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STATISTICAL TASK TEAM MEMBERS

Richard L. Smith
Chairperson
Chief, Division of Mining Information Systems
Denver Safety and Health Technology Center, Mine Safety and Health Administration

Jon Kogut
Mathematical Statistician
Division of Mining Information Systems
Denver Safety and Health Technology Center, Mine Safety and Health Administration

Michael D. Attfield
Epidemiologist
Division of Respiratory Disease Studies, National Institute of Occupational Safety and Health

Fred Siskind
Economist
Office of the Assistant Secretary for Policy, Department of Labor

Kevin Strickland
Supervisory Mining Engineer
District 2, Coal Mine Safety and Health, Mine Safety and Health Administration

Robert Parry
Industrial Engineer
Quality Assurance Division
Approval and Certification Center, Mine Safety and Health Administration

The statistical team would also like to acknowledge the following personnel for their contributions:

Carol C. Strong
Supervisory Computer Specialist
Division of Mining Information Systems
Denver Safety and Health Technology Center, Mine Safety and Health Administration

Allen E. Fries
Mathematician
Division of Mining Information Systems
Denver Safety and Health Technology Center, Mine Safety and Health Administration

Patricia Brower
Statistician (Health)
Division of Respiratory Disease Studies, National Institute of Occupational Safety and Health

Pete Suder, Jr.
General Engineer
Mine Waste and Geotechnical Engineering Division
Pittsburgh Safety and Health Technology Center, Mine Safety and Health Administration

John Seiler
Supervisory Electronics Engineer
Physical and Toxic Agents Division
Pittsburgh Safety and Health Technology Center, Mine Safety and Health Administration

Barbara Klein
Office Automation Assistant
Dust Division
Pittsburgh Safety and Health Technology Center, Mine Safety and Health Administration

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Introduction

In May 1991, the Secretary of Labor directed the Mine Safety and Health Administration (MSHA) to conduct a thorough review of the program to control respirable coal mine dust, and to develop recommendations on how the program could be improved. This request followed the announcement the previous month of widespread tampering with respirable dust samples taken by mine operators. The Coal Mine Respirable Dust Task Group (Task Group) was established by the Assistant Secretary for Mine Safety and Health to review the respirable coal mine dust program and to make recommendations for improving it. Because the disclosure of widespread operator tampering in the dust program raised concerns about the validity of existing information on miner exposure, the Task Group developed a short-term respirable dust Spot Inspection Program (SIP) and a Monitoring Inspection Program (MIP) to supplement existing data.

The SIP was intended to measure dust concentrations to which miners were actually exposed, to determine the extent and effectiveness of dust controls actually in use, and to assess the miners' and operators' knowledge and proficiency with respect to the dust program. This information was obtained during unannounced visits by MSHA inspectors and consisted of dust sampling, measurement of production and dust controls, and interviews with mine personnel. The MIP was intended to evaluate the operators' sampling program through MSHA observation of the operators' sampling and dust control practices. It consisted of special visits made by inspectors to mines during their mandatory bi-monthly sampling cycles. At these visits, which consisted of one shift, the inspector acted as a passive observer of the operators' sampling process but recorded data on dust controls in place, similar to that obtained in the SIP. In both the SIP and MIP, MSHA inspectors also recorded dust control plan specifications for comparison with the dust controls in place during dust sampling. SIP inspections used in the present statistical analysis were completed on October 31, 1991 and involved 723 Mechanized Mining Units (MMU's) at 565 underground coal mines. Also included in this analysis are results from MIP inspections involving 717 MMU's at 545 underground coal mines, many of which were also included in the SIP. The MIP ended on December 30, 1991.

The Statistical Team was one of six task teams established by the Task Group to assist in its comprehensive review of all aspects of the coal respirable dust program. The SIP and MIP data collection instruments, the selection criteria for MMU's to be included in the two programs, and the protocol for the mine visits were all designed by a team responsible for mine audits, prior to formation of the Statistical Team. The general mission of the Statistical Team was to utilize data obtained through the coal mine operators' respirable dust sampling program, the special SIP and MIP inspections, and MSHA's routine respirable dust inspections to evaluate the effectiveness of the operator and MSHA programs in monitoring respirable dust exposures and compliance. To this end, the Statistical Team met and communicated extensively with the Task Group and representatives of the other teams to determine issues and questions that should be addressed through statistical analysis of the available data.

Three databases were created in support of the analysis: a SIP database, a MIP database, and, for comparison with prior dust concentrations and production levels obtained through normal operator sampling, an Operator Sample database (POPERAT). The SIP and MIP databases were developed by staff from MSHA's Denver Safety and Health Technology Center (DSHTC), and POPERAT was developed from the statistical team's specifications by staff from MSHA's Information Systems Center (ISC). In order to provide an ample historical baseline against which SIP and MIP results can be compared, POPERAT contains underground coal dust sampling data, corresponding shift productions as provided by the operator, and quartz-adjusted dust standards from the last bimonthly sampling cycle of 1989 through the last bimonthly cycle of 1991. (Cycles are staggered for designated area samples, relative to designated occupation samples.) In particular, POPERAT contains results for samples taken during the MIP inspections. A fourth database utilized in the analysis is the existing MSHA Inspector Sample database (PINSPECT), provided directly by ISC. PINSPECT contains dust sample data, corresponding shift productions as determined by the inspector, and quartz-adjusted dust standards for underground respirable coal dust samples taken by MSHA inspectors between October 1, 1989 and July 31, 1992. In particular, PINSPECT includes results of all the SIP inspections. Finally, in order to take effects of mine size into account, DSHTC staff constructed an underground coal Mine Employment database (PMINE_EM) from quarterly employment data provided by operators under 30 CFR Part 50.

The Statistical team utilized information in these five databases so as to respond to the following questions and issues:

1. ***What are the dust concentrations to which underground coal miners are exposed? With what frequency is the respirable dust standard exceeded? How frequently do exposures of other miners on the section exceed that of the designated high risk miner?*** Dust concentrations reported by the SIP, MIP, and PINSPECT samples are presented in Section I, **Summary of Data,** along with a general description and analysis of other data compiled for this study. Section I also contains statistics on non-compliance with the dust standard, based on both single and average SIP samples. Estimation of non-compliance rates and dust exposures when samples are *not* being collected is discussed in Parts C and D of Section IV, **The Mine Environment.**

2. *How do ordinary operator samples and inspector dust samples compare with samples obtained through MSHA's special Spot Inspection and Monitoring Program?* Section II, **Comparison of Sampling Programs,** makes these comparisons and estimates the differences.

3. *How have Low Weight Gain (LWG) samples affected respirable dust exposure estimates and MSHA compliance determinations?* Section III, **Low Weight Gain Samples,** addresses this question and also compares the frequency of LWG samples in the SIP, MIP, PINSPECT, and POPERAT data.

4. *How do production rates and dust controls in effect during operator and inspector sampling compare with normal production rates and MSHA-approved dust control plans? How representative of normal operating conditions are dust concentrations obtained from operator or inspector samples?* An attempt to address these issues is made in Section IV, **The Mine Environment.**

5. *What level of knowledge, training, and proficiency is evident among miners and certified samplers interviewed as part of MSHA's special SIP?* Results of the SIP interviews are presented in Section V, **Knowledge, Training, and Proficiency.**

Section VI of the report summarizes **Findings** supported by the available data. Section VII, **Appendices,** includes Appendix A, a collection of descriptive statistical tabulations discussed in the narrative, and Appendix B, a detailed description of all five databases.

I. Summary of Data

A. Special Spot Inspection Program (SIP)

SIP Mine visits used in this analysis were carried out by MSHA inspectors between July 3, 1991 and October 31, 1991. Each mine visit was unannounced and consisted of collecting several respirable dust samples within a Mechanized Mining Unit (MMU), taking measurements of dust controls in place during the sampled shift, estimating shift production, and interviewing mine personnel with regard to their dust sampling practices and proficiency. Interviews were conducted confidentially for the high risk Designated Occupation (DO), a roof bolter, and the certified dust sampler or person responsible for health and safety at the mine. All interviews were carried out using interview sheets containing a written list of questions, and responses were recorded by each question on these sheets. At the mine office, the inspector also recorded data pertaining to the mine's dust sampling equipment, certification and proficiency of mine personnel responsible for dust sampling, and the MMU's recent production history. Prior to visiting the mine, the inspector compiled details of the MMU's mining system and specifications of the MSHA-approved Dust Control Plan (DCP) corresponding to the observed dust controls. These were submitted together with the SIP results. Dust samples were processed by MSHA's Respirable Dust Laboratory, and recorded in the usual way on MSHA's Inspector Sample Database (PINSPECT). Forms used by the inspector to collect SIP data are shown in Section 5.8 of Appendix B.

During the SIP inspection of an MMU, the inspector attempted to take a full-shift respirable dust sample on each of five different occupations (including the DO and a roof bolter) and a sample of the intake air. One of the five occupational samples was required to be on the Designated (high risk) Occupation (DO) for the MMU, and another of them was required for a roof bolter or other Designated Area (DA) when applicable. The remaining occupational dust samples are coded as non-DO (NDO) samples. To insure the integrity of the dust samples, the inspector was instructed to remain present on the section during the entire working shift and to conduct all interviews while dust sampling was taking place. The effect on shift production, and consequently on observed dust concentrations, of SIP interviews during the sampling shift is unknown. A complete description of all data elements compiled for the SIP database is presented in Section 2 of Appendix B.

A.1 SIP Selection Criteria

MMU's included in the SIP were selected separately by each MSHA District Manager, according to the following instructions:

1. MMU's at all mines determined by MSHA to have submitted more than 15 AWC dust samples.
2. All longwall MMU's.
3. MMU's at all underground Health Standards Compliance Mines.
4. MMU's at all mines having an injury/accident rate in the top 15 percent of its respective employee size group: 1-19, 20-49, and 50 or more employees.
5. MMU's at ten percent of all other mines in District.

The cohort of SIP MMU's, then, was designed not as a random sample representing underground coal mine MMU's in general, but rather as a target group emphasizing MMU's thought to have the greatest potential problems with (1) operator dust sample integrity, (2) respirable dust concentrations, or (3) general health and safety conditions. Data for a total of 723 MMU's meeting these criteria, including 80 longwall sections, were successfully coded and entered into the SIP database. Except for longwall MMU's, however, the SIP database contains no information on which of the criteria resulted in an MMU's inclusion. It is, therefore, essential that statistical results for the SIP MMU's not be generalized directly to all underground coal mines. Any conclusions drawn from analysis of these MMU's must be conditioned on their particular characteristics. Since virtually all longwall sections are included in the SIP group, conclusions drawn specifically about longwall MMU's are clearly justifiable. But inferences about other types of MMU should be generalized only to MMU's matching the characteristics of those studied.

A.2 SIP MMU's Compared to Non-SIP MMU's

In order to gain some degree of insight into how the SIP MMU's compare with non-SIP MMU's, all non-longwall records on MSHA's Inspector Sample database (PINSPECT, described in Appendix B, Section 4.2) were examined for the period July 1, 1990 through June 30, 1991 -- i.e., prior to SIP implementation. Each sample was identified with respect to whether or not it came from a SIP MMU, and a comparison was made (for non-longwall MMU's only) between the SIP and the non-SIP MMU's. The two groups were compared with respect to continuous miner dust concentrations (D), associated shift tonnages (T), the ratio of D to T (mg/m^3 per 1000 tons), and mine size as indicated by total underground employees.

Results of this comparison are summarized in Table I-1. Because of missing or invalid data and the fact that not all SIP MMU's could be located in PINSPECT for the target calendar period, the number of cases shown in Table I-1 is somewhat smaller than the actual number (643) non-longwall SIP MMU's. Since the distributions of quantities being compared were all highly skewed, differences between the SIP and non-SIP MMU's were tested for statistical significance using a standard non-parametric procedure. The geometric mean provides an estimate of the median value: the 50th percentile.

Table I-1. Continuous Miner Dust Concentrations, corresponding shift tonnages, dust to tonnage ratios, and mine employment for SIP and non-SIP MMU's. Dust concentrations and tonnages are from MSHA Inspector dust inspections prior to SIP. No longwall MMU's are included.

	SIP	Non-SIP	α
Trimmed Mean of D = Dust Concentration	1.28	1.11	
Standard Error	.06	.03	***
Number of Cases	557	1298	
Geometric Mean of T = Shift Tonnage	484.	421.	
Trimmed Mean of Shift Tonnage	546.	500.	
Standard Error	12.	10.	***
Number of Cases	556	1295	
Geometric Mean of D/(T/1000)	1.81	1.82	
Arithmetic Mean of $Log_e(D/(T/1000))$	.59	.60	
Standard Error	.04	.03	
Number of Cases	556	1295	
Geometric Mean Mine Employment	53.	58.	
Trimmed Mean Mine Employment	106.	138.	
Standard Error	6.9	5.4	
Number of Cases	375	933	

α denotes probability that a difference of the observed magnitude would be found if there were in fact no difference in distribution, based on the Wilcoxan-Mann-Whitney Rank Sum Test. Blank signifies $\alpha > .1$; *, **, and *** signify differences at the 90-percent, 95-percent, or 99-percent confidence levels, respectively.

Table I-1 shows that although both dust concentrations and shift tonnages tended to be greater for SIP than for non-SIP MMU's during inspector sampling, the two groups were essentially equivalent with respect to dust concentration per thousand tons of coal. The apparently substantial difference in mean mine sizes is due to a number of very large operations that skew the distribution upward and raise the mean values to rather uncharacteristic levels. The geometric mean, which is far less sensitive to extreme values, provides a more representative indication of mine size and shows little difference. The non-parametric Mann-Whitney test indicates no statistically significant difference in mine sizes.

B. Monitoring Inspection Program (MIP)

MSHA's special Monitoring Inspection Program was carried out between July 24, 1991 and December 19, 1991. MIP data used in this analysis were gathered from 717 MMU's at 545 underground coal mines, many of which were also included in the SIP. At some of the mines, the same MMU was visited twice, so only 692 distinct MMU's were included. The program consisted of monitoring the operators' respirable dust sampling activities, taking measurements of dust controls in place during the sampled shift, estimating shift production, and compiling data pertaining to the mine's dust sampling procedures and equipment. Prior to visiting the mine, the inspector compiled details of the MMU's mining system and specifications of the MSHA-approved Dust Control Plan (DCP) corresponding to the observed dust controls. These were submitted together with the MIP results. Dust samples were processed by MSHA's Respirable Dust Laboratory, and recorded in the usual way on MSHA's Operator Sample Database (POPERAT). Forms used by the inspector to collect MIP data are shown in Section 5.9 of Appendix B, and a complete description of all data elements compiled for the MIP database is presented in Section 3 of Appendix B.

MIP visitations were scheduled to coincide with what the mine operator presented as an ordinary dust sampling shift. The MSHA District Manager requested that each underground coal mine operator submit a sampling schedule showing when the operator would be collecting respirable dust samples. After notification from the operator, an attempt was made to schedule the mine's next regular "AAA" inspection for the date of a dust sampling shift and to monitor this shift as part of the inspection. As in the SIP inspections, the MSHA inspector was instructed to remain present at the monitored MMU throughout the sampling shift, in order to insure integrity of the dust sample.

B.1 MIP Selection Criteria

MSHA District Managers were requested to monitor dust sampling at 25 percent of the mines in each district. All MMU's were monitored that could be fit into the constraints of each MSHA District's "AAA" scheduling requirements. The MIP MMU's, therefore, should be somewhat more representative of underground coal mines in general than the SIP MMU's, at least within MSHA Districts.

B.2 MIP MMU's Compared to Non-MIP MMU's

In order to gain some degree of insight into how the MIP MMU's compare with non-MIP MMU's, the same kind of comparison was made as that described above for the SIP. All non-longwall records on PINSPECT (Appendix B, Section 4.2) were examined for the period July 1, 1990 through June 30, 1991 -- i.e., prior to MIP implementation. Each sample was identified with respect to whether or not it came from a MIP MMU, and a comparison was made (for non-longwall MMU's only) between the MIP and the non-MIP MMU's. The two groups were compared with respect to the same quantities described in the SIP vs. non-SIP analysis, and distributional differences were again tested for statistical significance.

Results of this comparison are summarized in Table I-2. Because of missing or invalid data and the fact that not all MIP MMU's could be located in PINSPECT for the target calendar period, the number of cases shown in Table I-2 is somewhat smaller than the actual number (682) of non-longwall MIP MMU's.

Table I-2. Continuous miner dust Concentrations, corresponding shift tonnages, dust to tonnage ratios, and mine employment for MIP and non-MIP MMU's. Dust concentrations and tonnages are from MSHA Inspector dust inspections prior to MIP. No longwall MMU's are included.

	MIP	**Non-MIP**	**α**
Trimmed Mean of D = Dust Concentration	1.21	1.14	
Standard Error	.06	.03	
Number of Cases	586	1269	
Geometric Mean of T = Shift Tonnage	462.	429.	
Trimmed Mean of Shift Tonnage	528.	508.	
Standard Error	12.	11.	*
Number of Cases	585	1266	
Geometric Mean of D/(T/1000)	1.79	1.83	
Arithmetic Mean of $Log_e(D/(T/1000))$	.58	.60	
Standard Error	.04	.03	
Number of Cases	585	1266	
Geometric Mean Mine Employment	56.	57.	
Trimmed Mean Mine Employment	124.	131.	
Standard Error	7.9	5.2	
Number of Cases	392	743	

α denotes probability that a difference of the observed magnitude would be found if there were in fact no difference in distribution, based on the Wilcoxan-Mann-Whitney Rank Sum Test. Blank signifies $\alpha > .1$; *, **, and *** signify differences at the 90-percent, 95-percent, or 99-percent confidence levels, respectively.

Table I-2 shows that, with the possible exception of shift tonnage, there is no significant difference between the MIP and non-MIP groups with respect to the quantities examined. Any systematic difference in shift tonnage appears too small to be of practical significance, especially in view of the fact that there is no statistically significant difference in dust concentration per thousand tons of coal.

C. Characteristics of SIP and MIP MMU's

C.1 Mining System and Size of Mine

Table I-3 provides a summary tally of all SIP and MIP MMU's by mining system. A finer classification in Appendices A-1 and A-2 shows the number of SIP and MIP MMU's by mining system cross-tabulated by ventilation system and size of mine.

Table I-3. Number of SIP and MIP MMU's, by mining system.

		Longwall	Continuous	Conventional	Other	Total
SIP	Count	80	525	70	48	723
	Pct.	11	73	10	7	100
MIP	Count	35	583	59	40	717
	Pct.	5	81	8	6	100

In Appendices A1 and A2, continuous mining systems are divided into deep cut (more than 20 feet) and non-deep cut MMU's. The ventilation system is specified by blowing or exhaust or both (V-Meth), curtain or tubing or both (V-Devic), and the presence or absence of belt air ventilation (Belt Air, yes or no). Mine size is based on the number of underground employees and is represented by small (1-50), medium (51-125), and large (above 125), employee size groups. Dust concentrations on all but eight of the 717 MIP MMU's were DO samples, and these eight MMU's are not included in Appendix A2.

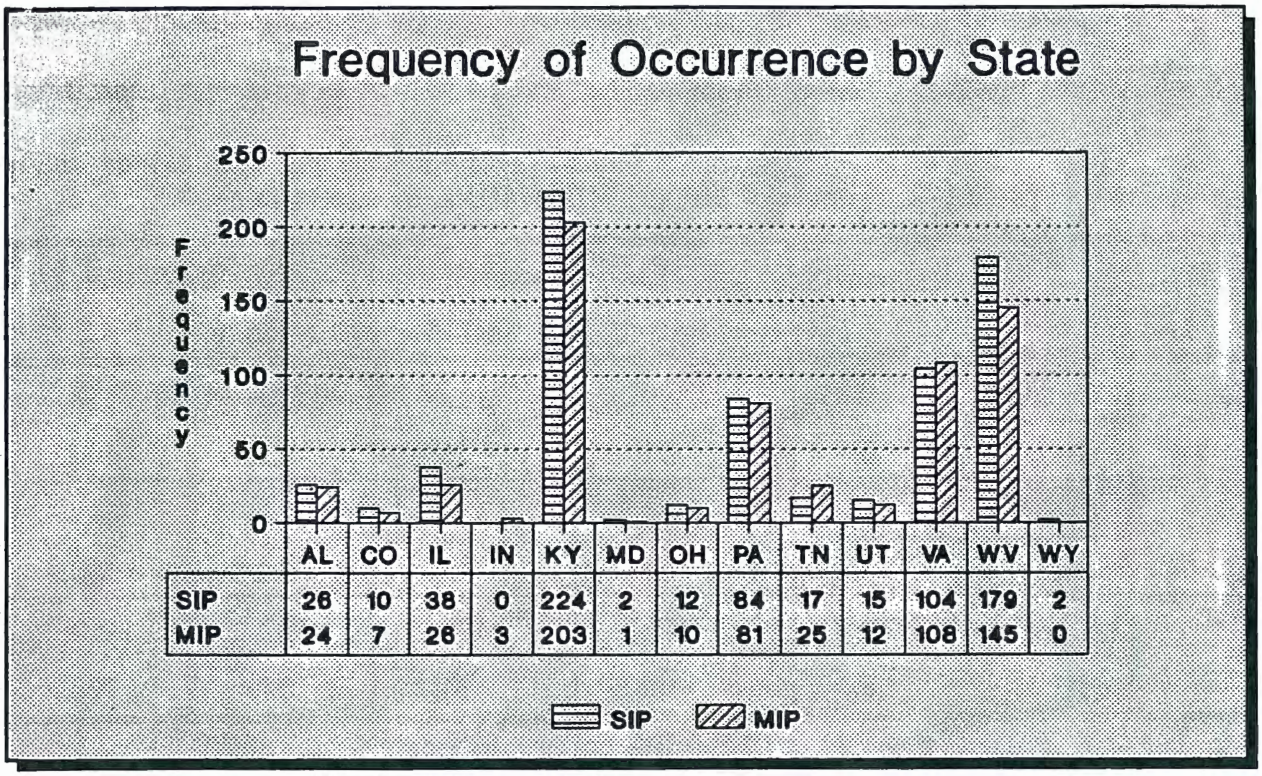
A summary of mine sizes for the SIP and MIP MMU's is provided in Table I-4, with mine sizes from PINSPECT added for comparison.

Table I-4. Number of SIP and MIP MMU's, by size of mine.

		Unknown	Small 1-50	Medium 51-125	Large >125	Total
SIP	Count	0	369	118	236	723
	Pct.	0.	51.	16.	33.	100.
MIP	Count	1	390	104	222	717
	Pct.	0.	54	15	31.	100.
INSP	Count	86	673	198	502	1459
	Pct.	6.	46	14.	34.	100.

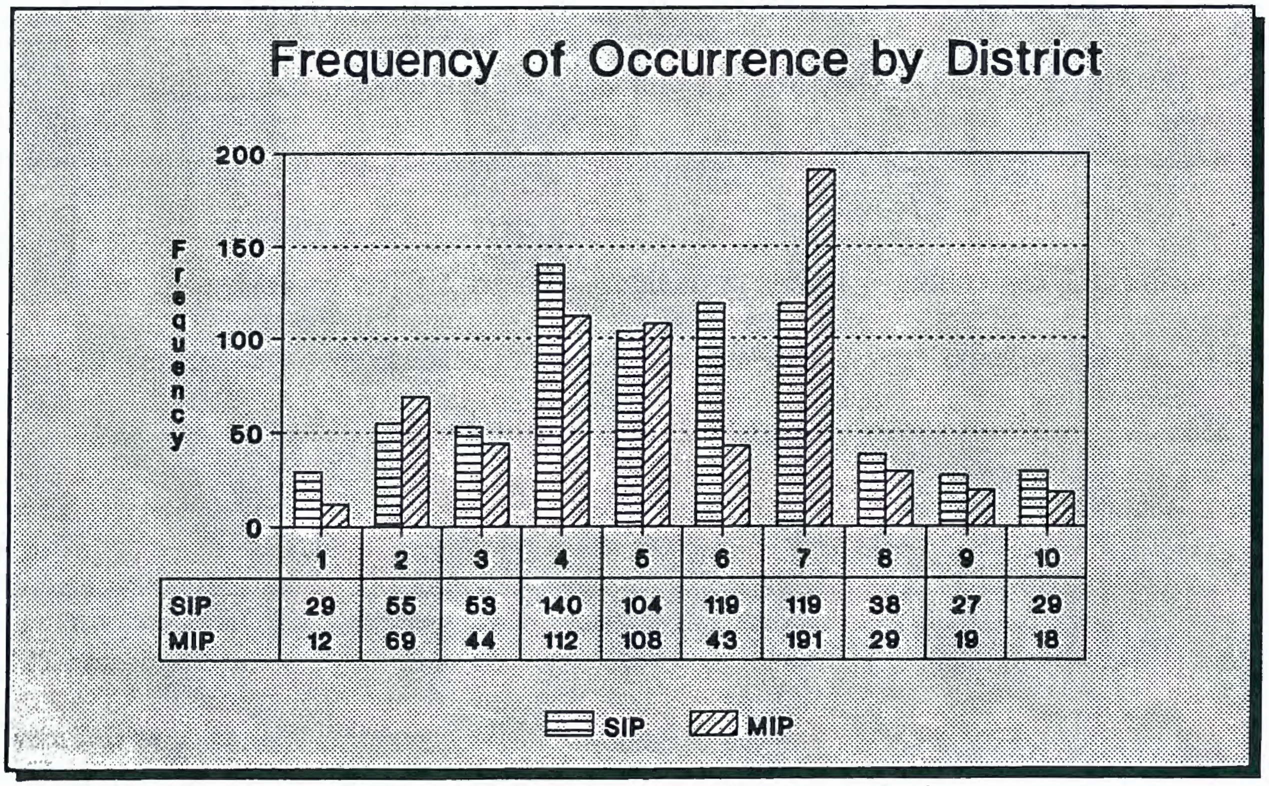
C.2 Geographic Distribution

Figures I-1 and I-2 show the distribution of SIP and MIP MMU's by state and MSHA Coal District, respectively. Only MMU's with valid DO dust concentration samples are included in these counts, and MMU's are counted only once for each program.



	AL	CO	IL	IN	KY	MD	OH	PA	TN	UT	VA	WV	WY
SIP	26	10	38	0	224	2	12	84	17	15	104	179	2
MIP	24	7	26	3	203	1	10	81	25	12	108	145	0

Figure I-1. Number of SIP and MIP MMU's, by state.



	1	2	3	4	5	6	7	8	9	10
SIP	29	55	53	140	104	119	119	38	27	29
MIP	12	69	44	112	108	43	191	29	19	18

Figure I-2. Number of SIP and MIP MMU's, by MSHA Coal District.

D. Respirable Coal Dust Concentrations

D.1 Exposures

D.1.1 Overall Dust Concentrations for DO, NDO, DA, and Intake Air Samples

Figure I-3 plots the cumulative percentage of cases in which dust concentration was less than or equal to any value specified along the horizontal axis. With the exception of eight DA samples, only DO samples were collected under MIP observation, and the MIP DA samples are not shown here or used in the remainder of this study. The horizontal line at 50 percent intersects each graph at the median dust concentration, and graphs shifted to the right represent generally higher dust concentrations than graphs on the left. Figure I-3 shows that the median SIP DO concentration is approximately 1.0 mg/m^3 and the median SIP NDO concentration is near 0.7 mg/m^3. The SIP DA and the MIP DO dust samples both exhibit medians of approximately 0.8 mg/m^3. More than 90 percent of the SIP intake air samples fall below 0.5

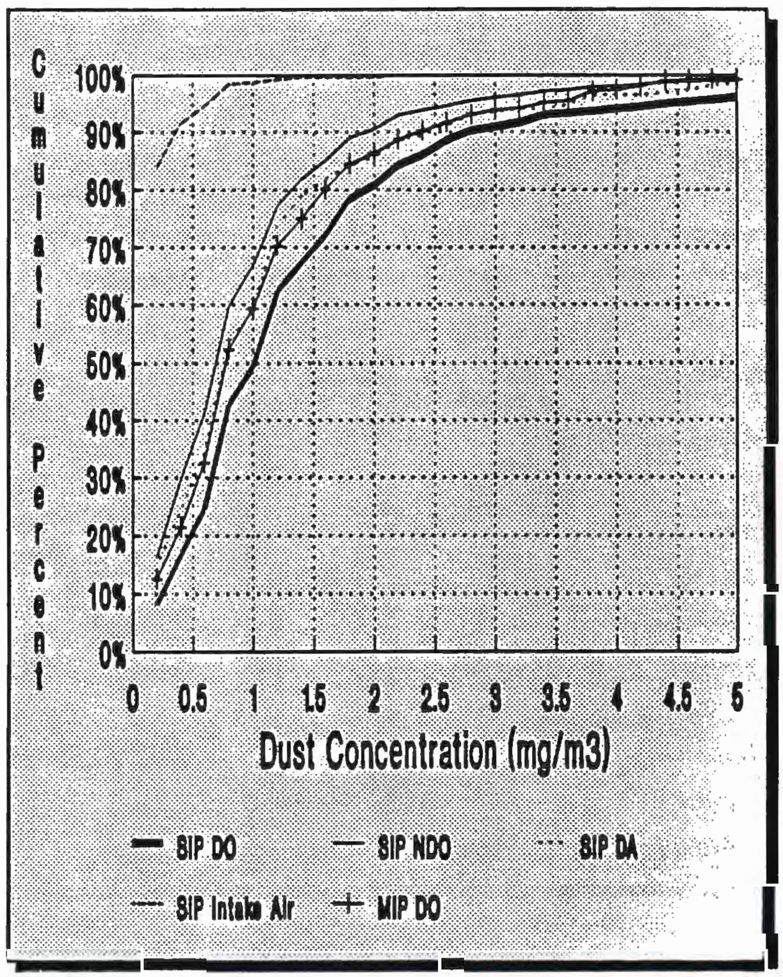


Figure I-3. Cumulative Frequency Distributions for DO, NDO, DA, and Intake Air Dust Concentrations.

mg/m^3, and nearly all of them fall below 1.0 mg/m^3. About 80 percent of the SIP DO concentrations are at or below 2.0 mg/m^3, whereas about 87 percent of the MIP DO concentrations fall at or below this threshold. Similarly, 10 percent of the SIP DO samples exceed 3.0 mg/m^3, and 10 percent of the MIP DO samples exceed 2.0 mg/m^3. Figure I-3 suggests that SIP DO dust concentrations tend to be higher than MIP DO concentrations and that both SIP and MIP DO concentrations tend to be higher than SIP NDO and DA concentrations. Comparisons of the SIP and MIP dust concentrations to those obtained from the ordinary MSHA inspector and operator programs will be discussed in Section II.

D.1.2 Dust Concentrations by Mining System and Sample Type

Table I-5. SIP and MIP dust concentrations, by mining system. Each cell contains (1st) mean sample dust concentration, (2nd) standard deviation, and (3rd) number of cases.

Mining System	MIP Dust Concentration (mg/m^3)	SIP Dust Concentration (mg/m^3)			
	DO	DO	NDO	DA	Intake Air
Longwall	1.87 1.33 33	1.58 1.08 80	1.13 .90 334	.40 --- 1	.31 .36 76
Deep Cut Continuous, > 20 ft.	1.22 .81 134	1.20 .76 152	.97 .72 626	.91 .57 56	.20 .21 146
Continuous, ≤ 20 ft.	1.12 .98 404	1.63 2.04 366	.94 1.12 1446	1.26 1.30 153	.17 .17 355
Conventional	1.21 1.39 56	1.86 2.55 67	1.11 1.09 262	1.16 1.31 18	.13 .08 64
Other	.57 .71 36	1.07 2.56 48	1.13 1.51 68	.89 1.13 9	.20 .25 47

Table I-5 contains a summary of SIP and MIP dust concentrations, organized by general mine classification. Table I-6 contains corresponding results for dust concentrations per thousand tons of shift production, and Table I-7 summarizes deviations of the observed

Table I-6. Logged SIP and MIP dust concentrations per thousand tons of shift production, by mining system. Each cell contains (1st) mean log of dust concentration per unit production, (2nd) standard deviation, and (3rd) number of cases.

Mining System	MIP $Log_e(D/(T/1000))$ DO	SIP $Log_e(D/(T/1000))$ DO	NDO
Longwall	-.46 .78 33	-.34 .86 80	-.73 1.00 334
Deep Cut Continuous, > 20 ft.	.57 .85 134	.54 .84 152	.28 1.00 626
Continuous, ≤ 20 ft.	.75 .96 404	1.12 1.03 366	.59 1.06 1446
Conventional	1.16 1.13 56	1.45 1.07 67	1.04 .97 262
Other	1.80 1.03 36	2.55 1.17 48	2.04 1.12 68

D = Dust Concentration, mg/m_3 T = Shift Tonnage

Table I-7. SIP and MIP deviations from quartz-adjusted dust standard, by mining system. Each cell contains (1st) mean deviation, (2nd) standard deviation, and (3rd) number of cases.

Mining System	MIP Deviation from Quartz-Adjusted Dust Std., mg/m^3) DO	SIP Deviation from Quartz-Adjusted Dust Std. (mg/m^3) DO	NDO	DA	Intake Air
Longwall	-.09 1.34 33	-.38 1.07 80	-.82 .92 334	-1.60 --- 1	-.69 .36 76
Deep Cut Continuous, > 20 ft.	-.60 .84 134	-.72 .77 152	-.94 .74 626	-.60 .67 56	-.80 .21 146
Continuous, ≤ 20 ft.	-.72 1.02 404	-.20 2.10 366	-.89 1.18 1446	-.16 1.44 153	-.82 .18 355
Conventional	-.77 1.38 56	-.13 2.55 67	-.88 1.08 262	-.54 1.27 18	-.87 .08 64
Other	-1.39 .78 36	-.89 2.57 48	-.85 1.50 68	-.76 1.45 9	-.80 .25 47

dust concentrations above or below the Quartz-Adjusted dust Standard (QAS) specific to the

MMU or designated area. Estimates of the median dust concentration per thousand tons of coal mined can be obtained by exponentiating the mean logged ratio listed for each category. For example, the median dust concentration (mg/m^3) per thousand tons of coal mined at SIP longwall MMU's is approximately exp(-.34) = 1.3 for the DO samples. The corresponding quantity at conventional MMU's is exp(1.45) = 4.3 mg/m^3 per thousand tons.

Deviations from the applicable dust standard are calculated separately within each MMU and expressed as positive or negative arithmetic differences: a positive deviation signifies that the dust concentration exceeds the standard, and a negative deviation signifies a concentration below the standard. DO and NDO dust concentrations are compared against the QAS established for the MMU. If applicable, DA samples are compared to the QAS established especially for the designated area; otherwise, they are compared to the MMU standard. The dust standard against which intake air samples are compared is 1.0 mg/m^3. Deviations from the applicable standard within MMU's are then averaged across all MMU's to form the positive or negative mean deviation shown in Table I-7.

Tables I-5 to I-7 indicate that for longwall and deep cut MMU's, higher average DO dust concentrations were observed during the MIP than during the SIP. This runs counter to the overall tendency, illustrated in Figure I-3, which is dominated by the larger number of MMU's that are neither longwall nor deep cut. In comparing MIP and SIP results, however, it must be recognized that it is not the same group of MMU's being compared and that the particular MMU's included can bias the comparison. This point is especially applicable to longwalls, since MIP data are available for only 33 of them. A valid comparison between the SIP and MIP results should be carried out only on those MMU's included in both programs, and such a comparison is presented in Part F of Section I.

To test for significant differences among mine classes and types of samples (DO, NDO, and DA), and to estimate the extent of those differences, separate analyses were performed for the SIP and MIP MMU's. Comparisons across mine classes and sample types (i.e., DO, NDO, or DA) are made in this subsection of the report. Since virtually all of the MIP samples are DO samples, the MIP analysis in Subsection D.1.2.1 consists entirely of comparing DO samples for different mining systems. In Subsection D.1.2.2, DO and NDO samples within SIP MMU's are compared for each mining system. Differences between the SIP and MIP dust concentrations in terms of how they compare with ordinary operator and MSHA inspector samples are discussed in Section II.

D.1.2.1 MIP DO Samples

Analysis of the statistical significance of apparent differences in mean MIP dust concentration shown in Table I-5 was done by means of an analysis of variance (ANOVA) on the logarithms of individual dust sample concentrations. Taking logarithms is necessary in order to stabilize residual variance between mining systems and satisfy assumptions of the statistical significance tests. Frequency distributions for the logged dust concentrations are displayed as histograms in Figure I-4, along with associated group statistics and ANOVA results. The mining systems are shown to differ with respect to dust concentration at a confidence level of more than 99.99 percent (tail probability $< .0001$).

An estimate of the median DO dust concentration for each group can be obtained by exponentiating the mean logged value given in Figure I-4. The longwall median, for example, is approximately $\exp(0.35) = 1.4$ mg/m^3. Other percentiles can be estimated in a similar way, using the points plotted in the histograms. Since six out of the 33 longwall

MMU's (18 percent), fall above 0.99, it follows that 18 percent of the MIP longwall MMU's have DO dust concentrations above exp(0.99) = 2.7 mg/m. In comparison, only nine

Log$_e$(DO Dust Concentration)

```
             Longwall          Continuous, ≤ 20'     Conventional         Other              Deep Cut, > 20'
MIDPOINTS...................+....................+....................+....................+................
   2.34 -|
   2.16 -|
   1.98 -|                      *                    *
   1.80 -|*                    *
   1.62 -|                                           *
   1.44 -| ***                  *********            *                                         *
   1.26 -| *                    *************        **                   *                    ****
   1.08 -| *                    *************        *                                         ****
   0.90 -|****                 ***********          *                                         ****
   0.72 -| *                    ****************     ***                  *                    ********
   0.54 -| ****                 ***************      **                                        *********
   0.36 -| M***                 ******************36 *****                *                    ******************
   0.18 -| ********             ******************40 ****                 *                    ******************23
   0.00 -|                     ******************32 ***                  **                   M*******
  -0.18 -|                      M*****************43 ***                  ***                  ****************
  -0.36 -| ***                  ******************45 M***                 **                   ***************
  -0.54 -|                      *
  -0.72 -|                      ******************46 ********             ****                 *************
  -0.90 -|*                    ******************37 ******               ***                  *********
  -1.08 -|                                                                N
  -1.26 -|                      *                                         ***
  -1.62 -| *                    ******************31 *****                ****                 ***
  -1.80 -|
  -1.98 -|
  -2.16 -|
  -2.34 -| *                    *******************  ******               ************         ***
  -2.52 -|
          LEGEND FOR GROUP MEANS:     M - MEAN COINCIDES WITH AN ASTERISK
                                      N - MEAN DOES NOT COINCIDE WITH ANY ASTERISK
```

	Longwall	Continuous, ≤ 20'	Conventional	Other	Deep Cut, > 20'
MEAN	0.352	-0.232	-0.346	-1.097	-0.013
STD.DEV.	0.843	0.865	1.087	1.029	0.705
S. E. M.	0.147	0.043	0.145	0.172	0.061
MAXIMUM	1.792	1.902	2.001	1.308	1.482
MINIMUM	-2.303	-2.303	-2.303	-2.303	-2.303
CASES INCL.	33	404	56	36	134

ANALYSIS OF VARIANCE TABLE FOR MEANS

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	TAIL PROBABILITY
System	45.1053	4	11.2763	15.07	0.0000
ERROR	492.3811	658	0.7483		

EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL

	DF	F VALUE	TAIL PROBABILITY
WELCH	4, 106	12.74	0.0000
BROWN-FORSYTHE	4, 181	13.08	0.0000
LEVENE'S TEST FOR VARIANCES	4, 658	5.22	0.0004

ALL GROUPS COMBINED

MEAN	-0.215
STD. DEV.	0.901
S. E. M.	0.035
MAXIMUM	2.001
MINIMUM	-2.303
CASES INCLUDED	663
ROBUST S.D.	0.870

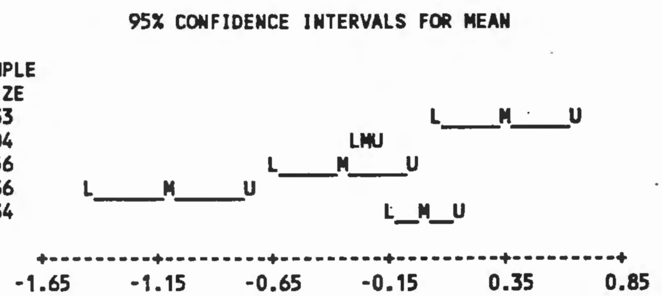
Figure I-4. Distributions of logged MIP DO dust concentrations, by mining system.

percent (35 out of 404) of the continuous (cut depth < 20 ft.) MMU's show concentrations above that level, and seven percent of the deep cut continuous MMU's do so.

Figure I-5 displays 95-percent confidence intervals for the mean logged dust concentration within each mining system and 90-percent intervals for the arithmetic difference between systems. If the confidence interval for the difference lies entirely to the *right* of the vertical zero-line, this indicates, at a 95-percent confidence level, that the first mining system listed tends to have *higher* DO dust concentrations than the second. If the interval lies entirely to the left of the zero-line, then the opposite conclusion can be drawn.

Log_e(DO Dust Concentration)

GROUP NO.	LABEL	MEAN	SAMPLE SIZE
1	Longwall	0.35	33
2	Continuous ≤20'	-0.23	404
3	Conventional	-0.35	56
4	Other	-1.10	36
5	Deep Cut >20'	-0.01	134



GROUP NO.	LABEL	GROUP NO.	LABEL	MEAN DIFF
1	Longwall	2	Contin.≤20'	0.58
1	Longwall	3	Convent'l	0.70
1	Longwall	4	Other	1.45
1	Longwall	5	Deep Cut	0.36
2	Contin.≤20'	3	Convent'l	0.11
2	Contin.≤20'	4	Other	0.87
2	Contin.≤20'	5	Deep Cut	-0.22
3	Convent'l	4	Other	0.75
3	Convent'l	5	Deep Cut	-0.33
4	Other	5	Deep Cut	-1.08

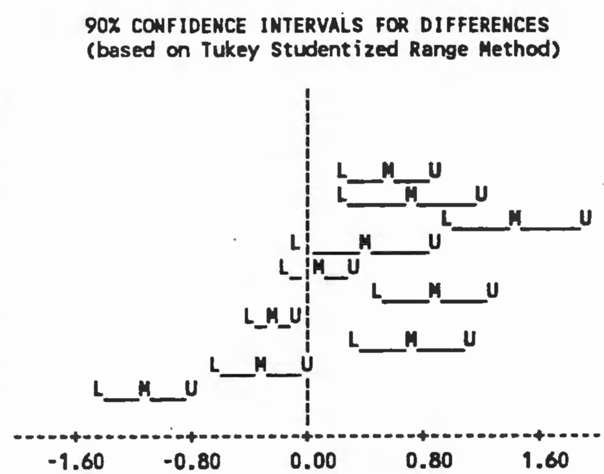


Figure I-5. Confidence intervals for mean logged MIP dust concentration, by mining system.

Longwall dust concentrations are shown to be significantly greater, as measured during the MIP, than concentrations for all other categories except deep cut. Deep Cut, in turn can be seen to have significantly greater concentrations than all other systems except longwalls.

Figures I-6 and I-7 contain histograms and corresponding confidence intervals for mean logged MIP DO concentrations per thousand tons of shift production. Figures I-8 and I-9 contain similar information on mean logged MIP DO excursions above or below the MMU-specific quartz-adjusted DO dust standard. Estimates of median excursions can be obtained by exponentiating the mean logged value presented. The median sampled dust concentration per thousand tons at MIP longwalls, for example, is estimated at exp(-0.46) = 0.63 mg/m^3 per thousand tons of shift production.

Log$_e$(DO Dust Concentration ÷ (Shift Tonnage/1000)

```
                 Longwall            Continuous. ≤ 20'   Conventional        Other               Deep Cut, > 20'
MIDPOINTS...................+...................+...................+...................+...................+
   5.4 |
   5.1 |
   4.8 |
   4.5 |                                                            *
   4.2 |
   3.9 |                                        *
   3.6 |                                                            **
   3.3 |                    *                   *
   3.0 |                    ****                                    **
   2.7 |                    ******              ***                 ***                 *
   2.4 |                    ***********         ****                ***                 **
   2.1 |                    ****************    *******             ****                ****
   1.8 |                    *****************25 ****                M**                 *****
   1.5 |                    *****************41 *********           *****               *********
   1.2 |                    *****************55 M**                 ***                 ****************
   0.9 |***                 M****************46 **                  *****               ****************
   0.6 |**                  *****************57 *******             *                   M****************26
   0.3 |***                 *****************43 ***                 ***                 ****************
   0.0 |****                *****************33 ***                 *                   ****************
  -0.3 |****                *****************22 ****                                    ************
  -0.6 |M*****              ******************* **                                      ******
  -0.9 |*****               *********           *                                       *
  -1.2 |**                  ******              *
  -1.5 |**                  ******              *
  -1.8 |*                   **                                                          **
  -2.1 |*                   **                                                          **
  -2.4 |
  -2.7 |
        LEGEND FOR GROUP MEANS:     M - MEAN COINCIDES WITH AN ASTERISK
                                    N - MEAN DOES NOT COINCIDE WITH ANY ASTERISK
```

	Longwall	Continuous. ≤ 20'	Conventional	Other	Deep Cut, > 20'
MEAN	-0.459	0.750	1.161	1.803	0.566
STD.DEV.	0.781	0.962	1.133	1.034	0.850
S. E. M.	0.136	0.048	0.151	0.172	0.073
MAXIMUM	0.964	3.283	3.769	4.605	2.695
MINIMUM	-2.238	-2.087	-1.386	0.051	-2.122
CASES INCL.	33	404	56	36	134

ANALYSIS OF VARIANCE TABLE FOR MEANS

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	TAIL PROBABILITY
System	102.0816	4	25.5204	28.14	0.0000
ERROR	596.8203	658	0.9070		

EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL

	DF	F VALUE	TAIL PROBABILITY
WELCH	4, 108	31.21	0.0000
BROWN-FORSYTHE	4, 203	27.55	0.0000
LEVENE'S TEST FOR VARIANCES	4, 658	3.24	0.0120

ALL GROUPS COMBINED
(EXCEPT CASES WITH UNUSED VALUES FOR VARIABLE System)

MEAN	0.745
STD. DEV.	1.027
S. E. M.	0.040
MAXIMUM	4.605
MINIMUM	-2.238
CASES INCLUDED	663
ROBUST S.D.	1.013

Figure I-6. Distributions of logged MIP DO dust concentrations per thousand tons of shift production, by mining system.

Log_e(DO Dust Concentration ÷ (Shift Tonnage/1000)

```
                                          95% CONFIDENCE INTERVALS FOR MEAN

  GROUP              SAMPLE
NO. LABEL             MEAN   SIZE
 1 Longwall          -0.46    33   L___M___U
 2 Continuous ≤20'    0.75   404                         L_M_U
 3 Conventional       1.16    56                            L_____M_____U
 4 Other              1.80    36                                      L_____M_____U
 5 Deep Cut >20'      0.57   134                     L_M_U

                                   +---------+---------+---------+---------+---------+
                                 -0.78     -0.18      0.42      1.02      1.62      2.22
```

```
                                                        90% CONFIDENCE INTERVALS FOR DIFFERENCES
                                                        (based on Tukey Studentized Range Method)

  GROUP            GROUP            MEAN                               |
NO. LABEL        NO. LABEL          DIFF                               |
                                                                       |
 1 Longwall      2 Contin.≤20'     -1.21               L___M___U       |
 1 Longwall      3 Convent'l       -1.62           L____M____U         |
 1 Longwall      4 Other           -2.26      L___M___U                |
 1 Longwall      5 Deep Cut        -1.02                 L_M_U         |
 2 Contin.≤20'   3 Convent'l       -0.41                       L__M__U
 2 Contin.≤20'   4 Other           -1.05                 L__M__U       |
 2 Contin.≤20'   5 Deep Cut         0.18                               L_M_U
 3 Convent'l     4 Other           -0.64                    L___M___U|
 3 Convent'l     5 Deep Cut         0.59                               | L__M__U
 4 Other         5 Deep Cut         1.24                               |     L__M__U
                                                                       |
                                        -----+---------+---------+---------+---------+--
                                          -2.40     -1.20      0.00      1.20      2.40
```

Figure I-7. Confidence intervals for mean logged MIP dust concentration per thousand tons of shift production, by mining system.

Log$_e$(DO Dust Concentration ÷ Quartz-Adjusted DO Dust Standard)

```
              Longwall           Continuous. ≤ 20'     Conventional           Other            Deep Cut, > 20'
MIDPOINTS....................+.....................+.....................+.....................+.....................+
  1.62 -|
  1.44 -|
  1.26 -|                         **                    *
  1.08 -| *                       ****                  *
  0.90 -|*                       ***                                                     **
  0.72 -| ****                    **************        *                    *            *
  0.54 -|                         ******                **                                *****
  0.36 -| *                       ****************      *                                 ******
  0.18 -| ***                     ******************    **                   *            **********
  0.00 -|*                       ******************    **                                *****
 -0.18 -| *****                   ******************32  **                   *            ***********
 -0.36 -| M***                    ******************25  *****                *            ******************20
 -0.54 -| *******                 ******************38  ****                 *            M*****************20
 -0.72 -|                         ******************34  ***                  ***          ***********
 -0.90 -|                        M*****************40  ***                  *            **************
 -1.08 -| ***                     ******************37  M****                **           **********
 -1.26 -|                         ******                                                  **
 -1.44 -|                         ******************37  *******              ****         *********
 -1.62 -| *                       ******************30  ******               ***          ********
 -1.80 -|                         **                                        N
 -1.98 -|                         ****                  *                    ***          *
 -2.16 -|                         **                    *
 -2.34 -| *                       ******************23  ***                  ****         **
 -2.52 -|                         *                                                       *
 -2.70 -|                        *
 -2.88 -|                                                                                 **
 -3.06 -| *                       ****************      ******               ************
 -3.24 -|
         LEGEND FOR GROUP MEANS:        M - MEAN COINCIDES WITH AN ASTERISK
                                        N - MEAN DOES NOT COINCIDE WITH ANY ASTERISK
```

	Longwall	Continuous, ≤ 20'	Conventional	Other	Deep Cut, > 20'
MEAN	-0.319	-0.819	-1.026	-1.766	-0.594
STD.DEV.	0.855	0.888	1.077	1.063	0.709
S. E. M.	0.149	0.044	0.144	0.177	0.061
MAXIMUM	1.099	1.224	1.308	0.778	0.903
MINIMUM	-2.996	-2.996	-2.996	-2.996	-2.833
CASES INCL.	33	404	56	36	134

ANALYSIS OF VARIANCE TABLE FOR MEANS

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	TAIL PROBABILITY
System	49.7305	4	12.4326	16.00	0.0000
ERROR	511.2188	658	0.7769		

EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL

	DF	F VALUE	TAIL PROBABILITY
WELCH	4, 106	13.12	0.0000
BROWN-FORSYTHE	4, 179	14.07	0.0000
LEVENE'S TEST FOR VARIANCES	4, 658	5.43	0.0003

ALL GROUPS COMBINED
(EXCEPT CASES WITH UNUSED VALUES FOR VARIABLE System)

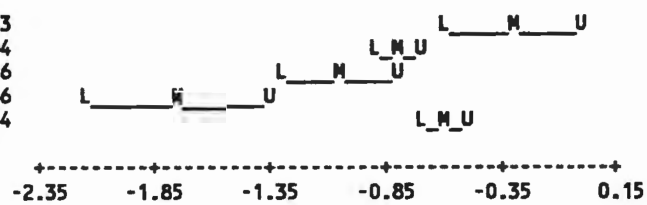
MEAN	-0.818
STD. DEV.	0.921
S. E. M.	0.036
MAXIMUM	1.308
MINIMUM	-2.996
CASES INCLUDED	663
ROBUST S.D.	0.900

Figure I-8. Distributions of logged MIP DO excursions above or below quartz-adjusted dust standard, by mining system.

Log_e(DO Dust Concentration ÷ Quartz-Adjusted DO Dust Standard)

95% CONFIDENCE INTERVALS FOR MEAN

GROUP NO.	LABEL	MEAN	SAMPLE SIZE
1	Longwall	-0.32	33
2	Continuous ≤20'	-0.82	404
3	Conventional	-1.03	56
4	Other	-1.77	36
5	Deep Cut >20'	-0.59	134



90% CONFIDENCE INTERVALS FOR DIFFERENCES
(based on Tukey Studentized Range Method)

GROUP NO.	LABEL	GROUP NO.	LABEL	MEAN DIFF
1	Longwall	2	Contin.≤20'	0.50
1	Longwall	3	Convent'l	0.71
1	Longwall	4	Other	1.45
1	Longwall	5	Deep Cut	0.28
2	Contin.≤20'	3	Convent'l	0.21
2	Contin.≤20'	4	Other	0.95
2	Contin.≤20'	5	Deep Cut	-0.23
3	Convent'l	4	Other	0.74
3	Convent'l	5	Deep Cut	-0.43
4	Other	5	Deep Cut	-1.17

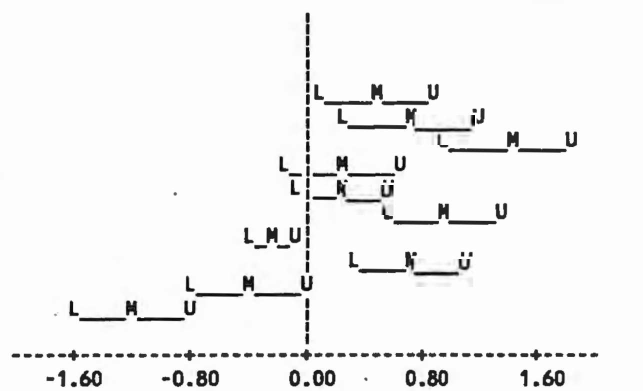


Figure I-9. Confidence intervals for mean logged MIP DO excursions above or below quartz-adjusted dust standard, by mining system.

D.1.2.2 SIP DO Samples Compared to SIP NDO Samples

At each of the SIP MMU's, several NDO dust samples (usually four) were taken along with a single DO sample. As demonstrated by Figure I-3, the DO samples tend to show somewhat higher dust concentrations than the NDO samples. The general tendency is confirmed in Table I-5, which shows the DO mean dust concentration to be greater than the NDO mean for each of the five mining systems considered, except "other." Table I-5 also indicates, however, that there may be substantial differences in dust concentration between mining systems. A two-way analysis of variance indicates not only that the DO and NDO samples differ significantly, but that the degree to which they differ varies significantly across the five mining systems. This suggests that separate comparisons should be made between DO and NDO samples for each mining system.

Table I-8 contains the sample mean difference between DO and NDO dust concentrations for each of the five systems. The standard error listed can be used to construct confidence intervals for the true mean differences. To obtain an approximate 90-percent confidence interval, 1.64 times the standard error is added and subtracted from the estimated mean. The difference, then, at 90-percent confidence, between DO and NDO dust concentrations at the SIP longwall units is 0.45 ± .21 mg/m^3. There is a probability of .05 that the true mean difference is less than .24, and a probability of .05 that it is greater than .66. It follows with 95-percent confidence that at SIP longwalls,

Table I-8. Mean difference between SIP DO and NDO dust concentrations, by mining system.

Mining System	Mean Diff. DO - NDO (mg/m^3)	Std. Error of Estimate
Longwall	.45	.13
Deep Cut, > 20 ft.	.23	.07
Continuous, ≤ 20 ft.	.69	.11
Conventional	.75	.32
Other	-.06	.41

DO concentrations exceed NDO concentrations, on average, by at least 0.24 mg/m^3. Since SIP longwalls comprise essentially *all* longwalls, this applies to longwall MMU's in general. Similarly, with 95-percent confidence, it can be concluded that DO concentrations exceed NDO concentrations by an average of at least .12 mg/m^3 at Deep Cut SIP MMU's, by at least .51 mg/m^3 at SIP continuous ($\leq$ 20 ft) mining sections, and by at least .23 mg/m^3 at conventional SIP MMU's. Since the confidence interval for "other" MMU's overlaps zero, the observed difference there is not statistically significant.

Despite the generally higher mean concentration found for the DO, individual SIP MMU's exhibit a great deal of variability in concentration among their own dust samples. Consequently, there are many individual cases in which one or more of the NDO samples within an MMU exceed the DO dust concentration. In 56% of the SIP MMUs at least one of the NDO sample dust concentrations is greater than the DO concentration. This percentage is approximately the same for longwalls, continuous, deep cut, and conventional operations. In 30% of the cases, the maximum NDO concentration exceeds the DO concentration by at least 0.5 mg/m^3, and in 15% of the cases, it exceeds the DO concentration by more than 1.0 mg/m^3.

The relative frequency of an individual NDO dust sample's exceeding the DO measurement is not, however, inconsistent with the observation above that, on average, dust concentrations tend to be higher for the DO. In particular it does not demonstrate that the DO is being improperly selected, although this may sometimes be the case. Because there were generally four NDO occupations sampled at each SIP MMU, and because of statistical uncertainty inherent in the sampling process, individual excursions by NDO sample concentrations above the DO concentration are not unexpected, even if the NDO mean falls below the DO mean concentration. The likelihood that at least one NDO sample will exceed the DO is actually quite high if two or three of the NDO samples come from locations only slightly less dusty than the DO position. In a group of one DO and four NDO samples, evidence of a tendency to improperly select the DO, based on individual NDO excursions, would require that the NDO maximum exceed the DO sample more than 80% of the time. There may be individual cases where the DO has been improperly selected, but, due to variability in the sampled dust concentrations, the specific MMU's cannot be identified without several replicated measurements on the DO and each of the NDO's. In the absence of such measurements, and considering the general tendency for DO concentrations to exceed NDO concentrations by the amounts indicated in Table I-8, the data do not support any conclusion that the DO is being improperly selected. In order to compile such evidence, or to identify particular cases where the DO was improperly designated, multiple samples would be needed for the DO and each NDO.

D.1.2.3 SIP DO Samples Compared by Mining System

Since the DO samples show, on average, the highest dust concentrations at SIP MMU's, they are examined in greater detail in Figures I-10 and I-11. SIP dust concentrations generally display a similar pattern as the MIP DO concentrations, but they display somewhat less variability across mining systems than what is seen in the MIP data. The SIP data, however, show *more* variability between mining systems with respect to dust concentrations per unit production than the MIP data.

Log$_e$(DO Dust Concentration)

```
               Longwall           Continuous, ≤ 20'   Conventional        Other               Deep Cut, > 20'
MIDPOINTS...................+...................+...................+...................+...................+
  3.0   -|                                        *
  2.8   -|                    *                                       *
  2.6   -|                    *
  2.4   -|                    ****
  2.2   -|                    *
  2.0   -|*                   *****               *
  1.8   -|*                   ***                 *
  1.6   -|*                   **********          ***
  1.4   -|                    *********           *                                       **
  1.2   -|**                  ********            *****                                   **
  1.0   -|****                *****************20 ***                 ***                 *****
  0.8   -|*******             ****************    ***                                     ***********
  0.6   -|**************      *****************27 *****               **                  ***************
  0.4   -|*********           *****************30 *****               *****               ******************
  0.2   -|M***********        *****************24 M**                 *                   **************
  0.0   -|********            M****************49 ********            **                  M****************20
 -0.2   -|*********           *****************26 ******              ***                 *****************20
 -0.4   -|**********          *****************37 *****               *                   **************
 -0.6   -|*                   *****************33 *****               *******             **********
 -0.8   -|                                                            N
 -1.0   -|                    *****************33 *******             ***                 *************
 -1.2   -|                                                            *****
 -1.4   -|
 -1.6   -|                    *****************20 ****                ******              *******
 -1.8   -|
 -2.0   -|
 -2.2   -|
 -2.4   -|*                   *********           *                   *********           *
          LEGEND FOR GROUP MEANS:      M - MEAN COINCIDES WITH AN ASTERISK
                                       N - MEAN DOES NOT COINCIDE WITH ANY ASTERISK
```

	Longwall	Continuous, ≤ 20'	Conventional	Other	Deep Cut, > 20'
MEAN	0.281	0.034	0.121	-0.745	-0.020
STD.DEV.	0.597	0.936	0.982	1.150	0.679
S. E. M.	0.067	0.049	0.120	0.166	0.055
MAXIMUM	1.946	2.896	2.918	2.879	1.459
MINIMUM	-2.303	-2.303	-2.303	-2.303	-2.303
CASES INCL.	80	366	67	48	152

ANALYSIS OF VARIANCE TABLE FOR MEANS

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	TAIL PROBABILITY
System	34.4052	4	8.6013	11.21	0.0000
ERROR	543.2092	708	0.7672		

EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL

	DF	F VALUE	TAIL PROBABILITY
WELCH	4, 177	9.14	0.0000
BROWN-FORSYTHE	4, 222	10.71	0.0000
LEVENE'S TEST FOR VARIANCES	4, 708	9.24	0.0000

ALL GROUPS COMBINED
(EXCEPT CASES WITH UNUSED VALUES FOR VARIABLE System

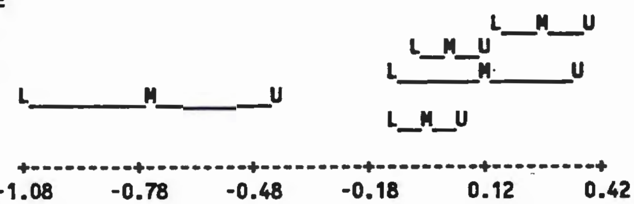
MEAN	0.006
STD. DEV.	0.901
S. E. M.	0.034
MAXIMUM	2.918
MINIMUM	-2.303
CASES INCLUDED	713
ROBUST S.D.	0.856

Figure I-10. Distributions of logged SIP DO dust concentrations, by mining system.

Log$_e$(DO Dust Concentration)

95% CONFIDENCE INTERVALS FOR MEAN

GROUP NO.	LABEL	MEAN	SAMPLE SIZE
1	Longwall	0.28	80
2	Continuous ≤20'	0.03	366
3	Conventional	0.12	67
4	Other	-0.75	48
5	Deep Cut	-0.02	152



90% CONFIDENCE INTERVALS

GROUP NO.	LABEL	GROUP NO.	LABEL	MEAN DIFF
1	Longwall	2	Contin.≤20'	0.25
1	Longwall	3	Convent'l	0.16
1	Longwall	4	Other	1.03
1	Longwall	5	Deep Cut	0.30
2	Contin.≤20'	3	Convent'l	-0.09
2	Contin.≤20'	4	Other	0.78
2	Contin.≤20'	5	Deep Cut	0.05
3	Convent'l	4	Other	0.87
3	Convent'l	5	Deep Cut	0.14
4	Other	5	Deep Cut	-0.73

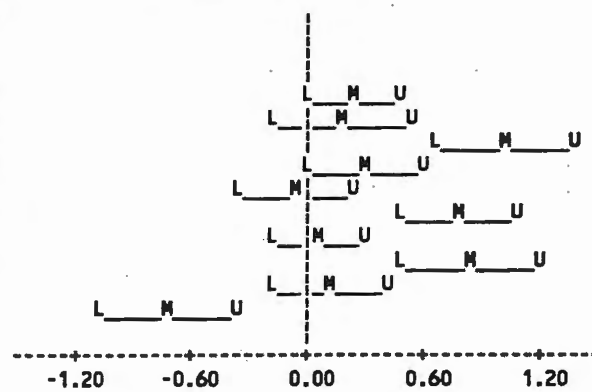


Figure I-11. Confidence intervals for mean logged SIP dust concentration, by mining system.

Log$_e$(DO Dust Concentration + (Shift Tonnage/1000)

```
               Longwall            Continuous, ≤ 20'    Conventional         Other               Deep Cut, > 20'
MIDPOINTS.....................+....................+....................+....................+....................+
   5.7 -                                                             *
   5.4 -                    *                                        *
   5.1 -
   4.8 -
   4.5 -                                                             ***
   4.2 -                    *                                        *
   3.9 -*                   *                    *                   *
   3.6 -                    **                   *                   *
   3.3 -                    ********             **                  ******
   3.0 -                    **********           **                  ***
   2.7 -                    **********           ****                ***                 **
   2.4 -                    ******************22 ******              M********           **
   2.1 -**                  ************         ****                *****               ****
   1.8 -                    ******************33 *******             ****                *******
   1.5 -                    ******************40 M***********        **                  *******
   1.2 -                    M*****************39 ***                 *****               ****************
   0.9 -****                ******************53 *************       **                  ******************23
   0.6 -**                  ******************49 *                                       M*****************27
   0.3 -*****               ******************28 ***                 *                   ********************
   0.0 -************        ******************29 *                                       **************
  -0.3 -M**************     **************       ****                                    ******************
  -0.6 -*************       **                   *                                       ***********
  -0.9 -****************    *******              *                                       **
  -1.2 -*******             **                                                           *
  -1.5 -*                   *                    *                                       **
  -1.8 -*                                                                                *
  -2.1 -*                   *
  -2.4 -                    *
        LEGEND FOR GROUP MEANS:      M - MEAN COINCIDES WITH AN ASTERISK
                                     N - MEAN DOES NOT COINCIDE WITH ANY ASTERISK
```

	Longwall	Continuous, ≤ 20'	Conventional	Other	Deep Cut, > 20'
MEAN	-0.338	1.122	1.447	2.547	0.545
STD.DEV.	0.862	1.030	1.072	1.168	0.841
S. E. M.	0.096	0.054	0.131	0.169	0.068
MAXIMUM	4.043	5.298	3.814	5.613	2.845
MINIMUM	-2.044	-2.322	-1.495	0.223	-1.751
CASES INCL.	80	366	67	48	152

ANALYSIS OF VARIANCE TABLE FOR MEANS

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	TAIL PROBABILITY
System	307.4275	4	76.8569	78.58	0.0000
ERROR	692.4721	708	0.9781		

EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL

	DF	F VALUE	TAIL PROBABILITY
WELCH	4, 175	78.95	0.0000
BROWN-FORSYTHE	4, 277	75.96	0.0000
LEVENE'S TEST FOR VARIANCES	4, 708	3.48	0.0080

ALL GROUPS COMBINED
(EXCEPT CASES WITH UNUSE
VALUES FOR VARIABLE System

MEAN	0.96
STD. DEV.	1.18
S. E. M.	0.04
MAXIMUM	5.61
MINIMUM	-2.32
CASES INCLUDED	71
ROBUST S.D.	1.15

Figure I-12. Distributions of logged SIP DO dust concentrations per thousand tons of shift production, by mining system.

Log_e(DO Dust Concentration ÷ (Shift Tonnage/1000)

```
                                   95% CONFIDENCE INTERVALS FOR MEAN

   GROUP                    SAMPLE
NO. LABEL            MEAN   SIZE
 1 Longwall         -0.34    80  L_M_U
 2 Continuous ≤ 20'  1.12   366                      LMU
 3 Conventional      1.45    67                        L__M__U
 4 Other             2.55    48                                       L__M__U
 5 Deep Cut > 20'    0.54   152              L_M_U

                               +---------+---------+---------+---------+---------+
                             -0.63     0.07      0.77      1.47      2.17      2.87
```

```
                                                90% CONFIDENCE INTERVALS

 GROUP           GROUP            MEAN                           |
NO. LABEL       NO. LABEL         DIFF                           |
                                                                 |
 1 Longwall      2 Contin.≤20'   -1.46             L_M_U         |
 1 Longwall      3 Convent'l     -1.78          L__M__U          |
 1 Longwall      4 Other         -2.89     L__M__U               |
 1 Longwall      5 Deep Cut      -0.88                L_M_U      |
 2 Contin.≤20'   3 Convent'l     -0.32                    L_M_U
 2 Contin.≤20'   4 Other         -1.43             L_M_U         |
 2 Contin.≤20'   5 Deep Cut       0.58                           | L_M_U
 3 Convent'l     4 Other         -1.10               L__M__U     |
 3 Convent'l     5 Deep Cut       0.90                           |   L_M_U
 4 Other         5 Deep Cut       2.00                           |          L_M_U
                                                                 |
                                  -----+---------+---------+---------+---------+--
                                     -3.00     -1.50      0.00      1.50      3.00
```

Figure I-13. Confidence intervals for mean logged SIP dust concentration per thousand tons of shift production, by mining system.

Log$_e$(DO Dust Concentration ÷ Quartz-Adjusted DO Dust Standard)

```
             Longwall             Continuous, ≤ 20'    Conventional         Other                Deep Cut, > 20'
MIDPOINTS....................+....................+....................+....................+....................+
   3.25 -
   3.00 -
   2.75 -
   2.50 -                     **
   2.25 -                     **                   *                    *
   2.00 -                     **
   1.75 -                     *****
   1.50 -                     *****
   1.25 -*                    *******              **
   1.00 -*                    *******              ***
   0.75 -*                    **************       *                                         ***
   0.50 -***                  ****************     *****                *                    ****
   0.25 -******               ******************20 ***                  ***                  *********
   0.00 -*************        ******************29 *******              *                    ****************
  -0.25 -****************     ******************40 ******               ******               ******************24
  -0.50 -M*************       M*****************46 M******              **                   ******************25
  -0.75 -******               ******************27 ****                 *                    M*************
  -1.00 -*****************    ******************60 ***********          ***                  ******************29
  -1.25 -                     *******                                   *                    **
  -1.50 -*                    ******************49 ************         M********            ******************
  -1.75 -                     **
  -2.00 -                     **                                        *****                *
  -2.25 -                     ****************     ****                 ******               ******
  -2.50 -
  -2.75 -                     **
  -3.00 -*                    ******               *                    *********            *
  -3.25 -
  -3.50 -
         LEGEND FOR GROUP MEANS:     M - MEAN COINCIDES WITH AN ASTERISK
                                     N - MEAN DOES NOT COINCIDE WITH ANY ASTERISK
```

	Longwall	Continuous, ≤ 20'	Conventional	Other	Deep Cut, > 20'
MEAN	-0.382	-0.540	-0.568	-1.407	-0.659
STD.DEV.	0.593	0.996	0.981	1.185	0.680
S. E. M.	0.066	0.052	0.120	0.171	0.055
MAXIMUM	1.253	2.526	2.225	2.186	0.765
MINIMUM	-2.996	-2.996	-2.996	-2.996	-2.996
CASES INCL.	80	366	67	48	152

ANALYSIS OF VARIANCE TABLE FOR MEANS

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	TAIL PROBABILITY
System	36.9191	4	9.2298	11.10	0.0000
ERROR	588.8968	708	0.8318		

EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL

	DF	F VALUE	TAIL PROBABILITY
WELCH	4, 178	8.63	0.0000
BROWN-FORSYTHE	4, 220	11.06	0.0000
LEVENE'S TEST FOR VARIANCES	4, 708	10.61	0.0000

ALL GROUPS COMBINED (EXCEPT CASES WITH UNUSED VALUES FOR VARIABLE System)

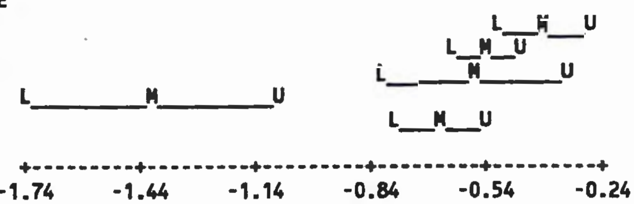
MEAN	-0.609
STD. DEV.	0.938
S. E. M.	0.035
MAXIMUM	2.526
MINIMUM	-2.996
CASES INCLUDED	713
ROBUST S.D.	0.881

Figure I-14. Distributions of logged SIP DO excursions above or below quartz-adjusted dust standard, by mining system.

Log$_e$(DO Dust Concentration ÷ Quartz-Adjusted DO Dust Standard)

95% CONFIDENCE INTERVALS

GROUP NO.	LABEL	MEAN	SAMPLE SIZE
1	Longwall	-0.38	80
2	Continuous ≤20'	-0.54	366
3	Conventional	-0.57	67
4	Other	-1.41	48
5	Deep Cut >20'	-0.66	152



90% CONFIDENCE INTERVALS

GROUP NO.	LABEL	GROUP NO.	LABEL	MEAN DIFF
1	Longwall	2	Contin.≤20'	0.16
1	Longwall	3	Convent'l	0.19
1	Longwall	4	Other	1.02
1	Longwall	5	Deep Cut	0.28
2	Contin.≤20'	3	Convent'l	0.03
2	Contin.≤20'	4	Other	0.87
2	Contin.≤20'	5	Deep Cut	0.12
3	Convent'l	4	Other	0.84
3	Convent'l	5	Deep Cut	0.09
4	Other	5	Deep Cut	-0.75

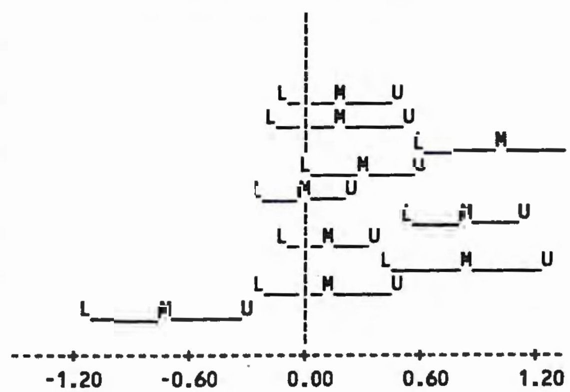


Figure I-15. Confidence intervals for mean logged SIP DO excursions above or below quartz-adjusted dust standard, by mining system.

D.1.2.4 SIP samples for Selected Mining and Ventilation Systems

Table I-9 contains mean SIP DO dust concentrations, mean dust concentrations per unit production, and mean deviations from the quartz-adjusted dust standard for those non-longwall SIP MMU's with complete ventilation system data. Deviations from the applicable standard are calculated separately within each MMU and expressed as positive or negative arithmetic differences: a positive deviation signifies that the DO dust concentration exceeds the standard, and a negative deviation signifies a concentration below the standard. The deviations within each MMU are then averaged to form the positive or negative mean deviation shown in Table I-9. The mean deviation, for example, for deep-cut MMU's with combined blowing and exhaust ventilation and no belt air is 0.36 mg/m^3 *below* the MMU-specific standard. This quantity is generally not the same as the deviation of the mean concentration from some overall standard. Continuing the same example, the mean concentration for the group falls 0.58 mg/m^3 below the 2.0 mg/m^3 standard.

Table I-9. Mean SIP DO dust concentration, dust concentration per unit production, and deviation from quartz-adjusted dust standard, by mining system, blowing or exhaust ventilation and presence or absence of belt air. Only combinations with at least 5 cases of fully specified ventilation system are included. Cases with unknown or no ventilation device (tubing, curtain, or both) are excluded.

"Deep Cut" has cut depth > 20 ft. "Continu" has cut depth ≤ 20 ft.				DO Dust Concentration, mg/m$_3$		Log(D/(T/1000) D = Dust Conc. T = Shift Tonnage		Deviation from Quartz-Adjusted Dust Standard, mg/m^3	
Mining System	Vent-Meth.	Belt Air	Cases (N)	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Continu	Exhaust	yes	17	0.86	0.49	0.86	0.94	-0.95	0.46
Deep Cut	Exhaust	yes	8	1.00	0.82	0.33	0.64	-1.00	0.82
Continu	Blow	no	28	2.21	2.16	1.25	0.85	0.37	2.31
Conv'l	Blow	no	11	2.03	1.91	1.10	1.51	0.05	1.91
Other	Blow	no	13	2.11	4.77	2.97	1.42	0.12	4.77
Deep Cut	Blow	no	73	1.18	0.66	0.47	0.79	-0.71	0.68
Continu	Exhaust	no	239	1.42	1.67	1.09	1.03	-0.38	1.74
Conv'l	Exhaust	no	37	2.04	3.15	1.66	0.90	0.04	3.15
Other	Exhaust	no	19	0.80	0.70	2.11	1.12	-1.09	0.81
Deep Cut	Exhaust	no	33	1.19	0.97	0.62	1.03	-0.74	0.10
Continu	Both	no	28	2.23	3.50	1.14	1.04	0.40	3.59
Conv'l	Both	no	10	1.27	1.49	1.29	1.15	-0.70	1.47
Other	Both	no	11	0.68	0.70	2.82	0.86	-1.32	0.71
Deep Cut	Both	no	9	1.42	0.91	0.57	0.55	-0.36	0.84
Significance of Group Differences: α						***			
Significance Based on Mean $Log_e(D)$				***		N/A		***	

Significance = α denotes probability that observed differences in the group means would arise by chance if there were in fact no real difference among groups. Blank signifies $\alpha > .1$; *, **, and *** signify differences at 90-percent, 95-percent, or 99-percent confidence levels, respectively.

Each standard deviation given in the table can be converted to a standard error of the estimated mean by dividing by the square root of the corresponding N. For example, the mean DO dust concentration for continuous MMU's (Cut Depth ≤ 20 ft.) with blowing ventilation and no belt air is 2.21 mg/m^3, with a standard deviation of 2.16, based on 28 cases. The standard error is $2.16 \div \sqrt{28}$, so standard error limits for the mean are $2.21 \pm .41$ mg/m^3. Considerably more precise estimates are derived by taking logarithms of the dust concentrations, and doing so reveals statistically significant differences among the MMU classes with respect to all three of the quantities presented.

Estimates of the median dust concentration per thousand tons of coal mined can be obtained by exponentiating the mean logged ratio listed for each MMU class. For example, the median dust concentration per thousand tons of coal mined at continuous MMU's (Cut Depth $\leq$ 20 ft.) with blowing ventilation and no belt air is exp(1.25) = 3.5 mg/m^3. During a shift, then, in which production were 600 tons, DO dust concentrations above or below 2.1 mg/m^3 could be expected with roughly equal probability.

It is worth pointing out that among MMU classes in Table I-9 with no belt air, all blowing systems except Deep-cut Continuous display, on average, positive deviation above the quartz-adjusted dust standard. Deep-cut MMU's with blowing ventilation, on the other hand, show a mean deviation of $0.71 \pm .08$ mg/m^3 *below* the standard, with essentially the same result for deep-cut MMU's with exhausting ventilation and slightly higher results for deep-cut MMU's with blowing-exhausting combinations. The group of 239 continuous MMU's ($\leq$ 20 ft.) with exhausting, rather than blowing, ventilation was also relatively low in dust, with a mean deviation below the quartz-adjusted standard of $0.38 \pm .11$.

Logged dust to tonnage ratios for the ventilation category with the most cases, exhausting systems with no belt air, is broken down further, in Figure I-16, by size of mine. There seems to be a trend toward decreasing dust concentration per unit production with increasing mine size. This trend is largely the result of longwall systems, which exist in

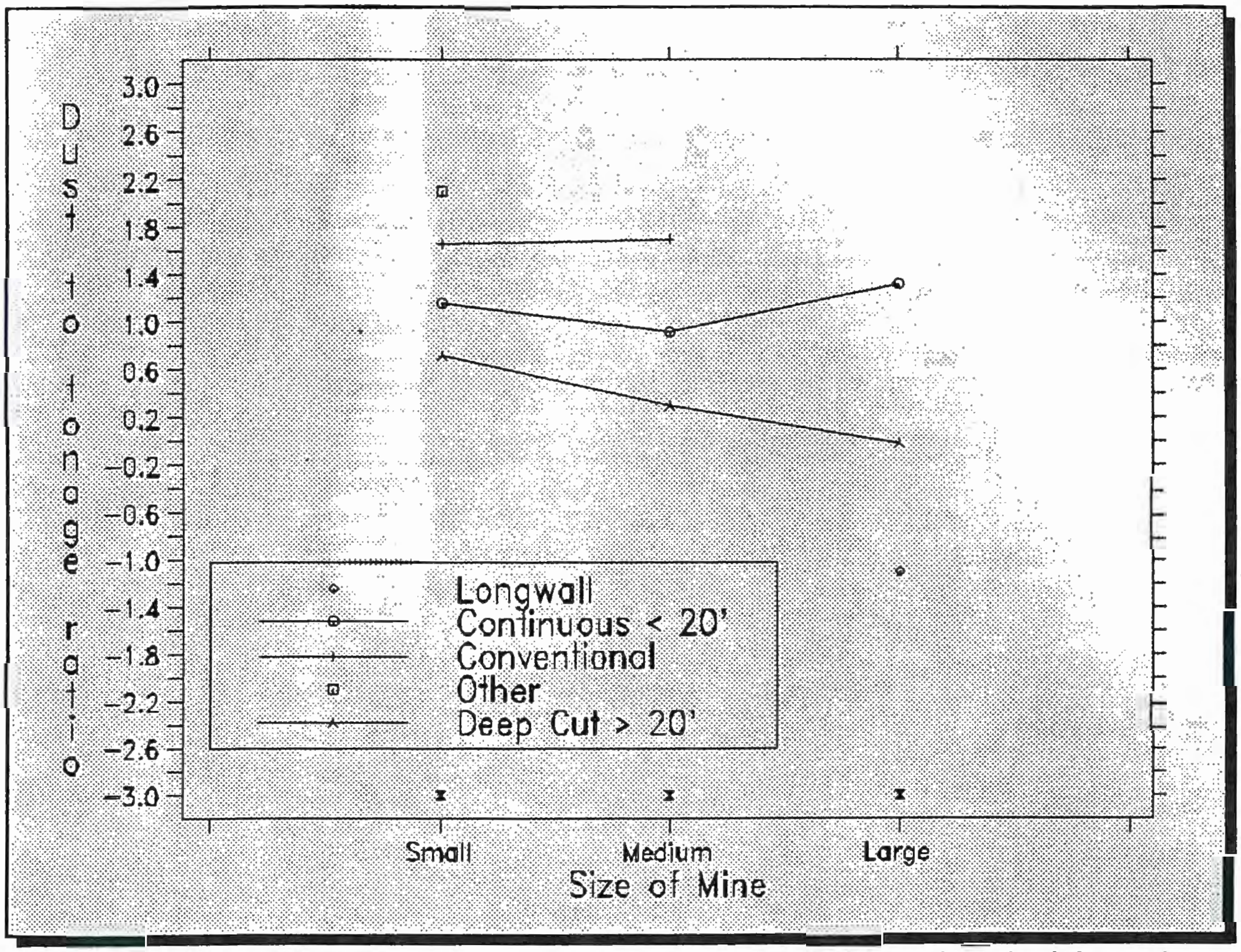


Figure I-16. Mean SIP deviations from adjusted quartz standard for selected mining and ventilation systems, by employee size group.

large mines and tend to have *low* dust-to-tonnage ratios (but high dust concentrations!), and systems classified "other," which are found primarily in small mines and tend to have *high* dust-to-tonnage ratios. Therefore, the effect of mine size on dust concentrations per unit production is statistically confounded with the effect of longwall or "other" mining system, and cannot be determined with confidence.

D.1.2.5 Effect of Belt Air on DO and Intake Air Samples.

An analysis was performed, separately for SIP longwalls, continuous (depth of cut ≤ 20 ft.), deep cut (> 20 ft.), and conventional MMU's to estimate the effect of belt air on

DO and intake air samples. MMU's classified as "other" were not included in this analysis, since none of them have belt air. The SIP MMU's within each of the remaining mining system categories were divided into two groups: those having a belt air system and those not having one. The two groups were then compared according to their mean DO and intake air dust concentrations, and the effect of belt air on dust concentration was estimated for each mining system.

Table I-10 summarizes the results of this analysis. Statistically, intake air is significantly dustier at belt air systems, but DO dust concentrations and DO dust accretions (the

Table I-10. Differences in dust samples between SIP MMU's having and not having belt air systems, by mining system.

Variable	Mining System	Belt Air: YES N	Mean₁	Std Dev	Belt Air: NO N	Mean₂	Std Dev	Belt Air Comparison DIFFERENCE Mean₁ - Mean₂: Diff.	S.E.	α
DO Dust Conc. mg/m³ (D)	Longwall	27	1.43	1.05	35	1.76	1.12	-.33	.28	*
	Continuous ≤ 20'	22	.93	.52	300	1.57	2.00	-.64	.16	***
	Deep Cut > 20'	16	1.19	.78	119	1.23	.79	-.04	.21	
	Conventional	1	.70	n/a	58	1.90	2.71	-1.20	-.--	
Log_e(D)	Longwall	27	.15	.69	35	.44	.49	-.29	.16	*
	Continuous ≤ 20'	22	-.28	.76	300	.01	.93	-.29	.17	
	Deep Cut > 20'	16	-.02	.65	119	-.01	.71	-.01	.17	
	Conventional	1	-.36	n/a	58	.12	1.00	-.48	-.--	
Intake Air Dust Conc. mg/m³ (A)	Longwall	17	.34	.25	20	.22	.13	.12	.07	*
	Continuous ≤ 20'	17	.34	.34	273	.16	.15	.18	.08	***
	Deep Cut > 20'	12	.32	.28	112	.19	.19	.13	.08	**
	Conventional	1	.10	n/a	54	.13	.08	-.03	-.--	
Log_e(A)	Longwall	17	-1.40	.84	20	-1.66	.54	.26	.24	
	Continuous ≤ 20'	17	-1.47	.86	265	-1.99	.55	.52	.21	***
	Deep Cut > 20'	12	-1.48	.84	111	-1.94	.62	.46	.25	**
	Conventional	1	-2.30	n/a	52	-2.08	.41	-.22	-.--	
DO Dust Accretion mg/m³ (D - A)	Longwall	17	.84	.55	20	1.26	.64	-.42	.20	**
	Continuous ≤ 20'	17	.62	.46	271	1.39	1.80	-.77	.16	***
	Deep Cut > 20'	12	.68	.88	111	1.04	.76	-.36	.26	*
	Conventional	1	.60	n/a	54	1.85	2.78	-1.25	-.--	
Log_e(D/A)	Longwall	17	1.41	1.0	20	1.95	.56	-.54	.27	*
	Continuous ≤ 20'	17	1.16	.79	263	2.01	.99	-.85	.20	***
	Deep Cut > 20'	12	1.26	1.14	110	1.94	.81	-.68	.34	**
	Conventional	1	1.95	n/a	52	2.24	1.00	-.29	-.--	

α denotes probability that a difference of the observed magnitude would be found if there were in fact no difference, based on the either the Wilcoxan-Mann-Whitney Rank Sum Test or a T-test with separate or pooled variance estimates as appropriate.
Blank signifies $\alpha > .1$; *, **, and *** signify differences at the 90-percent, 95-percent, or 99-percent confidence levels, respectively.

DO - intake air differences in concentration) are both significantly lower. At continuous MMU's, for example, the the mean intake air dust concentration with belt air is 0.18±.08 mg/m³ greater than without. The mean DO dust concentration, however, is 0.64±.16 mg/m³ *lower* at MMU's with belt air. More detail on the belt air comparisons, including test statistics and distributional properties of the Table I-10 variables, is presented in Appendix A3.

D.1.3 Dust Concentrations by Occupation

Tables I-11 and I-12 contain summary data on each of the occupations sampled during

Table I-11. SIP dust concentrations, by occupational classification.

			All measurements are in mg/m³				
Occ. Code	Occupational Classification	COUNT	MEAN	STD.DEV.	S.E.	C.V.	MAX
0	Unknown	76					
0	Roofbolter DA	219	1.182	1.169	.079	.989	9.4
1	Belt Man/Conveyor Man	13	0.885	0.801	.222	.905	3.4
2	Electrician	34	0.506	0.368	.063	.726	1.4
4	Mechanic	47	0.645	0.454	.066	.704	1.7
7	Blaster/Shooter/Shotfirer	7	0.571	0.675	.255	1.181	2.0
8	Stopping Builder/Vent.Man/Mason	5	1.500	1.032	.463	.687	2.4
9	Supply Man	3	1.000	0.854	.493	.854	1.8
10	Auger (Jack Setter) Intake side	6	1.383	1.212	.495	.876	3.7
12	Roof Bolter (TwinHead) Int. side	158	0.915	0.731	.058	.799	4.8
13	Cleanup Man	2	0.250	0.212	.150	.848	.4
14	Roof Bolter (TwinHead) Return side	149	1.179	1.084	.089	.918	7.7
16	Laborer	15	1.300	1.809	.467	1.391	6.9
17	Auger (Timberman) Return side	3	1.300	0.819	.473	.629	2.0
18	Auger (Timberman) Intake side	1	0.700	0.000	.000	0.000	.7
19	Roof Bolter (Mounted) Intake side	11	0.936	0.816	.246	.871	3.1
31	Shotfirer Helper	3	0.700	0.346	.200	.494	1.1
32	Brattice Man	4	1.200	0.560	.279	.466	2.0
33	Coal Drill Helper	2	1.650	0.778	.550	.471	2.2
34	Coal Drill Operator	71	1.258	1.727	.204	1.373	10.7
35	Continuous Miner Helper	245	1.280	1.265	.080	.987	9.4
36	Continuous Miner Operator	510	1.498	1.773	.078	1.183	18.1
37	Cutting Machine Helper	5	0.780	0.540	.241	.692	1.5
38	Cutting Machine Operator	66	1.927	2.575	.316	1.336	18.5
39	Hand Loaders	30	1.270	3.205	.585	2.523	17.8
40	Headgate Operator	66	0.665	0.445	.054	.669	3.1
41	Jack Setter (Longwall)	143	1.394	0.982	.082	.704	10.0
42	Loading Machine Helper	2	1.350	0.919	.650	.680	2.0
43	Loading Machine	39	1.310	1.334	.213	1.017	7.6
44	Longwall Operator (Tailgate side)	77	1.678	1.187	.135	.707	7.0
46	Roof Bolter (SingleHead)	296	1.294	1.121	.065	.866	7.6
47	Roof Bolter Helper (Single Head)	37	1.359	1.363	.224	1.002	7.6
48	Roof Bolter Mounted (Return side)	16	0.981	0.720	.180	.734	3.1
49	Section Foreman	86	0.759	0.587	.063	.773	3.0
50	Shuttle Car Operator (Onside)	504	0.808	0.834	.037	1.032	11.3
52	Tailgate Operator	4	0.850	0.597	.298	.7026	1.5
53	Utility Man	86	0.738	0.764	.082	1.034	5.6
54	Scoop Car Operator	225	0.898	0.988	.065	1.099	9.0
55	Auger Jack Setter (Return side)	2	2.650	2.616	1.850	.987	4.5
60	Longwall (Return Side Face Worker	7	1.971	1.397	.528	.708	4.5
64	Longwall Operator Headgate side	45	1.469	0.828	.123	.563	4.3
70	Auger Operator	4	1.525	1.384	.692	.907	3.0
72	Mobile Bridge Operator	84	0.836	0.661	.072	.790	3.7
73	Shuttle Car Operator	294	0.770	1.063	.061	1.379	14.2
74	Tractor Operator/Motorman	53	0.430	0.256	.035	.595	1.1

the SIP and MIP. The "S.E." listed in both tables is the standard error of the estimated

Table I-12. MIP dust concentrations, by occupational classification.

Occ. Code		All measurements are in mg/m³ COUNT	MEAN	STD.DEV.	S.E.M.	C.V.	MAX
0	Unknown	4	0.850	0.436	.260	.466	1.4
14	Roof Bolter (TwinHead) (Return Side)	1	0.400	0.00	0.000	0.000	.4
34	Coal Drill Operator	20	0.730	0.892	.189	1.185	3.7
36	Continuous Miner Operator	532	1.132	0.932	.040	.821	6.7
38	Cutting Machine Operator	54	1.196	1.404	.189	1.151	7.4
39	Hand Loaders	14	0.271	0.240	.067	.910	.9
41	Jack Setter (Longwall)	4	1.050	0.238	.119	.226	1.2
43	Loading Machine Operator	1	0.700	0.000	0.000	0.000	.7
44	Longwall Operator (Tailgate Side)	22	2.109	1.333	.284	.632	6.0
46	Roof Bolter (Single Head)	3	0.633	0.513	.296	.810	1.2
50	Shuttle Car Operator (Onside)	1	1.400	0.000	0.000	0.000	1.4
52	Tailgate Operator	3	0.333	0.321	.185	.964	.7
54	Scoop Car Operator	3	0.667	0.289	.166	.433	1.0
55	Auger (Jack Setter) (Return Side)	2	2.100	2.828	2.000	1.346	4.1
60	Longwall (Return-Side Face Worker)	5	2.400	1.245	.707	.565	4.5
70	Auger Operator	4	0.700	0.712	.355	1.016	1.5
72	Mobile Bridge Operator	1	0.800	0.000	0.000	0.000	.8

mean, and the "C.V." is the coefficient of variation. Since the MIP was intended to sample only the DO, far fewer occupations are represented as MIP samples. Samples that were voided as "excess" on MSHA's Respirable Dust Data System are included in Table I-12, but other voided samples are not counted. In Appendices A4, A5, and A6, a more detailed description is given of the frequency of dust concentration values observed, according to occupational category. Appendix A4 and A5 cover the SIP and MIP samples, respectively, and Appendix A6 covers all MSHA inspector samples collected from July 1, 1990 through June 30, 1991. In each of these appendices, a separate histogram and cumulative frequency tabulation is presented for every occupation having at least 20 observations. In addition, Appendix A4 contains histograms and tabulations for two composite categories, covering roof bolters (codes 12, 14, 19, 46, 47, and 48) and shuttle car operators (codes 50 and 73).

