RESPIRABLE COAL MINE DUST STANDARDS AND THEIR ENFORCEMENT UNDER THE FEDERAL COAL MINE HEALTH AND SAFETY ACT OF 1969*

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Abstract — The respirable dust standard contained in the Federal Coal Mine Health and Safety Act of 1969 is designed to prevent death and disability from pneumoconiosis. Beginning June 30, 1970, operators of coal mines are required to maintain the average concentration of respirable dust in the active workings at or below 3·0 mg/m³. The standard is reduced to 2·0 mg/m³ after December 30, 1972. A permit to operate at 4·5 mg/m³ is issued during the early stages of implementation. However, by December 30, 1975, all mines must meet the 2·0 mg/m³ standard. The Act requires frequent sampling by the operator along lines prescribed by the Department of the Interior and the Department of Health, Education, and Welfare. By regulation, each coal mine operator is required to take monthly samples in the area of highest risk in each coal-producing section. The Department of the Interior has equipped a semiautomatic laboratory capable of weighing over one million samples a year. This facility will be linked with a computer center to provide reliable and quick print-outs of respirable dust data within hours after weight determinations have been made.

INTRODUCTION

THE respirable dust standard contained in the Federal Coal Mine Health and Safety Act of 1969 is designed, in part, to prevent death and disability from "black lung" and other forms of occupational lung diseases to which coal miners have been subjected, and thus is one of the most important provisions in the Act. The law directs the Secretary of the Interior and the Secretary of Health, Education, and Welfare to prescribe the methods, locations, intervals, and manner in which coal mine operators shall sample the air in their mine workings. These regulations were published in the Federal Register on April 3, 1970 (U.S. DEPT. OF THE INTERIOR, 1970*a*).

Drafting of these regulations was difficult and time consuming. This was partly because of the complex nature of the Act and partly because of the lack of precedent in the United States for such an extensive dust sampling program. In addition, there was a need to design procedures and means for receiving, analyzing, weighing, and evaluating the samples.

Engineers of the Bureau of Mines actually began drafting regulations, in cooperation with representatives of Health, Education, and Welfare, last December, while

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the Health and Safety Bill was still under consideration by the Congress. Many drafts recommending alternate ways of sampling were prepared and discussed before one was agreed upon which would afford the required protection to the miner and still be wholly practicable in terms of administration and enforcement of the law.

The intent that Congress placed on this important issue, coupled with today's fuller recognition of the harmful physiological effects of breathing coal mine dust, has provided the magnitude and direction in which engineers and scientists of the Departments of the Interior and Health, Education, and Welfare formulated the respirable dust standards.

The end goal, simply stated, is to ensure that each miner can work in an environment sufficiently free of excessive concentrations of respirable dust during the period of his entire adult working life.

STANDARDS

Beginnning June 30, 1970, the operator of each coal mine is required to maintain the average concentration of respirable dust in the active workings at or below 3·0 mg/m^3. The standard is reduced to 2·0 mg/m^3 after December 30, 1972.

Any operator who determines that he will be unable to achieve these standards using available technology may apply for a permit of noncompliance. The Interim Compliance Panel may issue a permit of noncompliance for a dust concentration as high as 4·5 mg/m^3 while the standard is 3·0 mg/m^3, and for 3·0 mg/m^3 when the standard becomes 2·0 mg/m^3. However, by December 30, 1975, all mines must meet the 2·0 mg/m^3 standard. These regulations were published in the Federal Register on Tuesday, March 31, 1970 (U.S. DEPT. OF THE INTERIOR, 1970*b*).

OPERATORS' SAMPLING PROGRAM

The Act requires frequent sampling by the operator along lines prescribed by the Secretary of the Interior and the Secretary of Health, Education, and Welfare. By regulation, every coal mine operator is required to take monthly samples in the "high risk" operation in each coal-producing section. The high risk area is that mining occupation thought to be exposed to the greatest concentrations of respirable dust. Thus, if the high risk area is in compliance with Federal requirements, then all other occupations are assumed to be in compliance.

During the first calendar month after June 30, 1970, each operator shall collect 10 valid samples in this high risk area in each coal-producing section. Each subsequent month, the operator shall collect five valid samples unless the section falls into noncompliance, or the section is completed, or the dust standard is changed.

The Bureau of Mines, through investigations in 29 mines over a 15-month period, has determined those occupations exposed to the highest concentrations of respirable dust.

For a continuous-mining section, the continuous-miner operator shall be considered the high risk worker and the sample shall be taken in his working environment. In a conventional mining section, the cutting-machine operator is considered to be the high risk exposure.

For hand-loaded sections, one sample will be taken for each 10 hand-loaders. In longwall coal mine operations, samples will be collected in the working environment of the last miner on the return air side of the longwall face.

