

TABLE VI-2.—PARAMETERS DESCRIBING OVEREXPOSURE TO RESPIRABLE COAL MINE DUST, BASED ON OPERATOR DO SAMPLES

1990–1997 1999–2000	Parameter #1 (Percent)	Parameter #2 (Percent)	Parameter #3 (mg/m ³)	
			1990–1997	1999–2000
Number of Years	10	10	8	2
Median	52.6	20.1	1.24	1.00
Mean	51.0	20.5	1.26	1.00
(Std. Error)	(1.36)	(0.30)	(0.023)	0.07
2001	51.6	20.8	1.08	

Parameter #1: Percentage of MMUs exhibiting a pattern of recurrent overexposures.

Parameter #2: For those MMUs exhibiting a pattern of recurrent overexposures, the percentage of production shifts on which the DO was overexposed.

Parameter #3: for those MMUs exhibiting a pattern of recurrent overexposures, the mean excess above the applicable dust standard among valid DO measurements that exceeded the applicable dust standard.

Appendix VI.2 Application of the Attfield-Seixas Models

Attfield and Seixas (1995) provide separate logistic regression models for

CWP1+, CWP2+, and PMF as a function of cumulative dust exposure (mg-yr/m³). These models all have the following form:

$$\frac{p}{1-p} = e^{a_0 + a_1 \times \text{age} + a_2 \times \text{exposure} + a_3 \times \text{rank} \times \text{exposure}} \quad (\text{Eq. 1})$$

where p is the probability of disease at a specified age and cumulative exposure. The constant e is the base of the natural logarithms. The empirically estimated coefficients a₀ (the intercept), a₁, a₂, and a₃ differ for the three health effects considered and are presented in Table IV of Attfield and Seixas (op cit). The values for these coefficients are also shown in the Excel workbook (RiskRdxn.xlw) MSHA has placed into

the public record as part of these proceedings. The coefficient (a₃) of “rank” refers to an additional effect of cumulative exposure to coal mine dust in central Pennsylvania or southeastern West Virginia, which the authors attribute to the rank of the coal mined in those areas. Since few mines in those areas are currently operating, MSHA did not employ this additional effect in its application of the Attfield-Seixas

models (i.e., MSHA assumed that the value of the indicator variable for “rank” is zero).

From equation 1, assuming exposure outside central Pennsylvania and southeastern West Virginia, it follows that the prevalence of disease, assuming continued exposure at current levels and approximate linearity of the exposure effect, is (per thousand miners):

$$P_y = 1000 \times \frac{y}{1+y}$$

where $y = e^{a_0 + a_1 \times \text{age} + a_2 \times (\text{years of exposure}) \times (\text{current mean annual exposure})}$ (Eq. 2)

Similarly, the prevalence of disease, assuming reduced cumulative exposure

attributable to implementation of the proposed rules is (per thousand miners):

$$P_x = 1000 \times \frac{x}{1+x}$$

where $x = e^{a_0 + a_1 \times \text{age} + a_2 \times (\text{years of exposure}) \times (\text{reduced mean annual exposure})}$ (Eq. 3)

Note that the “reduced mean annual exposure” is the current mean annual exposure (based on 2001 data) reduced by eliminating overexposures on just that percentage of shifts for which overexposures have been shown to currently occur. MSHA then estimated the impact of eliminating all

overexposures on individual shifts by calculating (for ages 65, 73, and 80) the differences:

$$\Delta = P_y - P_x \quad (\text{Eq. 4})$$

It is these differences that are presented in Table VI-1. The calculations for each

specific entry are detailed in the EXCEL workbook, RiskRdxn.xlw, which has been placed into the public record.²⁸

²⁸ The method used here provides an approximation of the expected risk reduction (Δ), assuming approximate linearity of the exposure-response relationship over the exposure range of interest. This differs from the method used in the