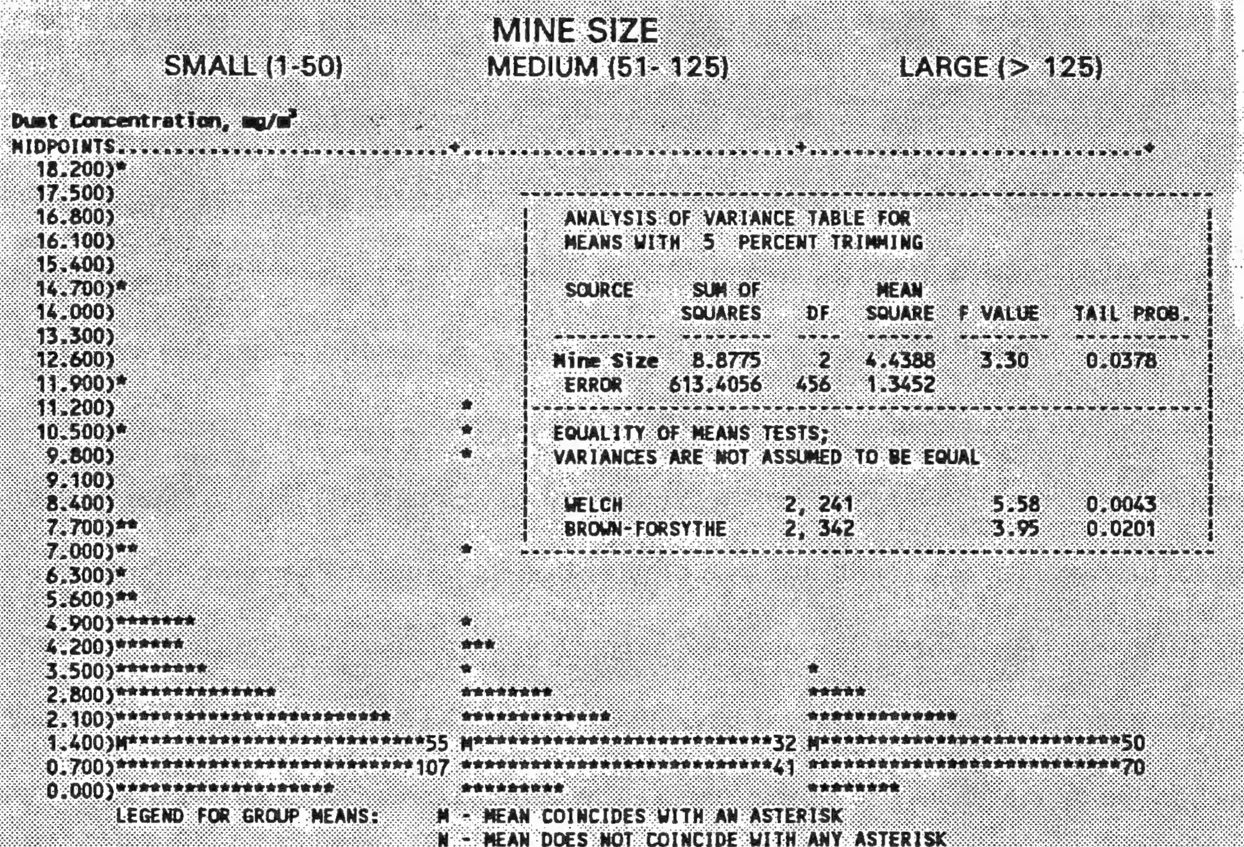
Appendices A4 through A6 can be used to determine the proportion of cases, by occupation, in which a specified dust concentration threshold is met or exceeded. For example, the SIP chart (Appendix A4) for continuous miner operators (category 36) shows that 81.2 percent of the dust samples were at or below 2.0 mg/m_3. It follows that 19.8 percent of the samples exceeded this threshold. Since the value recorded for individual coal dust concentrations at MSHA's coal respirable dust laboratory is always truncated to one decimal place, all of this 19.8 percent was actually measured at or above 2.1 mg/m_3. The same chart shows that 13.5 percent of the individual SIP continuous miner dust samples exceeded 2.4 mg/m^3, and therefore had concentrations measuring at least 2.5 mg/m^3. Similarly the SIP chart for the combined roof bolter categories shows that 12.1 percent of these samples exceeded 2.0 mg/m^3, and 8.7 percent of them measured at least 2.5 mg/m^3.

D.1.4 Mine Size Comparisons

Since dust concentration distributions are often highly skewed, statistical procedures can be misleading if they are directly applied to the raw data. Comparing SIP dust concentrations with respect to size of mine (based on number of employees) provides an example of the need for applying a transformation, such as logarithms, to the data in order to make the distributions more symmetric and stabilize the variance.

For continuous mining machine operators, SIP dust concentrations averaged 1.7 mg/m^3 for 251 MMU's at small mines (1-50 employees) and 1.6 mg/m^3 for 112 MMU's at medium sized mines (51-125 employees). At large mines, on the other hand, they averaged 1.1 mg/m_3. An Analysis of Variance (ANOVA) was performed directly on the unlogged dust concentrations, and the results indicated that dust concentrations differ significantly with respect to mine size, at a confidence level of more than 99 percent. Figure I-17 illustrates this difference, and confirms that the dust concentration distributions are similar at small and medium mines but tend to be lower at large mines. Figure I-17 also indicates, however, that much of the difference may be attributable to a few extreme cases. Therefore, a second ANOVA was performed with all cases deleted whose dust concentration ranked in the top five and bottom five percent. These results, shown as an inset in Figure I-17, still indicate a difference at 95-percent confidence ("tail probability" $\alpha < .05$).

Since the dust concentration distributions are markedly asymmetrical, however, the validity of the F-statistics on which these statistical tests are based is questionable. Taking logarithms of the dust concentrations results in frequency distributions much closer to the Normal Distribution for which these tests are valid. In addition, the logarithmic transform mitigates the influence of extreme, outlying values. Figure I-18 shows the normalizing effect of taking logarithms on the SIP dust concentrations for continuous mining machine operators.



	SMALL (1-50)	MEDIUM (51-125)	LARGE (> 125)
MEAN	1.688	1.597	1.099
STD.DEV.	2.128	1.838	0.642
S. E. M.	0.134	0.174	0.053
MAXIMUM	18.100	11.300	3.200
MINIMUM	0.100	0.100	0.100
CASES INCL.	251	112	147

ANALYSIS OF VARIANCE TABLE FOR MEANS

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	TAIL PROBABILITY
Mine Size	33.6153	2	16.8077	5.44	0.0046
ERROR	1567.2331	507	3.0912		
EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL					
WELCH		2, 241		11.00	0.0000
BROWN-FORSYTHE		2, 324		6.43	0.0018
LEVENE'S TEST FOR VARIANCES		2, 507		14.14	0.0000

ALL GROUPS COMBINED
(EXCEPT CASES WITH UNUS
VALUES FOR VARIABLE Num_
MEAN
STD. DEV.
S. E. M.
MAXIMUM
MINIMUM
CASES EXCLUDED
CASES INCLUDED
ROBUST S.D.

Figure I-17. SIP dust concentrations for continuous miner operators at small, medium, and large sized mines.

When the ANOVA is performed on the transformed data, however, no statistically significant difference is found between mine size groups.

MIP Dust Concentrations obtained from operator samples of continuous mining machine operators also show no statistically significant difference between mine size groups, using either the raw or the logarithmically transformed data. The MIP analysis is based on 268 small, 97 medium, and 166 large MMU's with a combined mean dust concentration of 1.13 ± .04 mg/m³ and combined standard deviation of 0.93 mg/m³.

A genuine difference between mine size groups does appear in the SIP continuous mining machine operator data, however, if dust concentrations are adjusted for shift production. Figure I-19 demonstrates this with histograms and an ANOVA of the log-transformed ratio of dust concentration to thousand tons of coal mined. The distributions here appear sufficiently symmetric for valid application of the statistical significance tests. Since the Levine Test for variance inequality shows unequal variances, either the Welch or Brown-Forsythe Test may be used to test for equality of mean logged dust concentration to production ratios. Both of these tests show a difference in means with more than 99 percent confidence ($\alpha < .01$). Since only dust samples taken on continuous miner operators are included, all of the MMU's being compared are continuous mining units. Therefore, these results are not conspicuously biased by differing mining systems associated with mine size.

Sample means of the log-transformed ratios in Figure I-19 can be exponentiated to derive estimates of the median (50-th percentile) dust-to-tonnage ratio for each mine size group. These are (in units of mg/m³ per thousand tons of mined coal):

exp(-0.475) = 0.62 for the small mines,

exp(-0.562) = 0.57 for the medium mines, and

```
                                     MINE SIZE
              SMALL (1-50)          MEDIUM (51- 125)              LARGE (> 125)

Log (Dust Concentration + (shift tonnage/1000)
MIDPOINTS.............................+.............................+.............................+
   3.000)
   2.750)
   2.500)*                             *
   2.250)**
   2.000)*                             *
   1.750)****                          *
   1.500)***                           **
   1.250)*****                         *
   1.000)*******
   0.750)************                  ****
   0.500)************                  ***                           ****
   0.250)***************               *********                     ******
   0.000)********************          *************                 ***********
  -0.250)***************************   ***********                   **************************
  -0.500)M**************************   M******************           ************************
  -0.750)**************************    ****                          M*********
  -1.000)***************************35 *******************           ***************************34
  -1.250)****                          *                             ****
  -1.500)***************************32 **************                ********************
  -1.750)**
  -2.000)**                                                          *
  -2.250)**********                    ******                        *****
  -2.500)
  -2.750)*                                                           *
  -3.000)***                           ***                           *
  -3.250)
  -3.500)
        LEGEND FOR GROUP MEANS:     M - MEAN COINCIDES WITH AN ASTERISK
                                    N - MEAN DOES NOT COINCIDE WITH ANY ASTERISK

MEAN          -0.475                        -0.562                        -0.760
STD.DEV.       0.996                         0.973                         0.656
S. E. M.       0.063                         0.092                         0.054
MAXIMUM        2.425                         2.526                         0.470
MINIMUM       -2.996                        -2.996                        -2.996
CASES INCL.    251                           112                           147

---------------------------------------------------------------------------        ALL GROUPS COMBINED
| ANALYSIS OF VARIANCE TABLE FOR MEANS                              TAIL   |      (EXCEPT CASES WITH UNUS
|  SOURCE         SUM OF SQUARES   DF   MEAN SQUARE  F VALUE  PROBABILITY  |     VALUES FOR VARIABLE Num E
|  --------       --------------  ----  -----------  -------  -----------  |        MEAN                -0.5
|  Mine Size              7.5322    2        3.7661     4.59       0.0106  |        STD. DEV.            0.9
|    ERROR              415.8722  507        0.8203                        |        S. E. M.             0.0
|--------------------------------------------------------------------------|        MAXIMUM              2.5
| EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL           |        MINIMUM             -2.9
|  WELCH                          2, 272                6.16       0.0024  |        CASES EXCLUDED      (
|  BROWN-FORSYTHE                 2, 365                4.86       0.0082  |        CASES INCLUDED      5
|--------------------------------------------------------------------------|
| LEVENE'S TEST FOR VARIANCES     2, 507                9.23       0.0001  |        ROBUST S.D.          0.8
---------------------------------------------------------------------------
```

Figure I-19. SIP dust concentration to shift production ratios for continuous mining machine operatc small, medium, and large mines.

$$\exp(-0.760) = 0.47 \text{ for the large mines.}$$

The apparent decreasing progression in logged dust-to tonnage ratio forms a statistically significant linear trend.

```
                                   MINE SIZE
               SMALL (1-50)       MEDIUM (51- 125)         LARGE (> 125)

Log (Dust Concentration, mg/m³)
MIDPOINTS.............................+.............................+.............................+
   2.800)*
   2.600)*
   2.400)**                          **
   2.200)                            *
   2.000)****                        *
   1.800)***
   1.600)********                    *
   1.400)******                      ****
   1.200)*******                     *                             **
   1.000)**************              *******                       ****
   0.800)*************               *******                       *******
   0.600)*****************           **********                    **************
   0.400)********************        **********                    ******************
   0.200)************                *************                 ************
   0.000)M***************************37 M*********                 M*********************
  -0.200)******************          *********                     *****************
  -0.400)************************    *********                     ******************
  -0.600)*********************       *********                     *************
  -0.800)
  -1.000)************************    *********                     ************
  -1.200)
  -1.400)
  -1.600)***************             *****                         ******
  -1.800)
  -2.000)
  -2.200)
  -2.400)****                        ****                          **
        LEGEND FOR GROUP MEANS:   M - MEAN COINCIDES WITH AN ASTERISK
                                  N - MEAN DOES NOT COINCIDE WITH ANY ASTERISK

MEAN          0.066                  0.049                    -0.092
STD.DEV.      0.936                  0.931                     0.658
S. E. M.      0.059                  0.088                     0.054
MAXIMUM       2.896                  2.425                     1.163
MINIMUM      -2.303                 -2.303                    -2.303
CASES INCL.     251                    112                       147

-----------------------------------------------------------------------------
| ANALYSIS OF VARIANCE TABLE FOR MEANS                              TAIL    |     ALL GROUPS COMBINED
|   SOURCE        SUM OF SQUARES   DF   MEAN SQUARE  F VALUE  PROBABILITY   |   (EXCEPT CASES WITH UNUSED
|   --------      --------------  ----  -----------  -------  -----------   | VALUES FOR VARIABLE Num_Emp )
|                                                                           |   MEAN             0.017
|  Mine Size            2.4542      2      1.2271      1.64     0.1943      |   STD. DEV.        0.865
|    ERROR            378.4548    507      0.7465                           |   S. E. M.         0.038
|---------------------------------------------------------------------------|   MAXIMUM          2.896
| EQUALITY OF MEANS TESTS; VARIANCES ARE NOT ASSUMED TO BE EQUAL            |   MINIMUM         -2.303
|  WELCH                            2, 272            2.18     0.1151      |   CASES EXCLUDED  (   0)
|  BROWN-FORSYTHE                   2, 367            1.72     0.1810      |   CASES INCLUDED     510
|---------------------------------------------------------------------------|
| LEVENE'S TEST FOR VARIANCES       2, 507            7.23     0.0008      |   ROBUST S.D.      0.823
-----------------------------------------------------------------------------
```

Figure I-18. Logged SIP dust concentrations for continuous miner operators at small, medium, and large mines.

Estimates can also be obtained from Figure I-19 of the mean dust-to-tonnage ratio for each mine size group. To do this, $s^2/2$ must be added to the sample mean before exponentiating, where s is the sample standard deviation of the log-transformed ratios. The estimates, again in units of mg/m^3 per thousand tons of coal mined, are:

$\exp(-0.475 + 0.996^2/2) = 1.02$ for the small mines,
$\exp(-0.562 + 0.973^2/2) = 0.92$ for the medium mines, and
$\exp(-0.760 + 0.656^2/2) = 0.58$ for the large mines.

D.2 Non-Compliance Determinations

D.2.1 Non-Compliance and Citable Non-Compliance

SIP non-compliance determinations were made based on either a single respirable dust sample or an average of several samples (usually five) at different locations within an MMU. Before discussing the outcomes of the single and multi-sample non-compliance determinations, a few points need to be clarified regarding the definition of citable non-compliance and the commensurability of single and multi-sample citable non-compliance criteria.

Each MMU and Designated Area has a respirable coal dust standard against which sample concentrations are compared. The maximum dust standard is 2.0 mg/m^3 and can be reduced for an MMU or designated area by an amount depending on the quartz content found in previous dust samples. DO and NDO samples are compared against the general MMU standard, set by quartz analysis of previous DO samples. DA and intake air samples are compared against standards dependent on previously analyzed quartz content of the designated area or intake air. If the standard has been reduced, due to quartz content, from 2.0 mg/m$_3$, it is called a "reduced standard." In this report, the specific standard against which a dust sample is compared is called a "quartz-adjusted standard," (QAS) whether or not the standard has actually been reduced. Any individual sample or multi-sample average that exceeds the QAS, by any amount, is called "non-compliant" or "out of compliance" in this report. This differs from MSHA's traditional terminology, wherein such samples are referred to as "above the applicable standard" but not necessarily non-compliant. In the terminology adopted for this report, a sample or sample average that is above the QAS is called non-compliant but not necessarily citable. To be "citable," the individual or average concentration must exceed the QAS by at least a specified amount.

An individual sample is considered, in this report, to be out of compliance if the dust concentration measured in the sample exceeds the applicable QAS. However, because of random errors associated with the coal dust measurement process, a dust concentration as measured does not reveal with certainty the true dust concentration in the sample. In order to achieve a high level of confidence that a concentration actually exceeds the QAS, it is necessary to require that the dust concentration exceed the QAS by an amount (a "margin of error") calculated to achieve the desired confidence level. If several, say N, random measurements are made at the *same* true dust concentration, then averaging these N measurements permits a reduction of the error margin by a factor proportional to $\sqrt{N}$.

In order to insure, with a high degree of confidence, that dust levels are in fact above the QAS before issuing a citation, MSHA has adopted a policy of not issuing citations unless a specified margin of error has been exceeded. Table I-13 contains the values at which citable single-sample non-compliance determination were made during the SIP. Single-sample concentrations were citable only if they were measured *at or above* the listed values. Multi-sample averages were citable for non-compliance if the average (usually of five samples) was at least 0.1 mg/m^3 above the QAS. Since each individual sample is expressed to one decimal place, the average of five samples can take on values in increments of 0.02. Under current MSHA policy, however, an average value of 2.08, is not citable if the QAS is

Table I-13. Criteria for SIP single-sample non-compliance determinations.

Quartz-Adjusted Dust Standard (QAS)	Single-Sample Minimum Value to Cite Non-Compliance
0.5	0.7
0.6	0.8
0.7	0.9
0.8	1.1
0.9	1.2
1.0	1.3
1.1	1.4
1.2	1.5
1.3	1.7
1.4	1.8
1.5	1.9
1.6	2.0
1.7	2.1
1.8	2.3
1.9	2.4
2.0	2.5

2.0 mg/m^3. As explained above, the magnitude of this margin depends on the number of samples used to estimate the true dust concentration. If the estimate is made based on a single sample, then this amounts to an average across one measurement. Therefore, to achieve commensurate confidence levels, the margin for a single sample measurement should be $\sqrt{N}$ times the size of the margin based on an average of N samples. Conversely, if the margin required for achieving the desired confidence using a single sample is known, then the margin required when averaging over a sample of size N should be set to that quantity divided by $\sqrt{N}$.

This is **not** precisely what was done for the SIP, where citable no-compliance determinations were made based on both single samples and multi-sample averages. For a citable non-compliance determination based on the average of five samples, MSHA requires that the average be at least 0.1 mg/m^3 above the QAS. For a QAS at 2.0 mg/m^3, this policy constitutes an error factor of five percent. The corresponding error margin for a single-sample non-compliance determination is $0.1\sqrt{5} = 0.22$. Since individual sample measurements are truncated toward zero to one decimal place, the margin would in practice have to be set at 0.3 to maintain minimal commensurability with the multi-sample non-compliance criterion.

This implies that the single-sample citation threshold used for the SIP was actually more lenient than the threshold for 5-sample averages. In other words, a higher level of confidence was required for issuing a citation based on a single sample. The single-sample threshold was, in fact, calculated to achieve 99-percent confidence at slighty above 2.4 and then set at 2.5 to accommodate truncation of individual sample values. Leaving aside the justifiability of upward, rather than downward, adjustment for truncation, and assuming a single-sample citability threshold as low as 2.4 (for a QAS of 2.0), a commensurate threshold for citability based on a five-sample average would have been $2.0 + 0.4/\sqrt{5} = 2.18$.

The inconsistency in confidence levels between single and multi-sample citation criteria arises from MSHA's numerical truncation of both single and multi-sample values. MSHA truncates the calculated average of 5 values that have each already been truncated, thereby artificially reducing the "average" used for non-compliance determinations. This compensates to some extent, for the lower confidence level implicit in the multi-sample citation threshold.

D.2.2 SIP Sample Averages

Another important consideration with respect to SIP multi-sample citable non-compliance determinations is that the quantity being estimated by the SIP sample averages is ill-defined. Calculations of the reduction in margin of error required for determining non-compliance based on a multi-sample average assume that all samples going into the average represent replicated measurements of the same dust concentration. Even measurements taken on the DO in the same MMU normally fail to satisfy this assumption, unless they are taken simultaneously instead of on different shifts. The SIP averages are formed from simultaneous measurements, but they were collected at locations within the MMU having potentially quite different dust concentrations, Intake air samples were left out of the average because they would rather obviously bias it downward in an unmeaningful way. The same kind of bias, though to a lesser degree, arises when averaging dust samples for different occupations. The average is not a very good estimator of exposure at any of the individual work location that enter into it. Indeed, for work locations differing in dust concentration by more than a trivial amount, a set of five separate single samples is technically a more efficient estimator of dust concentration than a five-sample average taken over the differing environments. And since no attempt has been made to weight the individual sample concentrations according to how much of the physical MMU working area they represent, it is unclear just what the SIP sample average *does* estimate.

Regardless of where exactly the thresholds for single and multi-sample non-compliance determinations should be set, the standards as executed under SIP are not quite commensurate. Under the SIP criteria, there is a built-in numerical bias in favor of issuing fewer single-sample citations than would be consistent with the multi-sample criterion, if it were applied to several measurements of the same environment. On the other hand, the SIP sample averages were collected at different locations, and such averages cannot be expected to improve the reliability of estimates for the dustiest locations. One would expect the averaged results to be diluted by samples taken at the less dusty locations. Both of these considerations should be kept in mind when considering results of the single and multi-sample compliance determinations presented below.

D.2.3 Comparison of Single and Multi-Sample Citability Determinations

Table I-14 contains a tally of the number of SIP MMU's in which either the single or multi-sample citation criteria were met. Note that failure to meet the citation criteria does ***not*** necessarily mean that the MMU was in compliance with the standard, or even that the evidence favors such a presumption. It means only that a citation could not be issued with sufficient confidence using the specified citation criteria. An MMU, operating under a 2.0 mg/m^3, with four out of five of its samples at 2.4 mg/m^3 and the remaining sample at 0.8 mg/m^3 would not be cited as out of compliance under either of these criteria. Clearly, however, it should not be judged to be in compliance either.

Table I-14. SIP single and multi-sample citability counts, by mining system.

Mining System	Multi-Sample	Single-Sample	
		Not Citable	Citable
Longwall	Not Citable	63	8
	Citable	1	8
Continuous ≤20'	Not Citable	211	63
	Citable	0	49
Deep Cut > 20'	Not Citable	142	26
	Citable	0	10
Continuous, ? depth	Not Citable	18	1
	Citable	0	3
Conventional	Not Citable	43	12
	Citable	0	12
Other	Not Citable	36	6
	Citable	0	5

The single-sample non-compliance citability counts shown include intake air samples, but intake air samples are not included in the multi-sample averages or non-compliance citability counts. Among the 723 SIP MMU's analyzed, there were 5 for which no single sample determination could be made, either because the QAS was unspecified or no valid sample was obtained. There was one additional MMU whose only valid sample was an intake air sample. Of the 718 MMU's with valid single samples, 203 had at least one citable single sample. 88 of the 717 with valid multi-sample averages met or exceeded the citation

threshold for multi-sample averages (i.e., QAS + 0.1). In addition to the 203 MMU's that had at least one citable single sample, there was exactly one MMU not citable using the single-sample criterion but citable according to the multi-sample average. 84 of the 717 MMU's for which both a single-sample and a multi-sample compliance determination could be made were citable on both counts. Although far fewer of the MMU's were citable by the multi-sample criterion than by a single-sample, there is no reason to think this would have occurred if all samples making up the multi-sample average had been taken at the highest risk location.

Among the 629 MMU's not citable according to their multi-sample average, 13 of them had their DO sample, plus at least one other sample, above the QAS but below the value required for citation on a single sample. In other words, these 13 MMU's, none of which were citable based on their multi-sample average, had at least two samples -- one of which was the DO sample -- above the QAS but not high enough to be cited according to the single-sample citation criterion.

A total of 82 SIP MMU's had DO samples with dust concentrations above the QAS. Of these 82 DO samples, 47 had dust concentrations at or above the threshold value for single-sample citation. The remaining 35 cases consisted of samples above the QAS but not sufficiently high to warrant citation under the single-sample criterion.

To provide some indication of how the single- to multi-sample comparison might be affected by using averages made up of replicated samples on the designated high risk occupation, Table I-15 presents results of single and multi-sample compliance determinations, based on Mine Operator DO samples, for 684 SIP MMU's whose operator records were

Table I-15. Single and multi-sample citability counts at 684 SIP MMU's with comparable counts based on operator samples

NOTE: There are 723 MMUs for which SIP data were collected. Of these, there are 684 for which SIP DO dust concentration and operator DO dust concentration are both available. Average concentrations are "citable" if they are at least 0.1 mg/m³ above the quartz-adjusted standard. Single samples are "citable" if they are at or above the values given in Table I-13.

<u>Operator Samples at 684 SIP MMUs</u>

(for the first group of five samples determining compliance in the sampling cycle immediately prior to the SIP inspection)

74 = Number of instances in which the average DO concentration was citable.

195 = Number of instances in which the maximum DO concentration* was citable.

73 = Number of instances in which **both** the average DO concentration **and** the maximum DO concentration were citable.

196 = Number of instances in which **either** the average DO concentration was citable **or** the maximum DO concentration was citable. (196 = 74+195-73)

<u>SIP Single Samples at 684 SIP MMUs</u>

103 = Number of instances in which the DO sample was citable.

152 = Number of instances in which the maximum NDO sample was citable.

67 = Number of instances in which **both** the DO sample **and** the maximum NDO sample were citable.

188 = Number of instances in which **either** the DO sample **or** the maximum NDO sample were citable. (188 = 103+152-67)

<u>Average SIP Sample Concentrations (excluding intake air) at 684 SIP MMUs</u>

77 = Number of instances in which the average SIP sample was citable.

<u>Single and Average SIP Sample Concentrations at 684 SIP MMUs</u>

76 = Number of instances in which **both** the average SIP sample was citable **and** the maximum SIP concentration was citable.

189 = Number of instances in which **either** the average SIP concentration was citable **or** the maximum SIP concentration was citable. (189 = 188+90-89)

successfully identified. SIP compliance determinations for just these 684 MMU's are also presented for comparison. At 74 of the MMU's, the average of five DO samples was citable, while at approximately the same number (77) of these MMU's, the SIP average, taken over five different work locations, was citable. This comparison, however, could be misleading, since general dust conditions may have been different during operator and SIP sampling In particular, it leaves open the possibility that a higher SIP multi-sample non-compliance rate may have been observed if the SIP samples had all been taken on the DO.

The number of citable cases for both the operator and the SIP single-sample determinations are based on the maximum of a set of five samples. The SIP measurements may be regarded as five independent measurements of five different areas. For the operator data however, an adjustment in confidence level must be made to reflect the fact that a determination is being made based not on a single sample but on the maximum from a set of five samples. Since the single sample criteria in Table I-13 were designed to provide 97.5 percent confidence in determining non-compliance using a single sample, a determination based on the maximum in a set of five is made at a confidence level of $100(.975^5) = 88$ percent.

D.2.4 Average and Maximum SIP Dust Concentrations, Relative to Citability Threshold.

In Figure I-20, a histogram and cumulative frequency tabulation is presented showing, for the 717 SIP MMU's with a valid multi-sample average, the deviation of that average above or below the MMU's QAS. An average sample concentration below the QAS appears as a negative deviation. Although individual sample concentrations are always truncated to one decimal place, sample averages, and hence their deviations from a standard, can take on intermediate values. The histogram bars in Figure I-20 include all values up to and including the one specified. The bar labeled ".099", for example, includes all deviations above negative .001 but less than or equal to .099. A zero deviation would be counted in this interval. Deviations greater than .099 in Figure 20 begin at 0.1 and are citable according to

Deviation of Average Dust Concentration from Quartz-Adjusted Standard, m/m^3	SYMBOL	COUNT	MEAN	STD.DEV.
	X	717	-0.769	1.075

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

DIFF.	5 10 15 20 25 30 35 40 45 50 55 60	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
≤-2.001	+	0	0	0.0	0.0
≤-1.901	+	0	0	0.0	0.0
≤-1.801	+XXXXXXXXXXXXXXXXX	17	17	2.4	2.4
≤-1.701	+XXXXXXXXXXXXXXXXXXX	19	36	2.6	5.0
≤-1.601	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	31	67	4.3	9.3
≤-1.501	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	42	109	5.9	15.2
≤-1.401	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	48	157	6.7	21.9
≤-1.301	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	44	201	6.1	28.0
≤-1.201	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	53	254	7.4	35.4
≤-1.101	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	53	307	7.4	42.8
≤-1.001	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	44	351	6.1	49.0
≤-.901	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	50	401	7.0	55.9
≤-.801	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	40	441	5.6	61.5
≤-.701	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	37	478	5.2	66.7
≤-.601	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXX	29	507	4.0	70.7
≤-.501	+XXXXXXXXXXXXXXXXXXXXXXXXXXXX	28	535	3.9	74.6
≤-.401	+XXXXXXXXXXXXXXX	15	550	2.1	76.7
≤-.301	+XXXXXXXXXXXXXXX	15	565	2.1	78.8
≤-.201	+XXXXXXXXXXXXXXXXXX	18	583	2.5	81.3
≤-.101	+XXXXXXXXXXXXXX	14	597	2.0	83.3
≤-.001	+XXXXXXXXXXXXXXXXX	17	614	2.4	85.6
≤0.099	+XXXXXXXXXXXXXXX	15	629	2.1	87.7
≤0.199	+XXXXXXXXXXX	11	640	1.5	89.3
≤0.299	+XXXXXXXXXX	10	650	1.4	90.7
≤0.399	+XXXXXXXXXX	10	660	1.4	92.1
≤0.499	+XXXXXXX	7	667	1.0	93.0
≤0.599	+XXX	3	670	0.4	93.4
≤0.699	+XXXXXXXX	8	678	1.1	94.6
≤0.799	+XXXXXX	6	684	0.8	95.4
≤0.899	+XXX	3	687	0.4	95.8
≤0.999	+	0	687	0.0	95.8
≤1.099	+XXXXX	5	692	0.7	96.5
≤1.199	+X	1	693	0.1	96.7
≤1.299	+X	1	694	0.1	96.8
≤1.399	+XX	2	696	0.3	97.1
≤1.499	+X	1	697	0.1	97.2
≤1.599	+XX	2	699	0.3	97.5
≤1.699	+X	1	700	0.1	97.6
≤1.799	+XX	2	702	0.3	97.9
≤1.899	+X	1	703	0.1	98.0
≤1.999	+XX	2	705	0.3	98.3
≤2.099	+	0	705	0.0	98.3
≤2.199	+X	1	706	0.1	98.5
≤2.299	+X	1	707	0.1	98.6
≤2.399	+	0	707	0.0	98.6
≤2.499	+	0	707	0.0	98.6
≤2.599	+X	1	708	0.1	98.7
≤2.699	+	0	708	0.0	98.7
≤2.799	+X	1	709	0.1	98.9
≤2.899	+X	1	710	0.1	99.0
≤2.999	+	0	710	0.0	99.0
>2.999	+XXXXXXX	7	717	1.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60				

Figure I-20. Frequency distribution of SIP multi-sample average dust concentrations, relative to the quartz-adjusted dust standard.

the multi-sample average citation criterion. Since 87.7 percent of the deviations fall at or below .099, the remaining 12.3 percent must fall at or above 0.1 and therefore meet the multi-sample citation criterion. An additional 15 multi-sample averages, amounting to 2.1 percent of the total, were either exactly at the standard or deviated from it by less than 0.1 mg/m^3.

Figure I-21 describes the frequency distribution of the maximum SIP single samples, relative to the threshold above which they would be cited. Since dust concentrations for individual samples are truncated to one decimal place, each interval in the Figure I-21 histogram covers only one possible value. A value of zero in Figure I-21 indicates that the sample concentration was anywhere up to 0.1 mg/m^3 below the minimum value required for a single-sample citation. The histogram bars above zero represent citable cases. Since 72.6 percent of the maximum concentration samples are at or below zero, it follows that 27.4 percent of the SIP MMU's had at least one citable single sample. Since 78.6 percent of the maximum samples deviated from the QAS by an amount of 0.4 mg/m^3 or less, it follows that 21.4 percent of them were citable.

D.2.5 DO Compliance and Non-Compliance

D.2.5.1 Compliance Comparisons by Mining and Ventilation System

"Out of compliance" in this report means simply that a single sample or sample average is measured above the QAS -- not necessarily that it is citable. Because of truncation, a single sample concentration out of compliance actually must exceed the QAS by at least 0.1 mg/m^3. Comparisons in this subsection are based on compliance or non-compliance of the single SIP DO sample only.

```
                     SYMBOL   COUNT    MEAN     STD.DEV.
                       X       718    -0.177     2.169

             EACH SYMBOL REPRESENTS 1 OBSERVATION
DEVIATION ABOVE
OR BELOW CITATION                                              FREQUENCY PERCENTAGE
THRESHOLD   5   10   15   20   25   30   35   40   45   50   55   60   INT.  CUM.  INT.  CUM.
mg/m3    +----+----+----+----+----+----+----+----+----+----+----+----+
 -2.0    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                             35    35   4.9   4.9
 -1.9    +XXXXXXXXXXXXXXXXXXXXXXXXXX                                      26    61   3.6   8.5
 -1.8    +XXXXXX                                                           6    67   0.8   9.3
 -1.7    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                                32    99   4.5  13.8
 -1.6    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                     43   142   6.0  19.8
 -1.5    +X                                                                1   143   0.1  19.9
 -1.4    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                              34   177   4.7  24.7
 -1.3    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                  46   223   6.4  31.1
 -1.2    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                     43   266   6.0  37.0
 -1.1    +XXXXXXXX                                                         8   274   1.1  38.2
 -1.0    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                   45   319   6.3  44.4
  -.9    +XXXXXXXXXXXXXXXXXXXXXXX                                         23   342   3.2  47.6
  -.8    +XXXXXXXXX                                                        9   351   1.3  48.9
  -.7    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                        40   391   5.6  54.5
  -.6    +XXXXXXXXXXXXXXXXXX                                              18   409   2.5  57.0
  -.5    +XXXXXXXX                                                         8   417   1.1  58.1
  -.4    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXX                                   29   446   4.0  62.1
  -.3    +XXXXXXXXXXXXXXXXXXXXXXX                                         23   469   3.2  65.3
  -.2    +XXXXXXXXXXXXXXXXXXXXXXXX                                        24   493   3.3  68.7
  -.1    +XXXXX                                                            5   498   0.7  69.4
  0.0    +XXXXXXXXXXXXXXXXXXXXXXX                                         23   521   3.2  72.6
  0.1    +XXXXXXXXXXXXXXXXX                                               17   538   2.4  74.9
  0.2    +XXXXX                                                            5   543   0.7  75.6
  0.3    +XXXXXXXX                                                         8   551   1.1  76.7
  0.4    +XXXXXXXXXXXXX                                                   13   564   1.8  78.6
  0.5    +XXX                                                              3   567   0.4  79.0
  0.6    +XXXXXXXX                                                         8   575   1.1  80.1
  0.7    +XXXXXXXXXXXXXXX                                                 15   590   2.1  82.2
  0.8    +XX                                                               2   592   0.3  82.5
  0.9    +XXXXXXXXXXX                                                     11   603   1.5  84.0
  1.0    +XXXXXXXXXXX                                                     11   614   1.5  85.5
  1.1    +XXXXX                                                            5   619   0.7  86.2
  1.2    +                                                                 0   619   0.0  86.2
  1.3    +XXXXX                                                            5   624   0.7  86.9
  1.4    +XXXXXXXX                                                         8   632   1.1  88.0
  1.5    +                                                                 0   632   0.0  88.0
  1.6    +XXXXXX                                                           6   638   0.8  88.9
  1.7    +XXXX                                                             4   642   0.6  89.4
  1.8    +XXXX                                                             4   646   0.6  90.0
  1.9    +XXXX                                                             4   650   0.6  90.5
  2.0    +XXXXX                                                            5   655   0.7  91.2
  2.1    +XXX                                                              3   658   0.4  91.6
  2.2    +                                                                 0   658   0.0  91.6
  2.3    +XXXXXXXX                                                         8   666   1.1  92.8
  2.4    +XXXXX                                                            5   671   0.7  93.5
  2.5    +                                                                 0   671   0.0  93.5
  2.6    +                                                                 0   671   0.0  93.5
  2.7    +XXX                                                              3   674   0.4  93.9
  2.8    +                                                                 0   674   0.0  93.9
  2.9    +X                                                                1   675   0.1  94.0
  3.0    +X                                                                1   676   0.1  94.2
   >3    +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                      42   718   5.8 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+
            5   10   15   20   25   30   35   40   45   50   55   60
```

Figure I-21. Frequency distribution of maximum SIP dust concentration, relative to single-sample citation threshold.

Table I-16 displays the number and percentage of SIP DO samples measured as out of compliance, broken down by mining system and blowing or exhaust ventilation. A signifi-

Table I-16. SIP DO Non-Compliance by Mining and Ventilation System.

MINING SYSTEM	VENTILATION METHOD	NUMBER OF CASES: DUST COMPLIANCE IN	NUMBER OF CASES: DUST COMPLIANCE OUT	NUMBER OF CASES: TOTAL	PERCENTAGE: DUST COMPLIANCE IN	PERCENTAGE: DUST COMPLIANCE OUT	PERCENTAGE: TOTAL
Longwall	TOTAL	62	18	80	77.5	22.5	100.0
Contin-uous ≤20'	Blowing	25	12	37	67.6	32.4	100.0
	Exhaust	226	63	289	78.2	21.8	100.0
	Both	25	12	37	67.6	32.4	100.0
	???	4	3	7	57.1	42.9	100.0
	TOTAL	280	90	370	75.7	24.3	100.0
Conven-tional	Blowing	8	6	14	57.1	42.9	100.0
	Exhaust	31	12	43	72.1	27.9	100.0
	Both	9	1	10	90.0	10.0	100.0
	???	0	0	0	0.0	0.0	0.0
	TOTAL	48	19	67	71.6	28.4	100.0
Other	Blowing	15	2	17	88.2	11.8	100.0
	Exhaust	17	2	19	89.5	10.5	100.0
	Both	10	1	11	90.9	9.1	100.0
	???	1	0	1	100.0	0.0	100.0
	TOTAL	43	5	48	89.6	10.4	100.0
Deep Cut >20'	Blowing	73	13	86	84.9	15.1	100.0
	Exhaust	42	7	49	85.7	14.3	100.0
	Both	11	2	13	84.6	15.4	100.0
	???	0	0	0	0.0	0.0	0.0
	TOTAL	126	22	148	85.1	14.9	100.0

TOTAL OF THE OBSERVED FREQUENCY TABLE IS 713 CASES.
An additional 10 SIP cases were of unknown compliance.

cantly higher rate of non-compliance is found among blowing ventilation systems at Continuous (≤ 20 ft. cut) and Conventional MMU's than among their counterparts with exhausting ventilation. Deep Cut (> 20 ft.) Continuous MMU's show no significant difference in non-compliance rate between blowing and exhausting ventilation. The 15-percent rate of non-compliance at Deep Cut (> 20 ft.) MMU's, and the 10-percent rate at "other" MMU's are significantly below the non-compliance rates at Longwall, Continuous (≤ 20 ft. cut), and Conventional MMU's. Both Conventional MMU's (28 percent and Continuous MMU's (≤

20 ft. cut) have higher non-compliance rates than Longwall MMU's. Since all of the SIP longwall MMU's are at relatively large mines, it may be that this last comparison arises as an artifact of a systematic difference in SIP non-compliance rates at MMU's in different sized mines. Before reading too much into the lower rate of non-compliance during SIP inspection of longwalls, it is important to compare rates of non-compliance during SIP at mines of varying sizes.

D.2.5.2 Compliance Comparisons by Mine Size

As in the previous subsections, "out of compliance" is here defined to mean simply that a single sample or sample average is measured above the QAS -- not necessarily that it is citable. Because of truncation, a single sample out of compliance actually must exceed the QAS by at least 0.1 mg/m^3. Comparisons in this subsection are based on compliance or non-compliance of the single SIP DO sample only.

Since all the SIP longwall MMU's were at large mines, and since Deep Cut (> 20 ft) Continuous MMU's, which tend to be at large mines, had a lower non-compliance rate during the SIP than other continuous MMU's, inclusion of these MMU's in a size group comparison could bias the analysis. The present analysis, therefore, is restricted to Continuous MMU's with cut depths of 20 feet or less, conventional MMU's, and MMU's classified as "other."

For MMU's in these three categories, Table I-17 shows the number and percentage of MMU's in and out of compliance, broken down by size of mine. "Small" mines are defined as those with 1-50 employees, "medium" are those with 51-125 employees, and "large" are those with more than 125 employees. About 26 percent of SIP MMU's at either small or

Table I-17. SIP DO Non-compliance rates, by size of mine.

MINE SIZE	COMPLIANCE		
	Number of Cases		
	IN	OUT	TOTAL
Small	246	86	332
Medium	58	21	79
Large	67	7	74
TOTAL	371	114	485
	Percentage		
	IN	OUT	TOTAL
Small	74.1	25.9	100.0
Medium	73.4	26.6	100.0
Large	90.5	9.5	100.0
TOTAL	76.5	23.5	100.0

PEARSON CHISQUARE	9.598	2	0.0082
LIKELIHOOD-RATIO CHISQ.	11.289	2	0.0035
TEST FOR LINEAR TREND	6.973	1	0.0083

6 CASES HAD INCOMPLETE DATA.

medium sized mines were out of compliance. In contrast, only about ten percent of the MMU's at large mines were out of compliance. Although this latter figure is based on only 7 cases of non-compliance among 74 large mine MMU's, the difference in non-compliance rates is statistically significant at a confidence level of more than 99 percent ($\alpha < .01$). This does not mean that, at 99-percent confidence, the difference is as great as the one observed. Rather, it means, at 99 percent confidence, that there is a difference of some magnitude.

D.3 Voided Samples

The most common voiding criteria used for voided SIP and MIP dust samples are presented below, along with comparable data for recent mine operator and regular MSHA inspector samples. A table of codes identifying the reason for voiding a sample concentration is presented in Table ??? of Appendix B.

<u>Voided SIP Samples:</u>

The total number of SIP dust samples collected, including DO, NDO, DA, and intake air samples, was 4450. A total of 75 SIP samples were voided for the following reasons:

20 NDO samples were erroneously voided for production, leaving 55 (1.2% of all SIP samples) that were correctly voided. One of the 20 samples erroneously voided for production was coded as voided by the operator. These samples were used in analyses for this report.

31 of the 55 correctly voided samples 0.7% of all SIP samples) were voided for invalid or missing time.

10 of the 55 correctly voided samples (0.2% of all SIP samples) were voided for a malfunctioning pump.

5 of the 55 correctly voided samples (0.1% of all SIP samples) were voided for contamination, oversized particles, or breakage.

Although none of the samples were actually voided for insufficient coal production, 76 otherwise valid DO samples were taken on shifts with production at less than 50% of the mine operator's average for the previous bimonthly sampling period. These 76 samples (11% of all 723 SIP DO samples) would have been voided had they been submitted by a mine operator.

Voided MIP Samples:

A total of 717 MIP dust samples were collected. Of these, 66 (9%) were voided for the following reasons:

21 of the samples (3% of all the MIP samples) were voided due to insufficient coal production.

20 of the samples (3%) were voided as excess samples (i.e., they were received onto MSHA's dust data processing system after five valid samples had already been received for the operator's bimonthly sampling cycle and were not needed for abatement of a violation. These samples were all used in the analyses of this report.

5 of the samples (0.7%) were voided for various reasons by the mine operator.

3 of the samples (0.4%) were voided on account of oversized particles or contamination.

1 sample was voided for missing or invalid time, and 1 was voided for breakage.

1/1/1991 - 12/31/91 Voided Operator Samples

A total of 78,995 underground mine operator samples were submitted in 1991. 10,085 of these 10,085 (13 percent) were voided. The most frequently cited void codes were:

3,329 (4% of all underground samples) were voided as excess samples.

1,712 (2%) were voided for insufficient production.

1,373 (2%) were voided at the mine operator's discretion ("operator voids").

638 (0.8%) were voided for contamination, oversized particles, or breakage.

531 (0.7%) were voided for missing or invalid time.

DO samples accounted for 59,488 of the 1991 underground operator samples. Of these, 1,705 (3 percent) were voided for production.

1/1/91 - December 19, 1991 Inspector Samples

A total of 16,276 MSHA inspector dust samples were collected at underground mines during 1991. 1,377 (8 percent) of these were voided. The most frequently cited void codes were:

638 (4% of all samples) were voided for insufficient production.

427 (3%) were voided for insufficient time.

111 (0.7% were voided for oversized particles or contamination.

10 samples were voided for breakage.

There were 2,566 inspector DO samples taken underground in 1991, and 75 of these (3 percent) were voided for insufficient production.

__Conclusion__

SIP dust samples were voided for missing, invalid, or insufficient time at approximately the same rate as operator samples. For the combined categories of contamination, oversized particles, and breakage SIP samples were voided at a significantly lower rate than the operator samples. However, if SIP DO samples had been subject to the same shift production criterion as operator samples (i.e., at least 50 percent of average production during the most recent sampling cycle), they would have been voided for insufficient coal production in 76 cases, amounting to 10.5 percent of all the SIP DO samples. At a confidence level of more than 99.99 percent, this is a significantly greater rate of invalid shift productions than the 3.0-percent production void rate observed for the 709 MIP DO samples (MPVR), the 1991 production void rate of 2.9 percent observed for regular MSHA inspector DO samples (IPVR), and the 1991 production void rate for operator DO samples (OPVR), which was 2.8 percent. MPVR, IPVR, and OPVR, on the other hand, form a group essentially equivalent production void rates, with no statistically significant difference among them. Compared to operator and regular inspector sampling, the SIP inspections coincided with unusually low production shifts at an unusually large group of MMU's.

E. Production and Dust Controls

This section contains only a description of data obtained through the SIP and MIP inspections, with production data obtained from the operator bimonthly sampling program and routine MSHA dust inspections used as a basis for comparison. An analysis of relationships between production, dust controls, dust concentrations, and compliance is presented in Section IV. A comprehensive tabulation of summary statistics on SIP and MIP planned and observed dust controls is introduced in Section E.3 and provided in Appendices A7 and A8.

Section E.1 presents cumulative frequency distributions of various production ratios for MMU's of all kinds grouped together. By expressing observed MMU shift production as a percentage of other production figures *for the same MMU,* the shift production values for all MMU's are standardized to comparable units (i.e., percentages). In section E.2, estimates are given of the deviation from normal production observed during SIP, MIP, and operator sampling. Since this deviation is expressed in tons, and production rates vary widely across systems of coal mining, it will be necessary to provide separate estimates for each major mining system category.

Definitions of several terms used in both subsections are as follows:

"SIP_Prod" is tonnage mined during the SIP dust sampling shift, as determined by the SIP inspector.

"C_9_Prod" is maximum shift tonnage produced at the MMU during the previous bimonthly sampling period, as determined by the SIP inspector from mine records. It refers to maximum production over all shifts during the bimonthly period, not just to production during sampling shifts.

"C10_Prod" is average shift tonnage covering the same bimonthly period as C_9_Prod, for production shifts when dust samples were not being collected at the MMU. C10_Prod was determined by the SIP inspector from mine records.

"A1C_Prod" is shift tonnage recorded by the MSHA inspector for the most recent MSHA BAB inspection prior to the SIP inspection.

"Op_Prod" is average shift tonnage as reported by the mine operator in conjunction with the most recent five valid operator dust samples in the sampling period prior to the SIP inspection.

"MIP_Prod" is tonnage mined during the MIP dust sampling shift, as determined by the MIP inspector.

"OpAv_Prd" is average shift tonnage as reported by the mine operator in conjunction with the most recent five valid operator dust samples in the sampling period prior to the MIP inspection.

"OpMax_Prd" is maximum shift tonnage as reported by the mine operator in conjunction with the most recent five valid operator dust samples in the sampling period prior to the MIP inspection.

The ratio between any two of the foregoing quantities is designated with a colon and expressed as a percentage. SIP_Prod:C10_Prod, for example, refers to SIP_Prod as a percentage of C10_Prod and should quantify the percentage of normal, non-sampling, MMU shift tonnage mined during the SIP sampling shift. All shift production units are presumed to be raw (run-of-mine) tons of coal.

E.1 Sampling Shift Production as a Percentage of the MMU Norm

Figure I-22 depicts the relative cumulative frequency distribution of the observed SIP shift production (SIP_Prod) expressed as a percentage of normal shift production (C10_Prod), of maximum shift production (C_9_Prod), and of shift production observed during the most recent MSHA BAB inspection prior to the SIP visit (A1C_Prod). The vertical axis represents the percentage of SIP MMU's for which the specified ratio was less than or equal to any point along the horizontal axis. The curve for SIP_Prod:C10_Prod, for example, shows that during the SIP inspection, about 70 percent of the MMU's mined less than 100 percent of their normal, non-dust-sampling shift production, and about 20 percent of the MMU's mined

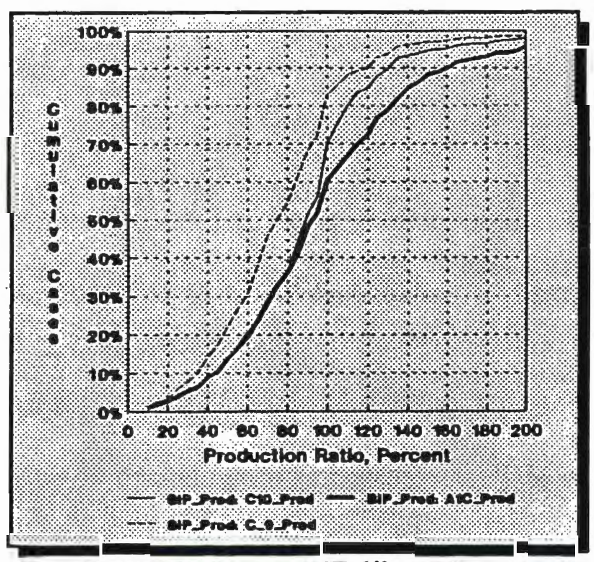


Figure I-22. Cumulative frequency of SIP shift production, expressed as percentage of average normal, maximum normal, and previous BAB shift production.

less than 60 percent. The curve for SIP_Prod:A1C_Prod shows that at about 60 percent of the MMU's, SIP shift production fell below production during the previous BAB inspection. The curve representing SIP_Prod:C_9_Prod indicates that, according to data provided by the SIP inspector, nearly 20 percent of the SIP MMU's mined more tonnage during their SIP inspection than their maximum tonnage over the previous bimonthly period. About 30 percent of the MMU's, on the other hand mined less than 60 percent of their production maximum.

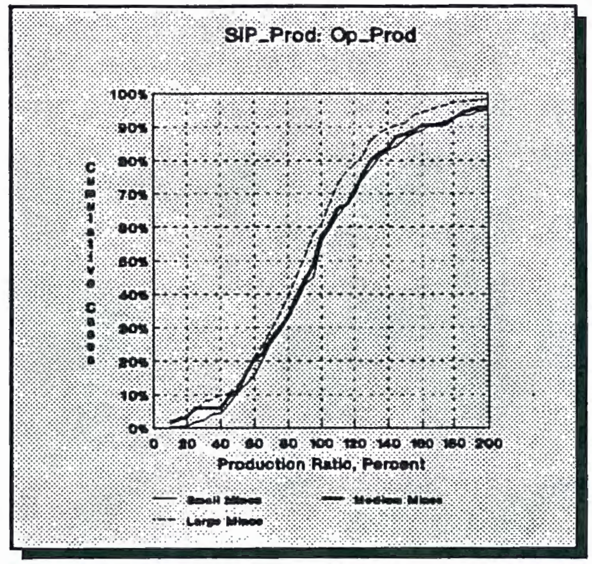


Figure I-23. Cumulative frequency of SIP shift production, expressed as a percentage of previous operator average dust sampling shift production, by mine size.

Figure I-23 shows SIP production as a percentage of average production during the previous cycle of operator dust sampling shifts (Op_Prod) and breaks the distribution down by small, medium, and large mines. Among large mines, a slightly greater percentage of MMU's were below operator sampling production levels during the SIP inspection than what was found among small and medium mines. Approximately 60 percent of MMU's at the small SIP mines had SIP shift production below average operator sampling production.

Figures I-24 and I-25 present production data for monitored shifts at the MIP MMU's, expressed as a percentage of either average or maximum production during the previous bimonthly cycle of operator sampling shifts (OpAv_Prd and OpMax_Prd, respectively). Inspectors did not collect data on average or maximum non-sampling shift production during the MIP inspections, so analogues of C_9_Prod and C10_Prod are not available for the MIP analysis. Although only about five percent of the MIP shift productions fall

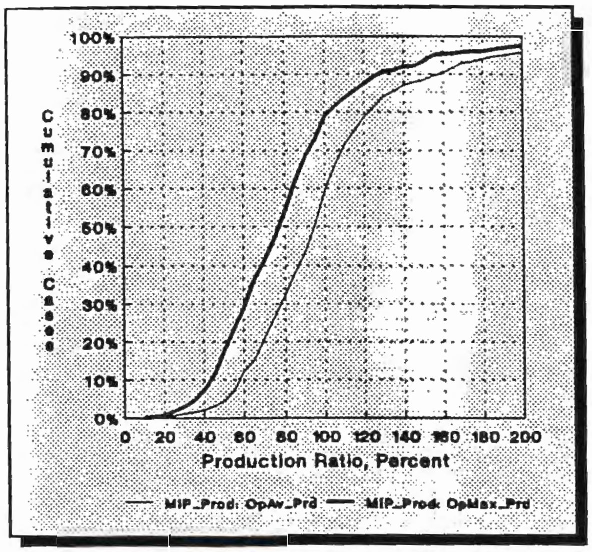


Figure I-24. Cumulative frequency distribution of MIP shift production, expressed as percentage of average and maximum operator sampling shift production.

below 50 percent of OpAvPrd, more than 60 percent of them fall below 100 percent of OpAv_Prd. Because of the number of MMU's, this is a statistically significant departure from the expected 50 percent ($\alpha < .01$). The practical significance of this seemingly minor statistical aberration stems from the fact that each sampling cycle's shift production requirement is set at 50 percent of average production over the previous cycle's dust sampling shifts. If MIP shift production is representative of MIP production over the entire concurrent sampling cycle[§], then for these 60 percent of MMU's, their shift production requirement during the *next* sampling cycle will be reduced from the current requirement. Although the requirement will be increased for forty percent of the MMU's, a ratio of sixty percent reductions to forty percent increases could, over time, render the production requirement meaningless for many MMU's. Figure I-24 also shows that more than five percent of the MIP MMU's sampled at shift production levels between 50 and 60 percent of their previous sampling production average. These dust samples are valid under the current criteria, and all five samples of the current cycle could validly be collected at this level of production. For an MMU taking all five samples at 60 percent of OpAv_Prd, the minimum production requirement for the next cycle will be set at

§ i.e., if the average shift production, taken over all MIP MMU's during their MIP visit, were approximately equal to the average shift production, taken over all MIP MMU's over all 5 shifts of the sampling cycle that includes the MIP shift. Under the null hypothesis of no special modification to production during the MIP visit, this is what would be expected, on average.

30 percent (i.e., 50 percent of 60 percent) of the current requirement. Figure I-25 illustrates that lower than average MIP production tended to be especially prevalent among large mines, with nearly 70 percent of the large-mine MMU's falling below their previous average sampling shift production. This is a significantly higher percentage than what was observed in Figure I-22 for large-mine SIP MMU's, relative to average non-sampling shift production (C10_Prod).

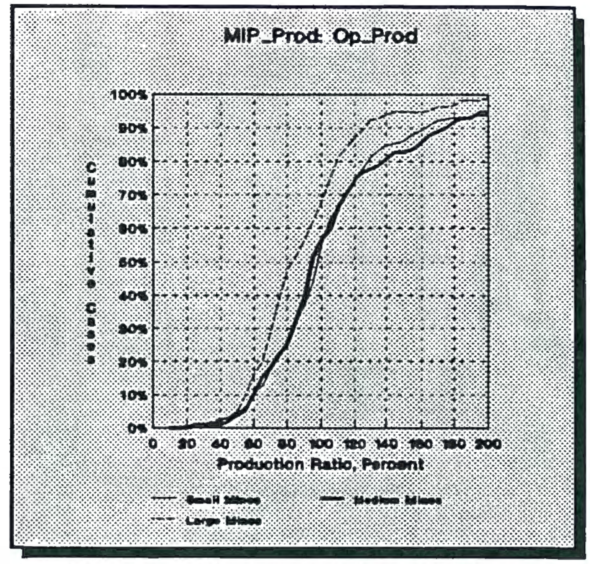


Figure I-25. Cumulative frequency distribution of MIP shift production, expressed as percentage of average operator sampling production, by size of mine.

To put the MIP results in better perspective, it is necessary to examine the ratio of Op_Prod to C10_Prod. From that, and the MIP_Prod:Op_Prod ratios of Figures I-24 and I-25, a rough estimate can be formed, by multiplication, of MIP_Prod:C10_Prod, even though C10_Prod was not obtained during the MIP visitations.

Figures I-26 and I-27 show, for the SIP mines, the cumulative frequency distribution of average operator sampling shift production (Op_Prod), expressed as a percentage of average (C10_Prod) and maximum (C9_Prod) non-sampling shift production. Figure 27 breaks the distribution of Op_Prod:C10_Prod down further by size of mine and indicates that reduced production during operator sampling shifts, as compared to average non-sampling shift production, is slightly less prevalent and extensive at large mines than at small and medium mines. What Figure 26 shows, for example, is that at about 10 percent of the SIP MMUs surveyed, average production during the most recent cycle of dust sampling shifts (OP_Prod, as reported by the mine operator) was less than 60 percent of average production

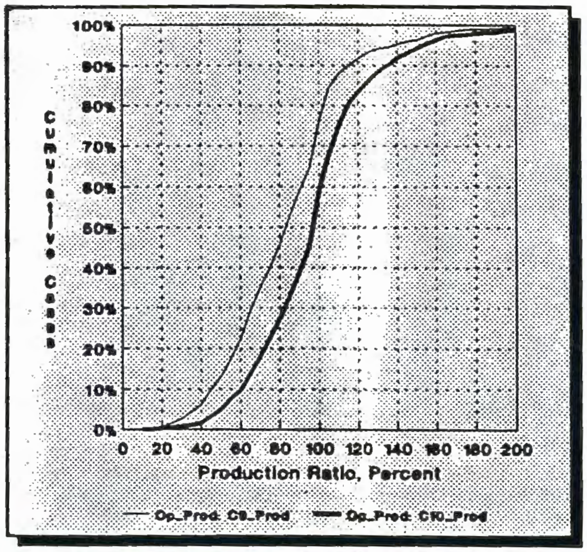


Figure I-26. Cumulative frequency distribution of Operator sample shift production (Op_Prod), expressed as a percentage of average (C10_Prod) and maximum (C9_Prod) non-sampling shift production.

during non-sampling shifts (C10_Prod, as determined by the SIP inspector). Since the production requirement for an individual sample permits production as low as 50 percent of the previous cycle's sampling shift average, this means that under the current definition, at 10 percent of the SIP MMUs, dust samples could validly be collected on shifts with less than 30 percent (50 percent of 60 percent) of average non-sampling shift production. There were two SIP MMUs whose average sampling shift production was approximately 30 percent of average non-sampling shift production. At these MMUs, an operator dust sample is considered valid under the current definition if it is collected on a shift with production of at least 15 percent of the non-sampling shift average.

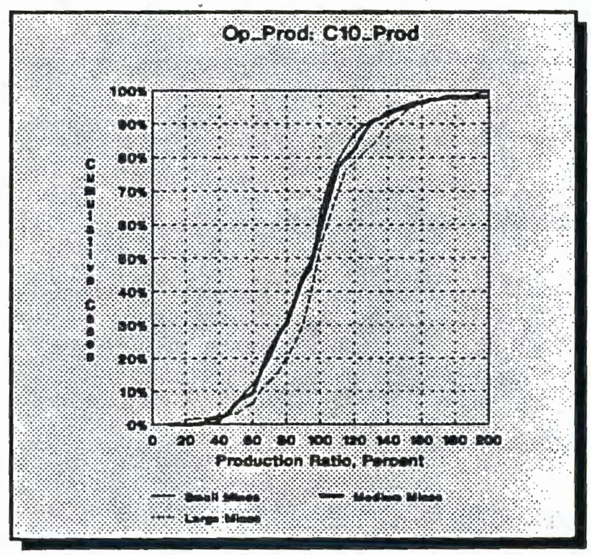


Figure I-27. Cumulative frequency distribution of operator average sampling shift production expressed as a percentage of average non-sampling shift production, by size of mine.

The median Op_Prod:C10_Prod ratio, according to Figure I-26, is approximately 96 percent. Multiplying this by the median MIP_Prod:OpAv_Prd ratio of 95 percent from Figure I-24 yields a rough estimate of 91 percent for the average MIP_Prod:C10_Prod. This is approximately equal to the median SIP_Prod:C10_Prod ratio of about 89 percent shown in Figure I-22.

E.2 Differences between Sampling Shift Tonnages and MMU Production Norms

Table I-18 contains summary statistics, by mining system, on the differences between tonnages as assessed by SIP_Prod, C10_Prod, Op_Prod, and A1C_Prod. Upper and lower

Table I-18. Differences between SIP sample shift tonnages and MMU production norms, by mining system.

Variable	Mining System	N	Min. Diff.	Max. Diff.	Mean Diff.	Std. Error	Std. Dev.	Upper Limit	Lower Limit	α
	Longwall	76	-5000	2500	-586	165	1442	-257	-914	***
SIP_Prod	Continuous ≤ 20'	347	-2544	612	-92	14	258	-65	-120	***
minus	Deep Cut > 20'	145	-1700	494	-121	24	291	-73	-168	***
C10_Prod	Conventional	68	-440	324	-59	14	114	-31	-86	***
	Other	48	-75	80	-3.4	3.4	24	3.4	-10.3	
	Longwall	78	-4403	2710	-545	148	1311	-250	-841	***
SIP_Prod	Continuous ≤ 20'	356	-780	580	-22	10	198	-1	-42	**
minus	Deep Cut > 20'	148	-718	590	-48	22	266	-5	-91	**
Op_Prod	Conventional	68	-472	333	-71	18	147	-36	-107	***
	Other	45	-91	93	0.8	4.5	30	10.0	-8.3	
	Longwall	76	-2253	2346	-21	102	885	181	-222	
OP_Prod	Continuous ≤ 20'	338	-2812	409	-72	14	266	-43	-100	***
minus	Deep Cut > 20'	143	-1630	461	-71	20	236	-32	-110	***
C10_Prod	Conventional	66	-248	397	14	14	112	41	-14	
	Other	45	-75	60	-4.6	3.1	21	1.7	-11.0	
	Longwall	70	-3700	2479	-286	153	1278	19	-591	*
SIP_Prod	Continuous ≤ 20'	302	-3140	1050	-54	16	281	-22	-86	***
minus	Deep Cut > 20'	120	-1871	962	-51	36	392	20	-121	
A1C_Prod	Conventional	61	-563	158	-58	18	142	-22	-94	***
	Other	42	-75	80	0.7	4.4	29	9.7	-8.3	
	Longwall	69	-3600	2732	-251	132	1100	13	-515	*
A1C_Prod	Continuous ≤ 20'	286	-3354	3140	-30	21	357	12	-71	
minus	Deep Cut > 20'	117	-1908	1741	-85	40	425	-8	-163	**
C10_Prod	Conventional	59	-311	323	-3	15	112	26	-32	
	Other	42	-80	55	-2.9	3.1	20	3.4	-9.3	

α denotes probability that a difference of the observed magnitude would be found if there were in fact no difference, based on paired T-test. Blank signifies $\alpha > .1$; *, **, and *** signify differences at the 90-percent, 95-percent, or 99-percent confidence levels, respectively. Upper and Lower Limits define a 95-percent confidence interval for the mean difference.

95-percent confidence limits are also provided for each estimated mean difference. On the average, for example, longwalls during their SIP sampling shift fell 586 tons short of their C10 production. This observed deficiency, relative to C10 production, implies a systematic reduction -- i.e., one that is not attributable to chance variations -- of 586 ± 165 tons. At 95-percent confidence, it can be said that longwall production was systematically reduced during the SIP sampling shift by an average amount somewhere between 257 and 914 tons, as compared to average non-sampling shift production. Similarly, deep cut continuous mines reduced their production by somewhere between 73 and 168 tons. The observed shortfalls in SIP shift production are statistically significant -- i.e., the systematic reductions can be said with confidence to be greater than zero -- for all mining systems except "other."

For longwalls, the difference between SIP shift production and average operator sampling production (Op_Prod) is nearly as great, on average, as the shortfall compared to C10 production. This is because there is no statistically significant difference, among longwalls, between Op_Prod and C10_Prod. For longwalls, there is no evidence that production is reduced during operator sampling as compared to non-sampling shifts. Since longwalls tend to be at larger mines, this finding is consistent with Figure 27, which shows that for large SIP mines, the median OP_prod was right at 100 percent of C10_Prod. There appears, however, to be a substantive and statistically significant reduction of 251 ± 132 tons during regular MSHA BAB inspections, and this reduction was more than doubled during the SIP inspection.

A similar pattern is evident for both deep cut and regular continuous mining MMU's, except that at these MMU's, shift production during operator sampling (OP_Prod) is reduced substantively and with statistical significance below C10 production. The average reduction at both deep cut and continuous MMU's is about 71 tons. Furthermore (not shown in Table I-18), OP_Prod is at least 141 tons below C10_Prod at 25 percent of the deep cut MMU's and at least 340 tons below at 10 percent of them. Similarly, at regular continuous MMU's, the 25th and 10th percentiles for the shortfall are 125 tons and 273 tons, respectively. A reduction in production during regular MSHA BAB inspections is also evident, with a larger reduction during the SIP inspection. At Deep Cut MMU's, there is less of a difference than at regular continuous MMU's between SIP_Prod and A1C_Prod, but this is because production has already been reduced by a greater amount during BAB inspections relative to normal, non-sampling shift production.

A potential weakness of the analysis presented in Table I-18 is that it relies on the SIP inspectors' determinations of C10 production, and this determination was not carried out in exactly the same way at all MMU's. In some cases the inspector obtained non-sampling shift production averages by direct examination of mine records, but in other cases the inspector relied on mine management to simply provide a number verbally with no documentation. The inspector did, however, record how the average was obtained (see item 27, Section 2.4 of Appendix B). To check whether the results of Table I-18 depend heavily on the method with which C10_Prod was obtained, the SIP_Prod - C10_Prod *differences* were divided into two groups for each mining system: those for which C10 was determined by direct examination of production records, and those for which C10 was provided without supporting documentation by mine management. To circumvent potential bias arising from an unequitable distribution of normal production values in these two groups, the frequency distribution of *differences* was then analyzed. For longwalls, there is no statistically significant difference between the two groups, but this may merely reflect the relatively small numbers (54 and 22) of MMU's with the necessary data element available for comparison. For both deep cut and continuous mining MMU's there is a small but statistically significant difference of about 10 tons between the two groups. C10 Production tends to be slightly larger at MMU's where it was provided verbally by mine management. The tendency is too small to have appreciable impact on the results shown in Table I-18.

E.3 Dust Controls

Table I-20. DO Dust Concentration, shift production, and key dust controls observed for SIP continuous MMU's, by depth of cut, blowing or exhausting ventilation, and compliance with the quartz-adjusted dust standard.

Cut Depth		DO Conc. mg/m^3	SIP Prod. tons	Number Water Jets	Av.Pres. psi	Face Air cfm	MeanEnt fpm	LastDXcut cfm	Scrubber cfm	LineCrtn. ft
Exhausting Ventilation										
	Avg. IN	0.86	381	25	91	8440	106	24,913	4137	15.8
	s.e.	.033	14.2	0.6	3.6	447	4.6	1,056	682	0.41
	N	213	213	212	210	208	193	210	16	202
≤20'										
	Avg OUT	3.61	410	24	81	6245	96	21,789	3100	16.7
	s.e.	.337	22.7	1.5	5.4	406	8.2	1,301	3100	.61
	N	63	63	61	59	62	62	62	2	62
	Avg. IN	0.83	559	29	116	10,516	102	28,664	5330	34.7
	s.e.	.066	46.7	2.1	11.7	1,506	11.8	2,855	788	2.32
>20	N	42	42	42	41	42	35	42	16	38
	Avg. OUT	2.84	731	28	106	13,099	117	28,487	5550	41.5
	s.e	.356	248	4.2	14.2	4,327	19.3	4,467	550	3.86
	N	7	7	7	7	7	6	7	2	6
Blowing Ventilation										
	Avg. IN	1.06	445	26	94	7037	90	24,175	5772	21.5
	s.e.	.085	52.5	2.2	9.4	459	11.3	1,906	535	1.36
	N	23	23	23	23	21	4	22	18	22
≤20'										
	Avg OUT	4.26	614	25	89	6208	78	22,734	5344	22.2
	s.e.	.749	116	3.3	12.7	500	17.5	2,606	498	1.39
	N	11	11	11	11	11	3	11	8	11
	Avg. IN	1.01	716	30	98	6977	271	19,516	5459	33.6
	s.e.	.055	42.7	1.7	5.3	315	98.8	946	174	1.62
>20'	N	73	73	73	73	73	5	71	68	71
	Avg. OUT	2.26	703	35	92	6506	---	20,307	5098	37.4
	s.e.	.124	88.1	6.3	10.4	504	---	2,162	385	3.28
	N	13	13	13	13	12	0	12	12	13

Table I-19. DO dust concentration, shift production, and key ventilation controls observed for SIP longwall MMU's, by compliance with the quartz-adjusted dust standard.

DO Dust Compliance		DO Conc. mg/m^3	SIP Prod. tons	Intake cfm	Tailgate fpm	Tailgate cfm
	Mean	1.17	2164	67,017	496	40,334
IN	Std.Err.	.053	166	7,238	37	4,550
	N	62	62	57	59	28
	Mean	2.97	3052	54,144	302	29,022
OUT	Std.Err.	.342	338	8,554	28	2131
	N	18	18	18	18	13

Table I-19 summarizes, for SIP longwalls grouped according to compliance or non-compliance with the QAS, averages of some key ventilation observations recorded during the SIP inspection. A similar summary, including additional information on the observed number of water jets, average pressure per jet, and length of line curtain, is provided for SIP continuous mining units in Table I-20, broken out by depth of cut and blowing or exhaust ventilation along with compliance or non-compliance with the QAS. Similar data was recorded during the MIP visits. In both tables, each of the ventilation variables is derived by averaging together up to two air measurements recorded by the SIP inspector. No statistically significant difference was found between the first and second air measurements.

A more comprehensive listing of summary statistics for the SIP and MIP MMU's, including data on dust control plan (DCP) requirements and ratios of the observed dust control values to values specified in the DCP may be found in Appendices A7 and A8, respectively. Each appendix contains a separate tabulation for longwall MMU's and non-longwall MMU's.

F. SIP-MIP Comparison for MMU's Included in Both

There are a total of 306 cases in which a SIP MMU was also monitored during operator DO sampling. Fourteen of these cases involved a second MIP visit to an MMU already included, leaving 292 unique MMU's in both programs.

F.1 Dust Concentrations and Shift Production

There were 28 longwall MMU's included in both SIP and MIP, and 21 of these had valid DO dust samples collected in both programs. Although the average dust concentration was higher for the MIP samples, the difference is not statistically significant and is attributable to just four MMU's. Production was not signicantly different, on average, for either all 28 MMU's or for those 21 with valid dust samples.

For non-longwall MMU's at medium and large mines, SIP DO concentrations also do not tend to differ significantly from the matching monitored observation. At small mines (1 - 50 employees), however, the monitored DO dust concentration tends to fall below the corresponding SIP concentration, by an average of 0.7 mg/m^3. This disparity remains statistically significant even when DO dust concentration is adjusted for differences in production and logarithms are taken so as to reduce the impact of unusual cases.

At the same time, for SIP-MIP MMU's other than longwalls, shift production tends to be slightly higher during the MIP visit than during the SIP inspection. This tendency cuts across small, medium, and large mines: although the tendency itself is statistically significant, there is no correlation with mine size for this effect.

The combination of lower MIP than SIP dust concentrations at small mines, together with slightly higher shift productions at mines of any size, results in a substantial, statistically significant difference in dust concentration per unit production at mines in the 1 - 50 employee group. For MMU's at mines in this size range, the median dust concentration measured per unit production is approximately 60 percent greater during the SIP inspection than during the MIP visit. A less pronounced affect, but in the same direction, is evident at mines in the 51 - 125 employee size group. No such effect is apparent at larger mines.

Among MMU's included in both the SIP and MIP programs, dust concentrations tended to be higher during SIP inspections than during monitored operator sampling shifts, except at mines with more than 125 employees. Due to wide variability, statistical significance of the observed difference was due largely to the effect at relatively small mines, but on average, SIP dust concentrations were higher than their MIP counterparts at mines in the 50 - 125 employee size group as well. At the same time, except at longwalls, shift production tended to be greater during MIP sampling than during SIP inspections for mines of all sizes. The two effects, taken together, result in substantially greater dust-to-tonnage ratios observed during SIP inspections than during monitored operator sampling, except at large mines. (All the longwalls and nearly all the deep cut MMU's occurred at large mines.)

F.2 Dust Controls

With two exceptions, no statistically significant differences were found between dust control measures in effect during the SIP and MIP visits. The two exceptions are mean entry air velocity at non-longwall MMU's and the number of operational water sprays. Mean entry air velocity is systematically higher during the SIP inspections by 12 $\pm$ 5 fpm. Mean entry air velocity is higher during the SIP inspection than during MIP visitation of the same MMU in 94 out of 168 cases with nonzero differences -- a subtle but statistically significant

($\alpha < .05$) deviation from the expected 50 percent. On average, approximately two additional water sprays were operational during the SIP inspections, as compared to MIP.

What differences were found relating to dust controls in place during SIP and MIP were in the direction of more dust control during the SIP inspections. In particular, there was some indication of some increased or enhanced ventilation during the SIP. This has the effect of further increasing, at fixed ventilation levels, the SIP dust-to-tonnage ratio relative to a comparable MIP-derived ratio.

II. Comparison of Sampling Programs

A. SIP Dust Concentrations Compared to Previous Operator Data

A.1 Data and Methods

Besides SIP sample dust concentrations and operator compliance sample dust concentrations from POPERAT, information used in the present analysis includes: (1) mine size (number of employees), (2) production tonnage achieved on the SIP sample shift and on each of the operator compliance samples shifts, and (3) the quartz-adjusted dust standard applicable to that particular MMU or designated area.

There was sufficient information for reasonably reliable analysis of sample data for four designated occupations: continuous miner operators, cutting machine operators, hand loaders, and shear/plow operators; and for designated area samples (roofbolters). The quantity of information on continuous miners permitted a detailed breakdown by mine size. Two mine size groupings were used: a fine breakdown consisting of nine groups (1 - 14, 15 - 24, 25 - 34, 35 - 49, 50 - 74, 75 - 124, 125 - 224, 225 - 334, 335 - 999), and a coarser breakdown consisting of two groups (1 - 124, 125 - 999). The rationale behind the first breakdown was to choose groups as equal in size as possible, allowing for reasonable cut points. The second grouping was arrived at after the results had been seen from using the first breakdown. It was felt to be an adequate reflection of a mine size effect. The designated area samples were analyzed in four groups (1 - 24, 25 - 49, 50 - 124, 125 - 999)

Natural logarithms were taken on the data in order to make the distributions of the derived variables of interest more symmetrical, and to stabilize the variances. Differences in the log(means) were exponentiated to obtain ratios of the geometric means. All further discussion of differences refers to differences in the log transformed data and not to the raw data.

Four variables (c1 - c4) representing comparisons (ratios) between the SIP sample and operator data for the same mining unit were employed in the analysis. The first variable was based on the mean of the logs of the five operator samples taken closest in time to the SIP sample (c1). The second and third variables were consisted of the means of the logs of the five samples from the second and third most recent operator sampling cycle, respectively (c2 and c3). The fourth variable consisted of the ratio between the SIP sample and a single sample from the most recent operator sampling cycle, the sample being selected from the day when production was most similar to that for the SIP sample. Figure A1 provides further information on how c1 - c4 were derived. In order to be sure that differences in production were not responsible for the observed differences in dust concentration, an analysis of covariance was undertaken on the log(dust concentration differences) allowing for log(production differences).

Analysis was also undertaken on the percentages of occasions the sections or faces were out of compliance with regard to the Quartz-Adjusted Dust Standard (QAS) in force for that unit. The percentages for the SIP data were compared with those obtained on the sample matched on production. A matched chi-square (McNemar) test was undertaken on the frequencies.

Designated area sample data were analyzed using the equivalent to comparison c1 for the designated occupation data. In actuality, however, most of the data for the area samples came from the first of the five days of sampling. Because of this, the comparison of the non-compliance rates was based on the single operator samples from day one only.

Since low weight gain (LWG) samples have been found to occur quite frequently among those supplied by operators (see Section III of the present report), an analysis was made of their contribution to the SIP versus operator differences. In this, all samples having concentrations less than 0.3 mg/m^3 in either the operator or MIP data were deleted, and the analysis repeated. This rejection criterion was adopted for convenience, and may have resulted in the exclusion of samples having genuinely valid low dust concentrations. However, no better approach seemed possible, there being no available way to tell fraudulently low samples from those occurring naturally.

A.2 Results

The results are presented in eight parts: A.2.1 Data description; A.2.2 Comparison of dust concentrations - continuous miners; A.2.3 Non-compliance rates - continuous miners; A.2.4 Comparison of dust concentrations - other designated occupations; A.2.5 Non-compliance rates - other designated occupations; A.2.6 Comparison of dust concentrations - designated area samples; A.2.7 Non-compliance rates - designated area samples; A.2.8 Influence of low weight gain samples.

A.2.1 Data Description

Table A1 gives a breakdown of the data available for the SIP - most recent sampling cycle mean (c1) by occupation and mine size. (Very similar numbers were obtained for c2 - c4) It can be seen that continuous miner operator samples form the bulk of the data, and are distributed in large numbers in both mine size groups. In contrast, cutting machine operator samples and hand loader samples were found almost exclusively in the smaller mines. Almost all the shear/plow operator samples were in the larger mine group. The majority of the roofbolter samples (156/197) were concentrated in the small to medium mines.

A.2.2 Dust Concentration Differences - Continuous Miners

A.2.2.1 Most Recent Cycle of Operator Data

Arithmetic mean values of the SIP and most recent operator dust concentrations are given in Table A2 for continuous miners, by mine size group. A plot of the differences in the natural logarithmic dust concentrations, with the means for each mine size group connected, is shown in Figure A2. It is seen that the SIP samples tended to be greater than those submitted by operators for mines employing less than about 125 miners. Among the larger mines, no such effect is apparent. Paired t-tests on the differences within each mine size group reveal that random variation was unlikely to be the explanation for the size of the ratios in most of the smaller mine size groups (Table A3).

Arithmetic mean levels of production for SIP and most recent operator are also shown in Table A2. In the majority of mine size groups production was generally lower when the SIP sample was taken.

A.2.2.2 Adjustment for Production Differences

In an attempt to adjust for production differences, an analysis of covariance was conducted on the concentration differences allowing for differences in production. The results of this are shown in Table A3, which gives the unadjusted and adjusted ratios of geometric mean dust concentrations after allowing for production differences. Overall, allowing for production did not affect the conclusions drawn from the unadjusted data: viz., among small to medium mines the SIP samples were systematically greater in dust concentration than those submitted by operators for the preceding sampling cycle.

A.2.2.3 Second and Third Most Recent Cycles of Operator Data

In order to assess the reliability of the findings in Table A3, ratios of geometric means between the SIP sample and the second and third most recent sampling cycle data (c2 and c3) were calculated. Table A4 shows these statistics by the two broad mine size groupings. Means of the c1 ratios are shown for comparison, and mean production ratios are given. The size of the ratios observed using c1 persist and are somewhat greater for the smaller mines when tabulated in a similar way using c2 and c3.

A.2.2.4 Comparison Using Data Matched for Production

The final analysis for the continuous miner sample data consists of presentation of the ratios of geometric means for the matched production data (c4). These are shown in Table A5. Figure A3 contains a plot of the natural logarithmic differences, with the means for each mine size group connected. It can be seen that the overall patterns of difference between the SIP and operator data persist after controlling so much as possible for production differences.

A.2.3 Non-compliance Rates for Continuous Miners

Non-compliance rates for the major mine size groups are given in Table A6 for the SIP sample and the single operator sample matched on production, respectively. For samples at the smaller mines, the SIP samples were more than twice as likely to be out of compliance than were the operator samples (26% compared to 11%, $p<0.01$). This was not true for the larger mines, where the non-compliance rates were not significantly different.

The geometric mean dust concentrations for the SIP non-compliance samples from continuous miners at the smaller mines were rather greater than those submitted by operators (3.0 mg/m^3 as opposed to 2.7 mg/m^3). However, in contrast, the SIP means were lower for the larger mines (2.1 mg/m^3 compared to 2.5 mg/m^3).

A.2.4 Comparison of Dust Concentrations for Other Designated Occupations

For designated occupations other than continuous miners, Table A7 shows arithmetic means of the SIP sample and the most recent operator sample average (c1), and ratios between their geometric means. The most obvious finding is the discrepancy between SIP and operator data for cutting machine operators and for hand loaders, where ratios of over 1.7 and 2.7 were found ($p<0.01$). In contrast, little difference was seen for shear/plow operations or for the miscellaneous group. Note that this pattern of differences echoes the previously-observed mine size effect, in that the cutting machine and hand loader jobs were found mostly in small operations (<125), while the shear/plow operations were large. Adjustment for production does not affect the conclusions drawn from the unadjusted data.

A.2.5 Non-compliance Rates for Other Designated Occupations

Non-compliance rates for designated occupations other than continuous miners are shown in Table A8. These were derived from the SIP samples and the sample from the most recent operator sampling period that was matched on production. The non-compliance rates are consistent with the geometric mean dust concentrations reported in A.2.4, in that cutting machine operators and hand loaders showed the greatest discrepancies ($p<0.05$ for cutting machine operators and $p<0.10$ for hand loaders), and shear/plow and miscellaneous occupations, the least.

A.2.6 Comparison of Dust Concentrations for Designated Area Samples

Table A9 shows the arithmetic mean dust concentrations for the SIP and most recent operator data by mine size. Table A9 also contains the ratios of geometric mean concentrations and reveals that SIP dust concentrations were consistently higher over all mine sizes. Statistical significance was evident for mine sizes smaller than 50 miners. Use of the second and third most recent operator data gave rise to similar results (not shown).

A.2.7 Non-compliance Rates for Designated Area Samples

The non-compliance rate for the SIP area samples was 29% compared to a rate of 10% for day one of the operator samples. The geometric mean dust concentration for the SIP non-compliance samples was about 67 percent greater than that for the operator samples (2.5 versus 1.5 mg/m^3)

A.2.8 Influence of Low Weight Gain Samples

The influence of LWG samples on the above results was examined by repeating the analyses after exclusion of samples having a concentration of less than 0.3 mg/m^3.

Included in the most recent operator data for the continuous miners were 578 LWG samples, while 36 SIP samples fell into that definition. As would be expected, exclusion of the LWG samples led to a systematic increase in the mean dust concentrations, particularly for the operator data (Tables A10 and A11). No major changes were seen in the mean production levels (not shown). Table A10 summarizes the SIP versus operator dust concentration levels and ratios for the smaller mine size group (1 - 124 employees), for the data with and without the LWG samples. It can be seen that there was still evidence that the SIP concentrations were systematically higher for the smaller mines. Concomitant with the increase in the mean dust levels brought about by the LWG exclusion was an increase in the proportion of non-compliance samples. This mainly affected the operator sample data for the smaller mines. In contrast, the ratios and non-compliance rates for the larger mines (125 - 999 employees) were little affected by the exclusion of LWG samples (Table A11). Overall, the main findings noted in sections A.2.2 for the complete set of data are not altered by exclusion of LWG samples, the statistical significance levels remaining unchanged for each of the two main mine size groupings.

Among the principal other designated operations, exclusion of LWG samples (4 SIP, 87 for most recent operator) led to an increase in the mean for the operator data for cutting machines from 0.92 to 1.22 mg/m^3, the ratio declining from the figure of 1.70 shown in Table A7 to 1.20. In contrast, there was only a slight increase in the operator mean for shear/plow jobs (1.50 to 1.52 mg/m^3), resulting in a marginal decline in the ratio (1.04 to 1.02). In this analysis zero SIP and 6 most recent operator samples were removed.

Lastly, consideration of the designated area samples after deletion of those with low weight gain led to a marked increase in the mean level for the operator data (from 0.54 to 0.85 mg/m^3 in mines employing <50 employees, and from 0.67 to 0.84 mg/m^3 for mines with 50 or more employees). The SIP means also increased, but the overall effect was a marked drop in the ratios (from 2.17 to 1.41 for the smaller mines, and from 1.43 to 1.24

for the larger mines). However, there was still evidence that the SIP data were systematically higher ($p < 0.01$ for the smaller mines).

A.3 Conclusions

A.3.1 Continuous Miner Operators

Dust concentrations for continuous miner operators in mines employing fewer than 125 miners, obtained during the SIP inspection, were generally greater than those collected during operator sampling for compliance. The ratio of geometric means varied between 1.5 and 1.7, depending on which operator cycle the comparison was based. The differences between SIP and operator compliance samples persisted after adjustment for production differences, and after matching by production.

In general, proportionately twice as many SIP samples for continuous miners at mines employing fewer than 125 workers were found to be out of compliance as compared with operator samples matched on production.

Despite the differences noted above, the SIP sample data indicated that mean dust concentrations were generally less than 2 mg/m^3, or the quartz-adjusted dust standard in effect at the time.

In contrast to the results for smaller mines, those for continuous miner operators at larger mines revealed no consistent differences between the SIP and operator sample over all the measures used.

A.3.2 Other Designated Occupations

Among other designated occupations, there was clear evidence that dust concentrations for DO cutting machine operators and hand loaders were greater during SIP sampling than were reported by operators. Similar findings did not emerge for shear/plow operations or the miscellaneous group of other designated occupations. This pattern may reflect the underlying mine size effect evident in the continuous miner data. The findings on non-compliance rates for other designated occupations reflected those for the mean dust concentrations.

A.3.3 DA Samples

Dust levels for SIP designated area samples were generally greater than those collected by operators, by an average about 30 percent,with ratios ranging from about 2.1 at the smaller mines to 1.4 at large mines. The non-compliance rate for SIP designated area samples was about three times as great as it was for operator samples. Moreover, the geometric mean dust level for the SIP samples that were out of compliance was about twice as great as that for the corresponding operator samples.

A.3.4 Effect of Low Weight Gain Samples

Low weight gain samples contributed substantially to the differences between the SIP and operator dust levels, particularly for the smaller mines. However, they were not totally responsible, since the SIP concentrations remained statistically significantly higher despite exclusion of LWG samples.

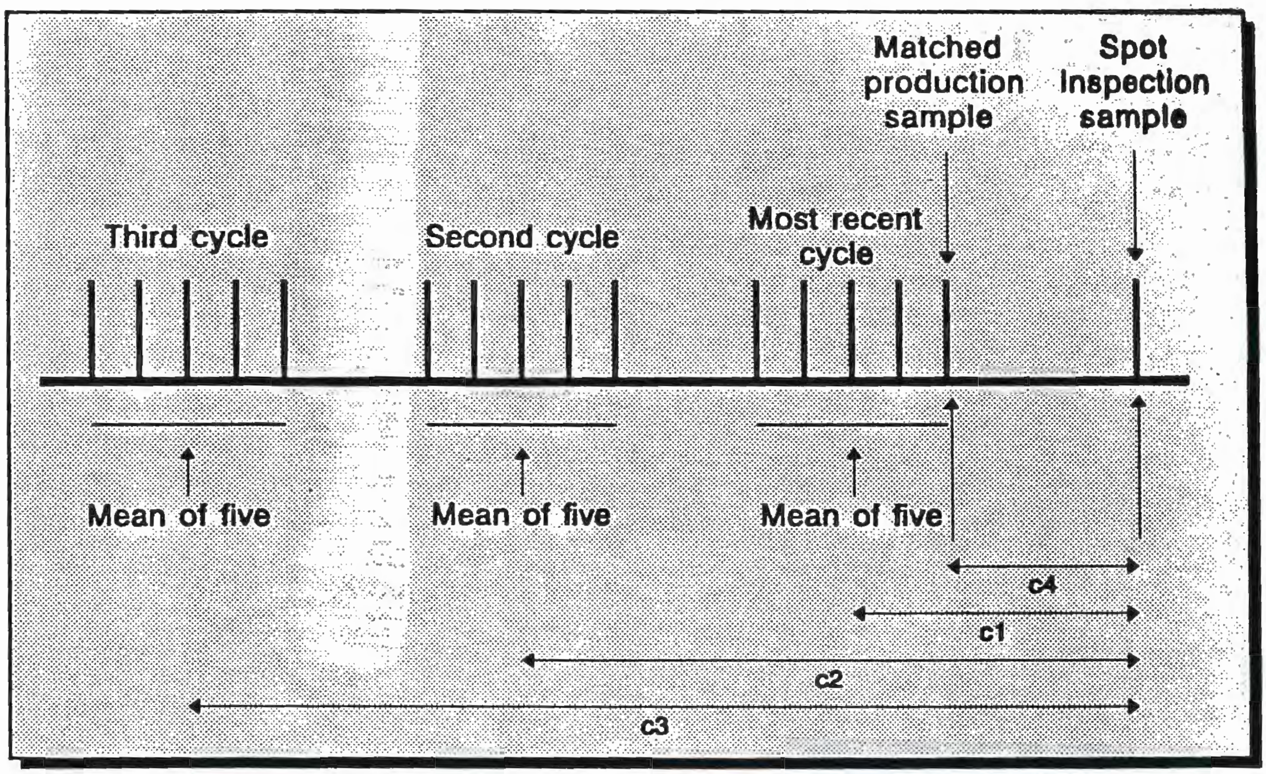


Figure II-A1. Chart showing data used in the analyses described in Section II-A.

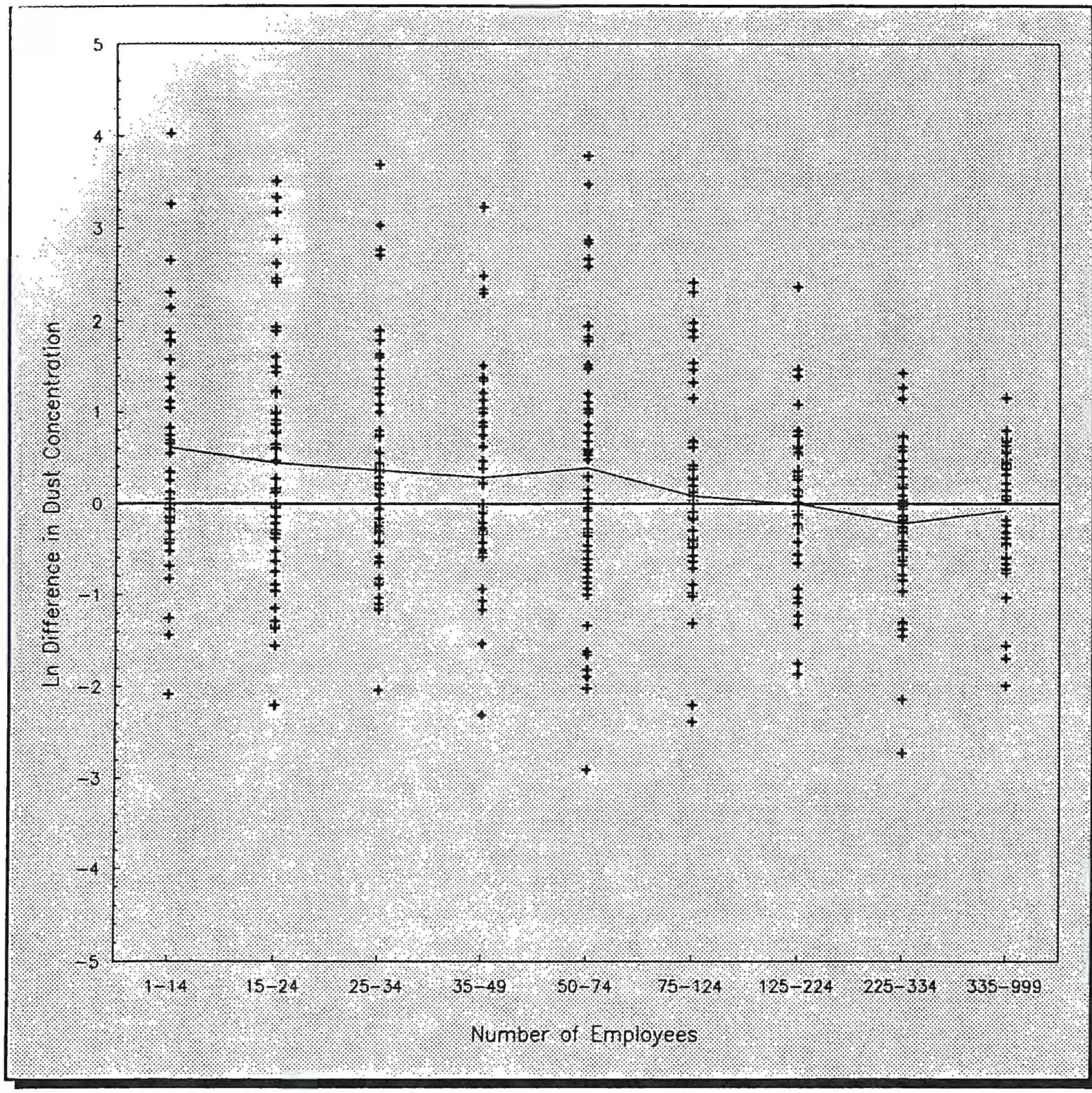


Figure II-A2. Differences in the natural logarithmic (ln) dust concentrations, and means for ln(SIP sample)-ln(mean operator sample data from most recent cycle) (c1), by mine size.

