

control respirable coal mine dust, including quartz.

(b) Quantitative Risk Assessment

The Quantitative Risk Assessment (QRA) in support of this rule has been updated to reflect more current data on the pattern of overexposures to respirable coal mine dust. The new data replaces some of the original information used to derive the risk estimates for the Single, Full-Shift Sample (65 FR 42068) and Plan Verification (65 FR 42122) Notice of Proposed Rulemakings. The updated analysis of risk provides the best available evidence pursuant to the requirements of section 101(a)(6)(A) of the Mine Act. Please refer to section VI. of the July 7, 2000 (63 FR 42123) notice of proposed rulemaking for the previous discussion of the QRA.

In this quantitative risk assessment (QRA), MSHA will demonstrate that eliminating overexposures on each and every shift would, over a 45-year occupational lifetime, significantly reduce the cumulative exposure to respirable coal mine dust, thereby reducing the risk of both simple CWP and PMF among miners. This reduction in risk would be attributed to reducing concentrations on just that percentage of shifts currently exhibiting a pattern of recurrent overexposure.

MSHA has estimated health benefits of the two rules based on eliminating excessive exposures at only those MMUs and roofbolter designated areas (RB-DAs) currently exhibiting a pattern of recurrent overexposures on individual shifts. In the previous proposed rule, MSHA used operator sampling data from the year 1999 to identify and characterize such MMUs. In the current proposed rule, MSHA has updated the analysis to 2001, included MSHA DO sampling data in addition to operator data, and expanded the quantitative analysis to include the reduction in risk expected for certain miners not previously considered (*i.e.*, miners working in RB-DAs). As a result, MSHA believes it has more accurately quantified the expected reduction in risk for the most exposed miner population currently subjected to recurrent overexposures.

By "exhibiting a pattern of recurrent overexposures," MSHA means that, for the same DO (MMU) or RB-DA, at least two valid MSHA or operator bimonthly samples exceeded the applicable standard in a given year. MMUs exhibiting such a pattern are highly likely to have experienced excessive

exposures on at least six shifts during the year under consideration.²

Based on 2001 MSHA and operator data, there were 716 MMUs (out of 1,256 total) at which dust concentrations for the DO exceeded the applicable standard on at least two of the sampling shifts (MSHA, datafile: DO_2001.ZIP). MSHA considers these 716 MMUs, representing 57 percent of all MMUs and more than one-half of all underground coal miners working in production areas, to have exhibited a pattern of recurrent overexposures. Valid DO samples were collected on a total of 20,905 shifts at these 716 MMUs, and the applicable standard was exceeded on 4,028 of these shifts, or 19.3 percent. For this 19.3 percent, the mean excess above the standard, as measured for the DO only, was 1.04 mg/m³.

These results are based on a large number of shifts (an average of nearly 30 at each of the 716 MMUs). Therefore, assuming representative operating conditions on these shifts, the results can be extrapolated to all production shifts, including those that were not sampled, at these same 716 MMUs. With 99-percent confidence, the overall percentage of production shifts on which the DO sample exceeded the standard was between 18.6 percent and 20.0 percent for 2001. At the same confidence level, again assuming representative operating conditions, the overall mean excess on noncompliant shifts at these MMUs was between 0.96 mg/m³ and 1.11 mg/m³. If, as some commenters on the earlier single sample proposed rule and the Dust Advisory Committee proceedings have alleged, operators tend to reduce production and/or increase dust controls on sampled shifts, then the true values could be higher than even the upper endpoints of these 99-percent confidence intervals.

² MSHA estimates an MMU average of 384 production shifts per year. At MMUs exhibiting a pattern of recurrent overexposures in 2001, valid DO samples were obtained on an average of about 30 of these 384 production shifts. If dust concentrations on two or more of the sampled shifts exceed the standard, then it follows, at a 95-percent confidence level, that the standard is exceeded on at least six shifts over the full year.

If a different definition of "exhibiting a recurrent pattern of overexposures" had been used in the QRA, the estimate of the reduction in risk and associated benefits would have been different. For example, if the criterion were that four or more bimonthly DO exposure measurements exceeded the applicable standard then overexposures would be expected, with 95% confidence, to occur on at least 20 shifts in a year of 384 shifts. Using more than two recorded overexposures as the criterion would arbitrarily reduce the population for which MSHA is estimating benefits and decrease the estimated number of prevented cases.

The available data suggest that, unless changes are made to bring dust concentrations down to at or below the dust standard on every shift, the same general pattern of overexposures observed in 2001 will persist into the future.³ Therefore, MSHA concludes that without the proposed changes:

- More than half of all MMUs would continue to have a pattern of recurrent overexposures on individual shifts;
- At those MMUs with recurrent overexposures, average respirable dust concentrations for the DO would continue to exceed the applicable standards on about 20 percent of all production shifts;
- Among those shifts on which DO exposure exceeds the applicable standards, the mean excess for the DO would continue to be approximately 1 mg/m³.

If all overexposures on individual shifts are eliminated, the reduction in total respirable coal mine dust inhaled by a miner over a working lifetime will depend on three factors: (1) The average volume of air inhaled on each shift that would otherwise have exceeded the applicable standard, (2) the degree of reduction in respirable dust concentration in the air inhaled on such shifts, and (3) the number of such shifts per working lifetime. While the inhaled dose (mg) could not be measured directly, it is biologically and quantitatively related to the accumulated exposure (*i.e.*, airborne concentration multiplied by duration, summed across jobs for each miner) used to predict CWP and PMF prevalences in the Attfield-Seixas models used in this QRA. If a miner inhales ten cubic meters of air on a shift (U.S. EPA, 1980), reducing the respirable coal mine dust concentration in that air by 1.04 mg/m³ will result in 10.4 mg less dust inhaled on that shift alone. Assuming the miner works 240 shifts per year, then reducing inhaled respirable dust by an average of 10.4 mg on 19.3 percent of the shifts will reduce the total respirable coal mine dust inhaled by 482 mg per year, or nearly 22,000 mg over a 45-year working lifetime:

1.04 mg less respirable coal mine dust per m³ of inhaled air
 × 10 m³ inhaled air per shift
 × 46.32 affected shifts (*i.e.*, 19.3% of 240) per work year
 × 45 work years per working lifetime
 = 21,678 mg less respirable coal mine dust inhaled per working lifetime.

In Section V, the strengths and weaknesses of various epidemiological

³ Appendix VI.1 compares the pattern observed in 2001 to that in earlier years.