications during testing. This prototype collected less dust than the cassette MSHA used at the time and showed considerable variations in the weights of the samples taken. During testing, the more tamper resistant the cassette became, the less accurate its measurements were. Consequently, MSHA did not adopt this prototype for use in its respirable coal dust control program.

The Bureau of Mines, MSHA, and NIOSH did not seek more federal funding for tamper-resistant cassette research from 1978 through 1991. By the time our review began in August 1991, most of the related documentation on prototype development had been destroyed, and agency personnel involved were no longer in the federal work force. As a result, we were unable to determine the extent to which the Bureau of Mines, MSHA, and NIOSH evaluated the test results and made appropriate decisions. In addition, we were unable to identify any factors, other than the perceived decrease in urgency, and other funding priorities that may have affected their decision not to pursue developing a tamper-resistant cassette.

In 1991, a manufacturer on its own initiative modified the cassette filter to prevent direct tampering. Beginning January 1992, MSHA required the use of this cassette in its program. This improved cassette incorporates advanced technology to reduce the opportunity for dust loss from the filter due to reverse flushing,[2] impact, or opening the cassette. These changes include the introduction of

- a heat-shrink tape that prevents opening the cassette after the coal dust samples are collected,
- a back-flow device that prevents reverse flushing to remove coal dust particles before testing, and
- an aluminum covering making it impossible to check the amount of dust collected on the filter without opening the cassette.

[2]Reverse flushing is blowing air back through the cassettes in the opposite direction to remove coal dust from the filter.

Federal officials believe that this improved cassette will reduce the likelihood of direct tampering with the filter cassette and improve the integrity of collecting the samples under MSHA's program.

Tamper-Resistant Pump Developed, but MSHA Will Not Mandate Its Use

In 1992, the same manufacturer that modified the cassette also developed a tamper-resistant pump, the Flow-Lite Elapsed Time (ET) unit, for monitoring industrial hygiene that could be used in MSHA's respirable coal dust control program. Although this pump is tamper resistant and commercially available, MSHA will not require coal mine operators to purchase it immediately. According to MSHA officials, coal mine operators will purchase the improved pumps as they replace those currently used, because only the tamper-resistant pumps are now produced.

NIOSH has approved three types of pumps for use in underground coal mines—the Model G approved in 1970, the Flow-Lite in 1986, and the Flow-Lite ET in 1992. These three pumps are manufactured by the same firm. The two older models have experienced problems; specifically (1) the air flow is difficult to adjust and maintain and can be misaligned by physical impact and (2) the actual volume of air sampled is not shown. Over the years, NIOSH has expressed concern about these problems. Despite NIOSH and MSHA officials' suggestions that these pumps be modified, the Bureau of Mines did not initiate research to improve the pumps.

In September 1991, MSHA awarded a contract to purchase 500 Flow-Lite ET model pumps, which incorporate tamper-resistant air volume indicators. Due to radio frequency interference problems discovered in the first pumps delivered, MSHA suspended the purchase order until the manufacturer corrected the problem in July 1992. MSHA requested that the Occupational Safety and Health Administration (OSHA) test the pump because OSHA has a facility to analyze and correct radio frequency interference problems. After OSHA certified that the pump conformed with the recommended radio frequency interference criteria, MSHA requested expeditious production and delivery of the pumps. As of December 18, 1992, MSHA had received and distributed 460 pumps and began inspections using the new pumps in January 1993.

Alternative Monitoring Devices Need Further Research and Development

The Bureau of Mines, MSHA, NIOSH, and miners support adopting a continuous fixed-site dust monitoring program that would reduce the need for mine operators or MSHA to conduct periodic sampling. MSHA officials have stated, however, that such technology remains years away. MSHA would prefer to devote its resources to developing this technology; therefore, implementing a full-scale sampling program using existing technology is not a priority in MSHA and the mining industry.

MSHA's Interagency Task Group

In June 1992, the Department of Labor released a report prepared by an MSHA interagency task group that had been established following the 1991 tampering scandal to study MSHA's respirable coal dust control program. This report contained recommendations to improve the respirable coal dust control program. The report recommended that MSHA (1) require the use of a tamper-resistant cassette when it became available and (2) consider requiring the use of other devices, including the pump and sampling head assembly, to make the entire sampling process tamper resistant.