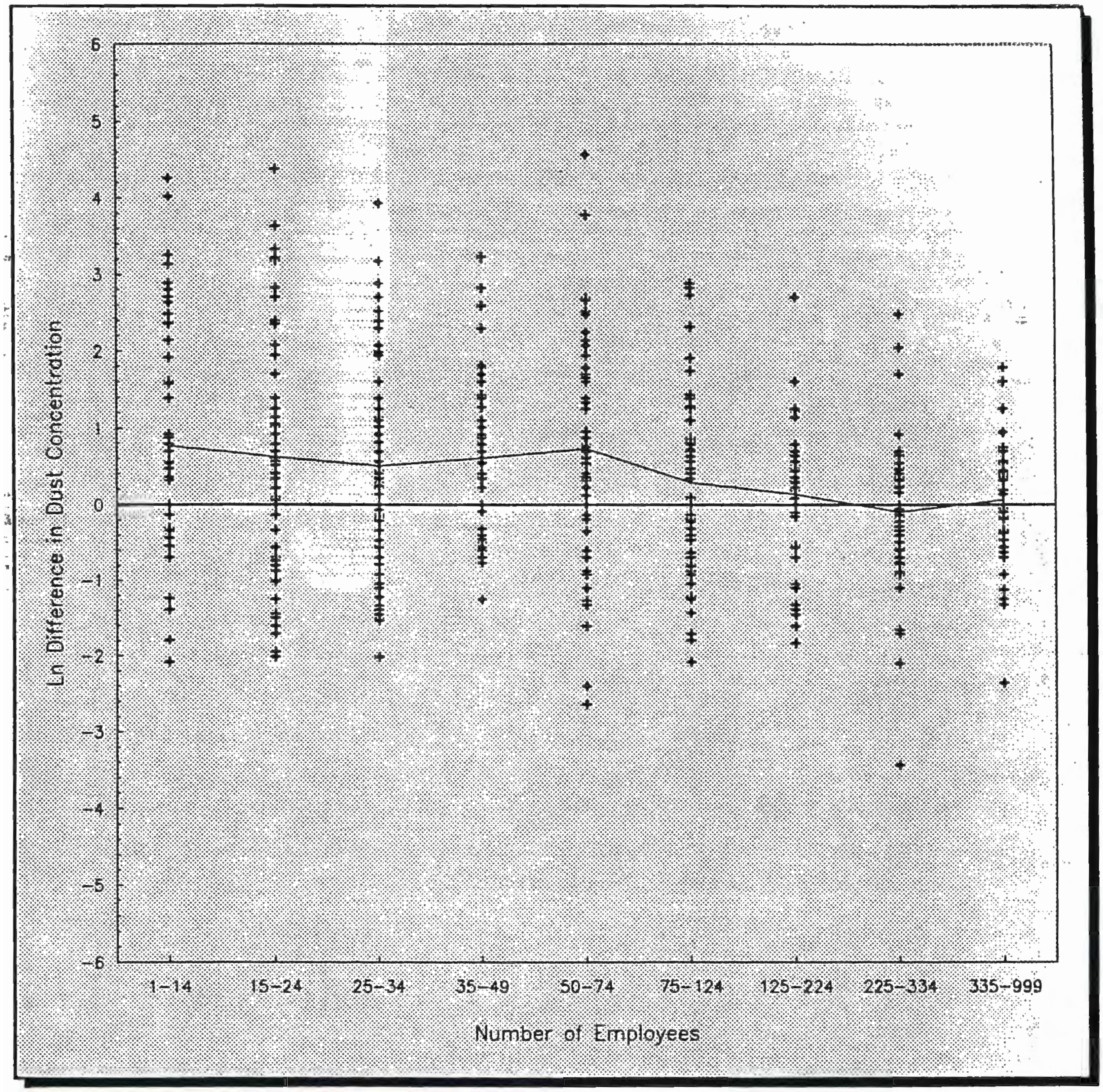


Figure II-A3. Differences in the natural logarithmic (ln) dust concentrations, and means for ln(SIP sample)-ln(production matched operator sample from most recent cycle) (c4), by mine size.

Table II-A1. Distribution of Designated Occupation codes within each mine size group.

Occupational Groups	Mine Size 1 - 124	Mine Size 125 - 999	Total
Continuous Miners	360	146	506
Cutting Machine	56	10	66
Hand Loaders	30	0	30
Shear/Plow	2	62	64
Other designated occupations	29	18	47
Total	477	236	713

Table II-A2. Continuous Miners - SIP sample data compared with mean of most recent operator cycle data (c1), by mine size.

		Arithmetic Mean Dust Concentration (mg/m^3)		Arithmetic Mean Production (tons)	
Number of Employees	No. of MMU's	SIP Sample	Mean of Most Recent Operator Samples	SIP Sample	Mean of Most Recent Operator Samples
1 - 14	57	1.56	0.80	308	346
15 - 24	63	1.41	0.89	403	438
25 - 34	65	1.61	0.94	477	470
35 - 49	47	1.34	0.94	577	567
50 - 74	60	1.61	0.90	478	512
75 - 124	53	1.61	1.15	505	560
125 - 224	50	1.23	1.18	584	645
225 - 334	54	1.03	1.27	585	646
335 - 999	40	0.97	0.97	465	475

Table II-A3. Continuous Miners - Ratios of geometric mean dust concentrations between SIP sample and mean of most recent cycle samples, unadjusted and adjusted for differences in production.

	Ratios of Geometric Mean Dust Concentrations			
Number of Employees	Unadjusted	α	Adjusted	α
1 - 14	1.84	***	1.87	***
15 - 24	1.56	***	1.60	***
25 - 34	1.44	***	1.38	**
35 - 49	1.33	*	1.27	
50 - 74	1.48	**	1.48	***
75 - 124	1.08		1.10	
125 - 224	0.99		1.00	
225 - 334	0.80	**	0.82	
335 - 999	0.92		0.92	

α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between the SIP and most recent operator dust concentrations, where blank = $\alpha>0.10$, * = $\alpha<0.10$, ** = $\alpha<0.05$, and *** = $\alpha<0.01$.

Table II-A4. Continuous Miners - Ratios of geometric means between SIP sample and mean of most recent operator samples (c1), mean of second most recent operator samples (c2), and mean of third most recent operator samples (c3), grouped into two mine size ranges.

Number of Employees	Ratios of Geometric Mean Dust Concentration and Production Using - Most Recent Operator Samples (c1)			Second Most Recent Operator Samples (c2)			Third Most Recent Operator Samples (c3)		
	conc.	α	prod.	conc.	α	prod.	conc.	α	prod.
1 - 124	1.45	***	0.89	1.57	***	0.92	1.67	***	0.97
125 - 999	0.90	*	0.86	0.80	***	0.83	0.88	*	0.81

α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between the SIP and operator dust concentrations, where blank = $\alpha>0.10$, * = $\alpha<0.10$, and *** = $\alpha<0.01$.

Table II-A5. Continuous Miners - Ratios of geometric means between SIP sample and single sample selected from the most recent operator cycle to have similar production, grouped into two mine size ranges.

		Ratios of Geometric Means		
Number of Employees	No. of MMU's	Dust Concentration	α	Production
1 - 124	345	1.80	***	0.92
125 - 999	144	1.03		0.90

α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between the SIP and production-matched dust concentrations, where blank = $\alpha > 0.10$ and *** = $\alpha < 0.01$.

Table II-A6. Continuous Miners - Non-compliance rates for the SIP sample and for the single operator sample selected from the most recent cycle to have similar production, by mine size.

		SIP Sample		Production-Matched Sample		
Number of Employees	No. of MMU's	n	%	n	%	α
1 - 124	345	88	26	39	11	***
125 - 999	144	14	10	20	14	

α = Probability that observed difference in rates would have occurred if no true difference between the SIP and production-matched operator sample existed, where blank = $\alpha > 0.10$ and *** = $\alpha < 0.01$.

Table II-A7. Other Designated Occupations - SIP sample data compared with mean of most recent operator cycle data (c1).

Occupation	No. of MMU's	Dust Concentration (mg/m^3): SIP Sample[1]	Dust Concentration (mg/m^3): Mean of Most Recent Operator Samples[2]	Dust Concentration (mg/m^3): Ratio[3]	Dust Concentration (mg/m^3): α[4]	Production (tons): SIP Sample[1]	Production (tons): Mean of Most Recent Operator Samples[2]	Production (tons): Ratio[3]
Cutting Machine	64	1.93	0.92	1.70	***	349	419	0.83
Hand Loaders	28	1.32	0.21	2.72	***	32	28	1.12
Shear/Plow	63	1.67	1.50	1.04		2583	3065	0.77
Other	43	1.01	0.91	1.13		679	864	0.80

[1] arithmetic mean
[2] arithmetic mean
[3] ratio of geometric means
[4] α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between the SIP and most recent operator dust concentrations, where blank = $\alpha > 0.10$ and *** = $\alpha < 0.01$.

Table II-A8. Other Designated Occupations - Non-compliance rates for the SIP sample and for the single operator sample selected from the most recent cycle to have similar production.

Occupation	No. of MMU's	SIP Sample		Production-Matched Sample		α
		n	%	n	%	
Cutting Machine	64	19	30	9	14	**
Hand Loaders	28	3	11	0	0	*
Shear/ Plow	63	18	29	16	25	
Other	43	5	12	6	14	

α = Probability that observed difference in rates would have occurred if no true difference between the SIP and production-matched operator sample existed, where blank = $\alpha > 0.10$, * = $\alpha < 0.10$, and ** = $\alpha < 0.05$.

Table II-A9. Designated Area Samples (Roofbolters) - SIP sample data versus the mean of the most recent operator samples (c1), by mine size.

Number of Employees	No. of MMU's	Dust Concentration (mg/m^3)			
		SIP Sample[1]	Mean of Most Recent Operator Samples[2]	Ratio[3]	α[4]
1 - 24	46	1.31	0.61	2.13	***
25 - 49	40	1.06	0.46	2.21	***
50 - 124	31	1.37	0.73	1.48	
125 - 999	22	0.87	0.59	1.36	

[1] arithmetic mean
[2] arithmetic mean
[3] ratio of geometric means
[4] α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between the SIP and most recent operator dust concentrations, where blank = $\alpha > 0.10$ and *** = $\alpha < 0.01$.

Table II-A10. Continuous miners - summary of SIP and operator data for small to medium mines (1 - 124 employees), with and without low weight gain samples.

Statistic	All data	LWG samples excluded
SIP dust concentration (mg/m^3)	1.53	1.62
Most recent operator samples (mg/m^3)	0.93	1.22
Ratio of SIP to most recent operator samples	1.45	1.14
Ratio of SIP to production matched operator sample	1.80	1.22
SIP non-compliance rate (%)	26	27
Operator production-matched sample non-compliance rate (%)	11	17

Table II-A11. Continuous miners - summary of SIP and operator data for large mines (125 - 999 employees), with and without low weight gain samples.

Statistic	All data	LWG samples excluded
SIP dust concentration (mg/m^3)	1.08	1.13
Most recent operator samples (mg/m^3)	1.16	1.24
Ratio of SIP to most recent operator samples	0.90	0.88
Ratio of SIP to production matched operator sample	1.03	0.99
SIP non-compliance rate (%)	10	10
Operator production-matched sample non-compliance rate (%)	14	13

B. SIP Dust Concentrations Compared to Previous Inspector Data

B.1 Data and Methods

Included in the database for the SIP data analyzed in part A were dust concentration data collected by inspectors during their previous BAB visit to the mine. This consisted of a single shift sample. For analysis of these data, the difference between the natural logarithmic values of the SIP and inspector sample was computed. Similar tabulations to those incorporated in part A were undertaken on this variable, including an analysis of the effect of low weight gain samples. One sample for which the BAB inspector sample production was 12,000 tons was omitted from the analysis, as its inclusion would have unduly influenced the results. A study of the effect of LWG samples was made by removing from the MIP and BAB data all samples having concentration less than 0.3 mg/m^3

B.2 Results

There are eight parts to this section: B.2.1 Data description; B.2.2 Comparison of dust concentrations - continuous miners; B.2.3 Non-compliance rates - continuous miners; B.2.4 Comparison of dust concentrations - other designated occupations; B.2.5 Non-compliance rates - other designated occupations; B.2.6 Comparison of dust concentrations - designated area samples; B.2.7 Non-compliance rates - designated area samples; and, B.2.8 Influence of low weight gain samples.

B.2.1 Data Description

Table B1 shows the information available by mine size and designated occupation. The general distribution is similar to that for Table II-A1, and reflects a predominance of

continuous miner samples. For designated area samples (roofbolters), the majority (110 [illegible]) were concentrated in the smaller mines.

B.2.2 Dust Concentration Differences for Continuous Miners

Examination of the SIP and BAB operator sample data in Table B2 reveals findings similar to those seen for the operator data in Table II-A2, in that for mines employing fewer than 125 miners, the SIP means were greater than the BAB samples, with the reverse being true in general for larger mines. Because the comparison involved only two single samples, there is more intrinsic variability involved compared to use of means, probably leading to the general lack of statistical significance. Arithmetic mean production, and ratios of geometric mean productions are also shown in the table, and reveal that fewer tons were generally cut when the SIP sample was being collected.

An analysis of covariance was undertaken to allow for production differences. The findings were basically the same as for the unadjusted data in Table B2.

Tabulation of the data by the two main mine size groups (1 - 124, 125 - 999) in Table B3 revealed evidence of a systematic difference between the SIP and BAB samples for the smaller mine group (ratio = 1.26, $\alpha < 0.01$), but not for the larger mine size group.

B.2.3 Non-compliance Rates for Continuous Miners

Non-compliance rates for selected job and mine sizes are given in Table B4 for the SIP sample and the BAB inspector sample, respectively. For samples at the smaller mines, the SIP samples were more likely to be out of compliance than were the BAB samples (25% compared to 18%, $\alpha < 0.05$). Although the same tendency was seen at the larger mines, (11% versus 9% non-compliance), this discrepancy could easily have arisen by chance ($\alpha > 0.10$).

The geometric mean dust concentrations for the SIP non-compliance samples from continuous miners at the smaller mines were rather greater than those submitted by operators (2.9 mg/m^3 as opposed to 2.5 mg/m^3). However, in contrast, the SIP means were lower for the larger mines (2.1 mg/m^3 compared to 2.3 mg/m^3).

B.2.4 Dust Concentration Differences for Other Designated Occupations

Results for the SIP and BAB data are shown in Table B5 for designated occupations other than continuous miners. The biggest ratios of geometric mean concentrations were seen for hand loaders ($\alpha < 0.01$) and cutting machine operators ($\alpha < 0.05$). A statistically significant, although smaller ratio was also seen for shear/plow operators. Adjustment for production did not affect the conclusions drawn from the unadjusted data.

B.2.5 Non-Compliance Rates for Other Designated Occupations

Non-compliance rates for other designated occupations are presented in Table B6. The rate for SIP samples for cutting machine operators was about three times that for the BAB samples ($\alpha < 0.05$). Elevated rates for SIP samples were also observed for hand loaders and shear/plow operators, but only the latter were statistically significant ($\alpha < 0.05$).

B.2.6 Dust Concentration Differences for Designated Area Samples

Table B7 gives the arithmetic mean dust concentrations and ratios of geometric mean dust concentrations by mine size for the SIP and most recent BAB inspector data for the designated area samples. The SIP samples tended to be higher at the smaller mines and lower at the larger mines. Tabulation into two broad mine size groups (1 - 49, 50 - 999), showed that for the smaller mine group, the SIP samples were generally greater than those collected by inspectors, by a factor of 42 percent in estimated medians (ratio = 1.42, $\alpha<0.01$).

B.2.7 Non-Compliance Rates for Designated Area Samples

Of the pairs of SIP and BAB samples for designated areas (n=140), 29% of the SIP samples were found to be out of compliance compared to 23% for the BAB data. This difference is not statistically significant ($\alpha>0.10$). The geometric mean dust concentration for the SIP and BAB non-compliance samples was 1.8 and 1.6 mg/m^3, respectively.

B.2.8 Influence of low weight gain samples

The numbers of low weight gain samples excluded were 36 from the SIP data and 48 from the BAB data. Table B8 gives a summary of the results of the analyses undertaken on the continuous miner data from the smaller mines (1 - 124 employees) with and without the LWG samples. Exclusion of the LWG samples led to a general increase in the mean dust concentrations, but the SIP:BAB ratio declined somewhat in magnitude. Despite this reduction, however, there was still evidence that the SIP data were systematically higher than the BAB samples ($\alpha<0.05$). The results for continuous miners at the larger miners (124 - 999 employees) after exclusion of the LWG observations were little different from those based on all of the data (Table B9).

Among the other designated occupation samples, no LWG samples were found in the shear/plow data, and hence the findings were unchanged from those reported earlier. For the cutting machines, the SIP:BAB ratio declined from 1.67 to 1.08 after the LWG observations were removed, and no longer demonstrated statistical significance.

Removal of LWG samples from the designated area sample data led to no overall change in the findings, in that the greatest SIP:BAB ratios were still seen in the smaller mines (see Table B7 for results including LWG samples). However, all of the ratios were closer to one after LWG removal, only that for the smallest mine size group demonstrating statistical significance ($\alpha < .05$).

B.3 Conclusions

B.3.1 Continuous Miner Operators

SIP dust concentrations for continuous miner operators in mines employing fewer than 125 miners were generally greater than those collected during BAB inspections. The ratio of geometric means was 1.26, corresponding to an increase of 26 percent in the estimated median. In general, SIP samples for continuous miners at mines employing fewer than 125 workers were more likely to be out of compliance as compared with BAB samples (25% compared with 18%). Despite these differences, the SIP sample data indicated that arithmetic mean dust concentration were generally less than 2 mg/m^3, or the reduced dust limit in effect at the time.

In contrast to the results for smaller mines, those for continuous miner operators at larger mines revealed no consistent differences between the SIP and BAB sample over all the measures used.

B.3.2 Other Designated Occupations

Among other designated occupations, there was clear evidence that dust concentrations during SIP sampling were greater than those measured during BAB sampling. The biggest ratios of geometric mean concentrations existed with the hand loaders and cutting machine operators. Overall, the observed pattern among these occupations may reflect the underlying mine size effect evident in the continuous miner data. The findings on non-compliance rates for other designated occupations reflected those for the dust concentrations.

B.3.3 Designated Areas

Dust levels for SIP designated area samples were generally greater than those from BAB samples in mines employing less than 50 miners. There was some evidence of the opposite effect for larger mines. The non-compliance rate for SIP designated area samples was slightly higher than that for the BAB samples.

B.3.4 Influence of Low Weight Gain Samples

Low weight gain samples appeared to be responsible for much, but not all, of the excess in the SIP dust levels over those collected during BAB inspections. This observation applies to smaller mines; for larger mines, LWG samples generally had little influence on the findings.

Table II-B1. Distribution of Designated Occupation codes within each mine size.

Occupational groups	Mine Size 1 - 124	Mine Size 125 - 999	Total
Continuous Miners	290	116	406
Cutting Machine	48	9	57
Hand Loaders	27	0	27
Shear/Plow	2	56	58
Other designated occupations	23	14	37
Total	390	195	585

Table II-B2. Continuous Miners - SIP sample data compared with most recent BAB inspector sample.

		Dust Concentration (mg/m^3)				Production (tons)		
Number of Employees	No. of MMU's	SIP Sample[1]	Most Recent BAB Inspector Sample[2]	Ratio[3]	α[4]	SIP Sample[1]	Most Recent BAB Inspector Sample[2]	Ratio[3]
1 - 14	53	1.66	1.07	1.79	***	296	335	0.86
15 - 24	50	1.30	1.17	1.24		402	427	0.81
25 - 34	58	1.58	1.18	1.22		463	530	0.84
35 - 49	37	1.06	0.98	1.16		613	707	0.88
50 - 74	50	1.71	1.48	1.11		474	527	0.83
75 - 124	42	1.62	1.49	1.04		503	564	0.82
125 - 224	40	1.25	1.26	0.96		581	670	0.90
225 - 334	44	0.98	1.03	0.92		609	655	0.96
335 - 999	32	0.97	1.48	0.79		485	464	0.89

[1] arithmetic mean
[2] arithmetic mean
[3] ratio of geometric means
[4] α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between SIP and BAB dust concentrations, where blank = $\alpha > 0.10$ and *** = $\alpha < 0.01$.

Table II-B3. Continuous Miners - Ratios of geometric means between SIP sample and most recent BAB inspector sample, by mine size.

Number of Employees	No. of MMU's	Ratios of Geometric Means: Dust Concentration	α	Production
1 - 124	290	1.26	***	0.84
125 - 999	116	0.90		0.92

α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between the SIP and BAB dust concentrations, where blank = $\alpha > 0.10$ and *** = $\alpha < 0.01$.

Table II-B4. Continuous Miners - Non-compliance rates for the SIP sample and for the most recent BAB inspector sample, by mine size.

		SIP Sample		Most Recent BAB Inspector Sample		
Number of Employees	No. of MMU's	n	%	n	%	α
1 - 124	290	73	25	52	18	**
125 - 999	116	13	11	10	9	

α = Probability that observed difference in rates would have occurred if no true difference between SIP and BAB samples existed, where blank = $\alpha > 0.10$ and ** = $\alpha < 0.05$.

Table II-B5. Other Designated Occupations - SIP sample data compared with most recent BAB inspector sample.

		Dust Concentration (mg/m³)				Production (tons)		
Occupation	No. of MMU's	SIP Sample[1]	Most Recent BAB Inspector Sample[2]	Ratio[3]	α[4]	SIP Sample[1]	Most Recent BAB Inspector Sample[2]	Ratio[3]
Cutting Machine	57	1.88	1.02	1.67	**	355	410	0.83
Hand Loaders	27	1.36	0.42	2.65	***	32	28	1.06
Shear/ Plow	58	1.71	1.32	1.18	**	2619	2884	0.85
Other	37	1.06	1.25	1.00		594	724	0.79

1 arithmetic mean
2 arithmetic mean
3 ratio of geometric means
4 α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between the SIP and BAB dust concentrations, where blank = $\alpha > 0.10$, ** = $\alpha < 0.05$, and *** = $\alpha < 0.01$.

Table II-B6. Other Designated Occupations - Non-compliance rates for the SIP sample and for most recent BAB inspector sample.

Occupation	No. of MMU's	SIP Sample n	SIP Sample %	Most Recent BAB Inspector Sample n	Most Recent BAB Inspector Sample %	α
Cutting Machine	57	15	26	5	9	**
Hand Loaders	27	3	11	2	7	
Shear/ Plow	58	18	31	8	14	**
Other	37	3	8	5	14	

α = Probability that observed difference in rates would have occurred if no true difference between the SIP and BAB samples existed, where blank = $\alpha > 0.10$ and ** = $\alpha < 0.05$.

Table II-B7. Designated Area Samples (Roofbolters) - SIP sample data compared with most recent BAB inspector sample, by mine size.

Number of Employees	No. of MMU's	Dust Concentration (mg/m³): SIP Sample[1]	Most Recent BAB Inspector Sample[2]	Ratio[3]	α[4]
1 - 24	40	1.39	1.05	1.44	**
25 - 49	37	0.99	0.67	1.40	*
50 - 124	33	1.13	1.40	0.73	*
125 - 999	30	0.78	0.79	0.89	

[1] arithmetic mean
[2] arithmetic mean
[3] ratio of geometric means
[4] α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between SIP and BAB dust concentrations, where blank = $\alpha > 0.10$, * = $\alpha < 0.10$, and ** = $\alpha < 0.05$.

Table II-B8. Continuous miners - summary of SIP and BAB for smaller mines (1 - 124 employees), with and without low weight gain samples.

Statistic	All data	LWG samples excluded
SIP dust concentration (mg/m³)	1.51	1.69
Most recent BAB samples (mg/m³)	1.23	1.40
Ratio of SIP to most recent BAB samples	1.26	1.12
SIP non-compliance rate (%)	25	29
BAB non-compliance rate (%)	18	21

Table II-B9. Continuous miners - summary of SIP and BAB for larger mines (125 - 999 employees), with and without low weight gain samples.

Statistic	All data	LWG samples excluded
SIP dust concentration (mg/m³)	1.07	1.13
Most recent BAB samples (mg/m³)	1.23	1.16
Ratio of SIP to most recent BAB samples	0.90	0.97
SIP non-compliance rate (%)	11	12
BAB non-compliance rate (%)	9	8

C. MIP Dust Concentrations and Previous Operator Data

C.1 Data and Methods

Besides MIP sample dust concentrations and operator compliance sample dust concentrations from POPERAT, information used in the present analysis includes: (1) mine size (number of employees), (2) production tonnage achieved on the MIP sample shift and on each of the operator compliance samples shifts, and (3) the quartz-adjusted dust standard applicable to that particular MMU or designated area.

Four variables representing the difference between the MSHA monitored sample (MIP) and operator data for the same mechanized mining unit were employed in the analysis (Figure C1). The first variable comprised the mean of the non-monitored operator samples taken in the same cycle as the MIP sample (c1). The second and third variables were based on the difference between the MIP sample and the mean of the five operator samples taken during each of the two previous cycles of compliance sampling, c2 and c3, respectively. The fourth variable consisted of the difference between the MIP sample concentration and the single concentration from the previous operator cycle, the sample being selected from the day for which production was closest to that for the monitored sample (c4). The natural logarithmic transformation was performed on MIP and operator sample data. All differences referred to in this section represent natural logarithmic differences. These differences were exponentiated to obtain the ratio of the geometric mean MIP sample to the geometric mean operator sample data.

Analysis was also undertaken on the percentages of occasions MMU's were out of compliance with regard to the QAS. This analysis was undertaken on the single samples from the data matched on production. A matched chi-square (McNemar) test was undertaken on the frequencies.

The findings were heavily influenced by mine size. For exploratory purposes, mine size was stratified into 9 groups of almost equal size (1 - 14, 15 - 24, 25 - 34, 35 - 49, 50 - 74, 75 - 124, 125 - 224, 225 - 334, 335 - 999). Later, two groups (1 - 124, and 125 - 999) were found to be adequate.

The data were analyzed both including and excluding LWG samples. This was not possible for the monitored:non-monitored comparison (c1) owing to lack of individual data points, but it was done for the most recent sampling period comparison and for the production-matched comparison.

In the following, attention has been restricted to data for continuous miner operators, as all other occupations had too few data points for reliable analysis. There were no MIP designated area sample data available for comparison.

C.2 Results

The results are presented in six parts: C.2.1. Data description; C.2.2. Differences between the monitored and non-monitored data for the same cycle; C.2.3. Differences between the monitored and operator data for the previous two cycles; C.2.4. Differences between the monitored and operator data with matched production; C.2.5. Non-compliance rates for the matched data; C.2.6. Influence of low weight gain samples.

C.2.1 Data Description

The distribution of MMUs by mine size and designated occupation is shown in Table II-C1. As in the previous analyses, continuous miner samples predominate and are abundant in both mine size groups. Cutting machine samples and hand loaders were found almost exclusively in the smaller mines. Almost all shear/plow operator samples were found in the larger mine group.

C.2.2 Same Cycle Operator Data

Figure C2 shows the differences in the natural logarithmic dust concentrations between the MIP sample and the mean of the non-monitored sample data in the same cycle (c1) after stratification by mine size. Each point represents one mining unit, and the connecting line represents the means for each group. Apart from the three larger mine groups, the mean differences are all positive, indicating that samples submitted for days when no inspector was present tended to be lower than those collected when the inspector was present. For the larger mines, the opposite seems to be true.

Table C2 shows the arithmetic mean dust concentrations and productions for MIP sample and the mean of the non-monitored sample data in the same cycle (c1). For mines with fewer than 125 employees, production was lower but dust levels were found to be higher when the inspector was present. In larger mines, both the MIP dust concentration and production tended to be lower than was assessed for the non-monitored days. Paired t-tests on the differences within each mine size group reveal that the ratios of the observed magnitude, for the larger mines, was unlikely to have occurred from chance variation (Table C3).

Because production may have affected dust levels, an attempt was made to correct for production differences using analysis of covariance. From the analysis, the difference in log dust concentrations observed in Figure C2 were found to be related to differences in production ($\alpha < 0.01$). Furthermore, after allowing for production differences, the statistical significance seen for larger mines in the unadjusted data disappeared, except for mines employing 125 - 224 workers.

C.2.3 Previous and Second Previous Cycle Data

Similar analysis to those in C.2.2 were undertaken on the differences between the MIP sample data and the operator data from two previous cycles. This information is summarized for dust concentration and production differences in Table C4. Two broad groupings of mine size are used, and the results for the current cycle from the previous analysis are included for comparison.

Table C4 shows that the same general trend existed for all three differences. That is, the MIP dust concentrations were greater than those from operator submitted samples for mines with fewer than 125 employees. In contrast, the opposite was true for larger mines. The production differences were largely small, on average, for the smaller mines.

C.2.4 Data Matched on Production

To check that production differences had not unduly influenced the results in the previous analyses, pairs of concentrations were obtained where production was as similar as possible. Table C5 gives the ratios of geometric mean dust concentration and production for these matched pairs, and Figure C3 illustrates these differences. Again, the same general tendencies as observed earlier are seen: monitored concentrations were higher in the smaller mines (ratio=1.4, $\alpha<.01$). However, in this case, and contrary to every other corresponding analysis in this section and report, there was evidence that the monitored concentrations were higher in the larger as well as the smaller mines, although the effect was not large (ratio = 1.16, $\alpha<.10$).

C.2.5 Non-Compliance Rates

Table C6 shows non-compliance rates for the MIP sample data and for the single operator sample from the previous cycle having production closest to the monitored sample. Non-compliance rates were all higher for the MIP sample, particularly for the smaller mines, where the rate was 50% higher (18% compared to 12%, $\alpha<0.05$). Data for the larger mines (125 or more employees) followed the same trend as for the previous analyses, in that little difference was seen between the MIP sample and the production-matched operator sample.

C.2.6 Influence of Low Weight Gain Samples

After exclusion of LWG samples from the MIP and most recent operator data, the MIP:operator ratio for continuous miners at the smaller mines (1 - 124 employees) dropped from 1.12 to 1.03 (refer to Table C4 - C6 for a better understanding of this and the other statements in this section). This magnitude of ratio could easily have occurred by chance ($\alpha>0.10$). The same effect was observed with the second most recent operator sample data. There was no change in the findings for larger mines. Removal of the LWG data for the production-matched samples also led to a reduction in the ratio, from 1.40 to 1.12 for the smaller mines (though statistical significance was preserved, $\alpha<0.05$), and from 1.16 to

1.00 for the larger mines ($\alpha > 0.10$). More MIP samples were non-compliance than were the production-matched most recent operator samples, after exclusion of LWG samples (21% compared with 16%), but the disparity was less than was seen when the LWG samples were included, and was not statistically significant.

C.3 Conclusions

All available evidence points to a systematic difference between dust concentrations collected by the mine operator depending on whether an inspector was present or absent at the coal face. Average measured dust concentrations were found to be up to 40 percent higher when the inspector was present at mines with fewer than 125 employees.

Mine size was found to have a bearing on the difference between monitored and non-monitored samples. The biggest difference was seen for mines employing between 25 and 34 miners, although a similar, though smaller effect was seen for all smaller mines (<125 employees). However, for larger mines, measured dust concentrations were found to be higher when the inspector was not present. Dust concentration differences (monitored versus non-monitored) were related to differences in production, and when production was accounted for, the significant differences observed for larger mines disappeared.

The findings on non-compliance rates for the MIP sample and the production matched operator sample echo those obtained on the ratio data noted in subsection C.2.4

A difference in frequency of low weight gain samples appeared to be the reason for much, though not all, of the excess dust levels observed in MIP sampling as compared to concentrations found during operator sampling.

Figure II-C1. Chart showing data used in the analysis described in part C.

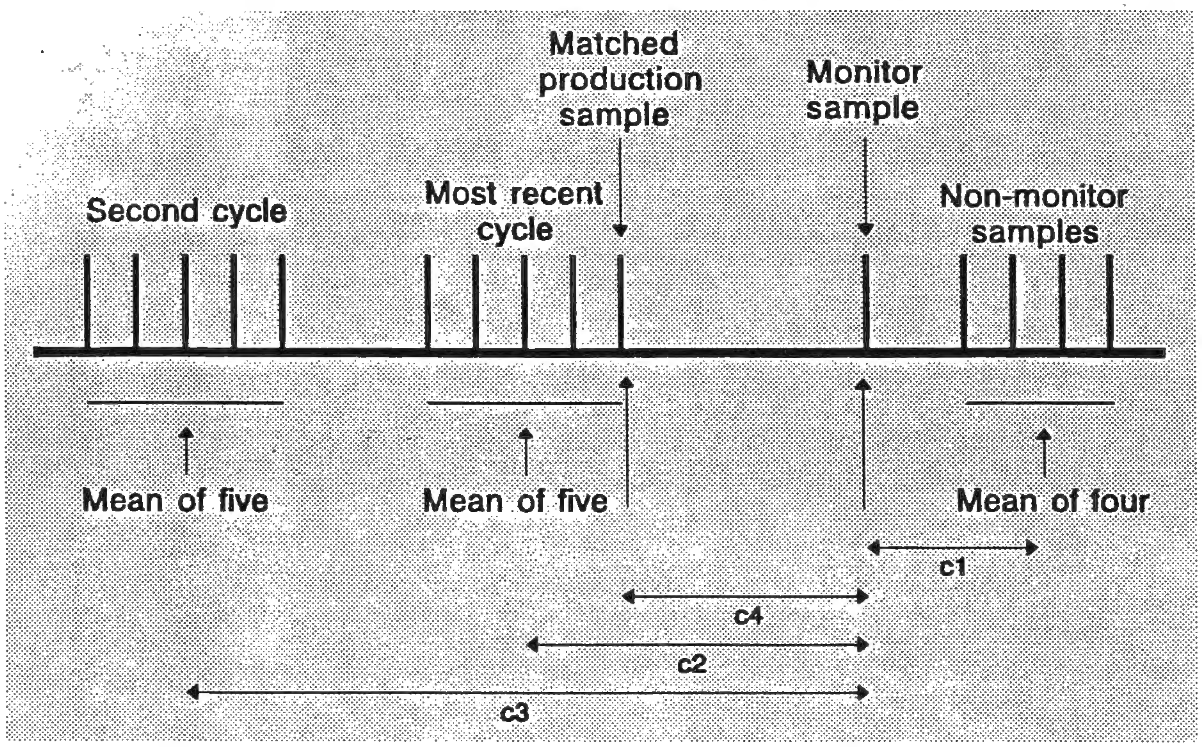


Figure II-C2. Differences in the natural logarithmic (ln) dust concentrations, and means ln(MIP sample) - ln(mean non-monitor sample data in the same cycle) (c1), by mine size.

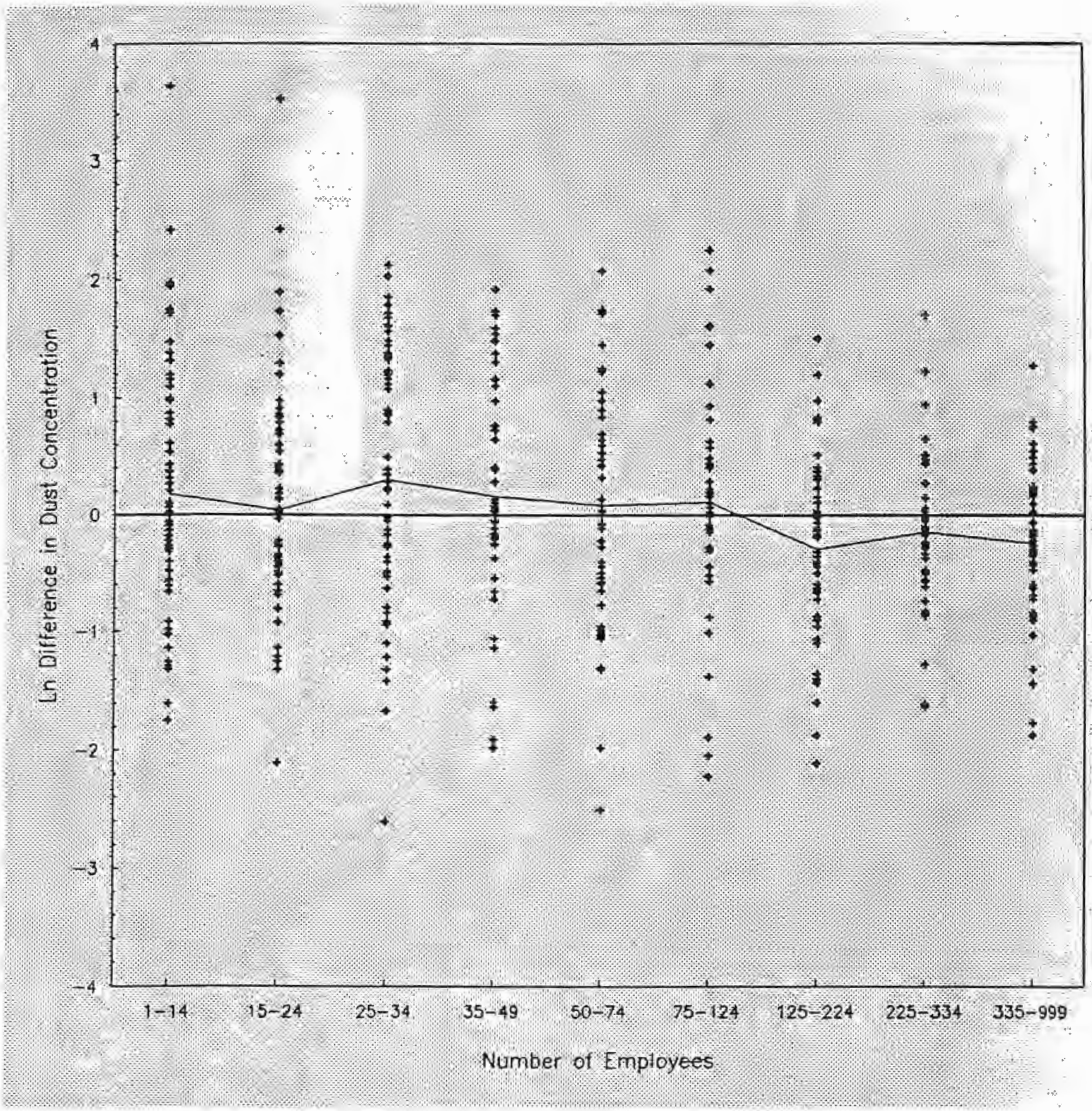


Figure II-C3. Differences in the natural logarithmic (ln) dust concentrations, and means for ln(MIP sample) - ln(production-matched operator sample data from previous cycle) (c4), by mine size.

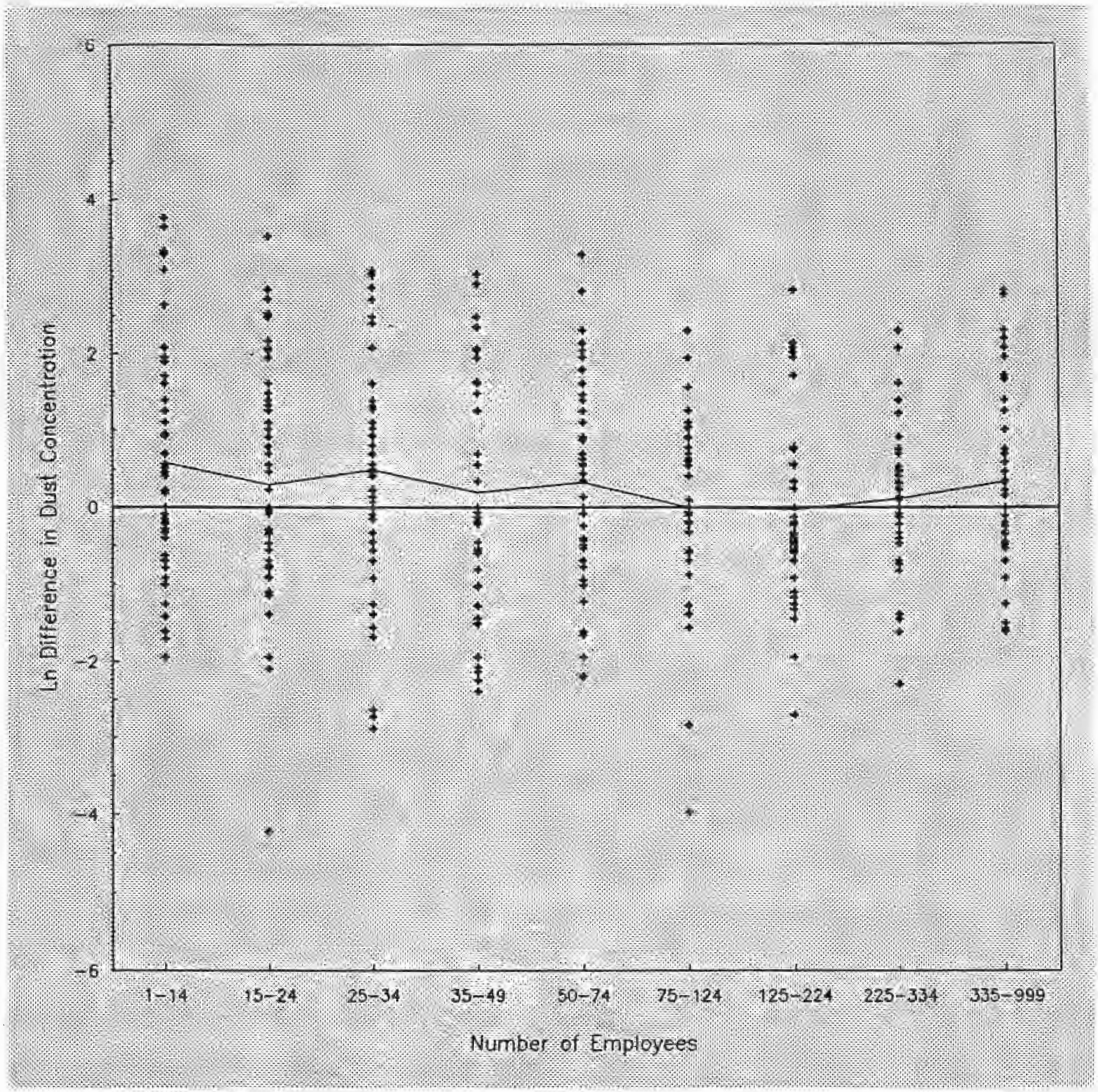


Table II-C1. Distribution of Designated Occupation codes within each mine size.

Occupational groups	Mine Size 1 - 124	125 - 999	Total
Continuous Miners	353	160	513
Cutting Machine	46	7	53
Hand Loaders	12	0	12
Shear/Plow	1	21	22
Other designated occupations	31	12	43
Total	443	200	643

Table II-C2. Continuous Miners - MIP sample data compared with mean of non-monitored data in the same operator cycle (c1), by mine size.

		Arithmetic Mean Dust Concentration (mg/m^3)		Arithmetic Mean Production (tons)	
Number of Employees	No. of MMU's	MIP Sample	Mean of Non-Monitored Operator Samples	MIP Sample	Mean of Non-Monitored Operator Samples
1 - 14	72	1.18	1.09	338	349
15 - 24	73	1.02	0.85	413	441
25 - 34	62	1.33	1.07	482	492
35 - 49	50	1.16	0.89	509	514
50 - 74	54	1.23	1.34	575	584
75 - 124	42	1.20	1.02	579	631
125 - 224	50	1.04	1.24	575	637
225 - 334	51	1.10	1.20	545	577
335 - 999	59	1.04	1.24	388	498

Table II-C3. Continuous Miners - Ratios of geometric mean dust concentrations between MIP and non-monitored operator samples in same cycle, unadjusted and adjusted for differences in production.

	Ratios of Geometric Mean Dust Concentrations			
Number of Employees	Unadjusted	α	Adjusted	α
1 - 14	1.19		1.16	
15 - 24	1.04		1.03	
25 - 34	1.35	**	1.32	**
35 - 49	1.18		1.12	
50 - 74	1.09		1.04	
75 - 124	1.11		1.14	
125 - 224	0.75	**	0.77	**
225 - 334	0.76	*	0.87	
335 - 999	0.78	***	0.86	

α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between MIP and non-monitored dust concentrations, where blank = $\alpha > 0.10$, * = $\alpha < 0.10$, ** = $\alpha < 0.05$, and *** = $\alpha < 0.01$.

Table II-C4. Continuous Miners - Ratios of geometric mean dust concentrations between MIP sample and mean of non-monitored operator samples in same cycle (c1), mean of most recent operator cycle samples (c2), and mean of second most recent operator cycle samples (c3), grouped into two mine size ranges.

Number of Employees	Ratios of Geometric Mean Dust Concentration and Production Using -								
	Non-monitored samples in same cycle (c1)			Most Recent Operator Samples (c2)			Second Most Recent Operator Samples (c3)		
	conc.	α	prod.	conc.	α	prod.	conc.	α	prod.
1 - 124	1.16	***	0.95	1.12	*	1.0	1.11		1.03
125 - 999	0.80	***	0.84	0.89	*	0.89	0.88	*	0.87

α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between MIP and non-monitored dust concentrations, where blank = $\alpha>0.10$, * = $\alpha<0.10$, and *** = $\alpha<0.01$.

Table II-C5. Continuous Miners - Ratios of geometric means between MIP sample and single sample from most recent operator cycle matched by production (c4), by mine size.

Number of Employees	No. of MMU's	Ratios of Geometric Means		
		Dust Concentration	α	Production
1 - 124	330	1.40	***	1.01
125 - 999	156	1.16	*	0.97

α = Probability that a ratio of the observed magnitude would be found if there were truly no difference between MIP and production-matched dust concentrations, where * = $\alpha<0.10$ and *** = $\alpha<0.01$.

Table II-C6. Non-compliance rates for the MIP sample and for the operator sample selected from the most recent cycle to have similar production, by mine size.

Number of Employees	No. of MMU's	MIP Sample		Most Recent Operator Sample		α
		n	%	n	%	
1 - 124	330	60	18	39	12	**
125 - 999	156	18	12	15	10	

α = Probability that observed difference in rates would have occurred if no true difference between the monitored and production-matched operator sample existed, where blank = $\alpha>0.10$ and ** = $\alpha<0.05$.

D. Summary of Combined Results from Parts A, B, AND C

D.1 Introduction

The intent of this part of the report is to examine and compare the results from the three preceding parts of Section II. the object being to determine what consistent features emerge from the totality of data available.

D.2 Results

D.2.1 Designated Occupations

Results from the Part A comparison of the SIP and operator samples clearly showed that among small to medium sized mines (<125 miners), the SIP-derived dust concentrations were greater than those for samples submitted by operators. This was seen for continuous miners, cutting machine operators, and hand loaders, and amounted to a ratio of geometric means from 1.5 - 2.7 depending on job. This range corresponds approximately to median SIP concentrations being higher by from 50 percent to 170 percent. Information on non-compliance rates supported these findings. In contrast, the data for larger mines did not reveal any major differences between the SIP and operator samples, whether they were for continuous miners or for shear/plow operations.

Comparison of the SIP and BAB data in part B of this report revealed a very similar pattern of results to that seen for the SIP - operator comparison noted above. That is, SIP DO concentrations at small to medium sized mines tended to be greater than the corresponding BAB dust concentrations. The ratio of geometric means varied between 1.3 and 2.6 depending on job. In contrast, no such effects were seen for the larger mines (after adjustment for production differences). These findings were supported by the results on non-compliance rates.

Taking these two sets of results (parts A and B) into account together for the small to medium mines, leads to the conclusion that the SIP study gave rise to dust concentrations higher than those reported by either operators or inspectors in previous sampling. Dust concentrations from operators were the smallest, with the BAB concentrations lying between the two. For small mines (<50 employees), the BAB sample concentrations lay closer to the operator than to the SIP measurements. However, for mines employing between 50 and 124 miners, the opposite was true. Among the larger mines (125 or more employees) the SIP sample concentrations tended, if anything, to be slightly lower than the operator reported samples. The BAB dust levels for this group were similar in magnitude to those for the SIP data except for the largest mines (>334 employees). In this group, the BAB sample concentrations were considerably greater than either the SIP or the operator reported data.

Comparison of the MIP and operator data in part C led to an observed pattern of results very similar to those for the SIP - operator comparison in part A. Again, at small to medium mines, the dust concentrations measured during the special sampling exercise were greater than those submitted by operators during ordinary sampling. The one principal divergence from the SIP results was that the MIP dust concentrations were substantially lower (compare Table II-C2 with II-A2), leading to smaller overall differences between the special program and routine data.

Taking all of the results into account at once, suggests the following rank order of dust levels for small to medium mines. At the top were the measurements made during the special studies, with the SIP concentrations being the greatest. At the bottom were the operator reported data. The BAB data tended to lie intermediately for the small and medium mines; but for larger mines the BAB concentrations tended to be exceed both the special program and routine operator collected data.

This conjectured ranking is somewhat suspect, in that it is made across different groups of mines, rather than on the same set of data. Although many of the same mines appear in the analyses in all three parts of this report (A, B, C), the three groups may be sufficiently different to invalidate comparison between them. To obtain a more valid comparison, a subset of mines was formed that had complete information available from all special and routine sampling on continuous miners. This information included SIP, BAB, and MIP samples, as well as the most recent mean concentration (used in c1 of part A), and the non-monitored mean concentration (used in variable c1 of part C). It was found that there were 126 MMUs for which complete information existed in the small to medium mines (<125 employees), and 36 MMUs in the larger mines. One sample for which the BAB inspector sample production was 12,000 tons was omitted from the analyses. As noted before, its inclusion would have unduly influenced the results.

Geometric mean dust concentrations were calculated and the results are shown in Table D1. Although the relative paucity of data makes the results more variable than those from the analyses in preceding sections, the same general trends emerge. For the small to medium mines, dust concentrations during the special exercises, SIP and MIP, were higher than those from routine sampling, with the SIP being the greatest. The BAB measurements fell between the special and routine sample data, being closer to the special samples than to the operator data. For larger mines, no obvious differences are seen among the five sample types, except for the BAB data, which were substantially higher in level.

Geometric mean production levels are shown for information, and indicate they may have had some bearing on the observed dust concentrations. To remove the effect of production, an analysis of covariance was undertaken. Overall, allowing for production did not affect the conclusion drawn from the unadjusted data: viz., among smaller mines the dust concentrations for special samples were higher than those from routine sampling.

After removal of LWG samples, the mean dust concentrations were generally higher, as would be expected. This was particularly true for the operator data. However, exclusion of the LWG samples from the analysis did not lead to major changes in the findings described above.

D.2.2 Designated Area Samples

The findings for designated area samples followed the same basic trends as those for designated occupations. In part A, the SIP - operator comparison showed that SIP dust concentrations were greater than those collected during operator sampling, the biggest differences being seen for the smaller mines. Comparison of the SIP and BAB data in part B, revealed the same tendency, although the differences were smaller overall, and were reversed for the larger mines. Based on these observations, it generally appears that there was a gradient in dust concentration levels from SIP to BAB to operator samples.

D.3 Conclusions

For designated occupations at small to medium mines (<125 employees), there is consistent evidence from every aspect of this investigation that dust samples taken as part of the two special exercises (SIP and MIP) showed significantly higher dust concentrations than samples submitted by operators during non-monitored routine operator cycles and samples collected during BAB inspections. In general, concentrations derived from surprise inspections (SIP samples) were the greatest, while those from routine operator sampling for compliance were the least. This is quantified, for continuous miner operators in the subset of MMU's with data in all categories, in Table II-D1. These findings remain in evidence even after account is taken of production differences. For the larger mines, no obvious differences between DO dust concentrations from special and routine sampling were noted overall. This applied to both continuous miners and to shear/plow machines. Concomitant with the elevated dust levels found in SIP and MIP samples was a greater frequency of non-compliance samples compared to routine operator samples that were not monitored.

Designated area samples from the SIP study were also greater than those collected by both operators during routine non-monitored DA sampling and those collected MSHA inspectors during BAB sampling. This effect too was most obvious for the small to medium sized mines.

Low weight gain samples were the reason for much, but not all, of the excess in dust levels evident during the special sampling programs, as compared to the dust concentrations reported by operators. For instance, SIP concentrations were about 50% greater than operator levels for small mines, on average (Table II-A4). This discrepancy dropped to about 20% after LWG samples were removed. Similar tendencies were seen in other analyses, and indicated that multiple factors may have caused the special sampling concentrations to be higher than the routine operator-ascertained levels.

Based on the data examined in this section, it appears that the main factor affecting differences between dust concentrations obtained during special and routine sampling is mine size, and not occupation.

Table II-D1. Geometric mean dust concentrations of spot inspection samples, monitored samples, and non-monitored samples (most recent cycle) for subset of mines with all sources of data, grouped by mine size.[1]

Variable	Number of Employees	Special samples		Inspector samples	Operator samples	
		SIP	MIP	BAB	MR*	NM*
Unadjusted mean dust concentration (mg/m³)	1 - 124	0.94	0.72	0.78	0.62	0.63
	125 - 999	0.80	0.93	1.16	0.86	0.95
Mean dust concentration adjusted for production (mg/m³)	1 - 124	0.98	0.72	0.76	0.62	0.62
	125 - 999	0.82	0.94	1.14	0.86	0.94
Mean production (tons)	1 - 124	345	410	441	398	424
	125 - 999	400	456	500	479	505

[1]Only continuous miner samples are included.

*MR = mean of five most recent operator samples (used in c1 of part A), NM = mean of four non-monitored operator samples in MIP samples (used in c1 of part B).

III. Low Weight Gain Samples

Low Weight Gain (LWG) dust samples are loosely defined as uncharacteristically low dust concentrations observed for a particular mining environment. The threshold for what is considered to be a LWG concentration depends on the mining system and location at which the dust sample was collected. Samples taken at the surface or at intake air shafts generally show levels of respirable dust between 0.1 and 0.3 mg/m^3 (see Figure I-5, Tables I-5 and I-10; also: Sharp, 1978, p.17; Boden & Gold, 1984, p. 432). In fact, 84 percent of the SIP intake air samples measured 0.2 mg/m^3 or less after truncation to one decimal place. Intake air concentrations, therefore, may be said to characteristically range up to 0.3 mg/m^3, and a reasonable LWG cutoff for intake air samples would have to be defined at a level falling below MSHA's current minimum measurement threshold of 0.1 mg/m^3.

DO dust sample measurements, on the other hand, are generally higher (see Figure I-3 and Table I-5), with only a relatively small percentage exhibiting concentrations in the range characteristic of intake air samples. 92 percent of the SIP DO sample dust concentrations measured at least 0.3 mg/m^3 after truncation, and about 85 percent measured at least 0.5 mg/m^3. This includes 76 SIP MMU's (14 of these 76 were longwalls) for which the SIP DO concentration was sampled on a shift with production less than 50 percent of the average shift production during the operator dust sampling cycle prior to SIP. Such samples would have been voided if they had been operator samples. If they are excluded, then the percentage of SIP DO dust samples at 0.3 or more mg/m^3 rises by one percentage point to 93. Furthermore, a disproportionately high number of the SIP DO samples measuring below 0.3 mg/m^3 come from MMU's classified as other than longwall, continuous, or conventional. If such MMU's are also excluded, then 95 percent of the remaining 592 SIP DO samples meeting the 50-percent shift production criterion (including all 66 at longwall MMU's) measure at least 0.3 mg/m^3. By the same token, however, since more than 31 percent of the DO dust concentrations obtained at SIP MMU's classified as "other" fall below 0.3 mg/m^3, these should not be regarded as low weight gain samples.

It is, therefore, evident from the frequency distributions of DO and intake air dust concentrations at longwall, continuous, and conventional SIP MMU's that concentrations up through those truncated to 0.2 mg/m^3 are far more characteristic of intake air samples than of DO samples on "normal" production shifts. Based on the SIP data, a normal DO sample at a longwall, continuous, or conventional MMU's should measure at least 0.3 mg/m^3 with probability of about 95 percent. Consequently, for the purposes of this study, concentrations up through those truncated to 0.2 mg/m^3 are defined as LWG dust samples at longwall, continuous, and conventional MMU's.

The primary focus of the analysis described in this section is the mine operator respirable dust sampling program. The analysis utilizes data from the mine operator dust sample database, POPERAT, documented in Appendix B. The time period covered comprises 13 bimonthly sampling cycles, from the last cycle of 1989 through the last cycle of 1991. The object is to evaluate the impact of LWG samples on MMU Compliance Determination Groups (CDG's). These are groups of operator samples, all taken on the DO for an MMU. Within each CDG, the first five valid samples processed by MSHA's respirable dust laboratory are used to calculate an average dust concentration. This average is then compared with the quartz-adjusted dust standard (QAS) to determine compliance or non-compliance. The DO dust samples within a CDG are each assigned a Sample Usage

Code (SUC). Samples making up the normal, bimonthly CDG are assigned an SUC = 1. If the MMU is found to be out of compliance with the QAS, the operator must submit abatement samples, comprising additional CDG's, until compliance is achieved. Abatement samples are assigned an SUC = 7 if their CDG achieves compliance. Otherwise, they are assigned an SUC of 3 or 4, and further abatement sampling is required.

A. Frequency of Low Weight Gain Samples

Tables III-1 through III-3, representing longwall, continuous, and conventional MMU's, respectively, show the number and percentage of LWG DO dust concentrations obtained from SIP, MIP, regular operator samples from Nov. 1, 1989 through Dec. 31,

Table III-1. Frequency of Low Weight Gain DO dust samples (concentrations < 0.3 mg/m³) obtained at longwall MMU's through SIP, MIP, regular mine operator, and regular MSHA inspector sampling.

Top number is count; bottom is percentage.

Sampling Program (valid DO samples only)		LWG Samples	Non-LWG Samples	Total
SIP (with normal shift production requirement)		0 0.0	66 100	66 100.0
Regular Inspector Oct. 1, 1989 - July 31, 1991		6 1.5	407 98.5	413 100.0
MIP (with normal shift production requirement)		2 6.1	31 93.9	33 100.0
Regular Operator Nov. 1, 1989 - Dec. 31, 1991	Bimonthly Compliance Determination Samples	240 5.1	4472 94.9	4712 100.0
	Abatement Samples, Compliance Not Achieved	2 0.3	625 99.7	627 100.0
	Abatement Samples, Compliance Achieved	43 4.2	975 95.8	1018 100.0

1991, and regular MSHA inspector samples from Oct 1, 1989 through July 31, 1991 (prior

Table III-2. Frequency of Low Weight Gain DO dust samples (concentrations < 0.3 mg/m³) obtained at continuous MMU's through SIP, MIP, regular mine operator, and regular MSHA inspector sampling.

Top number is count; bottom is percentage.

Sampling Program (valid DO samples only)		LWG Samples	Non-LWG Samples	Total
SIP (with normal shift production requirement)		28 6.0	436 94.0	464 100.0
Regular Inspector Oct. 1, 1989 - July 31, 1991		496 14.6	2903 85.4	3399 100.0
MIP (with normal shift production requirement)		53 10.1	470 89.9	523 100.0
Regular Operator Nov. 1, 1989 - Dec. 31, 1991	Bimonthly Compliance Determination Samples	21,186 24.4	65,613 75.6	86,799 100.0
	Abatement Samples, Compliance Not Achieved	126 7.2	1635 92.8	1761 100.0
	Abatement Samples, Compliance Achieved	1476 22.0	5236 78.0	6712 100.0

Table III-3. Frequency of Low Weight Gain DO dust samples (concentrations < 0.3 mg/m³) obtained at conventional MMU's through SIP, MIP, regular mine operator, and regular MSHA inspector sampling.

Top number is count; bottom is percentage.

Sampling Program (valid DO samples only)		LWG Samples	Non-LWG Samples	Total
SIP (with normal shift production requirement)		4 6.5	58 93.5	62 100.0
Regular Inspector Oct. 1, 1989 - July 31, 1991		101 22.9	340 77.1	441 100.0
MIP (with normal shift production requirement)		11 21.2	41 78.8	52 100.0
Regular Operator Nov. 1, 1989 - Dec. 31, 1991	Bimonthly Compliance Determination Samples	4193 36.1	7416 63.9	11,609 100.0
	Abatement Samples, Compliance Not Achieved	5 7.2	64 92.8	69 100.0
	Abatement Samples, Compliance Achieved	125 26.6	345 73.4	470 100.0

to SIP). SIP samples are limited to those meeting the same shift production criterion in force for operator samples. MMU's classified as "other" than longwall, continuous, or conventional are excluded because, based on the SIP data, DO concentrations falling below 0.3 mg/m^3 are not unusual at such MMU's.

Table III-4 summarizes the magnitude and statistical significance of differences in LWG frequency observed under the various sampling programs. For each comparison in

Table III-4. LWG odds ratio and statistical significance of differences in LWG frequency under SIP, MIP, Regular Inspector, and Operator compliance sampling programs.

LWG COMPARISON CATEGORIES (C1 vs. C2) (valid DO samples only)	LWG ODDS RATIO (C1 to C2) (Approx. Std. Error of Odds Ratio) Significance Level (α)		
	Longwall	Continuous	Conventional
Operator (compliance samples) vs. SIP	∞ N/A *	5.0 (.98) ***	8.2 (4.2) ***
MIP vs. SIP	∞ N/A **	1.8 (.43) **	3.9 (2.4) **
Regular Inspector vs. SIP	∞ N/A	2.7 (.53) ***	4.3 (2.3) ***
Regular Inspector vs. MIP	.23 (.19) **	1.5 (.23) ***	1.1 (.40)
Operator (compliance samples) vs. MIP	.83 (.61)	2.9 (.42) ***	2.1 (.72) **
Operator (compliance samples) vs. Regular Inspector	3.6 (1.5) ***	1.9 (.09) ***	1.9 (.22) ***

α denotes probability that a difference of the observed magnitude would be found if the proportion of LWG samples were identical in the two categories specified, based on a Chi-Square test of the corresponding contingency table. Blank signifies α > .1; *, **, and *** signify differences at the 90-percent, 95-percent, and 99-percent confidence levels, respectively.

Table III-4, the "odds ratio" represents the odds for obtaining a DO LWG sample in the first sampling program, expressed as a multiple of the odds in the second. Only those samples taken on shifts meeting the normal shift production criterion are included in the comparisons. For example, at continuous mining MMU's, the category with the most available data, the odds for LWG in ordinary operator compliance sampling (21,186/65,613 = .32, from Table III-2) are approximately 5.0 ± .98 times the odds observed under SIP (28/436 = .064, from Table III-2). The corresponding difference in proportion of LWG samples (21,186/86,799 = 24.4% vs. 28/464 = 6.0%, also from Table III-2) is statistically significant with 99-percent confidence (tail probability $\alpha < .01$). Similarly, at longwall MMU's, the odds for LWG among operator samples are about 3.6 ± 1.5 times the odds for LWG among regular inspector samples.

Since no LWG samples were observed under SIP at longwall MMU's, the odds ratio is not meaningful for comparisons involving SIP longwalls. The probability of observing LWG at longwall MMU's, however, is evidently lower under SIP than both under MIP (with 95-percent confidence) and under operator compliance sampling (with 90-percent confidence). Although the confidence level for imputing a difference is greater, for longwalls, in the operator vs. regular inspector comparison than in the operator vs. SIP comparison, the proportion of LWG samples observed under SIP (zero out of 66) is actually less than that observed among regular inspector samples (six out of 413). The lower confidence level for the operator vs. SIP longwall comparison is attributable to the relatively small SIP sample size. Similarly, the number of MIP longwall samples is too small to provide a reliable comparison with the operator program.

In general, LWG samples are shown to occur with significantly higher odds under operator compliance sampling than under SIP, MIP, or regular inspector sampling. For continuous and conventional MMU's the operator LWG odds are substantially higher than both the MIP and regular inspector LWG odds, and these, in turn, are both substantially higher than the odds for LWG under SIP sampling. Although LWG samples occur with far lower frequency among operator samples at longwall MMU's than at continuous or conventional MMU's, a similar pattern can be inferred for longwalls.

B. Low Weight Gain Patterns in Operator Sampling

Table III-5 breaks out the combined longwall, continuous, and conventional MMU operator DO samples according to the order in which they were taken within the sampling cycle (MMU's classified as "other" are excluded). Among the 103,120 DO samples with SUC = 1, 96,642 are one of the first five samples taken within the sampling cycle. For

Table III-5. Frequency of Low Weight Gain operator DO samples (concentrations < 0.3 mg/m^3), by sampling sequence within bimonthly cycle. MMU's not classified as longwall, continuous, or conventional are excluded.

Sample Sequence Number	(1) LWG Count / (2) Number of Samples ----> (3) LWG Percentage		
	Bimonthly Compliance Determination Samples	Abatement Samples, Compliance NOT Achieved	Abatement Samples, Compliance Achieved
1	4986 / 19,597 ---> 25.4	8 / 217 ---> 3.7	157 / 714 ---> 22.0
2	4879 / 19,586 ---> 24.9	6 / 217 ---> 2.8	160 / 703 ---> 22.8
3	5035 / 19,473 ---> 25.9	11 / 204 ---> 5.4	133 / 676 ---> 19.7
4	4897 / 19,362 ---> 25.3	12 / 199 ---> 6.0	143 / 650 ---> 22.0
5	4773 / 18,624 ---> 25.6	16 / 183 ---> 8.7	137 / 623 ---> 22.0
6	747 / 4375 ---> 17.1	16 / 188 ---> 8.5	139 / 664 ---> 20.9
7	166 / 1232 ---> 13.5	6 / 181 ---> 3.3	145 / 717 ---> 20.2
8	81 / 465 ---> 17.4	10 / 179 ---> 5.6	145 / 735 ---> 19.7
9	26 / 204 ---> 12.7	10 / 180 ---> 5.6	140 / 720 ---> 19.4
10	19 / 108 ---> 17.6	11 / 176 ---> 6.3	147 / 685 ---> 21.5
> 10	10 / 94 ---> 10.6	27 / 533 ---> 5.1	198 / 1313 --> 15.1
Total	25,619 /103,120 ---> 24.8	133 / 2457 ---> 5.4	1644 / 8200 --> 20.0

these, there is no significant difference in LWG rate between samples occupying different positions in the sampling sequence. In other words, LWG samples appear with approximately equal frequency as the first, second, third, fourth, or fifth sample collected within regular bimonthly CDG's. The LWG rates for these positions within the CDG all range between 24.9 and 25.9 percent, and the overall LWG rate for the first five samples is 25.4 percent. However, because one or more of the first five samples may be voided, or the samples may be processed in a different order from that in which they were collected, samples with SUC = 1 can also occupy positions beyond the fifth in a CDG, based on the sample-taken-date. There are 103,120 - 96,642 = 6478 such DO samples recorded in POPERAT, and only 16.2 percent of these samples are LWG. In summary, the LWG rate for bimonthly compliance (SUC = 1) DO samples is 25.4 percent when the samples are among the first five collected in a cycle, whereas it is 16.6 percent for subsequent compliance samples in the same cycle. This difference in LWG rates is statistically significant at a confidence level of more than 99.99 percent.

Operator abatement samples show a significantly lower LWG rate than regular compliance determination samples, even when compliance is achieved by the sample's CDG. As shown in Table III-5, 20.0 percent of the 8200 DO abatement samples whose CDG achieved compliance (i.e., SUC = 7) were LWG samples. For these "SUC = 7" abatement samples, the LWG rate does not differ significantly according to position in the sampling sequence so long as samples are among the first ten collected within a bimonthly period. There are 6887 such DO samples recorded in POPERAT, and 21.0 percent of them are LWG samples. The LWG rate for the first ten sequential positions ranges from 19.4 percent for the ninth sample collected to 22.8 percent for the second. As in the case of "SUC = 1" compliance samples, however, the LWG rate for later abatement samples falls significantly below the rate for samples taken earlier in the bimonthly period. Among the remaining 1313 valid "SUC = 7" DO dust samples whose position in the sampling sequence is greater than ten, 15.1 percent are LWG samples.

Another statistically significant pattern is evident with respect to the relative frequency of LWG samples at underground coal mines of different sizes. Small, medium, and large sized mines are here defined, respectively, as those with 50 or fewer employees, 51-125 employees, or more than 125 employees. Among operator DO dust samples, there is a statistically significant trend (tail probability $\alpha < .0001$) of increasing LWG sample frequency with decreasing mine size. From the last sampling cycle of 1989 through the end of 1991, 37 percent of the valid DO operator samples at small mines were LWG samples. This contrasts with 24 percent at medium sized mines and 11 percent at large mines.

C. LWG Sample Effect on Operator Dust Sample Averages

To assess the effect LWG samples have on exposure estimates and compliance determinations, the 103,120 operator compliance determination samples were aggregated by Compliance Determination Group (CDG), and average dust concentrations were calculated for each CDG with and without the LWG samples included. As in Sections A and B, only valid DO samples at longwall, continuous, and conventional mining MMU's were included. Over the 13-cycle period covered by POPERAT, there are a total of 21,294 CDG's at 3172

Table III-6. Number of Compliance Determination Groups (CDG's) with specified number of LWG and non-LWG samples.

Number of Non-LWG Samples	Number of LWG Samples					
	1	2	3	4	5	TOTAL
0	56	35	34	84	1075	1284
1	68	43	107	1242	0	1460
2	73	148	1671	0	0	1892
3	199	2414	0	0	0	2613
4	3830	0	0	0	0	3830
5	1	0	0	0	0	1
TOTAL	4227	2640	1812	1326	1075	11080

distinct MMU's. 11,080 of these CDG's at 2682 distinct underground MMU's contain at least one LWG sample. Table III-6 contains a tabulation of the number of LWG and non-LWG samples in each of those CDG's with at least one LWG sample. For example, there are 3830 CDG's containing exactly one LWG sample and four non-LWG samples. Perhaps more surprisingly, there are 1075 CDG's containing exactly five LWG samples and no non-LWG samples (these occur at 586 distinct MMU's). The single instance of a CDG with a total of six samples is the result of a coding error in POPERAT: the total should always equal five. In 847 cases, the CDG contains fewer than five samples: these are primarily the result of mine operators' failure to submit sufficient samples, but may also result from deletions of records from the data base.

Table III-7 contains a statistical summary of the 11,080 CDG's with at least one LWG sample. By deleting all LWG samples from the computation of CDG concentration averages, the overall mean of the CDG average DO dust concentrations for these CDG's

Table III-7. Impact of deleting LWG samples from mine operator Compliance Determination Groups (CDG's) containing at least one LWG sample.

	INCLUDING LWG SAMPLES	NOT INCLUDING LWG SAMPLES
Grand Mean of CDG Dust Concentrations, mg/m^3	0.61	1.01
Percentage of CDG's Exceeding QAS	3.2	10.8
Percentage of CDG's Exceeding QAS by > 0.1 mg/m^3	2.7	9.5
Percentage of CDG's Exceeding QAS by > 1.0 mg/m^3	0.7	3.5

Note: Percentages in this table are based only on the 11,080 CDG's containing at least one LWG sample. To obtain percentages based on all 21,294 CDG's, they should be multiplied by 11080/21294 = 0.52.

rises from 0.61 mg/m^3 to 1.01 mg/m^3. In about 15 percent of the individual CDG's, the average concentration increases by more than 0.5 mg/m^3, and in five percent of the cases, it increases by more than 1.0 mg/m^3. The percentage of CDG's whose average concentration exceeds the Quartz-Adjusted dust Standard (QAS) increases from 3.2 percent to 10.8 percent.

For the 2682 distinct MMU's with a CDG having at least one LWG sample, Table III-8 shows the number of MMU's in which deletion of the LWG samples raises the average concentration from below the QAS to a level above the QAS in a specified number of

CDG's. The number of CDG's can range from zero, if none of the 13 potential CDG's for an MMU go from below to above the QAS, to 13 if all of them do. 2140 of the 2682 MMU's had no CDG's in which deleting the LWG samples would have caused the average dust concentration to go from below to above the QAS. 27 MMU's had least three CDG's in which such a transition would have taken place. In the remaining 515 MMU's, deleting the LWG samples would cause a transition in one or two of the CDG's.

Table III-8. Number of MMU's with specified number of CDG's going from below to above QAS upon deletion of LWG samples.

Number of CDG Transitions from Below to Above QAS	Number of MMU's with Specified Number of Transitions
0	2140
1	420
2	95
3	21
4	3
5	2
6	1
> 6	0
Total No. of Transitions = 701 (1*420 + 2*95 + 3*21 + 4*3 + 5*2 + 6*1)	Total No. of MMU's = 2682 (MMU's with at least one LWG sample in a CDG)

Note: This table does not include 490 MMU's with no LWG sample in any CDG.

IV. Dust Generation, Compliance, and Controls

A. Characteristics of Non-Compliant MMU's

In what follows, SIP and MIP MMU's are evaluated with respect to compliance or non-compliance to both the quartz-adjusted dust standard (QAS) and the MMU's dust control plan (DCP). As explained in Section I.D.2.1, QAS non-compliance means, in the context of this report, that the quartz-adjusted standard has been exceeded by any amount. In this section, non-compliance with the QAS is determined by the single DO measurement taken during either the SIP or MIP and does not necessarily indicate citability. DCP non-compliance occurs when an observed dust control is less than the corresponding DCP requirement.

A.1 Comparison of MMU's In and Out of Compliance with the QAS

Table IV-1 lays out a comparison between SIP longwall MMU's in and out of compliance with the QAS according to the SIP DO sample concentration. Table IV-2 provides a similar comparison of the non-longwall SIP MMU's, and Tables IV-3 and IV-4 repeat these two comparisons using MIP data. The MMU's are compared with respect to dust controls in place at the time of the SIP or MIP sampling shift, their SIP or MIP shift production as a percentage of their production norms, ratios formed between observed dust controls and Dust Control Plan (DCP) requirements, and ratios formed between observed dust controls and SIP or MIP shift production. The "water factor" presented is summed water pressure (psi), taken over all water sprays in an MMU.

Tables IV-1 through IV-4 show that during both the SIP and MIP inspections, at both longwall and non-longwall MMU's, MMU's in compliance with the QAS tended to operate at a lower fraction of their production capacity than MMU's not in compliance. The production difference between compliant and non-compliant mines is statistically significant, when SIP or MIP shift production is expressed as a fraction of either C9_Prod (available only for SIP) or maximum operator sampling production. During a SIP inspection, for example, longwalls ***in*** QAS-compliance operate, on average, at 64±7 percent of capacity, as represented by their C9-production, whereas longwalls ***out*** of QAS-compliance are at a mean 86±10 percent. Similarly, during a MIP inspection, longwalls in QAS-compliance operate at a mean 63±4 percent of their OpMax_Prd whereas those out of compliance are at 89±31 percent. (Despite the large standard error due to averaging only 9 non-compliant MIP longwalls, the difference is statistically significant at 95-percent confidence.)

Tables IV-1 through IV-4 also show that during both the SIP and MIP inspections, dust controls in place tended to exceed DCP requirements by large margins, regardless of QAS-compliance. During SIP inspections, however, some of the plan requirements were exceeded to a significantly greater degree at MMU's in compliance with the QAS. At SIP longwalls, for example, observed intake air cfm was, on average, more than twice the DCP requirement at MMU's in compliance (SIP:DCP = 2.07±.16) and less than 50 percent greater at MMU's out of compliance (SIP:DCP = 1.44±.09). Similarly, at non-longwall SIP MMU's, face air cfm and mean entry air velocity exceeded the DCP plan requirements to a somewhat greater extent at MMU's in QAS-compliance than at MMU's out of QAS-compliance. At MIP MMU's, summarized by Tables IV-3 and IV-4, a similar pattern is indicated for face air cfm and water at non-longwall MMU's.

Table IV-1. Comparison of SIP Longwall MMU's in and out of compliance with quartz-adjusted dust standard.

	MMU's in Compliance			MMU's out of Compliance			α Statis-tical Signif-icance
	n	Trimmed Mean	Standard Error of Mean	n	Trimmed Mean	Standard Error of Mean	
SIP DO Dust Concentration	60	1.18	.05	18	2.84	.34	N/A
Quartz-Adjusted Dust Standard	60	1.98	.02	18	1.98	.06	
SIP Shift Production (B1A)	60	2,136	170	18	3,052	338	**
Maximum Production (C9)	58	3,825	238	18	3,937	528	
Average Production (C10)	57	2,818	174	17	3,112	507	
Production Ratio (SIP:C9)	55	0.64	.07	17	0.86	.10	**
Production Ratio (SIP:Op_max)	56	0.70	.05	16	0.85	.09	**
Intake Air cfm Ratio (SIP:DCP)	51	2.07	.16	15	1.44	.09	***
Midface Air Velocity Ratio (SIP:DCP)	28	1.58	.13	10	2.07	.43	*
Tailgate Air cfm Ratio (SIP:DCP)	14	2.54	.45	7	2.54	.46	
Water Spray Ratio (SIP:DCP)	60	1.36	.07	18	1.10	.07	***
Average Water psi Ratio (SIP:DCP)	57	1.55	.14	18	1.74	.17	*
Water Factor Ratio (SIP:DCP)	57	2.15	.21	18	1.91	.36	
Intake Air cfm per Tons Mined	46	34.0	4.4	16	16.1	2.1	***
Midface Air Velocity per Tons Mined	47	0.26	.03	16	0.13	.02	***
Tailgate Air cfm per Tons Mined	23	19.0	2.0	11	9.5	1.0	***
Water Sprays per 100 Tons Mined	51	4.3	.5	16	3.0	.5	
Water Factor per Tons Mined	50	5.9	.9	16	5.1	.9	
Intake Air cfm (DCP)	51	31,511	2,712	15	31,462	3,185	
Intake Air cfm (Observed)	55	65,647	7,472	18	47,547	8,554	
Midface Air Velocity (DCP)	28	283	14	10	192	23	***
Midface Air Velocity (Observed)	55	513	38	18	368	34	***
Tailgate Air cfm (DCP)	15	17,522	3,057	7	11,300	2,847	
Tailgate Air cfm (Observed)	28	38,117	4,550	13	28,700	2,131	
Number of Water Sprays (DCP)	60	66.8	3.7	18	73.7	6.2	
Number of Water Sprays (Observed)	60	85.6	4.3	18	83.2	6.4	
Average Water Pressure (DCP)	59	85.1	7.9	18	102.8	15.4	
Average Water Pressure (Observed)	58	131.0	11.6	18	159.4	28.7	**
Water Factor (DCP)	59	5,876	454	18	7,749	968	*
Water Factor (Observed)	58	11,315	1,075	18	13,584	1,667	

"Op_max" Production is maximum shift production reported by operator in conjunction with the most recent five valid operator dust samples in the sampling period prior to SIP inspection. See Section I.E for definitions of other production measures.

Trimmed Mean excludes largest and smallest value.

α denotes probability that a difference of the observed magnitude would be found if there were in fact no difference, based on either trimmed T-test or Wilcoxan-Mann-Whitney Rank Sum Test. Blank signifies $\alpha > .1$; *, **, and *** signify differences at the 90-percent, 95-percent, or 99-percent confidence levels, respectively. Significance tests are performed on logarithms, and separate, Winsorized variance estimates are used in T-Test when variance inequality is indicated at more than 90-percent confidence.

Table IV-2. Comparison of SIP Non-Longwall MMU's in and out of compliance with quartz-adjusted dust standard.

	MMU's in Compliance			MMU's out of Compliance			α Statistical Significance
	n	Trimmed Mean	Standard Error of Mean	n	Trimmed Mean	Standard Error of Mean	
SIP DO Dust Concentration	493	0.86	.02	136	3.79	.27	N/A
Quartz-Adjusted Dust Standard	493	1.92	.01	136	1.74	.04	***
SIP Shift Production (B1A)	493	429	14	136	499	25	***
Maximum Production (C9)	476	620	23	123	589	34	*
Average Production (C10)	471	510	18	123	515	28	
Production Ratio (SIP:C9)	470	0.78	.02	123	0.83	.04	*
Production Ratio (SIP:Op_MAX)	476	0.87	.02	124	0.95	.04	**
Face Air cfm Ratio (SIP:DCP)	452	1.72	.05	131	1.48	.07	***
Mean Entry Air Velocity Ratio (SIP:DCP)	301	1.70	.06	92	1.46	.06	**
Last Open Crosscut Air cfm Ratio (SIP:DCP)	449	2.34	.06	130	2.11	.08	
Scrubber Air cfm Ratio (SIP:DCP)	113	1.14	.05	24	1.02	.05	*
Water Spray Ratio (SIP:DCP)	414	1.15	.03	112	1.17	.04	
Average Water psi Ratio (SIP:DCP)	407	1.44	.04	110	1.37	.06	
Water Factor Ratio (SIP:DCP)	405	1.65	.05	110	1.60	.11	
Face Air cfm per Tons Mined	437	29.1	2.1	121	17.6	1.6	***
Mean Entry Air Velocity Per Tons Mined	303	.410	.029	91	.297	.035	**
Last Open Crosscut Air cfm Per Tons Mined	437	89.5	6.8	121	59.5	4.4	***
Scrubber Air cfm per Tons Mined	123	10.6	.8	22	7.5	.7	**
Water Sprays per 100 Tons Mined	377	7.3	.3	103	6.1	.4	*
Water Factor Per Tons Mined	376	7.0	.4	99	5.2	.9	**
Face Air cfm (DCP)	466	4,497	107	132	4,104	117	
Face Air cfm (Observed)	475	7,689	292	134	6,056	348	***
Mean Entry Air Velocity (DCP)	356	58.8	1.0	103	56.9	0.9	
Mean Entry Air Velocity (Observed)	328	102.4	3.8	99	92.3	6.0	
Last Open Crosscut Air cfm (DCP)	460	9,487	148	131	9,407	421	
Last Open Crosscut Air cfm (Observed)	475	22,621	638	134	20,102	802	
Scrubber Air cfm (DCP)	133	5,331	118	30	5,116	218	
Scrubber Air cfm (Observed)	131	5,439	190	26	5,150	316	
Number of Water Sprays (DCP)	414	24.0	0.6	114	22.4	1.0	
Number of Water Sprays (Observed)	415	26.6	0.6	115	25.1	1.2	
Average Water Pressure (DCP)	410	67.7	1.3	114	68.2	2.6	
Average Water Pressure (Observed)	412	94.8	2.6	111	88.6	4.3	
Water Factor (DCP)	410	1,759	75	114	1,570	109	
Water Factor (Observed)	412	2,711	122	111	2,345	206	

"Op_max" Production is maximum shift production reported by operator in conjunction with the most recent five valid operator dust samples in the sampling period prior to SIP inspection. See Section I.E for definitions of other production measures.

Trimmed Mean excludes largest and smallest value.

α denotes probability that a difference of the observed magnitude would be found if there were in fact no difference, based on either trimmed T-test or Wilcoxan-Mann-Whitney Rank Sum Test. Blank signifies $\alpha > .1$; *, **, and *** signify differences at the 90-percent, 95-percent, or 99-percent confidence levels, respectively. Significance tests are performed on logarithms, and separate, Winsorized variance estimates are used in T-Test when variance inequality is indicated at more than 90-percent confidence.

Table IV-3. Comparison of MIP Longwall MMU's in and out of compliance with quartz-adjusted dust standard.

	MMU's in Compliance			MMU's out of Compliance			α Statistical Significance
	n	Trimmed Mean	Standard Error of Mean	n	Trimmed Mean	Standard Error of Mean	
MIP DO Dust Concentration	23	1.17	.10	10	3.31	.38	N/A
Quartz-Adjusted Dust Standard	23	1.99	.02	10	2.00	.07	
MIP Shift Production (E2A)	23	2,390	288	10	2,968	508	
Max. Sampling Production (OpMaxPrd)	22	3,831	422	9	3,437	606	
Average Sampling Production (OpAvPrd)	22	2,972	309	9	2,575	528	
Production Ratio (MIP:OpMaxPrd)	22	0.63	.04	9	0.89	.31	**
Intake Air cfm Ratio (MIP:DCP)	19	1.43	.14	7	1.71	.18	
Midface Air Velocity Ratio (MIP:DCP)	9	1.71	.29	7	1.62	.38	
Tailgate Air cfm Ratio (MIP:DCP)	4	1.15	.46	1	N/A	N/A	N/A
Water Spray Ratio (MIP:DCP)	23	1.15	.06	10	1.29	.32	
Average Water psi Ratio (MIP:DCP)	23	1.51	.13	10	1.37	.26	
Water Factor Ratio (MIP:DCP)	23	1.72	.26	10	2.05	.49	
Intake Air cfm per Tons Mined	21	31.6	6.4	8	24.3	13.3	
Midface Air Velocity per Tons Mined	19	0.34	.06	9	0.17	.08	*
Tailgate Air cfm per Tons Mined	16	15.4	3.6	5	15.7	37.7	
Water Sprays per 100 Tons Mined	21	4.8	1.2	9	3.1	.6	
Water Factor per Tons Mined	21	6.7	1.4	9	3.2	.8	*
Intake Air cfm (DCP)	19	40,511	4,492	7	31,150	6,753	
Intake Air cfm (Observed)	23	57,231	7,023	9	60,388	15,913	
Midface Air Velocity (DCP)	9	306	69	7	238	43	
Midface Air Velocity (Observed)	21	615	102	10	510	102	
Tailgate Air cfm (DCP)	4	35,740	8,691	1	N/A	N/A	N/A
Tailgate Air cfm (Observed)	17	30,100	4,641	6	39,107	10,117	
Number of Water Sprays (DCP)	23	74.2	4.3	10	67.1	12.6	
Number of Water Sprays (Observed)	23	85.7	5.6	18	91.4	10.8	
Average Water Pressure (DCP)	23	93.6	4.9	10	68.2	6.5	***
Average Water Pressure (Observed)	23	137.0	15.6	10	82.6	18.4	***
Water Factor (DCP)	23	6,862	511	10	5,000	1,184	
Water Factor (Observed)	23	11,712	1,826	10	7,915	2,285	**

See Section I.E for definitions of production measures.

Trimmed Mean excludes largest and smallest value.

α denotes probability that a difference of the observed magnitude would be found if there were in fact no difference, based on either trimmed T-test or Wilcoxan-Mann-Whitney Rank Sum Test. Blank signifies $\alpha > .1$; *, **, and *** signify differences at the 90-percent, 95-percent, or 99-percent confidence levels, respectively. Significance tests are performed on logarithms, and separate, Winsorized variance estimates are used in T-Test when variance inequality is indicated at more than 90-percent confidence.

Table IV-4. Comparison of MIP Non-Longwall MMU's in and out of compliance with quartz-adjusted dust standard.

	MMU's in Compliance			MMU's out of Compliance			α Statistical Significance
	n	Trimmed Mean	Standard Error of Mean	n	Trimmed Mean	Standard Error of Mean	
MIP DO Dust Concentration	537	0.80	.02	106	2.91	.12	N/A
Quartz-Adjusted Dust Standard	537	1.88	.01	106	1.77	.04	***
MIP Shift Production (E2A)	537	512	24	106	682	93	***
Max. Sampling Production (OpMaxPrd)	512	657	38	97	765	109	
Average Sampling Production (OpAvPrd)	512	555	29	97	627	88	*
Production Ratio (MIP:OpMaxPrd)	490	0.89	.02	88	1.03	.06	***
Face Air cfm Ratio (MIP:DCP)	482	1.69	.05	92	1.41	.06	***
Mean Entry Air Velocity Ratio (MIP:DCP)	345	1.57	.04	69	1.42	.09	*
Last Open Crosscut Air cfm Ratio (MIP:DCP)	464	2.11	.05	92	2.19	.14	
Scrubber Air cfm Ratio (MIP:DCP)	100	1.02	.01	18	0.99	.01	
Water Spray Ratio (MIP:DCP)	439	1.14	.02	88	1.12	.04	
Average Water psi Ratio (MIP:DCP)	433	1.42	.04	86	1.25	.06	*
Water Factor Ratio (MIP:DCP)	430	1.61	.05	85	1.36	.06	**
Face Air cfm per Tons Mined	472	23.5	1.1	85	14.6	1.4	***
Mean Entry Air Velocity per Tons Mined	361	.367	.023	70	.248	.024	***
Last Open Crosscut Air cfm per Tons Mined	464	68.6	2.8	86	50.9	3.4	**
Scrubber Air cfm per Tons Mined	104	11.0	.8	18	8.6	.8	
Water Sprays per 100 Tons Mined	420	7.1	.3	80	5.6	.4	
Water Factor per Tons Mined	415	7.0	.4	78	4.9	.4	**
Face Air cfm (DCP)	494	4,513	151	95	4,288	165	
Face Air cfm (Observed)	496	7,060	212	93	6,114	361	
Mean Entry Air Velocity (DCP)	379	63.2	1.7	74	59.4	2.5	
Mean Entry Air Velocity (Observed)	381	95.6	2.8	75	85.0	5.2	*
Last Open Crosscut Air cfm (DCP)	480	10,478	272	93	9,963	375	
Last Open Crosscut Air cfm (Observed)	488	21,083	521	94	20,607	1,120	
Scrubber Air cfm (DCP)	116	5,244	135	21	5,086	170	
Scrubber Air cfm (Observed)	109	5,443	172	20	4,951	300	
Number of Water Sprays (DCP)	463	25.7	0.7	98	27.2	2.1	
Number of Water Sprays (Observed)	463	28.8	0.9	98	31.1	2.5	
Average Water Pressure (DCP)	462	71.9	1.4	98	70.4	2.4	
Average Water Pressure (Observed)	458	97.7	2.4	96	86.0	4.0	*
Water Factor (DCP)	462	1,946	81	98	1,965	187	
Water Factor (Observed)	458	3,025	167	96	2,768	352	

See Section I.E for definitions of production measures.

Trimmed Mean excludes largest and smallest value.

α denotes probability that a difference of the observed magnitude would be found if there were in fact no difference, based on either trimmed T-test or Wilcoxan-Mann-Whitney Rank Sum Test. Blank signifies $\alpha > .1$; *, **, and *** signify differences at the 90-percent, 95-percent, or 99-percent confidence levels, respectively. Significance tests are performed on logarithms, and separate, Winsorized variance estimates are used in T-Test when variance inequality is indicated at more than 90-percent confidence.

Figure IV-1 compares quantiles of the SIP:max production ratio for SIP longwall MMU's in and out of compliance with the QAS ("max" is C9_Prod). To the extent that the height of rectangles formed by the quantiles exceeds their width, this graph confirms that longwall MMU's out of compliance with the QAS tend to operate at a higher fraction of their C9 production during a SIP inspection than those in compliance. For one-fourth (the lower quartile) of compliant SIP longwalls, SIP shift production was less than about 41 percent of C9-production (SIP:max < 0.41).

Figures IV-2 through IV-7 compare quantiles of longwall SIP:DCP ratios for longwall MMU's in and out of QAS-compliance during the SIP, and Figures IV-8 through IV-15 provide similar comparisons for non-longwall MMU's. In a substantial percentage of MMU's, represented in the graphs by the upper quartile, controls were exceeded by large margins even when QAS-compliance was not achieved. Since Compliance with the DCP is indicated whenever the ratio of an observed dust control to the corresponding DCP parameter is greater than 1.0, the graphs demonstrate that during the SIP inspection, DCP requirements were exceeded in nearly all cases regardless of whether the MMU was in or out of compliance with the dust standard. For some controls, however, there is substantial difference in the degree of excess. Figure IV-3, for example, shows that one-fourth of compliant longwall MMU's exceeded the midface air velocity requirement by at least 85 percent (SIP:DCP ≥ 1.85). In contrast, at non-compliant longwalls the upper quartile exceeded the requirement by more than 210 percent (SIP:DCP > 3.1). On the other hand, compliant longwalls tended to exceed the intake air cfm requirement by a greater amount than non-compliant longwalls, as shown in Figure IV-4.

