

of safety for the miner. However, regardless of the particular PF allowed by MSHA, full compliance with the provisions of the approved respiratory protection program is necessary to ensure that a PAPR's protective value is not compromised.

E. Guidelines for Determining What Is a Feasible Dust Control

This proposed rule requires a mine operator to implement all feasible engineering or environmental controls that are technologically and economically feasible to control respirable coal mine dust. The Federal Mine Safety and Health Review Commission (Commission) has addressed the issue of what MSHA must consider when determining what is a feasible control for enforcement purposes. In cases involving the noise standard for metal and nonmetal mines, the Commission has held that a control is feasible when it: (1) Reduces exposure, (2) is economically achievable, and (3) is technologically achievable. See *Secretary of Labor v. Callanan Industries, Inc.*, 5 FMSHRC 1900 (1983), and *Secretary of Labor v. A.H. Smith*, 6 FMSHRC 199 (1984).

In determining technological feasibility of an engineering control, the Commission has ruled that a control is deemed achievable if through reasonable application of existing products, devices, or work methods with human skills and abilities, a workable engineering control can be applied to the exposure source. The control does not have to be "off-the-shelf" or already available but, it must have a realistic basis in present technical capabilities. Further, the Commission has held that MSHA must assess whether the cost of the control is disproportionate to the "expected benefits," and whether the cost is so great that it is irrational to require its use to achieve those results. The Commission has expressly stated that a cost-benefit analysis is unnecessary in order to determine whether an engineering control is feasible. According to the Commission, an engineering control may be feasible even though it fails to reduce the exposure to permissible levels in the standard, as long as there is a significant reduction in exposure.

Consistent with the Commission case law, MSHA would consider three factors in determining whether engineering or environmental controls are feasible at a particular mine: (1) The nature and extent of the overexposure; (2) the demonstrated effectiveness of available technology; and (3) whether the committed resources are

disproportionate to the expected results. As explained in the discussion of § 70.209 in Section IV of this proposed rule, the formal determination of whether all feasible engineering or environmental controls have, in fact, been implemented at a specific mine to prevent excessive dust concentrations will be made by the Administrator for Coal Mine Safety and Health based on the best available information, experience, and engineering judgement.

F. Application of New Technology for Monitoring Coal Mine Dust Levels

Because of the ever changing mining environment, more timely feedback on current dust conditions in the workplace should enhance miner health protection from coal workers' pneumoconiosis (CWP) and silicosis. To obtain such feedback requires a type of dust monitoring instrument designed to directly measure on a continuous basis the amount of respirable coal mine dust that is present in the work environment. The availability of this information on a real-time basis would enable mine personnel to optimize mining procedures and dust control parameters when dust levels approach the applicable dust standard, thus averting possible overexposure. Knowing the actual dust levels during the shift would also empower the miner to be more directly involved in the dust control process to safeguard their health.

The current monitoring program, which has been in effect since 1970, lacks this capability. Samples results are not known by mine personnel until days after completion of sampling. If there is an overexposure, corrective action does not occur until the overexposure has been confirmed by the dust processing laboratory and communicated to the operator and MSHA. Consequently, any corrective action that may be taken would only impact exposures on subsequent shifts. Therefore, the ability to continuously monitor and display dust concentrations during the shift, rather than depend solely on periodic measurements under the existing program, has been a goal for nearly two decades. Recent advancements in personal dust monitoring technology make this goal achievable within the next two years, presenting opportunities to further improve miner health protection from disabling occupational lung disease.

The health benefits of continuous monitoring were recognized by both the Task Group and the Dust Advisory Committee. In 1992, the Task Group concluded that continuous monitoring of the mine environment and dust control parameters offered the best long-

term solution for preventing occupational lung disease among coal miners. Similarly, the Dust Advisory Committee found that:

Worker exposure to excessive levels of dust can be prevented by implementing a hazard surveillance program that provides mine personnel with current information on actual dust levels in the work environment at all times, and on the status of key dust control parameters.

The Dust Advisory Committee's final report issued in 1996 made the following recommendation with regard to continuous dust monitors:

Once the technology for continuous dust monitors has been verified, these measures should be broadly applied in conjunction with other sampling methods for surveillance and determination of dust control at all MMUs and other locations at high risk of elevated dust exposure.

Over the past decade significant progress has been made as a result of the R&D efforts sponsored by the former U.S. Bureau of Mines in conjunction with MSHA. These efforts have advanced the technology for directly measuring and displaying the amount of respirable coal mine dust contained in mine air in real time, based on an inertial microweighing method called tapered element oscillating microbalance (TEOM®). The development and commercialization of this technology was pioneered by Rupprecht & Patashnick Co., Inc. (R&P).

A TEOM-based monitor consists of a filter mounted on the end of a hollow tapered tube. The other end of the tube is fixed rigidly to a base. The tube with the filter on the free end is oscillated at its natural frequency. This frequency depends on the physical characteristics of the hollow tube and the mass on its free end. Mine air is drawn through the filter that removes the respirable coal mine dust and then through the hollow tube. As more respirable dust particles are removed and deposited on the filter, the mass of the filter increases which causes the frequency of the tapered element to decrease. Because of the direct relationship between mass and frequency change, the amount of respirable coal mine dust deposited on the filter is determined by accurately measuring the frequency change. By combining the mass of dust and the known volume of air that was drawn through the filter during the period sampled yields a measurement of the respirable dust concentration.

While the capabilities of the TEOM method have been applied to a variety of particle monitoring applications, the first instrument designed specifically for mine use based on this technology was