The task group, however, concluded that the best long-term solution for improving the dust control program is to develop new technology that would continuously monitor the mine environment. The group, therefore, recommended the beginning of research to develop such instrumentation for actual use in the mines. In June 1992, the Assistant Secretary for MSHA renewed an earlier request made in May 1991 to the Director of the Bureau of Mines to initiate research to develop a continuous fixed-site dust monitor.

Statements in the interagency task group report reinforce MSHA's reluctance to undertake an ambitious role in monitoring dust levels with existing devices. For example, the task group was charged with addressing the issue of whether MSHA or the mine operator should be responsible for conducting compliance samples. According to the report, some in the mining community, particularly labor interests, argued that MSHA should 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 while collecting samples, or select the locations 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 recommended that MSHA not take over the operator sampling program, because the majority of operators do not engage in tampering.

The task group report acknowledged that changes in the personal dust sampler system used in MSHA's respirable coal dust control program would not significantly improve dust concentration measurements. Although MSHA requires the use of a tamper-resistant cassette and an improved pump is commercially available, methods for tampering with coal dust samples still exist. In fact, a personal sampling unit needs only to be removed from the mining environment to decrease the dust collected on the cassette. The report acknowledged that elimination of all tampering was not practical or feasible. Therefore, Bureau of Mines, MSHA, and NIOSH officials all recommend the start of research to develop continuous fixed-site monitoring devices, such as area samplers.

Progress Slow in Developing Continuous Monitoring Devices

Potential advantages of a continuous monitoring device include stronger construction, impact resistance, improved air flow rate, and continuous dust concentration readout. However, agency officials believe that the area sampler would best serve as a supplement to, rather than a replacement for, the personal sampler because an area or stationary sampler mounted on a mine wall may be outside the breathing zone of the high-risk miner.

The alternative technologies designed and tested over the years, have had problems. For example, the Bureau of Mines developed a prototype device in the late 1970s, hoping to use it as an area sampler. During field testing, however, MSHA found that aerosol sampling problems affected the calibration standards in that water droplets could not be differentiated from dust particles. Bureau of Mines, MSHA, and NIOSH officials agree that many complex factors affect development of a continuous monitor for use in underground mines. Bureau officials informed us that funding reductions, staff cutbacks, and other higher priorities precluded the agency from continuing this research.

During the early 1980s, MSHA tested another newly designed instrument—a hand-held "Respirable Aerosol Monitor" (RAM). The RAM measured respirable dust concentrations in real-time, is battery-operated, and easily carried by hand. The mining industry considered it to be an improved engineering tool because it provided a real-time reading. However, the RAM had accuracy problems, as coal dust sampling does not lend itself to area sampling. It did not measure worker exposure to coal dust, but gauged mass concentrations of coal dust produced at a specific location in a mine.

MSHA and the Bureau of Mines are now evaluating the effectiveness of an improved version of the hand-held, instantaneous readout dust monitor called the MINI-RAM. This instrument was originally developed in 1982 under a Bureau of Mines contract, but MSHA never used it because of its unreliability in the mine environment. This device's short-term measurement capability has the potential to (1) identify dust sources, (2) determine when sampling should be conducted, and (3) provide immediate feedback on the effectiveness of modifications to dust controls.

Federal Funds Allocated for Research

Budget constraints and higher priorities have reduced the attention given to researching and developing continuous monitoring devices. Since May 1991, however, MSHA and the Bureau of Mines have consulted regularly to develop research approaches and solutions involving continuous monitoring devices. During fiscal year 1992, the Bureau of Mines invested over $2 million in this effort. In fiscal year 1993, the Bureau has programmed $2.2 million to fund the long-term research projects designed and initiated in fiscal year 1992. (See app. III for a listing of funded projects for fiscal year 1993.)

Our work was performed in accordance with generally accepted government auditing standards between August 1991 and January 1993. As requested, we did not obtain written agency comments on this report. However, we did discuss its contents with MSHA and Bureau of Mines officials and incorporated their comments where appropriate.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this letter. At that time we will send copies to the Secretaries of Health and Human Services, Interior, and Labor as well as other interested parties.

If you have any questions regarding the information in this report, please call me at (202) 512-7014. Appendix IV lists the major contributors to this report.

Sincerely yours,

Linda G. Morra
Director, Education and
Employment Issues

Contents

Abbreviations

MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
RAM	Respirable Aerosol Monitor

Scope and Methodology

To answer the questions raised, we reviewed the laws and regulations under which the Mine Safety and Health Administration conducts its respirable coal dust control program and pertinent congressional hearings that dealt with the technology and devices used in the program. We assessed memoranda of understanding among the Bureau of Mines, MSHA, and the National Institute for Occupational Safety and Health concerning the research, testing, approval, and use of these technology and devices in MSHA's program to learn how these agencies coordinate their efforts.