Figure IV-1. SIP:MAX Production Ratio for Longwall MMU's

"MAX" is maximum non-sampling shift production as determined by SIP inspector

(i.e., MAX = C9_Prod)

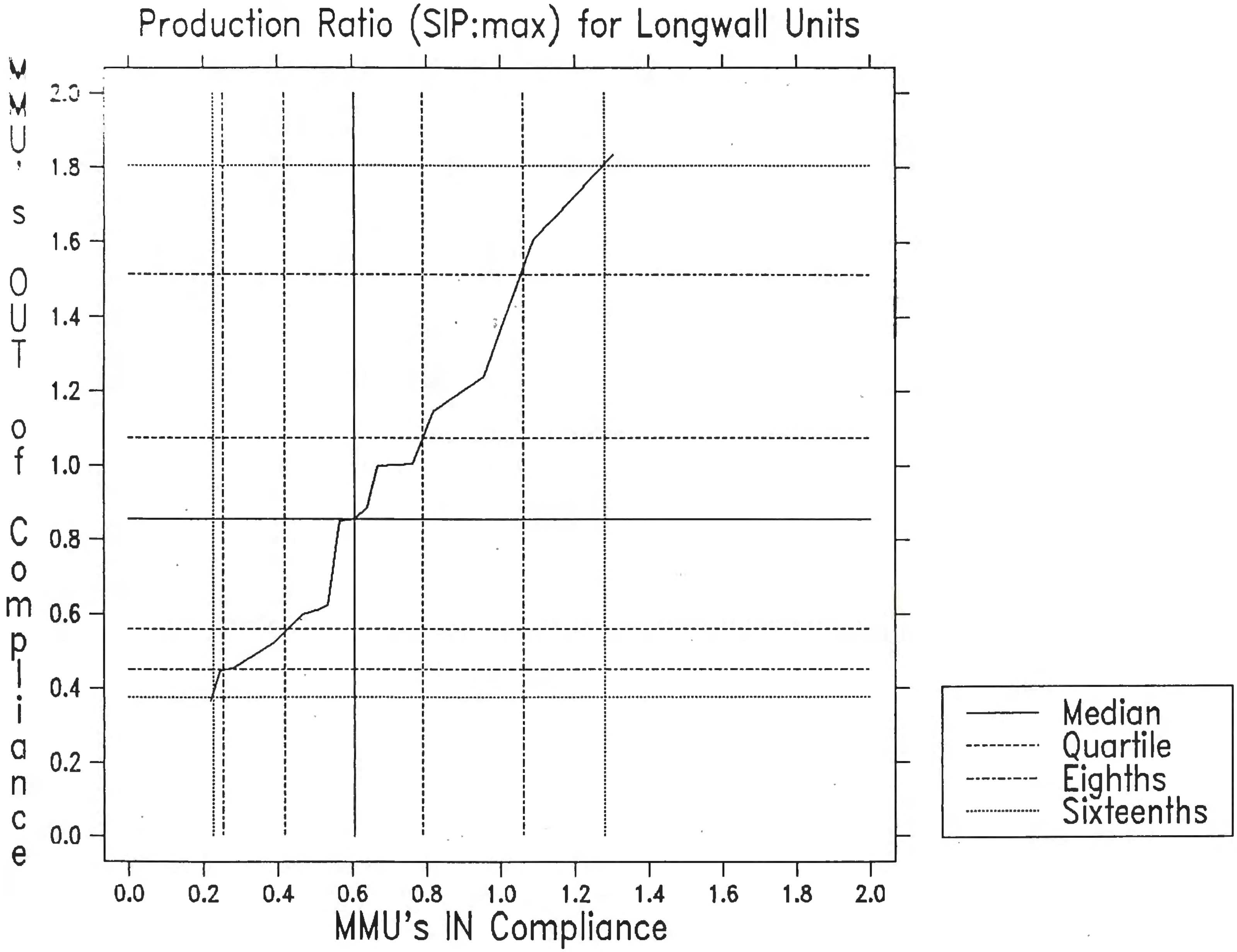
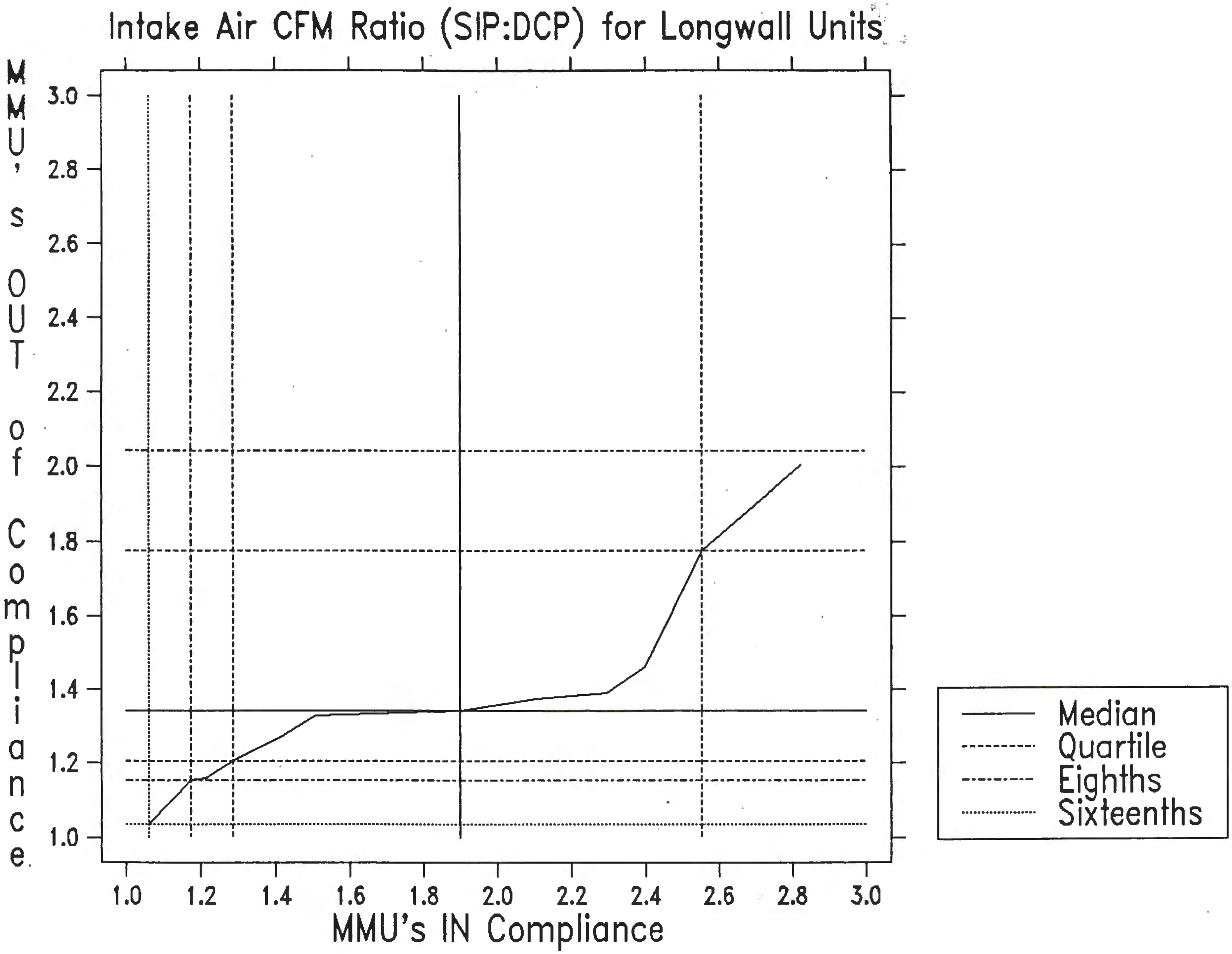
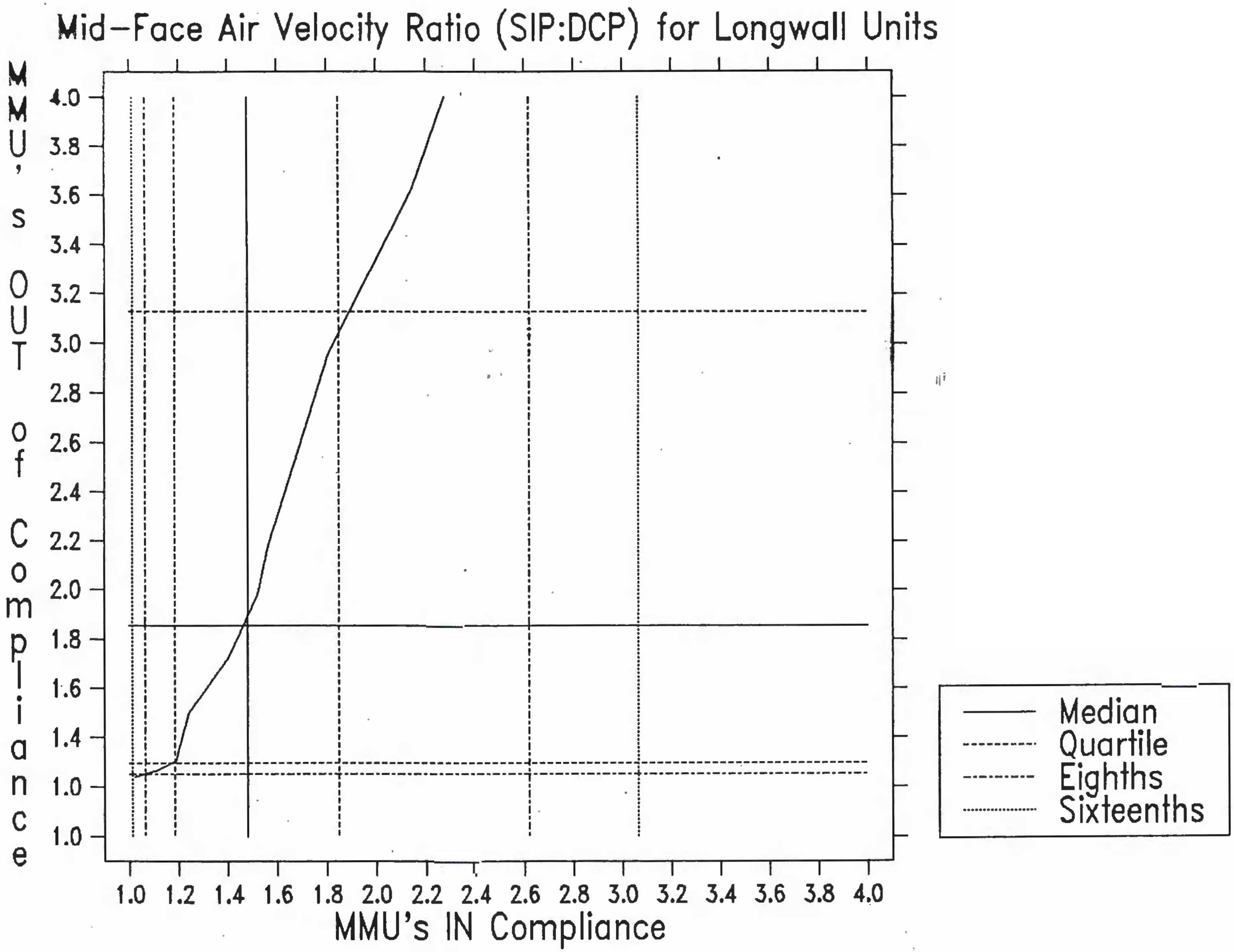

Production Ratio (SIP:max) for Longwall Units
MMU's OUT of Compliance
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
MMU's IN Compliance
Median
Quartile
Eighths
Sixteenths

Figure IV-2. SIP:DCP Intake Air CFM Ratio for Longwall MMU's



Intake Air CFM Ratio (SIP:DCP) for Longwall Units
MMU's OUT of Compliance
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0
MMU's IN Compliance
Median
Quartile
Eighths
Sixteenths

Figure IV-3. SIP:DCP Midface Air CFM Ratio for Longwall MMU's



Mid-Face Air Velocity Ratio (SIP:DCP) for Longwall Units
MMU's OUT of Compliance
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.0
1.0
1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0
MMU's IN Compliance
Median
Quartile
Eighths
Sixteenths

Figure IV-4. SIP:DCP Tailgate Air CFM Ratio for Longwall MMU's

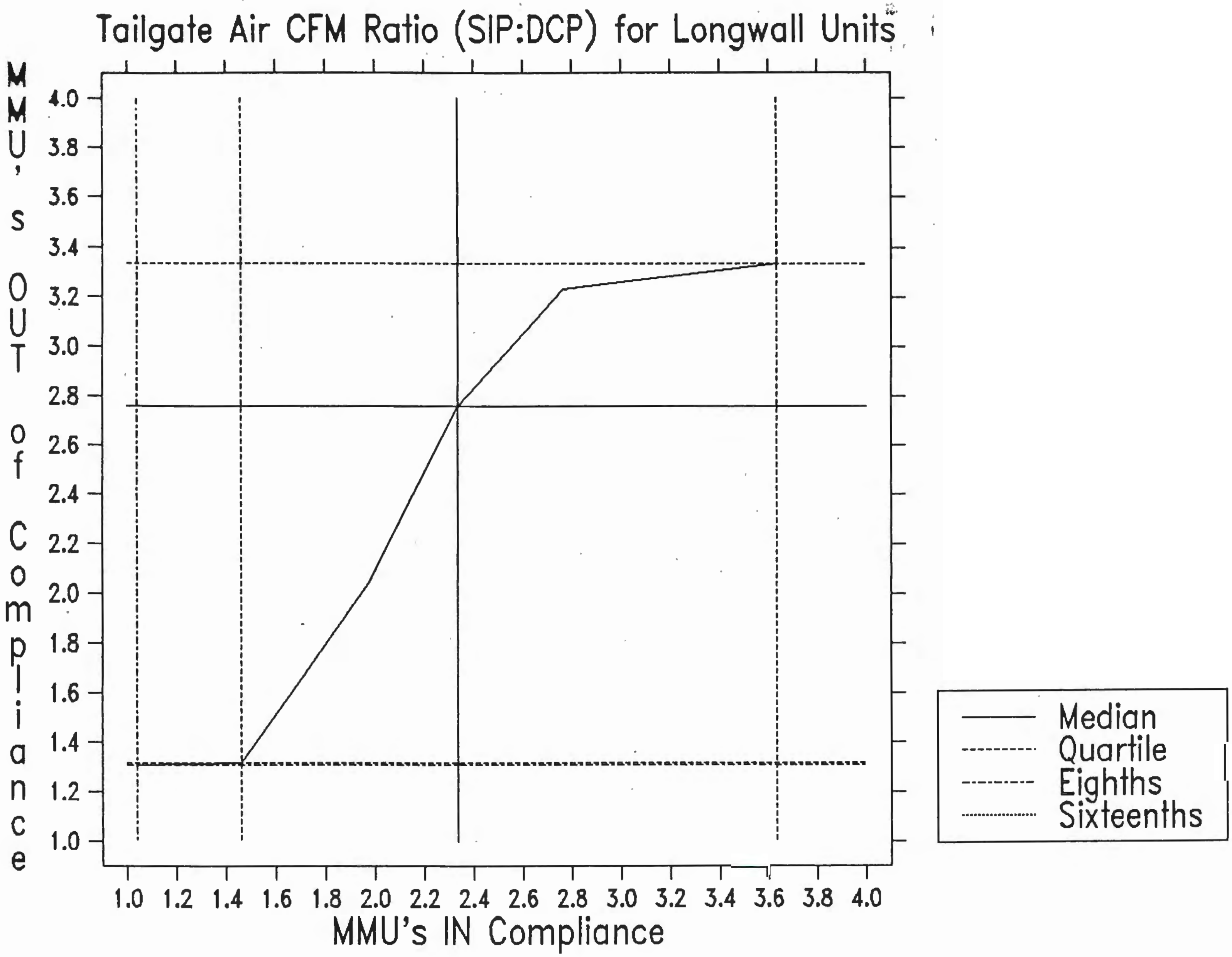
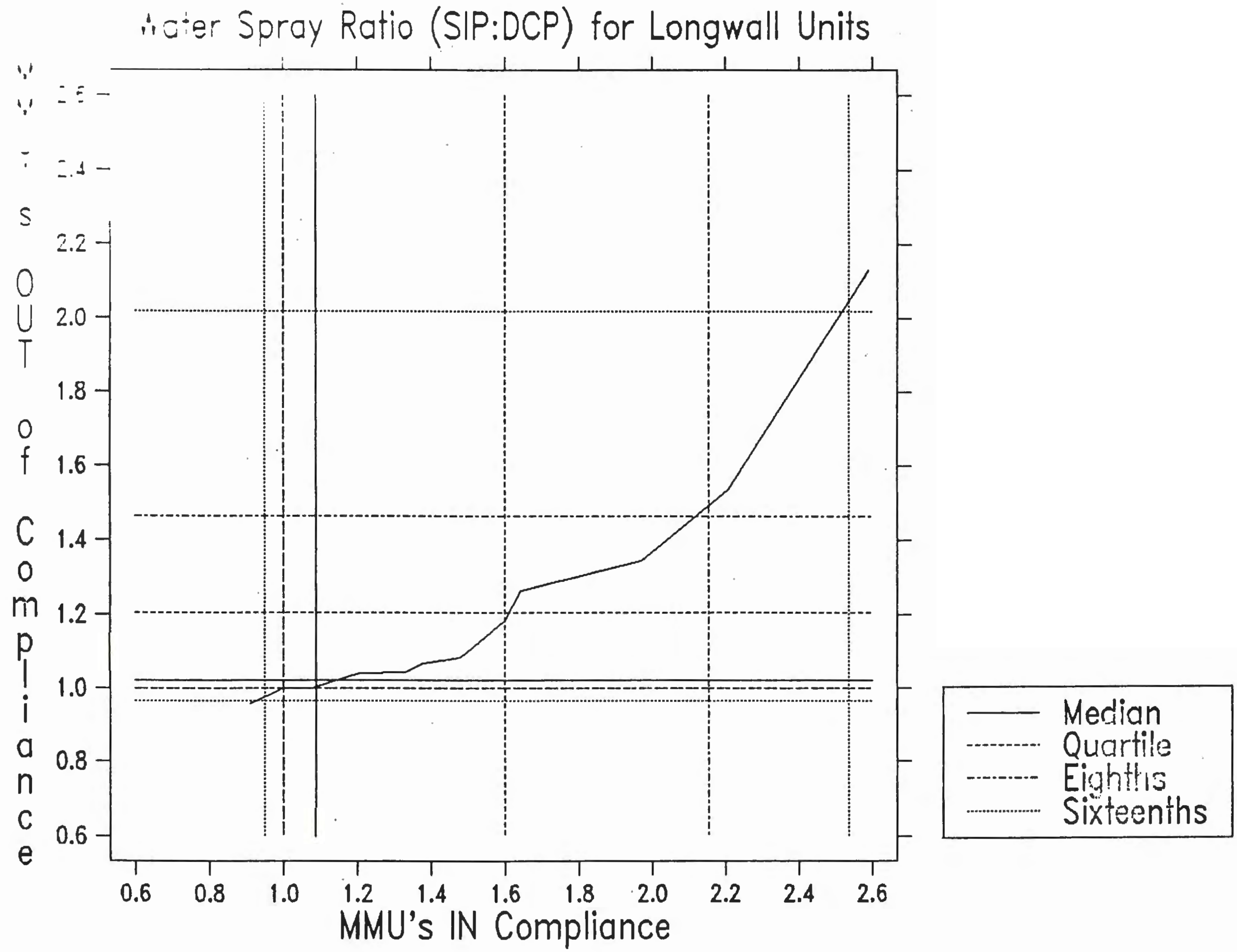

Tailgate Air CFM Ratio (SIP:DCP) for Longwall Units
MMU's OUT of Compliance
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0
MMU's IN Compliance
Median
Quartile
Eighths
Sixteenths

Figure IV-5. SIP:DCP Water Spray Ratio for Longwall MMU's



Water Spray Ratio (SIP:DCP) for Longwall Units
MMU's OUT of Compliance
MMU's IN Compliance
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
Median
Quartile
Eighths
Sixteenths

Figure IV-6. SIP:DCP Water PSI Ratio for Longwall MMU's

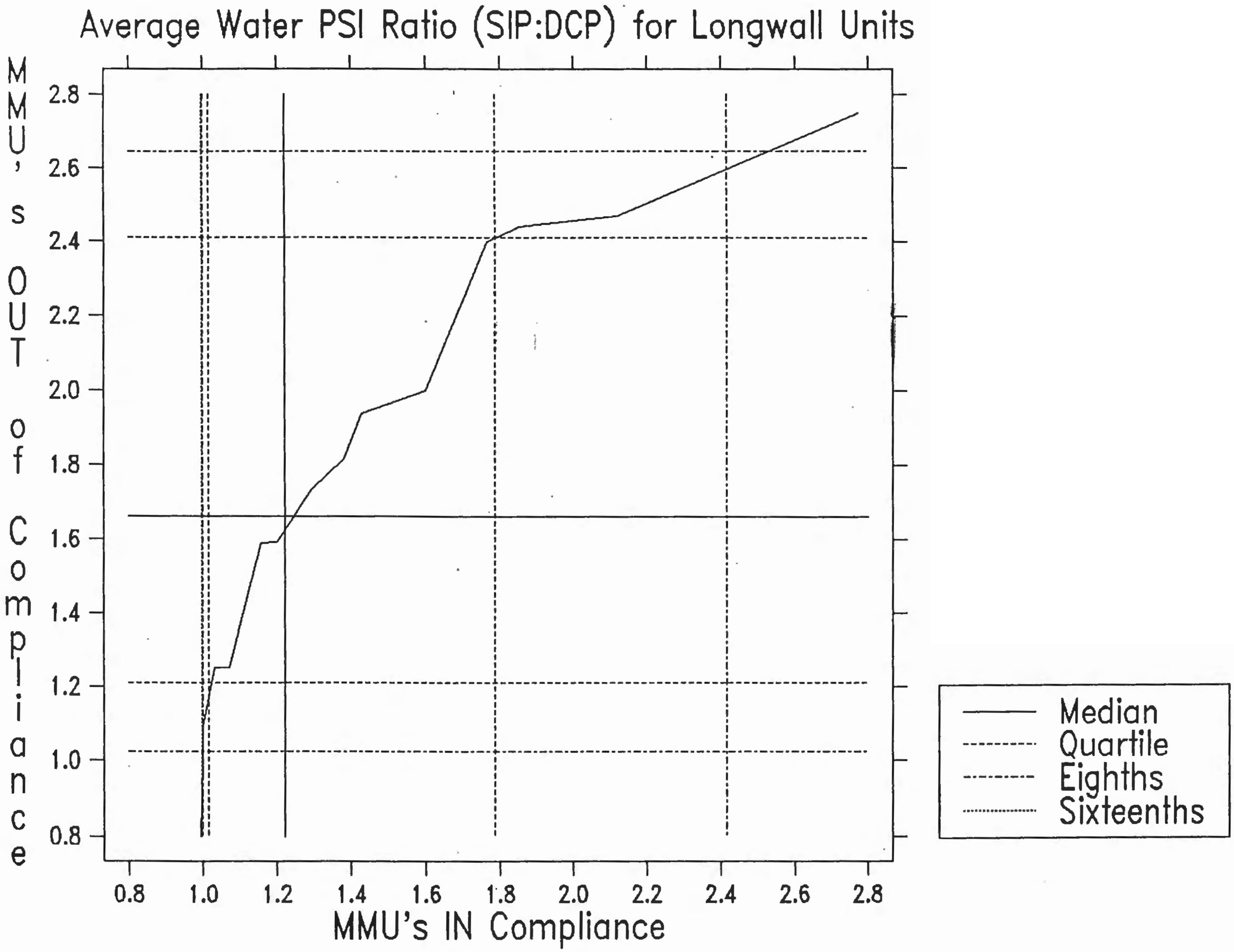
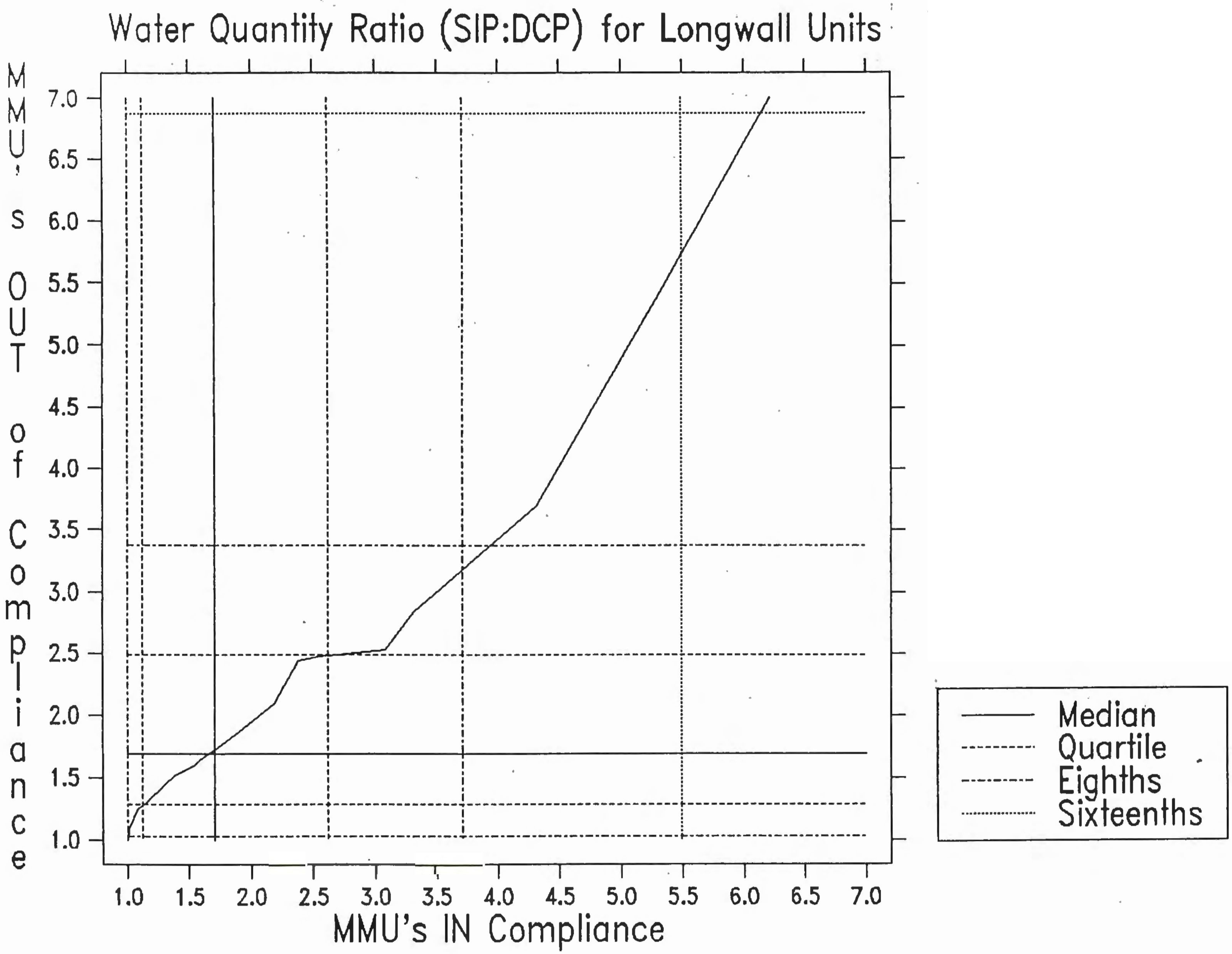

Average Water PSI Ratio (SIP:DCP) for Longwall Units
MMU's OUT of Compliance
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
MMU's IN Compliance
Median
Quartile
Eighths
Sixteenths

Figure IV-7. SIP:DCP Total Water Factor Ratio for Longwall MMU's



Water Quantity Ratio (SIP:DCP) for Longwall Units
MMU's OUT of Compliance
MMU's IN Compliance
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
Median
Quartile
Eighths
Sixteenths

Figure IV-8. SIP:MAX Production Ratio for Non-Longwall MMU's

"MAX" is maximum non-sampling shift production as determined by SIP inspector

(i.e., MAX = C9_Prod)

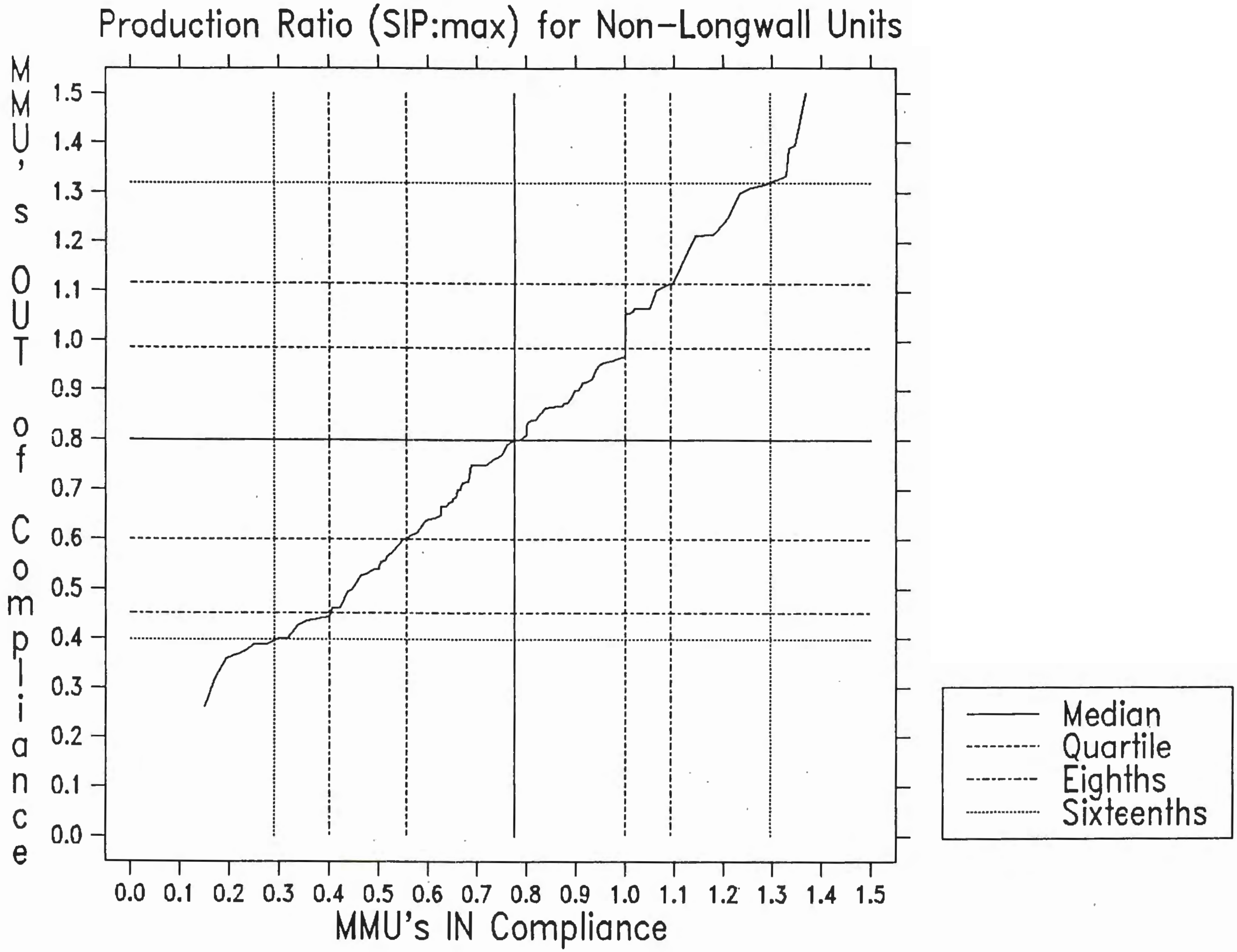

Production Ratio (SIP:max) for Non-Longwall Units
MMU's OUT of Compliance
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5
MMU's IN Compliance
Median
Quartile
Eighths
Sixteenths

Figure IV-9. SIP:DCP Face Air CFM Ratio for Non-Longwall MMU's

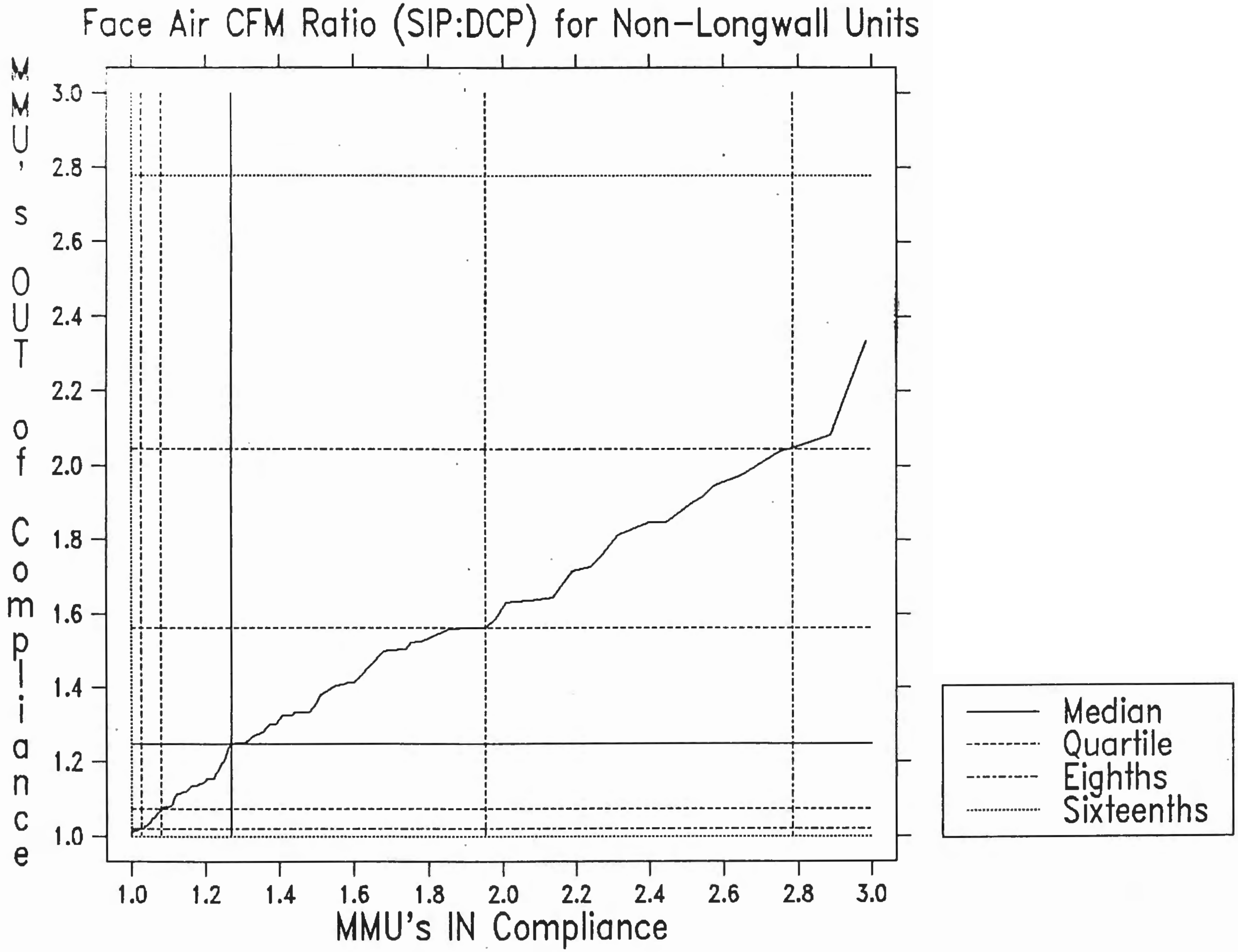

Face Air CFM Ratio (SIP:DCP) for Non-Longwall Units
MMU's OUT of Compliance
MMU's IN Compliance
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
Median
Quartile
Eighths
Sixteenths

Figure IV-10. SIP:DCP Mean Entry Air Velocity Ratio for Non-Longwall MMU's

Mean Entry Air Velocity Ratio (SIP:DCP) for Non-Longwall Units

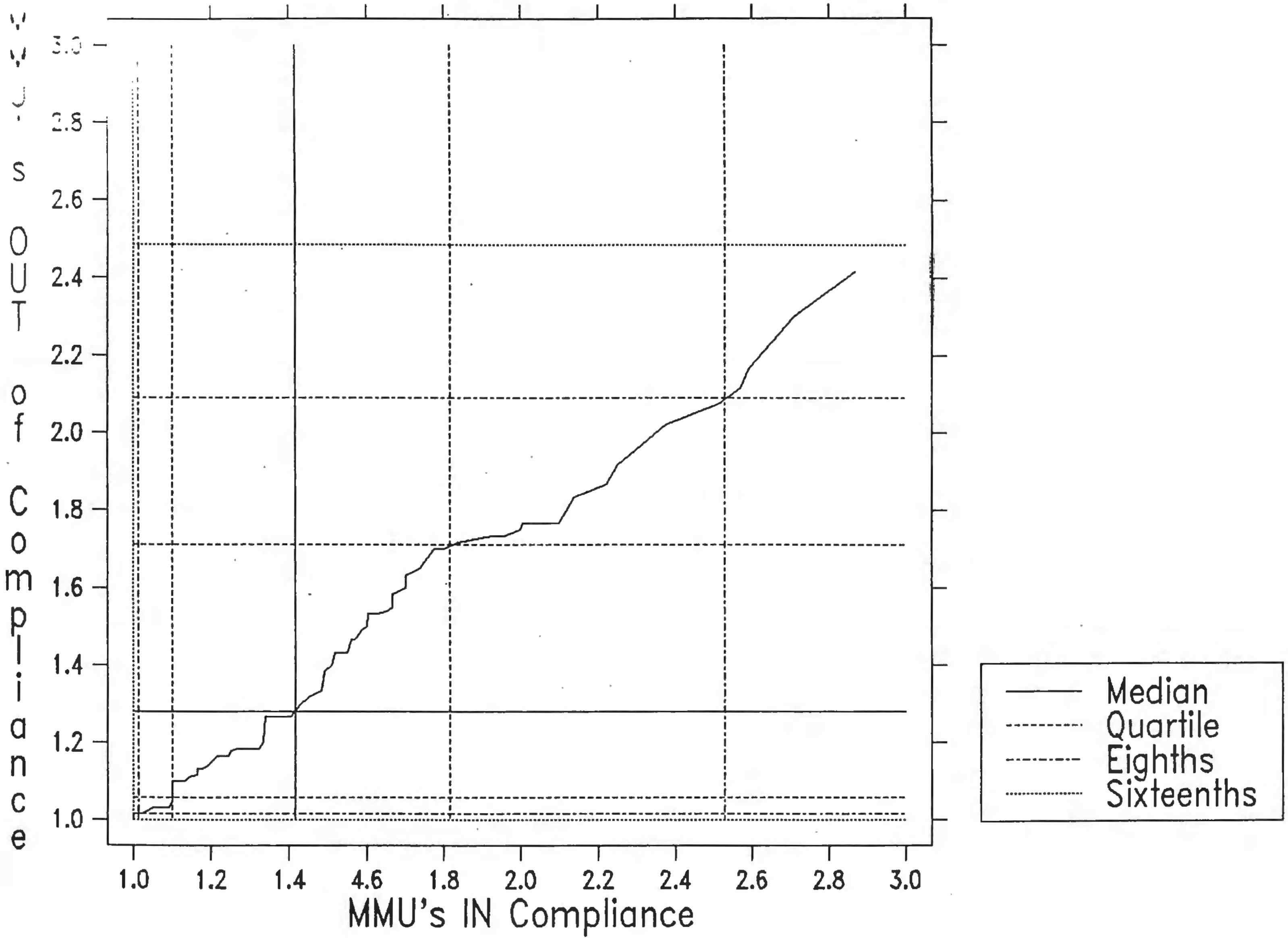


Figure IV-11. SIP:DCF Last Open Xcut CFM Ratio for Non-Longwall MMU's

Last Open Xcut Air CFM Ratio (SIP:DCP) for Non-Longwall Units

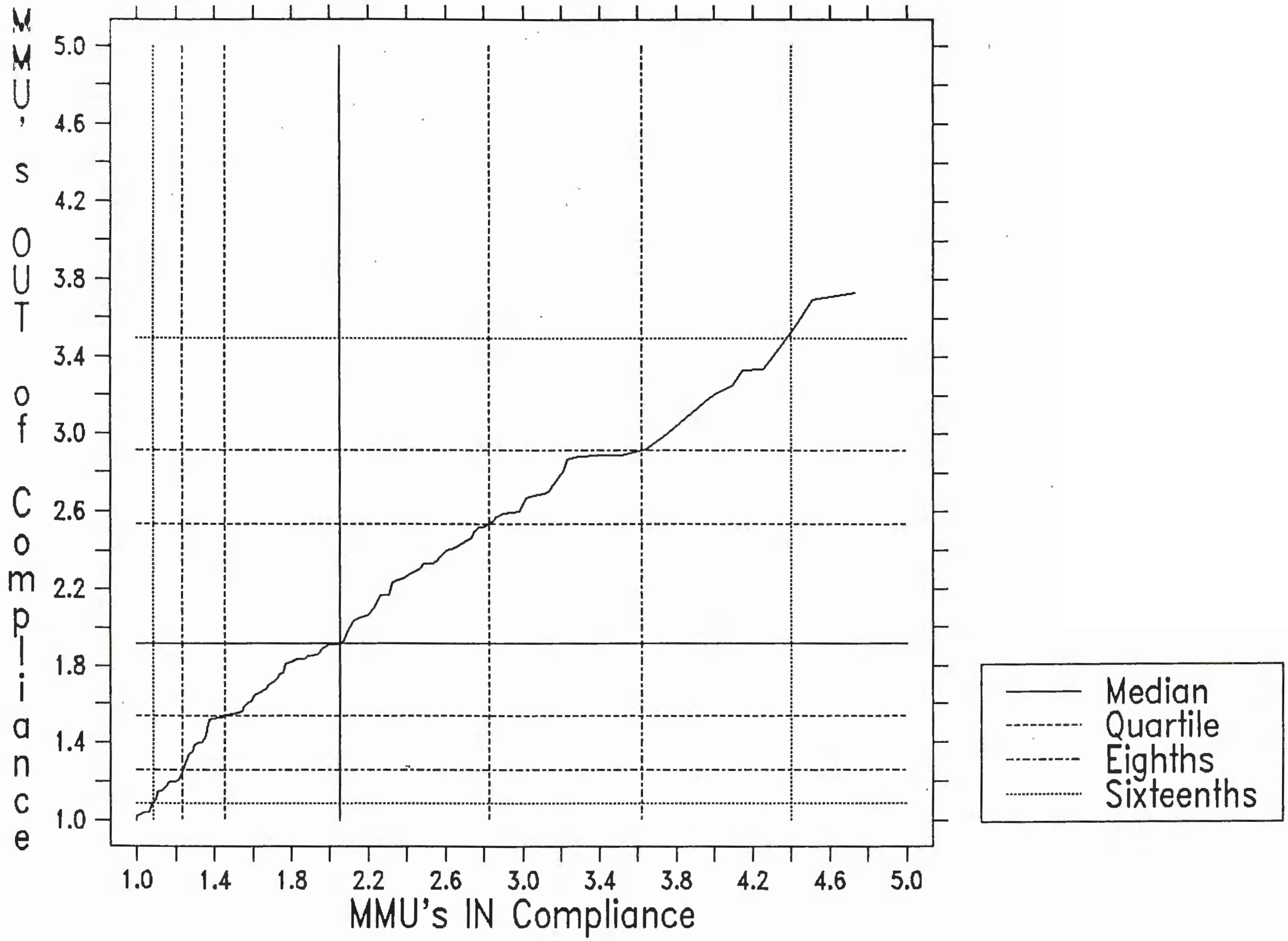


Figure IV-12. SIP:DCP Scrubber CFM Ratio for Non-Longwall MMU's

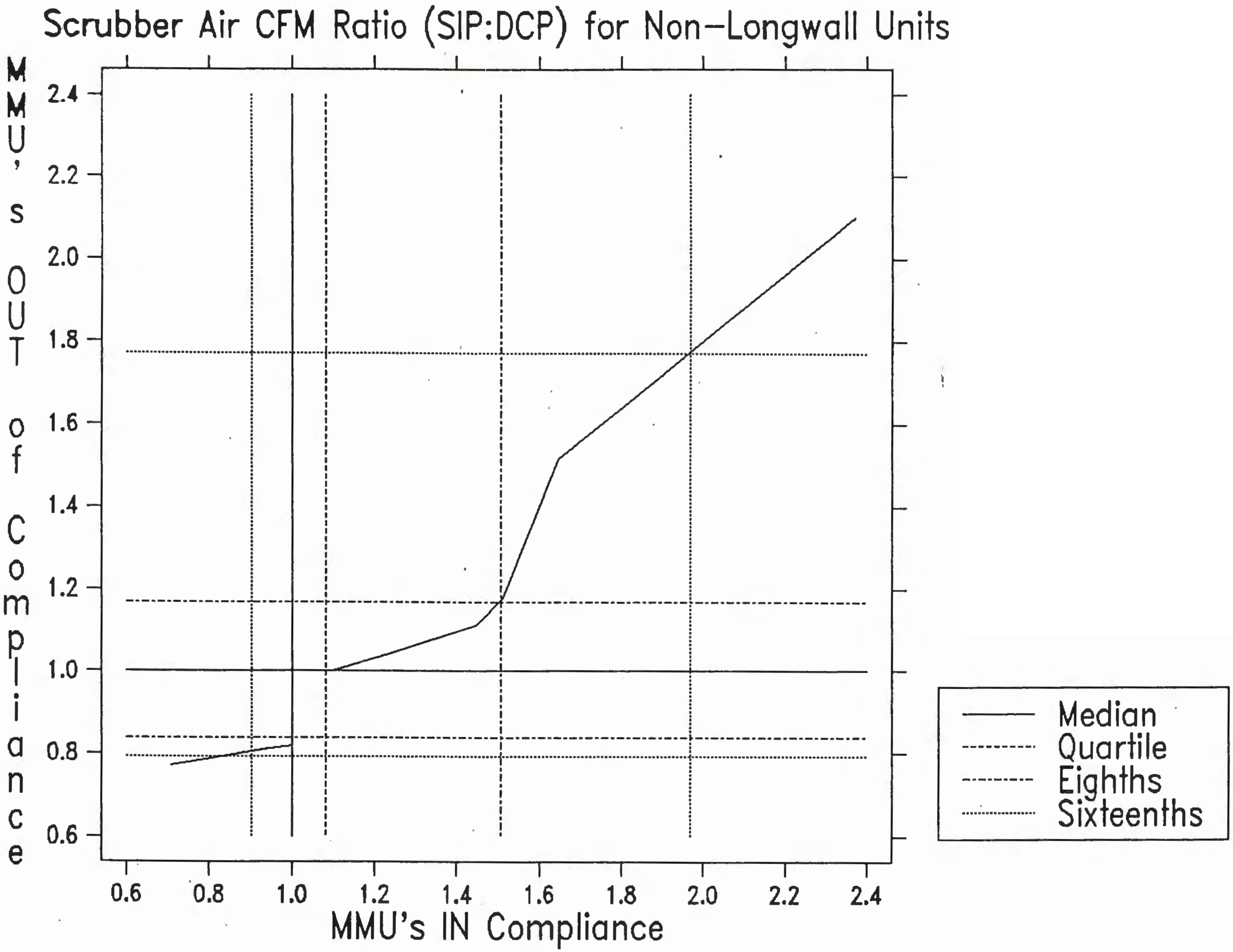
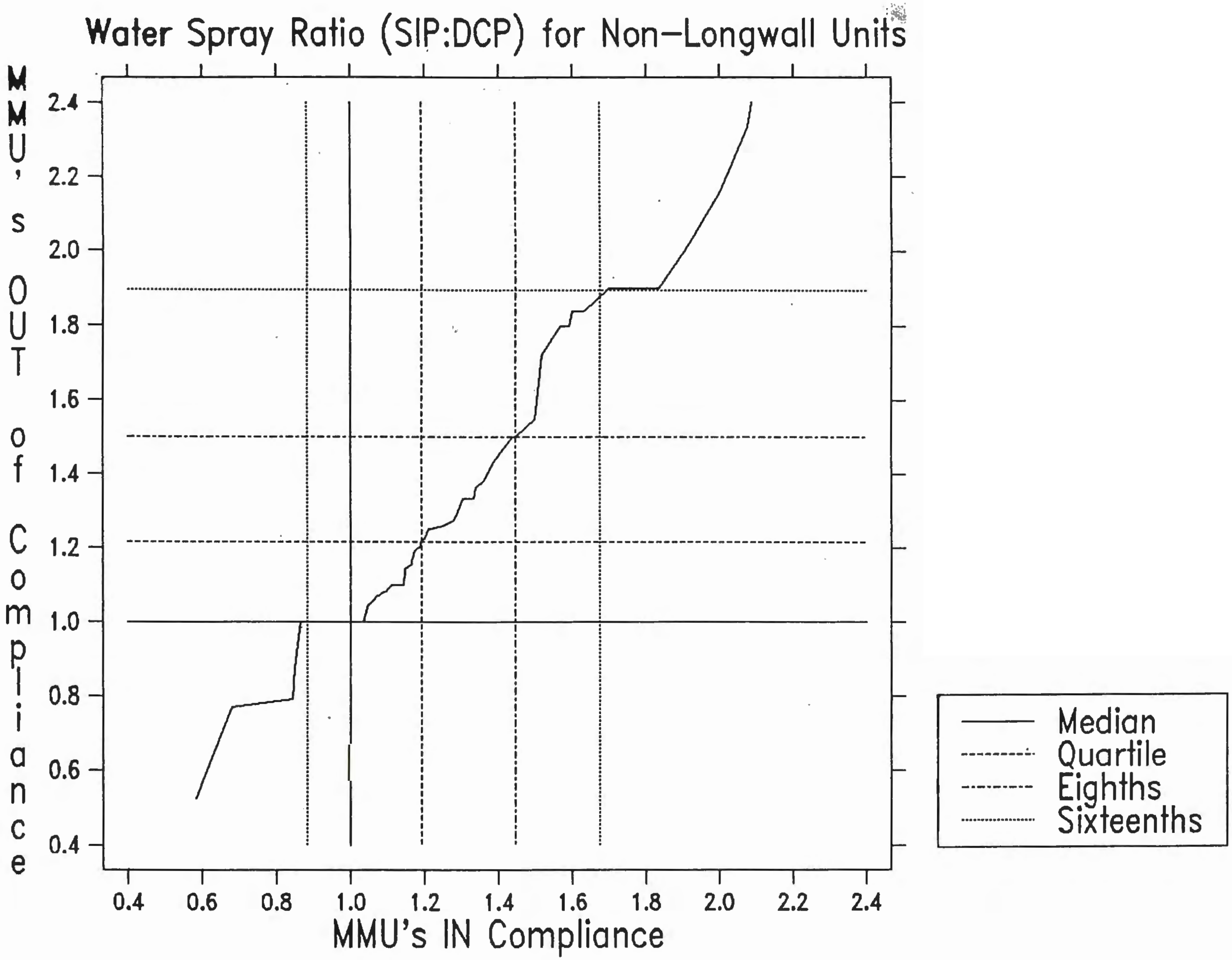
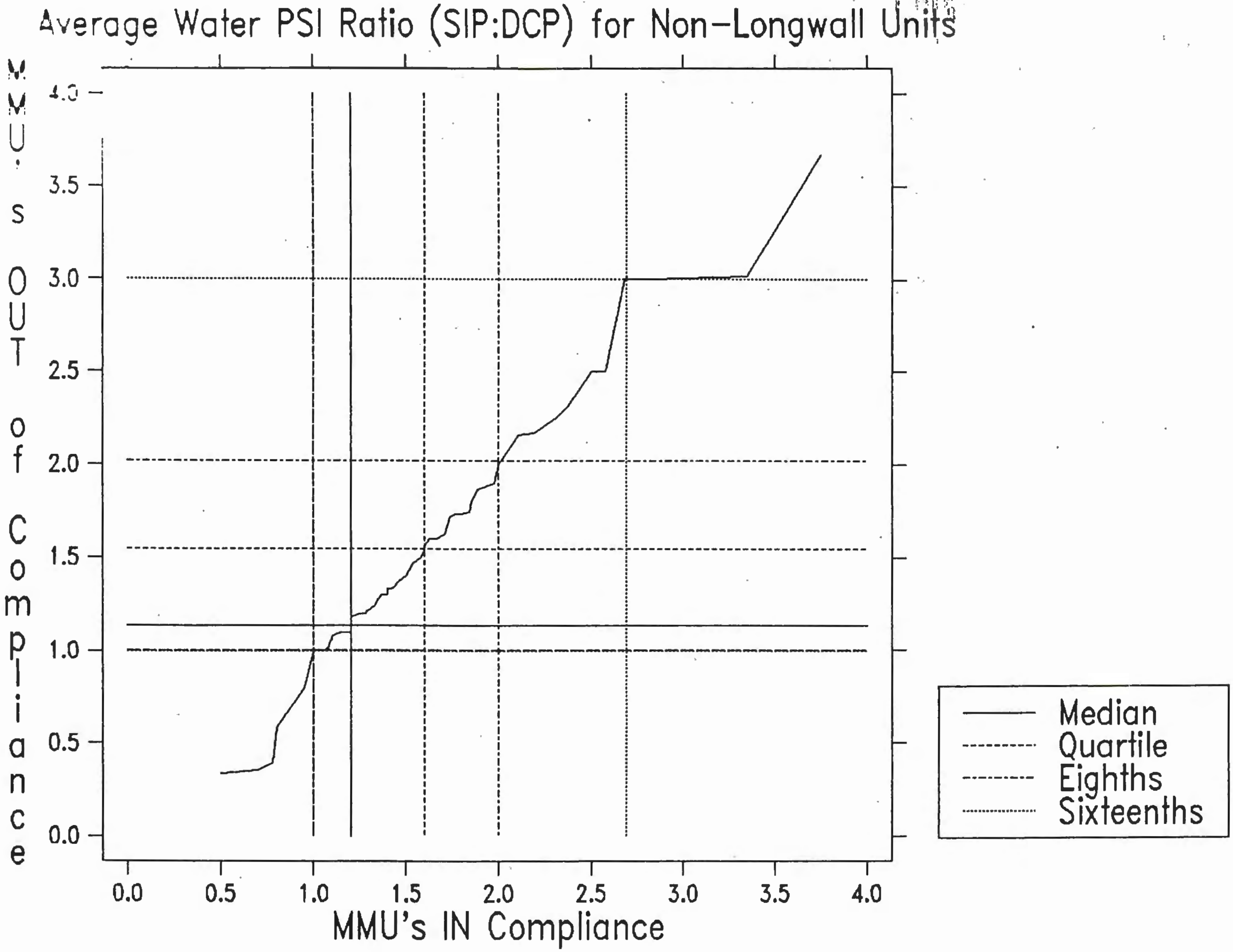

Scrubber Air CFM Ratio (SIP:DCP) for Non-Longwall Units
MMU's OUT of Compliance
MMU's IN Compliance
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
Median
Quartile
Eighths
Sixteenths

Figure IV-13. SIP:DCP Water Spray Ratio for Non-Longwall MMU's



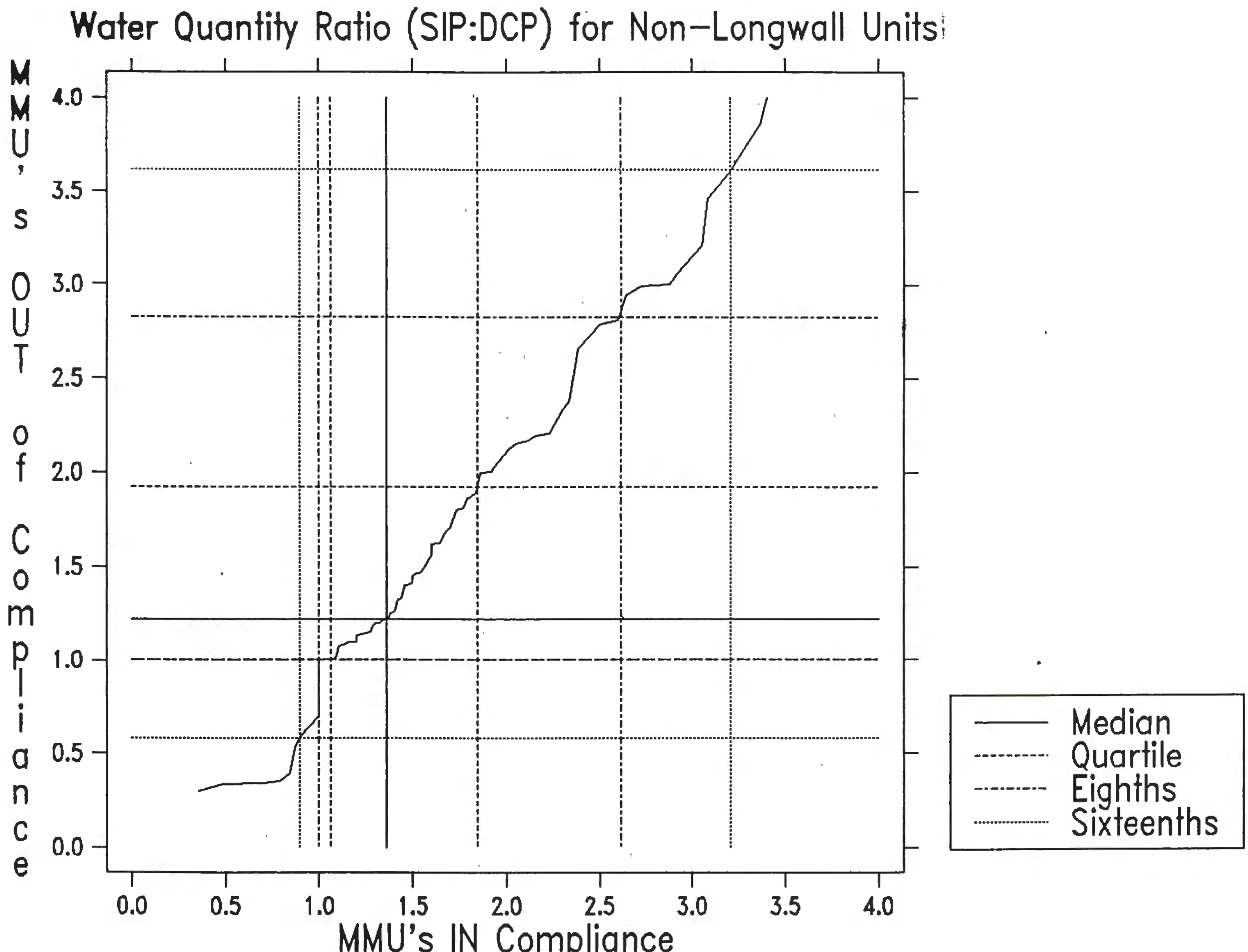
Water Spray Ratio (SIP:DCP) for Non-Longwall Units
MMU's OUT of Compliance
MMU's IN Compliance
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
Median
Quartile
Eighths
Sixteenths

Figure IV-14. SIP:DCP Average Water PSI Ratio for Non-Longwall MMU's



Average Water PSI Ratio (SIP:DCP) for Non-Longwall Units
MMU's OUT of Compliance
MMU's IN Compliance
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Median
Quartile
Eighths
Sixteenths

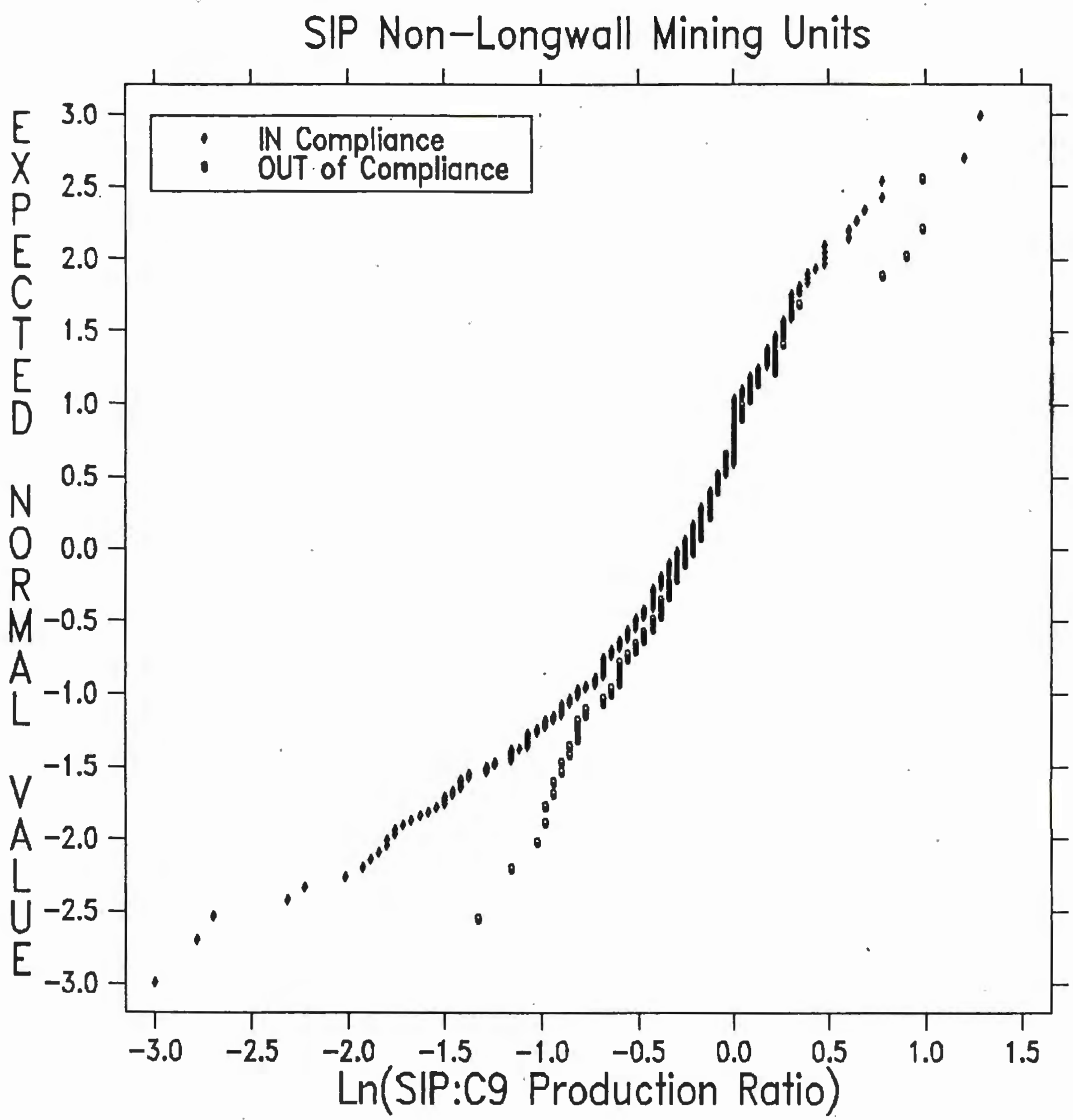
Figure IV-15. SIP:DCP Total Water Factor Ratio for Non-Longwall MMU's


Water Quantity Ratio (SIP:DCP) for Non-Longwall Units
MMU's OUT of Compliance
MMU's IN Compliance
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Median
Quartile
Eighths
Sixteenths

Although Figure IV-8 does not indicate any substantial difference in production ratio quantiles between SIP non-longwalls in and out of compliance, Figure IV-16 shows that MMU's in compliance with the dust standard do in fact diverge from those out of compliance. This graph contains natural logarithms of the production ratio plotted against units of standard deviations above or below the average ("expected normal score"). The two groups are seen to diverge in the lower tail of the frequency distribution. A significantly larger proportion of MMU's in compliance were producing, during the SIP inspection, at a relatively small fraction of their C9 Production. This demonstrates that the difference in mean production ratios noted in IV-2 is attributable to a minority of compliant MMU's with exceptionally low SIP:C9 production ratios.

A data listing for individual SIP MMU's is provided in Appendix A9, containing SIP and prior shift production, mining system, SIP DO and highest NDO dust concentration, planned and observed dust controls, and compliance or non-compliance with both the DCP and the dust standard. In Appendix A9, overall non-compliance with the DCP is indicated only when a dust control is observed to be less than 90-percent of the DCP requirement, or, in the case of water sprays, to fall short by at least five.

Figure IV-16. Divergence of SIP:C9 Production Ratios at Non-Longwall MMU's, by QAS-Compliance



SIP Non-Longwall Mining Units
IN Compliance
OUT of Compliance
EXPECTED NORMAL VALUE
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Ln(SIP:C9 Production Ratio)

A.2 Discriminant Function for QAS Non-Compliance at Longwalls

Based on observations of non-compliance rates during the SIP or MIP inspections, or during other sampling, a *prior* probability of non-compliance can be obtained by simply calculating the proportion of non-compliant MMU's. This prior probability is, by definition, equal for all MMU's under consideration and fails to distinguish cases in which non-compliance is more or less likely. Using DO samples collected during the SIP, for example, the non-compliance rate for longwall MMU's is 23 percent, and, using no other information, the prior probability of non-compliance for an arbitrary longwall is 0.23. Since there is a tendency, however, for MMU's in and out of compliance with the QAS to differ with respect to production ratios, actual:DCP dust control ratios, and (as will be shown below) size of mine, it is possible to derive a *posterior* probability of non-compliance, given the knowledge or supposition of these quantities for a particular longwall MMU.

To do this in a way that enables identification of MMU's likely to be out of compliance, it is helpful to identify factors tending to be different for compliant and non-compliant MMU's, and then to combine these factors into a *discriminant function*. The discriminant function is that linear combination of relevant factors that best distinguishes compliant from non-compliant MMU's and can often be a far more efficient indicator than any factor taken in isolation. For longwalls, Table IV-1 indicates that the SIP:DCP intake air cfm ratio is one such factor and that the SIP:C9 production ratio is another. Figure IV-17 illustrates the extent to which SIP:DCP intake air cfm distinguishes between the frequency distributions of compliant and non-compliant longwalls. For non-compliant longwalls, having a natural log of this ratio greater than 0.8 would amount to an excursion more than 2 standard deviations (σ) above the mean; for compliant longwalls, it would amount to less than ¼ σ. Therefore, if the ratio is observed to be large in a given MMU, the MMU is unlikely to be out of compliance. Figure IV-18 provides a similar illustration of the effectiveness of mine size (number of employees): having fewer than 150 employees (natural log < 5) is unusual for compliant MMU's (more than 2σ below the mean) but not unusual for non-compliant MMU's. At the other end of the scale, non-compliant longwall MMU's rarely occur at mines with more than 500 employees (natural log ≥ 6.2), but this amounts to an excursion of only about 1σ for compliant longwalls.

Table IV-5 contains the coefficients of the optimal discriminant function found using the SIP longwall data. If the function, evaluated for a given longwall MMU, yields a value

Table IV-5. Coefficients of Discriminant Function for Longwall Non-Compliance.

VARIABLE ("Ln" is natural logarithm)	COEFFICIENT	Approximate F-Statistic	Degrees of Freedom	
Constant	7.61			
Ln(Number of Employees)	2.30	9.92	1	62
Ln(Observed Shift Production)	-0.55	4.40	4	59
Ln(C9_Prod)	-0.66	6.94	2	61
Ln(Observed:DCP Intake Air CFM Ratio)	1.67	5.16	3	60
Ln(Average Water PSI)	-2.29	4.48	5	58
Ln(Observed:DCP Water Factor Ratio)	1.24	4.47	6	57

less than zero, then the posterior probability of non-compliance with the QAS is more than 50 percent. Higher posterior probabilities of non-compliance are obtained for more negative values of the discriminant function.

Figure IV-17. Divergence of SIP:DCP Intake Air CFM Ratios at Longwall MMU's, by QAS-Compliance

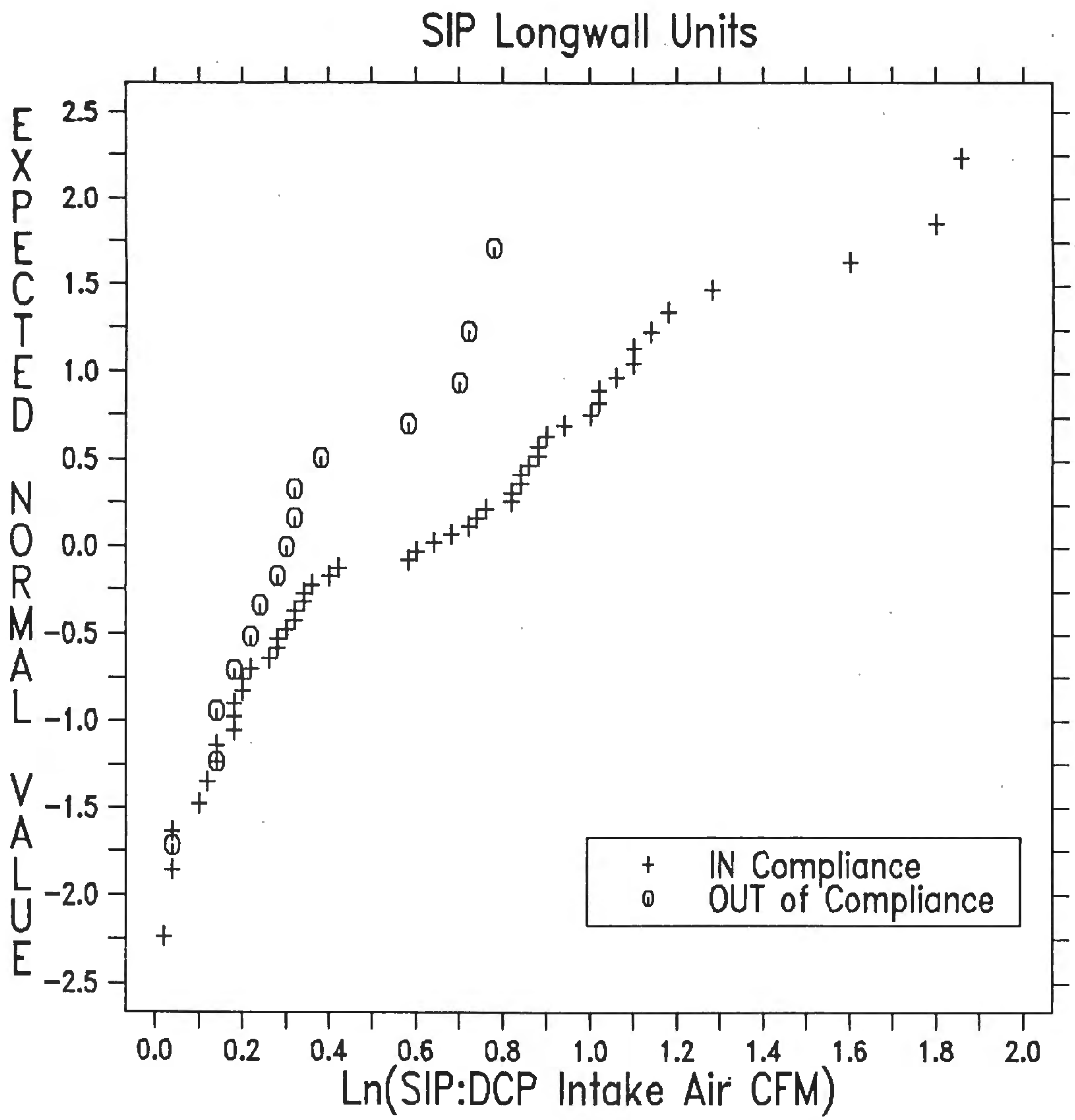
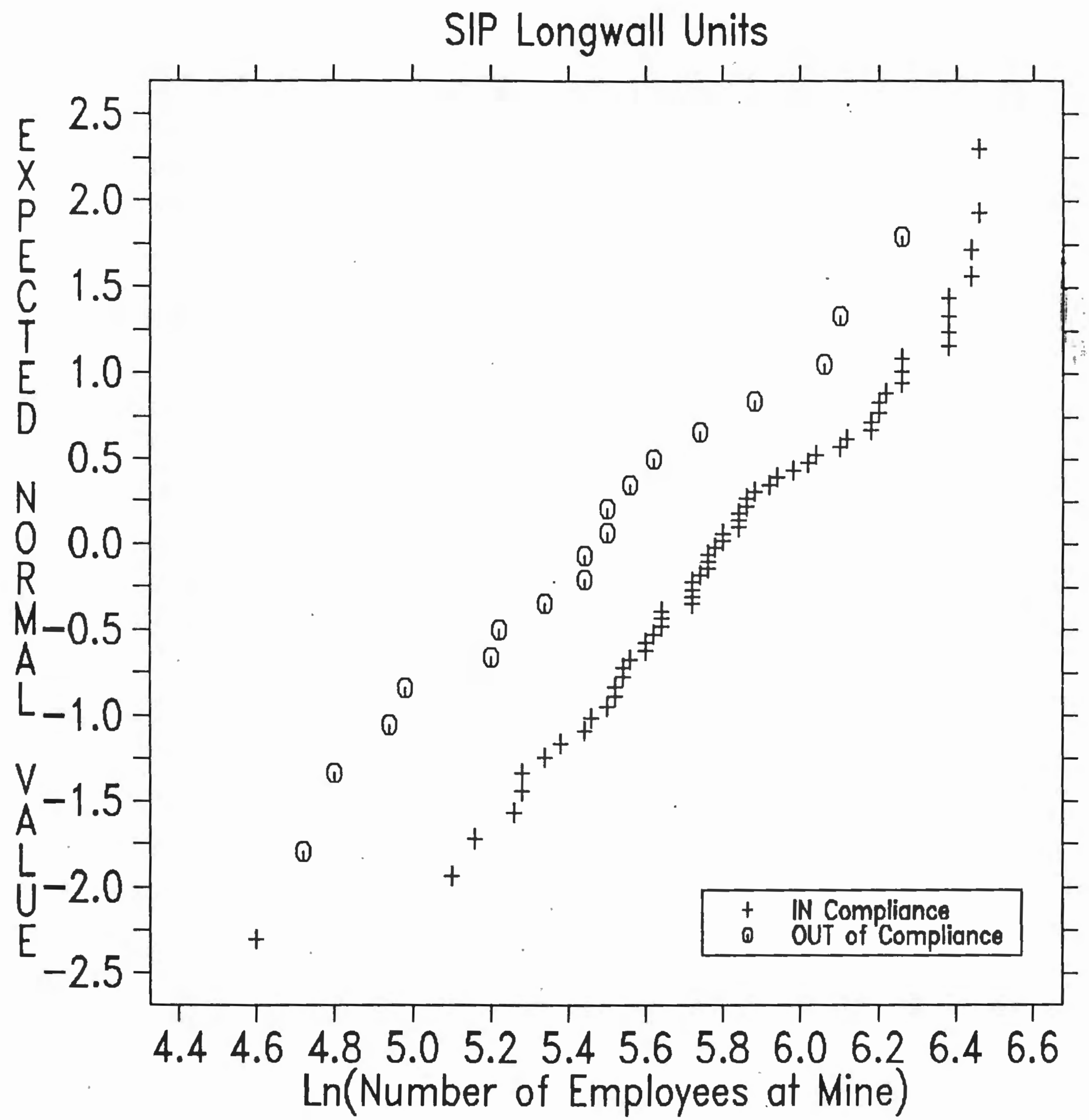

SIP Longwall Units
EXPECTED NORMAL VALUE
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Ln(SIP:DCP Intake Air CFM)
IN Compliance
OUT of Compliance

Figure IV-18. Divergence of Mine Sizes at Longwall MMU's, by QAS-Compliance


SIP Longwall Units
EXPECTED NORMAL VALUE
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
Ln(Number of Employees at Mine)
+ IN Compliance
@ OUT of Compliance

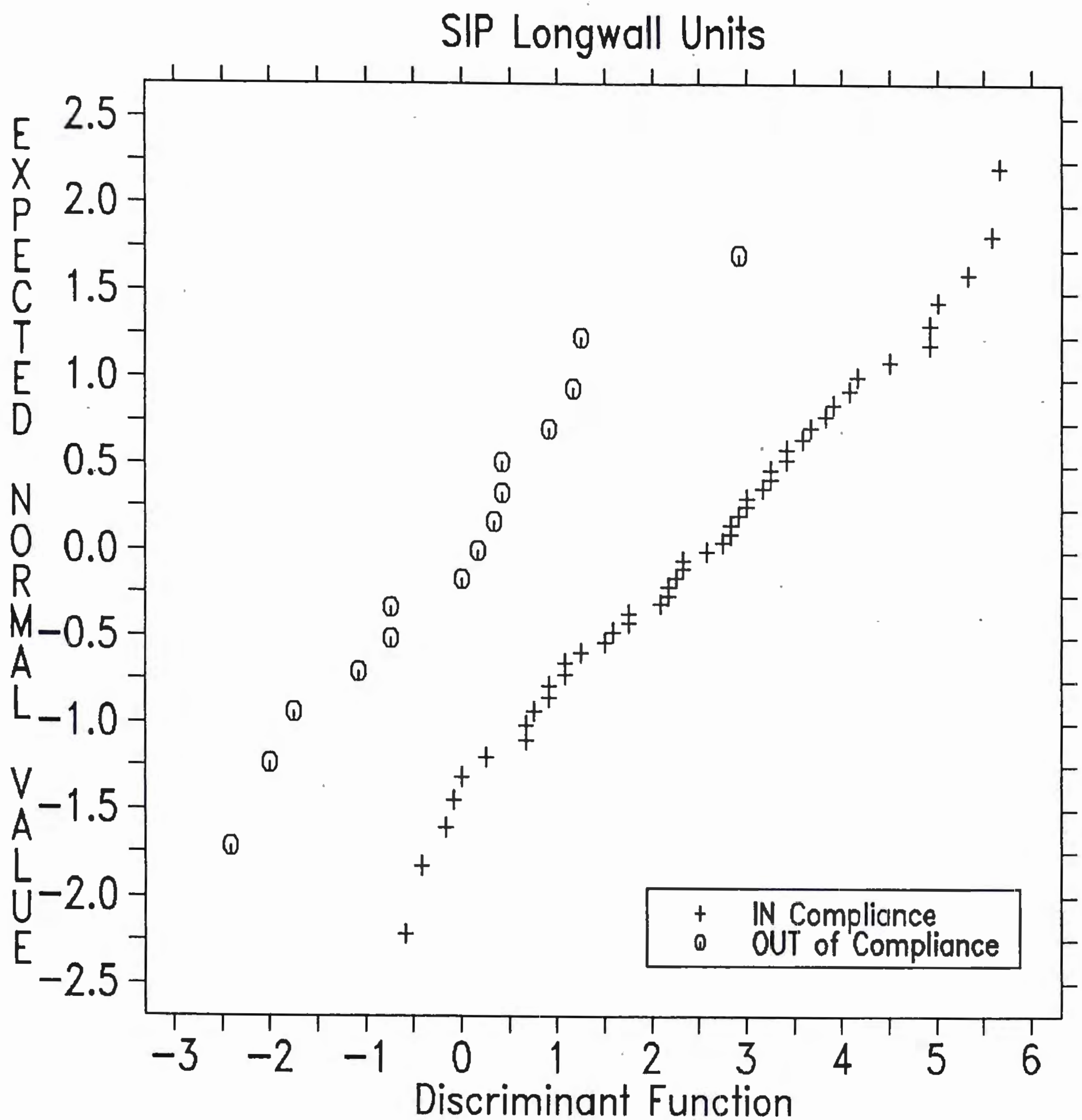
The power of the discriminant function to identify likely cases of non-compliance at longwall MMU's is illustrated in Figures IV-19 and IV-20. Values of the discriminant function less than -1.0 yield a high posterior probability (>0.95) of non-compliance. On the other hand, if the discriminant function evaluates to a value greater than 3.0, then the posterior probability of non-compliance is quite low (<.05).

A.3 Relationship between SIP Dust Concentrations and DCP Compliance.

Although nearly all of the MMU's exceeded most DCP requirements, there were 61 SIP MMU's that failed to meet some aspect of the DCP. Mean DO concentration for these MMU's is about 1.7 $\pm$ .2 mg/m^3, whereas mean DO concentration for MMUs complying with the DCP is 1.3 $\pm$ .05 mg/m^3. The mean of the *maximum* dust concentration found at SIP MMUs out of DCP compliance is 2.0 $\pm$ .2 mg/m^3, and the mean of maximum concentration among DCP-compliant MMUs is 1.9 $\pm$ .06 mg/m^3 .

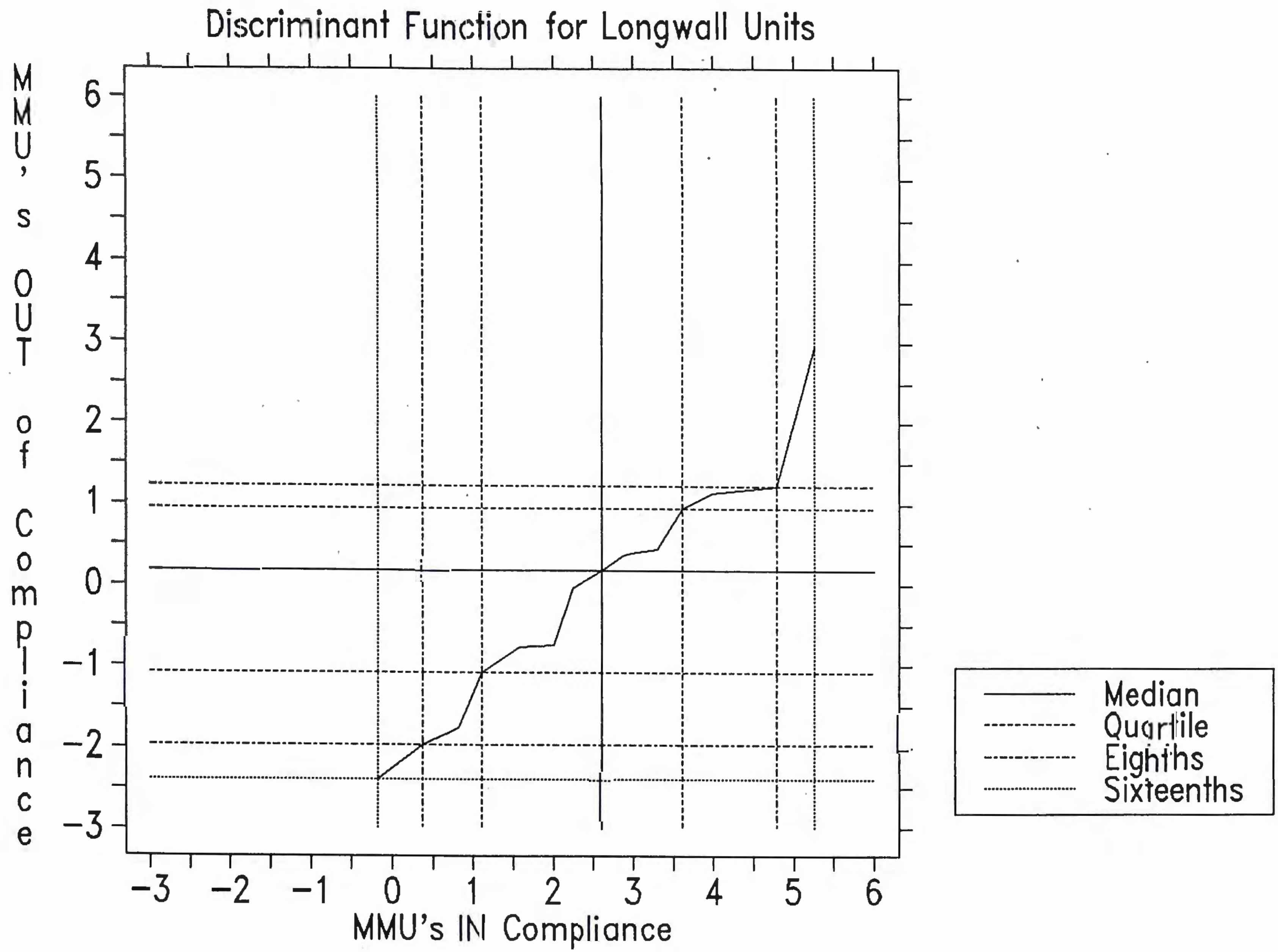
There is no statistically significant difference in maximum dust concentration found at SIP DCP-compliant MMUs, as compared to DCP non-compliant ones. However, there is a significant tendency for DO dust concentrations to be slightly higher, by an average 0.3 mg/m^3, among DCP non-compliant MMU's. In addition, there is significantly greater variability in DO dust concentration among the non-complying MMUs.

Figure IV-19. Divergence of Discriminant Function at Longwall MMU's, by QAS-Compliance



SIP Longwall Units
EXPECTED NORMAL VALUE
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3
−2
−1
0
1
2
3
4
5
6
Discriminant Function
+ IN Compliance
OUT of Compliance

Figure IV-20. Quantiles of Discriminant Function at SIP Longwall MMU's, by QAS-Compliance


Discriminant Function for Longwall Units
MMU's OUT of Compliance
MMU's IN Compliance
6
5
4
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
4
5
6
Median
Quartile
Eighths
Sixteenths

B. Regression Analyses on DO Dust Concentration

A series of linear and non-linear multiple regression analyses were carried out on the SIP MMU's, in which an attempt was made to predict DO dust concentration as a function of variables described in Tables IV-1 and IV-2. Water pressure, number of sprays, air quantity, and air velocity measurements were all taken into account, in addition to the ratio of observed production to previously established norms. These analyses were conducted using both the dust control variables as observed during the SIP sampling shift and also in terms of their ratios to dust control plan requirements. Separate analyses were conducted for longwall MMU's and for continuous mining MMU's cross-classified by depth of cut (≤ 20' vs. > 20 ft) and blowing or exhausting ventilation systems. It should be clearly understood that the results of these analyses apply only across MMU's and do not apply within any particular MMU.

For longwall units, about 33 percent[8] of the variation in dust concentration could be accounted for, with most of that effect attributable to the percentage of C9-Production actually mined, mine size (as represented by the number of employees, and intake air quantity (cfm). A small but statistically significant effect was also found in the ratio of operational to DCP water jets. By far the most significant single factor was the production ratio. Since the ventilation controls were highly correlated with one another, only one could actually be used in the regression model without causing computational singularities. The ventilation control used in the best-fitting model was intake air cfm, but this was largely due there being relatively few cases with missing values of this variable. For the minority of

---

[8]after a downward adjustment in explained variance to reflect the number of variables utilized

cases in which tailgate air cfm was available, this would have contributed more to the model. The form of the model yielding $R^2 = 33\%$ (adjusted for the number of independent variables) is:

$$\frac{\text{Dust Conc.}}{\text{QAS}} = \alpha_0 \frac{(\text{SIP\_Prod})^{\alpha 1}\ (\text{DCP water})^{\alpha 5}}{(\text{Mine Size})^{\alpha 2}\ (\text{SIP air CFM})^{\alpha 3}\ (\text{C9\_Prod})^{\alpha 4}\ (\text{SIP water})^{\alpha 5}}$$

The air, water, and mine size variables used are intake air cfm, total number of water sprays, and number of employees, respectively. The estimated coefficients are:

$$\begin{aligned}
\alpha_0 &= 5.51 \\
\alpha_1 &= 0.64 \pm .17 \\
\alpha_2 &= 0.34 \pm .16 \\
\alpha_3 &= 0.25 \pm .11 \\
\alpha_4 &= 0.28 \pm .15 \\
\alpha_5 &= 0.45 \pm .24
\end{aligned}$$

For the various varieties of continuous mining MMU, a maximum of only 13 percent of the variability could reliably be accounted for (adjusted R^2). The degree of predictive power implicit in so low a percentage of explained variation is too small to be of any practical value.

For longwalls and especially for continuous mining units, it should be understood that the weakness of these results applies only to relationships between production, dust controls, and DO dust concentration across ***different*** MMUs and should not be assumed to obtain in the same way within individual MMUs. Stronger relationships might well exist ***within*** an individual MMU.

C. Ratio Estimates for Average Dust Concentrations

Given the low SIP:C9 and SIP:C10 production ratios associated with many of the SIP samples, along with the fact that SIP concentrations tended nevertheless to be greater than concentrations obtained from either the MIP or unmonitored operator sampling, a conservative method for estimating the frequency distribution of dust exposures when sampling is ***not*** taking place is as follows:

For each MMU, define

$D^* = C10\_prod * D/(B1A\_Prod) = D \div (B1A\_Prod/C10\_Prod)$

where D^* = estimated mean dust exposure
D = measured single sample dust concentration

B1A_Prod/C10_Prod = ratio of production on the sampling shift to normal production.

Form a histogram of frequencies from the adjusted dust concentrations.

The lack of strong statistical association between dust concentration and production in Subsection B above does not nullify the utility of such ratio estimation, since the procedure suggested here applies ***within*** MMU's rather than ***between*** them. The effects that such an adjustment would have on the estimated frequency distribution of DO dust concentrations were evaluated by applying the adjustment to SIP DO concentrations, and the resulting frequency distribution is presented in Figure IV-21. Figure I-3 showed that about 20 percent of the unadjusted DO concentrations exceeded 2.0 mg/m^3. After adjustment, this percentage increases to 28.3 percent. The median unadjusted SIP DO dust concentration is approximately 1.0 mg/m^3. After adjustment, the median increases to about 1.25 mg/m^3. Roughly 12 percent of the unadjusted DO concentrations met or exceeded 2.5 mg/m^3. The adjusted

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration

mg/m³	5 10 15 20 25 30 35 40 45 50 55 60	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
≤1.0	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	276	276	40.9	40.9
≤1.1	+XXXXXXXXXXXXXXXXXXXXXXXX	24	300	3.6	44.5
≤1.2	+XXXXXXXXXXXXXXXXXXXXXXXXXX	26	326	3.9	48.4
≤1.3	+XXXXXXXXXXXXXXXXXXXXXXXXX	25	351	3.7	52.1
≤1.4	+XXXXXXXXXXXXXXXXXX	18	369	2.7	54.7
≤1.5	+XXXXXXXXXXXXXXXXXXXXX	21	390	3.1	57.9
≤1.6	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	31	421	4.6	62.5
≤1.7	+XXXXXXXXXXX	11	432	1.6	64.1
≤1.8	+XXXXXXXXXXXXXXXXX	17	449	2.5	66.6
≤1.9	+XXXXXXXXXXX	11	460	1.6	68.2
≤2.0	+XXXXXXXXXXXXXXXXXXXXXXX	23	483	3.4	71.7
≤2.1	+XXXXXXXXXXXXX	13	496	1.9	73.6
≤2.2	+XXXXXXXXXXXXXXXX	16	512	2.4	76.0
≤2.3	+XXXXXXXXXX	10	522	1.5	77.4
≤2.4	+XXXX	4	526	0.6	78.0
≤2.5	+XXXXXXXXXX	10	536	1.5	79.5
≤2.6	+XXXXXXXX	8	544	1.2	80.7
≤2.7	+XXX	3	547	0.4	81.2
≤2.8	+XXXXXXXXXX	10	557	1.5	82.6
≤2.9	+XXXXXXX	7	564	1.0	83.7
≤3.0	+XXXX	4	568	0.6	84.3
≤3.1	+XXXXXXX	7	575	1.0	85.3
≤3.2	+	0	575	0.0	85.3
≤3.3	+XX	2	577	0.3	85.6
≤3.4	+XXXXXX	6	583	0.9	86.5
≤3.5	+XXXX	4	587	0.6	87.1
≤3.6	+X	1	588	0.1	87.2
≤3.7	+XXX	3	591	0.4	87.7
≤3.8	+XXXX	4	595	0.6	88.3
≤3.9	+X	1	596	0.1	88.4
≤4.0	+XXX	3	599	0.4	88.9
≤4.1	+XX	2	601	0.3	89.2
≤4.2	+XXXXX	5	606	0.7	89.9
≤4.3	+XXXXX	5	611	0.7	90.7
≤4.4	+XX	2	613	0.3	90.9
≤4.5	+	0	613	0.0	90.9
≤4.6	+XXX	3	616	0.4	91.4
≤4.7	+XXXX	4	620	0.6	92.0
≤4.8	+XXXX	4	624	0.6	92.6
≤4.9	+XXXX	4	628	0.6	93.2
≤5.0	+X	1	629	0.1	93.3
>5.0	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	45	674	6.7	100.0
	5 10 15 20 25 30 35 40 45 50 55 60				

Figure IV-21. Frequency distribution of adjusted SIP DO dust concentrations

estimate is approximately 20 percent.

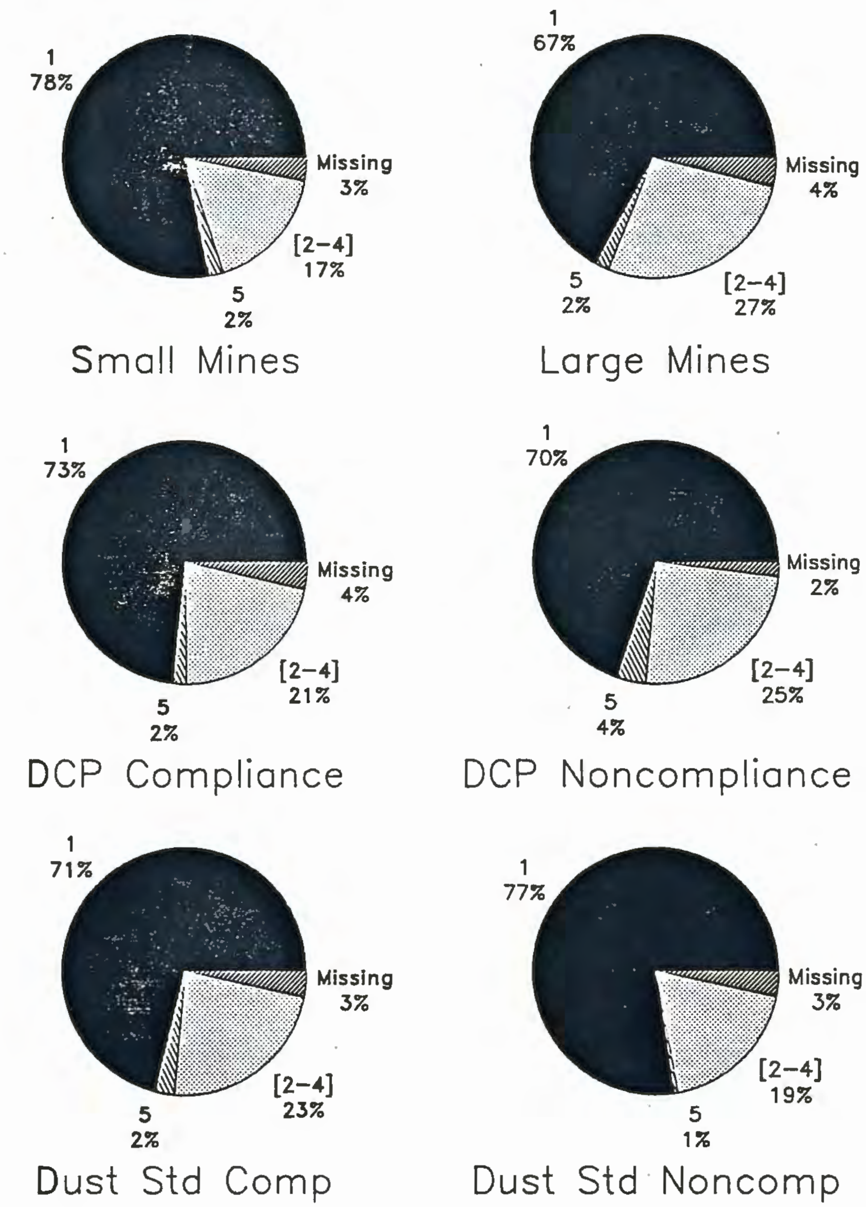
There is too much potential for propagating and magnifying a measurement error or other random fluctuation to apply this procedure with confidence to any single sample. It could, however, be legitimately extended to individual MMU's if the single sample dust concentration and shift production were replaced by averages.

V. Knowledge, Training, and Proficiency

Responses to several questions on the interview sheets that were answered somewhat differently, on average, by participants from QAS- or DCP-compliant MMU's than by participants from non-compliant MMU's are included in this section.

A complete tabulation and set of illustrations depicting responses to the interview questions is included as Appendix A10.

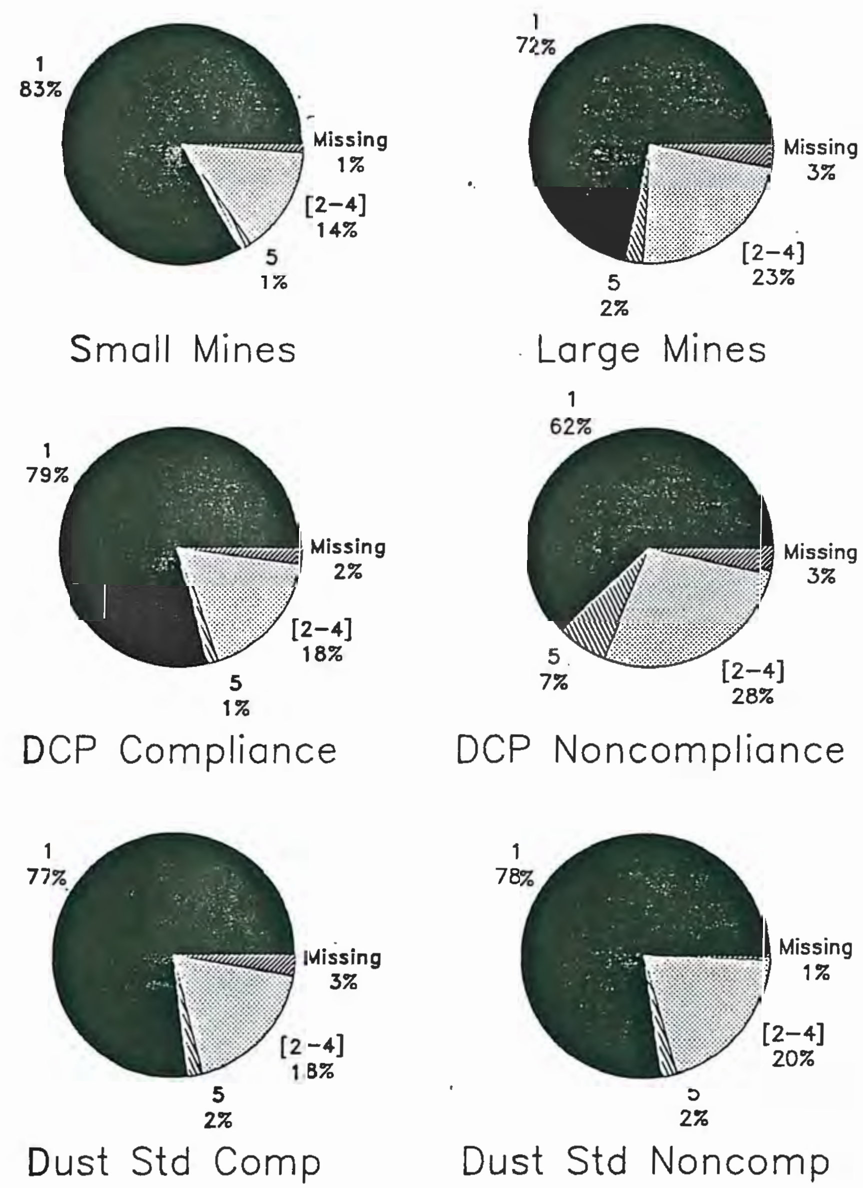
When you have reported a condition that could increase respirable dust, what action was taken?