In the coal mines in which there are two or more working sections, sampling cycles shall be staggered to provide continuous sampling of the mine atmosphere. In order to provide continuous sampling, staggered sampling cycles may be overlapped. In each of the above cases, the worker himself can wear the dust collecting apparatus or the sampler can be placed in his immediate environment. All samples will be taken portal to portal and the dust concentrations will be calculated on the basis of the worker's total time underground.

In addition to those high risk samples required in coal-producing sections, all underground workers must be periodically sampled as follows:

1. Every 180 days for each miner not employed in coal-producing sections.
2. Every 120 days for each miner employed in coal-producing sections.
3. Every 90 days for each miner exercising his option under the Act of moving from a highly dusty area to a less dusty area.

These latter three categories of non-high risk sampling will permit investigators of the Department of Health, Education, and Welfare to affix a respirable dust exposure to each miner and thus greatly assist their efforts in determining changing trends in coal workers' pneumoconiosis by relating each worker's dust exposure to X-ray evidence. These samples will also indicate those working areas of individual mines where the average dust concentrations are low. This information is needed by the company for placement of workers who exhibit evidence of the development of pneumoconiosis and exercise their option of being moved to low dusty areas.

Finally, a dust sample of the intake air will be required once each month in each coal-producing section. This sample will indicate the amount of respirable dust coming into each coal-producing section.

If the operator demonstrates that the average dust concentration of respirable dust in the working section is continuously maintained at or below 3·0 mg/m^3, he shall only be required to sample every other month. However, if at any time during the modified sampling frequency the dust concentrations exceed the 3·0 mg/m^3 standard, the operator shall return to the basic sampling cycle.

SAMPLING DEVICES

Respirable dust samples shall be collected with an MRE or any other device approved by the Secretary of the Interior and the Secretary of Health, Education, and Welfare. Up to January 1, 1971, the personal respirable dust sampler described by JACOBSON & LAMONICA (1969) can be used. The Secretary of the Interior and the Secretary of Health, Education, and Welfare have published new pump specifications, and manufacturing companies are now producing pumps according to these specifications.

All dust samples will be taken with a preweighed cassette, purchased by the operator, which will be sent to the Bureau of Mines for weighing and data analysis. Each sample will be accompanied with a data card which provides basic information required by the Bureau of Mines.

The Bureau is making ready a semi-automatic weighing operation in its Pittsburgh station capable of weighing over 1 million samples a year. The facility will be linked with the Bureau's computer center in Denver and various coal mine district offices to provide reliable and quick print-outs of respirable dust data within hours after weight determinations have been made.

COMPLIANCE

If, during samples taken by the operator, it is determined that the allowable cumulative concentration of respirable dust is ever exceeded, the Secretary of the Interior or his authorized representative shall take action in accordance with provisions of Section 104(i) of the Act. For example:

1. If the 3·0 mg/m^3 standard is in effect, the average respirable dust concentration during the basic sampling cycle must not accumulate to more than 30 mg/m^3 to be in compliance (3·0 mg/m^3 × 10 samples = 30 mg/m^3). If, and as soon as, the operator exceeds 30 mg/m^3, he is in violation. For example, if on the first sample 15 mg/m^3 is recorded and on the second sample 16 mg/m^3 is recorded, then the section is immediately in violation.
2. Once compliance for a basic sampling cycle has been achieved, then during the following standard sampling cycle, the first sample will be combined with the previous 10 samples taken in the basic sampling cycle. After adding the 11th sample, the 1st sample of the basic sampling cycle will be dropped. The remaining 10 samples shall be considered to determine compliance. If the total of these 10 samples exceeds 30 mg/m^3, the section is in violation.

Thereafter, as each subsequent sample (2, 3, 4, or 5) is received during a standard sampling cycle, the oldest sample will be discarded and compliance will be determined on the most current 10 samples. Thus, every time a new sample is added, a determination is made as to whether the section is in compliance. The Bureau's computer coupled with a telecommunication system will greatly assist the quick dissemination of this information.

Once it has been determined that the section is in violation, a notice will be issued and a reasonable time will be given to abate the undesirable situation. During this period, the operator shall collect a sample every production shift. If the reasonable time has expired and the violation has not been abated, the operator will be issued an order to stop production and only workers involved in corrective work will be permitted in the affected section.

Production may begin when the operator has presented evidence which convinces the District Manager or his representative that the violation has been abated.

Other Provisions in the Act are:

1. On or after June 30, 1970, any miner who shows evidence of the development of pneumoconiosis, based on criteria to be developed by the Secretary of Health, Education, and Welfare, shall be given the option of transferring from his present position to another position where the average respirable dust concentration is not more than 2·0 mg/m^3.
2. After June 30, 1973, the miner shall be afforded the option of transferring to a position where the average respirable dust concentration is not more than 1·0 mg/m^3.
3. Respirator equipment approved by the Secretary of the Interior and the Secretary of Health, Education, and Welfare shall be made available to all persons exposed to concentrations of dust in excess of the levels required to be maintained by the law. However, use of respirators shall not be substituted for environmental control measures in the active workings.