To learn whether a tamper-resistant cassette was available for MSHA's use in the 1970s, we reviewed the final reports for contracts awarded by MSHA to private manufacturers in the mid-1970s to develop tamper-resistant cassettes and the resultant reports and documents, to the extent they were available. We relied primarily on anecdotal information obtained in interviews to address the issues concerning these contracts as most of the documents relating to these contracts had been destroyed.

We reviewed reports on the overall respirable coal dust control program and other reports that focused on the technology and devices used in the program. We also learned about the efforts by federal agencies to research and develop improved cassettes, pumps, and continuous monitoring technology for MSHA and the coal industry's use.

We reviewed the final report issued by MSHA's interagency task group on the respirable coal dust control program to learn whether any recommendations addressed the technology and devices used to collect coal dust samples. We also obtained information on MSHA's actions and plans to implement these recommendations.

To obtain explanations and updates of the documentation we reviewed, we interviewed officials at MSHA headquarters in Arlington, Virginia, and MSHA's Safety and Health Technology Center in Pittsburgh, Pennsylvania. We met with officials at the Division of Respiratory Disease Studies, NIOSH, in Morgantown, West Virginia, Bureau of Mines headquarters in Washington, D.C., and the Bureau of Mines' Research Center in Bruceton, Pennsylvania, to discuss their responsibilities relative to MSHA's respirable coal dust control program. We interviewed retired federal officials who had been responsible for various aspects of coal dust sampling during the 1970s and early 1980s.

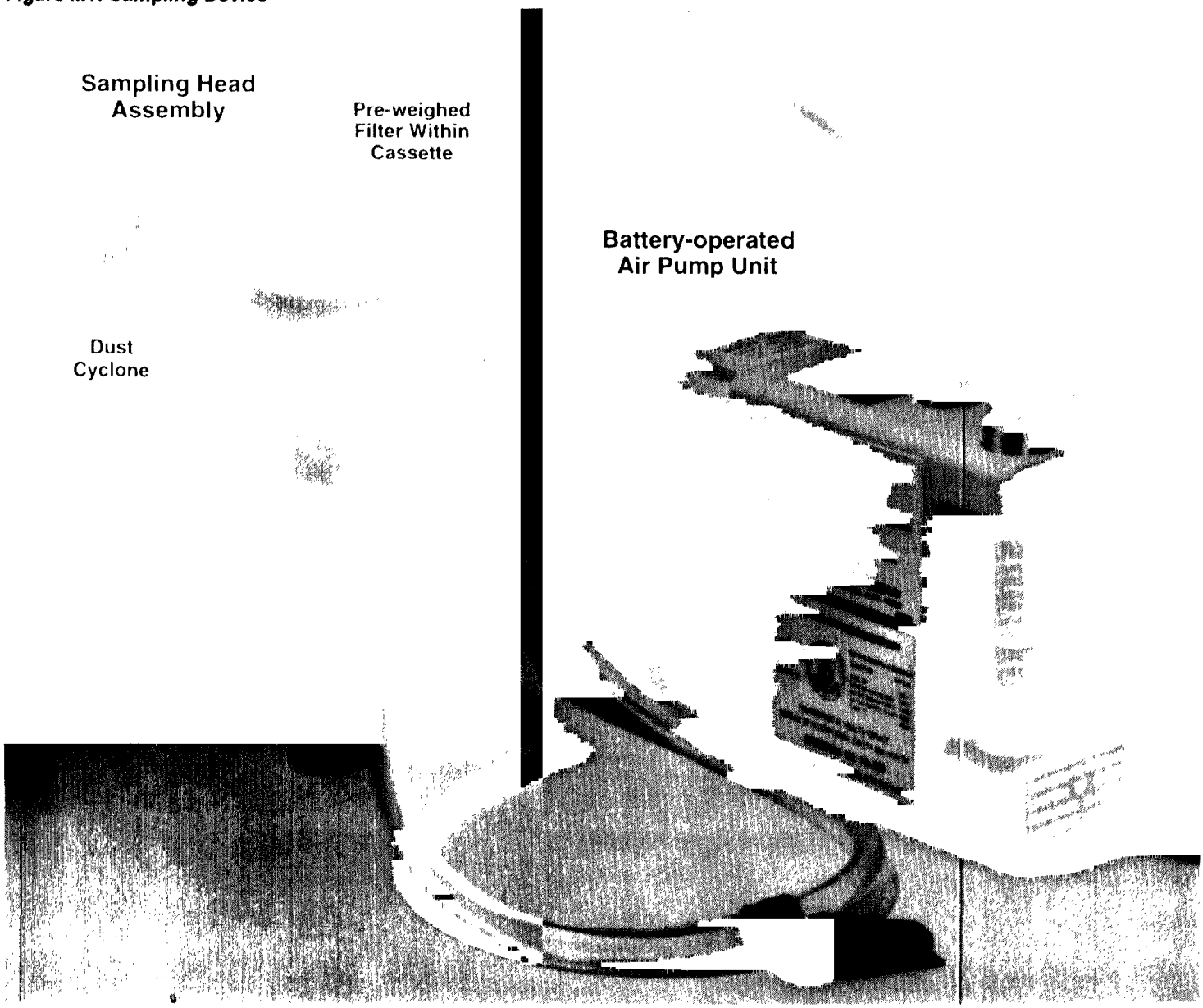
We interviewed officials at the United Mine Workers of America headquarters in Washington, D.C. We also interviewed officials from the