Roof Bolter Interview, #18

Correct Answer: 1) Addressed immediately

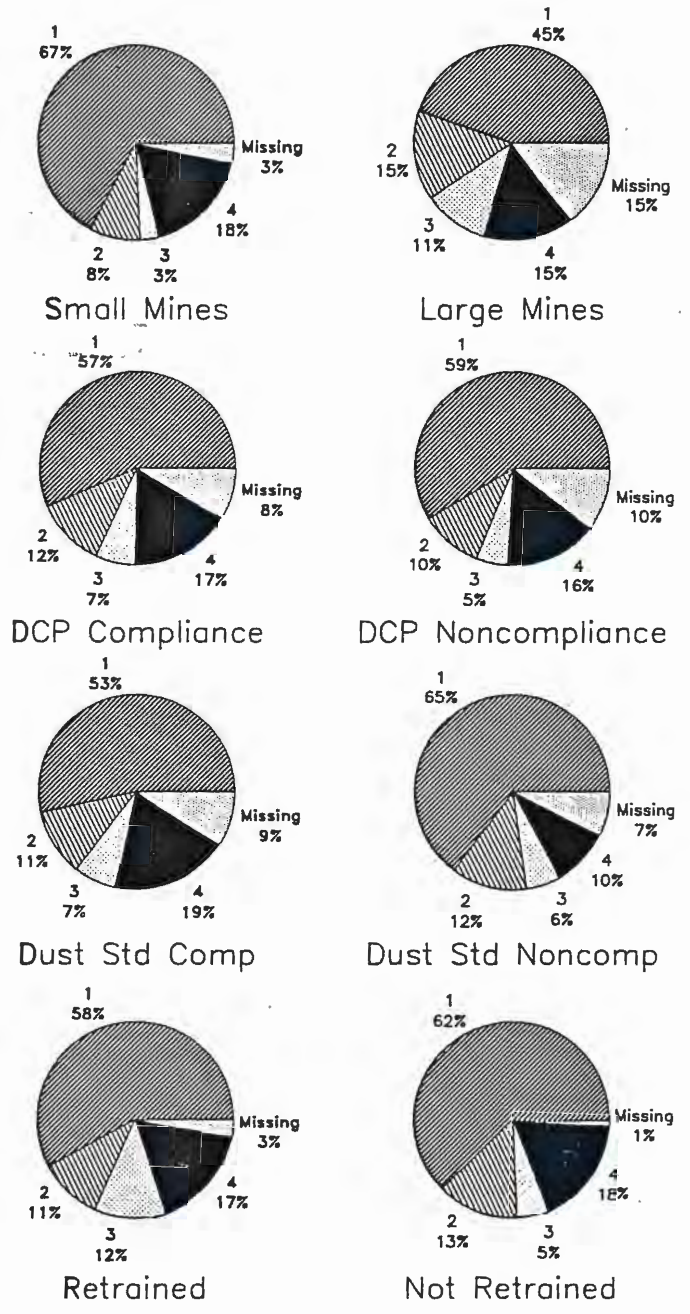
When you have reported a condition that could increase respirable dust, what action was taken?



Designated Occupation Interview, #22

Correct Answer: 1) Addressed immediately

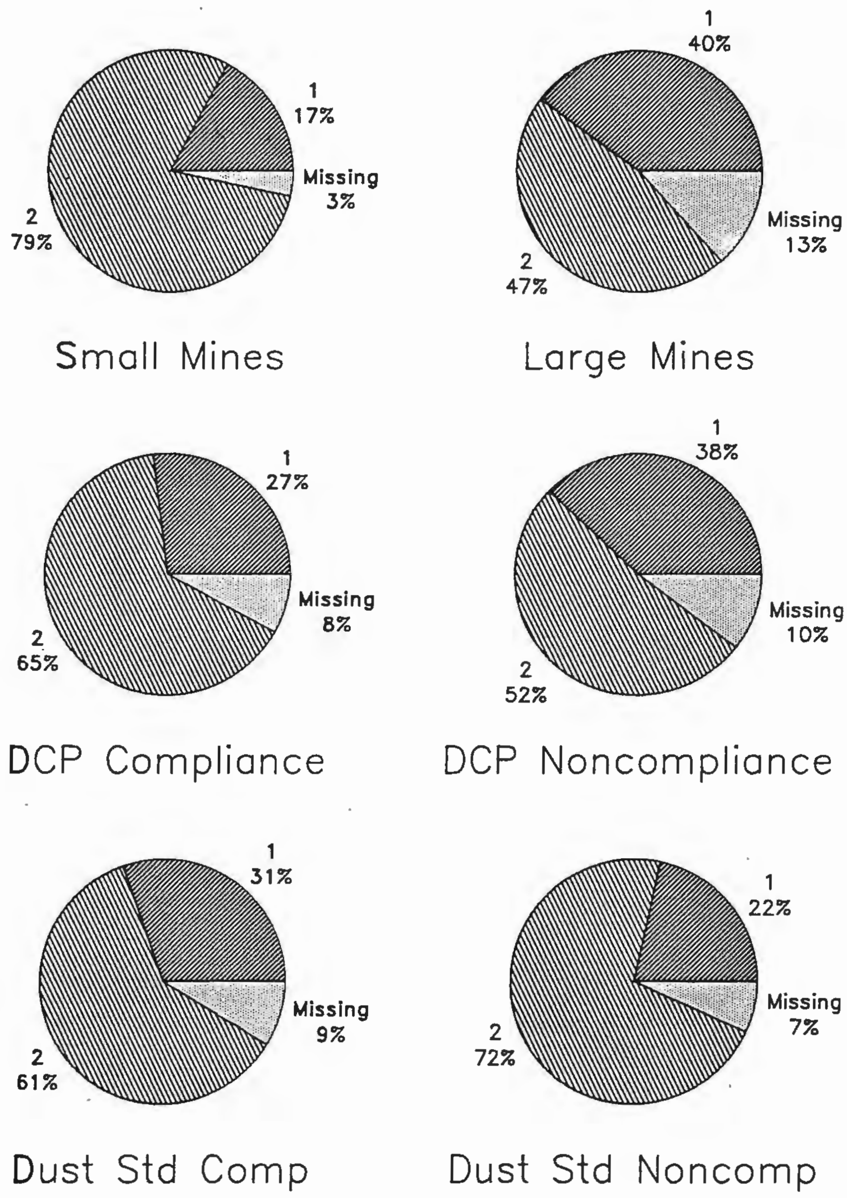
When company dust sampling is being conducted...



Certified Dust Sampler Interview, #6

Preferred Answer: 4) Samples are taken the way we normally mine, without consideration of the dust control plan

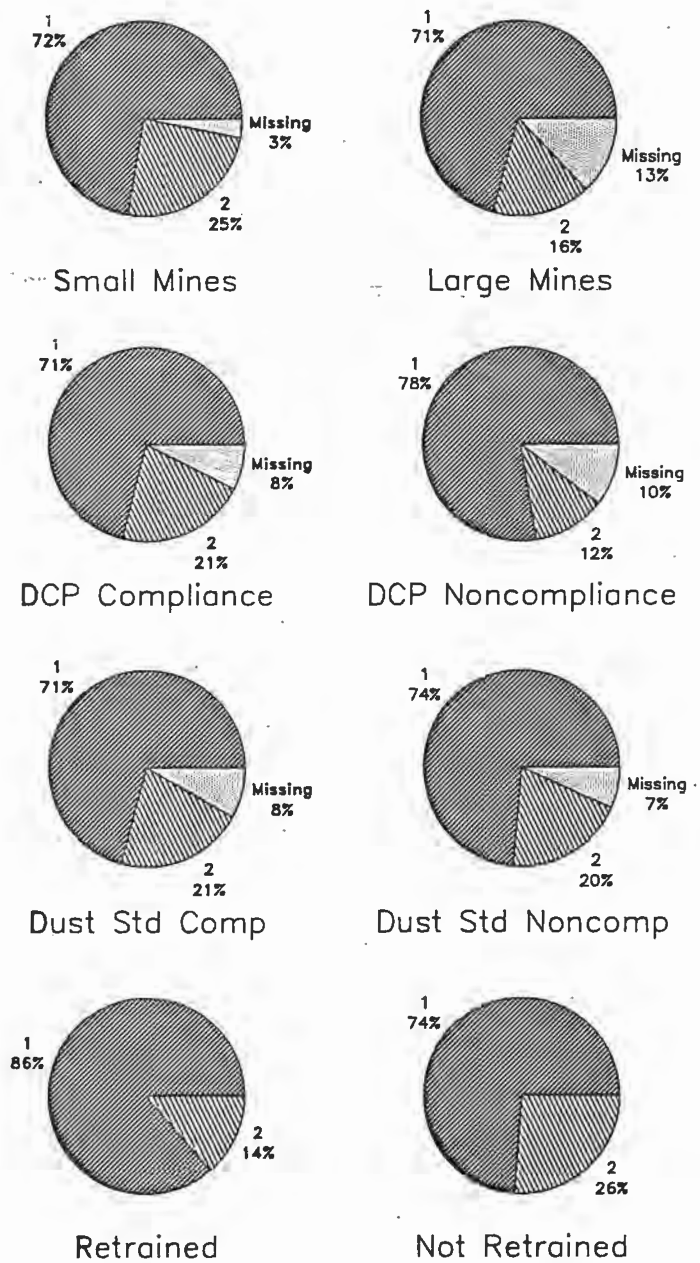
Since receiving initial certification, I...



Certified Dust Sampler Interview, #14

Answers: 1) Have had formal retraining
2) Have not had formal retraining

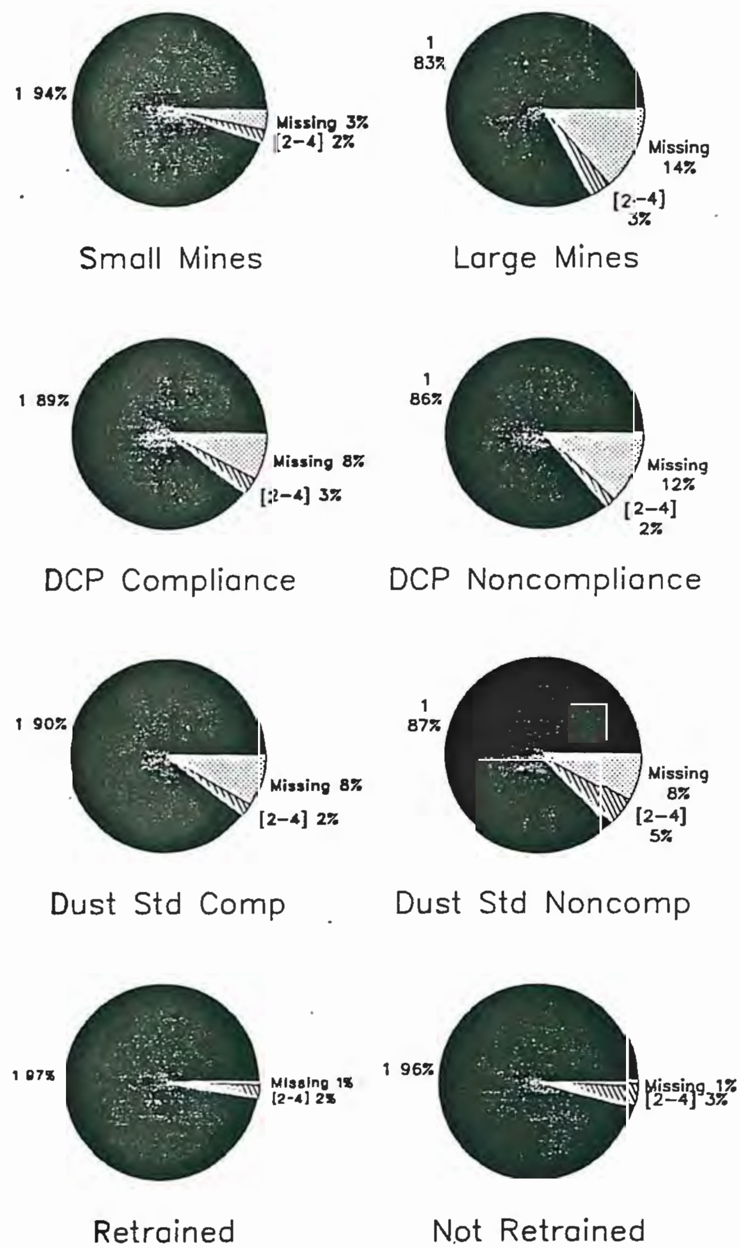
In order to do my job as a dust sampler better,



Certified Dust Sampler Interview, #15

Answers: 1) A retraining course would be helpful
2) A retraining course would not be helpful

The policy at this mine regarding the correction of conditions that could increase respirable dust which have been observed or reported is to...



Certified Dust Sampler Interview, #17

Preferred Answer: 1) Address them immediately

VI. Summary of Findings

A. Statistical Findings

Although both dust concentrations and shift tonnages tended to be greater for SIP than for non-SIP MMU's during inspector sampling, the two groups were essentially equivalent with respect to dust concentration per thousand tons of coal. (- 8 -) There is no significant difference between the MIP and non-MIP groups with respect to the quantities examined. (- 12 -)

Figure I-3 suggests that SIP DO dust concentrations tend to be higher than MIP DO concentrations and that both SIP and MIP DO concentrations tend to be higher than SIP NDO and DA concentrations. (- 16 -)

With 95-percent confidence, mean DO concentrations exceed NDO concentrations at SIP longwalls by at least 0.24 mg/m^3. Since SIP longwalls comprise essentially *all* longwalls, this applies to longwall MMU's in general. (- 29 -) Similarly, with 95-percent confidence, it can be concluded that DO concentrations exceed NDO concentrations by an average of at least .12 mg/m^3 at Deep Cut SIP MMU's, by at least .51 mg/m^3 at SIP continuous ($\leq$ 20 ft) mining sections, and by at least .23 mg/m^3 at conventional SIP MMU's. (- 29 -)

Considering the general tendency for DO concentrations to exceed NDO concentrations by the amounts indicated in Table I-8, the data do not support any conclusion that the DO is being improperly selected. In order to compile such evidence, or to identify particular cases where the DO was improperly designated, multiple samples would be needed for the DO and each NDO. (- 30 -)

Among MMU classes in Table I-9 with no belt air, all blowing systems except Deep-cut Continuous display, on average, positive deviation above the quartz-adjusted dust standard. Deep-cut MMU's with blowing ventilation, on the other hand, show a mean deviation of 0.71 $\pm$ .08 mg/m^3 *below* the standard, with essentially the same result for deep-cut MMU's with exhausting ventilation and slightly higher results for deep-cut MMU's with blowing-exhausting combinations. The group of 239 continuous MMU's ($\leq$ 20 ft.) with exhausting, rather than blowing, ventilation was also relatively low in dust, with a mean deviation below the quartz-adjusted standard of 0.38 $\pm$ .11. (- 39 -)

Statistically, intake air is significantly dustier at belt air systems, but DO dust concentrations and DO dust accretions (the DO - intake air differences in concentration) are both significantly lower. (- 42 -)

27.4 percent of the SIP MMU's had at least one citable single sample. (- 61 -)

Based on the SIP data, a significantly higher rate of non-compliance is found among blowing ventilation systems at Continuous ($\leq$ 20 ft. cut) and Conventional MMU's than among their counterparts with exhausting ventilation. Deep Cut

(> 20 ft.) Continuous MMU's show no significant difference in non-compliance rate between blowing and exhausting ventilation. The 15-percent rate of non-compliance at Deep Cut (> 20 ft.) MMU's, and the 10-percent rate at "other" MMU's are significantly below the non-compliance rates at Longwall, Continuous (≤ 20 ft. cut), and Conventional MMU's. Both Conventional MMU's (28 percent and Continuous MMU's (≤ 20 ft. cut) have higher non-compliance rates than Longwall MMU's. (- 63 -)

About 26 percent of SIP MMU's at either small or medium sized mines were out of compliance. In contrast, only about ten percent of the MMU's at large mines were out of compliance. Although this latter figure is based on only 7 cases of non-compliance among 74 large mine MMU's, the difference in non-compliance rates is statistically significant at a confidence level of more than 99 percent (- 65 -)

If SIP DO samples had been subject to the same shift production criterion as operator samples (i.e., at least 50 percent of average production during the most recent sampling cycle), they would have been voided for insufficient coal production in 76 cases, amounting to 10.5 percent of all the SIP DO samples. At a confidence level of more than 99.99 percent, this is a significantly greater rate of invalid shift productions than the 3.0-percent production void rate observed for the 709 MIP DO samples (MPVR), the 1991 production void rate of 2.9 percent observed for regular MSHA inspector DO samples (IPVR), and the 1991 production void rate for operator DO samples (OPVR), which was 2.8 percent. MPVR, IPVR, and OPVR, on the other hand, form a group essentially equivalent production void rates, with no statistically significant difference among them. Compared to operator and regular inspector sampling, the SIP inspections coincided with unusually low production shifts at an unusually large group of MMU's. (- 68 -)

During the SIP inspection, about 70 percent of the MMU's mined less than 100 percent of their normal, non-dust-sampling shift production, and about 20 percent of the MMU's mined less than 60 percent. (- 70 -) However, the effect on shift production, and consequently on observed dust concentrations, of SIP interviews during the sampling shift is unknown. (- 6 -)

For longwalls, there is no evidence that production is reduced during operator sampling as compared to non-sampling shifts. Since longwalls tend to be at larger mines, this finding is consistent with Figure I-27, which shows that for large SIP mines, the median operator sampling production was right at 100 percent of non-sampling production. There appears, however, to be a substantive and statistically significant reduction of 251 ± 132 tons during regular MSHA BAB inspections, and this reduction was more than doubled during the SIP inspection. (- 76 -)

As in longwalls, a pattern of reduced production during SIP and BAB inspections is evident for both deep cut and regular continuous mining MMU's. But at these MMU's, shift production during normal operator sampling falls substantively and with statistical significance below average non-sampling production. The average reduction during operator sampling at both deep cut and continuous

MMU's is about 71 tons. Furthermore, mean operator sampling production is at least 141 tons below non-sampling production at 25 percent of the deep cut MMU's and at least 340 tons below at 10 percent of them. Similarly, at regular continuous MMU's, the 25th and 10th percentiles for the shortfall are 125 tons and 273 tons, respectively. A reduction in production during regular MSHA BAB inspections is also evident, with a larger reduction during the SIP inspection. (- 77 -)

Dust concentrations for continuous miner operators in mines employing fewer than 125 miners, obtained during the SIP inspection, were generally greater than those collected during operator sampling for compliance. (- 91 -)

In contrast to the results for smaller mines, those for continuous miner operators at larger mines revealed no consistent differences between the SIP and operator sample over all the measures used. (- 91 -)

There was clear evidence that dust concentrations for DO cutting machine operators and hand loaders were greater during SIP sampling than were reported by operators. (- 92 -)

Dust levels for SIP designated area samples were generally greater than those collected by operators, by a factor ranging from about 40 percent at the largest mines to over 100 percent at the smallest. The non-compliance rate for SIP designated area samples was about three times as great as it was for operator samples. (- 92 -)

Low weight gain samples contributed substantially to the differences between the SIP and operator dust levels, particularly for the smaller mines. However, they were not totally responsible, since the SIP concentrations remained statistically significantly higher despite exclusion of LWG samples. (- 92 -)

SIP dust concentrations for continuous miner operators in mines employing fewer than 125 miners were generally greater than those collected during BAB inspections, by a factor in geometric means of 26 percent. In general, SIP samples for continuous miners at mines employing fewer than 125 workers were more likely to be out of compliance as compared with BAB samples (25% compared with 18%). In contrast to the results for smaller mines, those for continuous miner operators at larger mines revealed no consistent differences between the SIP and BAB sample over all the measures used. (- 108 -)

Among designated occupations other than continuous miner, there was clear evidence that dust concentrations during SIP sampling were greater than those measured during BAB sampling. The biggest ratios of geometric mean concentrations existed with the hand loaders and cutting machine operators. Overall, the observed pattern among these occupations may reflect the underlying mine size effect evident in the continuous miner data. The findings on non-compliance rates for other designated occupations reflected those for the dust concentrations. (- 109 -)

The combination of lower MIP than SIP dust concentrations at small mines, together with slightly higher shift productions at mines of any size, results in a substantial, statistically significant difference in DO dust concentration per unit production at mines in the 1 - 50 employee group. For MMU's at mines in this size range, the geometric mean dust concentration measured per unit production is approximately 60 percent greater during the SIP inspection than during the MIP visit. A less pronounced affect, but in the same direction, is evident at mines in the 51 - 125 employee size group. No such effect is apparent at larger mines. (- 80 -)

All available evidence points to a systematic difference between dust concentrations collected by the mine operator depending on whether an inspector was present or absent at the coal face. Geometric mean dust concentrations were found to be up to 40 percent higher when the inspector was present at mines with fewer than 125 employees. (- 121 -)

For designated occupations at small to medium mines (<125 employees), there is consistent evidence from every aspect of this investigation that dust samples taken as part of the two special exercises (SIP and MIP) showed significantly higher dust concentrations than samples submitted by operators during non-monitored routine operator cycles and samples collected during BAB inspections. In general, concentrations derived from surprise inspections (SIP samples) were the greatest, while those from routine operator sampling for compliance were the least. MIP and BAB samples occupied an intermediate position. This is quantified, for continuous miner operators in the subset of MMU's with data in all categories, in Table II-D1. These findings remain in evidence even after account is taken of production differences. For the larger mines, no obvious differences between DO dust concentrations from special and routine sampling were noted overall. This applied to both continuous miners and to shear/plow machines. Concomitant with the elevated dust levels found in SIP and MIP samples at small to medium sized mines was a greater frequency of non-compliance samples compared to routine operator samples that were not monitored. (- 134 -)

Designated area samples from the SIP study were also greater than those collected by both operators during routine non-monitored DA sampling and those collected MSHA inspectors during BAB sampling. This effect too was most obvious for the small to medium sized mines. (- 134 -)

Low weight gain samples were the reason for much, but not all, of the excess in dust levels evident during the special sampling programs, as compared to the dust concentrations reported by operators. For instance, SIP concentrations were about 50% greater than operator levels for small mines, on average (Table II-A4). This discrepancy dropped to about 20% after LWG samples were removed. Similar tendencies were seen in other analyses, and indicated that multiple factors may have caused the special sampling concentrations to be higher than the routine operator-ascertained levels. (- 134 -)

In general, LWG samples were shown to occur with significantly higher odds under operator compliance sampling than under SIP, MIP, or regular inspector sampling. For continuous and conventional MMU's the operator LWG odds are substantially higher than both the MIP and regular inspector LWG odds, and these, in turn, are both substantially higher than the odds for LWG under

SIP sampling. Although LWG samples occur with far lower frequency among operator samples at longwall MMU's than at continuous or conventional MMU's, a similar pattern can be inferred for longwalls. (- 143 -)

The LWG rate for routine bimonthly compliance DO samples is 25.4 percent when the samples are among the first five collected in a cycle, whereas it is 16.6 percent for subsequent compliance samples in the same cycle. This difference in LWG rates is statistically significant at a confidence level of more than 99.99 percent. Similarly,the LWG rate for later abatement samples falls significantly below the rate for samples taken earlier in the bimonthly period. (- 144 -)

During both the SIP and MIP inspections, at both longwall and non-longwall MMU's, MMU's in compliance with the QAS tended to operate at a significantly lower fraction of their production capacity than MMU's not in compliance. (- 151 -)

During both the SIP and MIP inspections, dust controls in place tended to exceed DCP requirements by large margins, regardless of QAS-compliance. (- 151 -)

Using observed and maximum shift production, observed and DCP-required dust controls, and mine size, it is possible to identify longwall MMU's having a high probability of non-compliance with the respirable dust standard. (- 217 -)

B. Potential Improvements in MSHA's Respirable Dust Data System

The inconsistency in confidence levels between single and multi-sample citation criteria arises from MSHA's numerical truncation of both single and multi-sample values. MSHA truncates the calculated average of 5 values that have each already been truncated, thereby artificially reducing the "average" used for non-compliance determinations. (- 54 -)

Several potential improvements in MSHA's automated respirable dust data system became apparent in the course of working with the POPERAT and PINSPECT databases:

In contrast with other parts of the automated Respirable Dust System, data entered into the respirable dust data base through the Inspector Dust Samples Subsystem currently undergoes no internal validation, cross-checking, or automatic editing. This allows data into the system containing errors and inconsistencies. A review of the automated Respirable Dust System needs to be conducted with the objective of developing ways of assuring the quality of inspector dust sample data and implementing a system of internal checks and edits.

Under the current system, data entered into the Operator Dust Sample Data Base and used to determine compliance or non-compliance can later be deleted with no record or audit trail remaining of the deleted data. Since there is no adequate audit trail, the sequence of events leading to a compliance or non-compliance determination cannot always be reconstructed. This diminishes the archival value of the data and should be rectified by generating appropriate records for an audit trail whenever the data are deleted or modified.

The Sample Usage Code (SUC) used in the Operator Sample data base is confusing and does not adequately distinguish different cases (see p. 4-5 of Appendix B). Different codes are assigned to abatement samples, depending on whether compliance is or is not achieved, but no such distinction is made for ordinary bimonthly compliance samples. Similarly, special codes are assigned to split-cycle abatement samples when compliance is ***not*** achieved, but there is no corresponding special code to distinguish split-cycle from same-cycle abatement samples when compliance ***is*** achieved. An analysis should be made of how best to improve the Sample Usage Code to maximize its information content and increase its usefulness. This may involve breaking the code into three parts: one indicating normal bimonthly or abatement sampling, another indicating same-cycle or split-cycle sampling, and a third indicating whether compliance was achieved.

Another area of potential improvement in the automated system is documentation for modified dust standards. Currently, a dust standard can be modified in the data base without adequate documentation in the system as to the basis for the modification.

<u>Recommendations for Coal Respirable Dust Data System</u>

1. A review of the automated Respirable Dust Data System should be conducted to identify means of improving the quality of data input via the Inspector Dust Samples Subsystem. A method of cross-checking and editing should be developed to assure that data recorded into the Inspector Dust Samples Subsystem is acceptable and internally consistent.

2. The Operator Dust Sample Subsystem should be modified so that an audit trail is automatically generated whenever data are modified or deleted. This audit trail should be adequate to permit later reconstructions of compliance or non-compliance determinations and to document the basis for any deletions.

3. An analysis should be made of how best to improve the Sample Usage Code to maximize its information content and increase its usefulness.

4. The Respirable Dust Data System should include a data field documenting the reason any time a reduced dust standard is put into effect.

5. Compliance determinations based on the average of five dust sample concentrations, each of which is truncated to one decimal place, should utilize two decimal places for the calculated average.

Report of the Statistical Task Team
of the
Coal Mine Respirable Dust Task Group

U.S. Department of Labor
Mine Safety and Health Administration

September 1993

- Appendices -

VII. Appendices

Appendix A. Descriptive Statistics

Appendix A1. Number of SIP MMU's, by mining system, blowing or exhaust ventilation, curtain or tubing, belt air, and mine size.

System	V-Meth	V-Devic	Belt Air	Employee Size Group				Total
				Unknown	Small 1-50	Medium 51-125	Large > 125	
Longwall	Blowing	Curtain	Yes	0	0	0	1	1
			No	0	0	1	0	1
			Unknown	0	0	0	0	0
			TOTAL	0	0	1	1	2
		Unknown	Yes	0	0	0	1	1
			No	0	0	0	3	3
			Unknown	0	0	0	1	1
			TOTAL	0	0	0	5	5
	Exhaust	Curtain	Yes	0	0	0	9	9
			No	0	0	0	3	3
			Unknown	0	0	0	3	3
			TOTAL	0	0	0	15	15
		Unknown	Yes	0	0	0	12	12
			No	0	0	1	19	20
			Unknown	0	0	0	2	2
			TOTAL	0	0	1	33	34
	Both	Unknown	Yes	0	0	0	4	4
			No	0	0	1	7	8
			Unknown	0	0	0	12	12
			TOTAL	0	0	1	23	24
Continuous Deep Cut	Blowing	Curtain	Yes	0	0	0	4	4
			No	0	15	15	44	74
			Unknown	0	0	1	5	6
			TOTAL	0	15	16	53	84
		Tubing	Yes	0	0	0	0	0
			No	0	0	0	1	1
			Unknown	0	0	0	0	0
			TOTAL	0	0	0	1	1
		Both	Yes	0	0	0	0	0
			No	0	0	0	0	0
			Unknown	0	0	0	1	1
			TOTAL	0	0	0	1	1
		Unknown	Yes	0	0	0	1	1
			No	0	0	0	0	0
			Unknown	0	0	0	1	1
			TOTAL	0	0	0	2	2

Exhaust	Curtain	Yes	0	0	1	6	7
		No	0	12	11	5	28
		Unknown	0	2	1	3	6
		TOTAL	0	14	13	14	41
	Tubing	Yes	0	0	1	0	1
		No	0	0	0	6	6
		Unknown	0	0	0	0	0
		TOTAL	0	0	1	6	7
	Unknown	Yes	0	0	0	0	0
		No	0	0	0	1	1
		Unknown	0	0	1	0	1
		TOTAL	0	0	1	1	2
Both	Curtain	Yes	0	0	0	3	3
		No	0	1	4	4	9
		Unknown	0	0	1	0	1
		TOTAL	0	1	5	7	13
	Unknown	Yes	0	0	0	0	0
		No	0	0	0	0	0
		Unknown	0	1	0	0	1
		TOTAL	0	1	0	0	1
Continuous Blowing not Deep Cut	Curtain	Yes	0	0	0	2	2
		No	0	12	6	8	26
		Unknown	0	2	3	1	6
		TOTAL	0	14	9	11	34
	Tubing	Yes	0	0	0	0	0
		No	0	1	0	1	2
		Unknown	0	0	0	0	0
		TOTAL	0	1	0	1	2
	Unknown	Yes	0	0	0	0	0
		No	0	0	1	0	1
		Unknown	0	0	0	0	0
		TOTAL	0	0	1	0	1
Exhaust	Curtain	Yes	0	4	0	12	16
		No	0	163	54	9	226
		Unknown	0	16	5	3	24
		TOTAL	0	183	59	24	266
	Tubing	Yes	0	0	0	2	2
		No	0	0	1	10	11
		Unknown	0	0	0	2	2
		TOTAL	0	0	1	14	15
	Both	Yes	0	0	0	0	0
		No	0	1	0	3	4
		Unknown	0	0	0	0	0
		TOTAL	0	1	0	3	4
	Unknown	Yes	0	0	0	0	0
		No	0	3	0	0	3
		Unknown	0	1	1	2	4
		TOTAL	0	4	1	2	7

Both	Curtain	Yes	0	0	0	2	2
		No	0	20	4	2	
		Unknown	0	3	2	1	6
		TOTAL	0	23	6	5	34
	Both	Yes	0	0	0	0	0
		No	0	0	0	2	2
		Unknown	0	0	0	0	0
		TOTAL	0	0	0	2	2
	Unknown	Yes	0	0	0	1	1
		No	0	0	0	0	0
		Unknown	0	0	0	0	0
		TOTAL	0	0	0	1	1
Unknown	Curtain	Yes	0	0	0	0	0
		No	0	3	0	0	3
		Unknown	0	0	0	0	0
		TOTAL	0	3	0	0	3
	Tubing	Yes	0	0	0	0	0
		No	0	0	0	1	1
		Unknown	0	0	0	0	0
		TOTAL	0	0	0	1	1
	Unknown	Yes	0	0	0	0	0
		No	0	0	0	0	0
		Unknown	0	2	1	0	3
		TOTAL	0	2	1	0	3
Convent'l Blowing	Curtain	Yes	0	0	0	1	1
		No	0	4	0	8	12
		Unknown	0	2	0	0	2
		TOTAL	0	6	0	9	15
Exhaust	Curtain	Yes	0	0	0	0	0
		No	0	38	1	0	39
		Unknown	0	5	0	0	5
		TOTAL	0	43	1	0	44
	Tubing	Yes	0	0	0	0	0
		No	0	0	0	0	0
		Unknown	0	1	0	0	1
		TOTAL	0	1	0	0	1
Both	Curtain	Yes	0	0	0	0	0
		No	0	9	0	1	10
		Unknown	0	0	0	0	0
		TOTAL	0	9	0	1	10
Other Blowing	Curtain	Yes	0	0	0	0	0
		No	0	1	0	0	1
		Unknown	0	0	0	0	0
		TOTAL	0	1	0	0	1
	Tubing	Yes	0	0	0	0	0
		No	0	12	0	0	12
		Unknown	0	4	0	0	4
		TOTAL	0	16	0	0	16

Exhaust	Curtain	Yes	0	0	0	0		0
		No	0	19	0	0		19
		Unknown	0	0	0	0		0
		TOTAL	0	19	0	0		19
Both	Tubing	Yes	0	0	0	0		0
		No	0	1	0	0		1
		Unknown	0	0	0	0		0
		TOTAL	0	1	0	0		1
	Both	Yes	0	0	0	0		0
		No	0	10	0	0		10
		Unknown	0	0	0	0		0
		TOTAL	0	10	0	0		10
Unknown	Curtain	Yes	0	0	0	0		0
		No	0	0	0	0		0
		Unknown	0	1	0	0		1
		TOTAL	0	1	0	0		1

Appendix A2. Number of MIP MMU's, by mining system, blowing or exhaust ventilation, curtain or tubing, belt air, and mine size.

System	V-Meth	V-Devic	Belt Air	Employee Size Group: Unknown	Small 1-50	Medium 51-125	Large > 125	Total
Longwall	Blowing	Curtain	Yes	0	0	0	2	2
			No	0	0	0	1	1
			Unknown	0	0	0	0	0
			TOTAL	0	0	0	3	3
		Unknown	Yes	0	0	0	1	1
			No	0	0	0	1	1
			Unknown	0	0	0	0	0
			TOTAL	0	0	0	2	2
	Exhaust	Curtain	Yes	0	0	0	1	1
			No	0	0	0	0	0
			Unknown	0	0	0	0	0
			TOTAL	0	0	0	1	1
		Unknown	Yes	0	0	0	9	9
			No	0	0	0	6	6
			Unknown	0	0	0	1	1
			TOTAL	0	0	0	16	16
	Both	Unknown	Yes	0	0	0	1	1
			No	0	0	0	0	0
			Unknown	0	0	0	0	0
			TOTAL	0	0	0	1	1
	Unknown	Unknown	Yes	0	0	0	4	4
			No	0	0	0	5	5
			Unknown	0	1	0	2	3
			TOTAL	0	1	0	11	12
Continuous Deep Cut	Blowing	Curtain	Yes	0	0	0	9	9
			No	0	13	16	32	61
			Unknown	0	1	2	3	6
			TOTAL	0	14	18	44	76
		Unknown	Yes	0	0	0	0	0
			No	0	0	0	1	1
			Unknown	0	0	0	0	0
			TOTAL	0	0	0	1	1
	Exhaust	Curtain	Yes	0	0	1	9	10
			No	0	12	5	5	22
			Unknown	0	1	0	2	3
			TOTAL	0	13	6	16	35
		Tubing	Yes	0	0	0	0	0
			No	0	0	0	6	6
			Unknown	0	0	0	0	0
			TOTAL	0	0	0	6	6
		Unknown	Yes	0	0	0	0	0
			No	0	0	1	0	1
			Unknown	0	0	0	0	0
			TOTAL	0	0	1	0	1

Both	Curtain	Yes	0	0	0	0	0
		No	0	4	9	6	19
		Unknown	0	0	0	1	1
		TOTAL	0	4	9	7	20
Continuous Blowing not Deep Cut	Curtain	Yes	0	0	0	3	3
		No	0	4	4	20	28
		Unknown	0	0	2	3	5
		TOTAL	0	4	6	26	36
Exhaust	Curtain	Yes	0	1	0	22	23
		No	1	210	51	13	275
		Unknown	0	8	1	2	11
		TOTAL	1	219	52	37	309
	Tubing	Yes	0	0	0	4	4
		No	0	0	1	22	23
		Unknown	0	0	0	1	1
		TOTAL	0	0	1	27	28
	Both	Yes	0	1	0	2	3
		No	0	1	0	4	5
		Unknown	0	0	0	0	0
		TOTAL	0	2	0	6	8
	Unknown	Yes	0	0	0	0	0
		No	0	2	2	1	5
		Unknown	0	2	0	0	2
		TOTAL	0	4	2	1	7
Both	Curtain	Yes	0	0	2	2	4
		No	0	23	3	1	27
		Unknown	0	4	0	1	5
		TOTAL	0	27	5	4	36
	Tubing	Yes	0	0	0	0	0
		No	0	3	0	0	3
		Unknown	0	0	0	0	0
		TOTAL	0	3	0	0	3
	Both	Yes	0	0	0	0	0
		No	0	0	0	3	3
		Unknown	0	0	0	1	1
		TOTAL	0	0	0	4	4
	Unknown	Yes	0	0	0	0	0
		No	0	0	1	0	1
		Unknown	0	1	1	0	2
		TOTAL	0	1	2	0	3
Unknown	Curtain	Yes	0	0	0	0	0
		No	0	3	0	0	3
		Unknown	0	0	0	0	0
		TOTAL	0	3	0	0	3
	Unknown	Yes	0	0	0	0	0
		No	0	0	1	0	1
		Unknown	0	0	0	1	1
		TOTAL	0	0	1	1	2

Convent'l	Blowing	Curtain	Yes	0	0	0	0	0
			No	0	4	0	5	9
			Unknown	0	1	0	0	1
			TOTAL	0	5	0	5	10
	Exhaust	Curtain	Yes	0	0	0	0	0
			No	0	35	0	0	35
			Unknown	0	2	0	0	2
			TOTAL	0	37	0	0	37
		Unknown	Yes	0	0	0	0	0
			No	0	1	0	0	1
			Unknown	0	0	0	0	0
			TOTAL	0	1	0	0	1
	Both	Curtain	Yes	0	0	0	0	0
			No	0	4	0	2	6
			Unknown	0	0	0	0	0
			TOTAL	0	4	0	2	6
	Unknown	Curtain	Yes	0	0	0	0	0
			No	0	1	0	0	1
			Unknown	0	0	0	0	0
			TOTAL	0	1	0	0	1
		Tubing	Yes	0	0	0	0	0
			No	0	1	0	0	1
			Unknown	0	0	0	0	0
			TOTAL	0	1	0	0	1
		Unknown	Yes	0	0	0	0	0
			No	0	0	0	0	0
			Unknown	0	1	0	0	1
			TOTAL	0	1	0	0	1
Other	Blowing	Curtain	Yes	0	0	0	0	0
			No	0	2	0	0	2
			Unknown	0	0	0	0	0
			TOTAL	0	2	0	0	2
		Tubing	Yes	0	0	0	0	0
			No	0	5	0	0	5
			Unknown	0	4	0	0	4
			TOTAL	0	9	0	0	9
		Both	Yes	0	0	0	0	0
			No	0	1	0	0	1
			Unknown	0	1	0	0	1
			TOTAL	0	2	0	0	2
	Exhaust	Curtain	Yes	0	0	0	0	0
			No	0	21	0	0	21
			Unknown	0	0	0	0	0
			TOTAL	0	21	0	0	21
	Both	Curtain	Yes	0	0	0	0	0
			No	0	2	0	0	2
			Unknown	0	2	0	0	2
			TOTAL	0	4	0	0	4

Both	Yes	0	0	0	0	0
	No	0	1	0	0	1
	Unknown	0	0	0	0	0
	TOTAL	0	1	0	0	1

Appendix A3. Belt Air Comparisons

```
DO Dust Concentration (DO_Conc)
******************************
GROUP    1 YES                    2 NO                       YES          NO            TEST STATISTICS   P-VALUE  DF
                                                  --------------------------------      --------------------------------
                                                  MEAN          1.4296      1.7600      LEVENE F FOR
   H                        X                     TRIM MEAN     1.3120      1.6333       VARIABILITY    0.03 0.8552 1,    60
   H                        XX                    STD DEV       1.0513      1.1181
   HHH                      XX                    S.E.M.        0.2023      0.1890      POOLED    T    -1.18 0.2412    60
  HHHH                    XXXXXX                  SAMPLE SIZE       27          35      SEPARATE  T    -1.19 0.2377    57.6
 HHHHH H H      H         XXXXXXX X         X     MAXIMUM       5.7000      7.0000      TRIM POOL.T    -1.69 0.0974    56
M-------------------M M--------------------M      MINIMUM       0.1000      0.7000      TRIM SEP. T    -1.69 0.0961    52.7
I  AN H=    2 CASES A I  AN X=     2 CASES  A     Z MAX         4.06        4.69
N    (N=    27)     X N    (N=     35)      X     Z MIN        -1.26       -0.95        MANN-WHIT.     336.0 0.0518
                                                  CASE (MAX)       250         242       (RANK SUMS      714.0       1239.0)
                                                  CASE (MIN)       246          59
                                                  2ND MAX       3.1000      3.3000
                                                  2ND MIN       0.7000      0.7000
```

```
Ln(DO_Conc)
******************************
GROUP    1 YES                    2 NO                       YES          NO            TEST STATISTICS   P-VALUE  DF
                                                  --------------------------------      --------------------------------
                                                  MEAN          0.1534      0.4357      LEVENE F FOR
                                                  TRIM MEAN     0.1881      0.4139       VARIABILITY    0.48 0.4922 1,    60
        H                                         STD DEV       0.6941      0.4887
        H H                      X XXXX           S.E.M.        0.1336      0.0826      POOLED    T    -1.88 0.0651    60
        HHHHH                    X XXXXX          SAMPLE SIZE       27          35      SEPARATE  T    -1.80 0.0790    44.7
 H      HHHHHH H  H              XXXXXXXX X       MAXIMUM       1.7405      1.9459      TRIM POOL.T    -1.88 0.0657    56
M-------------------M M--------------------M      MINIMUM      -2.3026     -0.3567      TRIM SEP. T    -1.87 0.0674    50.9
I  AN H=    2 CASES A I  AN X=     2 CASES  A     Z MAX         2.29        3.09
N    (N=    27)     X N    (N=     35)      X     Z MIN        -3.54       -1.62        MANN-WHIT.     336.0 0.0518
                                                  CASE (MAX)       250         242       (RANK SUMS      714.0       1239.0)
                                                  CASE (MIN)       246          59
                                                  2ND MAX       1.1314      1.1939
                                                  2ND MIN      -0.3567     -0.3567
```

```
Intake Air Dust Concentration (Intk)
******************************
GROUP    1 YES                    2 NO                       YES          NO            TEST STATISTICS   P-VALUE  DF
                                                  --------------------------------      --------------------------------
                                                  MEAN          0.3353      0.2200      LEVENE F FOR
                         X                        TRIM MEAN     0.3200      0.2111       VARIABILITY   13.87 0.0007 1,    35
 H                       X                        STD DEV       0.2473      0.1281
 H                     X X                        S.E.M.        0.0600      0.0287      POOLED    T     1.82 0.0773    35
 H        H            X X                        SAMPLE SIZE       17          20      SEPARATE  T     1.73 0.0962    23.1
 H H  H H H     H H    X X     X  X               MAXIMUM       0.8000      0.5000      TRIM POOL.T     1.58 0.1247    31
M-------------------M M--------------------M      MINIMUM       0.1000      0.1000      TRIM SEP. T     1.50 0.1493    20.5
I  AN H=    2 CASES A I  AN X=     2 CASES  A     Z MAX         1.88        2.19
N    (N=    17)     X N    (N=     20)      X     Z MIN        -0.95       -0.94        MANN-WHIT.     199.0 0.3587
                                                  CASE (MAX)       398          43       (RANK SUMS      352.0        351.0)
                                                  CASE (MIN)       246          40
                                                  2ND MAX       0.7000      0.5000
                                                  2ND MIN       0.1000      0.1000
```

Ln(Intk)
****

```
GROUP    1 YES                     2 NO

                                   X
H                                  X
H                            X     X
H             H              X     X
H    H    H  H H  HH         X     X     X X
M--------------------M  M--------------------M
I  AN H=   2 CASES   A  I  AN X=   2 CASES   A
N    (N=   17)       X  N   (N=   20)        X
```

	YES	NO
MEAN	-1.3988	-1.6564
TRIM MEAN	-1.4170	-1.6741
STD DEV	0.8409	0.5370
S.E.M.	0.2039	0.1201
SAMPLE SIZE	17	20
MAXIMUM	-0.2231	-0.6931
MINIMUM	-2.3026	-2.3026
Z MAX	1.40	1.79
Z MIN	-1.07	-1.20
CASE (MAX)	398	43
CASE (MIN)	246	40
2ND MAX	-0.3567	-0.6931
2ND MIN	-2.3026	-2.3026

TEST STATISTICS		P-VALUE	DF
LEVENE F FOR VARIABILITY	12.53	0.0012	1, 35
POOLED T	1.13	0.2672	35
SEPARATE T	1.09	0.2862	26.3
TRIM POOL.T	1.01	0.3212	31
TRIM SEP. T	0.97	0.3425	23.0
MANN-WHIT.	199.0	0.3587	
(RANK SUMS	352.0		351.0)

DO_Conc - Intk
****

```
GROUP    1 YES                     2 NO

  H H H                      X X     X
H H H H H                    X XX   X X
H HHH HHH  H  H            XXXXXXX XXXX    X
M--------------------M  M--------------------M
I  AN H=   1 CASES   A  I  AN X=   1 CASES   A
N    (N=   17)       X  N   (N=   20)        X
```

	YES	NO
MEAN	0.8353	1.2600
TRIM MEAN	0.8067	1.2222
STD DEV	0.5465	0.6435
S.E.M.	0.1325	0.1439
SAMPLE SIZE	17	20
MAXIMUM	2.1000	2.9000
MINIMUM	0.0000	0.3000
Z MAX	2.31	2.55
Z MIN	-1.53	-1.49
CASE (MAX)	331	155
CASE (MIN)	246	709
2ND MAX	1.6000	2.0000
2ND MIN	0.1000	0.5000

TEST STATISTICS		P-VALUE	DF
LEVENE F FOR VARIABILITY	0.58	0.4499	1, 35
POOLED T	-2.14	0.0393	35
SEPARATE T	-2.17	0.0368	35.0
TRIM POOL.T	-2.21	0.0345	31
TRIM SEP. T	-2.23	0.0330	30.8
MANN-WHIT.	105.5	0.0489	
(RANK SUMS	258.5		444.5)

Ln(DO_Conc/Intk)
****

```
GROUP    1 YES                     2 NO

    H
    H                                   XX
H   HH          H                    XXXXXXX
H   HHHH   HH  H HHH        X X  X XXXXXXX X
M--------------------M  M--------------------M
I  AN H=   1 CASES   A  I  AN X=   1 CASES   A
N    (N=   17)       X  N   (N=   20)        X
```

	YES	NO
MEAN	1.4086	1.9533
TRIM MEAN	1.3903	1.9819
STD DEV	0.9990	0.5600
S.E.M.	0.2423	0.1252
SAMPLE SIZE	17	20
MAXIMUM	3.0910	2.8332
MINIMUM	0.0000	0.5596
Z MAX	1.68	1.57
Z MIN	-1.41	-2.49
CASE (MAX)	331	46
CASE (MIN)	246	709
2ND MAX	2.8332	2.4849
2ND MIN	0.1335	0.8755

TEST STATISTICS		P-VALUE	DF
LEVENE F FOR VARIABILITY	12.98	0.0010	1, 35
POOLED T	-2.09	0.0443	35
SEPARATE T	-2.00	0.0571	24.2
TRIM POOL.T	-2.13	0.0409	31
TRIM SEP. T	-2.02	0.0571	20.0
MANN-WHIT.	118.5	0.1161	
(RANK SUMS	271.5		431.5)

DO Dust Concentration (DO_Conc)

```
********************************
GROUP   1 YES                2 NO               YES          NO             TEST STATISTICS   P-VALUE  DF
                                            -------------------------------  -------------------------------
                     X                      MEAN        0.9318     1.5720    LEVENE F FOR
 H                   X                      TRIM MEAN   0.9150     1.5215     VARIABILITY    4.18 0.0418 1,  320
 H                   X                      STD DEV     0.5223     1.9966
 HH                  XX                     S.E.M.      0.1113     0.1153    POOLED     T    -1.50 0.1351  320
 HH                  XXX                    SAMPLE SIZE     22        300    SEPARATE   T    -3.99 0.0001   83.4
 HHH                 XXXXXX XX X XX  X  X   MAXIMUM     2.1000    18.1000    TRIM POOL.T     -1.41 0.1596  316
M------------------M M------------------M   MINIMUM     0.1000     0.1000    TRIM SEP. T     -3.81 0.0003   68.0
I  AN H=    3 CASES  A  I  AN X=   26 CASES  A   Z MAX       2.24       8.28
N    (N=    22)     X  N    (N=  300)     X   Z MIN      -1.59      -0.74     MANN-WHIT.    2786.0 0.2217
                                            CASE (MAX)     190        317     (RANK SUMS     3039.0     48964.0)
                                            CASE (MIN)     469        207
                                            2ND MAX     1.8000    14.7000
                                            2ND MIN     0.2000     0.1000
```

Ln(DO_Conc)

```
********************************
GROUP   1 YES                2 NO               YES          NO             TEST STATISTICS   P-VALUE  DF
                                            -------------------------------  -------------------------------
                          X                 MEAN       -0.2810     0.0087    LEVENE F FOR
        H                XXX                TRIM MEAN  -0.2311     0.0067     VARIABILITY    1.34 0.2480 1,  320
       HH              XXXXXX               STD DEV     0.7583     0.9280
      HHHH           X  XXXXXXXX            S.E.M.      0.1617     0.0536    POOLED     T    -1.43 0.1540  320
  H   HHHHHH         X  XXXXXXXXX           SAMPLE SIZE     22        300    SEPARATE   T    -1.70 0.1010   25.8
 H H  HHHHHH       X X  XXXXXXXXXXXXXXX     MAXIMUM     0.7419     2.8959    TRIM POOL.T     -1.12 0.2624  316
M------------------M M------------------M   MINIMUM    -2.3026    -2.3026    TRIM SEP. T     -1.43 0.1665   23.7
I  AN H=    1 CASES  A  I  AN X=    8 CASES  A   Z MAX       1.35       3.11
N    (N=    22)     X  N    (N=  300)     X   Z MIN      -2.67      -2.49     MANN-WHIT.    2786.0 0.2217
                                            CASE (MAX)     190        317     (RANK SUMS     3039.0     48964.0)
                                            CASE (MIN)     469        207
                                            2ND MAX     0.5878     2.6878
                                            2ND MIN    -1.6094    -2.3026
```

Intake Air Dust Concentration (Intk)

```
********************************
GROUP   1 YES                2 NO               YES          NO             TEST STATISTICS   P-VALUE  DF
                                            -------------------------------  -------------------------------
                     X                      MEAN        0.3353     0.1626    LEVENE F FOR
                     X                      TRIM MEAN   0.2800     0.1601     VARIABILITY   20.33 0.0000 1,  288
  H                  X                      STD DEV     0.3408     0.1541
  H                  X                      S.E.M.      0.0827     0.0093    POOLED     T     4.06 0.0001  288
  HH  H              XX                     SAMPLE SIZE     17        273    SEPARATE   T     2.08 0.0540   16.4
  HH  H H   H    H   XXX XX X X X  X        MAXIMUM     1.4000     1.0000    TRIM POOL.T      2.80 0.0054  284
M------------------M M------------------M   MINIMUM     0.1000     0.0000    TRIM SEP. T      1.79 0.0938   14.6
I  AN H=    2 CASES  A  I  AN X=   32 CASES  A   Z MAX       3.12       5.43
N    (N=    17)     X  N    (N=  273)     X   Z MIN      -0.69      -1.06     MANN-WHIT.    3188.0 0.0019
                                            CASE (MAX)     393        567     (RANK SUMS     3341.0     38854.0)
                                            CASE (MIN)     111         53
                                            2ND MAX     0.8000     1.0000
                                            2ND MIN     0.1000     0.0000
```

Ln(Intk)

```
*******************************
GROUP    1 YES                    2 NO               YES          NO           TEST STATISTICS   P-VALUE  DF
                                                   ------------------------------  -------------------------------
                          X                         MEAN        -1.4687     -1.9944    LEVENE F FOR
                          X                         TRIM MEAN   -1.5335     -2.0008     VARIABILITY   12.56 0.0005 1,  280
 H                        X                         STD DEV      0.8608      0.5500
 H                        X                         S.E.M.       0.2088      0.0338    POOLED     T    3.67 0.0003  280
 H    H    H              X    X                    SAMPLE SIZE      17         265    SEPARATE   T    2.49 0.0237   16.8
 H    H    H H  H   H     X    X  X X X XX X        MAXIMUM      0.3365      0.0000    TRIM POOL.T     3.08 0.0023  276
M--------------------M  M--------------------M      MINIMUM     -2.3026     -2.3026    TRIM SEP. T     2.10 0.0532   14.7
I  AN H=    2 CASES  A  I  AN X=   32 CASES  A      Z MAX        2.10        3.63
N    (N=   17)       X  N    (N=  265)       X      Z MIN       -0.97       -0.56      MANN-WHIT.    3052.0 0.0027
                                                    CASE (MAX)      393         567     (RANK SUMS    3205.0    36698.0)
                                                    CASE (MIN)      111           7
                                                    2ND MAX     -0.2231      0.0000
                                                    2ND MIN     -2.3026     -2.3026
```

DO_Conc - Intk

```
*******************************
GROUP    1 YES                    2 NO               YES          NO           TEST STATISTICS   P-VALUE  DF
                                                   ------------------------------  -------------------------------
                           X                        MEAN         0.6176      1.3934    LEVENE F FOR
                          XX                        TRIM MEAN    0.5867      1.3509     VARIABILITY    4.19 0.0415 1,  286
 HH                       XX                        STD DEV      0.4640      1.8013
 HH                       XXX                       S.E.M.       0.1125      0.1094    POOLED     T   -1.77 0.0779  286
 HH                       XXXX                      SAMPLE SIZE      17         271    SEPARATE   T   -4.94 0.0000   57.5
 HHH                      XXXXXXXX XX X  XX  X      MAXIMUM      1.7000     14.5000    TRIM POOL.T    -1.69 0.0915  282
M--------------------M  M--------------------M      MINIMUM      0.0000     -0.3000    TRIM SEP. T    -4.90 0.0000   47.0
I  AN H=    2 CASES  A  I  AN X=   16 CASES  A      Z MAX        2.33        7.28
N    (N=   17)       X  N    (N=  271)       X      Z MIN       -1.33       -0.94      MANN-WHIT.    1581.0 0.0299
                                                    CASE (MAX)      190         519     (RANK SUMS    1734.0    39882.0)
                                                    CASE (MIN)      385         429
                                                    2ND MAX      1.3000     11.9000
                                                    2ND MIN      0.0000      0.0000
```

Ln(DO_Conc/Intk)

```
*******************************
GROUP    1 YES                    2 NO               YES          NO           TEST STATISTICS   P-VALUE  DF
                                                   ------------------------------  -------------------------------
                                X  X                MEAN         1.1613      2.0081    LEVENE F FOR
                                X XX                TRIM MEAN    1.1402      2.0087     VARIABILITY    0.72 0.3984 1,  278
                                X XX                STD DEV      0.7923      0.9900
   H HH                      X  X XXXX              S.E.M.       0.1922      0.0610    POOLED     T   -3.45 0.0006  278
   H HH HH                 X X  X XXXXX             SAMPLE SIZE      17         263    SEPARATE   T   -4.20 0.0005   19.4
   H HHHHHHHH           X  XXXXXXXXXXXXXX XX        MAXIMUM      2.6391      4.7875    TRIM POOL.T    -3.35 0.0009  274
M--------------------M  M--------------------M      MINIMUM      0.0000     -0.9163    TRIM SEP. T    -3.95 0.0011   16.4
I  AN H=    1 CASES  A  I  AN X=    8 CASES  A      Z MAX        1.87        2.81
N    (N=   17)       X  N    (N=  263)       X      Z MIN       -1.47       -2.95      MANN-WHIT.    1132.0 0.0006
                                                    CASE (MAX)      558         704     (RANK SUMS    1285.0    38055.0)
                                                    CASE (MIN)      385         429
                                                    2ND MAX      2.3979      4.7274
                                                    2ND MIN      0.0000      0.0000
```

DO Dust Concentration (DO_Conc)

```
*******************************
GROUP   1 YES                 2 NO                     YES         NO           TEST STATISTICS   P-VALUE  DF
                                               --------------------------------  -------------------------------
                          X  X                 MEAN         1.1937      1.2311   LEVENE F FOR
   H                      X XX X               TRIM MEAN    1.1357      1.2145    VARIABILITY     0.23 0.6297 1,  133
 H H                      XXXXXX               STD DEV      0.7844      0.7915
 H H                     XXXXXXX  X            S.E.M.       0.1961      0.0726   POOLED     T    -0.18 0.8595  133
 H H     H               XXXXXXXX XX           SAMPLE SIZE      16         119   SEPARATE   T    -0.18 0.8601   19.3
 HHH  HH H HH            XXXXXXXXXXX XXX    X  MAXIMUM      2.8000      4.3000   TRIM POOL.T     -0.35 0.7254  129
M-------------------M  M--------------------M  MINIMUM      0.4000      0.1000   TRIM SEP. T     -0.35 0.7321   16.2
I  AN H=    1 CASES  A  I  AN X=    3 CASES  A  Z MAX        2.05        3.88
N    (N=   16)       X  N    (N=  119)       X  Z MIN       -1.01       -1.43     MANN-WHIT.     909.0 0.7692
                                               CASE (MAX)      492         409    (RANK SUMS    1045.0      8135.0)
                                               CASE (MIN)       38         222
                                               2ND MAX      2.5000      4.1000
                                               2ND MIN      0.4000      0.2000
```

Ln(DO_Conc)

```
*******************************
GROUP   1 YES                 2 NO                     YES         NO           TEST STATISTICS   P-VALUE  DF
                                               --------------------------------  -------------------------------
                                   X           MEAN        -0.0203     -0.0088   LEVENE F FOR
          H                       XX X         TRIM MEAN   -0.0313     -0.0018    VARIABILITY     0.00 0.9640 1,  133
          H                   X  XXXXXXX       STD DEV      0.6479      0.7063
          H                   XX XXXXXXX       S.E.M.       0.1620      0.0647   POOLED     T    -0.06 0.9508  133
      HH  H   H H         X   XX XXXXXXX       SAMPLE SIZE      16         119   SEPARATE   T    -0.07 0.9480   20.1
      HH HH  HHHH      X  X   XX XXXXXXXXXX    MAXIMUM      1.0296      1.4586   TRIM POOL.T     -0.15 0.8804  129
M-------------------M  M--------------------M  MINIMUM     -0.9163     -2.3026   TRIM SEP. T     -0.15 0.8804   16.4
I  AN H=    1 CASES  A  I  AN X=    3 CASES  A  Z MAX        1.62        2.08
N    (N=   16)       X  N    (N=  119)       X  Z MIN       -1.38       -3.25     MANN-WHIT.     909.0 0.7692
                                               CASE (MAX)      492         409    (RANK SUMS    1045.0      8135.0)
                                               CASE (MIN)       38         222
                                               2ND MAX      0.9163      1.4110
                                               2ND MIN     -0.9163     -1.6094
```

Intake Air Dust Concentration (Intk)

```
*******************************
GROUP   1 YES                 2 NO                     YES         NO           TEST STATISTICS   P-VALUE  DF
                                               --------------------------------  -------------------------------
                          X                    MEAN         0.3167      0.1857   LEVENE F FOR
 H                        X                    TRIM MEAN    0.2700      0.1773    VARIABILITY     4.72 0.0318 1,  122
 H                        X                    STD DEV      0.2758      0.1931
 H   H                    X                    S.E.M.       0.0796      0.0182   POOLED     T     2.14 0.0347  122
 H H H                    X X                  SAMPLE SIZE      12         112   SEPARATE   T     1.60 0.1345   12.2
 H H HH      H           XX XX XX  X X      X  MAXIMUM      1.0000      1.3000   TRIM POOL.T      1.60 0.1120  118
M-------------------M  M--------------------M  MINIMUM      0.1000      0.0000   TRIM SEP. T      1.38 0.1974   10.2
I  AN H=    1 CASES  A  I  AN X=   13 CASES  A  Z MAX        2.48        5.77
N    (N=   12)       X  N    (N=  112)       X  Z MIN       -0.79       -0.96     MANN-WHIT.     891.0 0.0287
                                               CASE (MAX)      386         719    (RANK SUMS     969.0      6781.0)
                                               CASE (MIN)       94         561
                                               2ND MAX      0.5000      0.8000
                                               2ND MIN      0.1000      0.1000
```

Ln(Intk)
****

```
GROUP    1 YES                    2 NO

                         X
H                        X
H                        X
H          H             X
H   H      H             X    X
H   H    H H    H        X    X  X X X  XX  X
M--------------------M  M--------------------M
I  AN H=    1 CASES  A  I  AN X=   13 CASES  A
N    (N=    12)      X  N    (N=   111)      X
```

	YES	NO
MEAN	-1.4773	-1.9394
TRIM MEAN	-1.5425	-1.9563
STD DEV	0.8411	0.6236
S.E.M.	0.2428	0.0592
SAMPLE SIZE	12	111
MAXIMUM	0.0000	0.2624
MINIMUM	-2.3026	-2.3026
Z MAX	1.76	3.53
Z MIN	-0.98	-0.58
CASE (MAX)	386	719
CASE (MIN)	94	4
2ND MAX	-0.6931	-0.2231
2ND MIN	-2.3026	-2.3026

TEST STATISTICS		P-VALUE	DF
LEVENE F FOR VARIABILITY	4.32	0.0398	1, 121
POOLED T	2.35	0.0203	121
SEPARATE T	1.85	0.0885	12.3
TRIM POOL.T	1.97	0.0506	117
TRIM SEP. T	1.54	0.1545	9.9
MANN-WHIT.	879.0	0.0311	
(RANK SUMS	957.0		6669.0)

DO_Conc - Intk
****

```
GROUP    1 YES                    2 NO

                              X X
                              XXX X
    HH                       XXXX X
   HHH                      XXXXXXXX
 HH HHH     H  H         X XXXXXXXXXXXXXXXX X
M--------------------M  M--------------------M
I  AN H=    1 CASES  A  I  AN X=    4 CASES  A
N    (N=    12)      X  N    (N=   111)      X
```

	YES	NO
MEAN	0.6750	1.0378
TRIM MEAN	0.5900	1.0239
STD DEV	0.8771	0.7591
S.E.M.	0.2532	0.0720
SAMPLE SIZE	12	111
MAXIMUM	2.7000	4.0000
MINIMUM	-0.5000	-0.4000
Z MAX	2.31	3.90
Z MIN	-1.34	-1.89
CASE (MAX)	492	549
CASE (MIN)	386	194
2ND MAX	2.0000	3.5000
2ND MIN	-0.1000	0.0000

TEST STATISTICS		P-VALUE	DF
LEVENE F FOR VARIABILITY	0.01	0.9318	1, 121
POOLED T	-1.55	0.1239	121
SEPARATE T	-1.38	0.1916	12.8
TRIM POOL.T	-1.76	0.0808	117
TRIM SEP. T	-1.71	0.1161	10.6
MANN-WHIT.	438.0	0.0517	
(RANK SUMS	516.0		7110.0)

Ln(DO_Conc/Intk)
****

```
GROUP    1 YES                    2 NO

                                        X
                                    XX X XX
                                 X  XXXXXXXX
      H    H H                   XXXXXXXXXXX
 H H H H  HH HH    H      X  XXXXXXXXXXXXXXXXX
M--------------------M  M--------------------M
I  AN H=    1 CASES  A  I  AN X=    3 CASES  A
N    (N=    12)      X  N    (N=   110)      X
```

	YES	NO
MEAN	1.2583	1.9350
TRIM MEAN	1.2461	1.9429
STD DEV	1.1396	0.8117
S.E.M.	0.3290	0.0774
SAMPLE SIZE	12	110
MAXIMUM	3.3322	3.7136
MINIMUM	-0.6931	-0.6931
Z MAX	1.82	2.19
Z MIN	-1.71	-3.24
CASE (MAX)	492	549
CASE (MIN)	386	194
2ND MAX	2.1972	3.4657
2ND MIN	-0.2231	0.0000

TEST STATISTICS		P-VALUE	DF
LEVENE F FOR VARIABILITY	3.06	0.0827	1, 120
POOLED T	-2.63	0.0097	120
SEPARATE T	-2.00	0.0679	12.2
TRIM POOL.T	-2.59	0.0109	116
TRIM SEP. T	-2.12	0.0601	10.1
MANN-WHIT.	409.5	0.0310	
(RANK SUMS	487.5		7015.5)

```
DO Dust Concentration (DO_Conc)
*******************************
GROUP    1 YES                   2 NO               YES          NO            TEST STATISTICS   P-VALUE  DF
                                              ------------------------------   -------------------------------
                          X                   MEAN         0.7000      1.9034  LEVENE F FOR
                          X                   TRIM MEAN    0.0000      1.6393   VARIABILITY    0.00 1.0000 1,    0
                          X                   STD DEV      0.0000      2.7115
                          XX                  S.E.M.       0.0000      0.3560  POOLED     T   -0.44 0.6616   57
                          XX                  SAMPLE SIZE       1          58  SEPARATE   T   -3.38 0.0013   57.0
 H                        XXXXXXXX         X  MAXIMUM      0.7000     18.5000  TRIM POOL.T     0.00 1.0000    0
M------------------M M-------------------M    MINIMUM      0.7000      0.1000  TRIM SEP.  T    0.00 1.0000    0.0
I  AN H=    1 CASES  A I  AN X=    5 CASES  A Z MAX        0.00        6.12
N   (N=     1)       X N   (N=    58)      X  Z MIN        0.00       -0.67    MANN-WHIT.      17.0 0.4800
                                              CASE (MAX)        23        597   (RANK SUMS      18.0      1752.0)
                                              CASE (MIN)        23        418
                                              2ND MAX      0.7000      7.1000
                                              2ND MIN      0.7000      0.2000
```

```
Ln(DO_Conc)
*******************************
GROUP    1 YES                   2 NO               YES          NO            TEST STATISTICS   P-VALUE  DF
                                              ------------------------------   -------------------------------
                                              MEAN        -0.3567      0.1166  LEVENE F FOR
                             X                TRIM MEAN    0.0000      0.1098   VARIABILITY    0.00 1.0000 1,    0
                           X X                STD DEV      0.0000      0.9988
                           X X XXX            S.E.M.       0.0000      0.1311  POOLED     T   -0.47 0.6403   57
                        X  XXXXXXXXXX         SAMPLE SIZE       1          58  SEPARATE   T   -3.61 0.0006   57.0
        H             X X  XXXXXXXXXXXX  X    MAXIMUM     -0.3567      2.9178  TRIM POOL.T     0.00 1.0000    0
M------------------M M-------------------M    MINIMUM     -0.3567     -2.3026  TRIM SEP.  T    0.00 1.0000    0.0
I  AN H=    2 CASES  A I  AN X=    2 CASES  A Z MAX        0.00        2.80
N   (N=     1)       X N   (N=    58)      X  Z MIN        0.00       -2.42    MANN-WHIT.      17.0 0.4800
                                              CASE (MAX)        23        597   (RANK SUMS      18.0      1752.0)
                                              CASE (MIN)        23        418
                                              2ND MAX     -0.3567      1.9601
                                              2ND MIN     -0.3567     -1.6094
```

```
Intake Air Dust Concentration (Intk)
*******************************
GROUP    1 YES                   2 NO               YES          NO            TEST STATISTICS   P-VALUE  DF
                                              ------------------------------   -------------------------------
                             X                MEAN         0.1000      0.1333  LEVENE F FOR
                             X                TRIM MEAN    0.0000      0.1308   VARIABILITY    0.00 1.0000 1,    0
                             X                STD DEV      0.0000      0.0801
                             X                S.E.M.       0.0000      0.0109  POOLED     T   -0.41 0.6817   53
                             X    X           SAMPLE SIZE       1          54  SEPARATE   T   -3.06 0.0035   53.0
      H                 X    X    X        X  MAXIMUM      0.1000      0.4000  TRIM POOL.T     0.00 1.0000    0
M------------------M M-------------------M    MINIMUM      0.1000      0.0000  TRIM SEP.  T    0.00 1.0000    0.0
I  AN H=    1 CASES  A I  AN X=    7 CASES  A Z MAX        0.00        3.33
N   (N=     1)       X N   (N=    54)      X  Z MIN        0.00       -1.66    MANN-WHIT.      21.0 0.6354
                                              CASE (MAX)        23         33   (RANK SUMS      22.0      1518.0)
                                              CASE (MIN)        23        608
                                              2ND MAX      0.1000      0.4000
                                              2ND MIN      0.1000      0.0000
```

```
Ln(Intk)
********************************
GROUP    1 YES                   2 NO                      YES           NO          TEST STATISTICS    P-VALUE  DF
                                                   ------------------------------    ------------------------------
                         X                         MEAN        -2.3026     -2.0760    LEVENE F FOR
                         X                         TRIM MEAN    0.0000     -2.0946     VARIABILITY    0.00 1.0000 1,    0
                         X                         STD DEV      0.0000      0.4054
                         X                         S.E.M.       0.0000      0.0562    POOLED     T     -0.55 0.5822   51
                         X         X               SAMPLE SIZE       1          52    SEPARATE   T     -4.03 0.0002   51.0
 H                       X         X        X      MAXIMUM     -2.3026     -0.9163    TRIM POOL.T       0.00 1.0000   0
M-------------------M  M--------------------M      MINIMUM     -2.3026     -2.3026    TRIM SEP. T       0.00 1.0000   0.0
I  AN H=     1 CASES  A  I  AN X=     7 CASES  A   Z MAX        0.00        2.86
N    (N=     1)       X  N    (N=    52)       X   Z MIN        0.00       -0.56      MANN-WHIT.       19.0 0.5522
                                                   CASE (MAX)       23          33     (RANK SUMS       20.0       1411.0)
                                                   CASE (MIN)       23          24
                                                   2ND MAX     -2.3026     -0.9163
                                                   2ND MIN     -2.3026     -2.3026
```

```
DO_Conc - Intk
********************************
GROUP    1 YES                   2 NO                      YES           NO          TEST STATISTICS    P-VALUE  DF
                                                   ------------------------------    ------------------------------
                                                   MEAN         0.6000      1.8463    LEVENE F FOR
                         X                         TRIM MEAN    0.0000      1.5635     VARIABILITY    0.00 1.0000 1,    0
                         X                         STD DEV      0.0000      2.7834
                         XX                        S.E.M.       0.0000      0.3788    POOLED     T     -0.44 0.6591   53
                         XX                        SAMPLE SIZE       1          54    SEPARATE   T     -3.29 0.0018   53.0
 H                       XXXXXXXX           X      MAXIMUM      0.6000     18.4000    TRIM POOL.T       0.00 1.0000   0
M-------------------M  M--------------------M      MINIMUM      0.6000      0.0000    TRIM SEP. T       0.00 1.0000   0.0
I  AN H=     1 CASES  A  I  AN X=     5 CASES  A   Z MAX        0.00        5.95
N    (N=     1)       X  N    (N=    54)       X   Z MIN        0.00       -0.66      MANN-WHIT.       14.0 0.4121
                                                   CASE (MAX)       23         597     (RANK SUMS       15.0       1525.0)
                                                   CASE (MIN)       23         418
                                                   2ND MAX      0.6000      7.0000
                                                   2ND MIN      0.6000      0.0000
```

```
Ln(DO_Conc/Intk)
********************************
GROUP    1 YES                   2 NO                      YES           NO          TEST STATISTICS    P-VALUE  DF
                                                   ------------------------------    ------------------------------
                              X                    MEAN         1.9459      2.2394    LEVENE F FOR
                              X                    TRIM MEAN    0.0000      2.2246     VARIABILITY    0.00 1.0000 1,    0
                            X X                    STD DEV      0.0000      1.0039
                            X X    X               S.E.M.       0.0000      0.1392    POOLED     T     -0.29 0.7733   51
                            XXXXXXXXX              SAMPLE SIZE       1          52    SEPARATE   T     -2.11 0.0399   51.0
      H                 X XX XXXXXXXXXX X  X       MAXIMUM      1.9459      5.2204    TRIM POOL.T       0.00 1.0000   0
M-------------------M  M--------------------M      MINIMUM      1.9459      0.0000    TRIM SEP. T       0.00 1.0000   0.0
I  AN H=     2 CASES  A  I  AN X=     2 CASES  A   Z MAX        0.00        2.97
N    (N=     1)       X  N    (N=    52)       X   Z MIN        0.00       -2.23      MANN-WHIT.       19.0 0.6466
                                                   CASE (MAX)       23         597     (RANK SUMS       20.0       1411.0)
                                                   CASE (MIN)       23         418
                                                   2ND MAX      1.9459      4.2627
                                                   2ND MIN      1.9459      0.0000
```

Appendix A4. SIP Dust Concentration Distributions, by Occupation

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

ALL OCCUPATIONS COMBINED

EACH SYMBOL REPRESENTS 10 OBSERVATIONS

Dust Concentration, mg/m3

Axis: 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950

INTERVAL NAME	Histogram	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	AAAAAAAACCEKMMOQXYYZZZZCDGJJJKMNNNNNNNNNNNNQQRRRRYZZZZZZZZAA	586	586	15.6	15.6
0.3-0.4	AAACHMMOTYYYZZZZBCDJJLMNNNNNNNNNNQQRRRYYZZZZZZA	457	1043	12.2	27.8
0.5-0.6	AABEMOOUYYYZZZZBDEGJJKMNNNNNNNQQRRRWZZZZA	396	1439	10.5	38.3
0.7-0.8	AAAAACEMMMMOOOVXYYYYYZZZZZZZZZZBDDDEEHHJJJJJMMNNNNNNNNNQQRRRRRVYYZZZZZA	690	2129	18.4	56.7
0.9-1.0	ABMOYYZZZZDEHJJKNNNNRTYZZ	253	2382	6.7	63.4
1.1-1.2	AAAAJMMOOXYYZZZZZZZBDEEEGHJJJKMNNNNQRRYZZA	415	2797	11.1	74.5
1.3-1.4	AEOXYZZZEGJJMNNRYZ	177	2974	4.7	79.2
1.5-1.6	AMOYYZZDEJNNV	132	3106	3.5	82.7
1.7-1.8	AMXYZZZEEHJJNQV	154	3260	4.1	86.8
1.9-2.0	OYZFJNV	65	3325	1.7	88.5
2.1-2.2	AWYZBEHJNZ	98	3423	2.6	91.2
2.3-2.4	OYZN	41	3464	1.1	92.3
2.5-2.6	MZCN	42	3506	1.1	93.4
2.7-2.8	AZJN	42	3548	1.1	94.5
2.9-3.0	ZK	20	3568	0.5	95.0
3.1-3.2	ZL	20	3588	0.5	95.6
3.3-3.4	XZT	27	3615	0.7	96.3
3.5-3.6	B	11	3626	0.3	96.6
3.7-3.8	KK	21	3647	0.6	97.1
3.9-4.0	B	7	3654	0.2	97.3
4.1-4.2	Z	11	3665	0.3	97.6
4.3-4.4	Z	14	3679	0.4	98.0
4.5-4.6	S	6	3685	0.2	98.1
4.7-4.8	Z	8	3693	0.2	98.3
4.9-5.0	B	7	3700	0.2	98.5
>5.0	OZZBJZ	55	3755	1.5	100.0

Axis: 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

All Roof Bolter Classifications Combined

	SYMBOL	COUNT	MEAN	ST.DEV.
*12	M	158	0.915	0.731
*14	O	149	1.179	1.084
*19	T	11	0.936	0.816
*46	J	296	1.294	1.121
*47	K	37	1.359	1.363
*48	L	16	0.981	0.720
*DA	B	219	1.182	1.169

EACH SYMBOL REPRESENTS 2 OBSERVATIONS

Dust Concentration, mg/m3

```
INTERVAL                                                                                                            FREQUENCY PERCENTAGE
NAME       10   20   30   40   50   60   70   80   90  100  110  120  130  140  150  160  170  180  190  INT. CUM. INT.  CUM.
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2   |MMMMMMMMMMMOOOOOOJJJJJJJJJJJJJJJJKKKBBBBBBBBBBBBBB                                          101  101 11.4  11.4
0.3-0.4   |MMMMMMMMMMOOOOOOOTTJJJJJJJKLLBBBBBBBBBB                                                      80  181  9.0  20.4
0.5-0.6   |MMMMMMMMOOOOOOOOTJJJJJJJJJJJJKKLLBBBBBBBBBB                                                  88  269  9.9  30.4
0.7-0.8   |MMMMMMMMMMMMMMMMMMMMMOOOOOOOOOOOOOOOOJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJKLBBBBBBBBBBBBBBBBBBBBBBBB 177  446 20.0  50.3
0.9-1.0   |MMMMMOOOOOJJJJJJJJJJJKKKLBBBBBB                                                               64  510  7.2  57.6
1.1-1.2   |MMMMMMMMMMMOOOOOOOOOOTJJJJJJJJJJJJJJJJJKLBBBBBBBBBBBBBBBBB                                   117  627 13.2  70.8
1.3-1.4   |MMMOOOOOJJJJJJJJLLBBBBBB                                                                      49  676  5.5  76.3
1.5-1.6   |MMMMOOOOOJJJJJKBBB                                                                            36  712  4.1  80.4
1.7-1.8   |MMMMOOOOJJJJJJJJKBBB                                                                          40  752  4.5  84.9
1.9-2.0   |OOOJJJJJKKB                                                                                   21  773  2.4  87.2
2.1-2.2   |MOJJJJJJJBBB                                                                                  24  797  2.7  90.0
2.3-2.4   |MOJB                                                                                           7  804  0.8  90.7
2.5-2.6   |MOJKBB                                                                                        12  816  1.4  92.1
2.7-2.8   |OJJJBB                                                                                        12  828  1.4  93.5
2.9-3.0   |MJK                                                                                            6  834  0.7  94.1
3.1-3.2   |TJB                                                                                            5  839  0.6  94.7
3.3-3.4   |MJJ                                                                                            5  844  0.6  95.3
3.5-3.6   |JJB                                                                                            5  849  0.6  95.8
3.7-3.8   |JKBB                                                                                           7  856  0.8  96.6
3.9-4.0   |M                                                                                              2  858  0.2  96.8
4.1-4.2   |MJ                                                                                             4  862  0.5  97.3
4.3-4.4   |OJJ                                                                                            6  868  0.7  98.0
4.5-4.6   |B                                                                                              1  869  0.1  98.1
4.7-4.8   |OB                                                                                             3  872  0.3  98.4
4.9-5.0   |MJ                                                                                             4  876  0.5  98.9
>5.0      |OJJKB                                                                                         10  886  1.1 100.0
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
           10   20   30   40   50   60   70   80   90  100  110  120  130  140  150  160  170  180  190
```

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

Combined Shuttle Car Operator Classes

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	50	N	504	0.808	0.834
OCCUPATION CODE:	73	Z	294	0.770	1.063

EACH SYMBOL REPRESENTS 2 OBSERVATIONS

Dust Concentration, mg/m3

```
INTERVAL                                                                                                       FREQUENCY PERCENTAGE
NAME            10   20   30   40   50   60   70   80   90  100  110  120  130  140  150  160  170  180  190   INT. CUM. INT.  CUM.
            +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2     +NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ       182  182  22.8  22.8
0.3-0.4     +NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNZZZZZZZZZZZZZZZZZZZZZZZZZZ                              142  324  17.8  40.6
0.5-0.6     +NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNZZZZZZZZZZZZZZZZZ                                                    99  423  12.4  53.0
0.7-0.8     +NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNZZZZZZZZZZZZZZZZZZZZZZZZZZ                                  133  556  16.7  69.7
0.9-1.0     +NNNNNNNNNNNNNNNNNZZZZZZZZZZZZ                                                                         57  613   7.1  76.8
1.1-1.2     +NNNNNNNNNNNNNNNNNNNNNNNZZZZZZZZZZZZ                                                                   69  682   8.6  85.5
1.3-1.4     +NNNNNNNNNNZZZZ                                                                                        28  710   3.5  89.0
1.5-1.6     +NNNNNNNNZZ                                                                                            20  730   2.5  91.5
1.7-1.8     +NNNNNNZZ                                                                                              15  745   1.9  93.4
1.9-2.0     +NNN                                                                                                    5  750   0.6  94.0
2.1-2.2     +NNNZZ                                                                                                 10  760   1.3  95.2
2.3-2.4     +NNZ                                                                                                    5  765   0.6  95.9
2.5-2.6     +NNZZ                                                                                                   7  772   0.9  96.7
2.7-2.8     +NNNZ                                                                                                   7  779   0.9  97.6
2.9-3.0     +N                                                                                                      2  781   0.3  97.9
3.1-3.2     +N                                                                                                      1  782   0.1  98.0
3.3-3.4     +NZ                                                                                                     4  786   0.5  98.5
3.5-3.6     +N                                                                                                      2  788   0.3  98.7
3.7-3.8     +NN                                                                                                     3  791   0.4  99.1
3.9-4.0     +                                                                                                       0  791   0.0  99.1
4.1-4.2     +Z                                                                                                      2  793   0.3  99.4
4.3-4.4     +                                                                                                       0  793   0.0  99.4
4.5-4.6     +                                                                                                       0  793   0.0  99.4
4.7-4.8     +Z                                                                                                      1  794   0.1  99.5
4.9-5.0     +                                                                                                       0  794   0.0  99.5
>5.0        +NZ                                                                                                     4  798   0.5 100.0
            +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
                10   20   30   40   50   60   70   80   90  100  110  120  130  140  150  160  170  180  190
```

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	UNKNOWN	A	295	0.962	1.116

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	84	84	28.5	28.5
0.3-0.4	AAAAAAAAAAAAAAAAAAAAAAAAAAAA	28	112	9.5	38.0
0.5-0.6	AAAAAAAAAAAAAAAAAAAAAAAA	24	136	8.1	46.1
0.7-0.8	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	49	185	16.6	62.7
0.9-1.0	AAAAAAAAAAAAA	13	198	4.4	67.1
1.1-1.2	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	36	234	12.2	79.3
1.3-1.4	AAAAAAAAAAAA	12	246	4.1	83.4
1.5-1.6	AAAAAAA	7	253	2.4	85.8
1.7-1.8	AAAAAA	6	259	2.0	87.8
1.9-2.0	AA	2	261	0.7	88.5
2.1-2.2	AAAAAAA	7	268	2.4	90.8
2.3-2.4	AA	2	270	0.7	91.5
2.5-2.6	AAAA	4	274	1.4	92.9
2.7-2.8	AAAAA	5	279	1.7	94.6
2.9-3.0	A	1	280	0.3	94.9
3.1-3.2	A	1	281	0.3	95.3
3.3-3.4		0	281	0.0	95.3
3.5-3.6	AA	2	283	0.7	95.9
3.7-3.8	AAAA	4	287	1.4	97.3
3.9-4.0		0	287	0.0	97.3
4.1-4.2		0	287	0.0	97.3
4.3-4.4	A	1	288	0.3	97.6
4.5-4.6	A	1	289	0.3	98.0
4.7-4.8	AA	2	291	0.7	98.6
4.9-5.0	A	1	292	0.3	99.0
>5.0	AAA	3	295	1.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

```
 HISTOGRAM  for SIP DUST CONCENTRATIONS by OCCUPATION

                                       SYMBOL  COUNT     MEAN      ST.DEV.
     OCCUPATION CODE:    2               C       34      0.506        0.368

EACH SYMBOL REPRESENTS         1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                                FREQUENCY PERCENTAGE
NAME           5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
         -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  |CCCCCCCCCCCC                                                                                       12   12  35.3  35.3
0.3-0.4  |CCCCCCCC                                                                                            8   20  23.5  58.8
0.5-0.6  |CC                                                                                                  2   22   5.9  64.7
0.7-0.8  |CCCCCC                                                                                              6   28  17.6  82.4
0.9-1.0  |C                                                                                                   1   29   2.9  85.3
1.1-1.2  |CCCC                                                                                                4   33  11.8  97.1
1.3-1.4  |C                                                                                                   1   34   2.9 100.0
1.5-1.6  |                                                                                                    0   34   0.0 100.0
1.7-1.8  |                                                                                                    0   34   0.0 100.0
1.9-2.0  |                                                                                                    0   34   0.0 100.0
2.1-2.2  |                                                                                                    0   34   0.0 100.0
2.3-2.4  |                                                                                                    0   34   0.0 100.0
2.5-2.6  |                                                                                                    0   34   0.0 100.0
2.7-2.8  |                                                                                                    0   34   0.0 100.0
2.9-3.0  |                                                                                                    0   34   0.0 100.0
3.1-3.2  |                                                                                                    0   34   0.0 100.0
3.3-3.4  |                                                                                                    0   34   0.0 100.0
3.5-3.6  |                                                                                                    0   34   0.0 100.0
3.7-3.8  |                                                                                                    0   34   0.0 100.0
3.9-4.0  |                                                                                                    0   34   0.0 100.0
4.1-4.2  |                                                                                                    0   34   0.0 100.0
4.3-4.4  |                                                                                                    0   34   0.0 100.0
4.5-4.6  |                                                                                                    0   34   0.0 100.0
4.7-4.8  |                                                                                                    0   34   0.0 100.0
4.9-5.0  |                                                                                                    0   34   0.0 100.0
>5.0     |                                                                                                    0   34   0.0 100.0
         -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
               5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
```

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	4	E	47	0.645	0.454

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	EEEEEEEEEEEEE	13	13	27.7	27.7
0.3-0.4	EEEEE	5	18	10.6	38.3
0.5-0.6	EEEEEEEEEE	10	28	21.3	59.6
0.7-0.8	EEEEEE	6	34	12.8	72.3
0.9-1.0	EE	2	36	4.3	76.6
1.1-1.2	EEE	3	39	6.4	83.0
1.3-1.4	EEEEE	5	44	10.6	93.6
1.5-1.6	EE	2	46	4.3	97.9
1.7-1.8	E	1	47	2.1	100.0
1.9-2.0		0	47	0.0	100.0
2.1-2.2		0	47	0.0	100.0
2.3-2.4		0	47	0.0	100.0
2.5-2.6		0	47	0.0	100.0
2.7-2.8		0	47	0.0	100.0
2.9-3.0		0	47	0.0	100.0
3.1-3.2		0	47	0.0	100.0
3.3-3.4		0	47	0.0	100.0
3.5-3.6		0	47	0.0	100.0
3.7-3.8		0	47	0.0	100.0
3.9-4.0		0	47	0.0	100.0
4.1-4.2		0	47	0.0	100.0
4.3-4.4		0	47	0.0	100.0
4.5-4.6		0	47	0.0	100.0
4.7-4.8		0	47	0.0	100.0
4.9-5.0		0	47	0.0	100.0
>5.0		0	47	0.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	12	M	158	0.915	0.731

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME		FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	MMMMMMMMMMMMMMMMMMMMM	21	21	13.3	13.3
0.3-0.4	MMMMMMMMMMMMMMMMMMMM	20	41	12.7	25.9
0.5-0.6	MMMMMMMMMMMMMMMM	16	57	10.1	36.1
0.7-0.8	MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM	41	98	25.9	62.0
0.9-1.0	MMMMMMMMMM	10	108	6.3	68.4
1.1-1.2	MMMMMMMMMMMMMMMMMMMMM	21	129	13.3	81.6
1.3-1.4	MMMMM	5	134	3.2	84.8
1.5-1.6	MMMMMMM	7	141	4.4	89.2
1.7-1.8	MMMMMMMM	8	149	5.1	94.3
1.9-2.0		0	149	0.0	94.3
2.1-2.2	M	1	150	0.6	94.9
2.3-2.4	M	1	151	0.6	95.6
2.5-2.6	MM	2	153	1.3	96.8
2.7-2.8		0	153	0.0	96.8
2.9-3.0	M	1	154	0.6	97.5
3.1-3.2		0	154	0.0	97.5
3.3-3.4	M	1	155	0.6	98.1
3.5-3.6		0	155	0.0	98.1
3.7-3.8		0	155	0.0	98.1
3.9-4.0	M	1	156	0.6	98.7
4.1-4.2	M	1	157	0.6	99.4
4.3-4.4		0	157	0.0	99.4
4.5-4.6		0	157	0.0	99.4
4.7-4.8		0	157	0.0	99.4
4.9-5.0	M	1	158	0.6	100.0
>5.0		0	158	0.0	100.0

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	14	O	149	1.179	1.084

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	OOOOOOOOOOOOO	13	13	8.7	8.7
0.3-0.4	OOOOOOOOOOOOOO	14	27	9.4	18.1
0.5-0.6	OOOOOOOOOOOOOOO	15	42	10.1	28.2
0.7-0.8	OOOOOOOOOOOOOOOOOOOOOOOOOOOOOO	30	72	20.1	48.3
0.9-1.0	OOOOOOOOOO	10	82	6.7	55.0
1.1-1.2	OOOOOOOOOOOOOOOOOOOO	20	102	13.4	68.5
1.3-1.4	OOOOOOOOOO	10	112	6.7	75.2
1.5-1.6	OOOOOOOOOO	10	122	6.7	81.9
1.7-1.8	OOOOOOO	7	129	4.7	86.6
1.9-2.0	OOOOOO	6	135	4.0	90.6
2.1-2.2	OOO	3	138	2.0	92.6
2.3-2.4	OO	2	140	1.3	94.0
2.5-2.6	O	1	141	0.7	94.6
2.7-2.8	O	1	142	0.7	95.3
2.9-3.0		0	142	0.0	95.3
3.1-3.2		0	142	0.0	95.3
3.3-3.4	O	1	143	0.7	96.0
3.5-3.6		0	143	0.0	96.0
3.7-3.8		0	143	0.0	96.0
3.9-4.0		0	143	0.0	96.0
4.1-4.2	O	1	144	0.7	96.6
4.3-4.4	O	1	145	0.7	97.3
4.5-4.6		0	145	0.0	97.3
4.7-4.8	O	1	146	0.7	98.0
4.9-5.0	O	1	147	0.7	98.7
>5.0	OO	2	149	1.3	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: 34	X	71	1.258	1.727

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	XXXXXXXXXXXXXX	14	14	19.7	19.7
0.3-0.4	XXXXXXX	7	21	9.9	29.6
0.5-0.6	XXXXX	5	26	7.0	36.6
0.7-0.8	XXXXXXXXXXXXXXXXX	17	43	23.9	60.6
0.9-1.0	XX	2	45	2.8	63.4
1.1-1.2	XXXX	4	49	5.6	69.0
1.3-1.4	XX	2	51	2.8	71.8
1.5-1.6	XXX	3	54	4.2	76.1
1.7-1.8	XXXXXX	6	60	8.5	84.5
1.9-2.0		0	60	0.0	84.5
2.1-2.2	XXXX	4	64	5.6	90.1
2.3-2.4	X	1	65	1.4	91.5
2.5-2.6	X	1	66	1.4	93.0
2.7-2.8		0	66	0.0	93.0
2.9-3.0		0	66	0.0	93.0
3.1-3.2		0	66	0.0	93.0
3.3-3.4	X	1	67	1.4	94.4
3.5-3.6	X	1	68	1.4	95.8
3.7-3.8		0	68	0.0	95.8
3.9-4.0		0	68	0.0	95.8
4.1-4.2		0	68	0.0	95.8
4.3-4.4	X	1	69	1.4	97.2
4.5-4.6		0	69	0.0	97.2
4.7-4.8		0	69	0.0	97.2
4.9-5.0		0	69	0.0	97.2
>5.0	XX	2	71	2.8	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	35	Y	245	1.280	1.265

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

Scale: 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

INTERVAL NAME		FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	YYYYYYYYYYYYYYYYYYYY	20	20	8.2	8.2
0.3-0.4	YYYYYYYYYYYYYYYYYYYYYYYYY	25	45	10.2	18.4
0.5-0.6	YYYYYYYYYYYYYYYYYYYYYYYYYYYY	28	73	11.4	29.8
0.7-0.8	YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY	44	117	18.0	47.8
0.9-1.0	YYYYYYYYYYYYYYYYYYYY	20	137	8.2	55.9
1.1-1.2	YYYYYYYYYYYYYYYYYYYYYYYY	24	161	9.8	65.7
1.3-1.4	YYYYYYYYYYYYYYYY	16	177	6.5	72.2
1.5-1.6	YYYYYYYYYYYYYY	14	191	5.7	78.0
1.7-1.8	YYYYYYYYYY	10	201	4.1	82.0
1.9-2.0	YYYYYY	6	207	2.4	84.5
2.1-2.2	YYYYYYY	7	214	2.9	87.3
2.3-2.4	YYYYYYYY	8	222	3.3	90.6
2.5-2.6	Y	1	223	0.4	91.0
2.7-2.8	YYY	3	226	1.2	92.2
2.9-3.0	YY	2	228	0.8	93.1
3.1-3.2	YY	2	230	0.8	93.9
3.3-3.4	YYY	3	233	1.2	95.1
3.5-3.6		0	233	0.0	95.1
3.7-3.8	YY	2	235	0.8	95.9
3.9-4.0		0	235	0.0	95.9
4.1-4.2	YY	2	237	0.8	96.7
4.3-4.4	Y	1	238	0.4	97.1
4.5-4.6	YY	2	240	0.8	98.0
4.7-4.8		0	240	0.0	98.0
4.9-5.0		0	240	0.0	98.0
>5.0	YYYYY	5	245	2.0	100.0

Scale: 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	36	Z	510	1.498	1.773