4. Each operator shall, on or before June 30, 1970, and annually thereafter, submit a report to the Secretary of the Interior certifying the conditions relative to dust control which exist in the active workings. Such reports shall be submitted on forms obtained from any Coal Mine Health and Safety District Office of the Bureau of Mines.

Twice a year, respirable dust samples shall be collected in all coal-producing sections of the mine as part of the Bureau of Mines Dust Inspection Program. During these inspections, every worker in a mining section will have respirable dust samples taken in his working environment. In addition to these samples, a representative number of nonface workers will be sampled.

A sampling cycle shall consist of five samples; or, until the average has been determined to be in or out of compliance according to a statistical model established for each dust standard.

If, during a Bureau dust inspection, an inspector determines, based on a sampling cycle, that the applicable limit is exceeded, he shall promptly take action provided under the Act which is similar to that described under the company sampling program.

In addition to the regular Bureau dust inspections, the Bureau of Mines shall conduct frequent spot inspections of the active workings of coal mines to check the dust control program at the mine for its actual effectiveness. During these spot inspections, the Bureau does not anticipate collecting any respirable dust samples.

CONCLUSION

In conclusion, I would like to say that the results of our respirable dust efforts were regulations designed with three objectives. First, to provide a fruitful and positive impact on the health of miners; second to be comprehensive in their coverage and scope; and finally, to ensure against inequities and abuses in their application. We hope and believe that we have achieved these objectives.

Progress has been made in increasing tons per man. Unfortunately, similar strides have not been made in coal mine health and safety. In a society that is quickly changing from a quantitative materialism to one emphasizing the quality of our surroundings, it is necessary to maintain high efficiency while bringing about the required substantial increase in health and safety that our workers so richly deserve. The key to this may well be to apply the systems approach in mining. We must seek, through research and development, those changes required to enhance the miner's environment as we have similarly enhanced productivity in the past.

Section 201(b) of the Federal Coal Mine Health and Safety Act of 1969 clearly states our end goal, and I would like to close by reading it to you.

> "Among other things, it is the purpose of this title to provide, to the greatest extent possible, that the working conditions in each underground coal mine are sufficiently free of respirable dust concentrations in the mine atmosphere to permit each miner the opportunity to work underground during the period of his entire adult life without incurring any disability from pneumoconiosis or any other occupational-related disease."

It is hoped that this important legislation will establish a sound base for the development of a health protection program and stimulate an accelerated program of research that will improve environmental conditions in our nation's coal mines.

REFERENCES

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DISCUSSION

H. I. McKENZIE: Are you confident about getting the cooperation of the men in carrying the individual samplers, or, alternatively, have you had any experience where there has been an attempt to sabotage the results? Quite frankly, we have.

Mr. JACOBSON: We have had a minimum of difficulty with individuals not wanting to wear personal samplers. However, when sampling the "man of high risk" for compliance, the shift foreman can carry the sampler to the working place, position it on the mining machine, and remove it at the end of the shift. When individuals who are mobile refuse to be sampled, no procedure has been worked out to overcome their objection.

There have been instances of sabotage, both intentional and unintentional. Approximately 10% of the samples received contain excessive weights of dust resulting from inclusion of nonrespirable-sized particles ranging up to millimeters in diameter.

W. H. WALTON: How, in your semi-automatic weighing operation, do you distinguish between genuine and contaminated non-compliance samples? What action do you take if contamination is suspected.

Mr. JACOBSON: Every sample having a net weight of dust 6 milligrams or higher is examined for the presence of nonrespirable size dust particles.

If the sample contains no nonrespirable-sized particles, the data included on the Mine Data Card is transmitted to the computer. If there are nonrespirable size particles in the sample, the data on the card are transmitted to the computer with the notation of VOID in the "final weight" space. The mine operator is then notified and required to resample.

W. H. WALTON: I understand that attempts to sabotage samples by restricting the air flow have an unexpected effect. Would you comment?

Mr. JACOBSON: Many people have the concept that if you restrict the air flow you also restrict the quantity of dust going through. Cyclones operate on a velocity function, and the result of restricting the air flow is a shift in the sampling efficiency curve causing larger particles to escape the cyclone, thus an excessively high net weight of dust will result. If you reduce the flow from 2 to 1·4 l/min, the apparent concentration will increase by a factor of about 1·6.

B. SKOROBOHATYJ: Is there any loss of dust from the samples during mailing?

Mr. JACOBSON: We have collected samples at various locations, weighed them at those locations, placed them back in their capsules, put them in the mail and sent them to the laboratory and reweighed them. The net weight of dust was constant to $\pm 0 \cdot 1$ mg.

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