one private company that manufactures the sampling devices used in MSHA's program.

Sampling Devices for MSHA's Respirable Coal Dust Control Program

The following figure identifies the various components of a sampling device.

Figure II.1: Sampling Device



Source: Mine Safety and Health Administration.

Each sampling unit consists of a battery-operated air pump, a cyclone separator, and a sealed dust filter cassette assembly with a preweighed filter. The air pump passes air and airborne dust through a size selection system intended to collect respirable dust. The cyclone separator removes nonrespirable dust particles (those that do not ordinarily enter the miner's respiratory tract), and the preweighed filter within the cassette collects the respirable dust particles. In use, the sampling head attaches to the miner's clothing within his breathing zone and connects with a flexible tube to the air pump mounted to the miner's belt. Mine operators send the cassettes to the Mine Safety and Health Administration, and its officials weigh the filters to measure the dust collected during a work shift.

Bureau of Mines Funding for Advanced Dust Monitoring Technology

The Bureau of Mines is focusing long-term research on developing advanced dust monitoring technology to accurately measure and record respirable dust concentrations. The Mine Safety and Health Administration requested that the Bureau of Mines, in undertaking this research, aim to have such technology provide instantaneous and continuous monitoring readings of dust concentrations.

As part of this effort in 1992, the Bureau of Mines programmed $2.2 million. Of this amount $2 million was new research funding provided by the Congress to develop new, prototype respirable dust monitoring technologies capable of measuring dust concentrations during the coat extraction process. In 1993, the Bureau again programmed $2.2 million for these long-term in-house and contract research projects; this represents nearly 30 percent of the total funding under the Bureau's Occupational Health program. The direction and progress of the Bureau's projects were reviewed jointly in January 1992 by the Bureau of Mines and MSHA.

The Bureau of Mines estimates that a prototype continuous dust monitor suitable for MSHA's coal respirable dust monitoring program remains 3 to 5 years away. About $2 million a year will be needed to fund in-house and supporting contract research efforts during this period. The Bureau's funding estimate is based on prior research experience in developing sampling and monitoring devices for use in underground coal mines. Listed below are the specific projects funded by the Bureau of Mines.

Table III.1: Projects Funded by the Bureau of Mines

Project	Description	Funds allocated
Implementation of dust monitoring	Develop a continuous monitoring system for dust control parameters and investigate implementation strategies for continuous dust monitors.	$1,024,000
Continuous dust monitor development	Develop dust sensor technology for instantaneous and continuous, real-time sampling of coal mine dust concentrations suitable for compliance monitoring of federal standards.	300,000
Expert system for dust control	Design an expert system to provide advice to coal mine operators and federal inspectors on methods to achieve compliance with federal dust standards.	100,000
Broad agency announcement: "R&D in the Field of Monitoring of Mass Concentrations of Airborne Respirable Coal Mine Dust"	Competitive contract effort to canvass the private and federal sectors for advanced aerosol monitoring concepts suitable for underground mines.	376,000
Monitors for dust mass measurement	Provide improved technology for rapid, accurate, in-mine measurement and detailed characterization of respirable mine dusts.	200,000

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