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	36	36	7.1	7.1
0.3-0.4	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	45	81	8.8	15.9
0.5-0.6	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	43	124	8.4	24.3
0.7-0.8	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	93	217	18.2	42.5
0.9-1.0	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	37	254	7.3	49.8
1.1-1.2	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	69	323	13.5	63.3
1.3-1.4	ZZZZZZZZZZZZZZZZZZZZZZZZZ	25	348	4.9	68.2
1.5-1.6	ZZZZZZZZZZZZZZZZZZZZZZZZZ	25	373	4.9	73.1
1.7-1.8	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	28	401	5.5	78.6
1.9-2.0	ZZZZZZZZZZZZZ	13	414	2.5	81.2
2.1-2.2	ZZZZZZZZZZZZZZZZ	16	430	3.1	84.3
2.3-2.4	ZZZZZZZZZZZ	11	441	2.2	86.5
2.5-2.6	ZZZZZZZZZZZZZ	13	454	2.5	89.0
2.7-2.8	ZZZZZZZZZ	9	463	1.8	90.8
2.9-3.0	ZZZ	3	466	0.6	91.4
3.1-3.2	ZZZ	3	469	0.6	92.0
3.3-3.4	ZZZZZZZ	7	476	1.4	93.3
3.5-3.6		0	476	0.0	93.3
3.7-3.8	ZZ	2	478	0.4	93.7
3.9-4.0	ZZZ	3	481	0.6	94.3
4.1-4.2	Z	1	482	0.2	94.5
4.3-4.4	ZZZZ	4	486	0.8	95.3
4.5-4.6	Z	1	487	0.2	95.5
4.7-4.8	ZZ	2	489	0.4	95.9
4.9-5.0	Z	1	490	0.2	96.1
>5.0	ZZZZZZZZZZZZZZZZZZZZ	20	510	3.9	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	38	B	66	1.927	2.575

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	BBBB	4	4	6.1	6.1
0.3-0.4	BBBBBBB	7	11	10.6	16.7
0.5-0.6	BBBB	4	15	6.1	22.7
0.7-0.8	BBBBBBBBBBBB	12	27	18.2	40.9
0.9-1.0	BBBB	4	31	6.1	47.0
1.1-1.2	BBBBBBB	7	38	10.6	57.6
1.3-1.4	BB	2	40	3.0	60.6
1.5-1.6	BB	2	42	3.0	63.6
1.7-1.8	BBBBB	5	47	7.6	71.2
1.9-2.0		0	47	0.0	71.2
2.1-2.2	BBB	3	50	4.5	75.8
2.3-2.4		0	50	0.0	75.8
2.5-2.6	BB	2	52	3.0	78.8
2.7-2.8	B	1	53	1.5	80.3
2.9-3.0		0	53	0.0	80.3
3.1-3.2	B	1	54	1.5	81.8
3.3-3.4	BB	2	56	3.0	84.8
3.5-3.6	BB	2	58	3.0	87.9
3.7-3.8		0	58	0.0	87.9
3.9-4.0	B	1	59	1.5	89.4
4.1-4.2	B	1	60	1.5	90.9
4.3-4.4		0	60	0.0	90.9
4.5-4.6		0	60	0.0	90.9
4.7-4.8		0	60	0.0	90.9
4.9-5.0	BB	2	62	3.0	93.9
>5.0	BBBB	4	66	6.1	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: 39	C	30	1.270	3.205

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	CCCCCCCCC	9	9	30.0	30.0
0.3-0.4	CCCCCCC	7	16	23.3	53.3
0.5-0.6	CCC	3	19	10.0	63.3
0.7-0.8	CC	2	21	6.7	70.0
0.9-1.0		0	21	0.0	70.0
1.1-1.2	CC	2	23	6.7	76.7
1.3-1.4	CC	2	25	6.7	83.3
1.5-1.6		0	25	0.0	83.3
1.7-1.8	C	1	26	3.3	86.7
1.9-2.0	C	1	27	3.3	90.0
2.1-2.2		0	27	0.0	90.0
2.3-2.4		0	27	0.0	90.0
2.5-2.6	CC	2	29	6.7	96.7
2.7-2.8		0	29	0.0	96.7
2.9-3.0		0	29	0.0	96.7
3.1-3.2		0	29	0.0	96.7
3.3-3.4		0	29	0.0	96.7
3.5-3.6		0	29	0.0	96.7
3.7-3.8		0	29	0.0	96.7
3.9-4.0		0	29	0.0	96.7
4.1-4.2		0	29	0.0	96.7
4.3-4.4		0	29	0.0	96.7
4.5-4.6		0	29	0.0	96.7
4.7-4.8		0	29	0.0	96.7
4.9-5.0		0	29	0.0	96.7
>5.0	C	1	30	3.3	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

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HISTOGRAM  for SIP DUST CONCENTRATIONS by OCCUPATION

                                   SYMBOL  COUNT     MEAN     ST.DEV.
    OCCUPATION CODE:     40          D       66      0.665       0.445

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                          FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  |DDDDDDDDDDD                                                                                       11   11  16.7  16.7
0.3-0.4  |DDDDDDDD                                                                                           8   19  12.1  28.8
0.5-0.6  |DDDDDDDDDDDDD                                                                                     13   32  19.7  48.5
0.7-0.8  |DDDDDDDDDDDDDDDDDDDDD                                                                             21   53  31.8  80.3
0.9-1.0  |DDD                                                                                                3   56   4.5  84.8
1.1-1.2  |DDDDDDD                                                                                            7   63  10.6  95.5
1.3-1.4  |D                                                                                                  1   64   1.5  97.0
1.5-1.6  |D                                                                                                  1   65   1.5  98.5
1.7-1.8  |                                                                                                   0   65   0.0  98.5
1.9-2.0  |                                                                                                   0   65   0.0  98.5
2.1-2.2  |                                                                                                   0   65   0.0  98.5
2.3-2.4  |                                                                                                   0   65   0.0  98.5
2.5-2.6  |                                                                                                   0   65   0.0  98.5
2.7-2.8  |                                                                                                   0   65   0.0  98.5
2.9-3.0  |                                                                                                   0   65   0.0  98.5
3.1-3.2  |D                                                                                                  1   66   1.5 100.0
3.3-3.4  |                                                                                                   0   66   0.0 100.0
3.5-3.6  |                                                                                                   0   66   0.0 100.0
3.7-3.8  |                                                                                                   0   66   0.0 100.0
3.9-4.0  |                                                                                                   0   66   0.0 100.0
4.1-4.2  |                                                                                                   0   66   0.0 100.0
4.3-4.4  |                                                                                                   0   66   0.0 100.0
4.5-4.6  |                                                                                                   0   66   0.0 100.0
4.7-4.8  |                                                                                                   0   66   0.0 100.0
4.9-5.0  |                                                                                                   0   66   0.0 100.0
>5.0     |                                                                                                   0   66   0.0 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM  for SIP DUST CONCENTRATIONS by OCCUPATION

                                      SYMBOL  COUNT     MEAN     ST.DEV.
    OCCUPATION CODE:      41            E      143      1.394       0.982

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                             FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2   +EE                                                                                               2    2   1.4   1.4
0.3-0.4   +EE                                                                                               2    4   1.4   2.8
0.5-0.6   +EEEEEEEEEE                                                                                      10   14   7.0   9.8
0.7-0.8   +EEEEEEEEEEEEEEEEEEEEEEEE                                                                        24   38  16.8  26.6
0.9-1.0   +EEEEEEEEEE                                                                                      10   48   7.0  33.6
1.1-1.2   +EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE                                                               33   81  23.1  56.6
1.3-1.4   +EEEEEEEEEEEEE                                                                                   13   94   9.1  65.7
1.5-1.6   +EEEEEEEEEE                                                                                      10  104   7.0  72.7
1.7-1.8   +EEEEEEEEEEEEEE                                                                                  14  118   9.8  82.5
1.9-2.0   +EE                                                                                               2  120   1.4  83.9
2.1-2.2   +EEEEEEEEEEEE                                                                                    12  132   8.4  92.3
2.3-2.4   +EEE                                                                                              3  135   2.1  94.4
2.5-2.6   +                                                                                                 0  135   0.0  94.4
2.7-2.8   +E                                                                                                1  136   0.7  95.1
2.9-3.0   +EEE                                                                                              3  139   2.1  97.2
3.1-3.2   +E                                                                                                1  140   0.7  97.9
3.3-3.4   +                                                                                                 0  140   0.0  97.9
3.5-3.6   +                                                                                                 0  140   0.0  97.9
3.7-3.8   +EE                                                                                               2  142   1.4  99.3
3.9-4.0   +                                                                                                 0  142   0.0  99.3
4.1-4.2   +                                                                                                 0  142   0.0  99.3
4.3-4.4   +                                                                                                 0  142   0.0  99.3
4.5-4.6   +                                                                                                 0  142   0.0  99.3
4.7-4.8   +                                                                                                 0  142   0.0  99.3
4.9-5.0   +                                                                                                 0  142   0.0  99.3
>5.0      +E                                                                                                1  143   0.7 100.0
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
               5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM  for SIP DUST CONCENTRATIONS by OCCUPATION

                                      SYMBOL  COUNT     MEAN     ST.DEV.
     OCCUPATION CODE:    43             G      39      1.310       1.334

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                            FREQUENCY PERCENTAGE
NAME          5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95 INT. CUM. INT.  CUM.
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
 0.1-0.2 +GGGG                                                                                       4    4  10.3  10.3
 0.3-0.4 +GGGGG                                                                                      5    9  12.8  23.1
 0.5-0.6 +GGGG                                                                                       4   13  10.3  33.3
 0.7-0.8 +GGGG                                                                                       4   17  10.3  43.6
 0.9-1.0 +GGGG                                                                                       4   21  10.3  53.8
 1.1-1.2 +GGGGG                                                                                      5   26  12.8  66.7
 1.3-1.4 +GG                                                                                         2   28   5.1  71.8
 1.5-1.6 +G                                                                                          1   29   2.6  74.4
 1.7-1.8 +GG                                                                                         2   31   5.1  79.5
 1.9-2.0 +G                                                                                          1   32   2.6  82.1
 2.1-2.2 +GGG                                                                                        3   35   7.7  89.7
 2.3-2.4 +                                                                                           0   35   0.0  89.7
 2.5-2.6 +                                                                                           0   35   0.0  89.7
 2.7-2.8 +G                                                                                          1   36   2.6  92.3
 2.9-3.0 +                                                                                           0   36   0.0  92.3
 3.1-3.2 +G                                                                                          1   37   2.6  94.9
 3.3-3.4 +                                                                                           0   37   0.0  94.9
 3.5-3.6 +                                                                                           0   37   0.0  94.9
 3.7-3.8 +G                                                                                          1   38   2.6  97.4
 3.9-4.0 +                                                                                           0   38   0.0  97.4
 4.1-4.2 +                                                                                           0   38   0.0  97.4
 4.3-4.4 +                                                                                           0   38   0.0  97.4
 4.5-4.6 +                                                                                           0   38   0.0  97.4
 4.7-4.8 +                                                                                           0   38   0.0  97.4
 4.9-5.0 +                                                                                           0   38   0.0  97.4
 >5.0    +G                                                                                          1   39   2.6 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	44	H	77	1.678	1.187

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	H	1	1	1.3	1.3
0.3-0.4	H	1	2	1.3	2.6
0.5-0.6		0	2	0.0	2.6
0.7-0.8	HHHHHHHHHHHHHHH	15	17	19.5	22.1
0.9-1.0	HHHHHHH	7	24	9.1	31.2
1.1-1.2	HHHHHHHHHHHH	12	36	15.6	46.8
1.3-1.4	HHHHHH	6	42	7.8	54.5
1.5-1.6	HHH	3	45	3.9	58.4
1.7-1.8	HHHHHHHHHHHH	12	57	15.6	74.0
1.9-2.0	HH	2	59	2.6	76.6
2.1-2.2	HHHHH	5	64	6.5	83.1
2.3-2.4	HHH	3	67	3.9	87.0
2.5-2.6	H	1	68	1.3	88.3
2.7-2.8	HHH	3	71	3.9	92.2
2.9-3.0	H	1	72	1.3	93.5
3.1-3.2	H	1	73	1.3	94.8
3.3-3.4		0	73	0.0	94.8
3.5-3.6		0	73	0.0	94.8
3.7-3.8		0	73	0.0	94.8
3.9-4.0		0	73	0.0	94.8
4.1-4.2		0	73	0.0	94.8
4.3-4.4		0	73	0.0	94.8
4.5-4.6		0	73	0.0	94.8
4.7-4.8	H	1	74	1.3	96.1
4.9-5.0		0	74	0.0	96.1
>5.0	HHH	3	77	3.9	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

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                                  SYMBOL  COUNT     MEAN     ST.DEV.
     OCCUPATION CODE:     46         J     296      1.294       1.121

EACH SYMBOL REPRESENTS        1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                          FREQUENCY PERCENTAGE
NAME          5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2    -JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ                                                      34   34  11.5  11.5
0.3-0.4    -JJJJJJJJJJJJJJJJ                                                                        16   50   5.4  16.9
0.5-0.6    -JJJJJJJJJJJJJJJJJJJJJJJJJ                                                               25   75   8.4  25.3
0.7-0.8    -JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ                              58  133  19.6  44.9
0.9-1.0    -JJJJJJJJJJJJJJJJJJJJJJJJ                                                                24  157   8.1  53.0
1.1-1.2    -JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ                                                    36  193  12.2  65.2
1.3-1.4    -JJJJJJJJJJJJJJJJJJ                                                                      18  211   6.1  71.3
1.5-1.6    -JJJJJJJJJ                                                                                9  220   3.0  74.3
1.7-1.8    -JJJJJJJJJJJJJJJJ                                                                        16  236   5.4  79.7
1.9-2.0    -JJJJJJJJJJ                                                                              10  246   3.4  83.1
2.1-2.2    -JJJJJJJJJJJJJ                                                                           13  259   4.4  87.5
2.3-2.4    -JJ                                                                                       2  261   0.7  88.2
2.5-2.6    -JJJ                                                                                      3  264   1.0  89.2
2.7-2.8    -JJJJJJ                                                                                   6  270   2.0  91.2
2.9-3.0    -JJJ                                                                                      3  273   1.0  92.2
3.1-3.2    -JJ                                                                                       2  275   0.7  92.9
3.3-3.4    -JJJ                                                                                      3  278   1.0  93.9
3.5-3.6    -JJJ                                                                                      3  281   1.0  94.9
3.7-3.8    -JJ                                                                                       2  283   0.7  95.6
3.9-4.0    -J                                                                                        1  284   0.3  95.9
4.1-4.2    -JJ                                                                                       2  286   0.7  96.6
4.3-4.4    -JJJJ                                                                                     4  290   1.4  98.0
4.5-4.6    -                                                                                         0  290   0.0  98.0
4.7-4.8    -J                                                                                        1  291   0.3  98.3
4.9-5.0    -J                                                                                        1  292   0.3  98.6
>5.0       -JJJJ                                                                                     4  296   1.4 100.0
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
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WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	47	K	37	1.359	1.363

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	KKKKK	5	5	13.5	13.5
0.3-0.4	KK	2	7	5.4	18.9
0.5-0.6	KKKKK	5	12	13.5	32.4
0.7-0.8	KK	2	14	5.4	37.8
0.9-1.0	KKKKKK	6	20	16.2	54.1
1.1-1.2	KKK	3	23	8.1	62.2
1.3-1.4	K	1	24	2.7	64.9
1.5-1.6	KK	2	26	5.4	70.3
1.7-1.8	KK	2	28	5.4	75.7
1.9-2.0	KKK	3	31	8.1	83.8
2.1-2.2	K	1	32	2.7	86.5
2.3-2.4		0	32	0.0	86.5
2.5-2.6	KK	2	34	5.4	91.9
2.7-2.8		0	34	0.0	91.9
2.9-3.0	K	1	35	2.7	94.6
3.1-3.2		0	35	0.0	94.6
3.3-3.4		0	35	0.0	94.6
3.5-3.6		0	35	0.0	94.6
3.7-3.8	K	1	36	2.7	97.3
3.9-4.0		0	36	0.0	97.3
4.1-4.2		0	36	0.0	97.3
4.3-4.4		0	36	0.0	97.3
4.5-4.6		0	36	0.0	97.3
4.7-4.8		0	36	0.0	97.3
4.9-5.0		0	36	0.0	97.3
>5.0	K	1	37	2.7	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

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HISTOGRAM  for SIP DUST CONCENTRATIONS by OCCUPATION

                                      SYMBOL  COUNT     MEAN    ST.DEV.
     OCCUPATION CODE:     49             M      86      0.759      0.587

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                           FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  -MMMMMMMMMMMMMM                                                                                     14   14  16.3  16.3
0.3-0.4  -MMMMMMMMMMMMMMMMM                                                                                  17   31  19.8  36.0
0.5-0.6  -MMMMMMMMMM                                                                                         10   41  11.6  47.7
0.7-0.8  -MMMMMMMMMMMMMMMMMMMMM                                                                              21   62  24.4  72.1
0.9-1.0  -MMMMMM                                                                                              6   68   7.0  79.1
1.1-1.2  -MMMMMMMM                                                                                            8   76   9.3  88.4
1.3-1.4  -MM                                                                                                  2   78   2.3  90.7
1.5-1.6  -M                                                                                                   1   79   1.2  91.9
1.7-1.8  -MM                                                                                                  2   81   2.3  94.2
1.9-2.0  -M                                                                                                   1   82   1.2  95.3
2.1-2.2  -M                                                                                                   1   83   1.2  96.5
2.3-2.4  -                                                                                                    0   83   0.0  96.5
2.5-2.6  -                                                                                                    0   83   0.0  96.5
2.7-2.8  -MM                                                                                                  2   85   2.3  98.8
2.9-3.0  -M                                                                                                   1   86   1.2 100.0
3.1-3.2  -                                                                                                    0   86   0.0 100.0
3.3-3.4  -                                                                                                    0   86   0.0 100.0
3.5-3.6  -                                                                                                    0   86   0.0 100.0
3.7-3.8  -                                                                                                    0   86   0.0 100.0
3.9-4.0  -                                                                                                    0   86   0.0 100.0
4.1-4.2  -                                                                                                    0   86   0.0 100.0
4.3-4.4  -                                                                                                    0   86   0.0 100.0
4.5-4.6  -                                                                                                    0   86   0.0 100.0
4.7-4.8  -                                                                                                    0   86   0.0 100.0
4.9-5.0  -                                                                                                    0   86   0.0 100.0
>5.0     -                                                                                                    0   86   0.0 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM  for SIP DUST CONCENTRATIONS by OCCUPATION

                                   SYMBOL  COUNT     MEAN     ST.DEV.
    OCCUPATION CODE:    50           N      504      0.808       0.834

EACH SYMBOL REPRESENTS         1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                                  FREQUENCY PERCENTAGE
NAME           5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  -NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN* 107  107  21.2  21.2
0.3-0.4  -NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN       90  197  17.9  39.1
0.5-0.6  -NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN                                 65  262  12.9  52.0
0.7-0.8  -NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN                 81  343  16.1  68.1
0.9-1.0  -NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN                                                                 33  376   6.5  74.6
1.1-1.2  -NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN                                                    46  422   9.1  83.7
1.3-1.4  -NNNNNNNNNNNNNNNNNNN                                                                               19  441   3.8  87.5
1.5-1.6  -NNNNNNNNNNNNNNN                                                                                   15  456   3.0  90.5
1.7-1.8  -NNNNNNNNNNNN                                                                                      12  468   2.4  92.9
1.9-2.0  -NNNNN                                                                                              5  473   1.0  93.8
2.1-2.2  -NNNNNN                                                                                             6  479   1.2  95.0
2.3-2.4  -NNNN                                                                                               4  483   0.8  95.8
2.5-2.6  -NNNN                                                                                               4  487   0.8  96.6
2.7-2.8  -NNNNNN                                                                                             6  493   1.2  97.8
2.9-3.0  -N                                                                                                  1  494   0.2  98.0
3.1-3.2  -N                                                                                                  1  495   0.2  98.2
3.3-3.4  -NN                                                                                                 2  497   0.4  98.6
3.5-3.6  -NN                                                                                                 2  499   0.4  99.0
3.7-3.8  -NNN                                                                                                3  502   0.6  99.6
3.9-4.0  -                                                                                                   0  502   0.0  99.6
4.1-4.2  -                                                                                                   0  502   0.0  99.6
4.3-4.4  -                                                                                                   0  502   0.0  99.6
4.5-4.6  -                                                                                                   0  502   0.0  99.6
4.7-4.8  -                                                                                                   0  502   0.0  99.6
4.9-5.0  -                                                                                                   0  502   0.0  99.6
>5.0     -NN                                                                                                 2  504   0.4 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
               5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
```

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

```
                                        SYMBOL  COUNT     MEAN      ST.DEV.
     OCCUPATION CODE:    53               Q       86      0.738       0.764

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                                    FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT.  CUM.  INT.   CUM.
         -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  -QQQQQQQQQQQQQQQQQQQQ                                                                               20    20  23.3   23.3
0.3-0.4  -QQQQQQQQQQQQQ                                                                                      13    33  15.1   38.4
0.5-0.6  -QQQQQQQQQQQQQQ                                                                                     14    47  16.3   54.7
0.7-0.8  -QQQQQQQQQQQQQQQQQQQ                                                                                19    66  22.1   76.7
0.9-1.0  -QQ                                                                                                  2    68   2.3   79.1
1.1-1.2  -QQQQQQ                                                                                              6    74   7.0   86.0
1.3-1.4  -QQQQQQ                                                                                              6    80   7.0   93.0
1.5-1.6  -                                                                                                    0    80   0.0   93.0
1.7-1.8  -QQ                                                                                                  2    82   2.3   95.3
1.9-2.0  -Q                                                                                                   1    83   1.2   96.5
2.1-2.2  -                                                                                                    0    83   0.0   96.5
2.3-2.4  -                                                                                                    0    83   0.0   96.5
2.5-2.6  -Q                                                                                                   1    84   1.2   97.7
2.7-2.8  -                                                                                                    0    84   0.0   97.7
2.9-3.0  -                                                                                                    0    84   0.0   97.7
3.1-3.2  -                                                                                                    0    84   0.0   97.7
3.3-3.4  -Q                                                                                                   1    85   1.2   98.8
3.5-3.6  -                                                                                                    0    85   0.0   98.8
3.7-3.8  -                                                                                                    0    85   0.0   98.8
3.9-4.0  -                                                                                                    0    85   0.0   98.8
4.1-4.2  -                                                                                                    0    85   0.0   98.8
4.3-4.4  -                                                                                                    0    85   0.0   98.8
4.5-4.6  -                                                                                                    0    85   0.0   98.8
4.7-4.8  -                                                                                                    0    85   0.0   98.8
4.9-5.0  -                                                                                                    0    85   0.0   98.8
>5.0     -Q                                                                                                   1    86   1.2  100.0
         -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
```

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

```
                                    SYMBOL  COUNT    MEAN      ST.DEV.
    OCCUPATION CODE:    54            R      225     0.898       0.988

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                                     FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2    +RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR                                                        42   42  18.7  18.7
0.3-0.4    +RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR                                                               35   77  15.6  34.2
0.5-0.6    +RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR                                                              36  113  16.0  50.2
0.7-0.8    +RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR                                                           39  152  17.3  67.6
0.9-1.0    +RRRRRRRRRRRRRRR                                                                                   15  167   6.7  74.2
1.1-1.2    +RRRRRRRRRRRRRRRRR                                                                                 17  184   7.6  81.8
1.3-1.4    +RRRRRRRR                                                                                           8  192   3.6  85.3
1.5-1.6    +RRRRRRR                                                                                            7  199   3.1  88.4
1.7-1.8    +RRRR                                                                                               4  203   1.8  90.2
1.9-2.0    +RRRR                                                                                               4  207   1.8  92.0
2.1-2.2    +RRR                                                                                                3  210   1.3  93.3
2.3-2.4    +R                                                                                                  1  211   0.4  93.8
2.5-2.6    +RR                                                                                                 2  213   0.9  94.7
2.7-2.8    +RR                                                                                                 2  215   0.9  95.6
2.9-3.0    +R                                                                                                  1  216   0.4  96.0
3.1-3.2    +R                                                                                                  1  217   0.4  96.4
3.3-3.4    +R                                                                                                  1  218   0.4  96.9
3.5-3.6    +R                                                                                                  1  219   0.4  97.3
3.7-3.8    +R                                                                                                  1  220   0.4  97.8
3.9-4.0    +R                                                                                                  1  221   0.4  98.2
4.1-4.2    +R                                                                                                  1  222   0.4  98.7
4.3-4.4    +R                                                                                                  1  223   0.4  99.1
4.5-4.6    +                                                                                                   0  223   0.0  99.1
4.7-4.8    +                                                                                                   0  223   0.0  99.1
4.9-5.0    +                                                                                                   0  223   0.0  99.1
>5.0       +RR                                                                                                 2  225   0.9 100.0
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

```
                                      SYMBOL  COUNT     MEAN      ST.DEV.
     OCCUPATION CODE:     64            V      45       1.469       0.828

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                          FREQUENCY PERCENTAGE
NAME          5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2   -                                                                                               0    0   0.0   0.0
0.3-0.4   -VV                                                                                             2    2   4.4   4.4
0.5-0.6   -                                                                                               0    2   0.0   4.4
0.7-0.8   -VVVVVVVVV                                                                                      9   11  20.0  24.4
0.9-1.0   -VVVVVV                                                                                         6   17  13.3  37.8
1.1-1.2   -VVVVVVV                                                                                        7   24  15.6  53.3
1.3-1.4   -VV                                                                                             2   26   4.4  57.8
1.5-1.6   -VVV                                                                                            3   29   6.7  64.4
1.7-1.8   -VVVVVV                                                                                         6   35  13.3  77.8
1.9-2.0   -VVV                                                                                            3   38   6.7  84.4
2.1-2.2   -VVV                                                                                            3   41   6.7  91.1
2.3-2.4   -                                                                                               0   41   0.0  91.1
2.5-2.6   -                                                                                               0   41   0.0  91.1
2.7-2.8   -                                                                                               0   41   0.0  91.1
2.9-3.0   -                                                                                               0   41   0.0  91.1
3.1-3.2   -VV                                                                                             2   43   4.4  95.6
3.3-3.4   -                                                                                               0   43   0.0  95.6
3.5-3.6   -                                                                                               0   43   0.0  95.6
3.7-3.8   -V                                                                                              1   44   2.2  97.8
3.9-4.0   -                                                                                               0   44   0.0  97.8
4.1-4.2   -                                                                                               0   44   0.0  97.8
4.3-4.4   -V                                                                                              1   45   2.2 100.0
4.5-4.6   -                                                                                               0   45   0.0 100.0
4.7-4.8   -                                                                                               0   45   0.0 100.0
4.9-5.0   -                                                                                               0   45   0.0 100.0
>5.0      -                                                                                               0   45   0.0 100.0
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
```

HISTOGRAM for SIP DUST CONCENTRATIONS by OCCUPATION

```
                                        SYMBOL  COUNT     MEAN     ST.DEV.
    OCCUPATION CODE:     72               Y       84      0.836      0.661

EACH SYMBOL REPRESENTS         1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                    FREQUENCY PERCENTAGE
NAME         5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2    |YYYYYYYYYYY                                                                              11   11  13.1  13.1
0.3-0.4    |YYYYYYYYYYYYYYYYYYYYY                                                                    21   32  25.0  38.1
0.5-0.6    |YYYYYY                                                                                    6   38   7.1  45.2
0.7-0.8    |YYYYYYYYYYYYYYYYYY                                                                       18   56  21.4  66.7
0.9-1.0    |YYYYY                                                                                     5   61   6.0  72.6
1.1-1.2    |YYYYYYYY                                                                                  8   69   9.5  82.1
1.3-1.4    |YYYYYY                                                                                    6   75   7.1  89.3
1.5-1.6    |                                                                                          0   75   0.0  89.3
1.7-1.8    |YYYY                                                                                      4   79   4.8  94.0
1.9-2.0    |                                                                                          0   79   0.0  94.0
2.1-2.2    |YY                                                                                        2   81   2.4  96.4
2.3-2.4    |                                                                                          0   81   0.0  96.4
2.5-2.6    |                                                                                          0   81   0.0  96.4
2.7-2.8    |Y                                                                                         1   82   1.2  97.6
2.9-3.0    |                                                                                          0   82   0.0  97.6
3.1-3.2    |Y                                                                                         1   83   1.2  98.8
3.3-3.4    |                                                                                          0   83   0.0  98.8
3.5-3.6    |                                                                                          0   83   0.0  98.8
3.7-3.8    |Y                                                                                         1   84   1.2 100.0
3.9-4.0    |                                                                                          0   84   0.0 100.0
4.1-4.2    |                                                                                          0   84   0.0 100.0
4.3-4.4    |                                                                                          0   84   0.0 100.0
4.5-4.6    |                                                                                          0   84   0.0 100.0
4.7-4.8    |                                                                                          0   84   0.0 100.0
4.9-5.0    |                                                                                          0   84   0.0 100.0
>5.0       |                                                                                          0   84   0.0 100.0
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
             5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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```
HISTOGRAM  for SIP DUST CONCENTRATIONS by OCCUPATION

                                        SYMBOL  COUNT     MEAN      ST.DEV.
  OCCUPATION CODE:     73                 Z      294      0.770       1.063

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                                    FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
         ----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  -ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ                    75   75  25.5  25.5
0.3-0.4  -ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ                                           52  127  17.7  43.2
0.5-0.6  -ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ                                                             34  161  11.6  54.8
0.7-0.8  -ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ                                           52  213  17.7  72.4
0.9-1.0  -ZZZZZZZZZZZZZZZZZZZZZZZZ                                                                       24  237   8.2  80.6
1.1-1.2  -ZZZZZZZZZZZZZZZZZZZZZZZ                                                                        23  260   7.8  88.4
1.3-1.4  -ZZZZZZZZZ                                                                                       9  269   3.1  91.5
1.5-1.6  -ZZZZZ                                                                                           5  274   1.7  93.2
1.7-1.8  -ZZZ                                                                                             3  277   1.0  94.2
1.9-2.0  -                                                                                                0  277   0.0  94.2
2.1-2.2  -ZZZZ                                                                                            4  281   1.4  95.6
2.3-2.4  -Z                                                                                               1  282   0.3  95.9
2.5-2.6  -ZZZ                                                                                             3  285   1.0  96.9
2.7-2.8  -Z                                                                                               1  286   0.3  97.3
2.9-3.0  -Z                                                                                               1  287   0.3  97.6
3.1-3.2  -                                                                                                0  287   0.0  97.6
3.3-3.4  -ZZ                                                                                              2  289   0.7  98.3
3.5-3.6  -                                                                                                0  289   0.0  98.3
3.7-3.8  -                                                                                                0  289   0.0  98.3
3.9-4.0  -                                                                                                0  289   0.0  98.3
4.1-4.2  -ZZ                                                                                              2  291   0.7  99.0
4.3-4.4  -                                                                                                0  291   0.0  99.0
4.5-4.6  -                                                                                                0  291   0.0  99.0
4.7-4.8  -Z                                                                                               1  292   0.3  99.3
4.9-5.0  -                                                                                                0  292   0.0  99.3
>5.0     -ZZ                                                                                              2  294   0.7 100.0
         ----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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```
HISTOGRAM  for SIP DUST CONCENTRATIONS by OCCUPATION

                                     SYMBOL  COUNT     MEAN     ST.DEV.
    OCCUPATION CODE:    74             A      53      0.430       0.256

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                       FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2    -AAAAAAAAAAAAAAAAAAA                                                                           19   19  35.8  35.8
0.3-0.4    -AAAAAAAAAAAA                                                                                  12   31  22.6  58.5
0.5-0.6    -AAAAAAAAAAA                                                                                   11   42  20.8  79.2
0.7-0.8    -AAAAAAA                                                                                        7   49  13.2  92.5
0.9-1.0    -AAA                                                                                            3   52   5.7  98.1
1.1-1.2    -A                                                                                              1   53   1.9 100.0
1.3-1.4    -                                                                                               0   53   0.0 100.0
1.5-1.6    -                                                                                               0   53   0.0 100.0
1.7-1.8    -                                                                                               0   53   0.0 100.0
1.9-2.0    -                                                                                               0   53   0.0 100.0
2.1-2.2    -                                                                                               0   53   0.0 100.0
2.3-2.4    -                                                                                               0   53   0.0 100.0
2.5-2.6    -                                                                                               0   53   0.0 100.0
2.7-2.8    -                                                                                               0   53   0.0 100.0
2.9-3.0    -                                                                                               0   53   0.0 100.0
3.1-3.2    -                                                                                               0   53   0.0 100.0
3.3-3.4    -                                                                                               0   53   0.0 100.0
3.5-3.6    -                                                                                               0   53   0.0 100.0
3.7-3.8    -                                                                                               0   53   0.0 100.0
3.9-4.0    -                                                                                               0   53   0.0 100.0
4.1-4.2    -                                                                                               0   53   0.0 100.0
4.3-4.4    -                                                                                               0   53   0.0 100.0
4.5-4.6    -                                                                                               0   53   0.0 100.0
4.7-4.8    -                                                                                               0   53   0.0 100.0
4.9-5.0    -                                                                                               0   53   0.0 100.0
>5.0       -                                                                                               0   53   0.0 100.0
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
```

Appendix A5. MIP Dust Concentration Distributions, by Occupation

HISTOGRAM for MIP DUST CONCENTRATIONS by OCCUPATION

ALL OCCUPATIONS COMBINED

EACH SYMBOL REPRESENTS 2 OBSERVATIONS

Dust Concentration, mg/m3

```
INTERVAL                                                                                                     FREQUENCY PERCENTAGE
NAME          10   20   30   40   50   60   70   80   90  100  110  120  130  140  150  160  170  180  190  INT. CUM. INT.  CUM.
             -+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2      -|CCCCDDDDDDDDDDDDDDDDDDDDDDDDDDDDEEEEEEFFFFLNP                                                89   89  12.8  12.8
0.3-0.4      -|BCDDDDDDDDDDDDDDDDDDDDDDDDEEEFFI                                                             63  152   9.1  21.9
0.5-0.6      -|ACDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDEEEEFM                                                      78  230  11.2  33.1
0.7-0.8      -|CCDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDEEEGIQ                       135  365  19.5  52.6
0.9-1.0      -|ADDDDDDDDDDDDDDDDDDDDDDEF                                                                    50  415   7.2  59.8
1.1-1.2      -|CDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDEEGIIIP                                                       75  490  10.8  70.6
1.3-1.4      -|ADDDDDDDDDDDDDDIK                                                                            33  523   4.8  75.4
1.5-1.6      -|CDDDDDDDDDDDDDEEOP                                                                           35  558   5.0  80.4
1.7-1.8      -|DDDDDDDDDDDDEII                                                                              30  588   4.3  84.7
1.9-2.0      -|DDDDDEO                                                                                      13  601   1.9  86.6
2.1-2.2      -|CDDDDDDD                                                                                     16  617   2.3  88.9
2.3-2.4      -|DDDDI                                                                                        10  627   1.4  90.3
2.5-2.6      -|DDDDI                                                                                        10  637   1.4  91.8
2.7-2.8      -|DDDDD                                                                                        10  647   1.4  93.2
2.9-3.0      -|DDD                                                                                           5  652   0.7  93.9
3.1-3.2      -|DE                                                                                            3  655   0.4  94.4
3.3-3.4      -|DDDE                                                                                          7  662   1.0  95.4
3.5-3.6      -|D                                                                                             2  664   0.3  95.7
3.7-3.8      -|CDDDDI                                                                                       11  675   1.6  97.3
3.9-4.0      -|D                                                                                             2  677   0.3  97.6
4.1-4.2      -|DI                                                                                            4  681   0.6  98.1
4.3-4.4      -|DDD                                                                                           6  687   0.9  99.0
4.5-4.6      -|D                                                                                             2  689   0.3  99.3
4.7-4.8      -|                                                                                              0  689   0.0  99.3
4.9-5.0      -|                                                                                              0  689   0.0  99.3
>5.0         -|DEI                                                                                           5  694   0.7 100.0
             -+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              10   20   30   40   50   60   70   80   90  100  110  120  130  140  150  160  170  180  190
```

HISTOGRAM for MIP DUST CONCENTRATIONS by OCCUPATION

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: 34	C	21	0.733	0.869

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	CCCCCCCC	8	8	38.1	38.1
0.3-0.4	CC	2	10	9.5	47.6
0.5-0.6	CC	2	12	9.5	57.1
0.7-0.8	CCCC	4	16	19.0	76.2
0.9-1.0	C	1	17	4.8	81.0
1.1-1.2	C	1	18	4.8	85.7
1.3-1.4		0	18	0.0	85.7
1.5-1.6	C	1	19	4.8	90.5
1.7-1.8		0	19	0.0	90.5
1.9-2.0		0	19	0.0	90.5
2.1-2.2	C	1	20	4.8	95.2
2.3-2.4		0	20	0.0	95.2
2.5-2.6		0	20	0.0	95.2
2.7-2.8		0	20	0.0	95.2
2.9-3.0		0	20	0.0	95.2
3.1-3.2		0	20	0.0	95.2
3.3-3.4		0	20	0.0	95.2
3.5-3.6		0	20	0.0	95.2
3.7-3.8	C	1	21	4.8	100.0
3.9-4.0		0	21	0.0	100.0
4.1-4.2		0	21	0.0	100.0
4.3-4.4		0	21	0.0	100.0
4.5-4.6		0	21	0.0	100.0
4.7-4.8		0	21	0.0	100.0
4.9-5.0		0	21	0.0	100.0
>5.0		0	21	0.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for MIP DUST CONCENTRATIONS by OCCUPATION

```
                                            SYMBOL  COUNT     MEAN     ST.DEV.
     OCCUPATION CODE:   36                    D      549      1.133       0.931

EACH SYMBOL REPRESENTS         1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                          FREQUENCY PERCENTAGE
NAME           5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
          ----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2   |DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD                                           55   55  10.0  10.0
0.3-0.4   |DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD                                                 49  104   8.9  18.9
0.5-0.6   |DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD                                    62  166  11.3  30.2
0.7-0.8   |DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD* 120  286  21.9  52.1
0.9-1.0   |DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD                                                       43  329   7.8  59.9
1.1-1.2   |DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD                                      60  389  10.9  70.9
1.3-1.4   |DDDDDDDDDDDDDDDDDDDDDDDDDDDD                                                                      28  417   5.1  76.0
1.5-1.6   |DDDDDDDDDDDDDDDDDDDDDDDDDDD                                                                       27  444   4.9  80.9
1.7-1.8   |DDDDDDDDDDDDDDDDDDDDDDDD                                                                          24  468   4.4  85.2
1.9-2.0   |DDDDDDDDD                                                                                          9  477   1.6  86.9
2.1-2.2   |DDDDDDDDDDDDDD                                                                                    14  491   2.6  89.4
2.3-2.4   |DDDDDDDD                                                                                           8  499   1.5  90.9
2.5-2.6   |DDDDDDD                                                                                            7  506   1.3  92.2
2.7-2.8   |DDDDDDDDD                                                                                          9  515   1.6  93.8
2.9-3.0   |DDDDD                                                                                              5  520   0.9  94.7
3.1-3.2   |DD                                                                                                 2  522   0.4  95.1
3.3-3.4   |DDDDDD                                                                                             6  528   1.1  96.2
3.5-3.6   |D                                                                                                  1  529   0.2  96.4
3.7-3.8   |DDDDDDDDD                                                                                          9  538   1.6  98.0
3.9-4.0   |D                                                                                                  1  539   0.2  98.2
4.1-4.2   |DD                                                                                                 2  541   0.4  98.5
4.3-4.4   |DDDDD                                                                                              5  546   0.9  99.5
4.5-4.6   |D                                                                                                  1  547   0.2  99.6
4.7-4.8   |                                                                                                   0  547   0.0  99.6
4.9-5.0   |                                                                                                   0  547   0.0  99.6
>5.0      |DD                                                                                                 2  549   0.4 100.0
          ----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
               5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
```

HISTOGRAM for MIP DUST CONCENTRATIONS by OCCUPATION

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	38	E	56	1.202	1.399

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	EEEEEEEEEEEE	12	12	21.4	21.4
0.3-0.4	EEEEEE	6	18	10.7	32.1
0.5-0.6	EEEEEEEE	8	26	14.3	46.4
0.7-0.8	EEEEEE	6	32	10.7	57.1
0.9-1.0	EEE	3	35	5.4	62.5
1.1-1.2	EEEE	4	39	7.1	69.6
1.3-1.4	E	1	40	1.8	71.4
1.5-1.6	EEEE	4	44	7.1	78.6
1.7-1.8	EE	2	46	3.6	82.1
1.9-2.0	EE	2	48	3.6	85.7
2.1-2.2	E	1	49	1.8	87.5
2.3-2.4		0	49	0.0	87.5
2.5-2.6	E	1	50	1.8	89.3
2.7-2.8		0	50	0.0	89.3
2.9-3.0		0	50	0.0	89.3
3.1-3.2	E	1	51	1.8	91.1
3.3-3.4	E	1	52	1.8	92.9
3.5-3.6	E	1	53	1.8	94.6
3.7-3.8		0	53	0.0	94.6
3.9-4.0		0	53	0.0	94.6
4.1-4.2		0	53	0.0	94.6
4.3-4.4	E	1	54	1.8	96.4
4.5-4.6		0	54	0.0	96.4
4.7-4.8		0	54	0.0	96.4
4.9-5.0		0	54	0.0	96.4
>5.0	EE	2	56	3.6	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for MIP DUST CONCENTRATIONS by OCCUPATION

```
                                     SYMBOL  COUNT     MEAN     ST.DEV.
     OCCUPATION CODE:   44             I      22       2.109      1.333

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                        FREQUENCY PERCENTAGE
NAME          5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2   -                                                                                                0    0   0.0   0.0
0.3-0.4   -I                                                                                               1    1   4.5   4.5
0.5-0.6   -                                                                                                0    1   0.0   4.5
0.7-0.8   -I                                                                                               1    2   4.5   9.1
0.9-1.0   -                                                                                                0    2   0.0   9.1
1.1-1.2   -IIIII                                                                                           5    7  22.7  31.8
1.3-1.4   -II                                                                                              2    9   9.1  40.9
1.5-1.6   -                                                                                                0    9   0.0  40.9
1.7-1.8   -IIII                                                                                            4   13  18.2  59.1
1.9-2.0   -I                                                                                               1   14   4.5  63.6
2.1-2.2   -                                                                                                0   14   0.0  63.6
2.3-2.4   -II                                                                                              2   16   9.1  72.7
2.5-2.6   -I                                                                                               1   17   4.5  77.3
2.7-2.8   -I                                                                                               1   18   4.5  81.8
2.9-3.0   -                                                                                                0   18   0.0  81.8
3.1-3.2   -                                                                                                0   18   0.0  81.8
3.3-3.4   -                                                                                                0   18   0.0  81.8
3.5-3.6   -                                                                                                0   18   0.0  81.8
3.7-3.8   -I                                                                                               1   19   4.5  86.4
3.9-4.0   -I                                                                                               1   20   4.5  90.9
4.1-4.2   -I                                                                                               1   21   4.5  95.5
4.3-4.4   -                                                                                                0   21   0.0  95.5
4.5-4.6   -                                                                                                0   21   0.0  95.5
4.7-4.8   -                                                                                                0   21   0.0  95.5
4.9-5.0   -                                                                                                0   21   0.0  95.5
>5.0      -I                                                                                               1   22   4.5 100.0
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
```

Appendix A6. MSHA Inspector Dust Concentration Distributions, by Occupation, July 1, 1990 - June 30, 1991

ALL ROOF BOLTER CLASSIFICATIONS COMBINED

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

	SYMBOL	COUNT	MEAN	ST.DEV.	
OCCUPATION CODE:	12	I	403	1.007	1.271
OCCUPATION CODE:	14	K	456	1.087	1.224
OCCUPATION CODE:	19	O	65	1.060	0.514
OCCUPATION CODE:	46	F	1088	1.032	2.123
OCCUPATION CODE:	47	G	122	0.917	0.947
OCCUPATION CODE:	48	H	69	1.074	0.598

EACH SYMBOL REPRESENTS 2 OBSERVATIONS

Dust Concentration, mg/m3

```
INTERVAL                                                                                                          FREQUENCY PERCENTAGE
NAME         10   20   30   40   50  -60   70   80   90  100  110  120  130  140  150  160  170  180  190   INT. CUM. INT.  CUM.
            -+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2     -IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKKKKKKKOFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF*  397  397 18.0  18.0
0.3-0.4     -IIIIIIIIIIIIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKKKKKKKOOFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF*  258  655 11.7  29.7
0.5-0.6     -IIIIIIIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKKKKOOOFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF*  252  907 11.4  41.2
0.7-0.8     -IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKOOOOOO*  409 1316 18.6  59.7
0.9-1.0     -IIIIIIIIIIIIIKKKKKKKKKKKKKKKKOOOFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFGGGHHH                  160 1476  7.3  67.0
1.1-1.2     -IIIIIIIIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKKKKKOOOOOOOOOOFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF*  232 1708 10.5  77.5
1.3-1.4     -IIIIIIKKKKKKKKOOFFFFFFFFFFFFFFFFFFFGHHH                                                            77 1785  3.5  81.0
1.5-1.6     -IIIIIIIKKKKKKKKKOFFFFFFFFFFFFFFFGHHH                                                               72 1857  3.3  84.3
1.7-1.8     -IIIIIIIIKKKKKKKKKFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFGGGH                                             105 1962  4.8  89.1
1.9-2.0     -IKKKKOFFFFFFFGH                                                                                    30 1992  1.4  90.4
2.1-2.2     -IIIIKKKKKKKKKKOFFFFFFFFFFFFFHH                                                                     59 2051  2.7  93.1
2.3-2.4     -IIKKFFFFFG                                                                                         19 2070  0.9  94.0
2.5-2.6     -IIKOFFFFFG                                                                                         19 2089  0.9  94.8
2.7-2.8     -IIKKKKFFFFH                                                                                        21 2110  1.0  95.8
2.9-3.0     -IIFFH                                                                                               9 2119  0.4  96.2
3.1-3.2     -IG                                                                                                  3 2122  0.1  96.3
3.3-3.4     -IIKKKKFF                                                                                           15 2137  0.7  97.0
3.5-3.6     -IKFFGG                                                                                             11 2148  0.5  97.5
3.7-3.8     -KFF                                                                                                 5 2153  0.2  97.7
3.9-4.0     -KFF                                                                                                 5 2158  0.2  98.0
4.1-4.2     -IF                                                                                                  3 2161  0.1  98.1
4.3-4.4     -IFF                                                                                                 5 2166  0.2  98.3
4.5-4.6     -FF                                                                                                  3 2169  0.1  98.5
4.7-4.8     -IF                                                                                                  4 2173  0.2  98.6
4.9-5.0     -F                                                                                                   1 2174  0.0  98.7
>5.0        -IIIKKKFFFFFFFFG                                                                                    29 2203  1.3 100.0
            -+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
             10   20   30   40   50   60   70   80   90  100  110  120  130  140  150  160  170  180  190
```

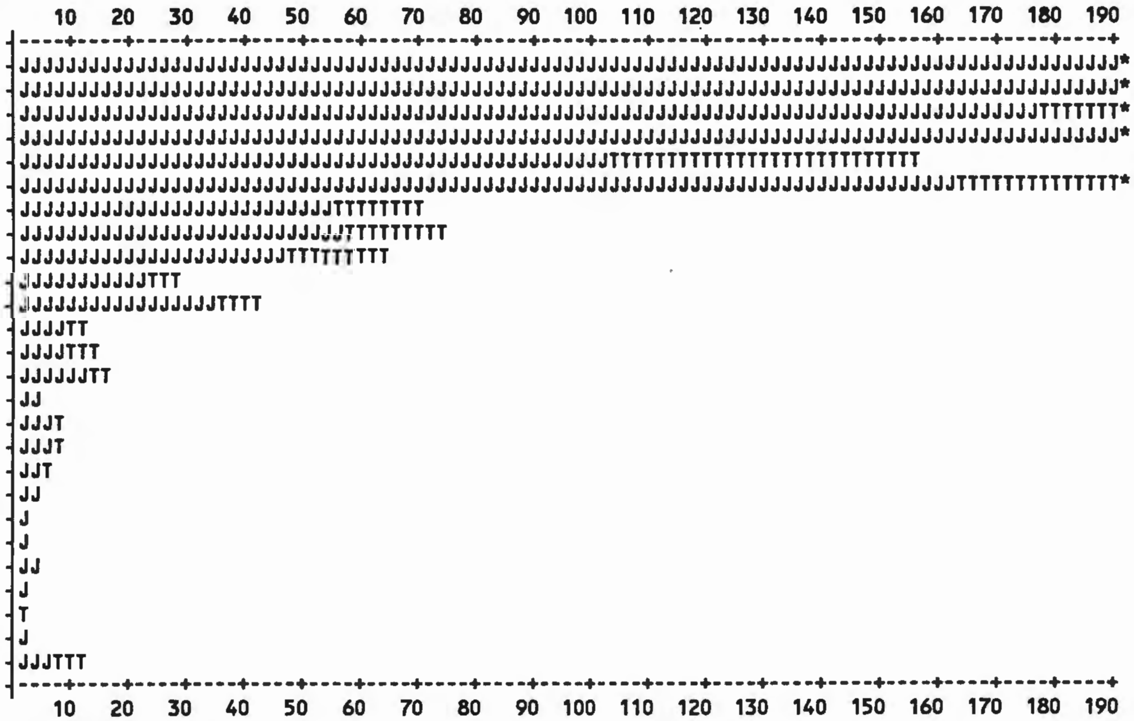
WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	50	J	1626	0.818	0.893
OCCUPATION CODE:	73	T	851	0.699	0.731

EACH SYMBOL REPRESENTS 2 OBSERVATIONS

Dust Concentration, mg/m3



INTERVAL NAME	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	643	643	26.0	26.0
0.3-0.4	331	974	13.4	39.3
0.5-0.6	280	1254	11.3	50.6
0.7-0.8	476	1730	19.2	69.8
0.9-1.0	156	1886	6.3	76.1
1.1-1.2	225	2111	9.1	85.2
1.3-1.4	70	2181	2.8	88.1
1.5-1.6	74	2255	3.0	91.0
1.7-1.8	64	2319	2.6	93.6
1.9-2.0	28	2347	1.1	94.8
2.1-2.2	42	2389	1.7	96.4
2.3-2.4	11	2400	0.4	96.9
2.5-2.6	14	2414	0.6	97.5
2.7-2.8	15	2429	0.6	98.1
2.9-3.0	3	2432	0.1	98.2
3.1-3.2	8	2440	0.3	98.5
3.3-3.4	7	2447	0.3	98.8
3.5-3.6	6	2453	0.2	99.0
3.7-3.8	4	2457	0.2	99.2
3.9-4.0	1	2458	0.0	99.2
4.1-4.2	1	2459	0.0	99.3
4.3-4.4	4	2463	0.2	99.4
4.5-4.6	1	2464	0.0	99.5
4.7-4.8	1	2465	0.0	99.5
4.9-5.0	1	2466	0.0	99.6
>5.0	11	2477	0.4	100.0

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

OCCUPATION CODE:	SYMBOL	COUNT	MEAN	ST.DEV.
1	A	20	0.605	0.458

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	AAAAAAAA	8	8	40.0	40.0
0.3-0.4		0	8	0.0	40.0
0.5-0.6	AAA	3	11	15.0	55.0
0.7-0.8	AAA	3	14	15.0	70.0
0.9-1.0	AAAA	4	18	20.0	90.0
1.1-1.2	A	1	19	5.0	95.0
1.3-1.4		0	19	0.0	95.0
1.5-1.6		0	19	0.0	95.0
1.7-1.8	A	1	20	5.0	100.0
1.9-2.0		0	20	0.0	100.0
2.1-2.2		0	20	0.0	100.0
2.3-2.4		0	20	0.0	100.0
2.5-2.6		0	20	0.0	100.0
2.7-2.8		0	20	0.0	100.0
2.9-3.0		0	20	0.0	100.0
3.1-3.2		0	20	0.0	100.0
3.3-3.4		0	20	0.0	100.0
3.5-3.6		0	20	0.0	100.0
3.7-3.8		0	20	0.0	100.0
3.9-4.0		0	20	0.0	100.0
4.1-4.2		0	20	0.0	100.0
4.3-4.4		0	20	0.0	100.0
4.5-4.6		0	20	0.0	100.0
4.7-4.8		0	20	0.0	100.0
4.9-5.0		0	20	0.0	100.0
>5.0		0	20	0.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	2	B	57	0.637	0.549

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	Histogram (5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95)	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	BBBBBBBBBBBBBBBBB	17	17	29.8	29.8
0.3-0.4	BBBBBBBBB	9	26	15.8	45.6
0.5-0.6	BBBBBBBBB	9	35	15.8	61.4
0.7-0.8	BBBBBBBBB	9	44	15.8	77.2
0.9-1.0	BB	2	46	3.5	80.7
1.1-1.2	BBB	3	49	5.3	86.0
1.3-1.4		0	49	0.0	86.0
1.5-1.6	BBB	3	52	5.3	91.2
1.7-1.8	BB	2	54	3.5	94.7
1.9-2.0	BB	2	56	3.5	98.2
2.1-2.2	B	1	57	1.8	100.0
2.3-2.4		0	57	0.0	100.0
2.5-2.6		0	57	0.0	100.0
2.7-2.8		0	57	0.0	100.0
2.9-3.0		0	57	0.0	100.0
3.1-3.2		0	57	0.0	100.0
3.3-3.4		0	57	0.0	100.0
3.5-3.6		0	57	0.0	100.0
3.7-3.8		0	57	0.0	100.0
3.9-4.0		0	57	0.0	100.0
4.1-4.2		0	57	0.0	100.0
4.3-4.4		0	57	0.0	100.0
4.5-4.6		0	57	0.0	100.0
4.7-4.8		0	57	0.0	100.0
4.9-5.0		0	57	0.0	100.0
>5.0		0	57	0.0	100.0

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: 4	C	112	0.756	0.655

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	33	33	29.5	29.5
0.3-0.4	CCCCCCCC	8	41	7.1	36.6
0.5-0.6	CCCCCCCCCCC	11	52	9.8	46.4
0.7-0.8	CCCCCCCCCCCCCCCCCCCCCCCCCCC	27	79	24.1	70.5
0.9-1.0	CCCCCCC	7	86	6.3	76.8
1.1-1.2	CCCCCCCCCCC	11	97	9.8	86.6
1.3-1.4	CC	2	99	1.8	88.4
1.5-1.6	C	1	100	0.9	89.3
1.7-1.8	CC	2	102	1.8	91.1
1.9-2.0	CCC	3	105	2.7	93.8
2.1-2.2	CCC	3	108	2.7	96.4
2.3-2.4	CC	2	110	1.8	98.2
2.5-2.6		0	110	0.0	98.2
2.7-2.8		0	110	0.0	98.2
2.9-3.0	C	1	111	0.9	99.1
3.1-3.2		0	111	0.0	99.1
3.3-3.4	C	1	112	0.9	100.0
3.5-3.6		0	112	0.0	100.0
3.7-3.8		0	112	0.0	100.0
3.9-4.0		0	112	0.0	100.0
4.1-4.2		0	112	0.0	100.0
4.3-4.4		0	112	0.0	100.0
4.5-4.6		0	112	0.0	100.0
4.7-4.8		0	112	0.0	100.0
4.9-5.0		0	112	0.0	100.0
>5.0		0	112	0.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	7	E	28	0.582	0.465

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	EEEEEEEEE	9	9	32.1	32.1
0.3-0.4	EEEEE	5	14	17.9	50.0
0.5-0.6	EEEE	4	18	14.3	64.3
0.7-0.8	EEE	3	21	10.7	75.0
0.9-1.0	EEE	3	24	10.7	85.7
1.1-1.2	EE	2	26	7.1	92.9
1.3-1.4		0	26	0.0	92.9
1.5-1.6		0	26	0.0	92.9
1.7-1.8	EE	2	28	7.1	100.0
1.9-2.0		0	28	0.0	100.0
2.1-2.2		0	28	0.0	100.0
2.3-2.4		0	28	0.0	100.0
2.5-2.6		0	28	0.0	100.0
2.7-2.8		0	28	0.0	100.0
2.9-3.0		0	28	0.0	100.0
3.1-3.2		0	28	0.0	100.0
3.3-3.4		0	28	0.0	100.0
3.5-3.6		0	28	0.0	100.0
3.7-3.8		0	28	0.0	100.0
3.9-4.0		0	28	0.0	100.0
4.1-4.2		0	28	0.0	100.0
4.3-4.4		0	28	0.0	100.0
4.5-4.6		0	28	0.0	100.0
4.7-4.8		0	28	0.0	100.0
4.9-5.0		0	28	0.0	100.0
>5.0		0	28	0.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: 12	I	403	1.007	1.271

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	62	62	15.4	15.4
0.3-0.4	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	56	118	13.9	29.3
0.5-0.6	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	45	163	11.2	40.4
0.7-0.8	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	86	249	21.3	61.8
0.9-1.0	IIIIIIIIIIIIIIIIIIIIIIIII	25	274	6.2	68.0
1.1-1.2	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	50	324	12.4	80.4
1.3-1.4	IIIIIIIIIIII	12	336	3.0	83.4
1.5-1.6	IIIIIIIIIIIII	13	349	3.2	86.6
1.7-1.8	IIIIIIIIIIIIIII	15	364	3.7	90.3
1.9-2.0	II	2	366	0.5	90.8
2.1-2.2	IIIIIIII	8	374	2.0	92.8
2.3-2.4	III	3	377	0.7	93.5
2.5-2.6	III	3	380	0.7	94.3
2.7-2.8	IIII	4	384	1.0	95.3
2.9-3.0	III	3	387	0.7	96.0
3.1-3.2	I	1	388	0.2	96.3
3.3-3.4	III	3	391	0.7	97.0
3.5-3.6	II	2	393	0.5	97.5
3.7-3.8		0	393	0.0	97.5
3.9-4.0		0	393	0.0	97.5
4.1-4.2	I	1	394	0.2	97.8
4.3-4.4	II	2	396	0.5	98.3
4.5-4.6		0	396	0.0	98.3
4.7-4.8	I	1	397	0.2	98.5
4.9-5.0		0	397	0.0	98.5
>5.0	IIIIII	6	403	1.5	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES  7/1/90 - 6/30/91

                                     SYMBOL  COUNT     MEAN     ST.DEV.
     OCCUPATION CODE:   14             K      456      1.087       1.224

EACH SYMBOL REPRESENTS         1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                             FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  |KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK                                         59   59  12.9  12.9
0.3-0.4  |KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK                                            56  115  12.3  25.2
0.5-0.6  |KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK                                                 51  166  11.2  36.4
0.7-0.8  |KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK         91  257  20.0  56.4
0.9-1.0  |KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK                                                                    32  289   7.0  63.4
1.1-1.2  |KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK                                                52  341  11.4  74.8
1.3-1.4  |KKKKKKKKKKKKKKK                                                                                     15  356   3.3  78.1
1.5-1.6  |KKKKKKKKKKKKKKKKKKK                                                                                 19  375   4.2  82.2
1.7-1.8  |KKKKKKKKKKKKKKKKKK                                                                                  18  393   3.9  86.2
1.9-2.0  |KKKKKKK                                                                                              7  400   1.5  87.7
2.1-2.2  |KKKKKKKKKKKKKKKKKKK                                                                                 19  419   4.2  91.9
2.3-2.4  |KKKKK                                                                                                5  424   1.1  93.0
2.5-2.6  |KKK                                                                                                  3  427   0.7  93.6
2.7-2.8  |KKKKKKKK                                                                                             8  435   1.8  95.4
2.9-3.0  |K                                                                                                    1  436   0.2  95.6
3.1-3.2  |                                                                                                     0  436   0.0  95.6
3.3-3.4  |KKKKKKKK                                                                                             8  444   1.8  97.4
3.5-3.6  |KK                                                                                                   2  446   0.4  97.8
3.7-3.8  |KK                                                                                                   2  448   0.4  98.2
3.9-4.0  |K                                                                                                    1  449   0.2  98.5
4.1-4.2  |                                                                                                     0  449   0.0  98.5
4.3-4.4  |                                                                                                     0  449   0.0  98.5
4.5-4.6  |                                                                                                     0  449   0.0  98.5
4.7-4.8  |K                                                                                                    1  450   0.2  98.7
4.9-5.0  |                                                                                                     0  450   0.0  98.7
>5.0     |KKKKKK                                                                                               6  456   1.3 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES  7/1/90 - 6/30/91

                                    SYMBOL  COUNT     MEAN      ST.DEV.
     OCCUPATION CODE:   16            L       31      0.726       0.566

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                      FREQUENCY PERCENTAGE
NAME          5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2   +LLLLLLLL                                                                                  8    8  25.8  25.8
0.3-0.4   +LLLL                                                                                      4   12  12.9  38.7
0.5-0.6   +LLLL                                                                                      4   16  12.9  51.6
0.7-0.8   +LLLLLLL                                                                                   7   23  22.6  74.2
0.9-1.0   +L                                                                                         1   24   3.2  77.4
1.1-1.2   +LL                                                                                        2   26   6.5  83.9
1.3-1.4   +                                                                                          0   26   0.0  83.9
1.5-1.6   +                                                                                          0   26   0.0  83.9
1.7-1.8   +LLLL                                                                                      4   30  12.9  96.8
1.9-2.0   +L                                                                                         1   31   3.2 100.0
2.1-2.2   +                                                                                          0   31   0.0 100.0
2.3-2.4   +                                                                                          0   31   0.0 100.0
2.5-2.6   +                                                                                          0   31   0.0 100.0
2.7-2.8   +                                                                                          0   31   0.0 100.0
2.9-3.0   +                                                                                          0   31   0.0 100.0
3.1-3.2   +                                                                                          0   31   0.0 100.0
3.3-3.4   +                                                                                          0   31   0.0 100.0
3.5-3.6   +                                                                                          0   31   0.0 100.0
3.7-3.8   +                                                                                          0   31   0.0 100.0
3.9-4.0   +                                                                                          0   31   0.0 100.0
4.1-4.2   +                                                                                          0   31   0.0 100.0
4.3-4.4   +                                                                                          0   31   0.0 100.0
4.5-4.6   +                                                                                          0   31   0.0 100.0
4.7-4.8   +                                                                                          0   31   0.0 100.0
4.9-5.0   +                                                                                          0   31   0.0 100.0
>5.0      +                                                                                          0   31   0.0 100.0
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
               5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: 19	0	65	1.060	0.514

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	000	3	3	4.6	4.6
0.3-0.4	0000	4	7	6.2	10.8
0.5-0.6	00000	5	12	7.7	18.5
0.7-0.8	000000000000	12	24	18.5	36.9
0.9-1.0	0000000	7	31	10.8	47.7
1.1-1.2	0000000000000000000	19	50	29.2	76.9
1.3-1.4	00000	5	55	7.7	84.6
1.5-1.6	00	2	57	3.1	87.7
1.7-1.8	0	1	58	1.5	89.2
1.9-2.0	000	3	61	4.6	93.8
2.1-2.2	000	3	64	4.6	98.5
2.3-2.4		0	64	0.0	98.5
2.5-2.6	0	1	65	1.5	100.0
2.7-2.8		0	65	0.0	100.0
2.9-3.0		0	65	0.0	100.0
3.1-3.2		0	65	0.0	100.0
3.3-3.4		0	65	0.0	100.0
3.5-3.6		0	65	0.0	100.0
3.7-3.8		0	65	0.0	100.0
3.9-4.0		0	65	0.0	100.0
4.1-4.2		0	65	0.0	100.0
4.3-4.4		0	65	0.0	100.0
4.5-4.6		0	65	0.0	100.0
4.7-4.8		0	65	0.0	100.0
4.9-5.0		0	65	0.0	100.0
>5.0		0	65	0.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	34	T	192	1.178	4.288

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME		FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT	45	45	23.4	23.4
0.3-0.4	TTTTTTTTTTTTTTTTTTTTTTTTTT	26	71	13.5	37.0
0.5-0.6	TTTTTTTTTTTTTTTTTTTTTTTTTT	26	97	13.5	50.5
0.7-0.8	TTTTTTTTTTTTTTTTTTTTTTTTTTT	27	124	14.1	64.6
0.9-1.0	TTTTTTTTTTTTTTT	15	139	7.8	72.4
1.1-1.2	TTTTTTTTTTTTTTTT	16	155	8.3	80.7
1.3-1.4	TTTTTT	6	161	3.1	83.9
1.5-1.6	TTTTT	5	166	2.6	86.5
1.7-1.8	TTT	3	169	1.6	88.0
1.9-2.0	TTT	3	172	1.6	89.6
2.1-2.2	TTTTTTT	7	179	3.6	93.2
2.3-2.4	T	1	180	0.5	93.8
2.5-2.6	TT	2	182	1.0	94.8
2.7-2.8	TTT	3	185	1.6	96.4
2.9-3.0		0	185	0.0	96.4
3.1-3.2	T	1	186	0.5	96.9
3.3-3.4	T	1	187	0.5	97.4
3.5-3.6		0	187	0.0	97.4
3.7-3.8	T	1	188	0.5	97.9
3.9-4.0	T	1	189	0.5	98.4
4.1-4.2	T	1	190	0.5	99.0
4.3-4.4		0	190	0.0	99.0
4.5-4.6		0	190	0.0	99.0
4.7-4.8		0	190	0.0	99.0
4.9-5.0		0	190	0.0	99.0
>5.0	TT	2	192	1.0	100.0

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: 35	U	856	1.157	1.873

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU*	138	138	16.1	16.1
0.3-0.4	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	84	222	9.8	25.9
0.5-0.6	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	85	307	9.9	35.9
0.7-0.8	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU*	148	455	17.3	53.2
0.9-1.0	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	59	514	6.9	60.0
1.1-1.2	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	88	602	10.3	70.3
1.3-1.4	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	42	644	4.9	75.2
1.5-1.6	UUUUUUUUUUUUUUUUUUUUUU	22	666	2.6	77.8
1.7-1.8	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	61	727	7.1	84.9
1.9-2.0	UUUUUUUUUUUUUUUUUUUUUUUUU	25	752	2.9	87.9
2.1-2.2	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	35	787	4.1	91.9
2.3-2.4	UUUUUUUUUUUUU	13	800	1.5	93.5
2.5-2.6	UUUUUUUUUUU	11	811	1.3	94.7
2.7-2.8	UUUUUUU	7	818	0.8	95.6
2.9-3.0	UUUU	4	822	0.5	96.0
3.1-3.2	UUU	3	825	0.4	96.4
3.3-3.4	UUUUUUU	7	832	0.8	97.2
3.5-3.6	UUU	3	835	0.4	97.5
3.7-3.8	UUU	3	838	0.4	97.9
3.9-4.0		0	838	0.0	97.9
4.1-4.2	UU	2	840	0.2	98.1
4.3-4.4	UU	2	842	0.2	98.4
4.5-4.6	U	1	843	0.1	98.5
4.7-4.8		0	843	0.0	98.5
4.9-5.0	UU	2	845	0.2	98.7
>5.0	UUUUUUUUUUU	11	856	1.3	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: 36	V	1855	1.177	1.260

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV*	266	266	14.3	14.3
0.3-0.4	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV*	173	439	9.3	23.7
0.5-0.6	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV*	168	607	9.1	32.7
0.7-0.8	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV*	341	948	18.4	51.1
0.9-1.0	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV*	141	1089	7.6	58.7
1.1-1.2	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV*	218	1307	11.8	70.5
1.3-1.4	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV	81	1388	4.4	74.8
1.5-1.6	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV	60	1448	3.2	78.1
1.7-1.8	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV*	116	1564	6.3	84.3
1.9-2.0	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV	48	1612	2.6	86.9
2.1-2.2	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV	60	1672	3.2	90.1
2.3-2.4	VVVVVVVVVVVVVVVVV	17	1689	0.9	91.1
2.5-2.6	VVVVVVVVVVVVVVVVVVVVV	21	1710	1.1	92.2
2.7-2.8	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV	31	1741	1.7	93.9
2.9-3.0	VVVVVVVVVVVVVVVVVVV	19	1760	1.0	94.9
3.1-3.2	VVVVVVVV	8	1768	0.4	95.3
3.3-3.4	VVVVVVVVVVVVVV	14	1782	0.8	96.1
3.5-3.6	VVVVV	5	1787	0.3	96.3
3.7-3.8	VVVVVVVVVVVVVVV	15	1802	0.8	97.1
3.9-4.0	VVV	3	1805	0.2	97.3
4.1-4.2	VVVVV	5	1810	0.3	97.6
4.3-4.4	VVVVV	5	1815	0.3	97.8
4.5-4.6	VV	2	1817	0.1	98.0
4.7-4.8	VVVV	4	1821	0.2	98.2
4.9-5.0	VVVV	4	1825	0.2	98.4
>5.0	VVVVVVVVVVVVVVVVVVVVVVVVVVVVVV	30	1855	1.6	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES  7/1/90 - 6/30/91

                                    SYMBOL  COUNT     MEAN     ST.DEV.
      OCCUPATION CODE:    38          X      205      1.406       2.228

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                      FREQUENCY PERCENTAGE
NAME           5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                                             49   49  23.9  23.9
0.3-0.4  +XXXXXXXXXXXXXXXXXXXXXX                                                                        22   71  10.7  34.6
0.5-0.6  +XXXXXXXXXXXXXXXX                                                                              16   87   7.8  42.4
0.7-0.8  +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                                                             33  120  16.1  58.5
0.9-1.0  +XXXXXXXXXX                                                                                    10  130   4.9  63.4
1.1-1.2  +XXXXXXX                                                                                        7  137   3.4  66.8
1.3-1.4  +XXXXX                                                                                          5  142   2.4  69.3
1.5-1.6  +XXX                                                                                            3  145   1.5  70.7
1.7-1.8  +XXXXXXXXXXXXXXXXXX                                                                            18  163   8.8  79.5
1.9-2.0  +XXXXX                                                                                          5  168   2.4  82.0
2.1-2.2  +XXXXX                                                                                          5  173   2.4  84.4
2.3-2.4  +X                                                                                              1  174   0.5  84.9
2.5-2.6  +XX                                                                                             2  176   1.0  85.9
2.7-2.8  +XXXXX                                                                                          5  181   2.4  88.3
2.9-3.0  +XX                                                                                             2  183   1.0  89.3
3.1-3.2  +XX                                                                                             2  185   1.0  90.2
3.3-3.4  +XXX                                                                                            3  188   1.5  91.7
3.5-3.6  +XX                                                                                             2  190   1.0  92.7
3.7-3.8  +XXX                                                                                            3  193   1.5  94.1
3.9-4.0  +X                                                                                              1  194   0.5  94.6
4.1-4.2  +XX                                                                                             2  196   1.0  95.6
4.3-4.4  +X                                                                                              1  197   0.5  96.1
4.5-4.6  +                                                                                               0  197   0.0  96.1
4.7-4.8  +X                                                                                              1  198   0.5  96.6
4.9-5.0  +                                                                                               0  198   0.0  96.6
>5.0     +XXXXXXX                                                                                        7  205   3.4 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
               5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
```

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	40	Z	125	0.755	0.731

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	ZZZZZZZZZZZZZZZZZZZZZZZZ	24	24	19.2	19.2
0.3-0.4	ZZZZZZZZZZZZZZZZZZZZZZZZZ	25	49	20.0	39.2
0.5-0.6	ZZZZZZZZZZZZZZZZZ	17	66	13.6	52.8
0.7-0.8	ZZZZZZZZZZZZZZZZZZZZZZZZZZ	26	92	20.8	73.6
0.9-1.0	ZZZZZ	5	97	4.0	77.6
1.1-1.2	ZZZZZZZZZZZZZZZ	15	112	12.0	89.6
1.3-1.4	Z	1	113	0.8	90.4
1.5-1.6	Z	1	114	0.8	91.2
1.7-1.8	ZZZ	3	117	2.4	93.6
1.9-2.0	ZZ	2	119	1.6	95.2
2.1-2.2	ZZ	2	121	1.6	96.8
2.3-2.4		0	121	0.0	96.8
2.5-2.6		0	121	0.0	96.8
2.7-2.8	Z	1	122	0.8	97.6
2.9-3.0		0	122	0.0	97.6
3.1-3.2	Z	1	123	0.8	98.4
3.3-3.4		0	123	0.0	98.4
3.5-3.6		0	123	0.0	98.4
3.7-3.8	Z	1	124	0.8	99.2
3.9-4.0		0	124	0.0	99.2
4.1-4.2		0	124	0.0	99.2
4.3-4.4		0	124	0.0	99.2
4.5-4.6		0	124	0.0	99.2
4.7-4.8		0	124	0.0	99.2
4.9-5.0		0	124	0.0	99.2
>5.0	Z	1	125	0.8	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

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                                        SYMBOL  COUNT     MEAN     ST.DEV.
      OCCUPATION CODE:   41               A      355      1.658      1.441

EACH SYMBOL REPRESENTS         1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                                FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95 INT. CUM. INT.  CUM.
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  +AAAAAAAA                                                                                          8    8   2.3   2.3
0.3-0.4  +AAAAAAAAAA                                                                                       10   18   2.8   5.1
0.5-0.6  +AAAAAAAAAAAAAAAAAAAA                                                                             20   38   5.6  10.7
0.7-0.8  +AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                                          56   94  15.8  26.5
0.9-1.0  +AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                                                              35  129   9.9  36.3
1.1-1.2  +AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                                                  47  176  13.2  49.6
1.3-1.4  +AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA                                                                  31  207   8.7  58.3
1.5-1.6  +AAAAAAAAAAAAAAAAAA                                                                               18  225   5.1  63.4
1.7-1.8  +AAAAAAAAAAAAAAAAAAAAAAAAAAAA                                                                     28  253   7.9  71.3
1.9-2.0  +AAAAAAAAAAAAAAAAA                                                                                17  270   4.8  76.1
2.1-2.2  +AAAAAAAAAAAAAAAAAAAA                                                                             20  290   5.6  81.7
2.3-2.4  +AAAAAAAA                                                                                          8  298   2.3  83.9
2.5-2.6  +AAAAAAAAAAAA                                                                                     12  310   3.4  87.3
2.7-2.8  +AAAAAAAA                                                                                          8  318   2.3  89.6
2.9-3.0  +                                                                                                  0  318   0.0  89.6
3.1-3.2  +AAAAA                                                                                             5  323   1.4  91.0
3.3-3.4  +AAAAAAA                                                                                           7  330   2.0  93.0
3.5-3.6  +AAA                                                                                               3  333   0.8  93.8
3.7-3.8  +AAAAAAAA                                                                                          8  341   2.3  96.1
3.9-4.0  +AA                                                                                                2  343   0.6  96.6
4.1-4.2  +                                                                                                  0  343   0.0  96.6
4.3-4.4  +AA                                                                                                2  345   0.6  97.2
4.5-4.6  +A                                                                                                 1  346   0.3  97.5
4.7-4.8  +                                                                                                  0  346   0.0  97.5
4.9-5.0  +A                                                                                                 1  347   0.3  97.7
>5.0     +AAAAAAAA                                                                                          8  355   2.3 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
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WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES  7/1/90 - 6/30/91

                                    SYMBOL  COUNT      MEAN      ST.DEV.
     OCCUPATION CODE:    43            C      116      0.914        1.110

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                          FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2   |CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC                                                                 33   33  28.4  28.4
0.3-0.4   |CCCCCCCCCCCCCCCCC                                                                                 17   50  14.7  43.1
0.5-0.6   |CCCCCCCCCCCCC                                                                                     13   63  11.2  54.3
0.7-0.8   |CCCCCCCCCCCCCCCCC                                                                                 17   80  14.7  69.0
0.9-1.0   |CCCCCCCC                                                                                           8   88   6.9  75.9
1.1-1.2   |CCCCCC                                                                                             6   94   5.2  81.0
1.3-1.4   |CC                                                                                                 2   96   1.7  82.8
1.5-1.6   |CCCC                                                                                               4  100   3.4  86.2
1.7-1.8   |C                                                                                                  1  101   0.9  87.1
1.9-2.0   |CCC                                                                                                3  104   2.6  89.7
2.1-2.2   |CC                                                                                                 2  106   1.7  91.4
2.3-2.4   |C                                                                                                  1  107   0.9  92.2
2.5-2.6   |                                                                                                   0  107   0.0  92.2
2.7-2.8   |CC                                                                                                 2  109   1.7  94.0
2.9-3.0   |C                                                                                                  1  110   0.9  94.8
3.1-3.2   |                                                                                                   0  110   0.0  94.8
3.3-3.4   |C                                                                                                  1  111   0.9  95.7
3.5-3.6   |                                                                                                   0  111   0.0  95.7
3.7-3.8   |                                                                                                   0  111   0.0  95.7
3.9-4.0   |C                                                                                                  1  112   0.9  96.6
4.1-4.2   |C                                                                                                  1  113   0.9  97.4
4.3-4.4   |                                                                                                   0  113   0.0  97.4
4.5-4.6   |                                                                                                   0  113   0.0  97.4
4.7-4.8   |                                                                                                   0  113   0.0  97.4
4.9-5.0   |                                                                                                   0  113   0.0  97.4
>5.0      |CCC                                                                                                3  116   2.6 100.0
          +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
               5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

```
                                 SYMBOL  COUNT     MEAN     ST.DEV.
      OCCUPATION CODE:   44        D      203      1.709      1.241

EACH SYMBOL REPRESENTS        1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                     FREQUENCY PERCENTAGE
NAME          5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
         -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  -DDDD                                                                                          4    4   2.0   2.0
0.3-0.4  -DDDDDDD                                                                                       7   11   3.4   5.4
0.5-0.6  -DDDDDDD                                                                                       7   18   3.4   8.9
0.7-0.8  -DDDDDDDDDDDDDDDDDDDDDDDDDDDDDD                                                               30   48  14.8  23.6
0.9-1.0  -DDDDDDDDDDDDDDDDDDDD                                                                         20   68   9.9  33.5
1.1-1.2  -DDDDDDDDDDDDDDDDDDDDDDDD                                                                     24   92  11.8  45.3
1.3-1.4  -DDDDDDDDDDDDDDDDD                                                                            17  109   8.4  53.7
1.5-1.6  -DDDDDD                                                                                        6  115   3.0  56.7
1.7-1.8  -DDDDDDDDDDDDDDDDDDDDDDDDDDDD                                                                 28  143  13.8  70.4
1.9-2.0  -DDDDDDDD                                                                                      8  151   3.9  74.4
2.1-2.2  -DDDDDDDDD                                                                                     9  160   4.4  78.8
2.3-2.4  -DDDDDD                                                                                        6  166   3.0  81.8
2.5-2.6  -DD                                                                                            2  168   1.0  82.8
2.7-2.8  -DDDDDDDDDDDD                                                                                 12  180   5.9  88.7
2.9-3.0  -DDD                                                                                           3  183   1.5  90.1
3.1-3.2  -DDDD                                                                                          4  187   2.0  92.1
3.3-3.4  -DDDD                                                                                          4  191   2.0  94.1
3.5-3.6  -                                                                                              0  191   0.0  94.1
3.7-3.8  -D                                                                                             1  192   0.5  94.6
3.9-4.0  -D                                                                                             1  193   0.5  95.1
4.1-4.2  -D                                                                                             1  194   0.5  95.6
4.3-4.4  -                                                                                              0  194   0.0  95.6
4.5-4.6  -D                                                                                             1  195   0.5  96.1
4.7-4.8  -D                                                                                             1  196   0.5  96.6
4.9-5.0  -                                                                                              0  196   0.0  96.6
>5.0     -DDDDDDD                                                                                       7  203   3.4 100.0
         -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

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                                 SYMBOL  COUNT     MEAN     ST.DEV.
     OCCUPATION CODE:  ·46          F     1088     1.032      2.123

EACH SYMBOL REPRESENTS        1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                              FREQUENCY  PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM.  INT.  CUM.
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF*  240  240  22.1  22.1
0.3-0.4  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF*  125  365  11.5  33.5
0.5-0.6  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF*  133  498  12.2  45.8
0.7-0.8  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF*  175  673  16.1  61.9
0.9-1.0  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF               84  757   7.7  69.6
1.1-1.2  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF         90  847   8.3  77.8
1.3-1.4  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF                                                              37  884   3.4  81.3
1.5-1.6  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFF                                                                      29  913   2.7  83.9
1.7-1.8  |FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF                                   64  977   5.9  89.8
1.9-2.0  |FFFFFFFFFFFFF                                                                                      13  990   1.2  91.0
2.1-2.2  |FFFFFFFFFFFFFFFFFFFFFFFFF                                                                          25 1015   2.3  93.3
2.3-2.4  |FFFFFFFFF                                                                                           9 1024   0.8  94.1
2.5-2.6  |FFFFFFFFFFF                                                                                        11 1035   1.0  95.1
2.7-2.8  |FFFFFFF                                                                                             7 1042   0.6  95.8
2.9-3.0  |FFF                                                                                                 3 1045   0.3  96.0
3.1-3.2  |F                                                                                                   1 1046   0.1  96.1
3.3-3.4  |FFFF                                                                                                4 1050   0.4  96.5
3.5-3.6  |FFFF                                                                                                4 1054   0.4  96.9
3.7-3.8  |FFF                                                                                                 3 1057   0.3  97.2
3.9-4.0  |FFFF                                                                                                4 1061   0.4  97.5
4.1-4.2  |FF                                                                                                  2 1063   0.2  97.7
4.3-4.4  |FFF                                                                                                 3 1066   0.3  98.0
4.5-4.6  |FFF                                                                                                 3 1069   0.3  98.3
4.7-4.8  |FF                                                                                                  2 1071   0.2  98.4
4.9-5.0  |F                                                                                                   1 1072   0.1  98.5
>5.0     |FFFFFFFFFFFFFFFF                                                                                   16 1088   1.5 100.0
         +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
```

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	47	G	122	0.917	0.947

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	GGGGGGGGGGGGGGGGGGGGGGGGGGGG	28	28	23.0	23.0
0.3-0.4	GGGGGGGGGGGGG	13	41	10.7	33.6
0.5-0.6	GGGGGGGGGGGGG	13	54	10.7	44.3
0.7-0.8	GGGGGGGGGGGGGGGGGGGGGGGGGGGGG	29	83	23.8	68.0
0.9-1.0	GGGGGG	6	89	4.9	73.0
1.1-1.2	GGGGGGGGGG	10	99	8.2	81.1
1.3-1.4	GG	2	101	1.6	82.8
1.5-1.6	GG	2	103	1.6	84.4
1.7-1.8	GGGGG	5	108	4.1	88.5
1.9-2.0	GGG	3	111	2.5	91.0
2.1-2.2	G	1	112	0.8	91.8
2.3-2.4	GG	2	114	1.6	93.4
2.5-2.6	G	1	115	0.8	94.3
2.7-2.8	G	1	116	0.8	95.1
2.9-3.0	G	1	117	0.8	95.9
3.1-3.2	G	1	118	0.8	96.7
3.3-3.4		0	118	0.0	96.7
3.5-3.6	GGG	3	121	2.5	99.2
3.7-3.8		0	121	0.0	99.2
3.9-4.0		0	121	0.0	99.2
4.1-4.2		0	121	0.0	99.2
4.3-4.4		0	121	0.0	99.2
4.5-4.6		0	121	0.0	99.2
4.7-4.8		0	121	0.0	99.2
4.9-5.0		0	121	0.0	99.2
>5.0	G	1	122	0.8	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	48	H	69	1.074	0.598

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	HHHHH	5	5	7.2	7.2
0.3-0.4	HHHH	4	9	5.8	13.0
0.5-0.6	HHHHH	5	14	7.2	20.3
0.7-0.8	HHHHHHHHHHHHHHHH	16	30	23.2	43.5
0.9-1.0	HHHHHH	6	36	8.7	52.2
1.1-1.2	HHHHHHHHHHH	11	47	15.9	68.1
1.3-1.4	HHHHHH	6	53	8.7	76.8
1.5-1.6	HHHHHHH	7	60	10.1	87.0
1.7-1.8	HH	2	62	2.9	89.9
1.9-2.0	HH	2	64	2.9	92.8
2.1-2.2	HHH	3	67	4.3	97.1
2.3-2.4		0	67	0.0	97.1
2.5-2.6		0	67	0.0	97.1
2.7-2.8	H	1	68	1.4	98.6
2.9-3.0	H	1	69	1.4	100.0
3.1-3.2		0	69	0.0	100.0
3.3-3.4		0	69	0.0	100.0
3.5-3.6		0	69	0.0	100.0
3.7-3.8		0	69	0.0	100.0
3.9-4.0		0	69	0.0	100.0
4.1-4.2		0	69	0.0	100.0
4.3-4.4		0	69	0.0	100.0
4.5-4.6		0	69	0.0	100.0
4.7-4.8		0	69	0.0	100.0
4.9-5.0		0	69	0.0	100.0
>5.0		0	69	0.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

```
                                        SYMBOL  COUNT     MEAN     ST.DEV.
      OCCUPATION CODE:   49               I      175      0.673      0.518

EACH SYMBOL REPRESENTS        1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                               FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2    +IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                      44   44  25.1  25.1
0.3-0.4    +IIIIIIIIIIIIIIIIIIIIII                                                                            22   66  12.6  37.7
0.5-0.6    +IIIIIIIIIIIIIIIIIIIIIIIIII                                                                        26   92  14.9  52.6
0.7-0.8    +IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                             37  129  21.1  73.7
0.9-1.0    +IIIIIIIIIIII                                                                                      12  141   6.9  80.6
1.1-1.2    +IIIIIIIIIIIIIIIII                                                                                 17  158   9.7  90.3
1.3-1.4    +III                                                                                                3  161   1.7  92.0
1.5-1.6    +IIII                                                                                               4  165   2.3  94.3
1.7-1.8    +IIIIII                                                                                             6  171   3.4  97.7
1.9-2.0    +II                                                                                                 2  173   1.1  98.9
2.1-2.2    +                                                                                                   0  173   0.0  98.9
2.3-2.4    +                                                                                                   0  173   0.0  98.9
2.5-2.6    +                                                                                                   0  173   0.0  98.9
2.7-2.8    +I                                                                                                  1  174   0.6  99.4
2.9-3.0    +                                                                                                   0  174   0.0  99.4
3.1-3.2    +                                                                                                   0  174   0.0  99.4
3.3-3.4    +I                                                                                                  1  175   0.6 100.0
3.5-3.6    +                                                                                                   0  175   0.0 100.0
3.7-3.8    +                                                                                                   0  175   0.0 100.0
3.9-4.0    +                                                                                                   0  175   0.0 100.0
4.1-4.2    +                                                                                                   0  175   0.0 100.0
4.3-4.4    +                                                                                                   0  175   0.0 100.0
4.5-4.6    +                                                                                                   0  175   0.0 100.0
4.7-4.8    +                                                                                                   0  175   0.0 100.0
4.9-5.0    +                                                                                                   0  175   0.0 100.0
>5.0       +                                                                                                   0  175   0.0 100.0
           +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
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WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	50	J	1626	0.818	0.893

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ*	390	390	24.0	24.0
0.3-0.4	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ*	210	600	12.9	36.9
0.5-0.6	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ*	176	776	10.8	47.7
0.7-0.8	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ*	319	1095	19.6	67.3
0.9-1.0	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ*	101	1196	6.2	73.6
1.1-1.2	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ*	161	1357	9.9	83.5
1.3-1.4	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ	53	1410	3.3	86.7
1.5-1.6	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ	55	1465	3.4	90.1
1.7-1.8	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ	45	1510	2.8	92.9
1.9-2.0	JJJJJJJJJJJJJJJJJJJJJ	21	1531	1.3	94.2
2.1-2.2	JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ	33	1564	2.0	96.2
2.3-2.4	JJJJJJJ	7	1571	0.4	96.6
2.5-2.6	JJJJJJJJ	8	1579	0.5	97.1
2.7-2.8	JJJJJJJJJJJ	11	1590	0.7	97.8
2.9-3.0	JJJ	3	1593	0.2	98.0
3.1-3.2	JJJJJJ	6	1599	0.4	98.3
3.3-3.4	JJJJJJ	6	1605	0.4	98.7
3.5-3.6	JJJJ	4	1609	0.2	99.0
3.7-3.8	JJJ	3	1612	0.2	99.1
3.9-4.0	J	1	1613	0.1	99.2
4.1-4.2	J	1	1614	0.1	99.3
4.3-4.4	JJJJ	4	1618	0.2	99.5
4.5-4.6	J	1	1619	0.1	99.6
4.7-4.8		0	1619	0.0	99.6
4.9-5.0	J	1	1620	0.1	99.6
>5.0	JJJJJJ	6	1626	0.4	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

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                                          SYMBOL  COUNT     MEAN     ST.DEV.
      OCCUPATION CODE:   53                 L      197      0.919      0.815

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

 INTERVAL                                                                                                 FREQUENCY PERCENTAGE
 NAME         5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95  INT. CUM. INT.  CUM.
          -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
 0.1-0.2  -LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL                                                      43   43  21.8  21.8
 0.3-0.4  -LLLLLLLLLLLLLLLLLLL                                                                              19   62   9.6  31.5
 0.5-0.6  -LLLLLLLLLLLLLLLLLLL                                                                              19   81   9.6  41.1
 0.7-0.8  -LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL                                                               34  115  17.3  58.4
 0.9-1.0  -LLLLLLLLLLL                                                                                      11  126   5.6  64.0
 1.1-1.2  -LLLLLLLLLLLLLLLLLLLLLLLLLLLLLL                                                                   30  156  15.2  79.2
 1.3-1.4  -LLLLLLL                                                                                           7  163   3.6  82.7
 1.5-1.6  -LLLLLLLLL                                                                                         9  172   4.6  87.3
 1.7-1.8  -LLLLLL                                                                                            6  178   3.0  90.4
 1.9-2.0  -L                                                                                                 1  179   0.5  90.9
 2.1-2.2  -LLLLLLL                                                                                           7  186   3.6  94.4
 2.3-2.4  -                                                                                                  0  186   0.0  94.4
 2.5-2.6  -LLLL                                                                                              4  190   2.0  96.4
 2.7-2.8  -LL                                                                                                2  192   1.0  97.5
 2.9-3.0  -L                                                                                                 1  193   0.5  98.0
 3.1-3.2  -L                                                                                                 1  194   0.5  98.5
 3.3-3.4  -                                                                                                  0  194   0.0  98.5
 3.5-3.6  -                                                                                                  0  194   0.0  98.5
 3.7-3.8  -L                                                                                                 1  195   0.5  99.0
 3.9-4.0  -L                                                                                                 1  196   0.5  99.5
 4.1-4.2  -                                                                                                  0  196   0.0  99.5
 4.3-4.4  -                                                                                                  0  196   0.0  99.5
 4.5-4.6  -                                                                                                  0  196   0.0  99.5
 4.7-4.8  -                                                                                                  0  196   0.0  99.5
 4.9-5.0  -                                                                                                  0  196   0.0  99.5
 >5.0     -L                                                                                                 1  197   0.5 100.0
          -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95
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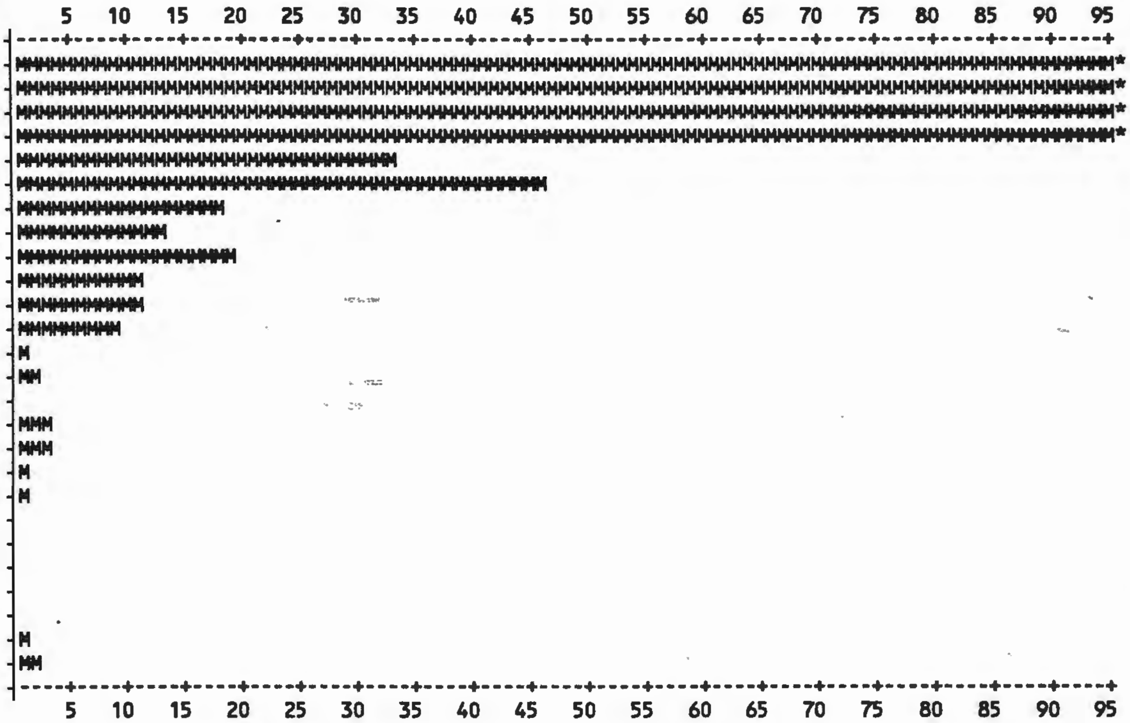
WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

	SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE: .54	M	697	0.699	0.691

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3



INTERVAL NAME	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	213	213	30.6	30.6
0.3-0.4	96	309	13.8	44.3
0.5-0.6	101	410	14.5	58.8
0.7-0.8	113	523	16.2	75.0
0.9-1.0	33	556	4.7	79.8
1.1-1.2	46	602	6.6	86.4
1.3-1.4	18	620	2.6	89.0
1.5-1.6	13	633	1.9	90.8
1.7-1.8	19	652	2.7	93.5
1.9-2.0	11	663	1.6	95.1
2.1-2.2	11	674	1.6	96.7
2.3-2.4	9	683	1.3	98.0
2.5-2.6	1	684	0.1	98.1
2.7-2.8	2	686	0.3	98.4
2.9-3.0	0	686	0.0	98.4
3.1-3.2	3	689	0.4	98.9
3.3-3.4	3	692	0.4	99.3
3.5-3.6	1	693	0.1	99.4
3.7-3.8	1	694	0.1	99.6
3.9-4.0	0	694	0.0	99.6
4.1-4.2	0	694	0.0	99.6
4.3-4.4	0	694	0.0	99.6
4.5-4.6	0	694	0.0	99.6
4.7-4.8	0	694	0.0	99.6
4.9-5.0	1	695	0.1	99.7
>5.0	2	697	0.3	100.0

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	64	P	105	1.556	1.159

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

Scale (observations): 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

INTERVAL NAME		FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	P	1	1	1.0	1.0
0.3-0.4		0	1	0.0	1.0
0.5-0.6	PPPPPPPPPPP	11	12	10.5	11.4
0.7-0.8	PPPPPPPPPPPPPPPPPPPPPPPP	24	36	22.9	34.3
0.9-1.0	PP	2	38	1.9	36.2
1.1-1.2	PPPPPPPPPPPP	12	50	11.4	47.6
1.3-1.4	PPPPPPPPPPP	11	61	10.5	58.1
1.5-1.6	PPPPP	5	66	4.8	62.9
1.7-1.8	PPPPPPPPPPP	11	77	10.5	73.3
1.9-2.0	PPPPP	5	82	4.8	78.1
2.1-2.2	PPPPPPPPP	9	91	8.6	86.7
2.3-2.4		0	91	0.0	86.7
2.5-2.6	PPP	3	94	2.9	89.5
2.7-2.8	PP	2	96	1.9	91.4
2.9-3.0		0	96	0.0	91.4
3.1-3.2	PPP	3	99	2.9	94.3
3.3-3.4		0	99	0.0	94.3
3.5-3.6	PP	2	101	1.9	96.2
3.7-3.8		0	101	0.0	96.2
3.9-4.0		0	101	0.0	96.2
4.1-4.2	P	1	102	1.0	97.1
4.3-4.4		0	102	0.0	97.1
4.5-4.6		0	102	0.0	97.1
4.7-4.8	P	1	103	1.0	98.1
4.9-5.0		0	103	0.0	98.1
>5.0	PP	2	105	1.9	100.0

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

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                                   SYMBOL  COUNT     MEAN     ST.DEV.
     OCCUPATION CODE:    72          S      284      0.893      1.118

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                          FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM. INT.  CUM.
            +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2     |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS                   78   78  27.5  27.5
0.3-0.4     |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS                                                                  31  109  10.9  38.4
0.5-0.6     |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS                                                    45  154  15.8  54.2
0.7-0.8     |SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS                                                          39  193  13.7  68.0
0.9-1.0     |SSSSSSSSSSSSSSSSSSS                                                                              19  212   6.7  74.6
1.1-1.2     |SSSSSSSSSSSSSSSSSS                                                                               18  230   6.3  81.0
1.3-1.4     |SSSSSS                                                                                            6  236   2.1  83.1
1.5-1.6     |SSSSSSS                                                                                           7  243   2.5  85.6
1.7-1.8     |SSSSSSSSSSSS                                                                                     12  255   4.2  89.8
1.9-2.0     |SSSSS                                                                                             5  260   1.8  91.5
2.1-2.2     |SSSSSS                                                                                            6  266   2.1  93.7
2.3-2.4     |SSSS                                                                                              4  270   1.4  95.1
2.5-2.6     |SS                                                                                                2  272   0.7  95.8
2.7-2.8     |S                                                                                                 1  273   0.4  96.1
2.9-3.0     |S                                                                                                 1  274   0.4  96.5
3.1-3.2     |                                                                                                  0  274   0.0  96.5
3.3-3.4     |S                                                                                                 1  275   0.4  96.8
3.5-3.6     |                                                                                                  0  275   0.0  96.8
3.7-3.8     |                                                                                                  0  275   0.0  96.8
3.9-4.0     |                                                                                                  0  275   0.0  96.8
4.1-4.2     |S                                                                                                 1  276   0.4  97.2
4.3-4.4     |SS                                                                                                2  278   0.7  97.9
4.5-4.6     |                                                                                                  0  278   0.0  97.9
4.7-4.8     |                                                                                                  0  278   0.0  97.9
4.9-5.0     |                                                                                                  0  278   0.0  97.9
>5.0        |SSSSSS                                                                                            6  284   2.1 100.0
            +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

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                                        SYMBOL  COUNT      MEAN      ST.DEV.
     OCCUPATION CODE:   73                T      851      0.699       0.731

EACH SYMBOL REPRESENTS          1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL                                                                                                           FREQUENCY PERCENTAGE
NAME          5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95   INT. CUM.  INT.  CUM.
         -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0.1-0.2  -TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT* 253  253  29.7  29.7
0.3-0.4  -TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT* 121  374  14.2  43.9
0.5-0.6  -TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT* 104  478  12.2  56.2
0.7-0.8  -TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT* 157  635  18.4  74.6
0.9-1.0  -TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT                                         55  690   6.5  81.1
1.1-1.2  -TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT                                64  754   7.5  88.6
1.3-1.4  -TTTTTTTTTTTTTTTTT                                                                              17  771   2.0  90.6
1.5-1.6  -TTTTTTTTTTTTTTTTTTT                                                                            19  790   2.2  92.8
1.7-1.8  -TTTTTTTTTTTTTTTTTTT                                                                            19  809   2.2  95.1
1.9-2.0  -TTTTTTT                                                                                         7  816   0.8  95.9
2.1-2.2  -TTTTTTTTT                                                                                       9  825   1.1  96.9
2.3-2.4  -TTTT                                                                                            4  829   0.5  97.4
2.5-2.6  -TTTTTT                                                                                          6  835   0.7  98.1
2.7-2.8  -TTTT                                                                                            4  839   0.5  98.6
2.9-3.0  -                                                                                                0  839   0.0  98.6
3.1-3.2  -TT                                                                                              2  841   0.2  98.8
3.3-3.4  -T                                                                                               1  842   0.1  98.9
3.5-3.6  -TT                                                                                              2  844   0.2  99.2
3.7-3.8  -T                                                                                               1  845   0.1  99.3
3.9-4.0  -                                                                                                0  845   0.0  99.3
4.1-4.2  -                                                                                                0  845   0.0  99.3
4.3-4.4  -                                                                                                0  845   0.0  99.3
4.5-4.6  -                                                                                                0  845   0.0  99.3
4.7-4.8  -T                                                                                               1  846   0.1  99.4
4.9-5.0  -                                                                                                0  846   0.0  99.4
>5.0     -TTTTT                                                                                           5  851   0.6 100.0
         -----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
              5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85   90   95

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.
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HISTOGRAM for REGULAR MSHA INSPECTOR SAMPLES 7/1/90 - 6/30/91

		SYMBOL	COUNT	MEAN	ST.DEV.
OCCUPATION CODE:	74	U	145	0.534	0.451

EACH SYMBOL REPRESENTS 1 OBSERVATIONS

Dust Concentration, mg/m3

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
0.1-0.2	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	51	51	35.2	35.2
0.3-0.4	UUUUUUUUUUUUUUUUUUUU	20	71	13.8	49.0
0.5-0.6	UUUUUUUUUUUUUUUUUUUUUUUUUUUUU	29	100	20.0	69.0
0.7-0.8	UUUUUUUUUUUUUUUUUUUUUU	22	122	15.2	84.1
0.9-1.0	UUUUU	5	127	3.4	87.6
1.1-1.2	UUUUUUU	7	134	4.8	92.4
1.3-1.4	UUUUU	5	139	3.4	95.9
1.5-1.6	U	1	140	0.7	96.6
1.7-1.8	UU	2	142	1.4	97.9
1.9-2.0	U	1	143	0.7	98.6
2.1-2.2	U	1	144	0.7	99.3
2.3-2.4		0	144	0.0	99.3
2.5-2.6	U	1	145	0.7	100.0
2.7-2.8		0	145	0.0	100.0
2.9-3.0		0	145	0.0	100.0
3.1-3.2		0	145	0.0	100.0
3.3-3.4		0	145	0.0	100.0
3.5-3.6		0	145	0.0	100.0
3.7-3.8		0	145	0.0	100.0
3.9-4.0		0	145	0.0	100.0
4.1-4.2		0	145	0.0	100.0
4.3-4.4		0	145	0.0	100.0
4.5-4.6		0	145	0.0	100.0
4.7-4.8		0	145	0.0	100.0
4.9-5.0		0	145	0.0	100.0
>5.0		0	145	0.0	100.0
	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95				

WHEN ANY GROUP BEYOND THE 26TH IS PLOTTED,
THE PLOT SYMBOLS CYCLE THROUGH THE LETTERS A TO Z.

Appendix A7. Dust Concentration, Production, Planned and Observed Controls for SIP Mines IN and OUT of Compliance

"Pln" or "plan" inside a varianle name indicates that it refers to Dust Control Plan (DCP).
"Ob" or "SIP" inside a variable name indicates that it is an observed value.
Xj, where j is a number, refers to variable #j.
Single value is used for averages of observed air quantities if only one measurement is available.
Ln(Xj) = Log_e(Xj)

"Z-score" is distance from mean, in multiples of the standard deviation.

SIP Longwall MMU's

VARIABLE	QAS Compliance	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
4 SIP_Prod		80	2364.0	1375.7	153.81	.58196	68.000	-1.67	6000.0	2.64	5932.0
observed shift	IN	62	2164.4	1303.6	165.56	.60230	68.000	-1.61	5016.0	2.19	4948.0
tonnage	OUT	18	3051.6	1432.4	337.62	.46941	100.00	-2.06	6000.0	2.06	5900.0
5 C9_Prod		78	3931.6	1894.9	214.56	.48197	540.00	-1.79	11000.	3.73	10460.
maximum	IN	60	3852.9	1792.5	231.41	.46524	540.00	-1.85	8800.0	2.76	8260.0
shift tonnage	OUT	18	4193.9	2240.1	527.99	.53412	1500.0	-1.20	11000.	3.04	9500.0
6 C10_Prod		76	2969.9	1525.5	174.98	.51365	368.00	-1.71	10000.	4.61	9632.0
average non-	IN	59	2845.2	1315.7	171.28	.46241	368.00	-1.88	5375.0	1.92	5007.0
sample tonnage	OUT	17	3402.5	2092.2	507.44	.61492	1157.0	-1.07	10000.	3.15	8843.0
8 DO dust		80	1.5750	1.0791	.12065	.68514	.10000	-1.37	7.0000	5.03	6.9000
Concentration	IN	62	1.1694	.42061	.05342	.35970	.10000	-2.54	2.0000	1.97	1.9000
	OUT	18	2.9722	1.4523	.34231	.48863	1.0000	-1.36	7.0000	2.77	6.0000
10 LplnIcfm		67	32060.	17791.	2173.5	.55493	9000.0	-1.30	75000.	2.41	66000.
DCP Intake cfm	IN	52	31885.	19175.	2659.1	.60139	9000.0	-1.19	75000.	2.25	66000.
	OUT	15	32667.	12337.	3185.4	.37766	21000.	-0.95	60000.	2.22	39000.
11 Lpln_vel		38	258.34	84.281	13.672	.32624	62.000	-2.33	400.00	1.68	338.00
DCP Midface fpm	IN	28	282.86	74.814	14.138	.26449	150.00	-1.78	400.00	1.57	250.00
	OUT	10	189.70	72.845	23.036	.38400	62.000	-1.75	300.00	1.51	238.00
12 LplnTcfm		22	16134.	10836.	2310.3	.67167	150.00	-1.47	42000.	2.39	41850.
DCP Tailgate cfm	IN	15	17996.	11839.	3056.7	.65785	150.00	-1.51	42000.	2.03	41850.
	OUT	7	12143.	7531.7	2846.7	.62026	5000.0	-0.95	23500.	1.51	18500.
13 LplnTvel		33	268.70	143.60	24.998	.53443	60.000	-1.45	850.00	4.05	790.00
DCP Tailgate fpm	IN	22	307.50	153.36	32.696	.49872	60.000	-1.61	850.00	3.54	790.00
	OUT	11	191.09	81.616	24.608	.42710	90.000	-1.24	350.00	1.95	260.00
14 plan_Nwj		80	69.562	28.183	3.1510	.40515	9.0000	-2.15	161.00	3.24	152.00
DCP water jets	IN	62	67.645	28.574	3.6289	.42241	9.0000	-2.05	161.00	3.27	152.00
total number	OUT	18	76.167	26.494	6.2446	.34784	46.000	-1.14	146.00	2.64	100.00
15 plan_psi		79	94.348	61.178	6.8831	.64843	20.000	-1.22	500.00	6.63	480.00
DCP Wt'd average	IN	61	90.051	59.718	7.6461	.66316	20.000	-1.17	500.00	6.86	480.00
water pressure	OUT	18	108.91	65.538	15.448	.60176	40.000	-1.05	275.00	2.53	235.00
16 Lob1Icfm		75	62034.	49508.	5716.7	.79808	12672.	-1.00	246000	3.72	233328
1st observed	IN	57	67013.	55476.	7348.0	.82784	12672.	-0.98	246000	3.23	233328
Intake cfm	OUT	18	46266.	13592.	3203.6	.29378	22800.	-1.73	72345.	1.92	49545.
17 Lob2Icfm		74	65914.	58590.	6810.9	.88887	17160.	-0.83	344880	4.76	327720
2nd observed	IN	56	67165.	54437.	7274.4	.81049	17160.	-0.92	237943	3.14	220783
Intake cfm	OUT	18	62022.	71638.	16885.	1.1550	23370.	-0.54	344880	3.95	321510
18 Lob1_vel		75	488.27	264.57	30.550	.54185	0.0000	-1.85	1580.0	4.13	1580.0
1st observed	IN	57	523.07	281.28	37.257	.53775	0.0000	-1.86	1580.0	3.76	1580.0
Midface fpm	OUT	18	378.06	164.74	38.829	.43575	185.00	-1.17	715.00	2.05	530.00
19 Lob2_vel		73	487.27	260.66	30.508	.53493	175.00	-1.20	1490.0	3.85	1315.0
2nd observed	IN	56	524.84	278.39	37.202	.53043	270.00	-0.92	1490.0	3.47	1220.0
Midface fpm	OUT	17	363.53	134.60	32.645	.37025	175.00	-1.40	625.00	1.94	450.00
20 Lob1Tcfm		41	36029.	21753.	3397.3	.60378	3200.0	-1.51	124125	4.05	120925
1st observed	IN	28	39687.	25080.	4739.7	.63195	3200.0	-1.45	124125	3.37	120925
Tailgate cfm	OUT	13	28149.	7973.3	2211.4	.28326	16555.	-1.45	45050.	2.12	28495.

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VARIABLE	QAS Compliance	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
21 Lob1Tvel		77	449.60	271.88	30.983	.60471	136.00	-1.15	1655.0	4.43	1519.0
1st observed	IN	59	495.39	289.06	37.632	.58350	187.00	-1.07	1655.0	4.01	1468.0
Tailgate fpm	OUT	18	299.50	119.35	28.132	.39851	136.00	-1.37	530.00	1.93	394.00
22 Lob2Tcfm		40	37988.	20404.	3226.1	.53712	14286.	-1.16	123075	4.17	108789
2nd observed	IN	28	40980.	23415.	4425.0	.57138	14286.	-1.14	123075	3.51	108789
Tailgate cfm	OUT	12	31006.	7372.1	2128.1	.23776	20400.	-1.44	45000.	1.90	24600.
23 Lob2Tvel		76	454.07	267.78	30.717	.58975	145.00	-1.15	1641.0	4.43	1496.0
2nd observed	IN	59	495.54	283.35	36.889	.57180	162.00	-1.18	1641.0	4.04	1479.0
Tailgate fpm	OUT	17	310.12	129.34	31.369	.41706	145.00	-1.28	613.00	2.34	468.00
24 SIP_Nwj		80	86.600	31.945	3.5716	.36888	12.000	-2.34	194.00	3.36	182.00
Total number	IN	62	87.064	33.436	4.2464	.38404	12.000	-2.24	194.00	3.20	182.00
water jets	OUT	18	85.000	26.966	6.3560	.31725	52.000	-1.22	146.00	2.26	94.000
25 SIP_psi		78	146.99	96.636	10.942	.65744	50.000	-1.00	610.00	4.79	560.00
Wt'd average	IN	60	137.18	86.587	11.178	.63118	50.000	-1.01	600.00	5.35	550.00
water pressure	OUT	18	179.68	121.68	28.681	.67724	73.800	-0.87	610.00	3.54	536.20
26 Dust_Std		80	1.9550	.18752	.02097	.09592	.90000	-5.63	2.0000	0.24	1.1000
quartz-adjusted	IN	62	1.9645	.16002	.02032	.08145	.90000	-6.65	2.0000	0.22	1.1000
MMU dust Std.	OUT	18	1.9222	.26470	.06239	.13770	.90000	-3.86	2.0000	0.29	1.1000
28 SIP_Icfm		75	63927.	50923.	5880.0	.79657	14916.	-0.96	241972	3.50	227056
Average Intake	IN	57	67017.	54647.	7238.2	.81543	14916.	-0.95	241972	3.20	227056
cfm	OUT	18	54144.	36291.	8553.9	.67027	23085.	-0.86	190760	3.76	167675
29 SIP_Lvel		75	483.94	261.58	30.205	.54053	0.0000	-1.85	1535.0	4.02	1535.0
Average Midface	IN	57	519.35	280.55	37.159	.54019	0.0000	-1.85	1535.0	3.62	1535.0
fpm	OUT	18	371.81	145.15	34.212	.39039	180.00	-1.32	627.50	1.76	447.50
30 SIP_Tcfm		41	36747.	20913.	3266.1	.56911	14703.	-1.05	123600	4.15	108897
Average Tailgate	IN	28	40334.	24075.	4549.8	.59691	14703.	-1.06	123600	3.46	108897
cfm	OUT	13	29022.	7682.7	2130.8	.26472	16555.	-1.62	45025.	2.08	28470.
31 SIP_Tvel		77	450.18	268.50	30.598	.59643	143.50	-1.14	1648.0	4.46	1504.5
Average Tailgate	IN	59	495.47	285.33	37.147	.57589	174.50	-1.12	1648.0	4.04	1473.5
fpm	OUT	18	301.75	118.65	27.966	.39321	143.50	-1.33	529.00	1.92	385.50
32 Plan_H2O		79	6379.1	3669.8	412.88	.57528	450.00	-1.62	17710.	3.09	17260.
X14 * X15	IN	61	5936.1	3443.0	440.84	.58002	450.00	-1.59	17710.	3.42	17260.
	OUT	18	7880.3	4106.1	967.83	.52106	2760.0	-1.25	15096.	1.76	12336.
33 SIP_H2O		78	12387.	7864.2	890.45	.63489	2700.0	-1.23	46800.	4.38	44100.
X24 * X25	IN	60	11842.	8061.9	1040.8	.68080	2700.0	-1.13	46800.	4.34	44100.
	OUT	18	14203.	7072.3	1667.0	.49794	5977.8	-1.16	32330.	2.56	26352.
34 Diff		80	-.38000	1.0710	.11974	-2.8183	-1.9000	-1.42	5.0000	5.02	6.9000
X8 - X26	IN	62	-.79516	.42443	.05390	-.53376	-1.9000	-2.60	0.0000	1.87	1.9000
	OUT	18	1.0500	1.3747	.32401	1.3092	.10000	-0.69	5.0000	2.87	4.9000
35 LnConc		80	.28127	.59720	.06677	2.1232	-2.3026	-4.33	1.9459	2.79	4.2485
Ln(X8)	IN	62	.07379	.46349	.05886	6.2814	-2.3026	-5.13	.69315	1.34	2.9957
	OUT	18	.99593	.43444	.10240	.43621	0.0000	-2.29	1.9459	2.19	1.9459
36 LnStd		80	.66349	.13154	.01471	.19825	-.10536	-5.85	.69315	0.23	.79851
Ln(X26)	IN	62	.67039	.11022	.01400	.16442	-.10536	-7.04	.69315	0.21	.79851
	OUT	18	.63976	.18985	.04475	.29675	-.10536	-3.92	.69315	0.28	.79851
37 LnRatio		80	-.38222	.59312	.06631	-1.5517	-2.9957	-4.41	1.2528	2.76	4.2485
Ln(X8/X26)	IN	62	-.59660	.46156	.05862	-.77366	-2.9957	-5.20	0.0000	1.29	2.9957
	OUT	18	.35617	.35416	.08348	.99435	.04879	-0.87	1.2528	2.53	1.2040
38 LnProd		80	7.5271	.82899	.09268	.11013	4.2195	-3.99	8.6995	1.41	4.4800
Ln(X4)	IN	62	7.4449	.79497	.10096	.10678	4.2195	-4.06	8.5204	1.35	4.3009
	OUT	18	7.8103	.90350	.21296	.11568	4.6052	-3.55	8.6995	0.98	4.0943

VARIABLE NO. NAME	GROUPING VARIABLE LEVEL	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
39 LnC9prd		78	8.1534	.52930	.05993	.06492	6.2916	-3.52	9.3057	2.18	3.0141
Ln(X5)	IN	60	8.1311	.54441	.07028	.06695	6.2916	-3.38	9.0825	1.75	2.7909
	OUT	18	8.2277	.48243	.11371	.05863	7.3132	-1.90	9.3057	2.23	1.9924
40 LnIcfm		75	10.847	.62018	.07161	.05717	9.6102	-1.99	12.397	2.50	2.7864
Ln(X28)	IN	57	10.868	.66727	.08838	.06140	9.6102	-1.89	12.397	2.29	2.7864
	OUT	18	10.780	.44869	.10576	.04162	10.047	-1.63	12.159	3.07	2.1118
41 LnIcfm_P		67	10.250	.49078	.05996	.04788	9.1050	-2.33	11.225	1.99	2.1203
Ln(X10)	IN	52	10.225	.52590	.07293	.05143	9.1050	-2.13	11.225	1.90	2.1203
	OUT	15	10.336	.34329	.08864	.03321	9.9523	-1.12	11.002	1.94	1.0498
42 LnLvel		74	6.0931	.43228	.05025	.07095	5.1930	-2.08	7.3363	2.88	2.1433
Ln(X29)	IN	56	6.1715	.42140	.05631	.06828	5.6168	-1.32	7.3363	2.76	1.7195
	OUT	18	5.8492	.38036	.08965	.06503	5.1930	-1.73	6.4417	1.56	1.2488
43 LnLvel_P		38	5.4892	.39485	.06405	.07193	4.1271	-3.45	5.9915	1.27	1.8643
Ln(X11)	IN	28	5.6073	.28783	.05440	.05133	5.0106	-2.07	5.9915	1.33	.98083
	OUT	10	5.1583	.47679	.15077	.09243	4.1271	-2.16	5.7038	1.14	1.5766
44 LnTcfm		41	10.391	.47658	.07443	.04587	9.5958	-1.67	11.725	2.80	2.1290
Ln(X30)	IN	28	10.459	.53728	.10154	.05137	9.5958	-1.61	11.725	2.36	2.1290
	OUT	13	10.243	.27008	.07491	.02637	9.7144	-1.96	10.715	1.75	1.0005
45 LnTcfm_P		22	9.3194	1.1840	.25243	.12705	5.0106	-3.64	10.645	1.12	5.6348
Ln(X12)	IN	15	9.3581	1.3887	.35857	.14840	5.0106	-3.13	10.645	0.93	5.6348
	OUT	7	9.2363	.62825	.23746	.06802	8.5172	-1.14	10.065	1.32	1.5476
46 LnTvel		77	5.9746	.50141	.05714	.08392	4.9663	-2.01	7.4073	2.86	2.4410
Ln(X31)	IN	59	6.0779	.48653	.06334	.08005	5.1619	-1.88	7.4073	2.73	2.2454
	OUT	18	5.6360	.39741	.09367	.07051	4.9663	-1.69	6.2710	1.60	1.3047
47 LnTvel_P		33	5.4636	.53530	.09318	.09798	4.0943	-2.56	6.7452	2.39	2.6509
Ln(X13)	IN	22	5.6103	.53021	.11304	.09451	4.0943	-2.86	6.7452	2.14	2.6509
	OUT	11	5.1701	.42948	.12949	.08307	4.4998	-1.56	5.8579	1.60	1.3581
48 LnNwj		80	4.3868	.41368	.04625	.09430	2.4849	-4.60	5.2679	2.13	2.7830
Ln(X24)	IN	62	4.3836	.44243	.05619	.10093	2.4849	-4.29	5.2679	2.00	2.7830
	OUT	18	4.3979	.30445	.07176	.06923	3.9512	-1.47	4.9836	1.92	1.0324
49 LnNwj_P		80	4.1557	.44199	.04942	.10636	2.1972	-4.43	5.0814	2.09	2.8842
Ln(X14)	IN	62	4.1187	.46798	.05943	.11362	2.1972	-4.11	5.0814	2.06	2.8842
	OUT	18	4.2831	.31592	.07446	.07376	3.8286	-1.44	4.9836	2.22	1.1550
50 LnPSI		78	4.8552	.48594	.05502	.10009	3.9120	-1.94	6.4135	3.21	2.5014
Ln(X25)	IN	60	4.7958	.47037	.06072	.09808	3.9120	-1.88	6.3969	3.40	2.4849
	OUT	18	5.0530	.49783	.11734	.09852	4.3014	-1.51	6.4135	2.73	2.1121
51 LnPSI_P		79	4.4274	.46165	.05194	.10427	2.9957	-3.10	6.2146	3.87	3.2189
Ln(X15)	IN	61	4.3911	.43921	.05624	.10002	2.9957	-3.18	6.2146	4.15	3.2189
	OUT	18	4.5507	.52553	.12387	.11548	3.6889	-1.64	5.6168	2.03	1.9279
52 LnH2O		78	9.2540	.58760	.06653	.06350	7.9010	-2.30	10.754	2.55	2.8526
Ln(X33)	IN	60	9.1950	.60729	.07840	.06605	7.9010	-2.13	10.754	2.57	2.8526
	OUT	18	9.4509	.48020	.11318	.05081	8.6958	-1.57	10.384	1.94	1.6879
53 LnH2O_P		79	8.5893	.63002	.07088	.07335	6.1092	-3.94	9.7819	1.89	3.6726
Ln(X32)	IN	61	8.5172	.63671	.08152	.07476	6.1092	-3.78	9.7819	1.99	3.6726
	OUT	18	8.8337	.55535	.13090	.06287	7.9230	-1.64	9.6222	1.42	1.6992
54 LnIcfm:		75	3.3596	1.0507	.12132	.31273	1.8084	-1.48	8.1771	4.59	6.3687
Ln(X28/X4)	IN	57	3.4826	1.0417	.13798	.29911	1.9650	-1.46	8.1771	4.51	6.2121
	OUT	18	2.9701	1.0096	.23796	.33991	1.8084	-1.15	6.1987	3.20	4.3903
55 LnLvel:		74	-1.4456	.98017	.11394	-.67802	-2.8302	-1.41	2.5884	4.12	5.4186
Ln(X29/X4)	IN	56	-1.2799	.92471	.12357	-.72246	-2.4833	-1.30	2.5884	4.18	5.0717
	OUT	18	-1.9611	.99360	.23419	-.50665	-2.8302	-0.87	1.3863	3.37	4.2165

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VARIABLE	QAS Compliance	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
56 LnTcfm:		41	2.9542	1.0651	.16634	.36055	1.3861	-1.47	6.9655	3.77	5.5794
Ln(X30/X4)	IN	28	3.1860	1.0813	.20435	.33940	1.3861	-1.66	6.9655	3.50	5.5794
	OUT	13	2.4547	.86891	.24099	.35397	1.6790	-0.89	5.1093	3.05	3.4303
57 LnTvel:		77	-1.5598	1.0016	.11414	-.64214	-3.1999	-1.64	2.6157	4.17	5.8156
Ln(X31/X4)	IN	59	-1.3723	.96806	.12603	-.70541	-2.8586	-1.54	2.6157	4.12	5.4742
	OUT	18	-2.1743	.87514	.20627	-.40250	-3.1999	-1.17	.69315	3.28	3.8930
58 LnNwj:		80	-3.1403	.89148	.09967	-.28389	-4.5131	-1.54	.37561	3.94	4.8887
Ln(X24/X4)	IN	62	-3.0613	.89015	.11305	-.29078	-4.5131	-1.63	.37561	3.86	4.8887
	OUT	18	-3.4124	.86536	.20397	-.25359	-4.4228	-1.17	-.57982	3.27	3.8430
59 LnH20:		78	1.7215	.96491	.10925	.56050	.09212	-1.69	4.9420	3.34	4.8499
Ln(X33/X4)	IN	60	1.7458	.96358	.12440	.55195	.09212	-1.72	4.9420	3.32	4.8499
	OUT	18	1.6406	.99283	.23401	.60516	.32208	-1.33	4.5850	2.97	4.2629
60 LnProd:		78	-.60890	.82326	.09322	-1.3521	-3.8309	-3.91	1.3700	2.40	5.2008
Ln(X4/X5)	IN	60	-.66634	.78035	.10074	-1.1711	-3.8309	-4.06	1.3700	2.61	5.2008
	OUT	18	-.41743	.95184	.22435	-2.2802	-3.7935	-3.55	.60614	1.08	4.3996
61 LnIcfm::		67	.57892	.42575	.05201	.73542	.02249	-1.31	1.8552	3.00	1.8327
Ln(X28/X10)	IN	52	.64757	.44903	.06227	.69341	.02249	-1.39	1.8552	2.69	1.8327
	OUT	15	.34090	.20442	.05278	.59966	.04814	-1.43	.69396	1.73	.64582
62 LnLvel::		38	.51113	.40929	.06640	.80076	.02794	-1.18	1.8104	3.17	1.7825
Ln(X29/X11)	IN	28	.43031	.33480	.06327	.77804	.02794	-1.20	1.3448	2.73	1.3169
	OUT	10	.73742	.52459	.16589	.71138	.16034	-1.10	1.8104	2.05	1.6501
63 LnTcfm::		21	.87199	.53946	.11772	.61866	-784E-6	-1.62	1.9530	2.00	1.9538
Ln(X30/X12)	IN	14	.85614	.57207	.15289	.66820	-784E-6	-1.50	1.9530	1.92	1.9538
	OUT	7	.90369	.50915	.19244	.56341	.21683	-1.35	1.5369	1.24	1.3200
64 LnTvel::		33	.59454	.60914	.10604	1.0246	.00853	-0.96	3.3130	4.46	3.3044
Ln(X31/X13)	IN	22	.57957	.70137	.14953	1.2101	.00853	-0.81	3.3130	3.90	3.3044
	OUT	11	.62447	.39096	.11788	.62607	.05827	-1.45	1.3143	1.76	1.2561
65 LnNwj::		80	.23114	.32269	.03608	1.3961	-.50353	-2.28	1.1436	2.83	1.6471
Ln(X24/X14)	IN	62	.26491	.34373	.04365	1.2975	-.50353	-2.24	1.1436	2.56	1.6471
	OUT	18	.11483	.20362	.04799	1.7732	-.04256	-0.77	.75633	3.15	.79889
66 LnPSI::		78	.43286	.50618	.05731	1.1694	-.39428	-1.63	2.6861	4.45	3.0804
Ln(X25/X15)	IN	60	.41202	.53350	.06888	1.2948	-.39428	-1.51	2.6861	4.26	3.0804
	OUT	18	.50233	.40748	.09604	.81118	-.30381	-1.98	1.2726	1.89	1.5764
67 LnH20::		78	.66665	.64635	.07318	.96955	-.50353	-1.81	3.4460	4.30	3.9495
Ln(X33/X32)	IN	60	.68149	.68104	.08792	.99934	-.50353	-1.74	3.4460	4.06	3.9495
	OUT	18	.61716	.52835	.12453	.85610	-.24010	-1.62	2.0289	2.67	2.2690

SIP Non-Longwall MMU's

VARIABLE	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
4 SIP_Prod		643	432.55	302.97	11.948	.70043	1.0000	-1.42	2112.0	5.54	2111.0
observed shift	IN	497	428.77	308.13	13.821	.71863	1.0000	-1.39	1680.0	4.06	1679.0
tonnage	OUT	136	458.28	287.55	24.657	.62745	45.000	-1.44	2112.0	5.75	2067.0
5 C9_Prod		613	620.45	477.26	19.276	.76921	8.0000	-1.28	5220.0	9.64	5212.0
maximum	IN	480	627.31	503.88	22.999	.80324	8.0000	-1.23	5220.0	9.11	5212.0
shift tonnage	OUT	123	600.48	374.38	33.757	.62347	60.000	-1.44	2500.0	5.07	2440.0
6 C10_Prod		608	515.33	369.38	14.980	.71678	8.0000	-1.37	3804.0	8.90	3796.0
average non-	IN	475	514.86	385.63	17.694	.74899	8.0000	-1.31	3804.0	8.53	3796.0
sample tonnage	OUT	123	520.99	307.93	27.765	.59104	60.000	-1.50	1741.0	3.96	1681.0
8 DO Dust		633	1.5077	1.9396	.07709	1.2864	.10000	-0.73	18.500	8.76	18.400
Concentration	IN	497	.86298	.48406	.02171	.56092	.10000	-1.58	2.0000	2.35	1.9000
	OUT	136	3.8640	3.1029	.26607	.80304	.70000	-1.02	18.500	4.72	17.800
11 CplnFcfm		611	4433.9	2130.7	86.197	.48053	1500.0	-1.38	20000.	7.31	18500.
DCP Face cfm	IN	469	4518.4	2312.2	106.77	.51172	1500.0	-1.31	20000.	6.70	18500.
	OUT	132	4128.9	1346.6	117.20	.32614	1500.0	-1.95	10000.	4.36	8500.0
12 Cpln_vel		469	58.770	17.630	.81407	.29998	1.0000	-3.28	300.00	13.68	299.00
DCP Mean Entry	IN	359	59.396	19.573	1.0330	.32954	25.000	-1.76	300.00	12.29	275.00
Air Velocity	OUT	103	56.505	8.6476	.85208	.15304	1.0000	-6.42	71.000	1.68	70.000
13 CplnLcfm		602	9585.0	3588.9	146.27	.37443	2100.0	-2.09	57600.	13.38	55500.
DCP Last Open	IN	463	9550.9	3195.1	148.49	.33453	2100.0	-2.33	39000.	9.22	36900.
Crosscut cfm	OUT	131	9741.2	4818.4	420.99	.49464	5000.0	-0.98	57600.	9.93	52600.
14 CplnScfm		166	5271.9	1317.4	102.25	.24990	1000.0	-3.24	8000.0	2.07	7000.0
DCP Scrubber	IN	133	5318.7	1357.5	117.71	.25524	1000.0	-3.18	8000.0	1.98	7000.0
cfm	OUT	30	5114.7	1191.8	217.59	.23302	3000.0	-1.77	7200.0	1.75	4200.0
15 plan_Nwj		539	23.842	11.276	.48570	.47295	1.0000	-2.03	120.00	8.53	119.00
DCP water jets	IN	417	24.223	11.568	.56647	.47754	1.0000	-2.01	120.00	8.28	119.00
total number	OUT	114	22.737	10.254	.96041	.45100	6.0000	-1.63	80.000	5.58	74.000
16 plan_psi		535	67.837	26.739	1.1560	.39416	15.000	-1.98	190.00	4.57	175.00
DCP Wt'd average	IN	413	67.855	26.603	1.3090	.39205	15.000	-1.99	190.00	4.59	175.00
water pressure	OUT	114	68.539	27.602	2.5852	.40272	20.000	-1.76	150.00	2.95	130.00
17 DepthCut		621	21.018	11.810	.47393	.56192	4.0000	-1.44	190.00	14.31	186.00
SIP Depth of	IN	477	21.021	9.9884	.45734	.47516	4.0000	-1.70	45.000	2.40	41.000
Cut observed	OUT	134	19.687	8.2055	.70884	.41681	6.0000	-1.67	40.000	2.48	34.000
18 LineCurt		604	19.871	11.779	.47928	.59278	0.0000	-1.69	74.000	4.60	74.000
SIP Line Curtain	IN	465	19.826	12.025	.55765	.60653	0.0000	-1.65	74.000	4.51	74.000
Distance obs'ved	OUT	132	19.614	10.611	.92356	.54099	8.0000	-1.09	50.000	2.86	42.000
19 Cob1Fcfm		609	7652.9	7014.1	284.23	.91653	1520.0	-0.87	74305.	9.50	72785.
1st observed	IN	467	8080.8	7638.0	353.44	.94520	1586.0	-0.85	74305.	8.67	72719.
Face CFM	OUT	133	6215.6	4182.1	362.63	.67284	1520.0	-1.12	37430.	7.46	35910.
20 Cob2Fcfm		568	7290.1	5597.3	234.86	.76780	52.000	-1.29	48350.	7.34	48298.
2nd observed	IN	440	7602.0	5909.5	281.73	.77737	1640.0	-1.01	48350.	6.90	46710.
Face cfm	OUT	123	6206.0	4238.6	382.19	.68299	52.000	-1.45	36500.	7.15	36448.

VARIABLE NO. NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
21 Cob1_vel		425	103.19	78.132	3.7899	.75718	6.0000	-1.24	670.00	7.25	664.00
1st observed	IN	322	107.14	82.021	4.5709	.76553	6.0000	-1.23	670.00	6.86	664.00
Mean entry air	OUT	97	89.577	63.838	6.4818	.71266	32.000	-0.90	622.00	8.34	590.00
22 Cob2_vel		401	101.64	78.010	3.8956	.76752	25.000	-0.98	858.00	9.70	833.00
2nd observed	IN	305	101.99	70.529	4.0385	.69155	25.000	-1.09	858.00	10.72	833.00
Mean entry air	OUT	93	101.39	99.976	10.367	.98608	47.000	-0.54	825.00	7.24	778.00
23 Cob1Lcfm		611	22048.	13183.	533.34	.59795	4950.0	-1.30	137597	8.76	132647
1st obs. Last	IN	468	22701.	14079.	650.79	.62018	4950.0	-1.26	137597	8.16	132647
Open X-cut cfm	OUT	133	20216.	9607.7	833.10	.47526	5215.0	-1.56	73500.	5.55	68285.
24 Cob2Lcfm		564	22864.	13463.	566.91	.58885	5160.0	-1.31	143318	8.95	138158
2nd obs. Last	IN	438	23457.	14373.	686.78	.61275	5160.0	-1.27	143318	8.34	138158
Open X-cut cfm	OUT	123	20738.	9521.5	858.52	.45912	7605.0	-1.38	57600.	3.87	49995.
25 Cob1Scfm		155	5417.9	2013.6	161.73	.37165	0.0000	-2.69	12518.	3.53	12518.
1st observed	IN	127	5483.5	2090.2	185.48	.38118	0.0000	-2.62	12518.	3.37	12518.
Scrubber cfm	OUT	26	5149.0	1678.9	329.25	.32606	0.0000	-3.07	8400.0	1.94	8400.0
26 Cob2Scfm		130	5431.2	2044.7	179.33	.37647	0.0000	-2.66	13112.	3.76	13112.
2nd observed	IN	110	5529.5	2100.5	200.27	.37987	0.0000	-2.63	13112.	3.61	13112.
Scrubber cfm	OUT	20	4890.5	1646.3	368.13	.33664	0.0000	-2.97	8400.0	2.13	8400.0
27 SIP_Nwj		540	26.456	12.508	.53825	.47279	1.0000	-2.04	100.00	5.88	99.000
Total Number of	IN	418	26.727	12.379	.60548	.46316	1.0000	-2.08	100.00	5.92	99.000
Water Jets	OUT	115	25.557	13.222	1.2329	.51735	3.0000	-1.71	98.000	5.48	95.000
28 SIP_psi		533	94.085	51.165	2.2162	.54382	20.000	-1.45	400.00	5.98	380.00
Wt'd Average	IN	415	95.494	52.862	2.5949	.55357	20.000	-1.43	400.00	5.76	380.00
Water Pressure	OUT	111	90.018	45.547	4.3231	.50598	23.000	-1.47	315.30	4.95	292.30
29 Dust_Std		643	1.8740	.30258	.01193	.16146	.40000	-4.87	2.0000	0.42	1.6000
Quartz-Adjusted	IN	497	1.9151	.23235	.01042	.12132	.60000	-5.66	2.0000	0.37	1.4000
MMU Dust Std.	OUT	136	1.7287	.44220	.03792	.25580	.40000	-3.00	2.0000	0.61	1.6000
31 SIP_Fcfm		621	7439.4	5914.2	237.33	.79498	1595.0	-0.99	55295.	8.09	53700.
Average Face	IN	478	7780.6	6347.9	290.35	.81586	1595.0	-0.97	55295.	7.49	53700.
Air cfm	OUT	134	6254.6	4029.9	348.13	.64431	1753.0	-1.12	36965.	7.62	35212.
32 SIP_Cvel		436	101.87	66.267	3.1736	.65050	6.0000	-1.45	587.50	7.33	581.50
Average Mean	IN	331	103.61	68.344	3.7565	.65960	6.0000	-1.43	587.50	7.08	581.50
Entry Air Vel.	OUT	99	95.450	59.695	5.9995	.62541	46.500	-0.82	450.50	5.95	404.00
33 SIP_Lcfm		622	22193.	13008.	521.57	.58611	4950.0	-1.33	140458	9.09	135508
Avg. Last Open	IN	478	22855.	13910.	636.24	.60862	4950.0	-1.29	140458	8.45	135508
X-cut Air cfm	OUT	134	20296.	9278.3	801.52	.45714	5215.0	-1.63	61050.	4.39	55835.
34 SIP_Scfm		159	5372.3	2081.9	165.10	.38753	0.0000	-2.58	11047.	2.73	11047.
Average Scrubber	IN	131	5440.4	2176.7	190.18	.40009	0.0000	-2.50	11047.	2.58	11047.
Air Velocity	OUT	26	5076.6	1613.8	316.50	.31789	0.0000	-3.15	8400.0	2.06	8400.0

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VARIABLE NO. NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	S M A L L E S T VALUE	S M A L L E S T Z-SCORE	L A R G E S T VALUE	L A R G E S T Z-SCORE	RANGE
35 Plan_H2O		535	1733.3	1445.6	62.497	.83397	15.000	-1.19	11470.	6.74	11455.
X15 * X16	IN	413	1778.6	1521.8	74.882	.85563	15.000	-1.16	11470.	6.37	11455.
	OUT	114	1611.4	1166.7	109.27	.72404	320.00	-1.11	7500.0	5.05	7180.0
36 SIP_H2O		533	2674.5	2408.6	104.33	.90058	20.000	-1.10	20402.	7.36	20382.
X27 * X28	IN	415	2751.1	2482.0	121.84	.90219	20.000	-1.10	20402.	7.11	20382.
	OUT	111	2436.3	2172.0	206.16	.89154	368.00	-0.95	14445.	5.53	14077.
37 Diff		633	-.36730	1.9829	.07881	-5.3985	-1.9000	-0.77	16.500	8.51	18.400
X8 - X29	IN	497	-1.0521	.50804	.02279	-.48288	-1.9000	-1.67	0.0000	2.07	1.9000
	OUT	136	2.1353	3.0696	.26321	1.4375	.10000	-0.66	16.500	4.68	16.400
38 LnConc		633	-.02872	.92659	.03683	-32.262	-2.3026	-2.45	2.9178	3.18	5.2204
Ln(X8)	IN	497	-.35366	.71553	.03210	-2.0232	-2.3026	-2.72	.69315	1.46	2.9957
	OUT	136	1.1587	.57368	.04919	.49509	-.35667	-2.64	2.9178	3.07	3.2744
39 LnStd		643	.60764	.22934	.00904	.37743	-.91629	-6.64	.69315	0.37	1.6094
Ln(X29)	IN	497	.63934	.15870	.00712	.24822	-.51083	-7.25	.69315	0.34	1.2040
	OUT	136	.49645	.36254	.03109	.73026	-.91629	-3.90	.69315	0.54	1.6094
40 LnRatio		633	-.63736	.96898	.03851	-1.5203	-2.9957	-2.43	2.5257	3.26	5.5215
Ln(X8/X29)	IN	497	-.99300	.71534	.03209	-.72038	-2.9957	-2.80	0.0000	1.39	2.9957
	OUT	136	.66228	.59014	.05060	.89107	.04879	-1.04	2.5257	3.16	2.4769
41 LnProd		643	5.7463	.96704	.03814	.16829	0.0000	-5.94	7.6554	1.97	7.6554
Ln(X4)	IN	497	5.7004	1.0340	.04638	.18139	0.0000	-5.51	7.4265	1.67	7.4265
	OUT	136	5.9466	.63568	.05451	.10690	3.8067	-3.37	7.6554	2.69	3.8487
42 LnC9prd		613	6.1017	.97338	.03931	.15952	2.0794	-4.13	8.5603	2.53	6.4808
Ln(X5)	IN	480	6.0738	1.0436	.04764	.17182	2.0794	-3.83	8.5603	2.38	6.4808
	OUT	123	6.2032	.66889	.06031	.10783	4.0943	-3.15	7.8240	2.42	3.7297
43 LnLiCurt		603	2.8355	.55251	.02250	.19485	0.0000	-5.13	4.3041	2.66	4.3041
Ln(X18)	IN	464	2.8262	.56671	.02631	.20052	0.0000	-4.99	4.3041	2.61	4.3041
	OUT	132	2.8511	.49211	.04283	.17261	2.0794	-1.57	3.9120	2.16	1.8326
44 LnFcfm		621	8.7425	.53929	.02164	.06169	7.3746	-2.54	10.920	4.04	3.5458
Ln(X31)	IN	478	8.7749	.56123	.02567	.06396	7.3746	-2.50	10.920	3.82	3.5458
	OUT	134	8.6243	.44605	.03853	.05172	7.4691	-2.59	10.518	4.24	3.0486
45 LnFcfm_P		611	8.3189	.37389	.01513	.04494	7.3132	-2.69	9.9035	4.24	2.5903
Ln(X11)	IN	469	8.3290	.39240	.01812	.04711	7.3132	-2.59	9.9035	4.01	2.5903
	OUT	132	8.2786	.30474	.02652	.03681	7.3132	-3.17	9.2103	3.06	1.8971
46 LnCvel		436	4.4949	.47191	.02260	.10499	1.7918	-5.73	6.3759	3.99	4.5841
Ln(X32)	IN	331	4.5053	.48884	.02687	.10850	1.7918	-5.55	6.3759	3.83	4.5841
	OUT	99	4.4519	.41302	.04151	.09277	3.8395	-1.48	6.1104	4.02	2.2709
47 LnCvel_P		469	4.0473	.25785	.01191	.06371	0.0000	-15.70	5.7038	6.42	5.7038
Ln(X12)	IN	359	4.0610	.18860	.00995	.04644	3.2189	-4.46	5.7038	8.71	2.4849
	OUT	103	3.9964	.42046	.04143	.10521	0.0000	-9.50	4.2627	0.63	4.2627
48 LnLcfm		622	9.8826	.48229	.01934	.04880	8.5071	-2.85	11.853	4.08	3.3455
Ln(X33)	IN	478	9.9023	.50125	.02293	.05062	8.5071	-2.78	11.853	3.89	3.3455
	OUT	134	9.8313	.41068	.03548	.04177	8.5593	-3.10	11.019	2.89	2.4602

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49 LnLcfm_P		602	9.1346	.22608	.00921	.02475	7.6497	-6.57	10.961	8.08	3.3116
Ln(X13)	IN	463	9.1330	.22643	.01052	.02479	7.6497	-6.55	10.571	6.35	2.9216
	OUT	131	9.1418	.23230	.02030	.02541	8.5172	-2.69	10.961	7.83	2.4441
50 LnScfm		153	8.5535	.45055	.03642	.05267	6.1738	-5.28	9.3099	1.68	3.1361
Ln(X34)	IN	126	8.5568	.48521	.04323	.05670	6.1738	-4.91	9.3099	1.55	3.1361
	OUT	25	8.5439	.24163	.04833	.02828	8.1315	-1.71	9.0360	2.04	.90446
51 LnScfm_P		166	8.5346	.28168	.02186	.03300	6.9078	-5.78	8.9872	1.61	2.0794
Ln(X14)	IN	133	8.5411	.29314	.02542	.03432	6.9078	-5.57	8.9872	1.52	2.0794
	OUT	30	8.5122	.24277	.04432	.02852	8.0064	-2.08	8.8818	1.52	.87547
52 LnNwj		540	3.1740	.46974	.02021	.14799	0.0000	-6.76	4.6052	3.05	4.6052
Ln(X27)	IN	418	3.1850	.47279	.02313	.14844	0.0000	-6.74	4.6052	3.00	4.6052
	OUT	115	3.1337	.46767	.04361	.14924	1.0986	-4.35	4.5850	3.10	3.4864
53 LnNwj_P		539	3.0699	.48322	.02081	.15741	0.0000	-6.35	4.7875	3.55	4.7875
Ln(X15)	IN	417	3.0853	.48208	.02361	.15625	0.0000	-6.40	4.7875	3.53	4.7875
	OUT	114	3.0389	.41049	.03845	.13508	1.7918	-3.04	4.3820	3.27	2.5903
54 LnPSI		533	4.4235	.48154	.02086	.10886	2.9957	-2.97	5.9915	3.26	2.9957
Ln(X28)	IN	415	4.4329	.49365	.02423	.11136	2.9957	-2.91	5.9915	3.16	2.9957
	OUT	111	4.3972	.44518	.04225	.10124	3.1355	-2.83	5.7535	3.05	2.6180
55 LnPSI_P		535	4.1430	.38907	.01682	.09391	2.7081	-3.69	5.2470	2.84	2.5390
Ln(X16)	IN	413	4.1431	.39151	.01926	.09450	2.7081	-3.67	5.2470	2.82	2.5390
	OUT	114	4.1537	.38440	.03600	.09255	2.9957	-3.01	5.0106	2.23	2.0149
56 LnH2O		533	7.6002	.76359	.03307	.10047	2.9957	-6.03	9.9234	3.04	6.9276
Ln(X36)	IN	415	7.6185	.78512	.03854	.10306	2.9957	-5.89	9.9234	2.94	6.9276
	OUT	111	7.5401	.69436	.06591	.09209	5.9081	-2.35	9.5781	2.94	3.6700
57 LnH2O_P		535	7.2123	.72217	.03122	.10013	2.7081	-6.24	9.3475	2.96	6.6394
Ln(X35)	IN	413	7.2278	.73692	.03626	.10196	2.7081	-6.13	9.3475	2.88	6.6394
	OUT	114	7.1925	.60671	.05682	.08435	5.7683	-2.35	8.9227	2.85	3.1543
58 LnProd:		613	-.37130	.58472	.02362	-1.5748	-6.2596	-10.07	1.2730	2.81	7.5325
Ln(X4/X5)	IN	480	-.38865	.61441	.02804	-1.5809	-6.2596	-9.56	1.2730	2.70	7.5325
	OUT	123	-.26131	.40840	.03682	-1.5629	-1.3361	-2.63	.98083	3.04	2.3170
59 LnFcfm:		621	2.9588	.87058	.03494	.29423	1.1077	-2.13	8.2990	6.13	7.1914
Ln(X31/X4)	IN	478	3.0280	.90884	.04157	.30014	1.1077	-2.11	8.2990	5.80	7.1914
	OUT	134	2.6834	.62513	.05400	.23296	1.4820	-1.92	4.8482	3.46	3.3662
60 LnCvel:		436	-1.2291	.90207	.04320	-.73393	-3.4606	-2.47	4.5539	6.41	8.0145
Ln(X32/X4)	IN	331	-1.1849	.94302	.05183	-.79589	-3.4606	-2.41	4.5539	6.09	8.0145
	OUT	99	-1.4225	.66810	.06715	-.46966	-2.6012	-1.76	.86650	3.43	3.4677
61 LnLcfm:		622	4.0969	.88566	.03551	.21618	1.8791	-2.50	10.177	6.86	8.2975
Ln(X33/X4)	IN	478	4.1500	.93905	.04295	.22628	1.8791	-2.42	10.177	6.42	8.2975
	OUT	134	3.8905	.62913	.05435	.16171	2.5294	-2.16	5.5157	2.58	2.9863
62 LnScfm:		153	2.2392	.72162	.05834	.32227	-.60614	-3.94	5.7881	4.92	6.3943
Ln(X34/X4)	IN	126	2.2790	.76097	.06779	.33390	-.60614	-3.79	5.7881	4.61	6.3943
	OUT	25	2.0357	.47432	.09486	.23300	1.2503	-1.66	3.1127	2.27	1.8624

SIP Non-Longwall MMU's

VARIABLE NO. NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
63 LnNwj:		540	-2.7972	.77684	.03343	-.27773	-6.2816	-4.49	3.4340	8.02	9.7156
Ln(X27/X4)	IN	418	-2.7672	.80117	.03919	-.28953	-5.5215	-3.44	3.4340	7.74	8.9554
	OUT	115	-2.9242	.67666	.06310	-.23140	-6.2816	-4.96	-1.2268	2.51	5.0549
64 LnH2O:		533	1.6312	.91999	.03985	.56398	-2.5257	-4.52	7.7231	6.62	10.249
Ln(X36/X4)	IN	415	1.6728	.94808	.04654	.56675	-2.5257	-4.43	7.7231	6.38	10.249
	OUT	111	1.4661	.80608	.07651	.54982	-1.0705	-3.15	4.4080	3.65	5.4785
65 LnFcfm::		598	.41928	.44949	.01838	1.0721	-1.0010	-3.16	2.7461	5.18	3.7472
Ln(X31/X11)	IN	458	.44266	.46603	.02178	1.0528	-1.0010	-3.10	2.7461	4.94	3.7472
	OUT	131	.33823	.37755	.03299	1.1162	-.30280	-1.70	1.7471	3.73	2.0499
66 LnCvel::		406	.44235	.43056	.02137	.97335	-.38077	-1.91	2.2815	4.27	2.6623
Ln(X32/X12)	IN	307	.44914	.43723	.02495	.97349	-.38077	-1.90	2.2815	4.19	2.6623
	OUT	93	.41390	.41006	.04252	.99073	-.21278	-1.53	2.0160	3.91	2.2288
67 LnLcfm::		591	.74924	.43618	.01794	.58215	-.44802	-2.74	2.7477	4.58	3.1957
Ln(X33/X13)	IN	453	.76753	.45287	.02128	.59003	-.44802	-2.68	2.7477	4.37	3.1957
	OUT	130	.70173	.37127	.03256	.52909	0.0000	-1.89	1.9145	3.27	1.9145
68 LnScfm::		139	.09158	.28192	.02391	3.0783	-.55637	-2.30	1.6192	5.42	2.1756
Ln(X34/X14)	IN	113	.10750	.29741	.02798	2.7666	-.55637	-2.23	1.6192	5.08	2.1756
	OUT	24	.02426	.19860	.04054	8.1873	-.26317	-1.45	.74194	3.61	1.0051
69 LnNwj::		537	.10126	.31718	.01369	3.1324	-2.5123	-8.24	2.0794	6.24	4.5917
Ln(X27/X15)	IN	417	.10265	.30167	.01477	2.9388	-1.9924	-6.94	2.0794	6.55	4.0719
	OUT	113	.09695	.37682	.03545	3.8867	-2.5123	-6.92	1.2528	3.07	3.7651
70 LnPSI::		527	.27621	.38671	.01685	1.4000	-1.0986	-3.56	1.9259	4.27	3.0245
Ln(X28/X16)	IN	410	.28750	.38127	.01883	1.3261	-.90387	-3.12	1.9259	4.30	2.8297
	OUT	110	.23545	.40966	.03906	1.7399	-1.0986	-3.26	1.3715	2.77	2.4701
71 LnH2O::		527	.37784	.51731	.02253	1.3691	-1.7469	-4.11	2.6835	4.46	4.4304
Ln(X36/X35)	IN	410	.39090	.50286	.02483	1.2864	-1.7469	-4.25	2.6835	4.56	4.4304
	OUT	110	.33136	.57323	.05466	1.7299	-1.2132	-2.69	2.2284	3.31	3.4416

Appendix A8. Dust Concentration, Production, Planned and Observed Controls for MIP Mines IN and OUT of Compliance

"Pln" or "plan" inside a variable name indicates that it refers to Dust Control Plan (DCP).
"Ob" or "SIP" inside a variable name indicates that it is an observed value.
Xj, where j is a number, refers to variable #j.
Single value is used for averages of observed air quantities if only one measurement is available.
$Ln(Xj) = Log_e(Xj)$

"Z-score" is distance from mean, in multiples of the standard deviation.

MIP Longwall MMU's

VARIABLE NO.	NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
4	MIP_Prod		35	2753.0	1543.3	260.87	.56060	533.00	-1.44	6560.0	2.47	6027.0
	observed shift	IN	23	2439.1	1379.4	287.61	.56552	533.00	-1.38	5380.0	2.13	4847.0
	tonnage	OUT	10	3182.6	1607.3	508.27	.50503	1525.0	-1.03	6560.0	2.10	5035.0
5	Dust_Std		35	1.9629	.13522	.02286	.06889	1.3000	-4.90	2.0000	0.27	.70000
	quartz-adjusted	IN	23	1.9739	.08643	.01802	.04379	1.7000	-3.17	2.0000	0.30	.30000
	MMU dust Std.	OUT	10	1.9300	.22136	.07000	.11469	1.3000	-2.85	2.0000	0.32	.70000
6	DO_Conc		33	1.8667	1.3266	.23093	.71066	.10000	-1.33	6.0000	3.12	5.9000
	DO dust	IN	23	1.1609	.49976	.10421	.43051	.10000	-2.12	2.0000	1.68	1.9000
	concentration	OUT	10	3.4900	1.2023	.38019	.34449	2.4000	-0.91	6.0000	2.09	3.6000
15	LplnIcfm		28	38730.	18457.	3488.1	.47656	11000.	-1.50	75000.	1.97	64000.
	DCP Intake	IN	19	40773.	19579.	4491.8	.48021	11000.	-1.52	75000.	1.75	64000.
	air cfm	OUT	7	36393.	17867.	6753.2	.49096	24000.	-0.69	75000.	2.16	51000.
16	Lpln_vel		18	275.56	169.35	39.916	.61457	100.00	-1.04	710.00	2.57	610.00
	DCP Midface	IN	9	328.89	206.30	68.768	.62727	110.00	-1.06	710.00	1.85	600.00
	air fpm	OUT	7	242.86	113.61	42.940	.46780	105.00	-1.21	405.00	1.43	300.00
17	LplnTcfm		6	27208.	19268.	7866.0	.70815	170.00	-1.40	51600.	1.27	51430.
	DCP Tailgate	IN	4	34520.	17382.	8691.1	.50354	15000.	-1.12	51600.	0.98	36600.
	air cfm	OUT	1	170.00	0.0000	0.0000	0.0000	170.00		170.00		0.0000
22	plan_Nwj		35	73.229	27.733	4.6877	.37872	22.000	-1.85	145.00	2.59	123.00
	DCP water jets	IN	23	74.043	20.718	4.3200	.27981	30.000	-2.13	114.00	1.93	84.000
	total number	OUT	10	70.400	39.984	12.644	.56795	22.000	-1.21	145.00	1.87	123.00
23	plan_psi		35	86.209	24.334	4.1131	.28227	44.800	-1.70	138.80	2.16	94.000
	DCP Wt'd average	IN	23	93.443	23.301	4.8585	.24935	44.800	-2.09	138.80	1.95	94.000
	water pressure	OUT	10	70.100	20.640	6.5269	.29444	45.000	-1.22	110.00	1.93	65.000
24	Lob1Icfm		33	57938.	31574.	5496.3	.54496	20790.	-1.18	148020	2.85	127230
	1st observed	IN	22	55575.	24507.	5224.8	.44097	20790.	-1.42	93917.	1.56	73127.
	Intake cfm	OUT	9	65904.	47739.	15913.	.72437	22400.	-0.91	148020	1.72	125620
25	Lob2Icfm		23	66225.	40282.	8399.4	.60827	24000.	-1.05	169175	2.56	145175
	2nd observed	IN	15	63855.	36539.	9434.4	.57222	24000.	-1.09	169175	2.88	145175
	Intake cfm	OUT	7	76342.	49935.	18874.	.65409	29088.	-0.95	148000	1.44	118912
26	Lob1_vel		32	605.81	415.89	73.520	.68651	181.00	-1.02	2048.0	3.47	1867.0
	1st observed	IN	20	650.65	476.04	106.45	.73164	181.00	-0.99	2048.0	2.94	1867.0
	Midface fpm	OUT	10	540.20	323.88	102.42	.59955	200.00	-1.05	1125.0	1.81	925.00
27	Lob2_vel		21	576.10	323.16	70.519	.56094	186.00	-1.21	1190.0	1.90	1004.0
	2nd observed	IN	12	620.08	351.97	101.60	.56761	186.00	-1.23	1190.0	1.62	1004.0
	Midface fpm	OUT	8	538.13	302.60	106.98	.56232	280.00	-0.85	1128.0	1.95	848.00
28	Lob1Tcfm		23	31342.	18538.	3865.4	.59146	185.00	-1.68	72500.	2.22	72315.
	1st observed	IN	16	29069.	16763.	4190.7	.57665	11980.	-1.02	72500.	2.59	60520.
	Tailgate cfm	OUT	6	36258.	24781.	10117.	.68347	185.00	-1.46	60933.	1.00	60748.
29	Lob2Tcfm		15	71398.	150454	38847.	2.1072	12300.	-0.39	611023	3.59	598723
	2nd observed	IN	10	32945.	21425.	6775.3	.65035	12300.	-0.96	71250.	1.79	58950.
	Tailgate cfm	OUT	4	177698	289331	144665	1.6282	21360.	-0.54	611023	1.50	589663

MIP Longwall MMU's

VARIABLE NO. NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
38 MIP_Nwj		35	88.343	29.809	5.0387	.33743	34.000	-1.82	154.00	2.20	120.00
Total number	IN	23	86.565	26.860	5.6006	.31028	37.000	-1.85	154.00	2.51	117.00
water jets	OUT	10	91.000	34.127	10.792	.37502	34.000	-1.67	145.00	1.58	111.00
39 MIP_psi		35	131.55	70.825	11.972	.53837	54.000	-1.10	390.00	3.65	336.00
Wt'd average	IN	23	145.08	74.615	15.558	.51429	70.000	-1.01	390.00	3.28	320.00
water pressure	OUT	10	96.520	58.277	18.429	.60379	54.000	-0.73	250.00	2.63	196.00
45 MIP_Icfm		34	61210.	36478.	6255.9	.59595	20790.	-1.11	169175	2.96	148385
Average Intake	IN	23	60514.	33680.	7022.8	.55657	20790.	-1.18	169175	3.23	148385
air cfm	OUT	9	65904.	47739.	15913.	.72437	22400.	-0.91	148020	1.72	125620
46 MIP_Lvel		33	614.73	412.53	71.813	.67109	181.00	-1.05	2048.0	3.47	1867.0
Average Midface	IN	21	662.52	467.17	101.94	.70513	181.00	-1.03	2048.0	2.97	1867.0
air velocity	OUT	10	540.20	323.88	102.42	.59955	200.00	-1.05	1125.0	1.81	925.00
47 MIP_Tcfm		24	32990.	19845.	4050.9	.60156	185.00	-1.65	72500.	1.99	72315.
Average Tailgate	IN	17	31528.	19137.	4641.5	.60699	11980.	-1.02	72500.	2.14	60520.
air cfm	OUT	6	36258.	24781.	10117.	.68347	185.00	-1.46	60933.	1.00	60748.
48 OP_Max_P		32	3909.7	2176.4	384.74	.55668	980.00	-1.35	9900.0	2.75	8920.0
Maximum shift	IN	22	3830.7	1980.5	422.24	.51700	980.00	-1.44	9073.0	2.65	8093.0
tonnage rprtd	OUT	9	3437.0	1818.0	605.99	.52894	1410.0	-1.11	7191.0	2.06	5781.0
49 OP_Av_P		32	3137.8	1757.0	310.60	.55994	928.00	-1.26	8640.0	3.13	7712.0
Average shift	IN	22	3009.5	1450.3	309.20	.48191	928.00	-1.44	5838.0	1.95	4910.0
tonnage rprtd	OUT	9	2840.3	1585.0	528.32	.55802	1311.2	-0.96	6225.0	2.14	4913.8
50 Plan_H20		35	6377.2	2864.0	484.10	.44910	1100.0	-1.84	12325.	2.08	11225.
X22 * X23	IN	23	6862.1	2448.4	510.52	.35679	2100.0	-1.95	11625.	1.95	9525.0
	OUT	10	5342.5	3744.9	1184.2	.70095	1100.0	-1.13	12325.	1.86	11225.
51 MIP_H20		35	11881.	8359.9	1413.1	.70364	2590.0	-1.11	45240.	3.99	42650.
X38 * X39	IN	23	12773.	8756.6	1825.9	.68554	2590.0	-1.16	45240.	3.71	42650.
	OUT	10	9223.1	7225.3	2284.8	.78340	2913.8	-0.87	26000.	2.32	23086.
52 Diff		33	-.09394	1.3363	.23261	-14.225	-1.9000	-1.35	4.0000	3.06	5.9000
X6 - X5	IN	23	-.81304	.51461	.10730	-.63294	-1.9000	-2.11	0.0000	1.58	1.9000
	OUT	10	1.5600	1.1578	.36612	.74216	.40000	-1.00	4.0000	2.11	3.6000
53 LnConc		33	.35162	.84326	.14679	2.3982	-2.3026	-3.15	1.7918	1.71	4.0943
Ln(X6)	IN	23	-.01745	.72180	.15051	-41.373	-2.3026	-3.17	.69315	0.98	2.9957
	OUT	10	1.2005	.32565	.10298	.27127	.87547	-1.00	1.7918	1.82	.91629
54 LnStd		35	.67155	.08082	.01366	.12035	.26236	-5.06	.69315	0.27	.43078
Ln(X5)	IN	23	.67902	.04682	.00976	.06896	.53063	-3.17	.69315	0.30	.16252
	OUT	10	.65007	.13623	.04308	.20956	.26236	-2.85	.69315	0.32	.43078
55 LnRatio		33	-.31862	.85507	.14885	-2.6837	-2.9957	-3.13	1.0986	1.66	4.0943
Ln(X6/X5)	IN	23	-.69646	.72877	.15196	-1.0464	-2.9957	-3.16	0.0000	0.96	2.9957
	OUT	10	.55042	.31209	.09869	.56701	.18232	-1.18	1.0986	1.76	.91629
56 LnProd		35	7.7474	.63600	.10750	.08209	6.2785	-2.31	8.7887	1.64	2.5102
Ln(X4)	IN	23	7.6132	.67021	.13975	.08803	6.2785	-1.99	8.5904	1.46	2.3119
	OUT	10	7.9599	.47740	.15097	.05998	7.3297	-1.32	8.7887	1.74	1.4590
57 LnMAXprd		32	8.1343	.53052	.09378	.06522	6.8876	-2.35	9.2003	2.01	2.3127
Ln(X48)	IN	22	8.1288	.51222	.10921	.06301	6.8876	-2.42	9.1131	1.92	2.2255
	OUT	9	8.0295	.49741	.16580	.06195	7.2513	-1.56	8.8806	1.71	1.6292
58 LnAVprd		32	7.9149	.52633	.09304	.06650	6.8330	-2.06	9.0642	2.18	2.2311
Ln(X49)	IN	22	7.8965	.49646	.10584	.06287	6.8330	-2.14	8.6721	1.56	1.8391
	OUT	9	7.8322	.50274	.16758	.06419	7.1787	-1.30	8.7363	1.80	1.5576
59 LnIcfm		34	10.876	.53706	.09210	.04938	9.9422	-1.74	12.039	2.17	2.0965
Ln(X45)	IN	23	10.879	.52036	.10850	.04783	9.9422	-1.80	12.039	2.23	2.0965
	OUT	9	10.892	.65741	.21914	.06036	10.017	-1.33	11.905	1.54	1.8883

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VARIABLE NO. NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
60 LnIcfm_P		28	10.450	.49941	.09438	.04779	9.3057	-2.29	11.225	1.55	1.9196
Ln(X15)	IN	19	10.484	.56091	.12868	.05350	9.3057	-2.10	11.225	1.32	1.9196
	OUT	7	10.426	.39180	.14808	.03758	10.086	-0.87	11.225	2.04	1.1394
61 LnLvel		33	6.2393	.59993	.10443	.09615	5.1985	-1.73	7.6246	2.31	2.4261
Ln(X46)	IN	21	6.2951	.63969	.13959	.10162	5.1985	-1.71	7.6246	2.08	2.4261
	OUT	10	6.1331	.59153	.18706	.09645	5.2983	-1.41	7.0255	1.51	1.7272
62 LnLvel_P		18	5.4561	.58592	.13810	.10739	4.6052	-1.45	6.5653	1.89	1.9601
Ln(X16)	IN	9	5.6293	.61141	.20380	.10861	4.7005	-1.52	6.5653	1.53	1.8648
	OUT	7	5.3776	.54520	.20607	.10138	4.6540	-1.33	6.0039	1.15	1.3499
63 LnTcfm		24	10.088	1.1713	.23909	.11611	5.2204	-4.16	11.191	0.94	5.9710
Ln(X47)	IN	17	10.202	.56618	.13732	.05550	9.3910	-1.43	11.191	1.75	1.8003
	OUT	6	9.6878	2.2374	.91343	.23095	5.2204	-2.00	11.018	0.59	5.7972
64 LnTcfm_P		6	9.4338	2.1540	.87938	.22833	5.1358	-2.00	10.851	0.66	5.7155
Ln(X17)	IN	4	10.335	.57641	.28821	.05577	9.6158	-1.25	10.851	0.90	1.2355
	OUT	1	5.1358	0.0000	0.0000	0.0000	5.1358		5.1358		0.0000
65 LnNwj		35	4.4204	.36700	.06204	.08302	3.5264	-2.44	5.0370	1.68	1.5106
Ln(X38)	IN	23	4.4139	.31976	.06668	.07244	3.6109	-2.51	5.0370	1.95	1.4260
	OUT	10	4.4298	.45567	.14410	.10287	3.5264	-1.98	4.9767	1.20	1.4504
66 LnNwj_P		35	4.2149	.42280	.07147	.10031	3.0910	-2.66	4.9767	1.80	1.8857
Ln(X22)	IN	23	4.2612	.31702	.06610	.07440	3.4012	-2.71	4.7362	1.50	1.3350
	OUT	10	4.0998	.60313	.19073	.14711	3.0910	-1.67	4.9767	1.45	1.8857
67 LnPSI		35	4.7711	.45268	.07652	.09488	3.9890	-1.73	5.9661	2.64	1.9772
Ln(X39)	IN	23	4.8854	.41145	.08579	.08422	4.2485	-1.55	5.9661	2.63	1.7177
	OUT	10	4.4592	.45205	.14295	.10137	3.9890	-1.04	5.5215	2.35	1.5325
68 LnPSI_P		35	4.4143	.30408	.05140	.06888	3.8022	-2.01	4.9330	1.71	1.1308
Ln(X23)	IN	23	4.5035	.27714	.05779	.06154	3.8022	-2.53	4.9330	1.55	1.1308
	OUT	10	4.2111	.29412	.09301	.06984	3.8067	-1.38	4.7005	1.66	.89382
69 LnH2O		35	9.1915	.62382	.10544	.06787	7.8594	-2.14	10.720	2.45	2.8603
Ln(X51)	IN	23	9.2993	.55046	.11478	.05919	7.8594	-2.62	10.720	2.58	2.8603
	OUT	10	8.8890	.71672	.22665	.08063	7.9772	-1.27	10.166	1.78	2.1886
70 LnH2O_P		35	8.6292	.57745	.09761	.06692	7.0031	-2.82	9.4194	1.37	2.4163
Ln(X50)	IN	23	8.7646	.39955	.08331	.04559	7.6497	-2.79	9.3609	1.49	1.7112
	OUT	10	8.3109	.83406	.26375	.10036	7.0031	-1.57	9.4194	1.33	2.4163
71 LnIcfm:		34	3.1280	.88345	.15151	.28243	1.9459	-1.34	4.8147	1.91	2.8688
Ln(X45/X4)	IN	23	3.2659	.84851	.17693	.25981	1.9840	-1.51	4.8147	1.83	2.8307
	OUT	9	2.9075	1.0096	.33652	.34723	1.9459	-0.95	4.5754	1.65	2.6294
72 LnLvel:		33	-1.5249	.90572	.15767	-.59396	-2.9026	-1.52	-.08499	1.59	2.8176
Ln(46/X4)	IN	21	-1.3318	.89028	.19427	-.66848	-2.7951	-1.64	-.08499	1.40	2.7101
	OUT	10	-1.8268	.92236	.29168	-.50492	-2.9026	-1.17	-.41285	1.53	2.4898
73 LnTcfm:		24	2.4413	1.4066	.28711	.57615	-2.8505	-3.76	4.3366	1.35	7.1871
Ln(X47/X4)	IN	17	2.6352	.86212	.20910	.32716	1.4441	-1.38	4.3366	1.97	2.8925
	OUT	6	1.8291	2.4731	1.0096	1.3521	-2.8505	-1.89	3.6034	0.72	6.4539
74 LnNwj:		35	-3.3270	.76018	.12849	-.22849	-4.7539	-1.88	-1.5336	2.36	3.2203
Ln(X38/X4)	IN	23	-3.1993	.77794	.16221	-.24316	-4.2466	-1.35	-1.5336	2.14	2.7130
	OUT	10	-3.5301	.59972	.18965	-.16989	-4.7330	-2.01	-2.7972	1.22	1.9359
75 LnH2O:		35	1.4441	.90102	.15230	.62393	-.44254	-2.09	3.1844	1.93	3.6270
Ln(X51/X4)	IN	23	1.6861	.84837	.17690	.50316	.12786	-1.84	3.1844	1.77	3.0566
	OUT	10	.92914	.78062	.24685	.84015	-.44254	-1.76	1.9883	1.36	2.4309
76 LnProd:		32	-.41134	.50970	.09010	-1.2391	-1.4917	-2.12	1.2658	3.29	2.7575
Ln(X4/X48)	IN	22	-.52101	.37401	.07974	-.71786	-1.4917	-2.60	.01117	1.42	1.5028
	OUT	9	-.02581	.54731	.18244	-21.205	-.49674	-0.86	1.2658	2.36	1.7626

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VARIABLE NO.	NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
77	LnIcfm::		28	.39182	.33098	.06255	.84471	-.19163	-1.76	1.2502	2.59	1.4419
	Ln(X59/X60)	IN	19	.35463	.34295	.07868	.96709	0.0000	-1.03	1.2502	2.61	1.2502
		OUT	7	.44917	.34729	.13126	.77318	-.19163	-1.85	.75518	0.88	.94681
78	LnLvel::		18	.55890	.53174	.12533	.95141	-.09038	-1.22	1.5707	1.90	1.6611
	Ln(X61/X62)	IN	9	.50000	.46554	.15518	.93109	0.0000	-1.07	1.2130	1.53	1.2130
		OUT	7	.44192	.54901	.20751	1.2423	-.09038	-0.97	1.2321	1.44	1.3225
79	LnTcfm::		6	.30687	.40681	.16608	1.3257	0.0000	-0.75	1.0647	1.86	1.0647
	Ln(X63/X64)	IN	4	.33305	.50381	.25190	1.5127	0.0000	-0.66	1.0647	1.45	1.0647
		OUT	1	.08456	0.0000	0.0000	0.0000	.08456		.08456		0.0000
80	LnNwj::		35	.20556	.29153	.04928	1.4182	0.0000	-0.71	1.4733	4.35	1.4733
	Ln(X65/X66)	IN	23	.15277	.19314	.04027	1.2643	0.0000	-0.79	.78330	3.26	.78330
		OUT	10	.32998	.45315	.14330	1.3733	0.0000	-0.73	1.4733	2.52	1.4733
81	LnPSI::		35	.35674	.41103	.06948	1.1522	-.70412	-2.58	1.1787	2.00	1.8828
	Ln(X67/X68)	IN	23	.38194	.35349	.07371	.92550	0.0000	-1.08	1.1787	2.25	1.1787
		OUT	10	.24814	.53593	.16947	2.1597	-.70412	-1.78	1.1394	1.66	1.8436
82	LnH2O::		35	.56230	.51151	.08646	.90967	-.41643	-1.91	1.9620	2.74	2.3784
	Ln(X69/X70)	IN	23	.53471	.44786	.09339	.83758	0.0000	-1.19	1.9620	3.19	1.9620
		OUT	10	.57812	.68060	.21523	1.1773	-.41643	-1.46	1.6022	1.50	2.0186

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VARIABLE NO.	NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
4	MIP_Prod		674	430.57	281.54	10.845	.65389	8.0000	-1.50	1710.0	4.54	1702.0
	observed shift	IN	514	434.41	287.15	12.666	.66101	8.0000	-1.48	1710.0	4.44	1702.0
	tonnage	OUT	96	477.05	256.43	26.172	.53753	90.000	-1.51	1470.0	3.87	1380.0
5	Dust_Std		674	1.8588	.30193	.01163	.16244	.40000	-4.83	2.0000	0.47	1.6000
	Quartz-Adjusted	IN	514	1.8782	.27894	.01230	.14852	.60000	-4.58	2.0000	0.44	1.4000
	MMU Dust Std.	OUT	96	1.7469	.38742	.03954	.22178	.40000	-3.48	2.0000	0.65	1.6000
6	DO_Conc		610	1.1149	.99082	.04012	.88870	.10000	-1.02	7.4000	6.34	7.3000
	DO dust	IN	514	.78560	.46619	.02056	.59342	.10000	-1.47	2.0000	2.60	1.9000
	concentration	OUT	96	2.8781	1.1796	.12039	.40984	.80000	-1.76	7.4000	3.83	6.6000
18	CplnFcfm		652	4563.7	3110.4	121.81	.68156	3.0000	-1.47	48000.	13.96	47997.
	DCP Face air cfm	IN	494	4591.5	3366.5	151.47	.73319	3.0000	-1.36	48000.	12.89	47997.
		OUT	95	4376.6	1608.6	165.04	.36754	3000.0	-0.86	14000.	5.98	11000.
19	Cpln_vel		498	63.201	30.973	1.3879	.49008	11.000	-1.69	387.00	10.45	376.00
	DCP Mean Entry	IN	379	63.966	33.859	1.7392	.52933	11.000	-1.56	387.00	9.54	376.00
	air velocity	OUT	74	60.946	21.733	2.5264	.35660	20.000	-1.88	210.00	6.86	190.00
20	CplnLcfm		635	10486.	5594.4	222.01	.53351	3000.0	-1.34	68900.	10.44	65900.
	DCP Last Open	IN	480	10589.	5956.0	271.85	.56248	5000.0	-0.94	68900.	9.79	63900.
	X-cut cfm	OUT	93	10050.	3620.0	375.37	.36018	3000.0	-1.95	25056.	4.15	22056.
21	CplnScfm		152	5191.0	1397.8	113.37	.26927	2.0000	-3.71	9000.0	2.73	8998.0
	DCP Scrubber	IN	116	5232.2	1452.5	134.86	.27762	2.0000	-3.60	9000.0	2.59	8998.0
	air cfm	OUT	21	5092.3	781.09	170.45	.15339	3800.0	-1.65	6500.0	1.80	2700.0
22	plan_Nwj		585	23.562	10.468	.43278	.44425	1.0000	-2.16	126.00	9.79	125.00
	DCP water jets	IN	440	23.382	10.839	.51671	.46355	1.0000	-2.07	126.00	9.47	125.00
	total number	OUT	88	23.386	9.4801	1.0106	.40537	2.0000	-2.26	62.000	4.07	60.000
23	plan_psi		584	71.072	28.558	1.1817	.40182	20.000	-1.79	250.00	6.27	230.00
	DCP Wt'd average	IN	439	71.085	29.228	1.3950	.41117	20.000	-1.75	250.00	6.12	230.00
	watter pressure	OUT	88	70.839	24.726	2.6358	.34904	30.000	-1.65	150.00	3.20	120.00
30	Cob1Fcfm		636	7017.2	4583.1	181.73	.65313	1798.0	-1.14	38057.	6.77	36259.
	1st observed	IN	486	7159.0	4735.4	214.80	.66146	1798.0	-1.13	38057.	6.52	36259.
	Face air cfm	OUT	90	6291.5	3519.5	370.99	.55941	2368.0	-1.11	20600.	4.07	18232.
31	Cob2Fcfm		513	7006.1	5506.9	243.13	.78601	0.0000	-1.27	62000.	9.99	62000.
	2nd observed	IN	388	7254.2	5908.5	299.96	.81450	0.0000	-1.23	62000.	9.27	62000.
	Face air cfm	OUT	81	6168.4	4101.4	455.71	.66490	3018.0	-0.77	31400.	6.15	28382.
32	Cob1_vel		485	93.493	46.563	2.1143	.49804	0.0000	-2.01	403.00	6.65	403.00
	1st obs. Mean	IN	370	95.495	48.088	2.5000	.50357	0.0000	-1.99	403.00	6.39	403.00
	Entry air vel.	OUT	71	87.451	45.850	5.4414	.52429	30.000	-1.25	292.00	4.46	262.00
33	Cob2_vel		398	101.63	80.166	4.0184	.78880	0.0000	-1.27	781.00	8.47	781.00
	2nd obs. Mean	IN	306	103.62	78.153	4.4677	.75422	0.0000	-1.33	778.00	8.63	778.00
	Entry air vel.	OUT	61	92.607	97.197	12.445	1.0496	31.000	-0.63	781.00	7.08	750.00
34	Cob1Lcfm		628	21381.	11723.	467.80	.54829	2870.0	-1.58	84335.	5.37	81465.
	1st obs. Last	IN	476	21347.	11553.	529.53	.54119	2870.0	-1.60	84335.	5.45	81465.
	open X-cut cfm	OUT	92	20980.	10965.	1143.2	.52264	8883.0	-1.10	68764.	4.36	59881.
35	Cob2Lcfm		504	21435.	11885.	529.40	.55446	101.00	-1.80	84335.	5.29	84234.
	2nd obs. Last	IN	382	21493.	11856.	606.61	.55163	1900.0	-1.65	84335.	5.30	82435.
	open X-cut cfm	OUT	78	21136.	10797.	1222.5	.51083	9000.0	-1.12	68764.	4.41	59764.
36	Cob1Scfm		146	5305.8	1681.5	139.16	.31692	0.0000	-3.16	14720.	5.60	14720.
	1st observed	IN	109	5478.6	1791.8	171.62	.32705	0.0000	-3.06	14720.	5.16	14720.
	Scrubber air cfm	OUT	20	4766.5	1342.8	300.26	.28172	0.0000	-3.55	6215.0	1.08	6215.0
37	Cob2Scfm		101	5221.8	1251.2	124.50	.23961	500.00	-3.77	8775.0	2.84	8275.0
	2nd observed	IN	76	5264.1	1363.2	156.37	.25897	500.00	-3.49	8775.0	2.58	8275.0
	Scrubber air cfm	OUT	15	5035.3	755.50	195.07	.15004	3300.0	-2.30	6215.0	1.56	2915.0

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38	MIP_Nwj		585	26.063	11.534	.47687	.44254	1.0000	-2.17	126.00	8.66	125.00
	Total number of	IN	440	25.966	11.882	.56645	.45760	1.0000	-2.10	126.00	8.42	125.00
	water jets	OUT	88	25.341	10.099	1.0766	.39854	5.0000	-2.01	62.000	3.63	57.000
39	MIP_psi		577	92.683	47.066	1.9594	.50781	25.000	-1.44	372.90	5.95	347.90
	Wt'd average	IN	435	95.685	49.356	2.3665	.51582	25.000	-1.43	372.90	5.62	347.90
	water pressure	OUT	86	85.997	37.079	3.9983	.43117	30.000	-1.51	210.00	3.34	180.00
45	MIP_Fcfm		651	6961.6	4565.1	178.92	.65575	1575.0	-1.18	38057.	6.81	36482.
	Average Face	IN	496	7111.8	4724.3	212.13	.66429	1575.0	-1.17	38057.	6.55	36482.
	air cfm	OUT	93	6229.7	3481.4	361.00	.55883	2368.0	-1.11	20600.	4.13	18232.
46	MIP_Cvel		501	94.281	52.066	2.3261	.55224	0.0000	-1.81	604.00	9.79	604.00
	Average Mean	IN	381	96.677	55.122	2.8240	.57017	0.0000	-1.75	604.00	9.20	604.00
	Entry air Vel.	OUT	75	87.067	44.829	5.1764	.51488	30.000	-1.27	292.00	4.57	262.00
47	MIP_Lcfm		644	21234.	11648.	459.00	.54856	2870.0	-1.58	84335.	5.42	81465.
	Avg. Last Open	IN	488	21176.	11498.	520.50	.54299	2870.0	-1.59	84335.	5.49	81465.
	X-cut air cfm	OUT	94.	20994.	10854.	1119.5	.51702	8883.0	-1.12	68764.	4.40	59881.
48	MIP_Scfm		146	5305.8	1681.5	139.16	.31692	0.0000	-3.16	14720.	5.60	14720.
	Average Scrubber	IN	109	5478.6	1791.8	171.62	.32705	0.0000	-3.06	14720.	5.16	14720.
	air cfm	OUT	20	4766.5	1342.8	300.26	.28172	0.0000	-3.55	6215.0	1.08	6215.0
49	OP_Max_P		638	533.89	358.99	14.212	.67240	10.000	-1.46	3696.0	8.81	3686.0
	maximum shift	IN	490	530.08	344.09	15.544	.64913	10.000	-1.51	2000.0	4.27	1990.0
	tonnage rprtd	OUT	88	557.19	448.40	47.800	.80475	54.000	-1.12	3696.0	7.00	3642.0
50	OP_Av_P		638	454.38	283.61	11.228	.62417	9.6000	-1.57	1640.0	4.18	1630.4
	average shift	IN	490	454.38	289.50	13.078	.63713	9.6000	-1.54	1640.0	4.10	1630.4
	tonnage rprtd	OUT	88	457.77	252.50	26.917	.55159	50.750	-1.61	1186.2	2.88	1135.4
51	Plan_H20		584	1715.4	1197.0	49.533	.69779	50.000	-1.39	11252.	7.97	11202.
	X22 * X23	IN	439	1706.1	1240.7	59.217	.72723	50.000	-1.33	11252.	7.69	11202.
		OUT	88	1678.7	988.29	105.35	.58873	150.00	-1.55	6200.0	4.57	6050.0
52	MIP_H20		577	2530.7	2032.5	84.614	.80313	60.000	-1.22	18000.	7.61	17940.
	X38 * X39	IN	435	2600.1	2100.6	100.72	.80790	60.000	-1.21	18000.	7.33	17940.
		OUT	86	2260.2	1640.3	176.87	.72570	400.00	-1.13	10540.	5.05	10140.
53	Diff		610	-.74262	1.0237	.04145	-1.3785	-1.9000	-1.13	5.4000	6.00	7.3000
	X6 - X5	IN	514	-1.0926	.51442	.02269	-.47082	-1.9000	-1.57	0.0000	2.12	1.9000
		OUT	96	1.1312	1.0385	.10599	.91797	.10000	-0.99	5.4000	4.11	5.3000
54	LnConc		610	-.24533	.89211	.03612	-3.6364	-2.3026	-2.31	2.0015	2.52	4.3041
	Ln(X6)	IN	514	-.47346	.76297	.03365	-1.6115	-2.3026	-2.40	.69315	1.53	2.9957
		OUT	96	.97612	.41130	.04198	.42136	-.22314	-2.92	2.0015	2.49	2.2246
55	LnStd		674	.60149	.21022	.00810	.34950	-.91629	-7.22	.69315	0.44	1.6094
	Ln(X5)	IN	514	.61510	.19013	.00839	.30910	-.51083	-5.92	.69315	0.41	1.2040
		OUT	96	.52442	.28467	.02905	.54283	-.91629	-5.06	.69315	0.59	1.6094
56	LnRatio		610	-.84616	.91305	.03697	-1.0791	-2.9957	-2.35	1.3083	2.36	4.3041
	Ln(X6/X5)	IN	514	-1.0886	.77295	.03409	-.71006	-2.9957	-2.47	0.0000	1.41	2.9957
		OUT	96	.45170	.31295	.03194	.69282	.04879	-1.29	1.3083	2.74	1.2595
57	LnProd		674	5.8137	.81314	.03132	.13987	2.0794	-4.59	7.4442	2.01	5.3648
	Ln(X4)	IN	514	5.8202	.81388	.03590	.13984	2.0794	-4.60	7.4442	2.00	5.3648
		OUT	96	6.0350	.52624	.05371	.08720	4.4998	-2.92	7.2930	2.39	2.7932
58	LnMAXprd		638	6.0449	.77512	.03069	.12823	2.3026	-4.83	8.2150	2.80	5.9124
	Ln(X49)	IN	490	6.0361	.78718	.03556	.13041	2.3026	-4.74	7.6009	1.99	5.2983
		OUT	88	6.1073	.66093	.07046	.10822	3.9890	-3.21	8.2150	3.19	4.2260
59	LnAVprd		638	5.8975	.75646	.02995	.12827	2.2618	-4.81	7.4025	1.99	5.1407
	Ln(X50)	IN	490	5.8895	.77358	.03495	.13135	2.2618	-4.69	7.4025	1.96	5.1407
		OUT	88	5.9619	.60998	.06502	.10231	3.9269	-3.34	7.0785	1.83	3.1516

VARIABLE NO. NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
60 LnFcfm		651	8.7092	.49084	.01924	.05636	7.3620	-2.74	10.547	3.74	3.1848
Ln(X45)	IN	496	8.7263	.49957	.02243	.05725	7.3620	-2.73	10.547	3.64	3.1848
	OUT	93	8.6367	.41448	.04298	.04799	7.7698	-2.09	9.9330	3.13	2.1632
61 LnFcfm_P		652	8.3215	.47485	.01860	.05706	1.0986	-15.21	10.779	5.18	9.6803
Ln(X18)	IN	494	8.3167	.50923	.02291	.06123	1.0986	-14.17	10.779	4.84	9.6803
	OUT	95	8.3356	.29539	.03031	.03544	8.0064	-1.11	9.5468	4.10	1.5404
62 LnCvel		499	4.4552	.40660	.01820	.09126	3.4012	-2.59	6.4036	4.79	3.0024
Ln(X46)	IN	379	4.4785	.41104	.02111	.09178	3.4340	-2.54	6.4036	4.68	2.9696
	OUT	75	4.3702	.42070	.04858	.09627	3.4012	-2.30	5.6768	3.11	2.2756
63 LnCvel_P		498	4.0992	.25712	.01152	.06273	2.3979	-6.62	5.9584	7.23	3.5605
Ln(X19)	IN	379	4.1066	.26322	.01352	.06410	2.3979	-6.49	5.9584	7.04	3.5605
	OUT	74	4.0710	.26296	.03057	.06459	2.9957	-4.09	5.3471	4.85	2.3514
64 LnLcfm		644	9.8434	.47644	.01877	.04840	7.9621	-3.95	11.343	3.15	3.3805
Ln(X47)	IN	488	9.8413	.47684	.02159	.04845	7.9621	-3.94	11.343	3.15	3.3805
	OUT	94	9.8496	.43724	.04510	.04439	9.0919	-1.73	11.138	2.95	2.0465
65 LnLcfm_P		635	9.1928	.30860	.01225	.03357	8.0064	-3.84	11.140	6.31	3.1340
Ln(X20)	IN	480	9.2000	.30663	.01400	.03333	8.5172	-2.23	11.140	6.33	2.6232
	OUT	93	9.1729	.27073	.02807	.02951	8.0064	-4.31	10.129	3.53	2.1225
66 LnScfm		143	8.5639	.25514	.02134	.02979	7.6962	-3.40	9.5970	4.05	1.9007
Ln(X48)	IN	107	8.5900	.26949	.02605	.03137	7.6962	-3.32	9.5970	3.74	1.9007
	OUT	19	8.5091	.15971	.03664	.01877	8.1017	-2.55	8.7347	1.41	.63304
67 LnScfm_P		152	8.4577	.76518	.06206	.09047	.69315	-10.15	9.1050	0.85	8.4118
Ln(X21)	IN	116	8.4450	.86488	.08030	.10241	.69315	-8.96	9.1050	0.76	8.4118
	OUT	21	8.5241	.15540	.03391	.01823	8.2428	-1.81	8.7796	1.64	.53680
68 LnNwj		585	3.1723	.44180	.01827	.13927	0.0000	-7.18	4.8363	3.77	4.8363
Ln(X38)	IN	440	3.1651	.45326	.02161	.14321	0.0000	-6.98	4.8363	3.69	4.8363
	OUT	88	3.1502	.42489	.04529	.13488	1.6094	-3.63	4.1271	2.30	2.5177
69 LnNwj_P		585	3.0764	.43749	.01809	.14221	0.0000	-7.03	4.8363	4.02	4.8363
Ln(X22)	IN	440	3.0656	.44737	.02133	.14593	0.0000	-6.85	4.8363	3.96	4.8363
	OUT	88	3.0670	.44719	.04767	.14581	.69315	-5.31	4.1271	2.37	3.4340
70 LnPSI		577	4.4224	.45299	.01886	.10243	3.2189	-2.66	5.9213	3.31	2.7024
Ln(X39)	IN	435	4.4496	.46503	.02230	.10451	3.2189	-2.65	5.9213	3.16	2.7024
	OUT	86	4.3787	.37877	.04084	.08650	3.4012	-2.58	5.3471	2.56	1.9459
71 LnPSI_P		584	4.1892	.38684	.01601	.09234	2.9957	-3.09	5.5215	3.44	2.5257
Ln(X23)	IN	439	4.1865	.39418	.01881	.09415	2.9957	-3.02	5.5215	3.39	2.5257
	OUT	88	4.2043	.33361	.03556	.07935	3.4012	-2.41	5.0106	2.42	1.6094
72 LnH2O		577	7.5980	.68549	.02854	.09022	4.0943	-5.11	9.7981	3.21	5.7038
Ln(X52)	IN	435	7.6176	.70383	.03375	.09239	4.0943	-5.01	9.7981	3.10	5.7038
	OUT	86	7.5309	.60952	.06573	.08094	5.9915	-2.53	9.2629	2.84	3.2715
73 LnH2O_P		584	7.2653	.61067	.02527	.08405	3.9120	-5.49	9.3283	3.38	5.4163
Ln(X51)	IN	439	7.2517	.62438	.02980	.08610	3.9120	-5.35	9.3283	3.33	5.4163
	OUT	88	7.2713	.57341	.06113	.07886	5.0106	-3.94	8.7323	2.55	3.7217
74 LnProd:		638	-.21596	.45262	.01792	-2.0959	-2.3693	-4.76	1.3987	3.57	3.7680
Ln(X4/X49)	IN	490	-.19867	.40502	.01830	-2.0386	-1.7918	-3.93	1.2411	3.55	3.0329
	OUT	88	-.05998	.46793	.04988	-7.8008	-1.8764	-3.88	1.3987	3.12	3.2751
75 LnFcfm:		651	2.8699	.74270	.02911	.25879	1.1537	-2.31	5.7372	3.86	4.5835
Ln(X45/X4)	IN	496	2.8787	.74725	.03355	.25958	1.1537	-2.31	5.2983	3.24	4.1446
	OUT	93	2.6027	.52250	.05418	.20075	1.4492	-2.21	4.5214	3.67	3.0722
76 LnCvel:		499	-1.3675	.82846	.03709	-.60583	-3.3707	-2.42	1.3297	3.26	4.7005
Ln(X46/X4)	IN	379	-1.3439	.85117	.04372	-.63334	-3.2720	-2.27	1.3297	3.14	4.6017
	OUT	75	-1.6016	.66228	.07647	-.41351	-3.3707	-2.67	.12222	2.60	3.4930

MIP Non-Longwall MMU's

VARIABLE NO.	NAME	QAS COMPLIANCE	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION	ST.ERR OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE
77	LnLcfm: Ln(X47/X4)		644	3.9974	.76658	.03021	.19177	1.9532	-2.67	7.9456	5.15	5.9924
		IN	488	3.9911	.77890	.03526	.19516	1.9532	-2.62	7.9456	5.08	5.9924
		OUT	94	3.8132	.58228	.06006	.15270	2.5341	-2.20	5.2341	2.44	2.7000
78	LnScfm: Ln(X48/X4)		143	2.2790	.57944	.04846	.25425	1.1632	-1.93	3.8808	2.76	2.7176
		IN	107	2.2691	.60563	.05855	.26691	1.1632	-1.83	3.8808	2.66	2.7176
		OUT	19	2.1191	.31521	.07231	.14875	1.4417	-2.15	2.5847	1.48	1.1430
79	LnNwj: Ln(X38/X4)		585	-2.8208	.71230	.02945	-.25252	-5.5616	-3.85	-.27193	3.58	5.2897
		IN	440	-2.8558	.71239	.03396	-.24946	-5.5616	-3.80	-.27193	3.63	5.2897
		OUT	88	-2.9379	.55968	.05966	-.19051	-5.2842	-4.19	-.76214	3.89	4.5221
80	LnH2O: Ln(X52/X4)		577	1.6037	.84534	.03519	.52712	-1.6292	-3.82	4.7387	3.71	6.3679
		IN	435	1.5963	.86735	.04159	.54335	-1.6292	-3.72	4.7387	3.62	6.3679
		OUT	86	1.4404	.69662	.07512	.48362	-.90219	-3.36	3.5946	3.09	4.4968
81	LnFcfm:: Ln(X45/X18)		636	.38377	.43283	.01716	1.1278	-.79851	-2.73	2.1941	4.18	2.9926
		IN	482	.40540	.45748	.02084	1.1285	-.79851	-2.63	2.1941	3.91	2.9926
		OUT	92	.29944	.32145	.03351	1.0735	-.64203	-2.93	1.4586	3.61	2.1006
82	LnCvel:: Ln(X46/X19)		459	.36580	.38285	.01787	1.0466	-.66036	-2.68	2.3092	5.08	2.9696
		IN	346	.38734	.39346	.02115	1.0158	-.66036	-2.66	2.3092	4.88	2.9696
		OUT	69	.29850	.37174	.04475	1.2454	-.48343	-2.10	1.5824	3.45	2.0658
83	LnLcfm:: Ln(X47/X20)		618	.64699	.47786	.01922	.73858	-1.1429	-3.75	2.2376	3.33	3.3805
		IN	464	.63693	.47057	.02185	.73881	-1.1429	-3.78	2.2376	3.40	3.3805
		OUT	92	.67311	.48689	.05076	.72335	-.01309	-1.41	2.0335	2.79	2.0465
84	LnScfm:: Ln(X48/X21)		132	.01887	.12745	.01109	6.7546	-.40923	-3.36	.78016	5.97	1.1894
		IN	100	.01841	.12265	.01226	6.6610	-.40923	-3.49	.62861	4.98	1.0378
		OUT	18	-.01154	.04524	.01066	-3.9190	-.14108	-2.86	.07146	1.83	.21254
85	LnNwj:: Ln(X38/X22)		584	.08956	.26064	.01079	2.9102	-1.0986	-4.56	1.2730	4.54	2.3716
		IN	439	.09109	.26407	.01260	2.8991	-1.0986	-4.51	1.2730	4.48	2.3716
		OUT	88	.08316	.27656	.02948	3.3258	-1.0986	-4.27	.92954	3.06	2.0281
86	LnPSI:: Ln(X39/X23)		575	.23546	.38045	.01587	1.6158	-.88730	-2.95	1.7636	4.02	2.6509
		IN	433	.26385	.40127	.01928	1.5208	-.88730	-2.87	1.7636	3.74	2.6509
		OUT	86	.17857	.32556	.03511	1.8232	-.78846	-2.97	1.3863	3.71	2.1748
87	LnH2O:: Ln(X52/X51)		575	.32516	.49992	.02085	1.5375	-1.2572	-3.17	2.5520	4.45	3.8093
		IN	433	.35574	.52130	.02505	1.4654	-.97827	-2.56	2.5520	4.21	3.5303
		OUT	86	.25894	.46174	.04979	1.7832	-1.2572	-3.28	2.3158	4.45	3.5730

Appendix A9. Summary Data for Individual SIP MMU's.

SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	--DO-- DUST CONC OCC	SIP	OPER	SD	--SIP-- HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
0100323	0050	CON >20	708	-9	776	101	YY	2.0	36	0.9	1.0	0.7	NDO 14	1.3	1.000	YYY	40	40	B	4575	-9	4000	-9	22	70.0	22	50.0
0100323	0090	CON >20	681	1050	718	124	NY	1.7	35	0.8	1.4	0.8	NDO 50	1.5	1.133	YYY	40	40	B	5930	-9	4000	300	56	40.0	44	50.0
0100515	0100	CON >20	725	620	458	1	YY	1.7	36	0.5	0.3	0.3	DO 36	0.5	0.367	YYY	40	40	B	6300	-9	5400	-9	21	85.0	21	85.0
0100515	0210	CON >20	70	420	388	1	YY	1.3	36	0.4	1.9	1.3	NDO 12	1.2	0.667	YYY	40	40	B	6420	352	6000	300	20	122.8	20	80.0
0100515	0290	CON >20	560	688	423	1	YY	2.0	36	0.4	0.8	0.5	NDO 41	1.1	0.517	YYY	40	40	B	6800	-9	6800	-9	26	116.2	23	80.0
0100758	0040	CON	200	-9	158	10	YY	2.0	36	0.2	1.5	0.6	NDO 50	1.1	0.360	YYY	10	10	E	30900	303	14000	60	36	200.0	24	70.0
0100758	0060	CON	210	200	240	14	NY	2.0	36	1.7	1.6	1.2	DO 36	1.7	1.500	YYY	10	10	E	29195	224	14000	60	46	90.0	17	70.0
0100758	0170	LNGWALL	3615	2700	2967	368	YY	2.0	44	1.5	1.1	0.4	DO 44	1.5	1.020	YYY	-9	-9	E	149940	0	25000	-9	60	350.0	40	120.0
0100758	0190	LNGWALL	504	1800	2215	150	YY	2.0	44	1.2	1.7	1.0	DO 44	1.2	0.740	YYN	-9	-9	E	60301	589	25000	400	128	80.9	65	120.0
0100759	0130	LNGWALL	2036	-9	3587	738	YY	2.0	44	1.0	1.6	0.6	DO 44	1.0	0.660	YYY	-9	-9	E	40000	408	17500	350	45	80.0	45	70.0
0100759	0140	CON >20	594	1190	1234	233	YY	2.0	36	0.4	1.7	0.4	NDO 14	1.2	0.686	YYY	40	40	B	14900	-9	5000	-9	33	200.0	33	70.0
0100821	0170	CON >20	165	530	515	138	YY	1.3	36	0.5	0.9	1.2	NDO 14	1.5	1.067	YYY	40	40	B	5393	-9	4900	-9	22	100.0	14	100.0
0100851	0080	CON	450	550	417	113	YY	2.0	36	1.1	0.5	0.4	DO 36	1.1	0.520	YYY	10	10	E	47500	339	15000	60	25	250.0	25	100.0
0100851	0160	LNGWALL	1368	1796	2217	674	YY	2.0	60	1.2	1.3	0.9	DO 60	1.2	1.080	YYY	-9	-9		65840	660	-9	400	85	125.0	79	60.0
0100851	0170	CON	592	-9	559	131	YY	1.7	36	1.2	1.1	1.1	NDO 12	1.5	1.171	YYY	10	10	E	8720	290	3000	-9	23	140.0	23	100.0
0101247	0030	CON	385	660	498	128	YY	2.0	36	0.5	0.9	0.6	NDO 35	0.7	0.480	YYY	10	10	E	48350	308	18000	60	32	400.0	15	58.3
0101247	0100	CON >20	490	556	445	88	YY	2.0	36	0.4	0.9	0.4	NDO 14	0.5	0.440	YNY	5	10	E	33600	-9	18000	-9	8	290.0	14	125.0
0101247	0200	LNGWALL	2000	-9	2421	956	YY	2.0	44	1.1	1.6	0.3	DO 44	1.1	0.680	YNY	-9	-9	E	60836	1126	25000	-9	54	50.0	66	50.0
0101247	0230	LNGWALL	600	-9	-9	-9	YY	2.0	60	0.7	-9.0	-9.0	DO 60	0.7	0.360	YYY	-9	-9	E	57720	-9	25000	-9	75	200.0	75	30.0
0101322	0060	CON	280	384	398	80	YY	2.0	36	0.7	0.5	0.3	DO 36	0.7	0.560	YYY	10	10	E	27325	195	20000	60	24	340.0	24	125.0
0101322	0110	LNGWALL	3200	2060	2033	184	YY	2.0	44	1.8	0.9	0.4	DO 44	1.8	1.060	YYY	-9	-9	E	159820	1370	25000	-9	49	150.0	49	150.0
0101401	0050	CON >20	400	192	470	109	YY	2.0	36	0.4	0.8	0.2	DO 36	0.4	0.280	YYY	10	10	E	34000	253	17000	60	26	150.0	18	125.0
0101401	0090	CON	366	-9	359	85	YY	2.0	36	1.2	0.7	0.5	DO 36	1.2	0.950	YYY	10	10	E	31500	262	17000	60	50	200.0	50	125.0
0101401	0150	LNGWALL	573	1620	2316	399	YY	2.0	44	1.5	1.3	0.3	NDO 41	1.8	1.420	YYY	-9	-9	E	147764	1490	25000	400	111	120.0	111	120.0
0102776	0020	CON >20	183	754	231	40	YY	2.0	36	1.1	0.9	0.5	DO 36	1.1	0.780	YYY	40	40	B	3728	858	4000	60	20	100.0	18	60.0
0102876	0010	CON (?)	70	-9	-9	-9	NN	2.0	70	3.0	-9.0	-9.0	NDO 46	4.4	2.520	Y	-9	-9		6200	-9	4500	-9	16	-9.0	-9	-9.0
0500259	0010	CONVEN	20	60	36	5	YY	2.0	38	0.4	0.5	0.6	DO 38	0.4	0.200	Y	10	10	E	4400	66	3000	60	-9	-9.0	-9	-9.0
0502820	0090	LNGWALL	1080	2310	2153	645	YY	2.0	44	0.7	3.5	1.0	NDO 41	2.4	1.200	YYY	-9	-9	E	54085	305	45000	150	38	120.0	38	120.0
0502820	0120	CON >20	480	270	283	84	YY	2.0	36	0.5	0.9	0.4	NDO 46	1.4	0.900	YYY	10	10	E	12000	60	12000	60	68	125.0	68	125.0
0503455	0100	CON >20	1425	375	1075	390	YY	2.0	36	1.4	1.0	0.4	NDO 4	1.4	1.260	YYY	-9	30	E	-9	315	8000	60	48	160.0	48	120.0
0503505	0030	CON	430	-9	680	181	NY	2.0	36	1.2	1.3	0.3	NDO 48	3.1	1.740	YYY	20	20	E	11035	75	7000	60	55	200.0	55	140.9
0503505	0060	LNGWALL	4323	4100	4013	973	NN	1.7	44	2.0	1.7	0.4	NDO 41	2.1	1.800	YYN	-9	-9	E	65600	418	50000	62	81	73.8	76	100.0
0503672	0010	CON >20	444	1200	678	238	YY	2.0	36	1.2	1.4	0.2	DO 36	1.2	1.180	YYY	40	40	E	14580	75	14580	81	57	130.0	57	130.0
0503672	0040	CON >20	574	1200	1253	321	YY	2.0	36	1.7	1.3	0.8	NDO 12	1.7	1.400	YYY	29	40	E	14000	80	14000	80	57	190.0	57	190.0
0503793	0010	CON	120	120	125	21	YY	1.5	36	0.2	0.2	0.1	NDO 73	1.1	0.425	YYY	15	15	E	7400	113	6000	60	12	75.0	12	50.0
0504184	0030	CON	2112	1150	1533	443	NN	2.0	36	2.5	1.3	0.7	DO 36	2.5	2.320	YYY	30	20	E	36500	185	10000	60	50	150.0	50	150.0
1100585	0040	CON >20	826	958	1009	200	YY	2.0	36	1.0	1.3	0.4	DO 36	1.0	0.780	YYY	20	30	B	5665	-9	5500	60	40	122.5	36	100.0
1100585	0110	CON >20	952	1002	1109	261	YY	2.0	36	1.5	1.4	0.3	DO 36	1.5	0.960	YYY	30	34	B	6400	-9	5500	60	42	110.0	36	100.0
1100589	0010	CON >20	520	365	412	69	NY	2.0	36	3.2	1.1	0.8	DO 36	3.2	1.520	NYY	-9	35	B	5200	-9	6500	60	46	130.0	25	80.0
1100589	0060	LNGWALL	1475	2310	2537	428	YY	2.0	44	1.2	2.0	1.0	NDO 41	1.7	1.160	YY	-9	-9		24000	320	20000	300	60	-9.0	50	125.0
1100590	0020	CON	560	-9	615	183	YY	2.0	36	1.4	1.5	1.1	DO 36	1.4	1.100	YYY	25	25	B	7240	-9	5700	-9	46	100.0	25	80.0
1100590	0050	LNGWALL	3100	-9	1641	1591	YY	2.0	44	1.7	1.9	0.6	NDO 41	2.2	1.580	YYY	-9	-9		38010	360	20000	250	80	135.0	50	125.0
1100598	0020	CON >20	896	1000	979	94	YY	2.0	36	1.5	1.5	0.5	DO 36	1.5	1.360	YYY	35	35	B	7350	-9	5500	-9	30	102.2	25	100.0

SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	--DO-- DUST CONC OCC	SIP	OPER	SD	--SIP-- HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
1100598	0070	CON >20	1120	875	915	36	YY	2.0	36	2.0	1.7	0.5	DO 36	2.0	1.460	YYY	35	35	B	6125	-9	5500	-9	36	151.8	25	100.0
1100599	0140	CON >20	240	-9	363	96	YY	2.0	36	0.8	3.0	1.6	NDO 46	0.8	0.720	YYY	20	35	B	7475	-9	6000	-9	28	170.0	28	100.0
1100599	0170	LNGWALL	2619	2306	3229	713	YY	1.7	44	0.7	3.0	2.1	NDO 41	1.0	0.520	YYY	-9	-9		63105	710	20000	375	93	175.0	67	100.0
1100599	0180	CON >20	210	225	289	94	YY	2.0	36	0.4	3.4	1.3	NDO 50	0.5	0.420	YYY	35	35	B	13500	-9	5000	-9	34	110.0	25	100.0
1100601	0100	CON >20	315	-9	301	93	YY	2.0	36	1.1	0.7	0.4	DO 36	1.1	0.660	YYY	35	-9	E	6500	-9	6000	-9	37	150.0	31	80.0
1100601	0150	CON >20	208	135	279	71	YY	2.0	36	2.4	1.6	2.6	DO 36	2.4	0.900	YYY	35	40	E	7041	68	6000	-9	31	160.0	26	80.0
1100601	0180	LNGWALL	1500	1735	1562	753	YY	1.5	44	0.8	1.0	1.0	NDO 41	1.0	0.640	YYY	-9	-9		57300	290	21000	250	85	108.2	46	60.0
1100601	0190	LNGWALL	2640	1997	2508	603	YY	2.0	44	2.2	0.6	0.2	NDO 41	2.2	1.840	YYY	-9	-9		38370	295	21000	250	98	214.2	46	60.0
1100612	0010	CON	657	940	882	192	NN	2.0	36	2.6	1.4	0.5	NDO 46	3.1	2.800	YYY	25	25	B	5978	-9	5000	60	45	130.0	25	100.0
1100784	0030	CON >20	396	337	335	62	YY	2.0	36	0.8	0.4	0.4	NDO 73	1.2	0.940	YY	30	40	B	6700	-9	-9	-9	40	80.0	25	80.0
1100784	0060	LNGWALL	850	100	1095	218	YY	2.0	44	1.2	0.8	0.8	NDO 41	1.5	1.260	YYY	-9	-9		32340	320	20000	275	36	100.0	36	100.0
1101008	0020	CON >20	1215	486	948	148	YY	2.0	36	1.7	1.4	0.3	DO 36	1.7	1.200	YYY	30	35	B	6200	-9	5500	90	40	83.0	25	75.0
1101008	0040	CON >20	1008	720	942	150	YY	2.0	36	1.7	1.1	0.3	DO 36	1.7	0.960	YYY	25	35	C	7900	-9	5500	60	34	130.0	25	75.0
1101008	0050	CON >20	969	-9	833	180	YY	2.0	36	0.9	1.2	0.7	NDO 46	1.0	0.860	YYY	35	35	C	5720	-9	5500	60	82	132.6	50	75.0
1102236	0030	CON >20	960	1040	1093	152	YY	2.0	36	1.0	1.1	0.3	DO 36	1.0	0.520	YYY	40	40	B	12951	-9	6000	60	42	120.0	42	100.0
1102236	0100	CON >20	1164	840	1037	143	YY	2.0	36	0.8	0.8	0.4	NDO 50	1.0	0.860	YY	37	40	B	7488	-9	6000	60	36	200.0	25	-9.0
1102371	0010	CON >20	583	560	527	108	YY	2.0	36	1.1	1.1	0.4	DO 36	1.1	0.760	YYY	40	40	B	6980	-9	6500	-9	48	116.4	40	85.0
1102371	0020	CON >20	1095	623	980	260	NN	2.0	36	2.1	0.9	0.1	NDO 49	2.8	2.100	YYY	30	40	B	6716	-9	6500	-9	98	147.4	80	85.0
1102371	0050	CON >20	1277	700	984	216	YY	2.0	36	0.8	1.7	0.8	DO 36	0.8	0.560	YNY	40	40	B	7520	-9	6500	60	100	154.7	120	85.0
1102392	0050	LNGWALL	2205	-9	1474	999	YY	2.0	44	1.2	0.6	0.2	DO 44	1.2	0.980	YYY	-9	-9		36230	445	23500	300	71	150.0	50	125.0
1102392	0060	CON	310	390	379	116	YY	2.0	36	1.5	0.9	0.3	NDO 73	2.2	1.380	YYY	25	25	B	6400	-9	5000	-9	48	80.0	32	80.0
1102408	0010	CON	647	525	707	77	YY	2.0	36	1.1	1.2	0.4	DO 36	1.1	0.880	YY	30	30	B	-9	-9	5500	60	46	125.9	25	100.0
1102408	0030	CON >20	765	629	603	151	YY	2.0	36	2.4	1.1	0.3	DO 36	2.4	1.760	YYY	25	35	B	6165	-9	5750	60	46	119.0	25	100.0
1102440	0030	CON (?)	900	820	1168	171	NN	2.0	36	1.4	1.7	1.0	NDO 53	5.6	2.620	YYY	30	35	C	5940	-9	5500	60	45	120.0	25	75.0
1102440	0060	CON (?)	756	900	1171	291	YY	2.0	36	0.7	2.6	0.7	NDO 50	1.2	0.800	YYY	25	35	C	6900	-9	5500	60	40	100.5	25	75.0
1102636	0040	CON	780	1200	1202	167	YY	2.0	36	1.5	1.6	0.7	DO 36	1.5	0.920	YYY	25	25	B	5100	-9	5000	-9	33	210.0	30	75.0
1102664	0040	CON >20	1420	1048	1059	178	YY	2.0	36	0.7	2.0	0.5	NDO 50	1.4	1.160	YYY	27	35	B	7119	-9	5500	60	88	153.1	40	100.0
1102752	0610	LNGWALL	1925	3600	2720	930	YY	2.0	44	0.7	1.4	0.7	NDO 41	0.7	0.660	YYY	-9	-9		40600	520	20000	200	78	600.0	35	500.0
1102752	0620	CON >20	560	264	419	118	YY	2.0	36	1.4	2.1	1.3	NDO 50	1.7	1.280	YYY	30	30	B	5370	-9	5000	-9	28	104.8	20	75.0
1102790	0010	CON >20	1082	1176	1410	295	YY	2.0	36	1.0	0.9	0.3	NDO 50	1.4	1.060	YYY	40	40	B	10950	-9	6000	60	48	136.0	25	100.0
1102846	0010	CON >20	420	592	741	169	YY	1.7	36	1.8	0.9	0.7	NDO 46	2.2	1.480	YYY	30	40	B	6500	-9	5700	-9	31	118.1	18	100.0
1500672	0120	CONVEN	953	873	947	123	YY	2.0	38	0.5	3.0	1.6	NDO 43	1.2	0.700	YYY	10	10	C	5800	88	3000	60	6	120.0	6	25.0
1501362	0030	CON >20	252	480	400	66	YY	2.0	36	0.8	0.9	0.8	DO 36	0.8	0.333	YYY	22	25	B	4800	-9	4200	60	34	115.0	34	115.0
1502055	0320	CON	460	230	227	28	YY	1.7	36	1.0	0.3	0.1	NDO 12	1.1	0.883	YYY	10	10	E	11904	99	6000	60	29	270.0	29	80.0
1502055	0400	LNGWALL	1109	1200	1060	169	YY	2.0	41	1.2	0.9	0.3	NDO 44	1.7	1.140	YYY	-9	-9		34754	270	32000	200	115	95.0	114	75.0
1502085	0010	CON >20	800	810	623	189	NY	1.5	36	1.5	0.1	0.1	DO 36	1.5	1.386	YYY	35	30	B	6150	-9	5200	-9	26	100.0	24	100.0
1502091	0020	CON	574	1210	1064	227	YY	2.0	36	0.4	2.6	0.9	NDO 46	0.5	0.350	YYY	20	26	E	8243	42	8000	40	22	55.0	17	45.0
1502096	0030	CON >20	602	-9	487	97	YY	2.0	36	1.2	1.7	0.8	NDO 35	1.4	1.140	YYY	40	45	E	7100	61	4500	60	16	165.0	16	60.0
1502132	0270	CONVEN	972	1100	1267	157	YY	2.0	38	0.7	2.0	0.5	NDO 43	1.2	0.860	YYY	10	10	B	5120	65	3000	60	15	60.0	13	60.0
1502132	0290	CONVEN	880	1333	1214	123	YY	2.0	38	1.2	1.2	0.5	DO 38	1.2	0.820	YYY	10	10	B	4800	60	3000	60	15	60.0	8	32.5
1502132	0300	CONVEN	892	1350	1167	180	YY	2.0	38	0.2	1.9	0.9	NDO 46	1.4	0.620	YYY	10	10	B	3560	-9	3000	60	15	60.0	13	60.0
1502132	0310	CONVEN	1064	1100	1177	92	NN	2.0	38	0.7	1.7	1.2	NDO 43	7.6	2.400	YYY	11	10	B	3660	-9	3000	60	15	60.0	13	60.0
1502132	0320	CONVEN	936	1150	1246	107	YY	2.0	38	0.8	2.0	1.2	NDO 43	1.0	0.800	NYY	10	10	B	3910	-9	5000	60	15	60.0	13	60.0

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AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	OPERATOR AVERAGE SD	DUST COMP SA	DO DUST STD	DO DUST CONC OCC	DO DUST CONC SIP	DO DUST CONC OPER	DO DUST CONC SD	SIP HIGHEST EXPOSURE OCC	SIP HIGHEST EXPOSURE CONC	SIP AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	LINE CURTAIN SPE	M F V	AIR QUANTITY MEASURED CFM	AIR QUANTITY MEASURED FPM	AIR QUANTITY SPECIFIED CFM	AIR QUANTITY SPECIFIED FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WATER PRESSURE MEASURED WTD AVG PSI	WATER PRESSURE SPECIFIED TOTAL SPRAY	WATER PRESSURE SPECIFIED WTD PSI
1502410	0020	CON	456	840	852	109	YY	2.0	36	0.4	0.1	0.0	NDO 46	1.5	0.483	YYY	20	20	E	10896	116	6000	60	22	135.7	18	50.0
1502502	0080	CON >20	690	1200	1159	166	NN	2.0	36	3.1	0.7	0.3	DO 36	3.1	2.217	YYY	30	34	C	6050	-9	4500	60	19	154.7	18	90.0
1502502	0130	LNGWALL	5000	-9	8200	2315	NN	2.0	60	3.3	0.9	0.6	NDO 60	4.5	2.650	YNY	-9	-9		28350	290	23500	200	115	200.0	120	125.8
1502539	0020	CONVEN	400	350	431	49	YY	2.0	38	1.8	0.2	0.1	NDO 43	2.1	1.183	Y	10	10	E	5600	60	3000	60	-9	-9.0	-9	-9.0
1502705	0040	CON >20	650	1080	1091	121	YY	2.0	36	0.7	1.6	0.3	NDO 12	1.0	0.800	YYY	10	10	B	5700	-9	5000	-9	24	150.0	21	65.0
1502705	0310	CON >20	1325	960	1272	263	YY	2.0	36	0.8	1.0	0.2	NDO 36	0.8	0.720	YYY	10	10	B	6300	-9	5000	-9	24	150.0	21	65.0
1502705	0320	CON >20	1020	1325	1113	151	YY	2.0	36	1.0	1.2	0.4	NDO 12	1.1	0.860	YY	-9	10	B	8250	-9	-9	-9	24	100.0	21	65.0
1502705	0350	CON >20	950	989	996	156	YY	2.0	36	1.4	1.7	1.3	NDO 35	1.7	1.240	YYY	-9	10	B	5700	-9	5000	-9	22	110.0	16	65.0
1502709	0440	CON >20	960	700	1161	173	NY	2.0	35	1.2	1.4	0.4	NDO 36	2.5	1.300	YYY	10	10	B	5800	-9	5000	-9	46	130.0	43	112.3
1502709	0480	CON >20	1000	1300	1223	287	YY	2.0	36	0.4	1.6	0.5	NDO 14	1.4	0.800	YYY	10	10	B	6800	-9	5000	-9	44	230.0	44	90.0
1502709	0540	CON >20	1170	780	1106	201	YY	2.0	36	1.7	1.4	0.5	DO 36	1.7	1.320	YYY	10	10	B	7000	-9	5000	-9	21	120.0	24	90.0
1502709	0550	CON >20	1250	1100	1256	316	YY	2.0	35	2.0	1.9	0.5	NDO 72	2.2	1.600	YYY	10	10	B	7200	-9	5000	-9	26	225.8	26	122.3
1502709	0560	CON >20	1250	-9	1007	304	YY	2.0	36	1.5	2.7	0.7	NDO 35	2.4	1.680	YYY	10	10	B	7000	-9	5000	-9	32	125.0	33	79.1
1503178	0010	CON >20	430	712	966	181	YY	2.0	36	1.3	1.7	1.3	DO 36	1.3	1.020	YYY	10	10	B	5100	-9	5000	-9	19	100.0	19	100.0
1503178	0020	CON (?)	780	853	1061	194	YY	2.0	36	1.2	3.1	1.4	NDO 54	2.1	1.650	YYY	10	-9	B	9000	-9	5000	-9	19	160.0	19	100.0
1503178	0030	CON >20	670	754	883	155	NY	2.0	36	3.0	2.1	1.3	NDO 35	3.7	2.060	YYY	10	10	B	6250	-9	5000	-9	19	100.0	19	100.0
1503178	0040	CON (?)	440	712	1102	175	YY	2.0	36	1.0	1.9	0.2	NDO 50	1.4	1.100	YYY	10	-9	B	8250	-9	5000	-9	19	160.0	19	100.0
1503752	0030	CON >20	1152	600	654	24	YY	2.0	36	0.8	0.7	0.3	DO 36	0.8	0.640	YYY	34	34	E	7280	-9	6800	-9	20	113.0	18	50.0
1504020	0030	CON	400	420	605	91	YY	2.0	36	1.2	0.4	0.4	DO 36	1.2	0.860	YYY	16	20	E	5040	72	4800	60	26	71.5	26	50.0
1504020	0130	CON	433	6	734	170	YY	2.0	36	1.4	1.3	0.6	DO 36	1.4	0.880	YYY	18	20	C	7964	-9	7000	60	26	118.0	26	50.0
1504020	0140	LNGWALL	1300	4559	4896	1441	YY	2.0	44	1.7	1.3	1.1	DO 44	1.7	1.300	YYY	0	-9	B	22089	440	20000	330	120	136.3	114	100.0
1504020	0160	CON	504	1000	734	202	YY	2.0	36	1.2	2.0	1.3	NDO 50	1.4	0.960	YYY	29	40	B	8904	-9	6700	60	31	100.0	26	50.0
1504079	0010	CONVEN	450	-9	117	11	YY	2.0	34	0.2	0.4	0.3	DO 34	0.2	0.133	Y	10	10	E	3250	61	3000	60	-9	-9.0	-9	-9.0
1504244	0020	CON	604	800	467	101	YY	1.7	36	1.5	0.4	0.2	DO 36	1.5	0.760	YYY	-9	20	E	16929	-9	5760	60	14	59.0	14	50.0
1504670	0030	CON >20	1336	832	867	297	YY	2.0	36	0.5	0.8	0.4	NDO 50	0.8	0.657	YYY	10	-9		17856	68	8500	60	31	100.0	15	100.0
1504670	0040	LNGWALL	3200	4925	2473	966	YY	2.0	60	1.4	2.4	-9.0	DO 60	1.4	1.160	YNY	-9	-9	E	61880	442	45000	350	94	220.7	105	103.8
1505184	0020	CON	460	500	305	29	NN	1.7	36	1.2	0.6	0.2	NDO 46	3.0	2.017	YYY	20	20	E	5220	65	3000	60	40	75.0	36	75.0
1505423	0060	CON >20	710	521	319	21	YY	1.0	36	0.1	0.5	0.2	NDO 73	0.8	0.357	YY	10	25	E	-9	-9	6000	60	28	150.0	28	120.0
1505423	0090	CON	792	920	317	19	NN	1.0	36	2.1	0.5	0.1	NDO 50	3.0	1.700	YYY	20	20	E	8190	102	6000	60	28	80.0	32	100.0
1505436	0010	CON	262	250	345	54	YY	1.2	36	1.0	0.6	0.4	DO 36	1.0	0.540	YYY	20	20	E	4536	94	4500	60	13	60.0	12	50.0
1506287	0010	CON	448	600	250	0	YY	2.0	36	0.7	0.6	0.3	NDO 73	1.2	0.825	YYY	20	-9	B	7197	-9	6000	-9	15	100.0	14	20.0
1506388	0030	CON	400	425	362	108	NY	2.0	36	0.4	0.6	0.6	NDO 46	1.8	0.683	YYY	20	20	E	4956	103	4500	60	18	77.8	18	100.0
1506702	0010	CON	180	200	140	19	YY	2.0	55	0.8	0.8	0.4	DO 55	0.8	0.580	YYY	10	10	E	4536	88	4000	60	24	106.0	24	100.0
1507082	0010	CON	75	500	470	55	YY	2.0	36	0.8	1.1	0.9	NDO 50	1.2	0.740	YY	20	20	E	7672	91	6000	60	21	65.0	20	-9.0
1507082	0030	CON	800	583	489	69	YY	1.7	36	1.0	0.7	0.6	NDO 50	1.5	1.000	YYY	20	20	E	19440	-9	7200	60	25	85.0	22	80.0
1507082	0040	CON	650	-9	455	61	YY	2.0	36	0.7	0.9	0.4	DO 36	0.7	0.520	YYY	-9	20	E	20760	-9	6000	60	22	80.0	22	80.0
1507201	0020	CON	320	350	325	39	NY	1.3	36	1.2	1.5	1.1	NDO 46	2.1	1.317	YYY	20	20	E	4855	82	4500	60	20	80.0	20	75.0
1507986	0010	CON	520	450	535	53	YY	2.0	36	2.4	2.9	2.3	DO 36	2.4	1.367	YYY	15	20	C	7170	60	4500	60	32	100.0	32	100.0
1508413	0010	CON	35	650	812	45	YY	2.0	36	0.2	1.8	1.7	NDO 14	1.0	0.480	YYY	20	20	E	5894	-9	4500	60	22	58.0	22	50.0
1508413	0020	CON >20	520	850	833	49	YY	2.0	36	2.1	1.9	2.6	DO 36	2.1	1.260	YYY	34	34	B	8256	-9	4500	1	30	108.0	22	50.0
1508413	0030	CON >20	480	1000	803	13	NY	2.0	36	1.5	1.7	1.0	NDO 50	3.8	1.880	YYY	39	39	B	7560	-9	7200	-9	41	60.0	41	50.0
1508413	0040	CON >20	480	800	710	85	NN	2.0	36	1.2	2.5	1.6	NDO 12	4.8	2.300	YY	42	43	B	8415	-9	-9	-9	22	120.0	22	50.0
1508682	0010	CON	336	180	369	10	NN	2.0	36	10.6	1.1	0.1	DO 36	10.6	3.867	YYY	20	20	C	7059	103	4500	60	20	90.0	16	40.0

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SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	OPERATOR AVERAGE SD	DUST COMP SA	DO DUST STD	DO DUST CONC OCC	DO DUST CONC SIP	DO DUST CONC OPER	DO DUST CONC SD	SIP HIGHEST EXPOSURE OCC	SIP HIGHEST EXPOSURE CONC	SIP AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	LINE CURTAIN SPE	M F V	AIR QUANTITY MEASURED CFM	AIR QUANTITY MEASURED FPM	AIR QUANTITY SPECIFIED CFM	AIR QUANTITY SPECIFIED FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WATER PRESSURE MEASURED WTD AVG PSI	WATER PRESSURE SPECIFIED TOTAL SPRAY	WATER PRESSURE SPECIFIED WTD PSI
1508976	0040	CON	302	256	248	33	YY	2.0	36	0.7	0.5	0.2	NDO 72	0.8	0.667	YYY	20	20	C	8750	186	4500	60	15	56.0	16	50.0
1508977	0010	CON	576	504	250	37	NY	2.0	36	1.1	0.8	0.3	NDO 47	3.0	1.850	YYY	20	20	E	7988	112	4500	60	14	65.0	14	55.0
1508977	0050	CON	256	250	214	37	YY	2.0	36	0.5	0.8	0.4	NDO 14	0.8	0.400	YYY	10	-9	E	5535	76	4500	60	22	75.0	14	55.0
1509533	0010	CONVEN	242	300	224	36	YY	2.0	38	0.4	1.0	0.5	NDO 54	0.5	0.360	Y	10	10	B	3840	-9	3000	-9	-9	-9.0	-9	-9.0
1509568	0050	CON	400	800	369	30	YY	2.0	36	1.2	0.4	0.2	DO 36	1.2	0.467	YY	20	-9	E	4830	86	4500	60	32	102.0	32	-9.0
1509571	0010	CON >20	348	650	650	0	NN	2.0	36	-9.0	1.1	0.7	NDO 73	4.2	2.160	YYY	34	34	B	12483	-9	6000	-9	30	100.0	30	50.0
1509571	0020	CON	880	600	652	4	NY	2.0	36	1.5	1.2	1.4	NDO 12	3.3	1.880	YYY	45	20	E	9300	-9	4600	60	22	50.0	12	50.0
1509571	0030	CON >20	775	450	400	0	NY	2.0	36	2.8	0.9	0.6	DO 36	2.8	1.700	YYY	37	37	B	6980	-9	6500	-9	22	150.0	22	50.0
1509763	0020	CONVEN	408	300	252	65	YY	2.0	38	1.0	0.1	0.1	NDO 34	1.8	1.120	Y	10	10	E	4816	75	3400	60	-9	-9.0	-9	-9.0
1510274	0010	OTHER	60	65	62	1	NY	2.0	39	1.2	0.1	0.0	NDO 34	3.3	1.420	Y	10	10	E	3168	99	3000	60	-9	-9.0	-9	-9.0
1510396	0020	CON	360	350	310	15	NY	2.0	36	1.0	0.4	0.2	NDO 46	2.4	1.233	YYY	20	20	B	5435	81	4500	60	16	55.0	16	50.0
1510753	0020	CON	525	512	602	34	YY	2.0	36	0.5	0.7	0.2	DO 36	0.5	0.400	YYY	20	20	E	6894	65	-9	60	22	75.0	22	50.0
1510753	0030	CON	625	550	571	43	YY	1.5	36	0.4	0.8	0.5	NDO 73	0.8	0.500	YYY	-9	20	E	6000	-9	6000	60	32	50.0	32	50.0
1510818	0040	CON	420	-9	246	71	NY	0.9	36	1.2	1.3	0.5	DO 36	1.2	0.640	YYY	20	20	E	4944	63	4500	60	28	110.0	12	80.0
1511035	0020	CON	900	600	475	16	YY	2.0	36	2.0	0.8	0.4	NDO 14	2.0	1.460	YYY	20	20	E	4620	72	4500	60	25	90.0	25	75.0
1511292	0020	CONVEN	95	250	94	14	YY	2.0	38	1.1	0.3	0.3	DO 38	1.1	0.640	Y	15	10	E	14780	-9	3000	60	-9	-9.0	-9	-9.0
1511726	0070	LNGWALL	316	1400	1412	355	NN	0.9	41	0.7	0.8	0.5	NDO 44	2.4	1.260	YYY	-9	-9		35300	299	30000	180	113	55.0	113	50.0
1511905	0020	CON	430	450	469	104	YY	1.7	36	1.5	0.4	0.3	DO 36	1.5	0.800	YYY	20	20	E	4592	61	4500	60	21	70.0	21	65.0
1511905	0030	CON	528	405	489	149	NN	0.4	36	1.4	1.4	1.3	DO 36	1.4	0.640	YYY	16	16	E	4774	61	4500	60	35	70.0	35	65.0
1511964	0010	CON	350	500	368	42	NY	2.0	36	3.4	0.6	0.2	DO 36	3.4	1.783	YYY	20	20	E	4640	72	4500	60	22	55.0	22	55.0
1512057	0010	CON	500	350	405	82	YY	2.0	36	1.8	1.2	1.0	DO 36	1.8	0.775	YY	10	20	E	-9	-9	4500	60	24	80.0	24	75.0
1512057	0020	CON	450	650	498	103	YY	2.0	36	0.7	0.6	0.4	NDO 73	1.2	0.780	YYY	10	10	E	17000	-9	4500	60	27	78.0	27	75.0
1512134	0010	CON	125	95	112	8	YY	2.0	70	0.2	1.0	0.8	NDO 13	0.4	0.267	YYY	10	10	C	5112	-9	5000	60	34	105.9	34	100.0
1512272	0010	CON >20	602	510	603	113	YY	2.0	36	0.4	1.5	1.0	NDO 35	0.5	0.320	YYY	43	52	E	7320	76	7000	60	29	55.7	27	48.5
1512272	0030	CON >20	1000	675	824	200	YY	2.0	36	0.5	0.5	0.2	NDO 73	1.1	0.580	YYY	-9	52	E	7800	-9	6000	60	25	60.0	25	50.0
1512334	0010	CON	240	275	432	58	YY	2.0	36	0.1	0.1	0.0	NDO 46	0.6	0.217	YYY	20	20	C	13080	60	4500	60	24	75.0	24	75.0
1512475	0060	CON >20	304	300	249	8	YY	2.0	36	0.8	1.3	0.7	NDO 72	1.0	0.767	YYY	40	40	E	5232	-9	4160	60	23	75.0	23	75.0
1512963	0010	CONVEN	360	300	523	132	YY	2.0	38	1.8	0.9	0.3	DO 38	1.8	0.860	Y	10	-9	E	10094	111	5000	60	-9	-9.0	-9	-9.0
1513087	0010	CONVEN	388	400	200	0	NN	2.0	38	7.1	0.7	0.4	DO 38	7.1	3.560	Y	10	10	E	3720	88	3600	60	-9	-9.0	-9	-9.0
1513191	0010	CON	200	180	206	20	YY	2.0	36	0.7	0.8	0.2	NDO 72	1.4	0.850	YYY	20	20	C	4800	100	4500	60	16	65.5	16	60.0
1513362	0030	CON	450	500	209	21	NY	1.3	36	2.5	0.5	0.3	DO 36	2.5	1.086	YYY	20	20	B	5400	113	5000	-9	28	100.0	28	100.0
1513469	0010	CONVEN	684	700	915	61	NN	2.0	38	6.3	0.9	0.3	DO 38	6.3	2.380	YYY	10	10	B	3300	-9	3000	-9	15	66.0	13	62.3
1513469	0050	CONVEN	798	910	953	118	NN	2.0	38	4.8	0.7	0.4	DO 38	4.8	2.420	YYN	10	10	B	3225	-9	3000	-9	15	38.7	15	66.0
1513537	0020	CON	200	450	169	7	YY	1.5	36	0.8	0.1	0.0	NDO 47	1.1	0.650	YYY	14	20	E	7896	74	3000	60	14	70.0	12	60.0
1513559	0010	CON	396	820	600	0	YY	2.0	36	0.7	1.1	0.5	DO 36	0.7	0.400	YYY	20	20	E	5100	75	4500	60	22	60.0	22	50.0
1513720	0030	CON >20	750	-9	604	82	YY	2.0	36	1.0	0.8	0.4	NDO 12	1.1	0.940	YYY	74	34	E	8400	105	7100	60	22	50.0	22	50.0
1513720	0040	CON >20	700	-9	617	71	NY	2.0	36	4.1	1.1	0.7	DO 36	4.1	1.760	YYY	34	34	E	8160	85	7100	60	22	55.0	22	50.0
1513881	0010	CON >20	400	700	720	101	YY	2.0	36	1.2	1.0	0.4	DO 36	1.2	0.920	YYY	10	10	B	6200	-9	5000	-9	23	160.0	20	87.0
1513881	0020	CONVEN	560	1123	936	134	YY	2.0	38	2.2	2.8	3.6	DO 38	2.2	1.150	YYY	10	10	B	6741	-9	4000	60	19	70.0	10	50.0
1513881	0060	LNGWALL	2400	1867	2579	426	NY	2.0	64	2.0	1.5	0.6	NDO 40	3.1	1.980	YYY	-9	-9		30250	-9	20000	-9	124	250.0	124	80.0
1513906	0010	CON	300	366	360	19	YY	2.0	36	1.2	0.2	0.1	NDO 14	2.4	1.020	YYY	20	20	E	5328	111	4500	60	17	70.0	14	50.0
1513920	0050	CONVEN	502	-9	-9	-9	NY	2.0	38	2.5	-9.0	-9.0	DO 38	2.5	1.680	YYY	10	10	B	3000	-9	3000	-9	19	115.8	10	50.0
1514006	0010	CON	384	-9	330	61	NN	1.5	36	2.7	1.4	1.0	NDO 14	4.1	3.200	YYY	20	20	E	4768	74	4500	60	21	100.0	21	80.0

SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	OPERATOR AVERAGE SD	DUST COMP SA	DO DUST STD	--DO-- DUST CONC OCC	--DO-- DUST CONC SIP	--DO-- DUST CONC OPER	--DO-- DUST CONC SD	--SIP-- HIGHEST EXPOSURE OCC	--SIP-- HIGHEST EXPOSURE CONC	--SIP-- AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	LINE CURTAIN SPE	M F V	AIR QUANTITY MEASURED CFM	AIR QUANTITY MEASURED FPM	AIR QUANTITY SPECIFIED CFM	AIR QUANTITY SPECIFIED FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WATER PRESSURE MEASURED WTD AVG PSI	WATER PRESSURE SPECIFIED TOTAL SPRAY	WATER PRESSURE SPECIFIED WTD PSI
1514074	0020	CON >20	700	1004	832	190	YY	2.0	36	0.5	1.3	0.5	NDO 14	0.7	0.500	YYY	10	10	B	5625	-9	5000	-9	17	100.0	17	100.0
1514074	0030	CON >20	774	977	890	240	YY	2.0	36	0.4	0.9	0.2	NDO 14	0.7	0.520	YYY	10	10	B	5350	-9	5000	-9	17	100.0	17	100.0
1514074	0040	CON >20	1089	1131	848	154	YY	2.0	36	0.7	0.8	0.4	NDO 14	0.8	0.720	YYY	10	10	B	5430	-9	5000	-9	17	110.0	17	100.0
1514178	0020	CON	400	3540	390	42	NY	2.0	36	1.1	1.3	0.4	NDO 72	3.7	1.233	YYY	20	20	E	4500	60	4500	60	16	60.0	16	60.0
1514296	0010	CONVEN	320	350	326	88	YY	2.0	38	2.2	0.8	0.4	DO 38	2.2	1.300	Y	10	10	B	3245	-9	3000	60	-9	-9.0	-9	-9.0
1514410	0010	CON	242	420	396	32	YY	2.0	36	1.2	1.7	0.9	DO 36	1.2	0.900	YY	10	10	B	-9	-9	3000	-9	20	50.0	3	50.0
1514474	0010	OTHER	50	-9	107	11	YY	2.0	34	0.5	0.6	0.3	NDO 7	2.0	1.040		0	10	E	-9	-9	3000	60	-9	-9.0	-9	-9.0
1514499	0020	CONVEN	85	-9	260	29		2.0	38	-9.0	0.6	0.3	-9	-9.0	-9.000		-9	10	B	-9	-9	4500	60	-9	-9.0	-9	-9.0
1514508	0010	CON	375	340	356	16	YY	2.0	36	1.0	0.8	0.5	DO 36	1.0	0.633	YYY	20	20	E	3964	63	3400	60	21	75.0	21	75.0
1514758	0010	CON	195	300	187	15	YY	2.0	36	0.4	1.3	0.2	DO 36	0.4	0.150	YYY	20	-9	E	4788	85	4500	60	16	78.8	16	75.0
1514953	0010	CON	275	-9	417	17	YY	2.0	36	0.8	0.1	0.0	NDO 47	1.0	0.640	YYY	20	20	E	4656	97	4656	97	17	120.0	17	120.0
1514990	0010	CON	570	425	529	99	NY	2.0	36	5.6	0.1	0.0	DO 36	5.6	1.620	Y	20	20	E	6812	57	5000	60	-9	-9.0	20	50.0
1515042	0020	CONVEN	151	162	316	121	YY	2.0	38	0.4	0.9	0.4	NDO 33	2.2	1.033	Y	10	10	E	5716	137	4000	60	-9	-9.0	-9	-9.0
1515120	0020	CONVEN	80	240	330	31		2.0	38	-9.0	0.4	0.3	-9	-9.0	-9.000	Y	-9	10	E	12000	200	3000	60	-9	-9.0	1	40.0
1515307	0010	CON	550	-9	345	63	NN	2.0	36	6.6	0.5	0.4	DO 36	6.6	2.220	YYY	20	20	E	5120	85	4500	60	14	50.0	14	50.0
1515410	0010	CONVEN	360	375	264	97	NN	2.0	38	4.8	0.9	1.1	DO 38	4.8	3.020	Y	10	10	E	3084	61	3000	60	-9	-9.0	-9	-9.0
1515509	0010	CONVEN	264	200	338	36	YY	2.0	38	0.7	0.8	0.8	NDO 34	0.8	0.620	Y	10	10	E	4500	90	3800	60	-9	-9.0	-9	-9.0
1515517	0020	OTHER	70	120	90	4	NY	2.0	34	0.2	0.6	0.2	NDO 16	3.4	1.020	Y	10	10	E	3437	76	3000	60	-9	-9.0	-9	-9.0
1515524	0020	CON	385	450	383	40	YY	2.0	36	0.8	0.2	0.1	NDO 46	2.0	1.180	YYY	20	20	E	4950	95	4500	60	32	60.0	20	50.0
1515524	0040	CON	339	658	370	20	YY	2.0	36	1.2	0.3	0.3	NDO 14	2.0	1.100	YYY	20	20	E	5808	88	4500	-9	27	80.0	14	50.0
1515543	0010	CON	402	500	325	61	YY	2.0	36	1.1	1.3	1.5	DO 36	1.1	0.540	YYY	20	20	E	7560	118	4500	60	25	50.0	25	50.0
1515557	0010	CON	270	200	250	0	YY	2.0	36	0.1	0.8	-9.0	NDO 46	0.3	0.260	YYY	20	20	E	5200	68	4500	60	23	60.0	16	60.0
1515558	0010	CON	480	481	600	0	YY	2.0	36	1.1	0.8	0.3	DO 36	1.1	0.800	YYY	20	20	E	7344	91	4500	60	18	120.0	14	75.0
1515558	0030	CON	525	520	619	29	YY	2.0	36	0.8	1.1	0.6	DO 36	0.8	0.583	YYY	20	20	E	5817	73	4500	60	14	125.0	14	75.0
1515592	0020	CON	800	650	378	77	YY	2.0	36	1.2	0.7	0.8	NDO 46	1.4	1.000	YYY	20	20	E	6446	73	4500	60	19	100.0	19	100.0
1515594	0010	CONVEN	102	65	223	57	NY	2.0	38	0.8	0.2	0.1	NDO 54	4.0	1.920	Y	10	10	E	7972	114	3840	60	-9	-9.0	-9	-9.0
1515605	0020	CON	330	410	313	127	YY	2.0	36	0.7	1.1	1.8	NDO 12	1.1	0.700	YYN	20	20	E	8540	106	5000	60	28	70.0	28	100.0
1515637	0010	CON	300	410	315	20	NN	1.2	36	3.8	0.3	0.4	NDO 73	14.2	4.967	YYY	20	20	B	7200	-9	4500	-9	22	100.0	18	40.0
1515658	0010	CONVEN	240	300	160	3	YY	2.0	38	0.2	0.1	0.0	NDO 34	0.4	0.200	Y	10	10	E	5700	67	3000	60	-9	-9.0	-9	-9.0
1515670	0010	CON	300	-9	-9	-9	YY	2.0	36	0.5	-9.0	-9.0	NDO 73	1.7	1.020	YYY	20	20	E	3840	60	3500	60	19	60.5	19	50.0
1515673	0020	CON	85	-9	289	56	NY	2.0	36	0.4	1.0	0.3	NDO 46	5.8	1.900	YYY	20	20	C	4704	94	4500	60	16	65.3	16	60.0
1515711	0020	CON >20	560	750	595	129	NY	2.0	36	1.2	1.3	0.9	DO 36	1.2	0.529	YYY	40	40	E	9200	104	6000	80	23	110.0	23	100.0
1515713	0020	CON	630	-9	943	156	YY	2.0	36	0.7	0.7	0.8	NDO 14	2.1	0.900	YYY	20	20	E	7500	93	5000	60	21	62.4	19	60.0
1515736	0010	CON	720	700	390	40	YY	2.0	36	1.0	0.7	0.1	NDO 35	1.4	0.867	YYY	10	10	E	6552	66	3000	60	20	50.0	20	50.0
1515865	0010	CONVEN	350	450	823	18	YY	2.0	38	1.0	0.6	0.1	DO 38	1.0	0.550	Y	10	10	E	4130	74	4000	70	-9	-9.0	-9	-9.0
1515887	0010	CON	490	-9	337	42	YY	1.3	36	0.2	0.5	0.5	NDO 14	0.8	0.380	YYY	20	20	E	6560	102	4500	60	18	50.0	16	50.0
1515887	0020	CON	600	-9	306	18	NN	2.0	36	2.4	0.1	0.1	NDO 14	6.6	3.020	YYY	20	20	E	6048	94	6000	60	16	50.0	16	50.0
1515899	0010	CON	350	800	457	50	NY	2.0	36	2.5	0.5	0.3	NDO 73	5.1	1.920	YYY	20	20	E	5838	73	5000	60	16	60.8	16	50.0
1516028	0010	CONVEN	120	200	177	5	YY	2.0	38	0.5	0.4	0.3	NDO 73	0.6	0.340	Y	10	10	E	6860	70	3000	60	-9	-9.0	-9	-9.0
1516074	0020	CON	400	-9	507	119	NY	2.0	36	2.5	2.6	2.8	DO 36	2.5	1.400	YYY	20	20	C	4624	72	4500	60	14	75.7	14	75.0
1516084	0010	CON >20	600	-9	731	109	NN	2.0	36	1.2	2.5	3.1	NDO 14	4.8	2.200	YYY	40	40	C	5562	86	4500	60	21	100.0	21	100.0
1516121	0020	CON	530	450	417	77	NY	1.7	36	3.4	1.0	0.5	DO 36	3.4	1.460	YYY	20	20	E	5012	63	4500	60	18	66.0	18	65.0
1516121	0030	CON	450	475	423	98	NY	1.7	36	1.7	0.6	0.9	DO 36	1.7	1.160	YYY	20	20	E	4592	61	4500	60	21	70.0	21	65.0

SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	DO DUST CONC OCC	SIP	OPER	SD	SIP HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
1516149	0010	CON (?)	264	350	397	23	NY	2.0	36	3.3	0.7	0.3	DO 36	3.3	1.340	YYY	20	20	E	4560	71	4500	-9	12	60.0	12	50.0
1516162	0010	CON	830	450	647	13	YY	1.7	36	1.4	0.7	0.1	DO 36	1.4	0.950	YYY	20	20	B	8105	-9	6000	-9	25	66.0	25	65.0
1516162	0020	CON	840	350	650	0	NY	2.0	36	4.0	0.6	0.2	DO 36	4.0	2.000	YYY	20	20	B	8000	-9	6000	-9	25	82.0	25	65.0
1516247	0010	OTHER	90	75	57	11	YY	2.0	54	0.5	0.1	0.0	DO 54	0.5	0.200	Y	10	10	E	3067	73	3000	60	-9	-9.0	-9	-9.0
1516262	0010	CON >20	1296	1200	1834	294	YY	2.0	36	1.4	1.5	0.4	NDO 50	1.7	1.083	YYY	40	40	C	9000	-9	4500	60	40	90.0	40	90.0
1516279	0010	CONVEN	408	250	304	8	NN	2.0	38	18.5	0.2	-9.0	DO 38	18.5	4.560	Y	10	10	E	4716	65	3000	60	-9	-9.0	-9	-9.0
1516287	0010	CON	400	720	600	0	YY	2.0	36	2.4	0.8	0.3	DO 36	2.4	1.000	YYY	20	20	E	5680	88	4500	60	16	70.6	16	70.6
1516336	0030	CONVEN	140	-9	221	35	NY	2.0	38	3.5	0.4	0.8	DO 38	3.5	1.040	Y	15	15	E	3600	605	3500	60	-9	-9.0	-9	-9.0
1516344	0010	CONVEN	540	400	831	14	YY	2.0	38	0.5	0.9	0.4	DO 38	0.5	0.340	Y	10	10	E	5536	86	3200	60	-9	-9.0	-9	-9.0
1516345	0010	CON	170	105	175	5	YY	2.0	36	0.7	0.7	0.4	NDO 54	0.8	0.600	YYY	20	20	E	6000	115	4500	60	14	60.0	14	50.0
1516388	0010	CON >20	643	300	413	74	YY	2.0	36	0.7	1.8	1.3	DO 36	0.7	0.333	YNY	45	45	E	7488	76	4500	60	14	65.0	26	60.0
1516410	0010	CON	630	-9	389	57	NN	1.5	36	2.0	1.0	1.2	NDO 14	2.8	1.817	YNY	20	20	E	14445	188	4500	60	16	79.6	47	80.0
1516412	0020	CON >20	450	1728	350	9	YY	2.0	36	0.8	1.2	0.1	NDO 46	1.0	0.700	YYY	40	40	C	10804	112	4500	60	24	100.0	24	100.0
1516413	0010	CON >20	350	1000	385	111	YY	1.3	36	0.8	0.2	0.0	DO 36	0.8	0.460	YYY	40	40	C	4760	80	4500	60	19	100.0	19	100.0
1516417	0010	OTHER	100	120	76	9	NY	0.6	0	1.1	0.1	0.0	NDO 46	1.1	0.683	Y	10	10	E	3335	94	3000	60	-9	-9.0	-9	-9.0
1516418	0010	CON	650	300	221	27	NY	1.5	36	0.5	0.4	0.2	NDO 46	4.8	1.000	YYY	20	20	C	4762	110	4500	60	16	75.0	18	75.0
1516474	0010	CON	160	225	163	8	YY	2.0	36	0.4	0.1	0.0	NDO 35	0.7	0.433	YYY	20	20	E	4676	103	4500	60	14	95.0	14	80.0
1516492	0010	CONVEN	300	300	300	0	NY	2.0	38	3.3	0.6	0.3	DO 38	3.3	1.300	N	10	9	E	2300	66	3000	60	-9	-9.0	-9	-9.0
1516495	0010	CON	252	640	537	153	NY	1.5	36	2.5	0.4	0.4	DO 36	2.5	1.200	YYY	20	20	E	6872	71	6000	60	29	101.6	29	65.0
1516499	0010	CON	550	510	628	23	YY	0.9	36	0.4	0.5	0.2	NDO 35	0.5	0.320	YYY	20	20	E	3514	61	3400	60	12	55.0	12	50.0
1516503	0010	CON >20	540	900	940	74	YY	2.0	36	1.0	1.9	1.6	NDO 35	1.1	0.740	YYY	11	10	B	6240	-9	5000	-9	19	47.6	18	50.0
1516549	0010	CONVEN	288	350	347	57	NY	2.0	38	4.0	0.4	0.4	DO 38	4.0	1.167	Y	10	10	E	3510	61	3000	60	-9	-9.0	-9	-9.0
1516586	0010	CON	325	327	325	63	NY	2.0	36	4.0	2.2	0.6	DO 36	4.0	1.740	YYY	20	20	E	4620	61	4500	60	14	50.0	14	50.0
1516587	0020	CON	192	335	281	27	YY	2.0	36	0.2	0.1	0.0	NDO 46	0.7	0.400	YYY	20	20	B	5400	-9	4500	60	22	100.0	22	100.0
1516611	0010	OTHER	38	50	80	0	YY	2.0	39	0.2	0.2	0.1	NDO 46	0.4	0.220	Y	10	10	E	3000	116	3000	60	-9	-9.0	-9	-9.0
1516616	0010	CON	530	400	456	50	NN	0.5	36	5.1	0.3	0.2	DO 36	5.1	1.850	YYY	20	20	E	4858	60	4800	60	35	105.0	35	100.0
1516621	0010	OTHER	170	200	200	0	YY	2.0	54	0.5	0.7	0.2	NDO 46	0.7	0.367	Y	10	10	E	3000	60	3000	60	-9	-9.0	-9	-9.0
1516633	0020	CON >20	725	-9	394	132	YY	2.0	36	0.2	1.5	-9.0	NDO 50	2.1	1.500	YYY	38	38	E	8300	103	5262	60	22	70.0	22	70.0
1516633	0040	CON >20	876	-9	362	34	YY	2.0	36	2.4	0.3	0.1	DO 36	2.4	0.600	YYY	-9	38	E	17400	-9	4262	60	22	80.0	22	70.0
1516637	0010	CON	240	-9	242	55	NN	1.3	38	4.1	0.7	0.6	NDO 34	10.7	5.667	Y	10	10	E	3360	62	3000	60	-9	-9.0	-9	-9.0
1516638	0010	CON	375	-9	423	12	NY	2.0	36	4.0	0.4	-9.0	DO 36	4.0	2.020	YYY	20	20	E	4955	825	4500	60	24	85.0	18	80.0
1516638	0020	CON	425	-9	422	11	NN	2.0	36	5.1	0.2	-9.0	DO 36	5.1	2.680	YYY	20	20	E	4955	72	4500	60	24	87.9	18	80.0
1516638	0030	CONVEN	184	500	595	35	YY	2.0	38	2.2	0.5	0.1	DO 38	2.2	1.440	Y	10	10	E	5200	96	4800	60	-9	-9.0	-9	-9.0
1516660	0010	OTHER	57	50	106	24	NN	2.0	34	1.4	0.6	0.4	NDO 16	6.9	2.183	Y	30	10	E	3000	60	3000	60	-9	-9.0	-9	-9.0
1516666	0010	CON	300	400	247	40	NY	2.0	36	2.8	1.0	1.2	DO 36	2.8	1.200	YYN	20	20	E	3240	67	3000	60	17	59.0	17	150.0
1516674	0020	CONVEN	300	250	217	22	NY	2.0	38	1.5	0.4	0.4	NDO 53	3.3	1.980	Y	10	10	E	3095	60	3000	60	-9	-9.0	-9	-9.0
1516678	0010	CON	384	750	863	28	NN	1.7	36	2.5	0.7	0.2	NDO 14	4.3	1.850	YYY	20	20	E	7632	90	6000	60	21	53.0	21	50.0
1516695	0010	CON	600	-9	415	58	YY	2.0	36	1.7	0.8	0.6	DO 36	1.7	1.200	YYY	20	20	C	6060	89	4500	60	16	80.0	16	65.0
1516699	0010	CON	340	-9	287	48	YY	2.0	38	0.8	0.8	0.7	NDO 34	2.1	1.200	Y	10	10	E	3510	61	3000	60	-9	-9.0	-9	-9.0
1516712	0020	OTHER	60	-9	84	16	YY	2.0	34	0.2	0.3	0.3	NDO 46	1.4	0.625	Y	10	10	E	3136	98	3000	60	-9	-9.0	-9	-9.0
1516713	0010	OTHER	20	80	34	3	YY	2.0	34	0.2	0.3	0.3	NDO 74	0.4	0.280	Y	10	10	E	3000	60	3000	60	-9	-9.0	-9	-9.0
1516717	0010	CONVEN	356	275	251	41	NY	2.0	37	1.5	0.4	0.4	NDO 54	2.5	2.025	Y	10	10	E	4488	62	4500	60	-9	-9.0	-9	-9.0
1516719	0010	OTHER	80	75	50	3	NY	2.0	34	0.1	0.1	0.0	NDO 46	3.7	0.940	Y	10	10	E	3320	110	3000	60	-9	-9.0	-9	-9.0

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SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	--DO-- DUST CONC OCC	SIP	OPER	SD	--SIP-- HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
1516729	0010	CONVEN	286	-9	500	0	YY	2.0	38	0.8	1.0	0.7	NDO 46	1.2	0.880	Y	10	10	E	6020	103	3000	60	-9	-9.0	-9	-9.0
1516738	0010	OTHER	125	100	160	39	NY	2.0	34	2.5	0.6	0.2	NDO 46	3.5	1.820	Y	10	10	E	3612	63	3300	60	-9	-9.0	-9	-9.0
1516741	0010	CONVEN	175	270	273	23	YY	2.0	38	0.5	0.6	0.4	NDO 34	1.5	1.017	Y	10	10	E	3756	89	3000	60	-9	-9.0	-9	-9.0
1516744	0010	CON	750	550	521	46	NN	1.3	36	4.4	0.1	0.0	DO 36	4.4	2.320	YYY	20	20	B	6000	-9	4800	-9	28	55.0	14	50.0
1516748	0020	CON	720	360	300	0	YY	1.2	36	0.7	0.8	0.2	DO 36	0.7	0.367	YYY	20	20	E	12740	90	5400	70	19	156.8	19	60.0
1516766	0010	CON	820	515	533	37	NN	0.9	36	2.4	0.9	0.9	DO 36	2.4	1.600	YYY	20	20	E	4960	61	4800	60	14	67.0	14	50.0
1516779	0020	CON	290	425	554	47	NY	2.0	36	0.5	0.7	0.2	NDO 46	2.7	0.933	YYY	20	20	E	3570	61	3400	60	14	55.0	14	50.0
1516780	0010	CONVEN	84	340	288	33		1.5	38	-9.0	0.1	0.0	-9	-9.0	-9.000	Y	10	10	E	5002	102	5000	60	-9	-9.0	-9	-9.0
1516784	0020	CONVEN	200	250	233	67	NN	2.0	38	5.3	3.3	-9.0	DO 38	5.3	2.660	N	10	10	C	3024	63	3500	60	-9	-9.0	-9	-9.0
1516792	0010	CONVEN	250	125	363	593	YY	2.0	38	0.8	0.9	0.3	NDO 37	1.1	0.683	YYY	10	10	E	9550	70	3000	60	1	20.0	1	15.0
1516795	0020	CON	500	500	474	20	YY	2.0	36	0.8	1.0	0.7	NDO 32	2.0	1.067	YYY	20	20	E	7840	120	6000	60	25	70.0	25	50.0
1516796	0010	CONVEN	375	390	303	13	YY	2.0	38	1.8	1.0	0.9	DO 38	1.8	1.017	Y	10	10	E	3500	60	3000	60	-9	-9.0	-9	-9.0
1516809	0010	CON	540	-9	607	13	YY	2.0	36	1.8	0.7	0.3	DO 36	1.8	1.040	YYY	20	20	E	4590	63	4500	60	16	75.0	16	75.0
1516816	0010	OTHER	275	225	200	0	NN	2.0	34	0.8	0.7	0.3	NDO 54	9.0	2.820	Y	10	10	B	3120	-9	3000	-9	-9	-9.0	-9	-9.0
1516819	0010	CON	768	400	600	0	YY	2.0	36	0.7	0.9	0.4	NDO 12	1.0	0.520	YYY	20	20	E	10104	112	5400	60	21	110.0	20	85.0
1516832	0010	CON	768	700	522	25	YY	2.0	36	2.0	0.9	-9.0	DO 36	2.0	0.820	YYY	20	20	B	7900	-9	6500	-9	22	84.0	20	50.0
1516837	0010	CON	360	450	500	0	NY	2.0	36	1.7	2.0	1.1	NDO 35	2.7	1.100	YYY	20	20	E	8470	124	7000	60	21	70.0	21	70.0
1516838	0010	OTHER	80	80	50	0	YY	2.0	34	0.2	0.3	0.3	NDO 46	2.1	0.720	Y	10	10	E	3760	117	3000	60	-9	-9.0	-9	-9.0
1516841	0010	OTHER	56	60	72	6	YY	2.0	34	0.5	0.3	0.3	NDO 46	0.7	0.600	Y	10	10	E	3000	97	3000	60	-9	-9.0	-9	-9.0
1516856	0010	CONVEN	342	-9	269	23	NN	2.0	38	3.5	0.3	0.2	NDO 46	4.4	3.080	Y	10	10	E	3600	75	3000	60	-9	-9.0	-9	-9.0
1516896	0010	CON >20	480	500	624	40	NN	0.4	36	5.0	0.3	0.1	DO 36	5.0	2.640	YYY	35	35	B	6800	-9	6200	-9	24	90.0	22	90.0
1516908	0020	CON	72	540	-9	-9	YY	2.0	36	1.4	-9.0	-9.0	DO 36	1.4	0.580	YYY	20	20	E	24360	380	4500	70	31	80.0	24	80.0
1516912	0010	CON	430	-9	114	36	YY	2.0	36	1.2	0.7	0.3	DO 36	1.2	1.040	YYY	20	20	E	6720	84	4500	60	22	55.0	22	50.0
1516922	0010	CON	583	600	1133	96	NN	1.7	36	2.5	0.4	0.4	NDO 46	3.7	1.986	YYY	40	20	C	5000	78	4500	60	31	100.0	31	100.0
1516923	0010	CON	500	800	394	80	NN	0.9	36	5.0	1.5	2.0	DO 36	5.0	1.900	YYY	20	20	E	6342	100	4500	60	22	70.0	21	65.0
1516928	0010	CON	375	645	715	87	NY	2.0	36	0.7	0.6	-9.0	NDO 73	4.1	1.833	YYY	20	20	C	3072	61	3000	60	18	50.0	18	50.0
1516930	0010	CONVEN	400	-9	400	0	YY	2.0	38	1.1	0.7	0.2	NDO 43	1.4	0.720	Y	10	10	B	5658	71	3000	-9	-9	-9.0	-9	-9.0
1516931	0010	CONVEN	450	375	382	45	NY	2.0	38	2.5	1.1	1.8	DO 38	2.5	1.120	Y	10	10	E	3399	81	3000	60	-9	-9.0	-9	-9.0
1516943	0010	OTHER	56	85	29	4	YY	2.0	7	0.2	0.4	-9.0	NDO 54	1.2	0.775	Y	10	10	E	3000	60	3000	60	-9	-9.0	-9	-9.0
1516944	0010	CONVEN	125	250	245	139	NY	2.0	38	1.5	2.3	2.6	NDO 46	3.8	1.860	Y	10	10	E	4992	104	4500	60	7	65.0	-9	-9.0
1516952	0010	CON	725	750	736	24	YY	2.0	36	1.2	0.8	0.3	DO 36	1.2	0.650	YYY	20	20	E	6560	80	4500	60	38	110.0	35	75.0
1516962	0010	OTHER	200	120	167	49	NY	2.0	54	1.5	0.6	0.3	NDO 34	3.5	1.700	Y	10	10	E	3000	60	3000	60	-9	-9.0	-9	-9.0
1516965	0010	CON >20	500	-9	-9	-9	YY	2.0	36	1.1	-9.0	-9.0	NDO 12	2.4	1.240	YY	34	20	E	5400	77	6000	60	19	75.0	19	-9.0
1516970	0010	CONVEN	160	197	178	23	YY	2.0	43	0.5	0.2	0.1	NDO 46	1.0	0.680	Y	10	10	E	48000	67	3400	60	-9	-9.0	-9	-9.0
1516991	0010	CONVEN	300	400	295	62	NY	2.0	38	3.1	0.6	0.3	DO 38	3.1	1.333	Y	10	10	E	3972	75	3000	60	-9	-9.0	-9	-9.0
1516993	0010	CON	575	350	369	43	YY	2.0	36	1.1	2.7	1.9	DO 36	1.1	0.780	YYY	20	20	B	5166	-9	4500	-9	19	64.1	16	50.0
1516998	0010	CON	480	-9	372	110	YY	2.0	36	2.0	0.7	0.2	DO 36	2.0	0.980	YYY	18	20	C	5805	60	4500	60	36	60.0	24	60.0
1517001	0020	CON	115	-9	460	0	YY	2.0	36	0.2	0.9	0.3	NDO 2	1.1	0.320	YNY	20	20	E	4290	64	3900	60	15	60.0	20	50.0
1517027	0010	CON	829	680	671	64	NY	1.2	36	1.5	1.0	0.2	NDO 35	1.8	1.180	YYY	20	20	E	5840	62	5500	60	26	60.0	26	50.0
1517054	0010	OTHER	90	90	-9	-9	YY	2.0	34	1.5	-9.0	-9.0	NDO 46	2.2	1.675	Y	10	10	E	3486	62	3200	60	-9	-9.0	-9	-9.0
1517055	0010	CON (?)	840	400	748	-9	YY	2.0	36	0.2	2.0	-9.0	DO 36	0.2	0.180	YYY	47	48	E	8344	74	6600	60	25	55.0	21	50.0
1517073	0010	CON	768	-9	445	206	YY	2.0	36	1.1	0.3	0.3	NDO 12	1.1	0.780	YYY	20	20	E	9197	103	4800	60	23	73.0	23	50.0
1517077	0010	CON	400	-9	-9	-9	NN	2.0	36	1.8	-9.0	-9.0	NDO 46	4.3	2.220	YYY	20	20	C	5016	102	4500	60	22	79.6	23	75.0

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AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	DO DUST CONC OCC	SIP	OPER	SD	SIP HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
1517082	0010	CONVEN	175	-9	-9	-9	YY	2.0	38	1.2	-9.0	-9.0	DO 38	1.2	0.740	Y	10	10	E	3200	80	3000	60	-9	-9.0	-9	-9.0
1800621	0220	CON >20	566	-9	825	238	YY	2.0	36	0.5	0.9	-9.0	NDO 35	0.7	0.517	YNY	10	10	C	9413	66	-9	60	28	130.0	49	70.0
1800621	0570	LNGWALL	4650	3450	5374	1210	YY	2.0	44	1.8	2.0	0.6	NDO 41	2.0	1.471	YY	-9	-9	.	-9	411	-9	-9	80	110.0	50	80.0
3300941	0040	CON	315	382	358	82	YY	2.0	36	0.5	1.2	0.7	NDO 73	0.8	0.680	YYY	10	10	E	4451	61	4000	60	42	160.0	30	75.0
3301157	0460	LNGWALL	4714	5343	4971	591	YY	2.0	44	1.7	1.5	0.2	DO 44	1.7	1.080	YYY	-9	-9	E	71710	387	35000	300	85	125.0	39	120.0
3301157	0720	CON (?)	496	270	276	32	YY	1.7	36	1.5	0.8	0.7	DO 36	1.5	0.740	YYY	10	10	E	7800	80	-9	60	33	120.0	33	80.0
3301159	0270	LNGWALL	400	2354	3336	1060	YY	2.0	44	0.7	2.1	0.6	DO 44	0.7	0.360	YYY	-9	-9		35910	460	35000	320	91	76.2	29	50.0
3301172	0030	CON	152	607	562	293	YY	2.0	36	1.0	1.6	0.4	DO 36	1.0	0.825	YYY	20	20	E	6288	82	3000	60	37	75.0	32	75.0
3301172	0050	CON >20	767	540	683	220	YY	2.0	36	1.8	1.0	0.5	DO 36	1.8	1.080	YY	30	30	B	6321	-9	-9	60	40	118.5	40	75.0
3301172	0320	LNGWALL	3002	3220	4667	1480	YY	2.0	44	2.0	2.2	0.9	DO 44	2.0	1.325	YYY	-9	-9	E	51700	316	30000	-9	74	52.8	77	53.2
3301173	0050	CON >20	235	330	392	178	YY	2.0	36	0.7	1.1	0.9	DO 36	0.7	0.440	NYY	30	30	B	6282	-9	7000	-9	34	125.0	34	75.0
3301173	0200	LNGWALL	1192	1781	4228	858	YY	2.0	44	0.7	1.6	0.5	NDO 41	1.4	0.740	YYY	-9	-9	E	58830	425	30000	320	49	98.8	48	75.0
3301173	0230	LNGWALL	3090	886	2904	620	YY	2.0	44	1.2	1.0	0.4	NDO 41	2.1	0.820	YYY	-9	-9	E	97320	380	30000	320	46	126.1	46	64.1
3304165	0020	CON	265	-9	505	51	YY	2.0	36	0.8	1.3	1.0	DO 36	0.8	0.560	YYY	20	20	C	4320	77	3500	60	25	110.0	18	50.0
3304186	0010	CON	148	468	431	56	YY	2.0	36	0.8	0.5	0.4	DO 36	0.8	0.500	YYN	20	20	E	17230	191	3000	60	28	25.0	14	50.0
3600821	0080	CON >20	300	250	542	112	NY	2.0	36	2.8	1.5	0.2	DO 36	2.8	1.400	YYY	40	40	B	3168	-9	3000	-9	18	35.0	18	35.0
3600821	0090	CON >20	358	358	415	79	NY	2.0	36	1.4	0.8	0.3	NDO 14	4.7	2.017	YYY	40	40	B	3420	-9	3000	-9	19	35.0	19	35.0
3600823	0080	CON >20	377	355	441	101	YY	2.0	36	0.8	0.8	0.3	DO 36	0.8	0.640	YYY	40	40	C	4140	-9	4000	-9	22	30.0	22	30.0
3600823	0100	CON	349	-9	243	76	YY	2.0	36	1.4	1.6	0.6	NDO 35	2.0	1.120	YYY	20	20	B	4125	-9	4000	-9	22	40.0	26	30.0
3600840	0260	LNGWALL	1832	2268	2113	518	YY	2.0	41	0.8	2.1	0.5	NDO 4	1.0	0.667	YYY	-9	-9		37128	282	11000	-9	140	82.2	76	70.0
3600840	0740	LNGWALL	918	1092	1324	379	YY	2.0	41	0.8	0.8	0.2	NDO 41	1.7	1.167	YYY	-9	-9		17160	513	9000	-9	12	300.0	9	50.0
3600840	0940	CON	151	209	148	34	YY	1.7	36	0.1	0.3	0.2	NDO 50	0.4	0.200	YYY	20	20	E	9680	124	3300	-9	32	52.0	24	50.0
3600926	0040	CON	103	197	190	69	YY	1.7	36	0.7	0.7	0.4	DO 36	0.7	0.420	NYY	10	10	E	8043	25	-9	60	25	200.0	16	75.0
3600926	0110	LNGWALL	420	630	1349	546	YY	2.0	52	0.7	5.2	2.1	NDO 41	1.2	0.900	YYY	-9	-9		27666	350	9000	-9	100	169.3	37	100.0
3600958	0490	CON >20	630	508	478	122	NY	2.0	36	1.7	0.9	0.6	NDO 19	3.1	1.260	YY	20	40	B	6000	50	-9	-9	21	60.0	25	30.0
3600958	0500	LNGWALL	2327	3478	3549	1069	YY	2.0	44	2.4	1.5	0.7	DO 44	2.4	1.333	YYY	-9	-9	E	33600	480	26000	-9	132	160.0	86	150.0
3600970	0030	CON (?)	451	145	270	94	YY	2.0	36	0.6	0.3	0.3	NDO 14	2.0	0.860	YYY	10	-9	E	5700	44	5000	-9	26	175.0	12	150.0
3600970	0150	LNGWALL	2515	2350	2273	755	YY	2.0	44	1.2	0.8	0.5	NDO 41	2.4	1.520	YYY	-9	-9	E	18720	328	15000	-9	123	103.3	81	100.3
3601107	0020	CON	175	215	211	17	NN	2.0	55	4.5	0.6	0.5	DO 55	4.5	2.200	YYY	10	10	C	4239	-9	3600	-9	10	150.0	7	50.0
3601789	0020	OTHER	45	45	50	5	NN	2.0	39	2.5	0.4	0.2	DO 39	2.5	2.500	Y	15	20	C	1753	-9	1500	-9	-9	-9.0	-9	-9.0
3601886	0030	OTHER	40	20	34	3	YY	2.0	39	0.5	0.1	0.1	DO 39	0.5	0.500		20	20	C	-9	-9	-9	-9	-9	-9.0	-9	-9.0
3601892	0080	OTHER	65	65	75	0	NN	2.0	39	17.8	0.3	0.1	DO 39	17.8	17.800	Y	20	20	B	3685	-9	1500	-9	-9	-9.0	-9	-9.0
3601920	0010	OTHER	50	-9	50	0	Y	2.0	0	0.4	0.1	0.0	DO 0	0.4	-9.000		20	20	C	-9	-9	-9	-9	-9	-9.0	-9	-9.0
3602022	0010	OTHER	17	10	8	0	YY	2.0	39	0.4	0.4	0.0	DO 39	0.4	0.400		14	20		-9	-9	-9	-9	-9	-9.0	-9	-9.0
3602053	0010	OTHER	25	-9	30	0	YY	2.0	39	0.1	0.1	0.1	DO 39	0.1	0.100	Y	12	12	B	1748	-9	1500	-9	-9	-9.0	-9	-9.0
3602203	0010	OTHER	20	25	21	2	YY	2.0	39	0.5	0.4	-9.0	DO 39	0.5	0.500		-9	-9	B	-9	-9	1500	-9	-9	-9.0	-9	-9.0
3602257	0020	OTHER	30	20	20	0	YY	2.0	39	0.1	0.1	0.1	DO 39	0.1	0.100	Y	10	10	B	2667	-9	2678	-9	-9	-9.0	-9	-9.0
3602404	0100	CON >20	25	204	325	90	YY	2.0	36	0.5	0.6	0.7	NDO 35	1.2	0.567	YYY	10	40	B	5420	61	4500	-9	21	40.0	20	38.0
3602404	0360	CON >20	126	168	237	49	YY	2.0	36	0.8	1.0	1.2	NDO 50	1.2	0.860	YYY	35	40	B	8100	105	7000	-9	22	75.0	20	38.0
3602448	0060	CON	174	208	206	35	NY	2.0	36	2.8	0.6	0.1	DO 36	2.8	1.483	YNY	20	20	E	10416	179	4500	-9	19	65.0	24	50.0
3602448	0070	CON	243	167	242	69	YY	2.0	36	1.2	1.6	0.8	DO 36	1.2	0.600	YYY	20	20	E	6300	78	4500	-9	22	125.0	24	50.0
3602581	0170	CON	630	536	635	91	NY	1.7	36	1.7	0.4	0.4	NDO 14	2.0	1.340	YYY	20	20	E	3750	46	3000	-9	25	50.0	25	50.0
3602581	0210	CON	420	-9	569	95	YY	2.0	36	1.8	0.2	0.1	NDO 35	2.0	1.580	YYY	20	20	E	4300	-9	3000	-9	24	52.0	24	50.0

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AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	--DO-- DUST CONC OCC	SIP	OPER	SD	--SIP-- HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
3603636	0010	CON	86	160	177	17	YY	2.0	36	0.5	0.9	0.4	NDO 35	0.5	0.425	YYY	20	20	E	4983	80	4000	-9	15	100.0	17	61.2
3603636	0020	CON	160	-9	166	7	YY	2.0	36	1.5	1.3	0.7	DO 36	1.5	0.900	YYY	18	20	E	9450	185	4000	-9	21	76.7	21	60.0
3604281	0130	LNGWALL	2651	2530	2863	554	YY	2.0	44	1.0	0.8	0.2	NDO 41	1.2	0.880	YYY	-9	-9	E	45243	391	20000	160	72	86.7	45	100.0
3604281	0220	CON (?)	272	246	380	113	YY	2.0	36	0.7	0.4	0.2	DO 36	0.7	0.483	YYY	10	10	E	5020	-9	5000	-9	51	220.0	35	100.0
3604597	0020	CON >20	110	435	465	196	YY	2.0	36	1.4	1.2	0.8	NDO 73	1.5	1.020	YYY	30	40	B	3354	-9	3000	-9	25	38.4	18	20.0
3604597	0030	CON >20	362	-9	690	944	YY	2.0	36	1.0	1.5	1.2	DO 36	1.0	0.800	YYY	40	40	B	3197	-9	3000	-9	32	34.7	18	20.0
3604852	0090	CON >20	271	-9	-9	-9	YY	2.0	36	2.4	-9.0	-9.0	DO 36	2.4	1.400	YYY	40	40	B	6112	-9	4000	-9	63	40.0	18	25.0
3604852	0140	CON >20	382	331	358	92	YY	2.0	36	0.8	0.8	0.3	DO 36	0.8	0.717	YYY	40	40	B	4284	-9	4000	-9	27	35.0	17	25.0
3605018	0070	CON	30	320	314	71	YY	2.0	36	0.5	0.3	0.1	NDO 14	1.0	0.460	YNY	10	10	E	11570	196	6000	50	17	280.0	75	150.0
3605018	0110	LNGWALL	4320	3790	5511	936	YY	2.0	44	1.7	1.4	0.4	NDO 64	2.0	1.340	YYY	-9	-9	E	39160	410	18020	-9	161	110.0	161	110.0
3605123	0020	CON	312	300	503	139	YY	2.0	36	0.2	1.2	1.0	NDO 14	0.5	0.267	YYY	20	20	E	10042	161	4000	-9	15	65.0	15	56.3
3605123	0040	CON	180	-9	427	110	YY	2.0	36	0.2	1.0	0.8	NDO 35	0.8	0.317	YYY	20	20	E	4867	-9	4000	-9	20	65.0	23	65.0
3605374	0170	CON >20	337	681	630	195	YY	2.0	36	0.8	0.9	0.4	NDO 14	1.2	0.960	YYY	40	40	B	5095	-9	5000	-9	25	30.0	25	25.0
3605374	0190	CON >20	91	326	361	95	YY	2.0	36	0.7	0.9	0.2	NDO 12	1.7	1.100	YYY	40	40	B	5412	-9	5000	-9	32	30.0	21	25.0
3605466	0190	CON	384	-9	502	150	YY	2.0	36	0.2	1.1	0.8	NDO 53	0.8	0.400	YYY	10	20	E	7630	-9	6000	-9	32	280.0	31	100.0
3605466	0210	LNGWALL	1590	4680	4471	999	YY	2.0	44	1.4	1.9	0.5	DO 44	1.4	0.840	YYY	-9	-9	E	28000	376	20000	-9	77	225.0	74	80.0
3605495	0010	OTHER	15	12	16	1	YY	2.0	39	1.4	0.1	0.0	DO 39	1.4	1.400	Y	15	15	B	1696	6	1712	-9	-9	-9.0	-9	-9.0
3605689	0010	OTHER	40	30	30	0	YY	2.0	39	0.3	0.3	0.1	DO 39	0.3	0.300	Y	20	20	B	1649	-9	1500	-9	-9	-9.0	-9	-9.0
3605708	0050	CON >20	170	900	305	252	NY	2.0	36	3.1	0.5	0.4	DO 36	3.1	1.075	NYY	24	40	B	4545	53	6000	-9	14	51.0	14	45.0
3605708	0070	CON >20	725	735	896	60	NY	2.0	36	1.5	1.2	1.3	NDO 12	2.5	1.140	YYY	40	40	B	4914	78	4000	-9	14	41.0	14	40.0
3606018	0070	CON (?)	236	253	306	90	YY	2.0	36	1.5	1.3	0.5	NDO 35	2.1	1.260	YYY	40	-9	B	3040	304	3000	-9	22	30.0	22	20.0
3606018	0090	CON >20	450	-9	484	163	YY	2.0	36	1.2	1.4	0.5	NDO 35	1.5	1.200	YYY	40	-9	B	3264	-9	3000	-9	22	30.0	22	20.0
3606031	0010	OTHER	50	15	15	0	YY	2.0	39	1.4	0.1	0.0	DO 39	1.4	1.400	Y	20	20	C	1638	-9	1500	-9	-9	-9.0	-9	-9.0
3606132	0010	OTHER	40	45	45	0	YY	2.0	39	0.3	0.4	0.3	DO 39	0.3	0.300	Y	-9	20	C	3168	-9	1500	-9	-9	-9.0	-9	-9.0
3606279	0010	OTHER	150	70	57	20	NN	2.0	39	2.6	0.1	0.0	DO 39	2.6	2.600		8	10	B	9920	-9	-9	-9	-9	-9.0	-9	-9.0
3606448	0010	OTHER	20	20	20	0	YY	2.0	39	1.7	0.1	0.0	DO 39	1.7	1.700		20	20	B	-9	-9	-9	-9	-9	-9.0	-9	-9.0
3606453	0010	OTHER	10	10	10	1	YY	2.0	39	2.0	0.9	0.6	DO 39	2.0	2.000		10	10	E	1920	-9	-9	-9	-9	-9.0	-9	-9.0
3606583	0010	CON	345	260	281	16	NY	1.7	36	1.2	0.2	0.2	NDO 46	2.5	1.660	YYY	20	20	E	4118	-9	4000	-9	25	170.0	19	60.0
3606583	0030	CON	185	210	272	10	YY	2.0	36	1.1	1.5	1.9	NDO 46	1.4	0.940	YYY	20	20	E	4620	-9	4000	-9	26	60.0	26	60.0
3606649	0010	OTHER	25	40	23	2	YY	2.0	39	0.1	0.2	0.1	DO 39	0.1	0.100	Y	15	20	B	1822	-9	1500	-9	-9	-9.0	-9	-9.0
3606815	0010	OTHER	40	30	30	2	YY	2.0	39	0.4	0.2	0.0	DO 39	0.4	0.400	Y	18	20	C	1640	-9	1500	-9	-9	-9.0	-9	-9.0
3606873	0020	CON	550	504	475	31	YY	2.0	36	0.4	1.3	0.5	NDO 12	0.6	0.383	YYY	18	20	E	3888	-9	3000	-9	24	45.0	24	40.0
3606967	0010	CON >20	142	-9	132	48	YY	2.0	36	1.2	1.2	0.5	NDO 47	1.4	0.950	YYY	20	20	E	6225	-9	4000	-9	16	111.3	14	60.0
3606967	0060	CON >20	280	60	212	40	YY	2.0	36	0.7	1.1	0.8	NDO 46	1.1	0.850	YYY	20	20	E	9612	-9	4000	-9	18	90.0	14	60.0
3607045	0020	CON	308	240	310	25	YY	2.0	36	0.1	0.4	0.3	NDO 73	0.5	0.200	YYY	19	20	E	6393	99	4500	-9	26	185.0	22	100.0
3607045	0030	CON	372	-9	343	26	YY	2.0	36	0.4	0.7	0.7	NDO 73	0.7	0.333	YYY	20	20	E	12480	-9	6000	-9	34	110.0	34	100.0
3607175	0010	OTHER	25	25	30	0	YY	2.0	39	0.8	0.1	0.0	DO 39	0.8	0.800	Y	-9	20	C	1869	-9	1500	-9	-9	-9.0	-9	-9.0
3607230	0110	LNGWALL	4984	5589	4741	1277	YY	2.0	44	1.2	1.2	0.8	NDO 41	2.1	1.200	YY	-9	-9	E	42000	440	-9	-9	79	105.2	77	100.0
3607230	0120	LNGWALL	4800	5550	4229	870	YY	2.0	44	1.4	1.3	0.3	DO 44	1.4	1.000	YY	-9	-9	E	-9	-9	-9	-9	194	140.0	77	100.0
3607230	0130	CON	210	490	418	117	YY	2.0	36	0.4	0.5	0.2	NDO 48	0.5	0.400	YYY	10	-9	E	8000	130	5000	-9	55	60.0	30	60.0
3607367	0010	OTHER	8	30	8	0	YY	2.0	39	0.1	0.2	0.1	DO 39	0.1	0.100		-9	-9	C	-9	-9	-9	-9	-9	-9.0	-9	-9.0
3607369	0010	OTHER	8	8	-9	-9	YY	2.0	39	0.1	-9.0	-9.0	DO 39	0.1	0.100	Y	6	6	B	3277	-9	3284	-9	-9	-9.0	-9	-9.0
3607416	0080	LNGWALL	2800	3233	1827	1350	YY	2.0	44	1.8	1.1	0.6	DO 44	1.8	1.450	YYY	-9	-9	E	44800	450	25000	200	123	100.0	77	100.0

SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	DO DUST CONC OCC	SIP	OPER	SD	SIP HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
3607446	0030	CON >20	294	-9	401	71	YY	2.0	36	1.5	0.4	0.3	DO 36	1.5	0.767	YNN	20	20	E	5112	98	3000	-9	28	45.0	33	100.0
3607469	0010	OTHER	20	15	15	2	YY	2.0	39	0.3	0.1	0.0	DO 39	0.3	0.300		12	20	C	-9	-9	-9	-9	-9	-9.0	-9	-9.0
3607547	0010	OTHER	9	10	10	0	YY	2.0	39	0.7	0.1	0.0	DO 39	0.7	0.700	Y	9	20	C	3218	-9	3000	-9	-9	-9.0	-9	-9.0
3607554	0010	OTHER	12	10	10	0	YY	2.0	39	0.3	0.1	0.0	DO 39	0.3	0.300	Y	12	12	B	1595	-9	1500	-9	-9	-9.0	-9	-9.0
3607558	0010	OTHER	10	25	10	0	YY	2.0	39	0.3	0.2	0.1	DO 39	0.3	0.300		10	-9	B	-9	-9	-9	-9	-9	-9.0	-9	-9.0
3607773	0010	OTHER	10	20	10	0	YY	2.0	39	0.1	0.1	0.0	DO 39	0.1	0.100		-9	-9	B	-9	-9	-9	-9	-9	-9.0	-9	-9.0
3607813	0030	OTHER	40	20	30	0	YY	2.0	39	0.6	0.5	0.3	DO 39	0.6	0.600	Y	20	20	B	3147	-9	3147	-9	-9	-9.0	-9	-9.0
3607885	0040	CON	182	126	166	48	YY	2.0	36	0.4	0.4	0.5	NDO 12	1.1	0.483	YYY	20	20	E	4671	61	4000	-9	19	60.0	22	50.0
3607885	0060	CON >20	274	-9	210	64	YY	2.0	36	0.2	0.7	0.4	NDO 73	0.7	0.483	YYY	37	37	B	3930	-9	3000	-9	19	35.0	19	25.0
3607987	0020	CON >20	442	600	458	60	YY	2.0	36	-9.0	0.2	0.0	NDO 49	0.7	0.425	YYY	-9	-9	E	5200	-9	3000	-9	25	75.0	23	50.0
3608031	0010	OTHER	18	15	18	0	YY	2.0	39	0.1	0.1	0.0	DO 39	0.1	0.100	Y	15	20	C	1940	-9	1500	-9	-9	-9.0	-9	-9.0
3608089	0020	CON	54	240	239	106		2.0	36	-9.0	0.5	0.3	-9	-9.0	-9.000	YYY	20	20	E	8816	149	4000	60	15	70.0	15	75.0
3608139	0020	CON >20	190	450	459	178	NN	2.0	36	0.5	1.4	0.5	NDO 46	4.4	2.460	YY	40	40	B	3638	-9	-9	-9	17	30.0	17	30.0
3608220	0010	OTHER	15	-9	11	3	YY	2.0	39	0.1	0.1	0.0	DO 39	0.1	0.100	Y	10	10	B	3110	-9	3000	-9	-9	-9.0	-9	-9.0
3608246	0010	OTHER	15	-9	-9	-9	YY	2.0	39	1.1	-9.0	-9.0	DO 39	1.1	1.100		8	8	B	3047	-9	-9	-9	-9	-9.0	-9	-9.0
4000577	0010	CON	183	180	170	13	NY	2.0	36	3.4	0.9	0.3	DO 36	3.4	1.050	YYN	10	10	E	4060	78	3500	60	12	50.0	12	150.0
4001746	0010	CON	600	550	534	43	NY	0.6	36	0.2	0.2	0.1	NDO 76	1.0	0.517	YYY	20	20	E	5790	68	4750	60	48	90.0	48	85.0
4001813	0020	CONVEN	85	127	132	31	YY	2.0	38	0.2	0.7	0.2	NDO 46	0.8	0.460	N	10	10	E	3570	72	9000	-9	-9	-9.0	-9	-9.0
4001874	0020	CON	350	350	372	9	NY	2.0	36	1.4	0.6	0.1	NDO 12	2.5	1.440	YYY	20	20	E	4680	95	4500	60	17	125.0	17	85.0
4001977	0030	CON	290	300	287	30	NN	2.0	36	2.1	2.6	1.9	NDO 46	5.7	2.560	YYY	20	20	C	4004	97	3500	60	16	140.0	16	100.0
4002045	0010	CON	180	150	146	21	NY	2.0	36	0.4	0.8	0.4	NDO 46	2.5	0.617	YYY	20	20	C	4880	76	4500	60	16	60.0	16	80.0
4002054	0010	CONVEN	140	125	114	11	YY	2.0	38	0.8	0.6	0.3	NDO 46	1.1	0.880	Y	10	10	E	4500	60	4500	60	-9	-9.0	-9	-9.0
4002666	0020	CONVEN	128	195	155	4	YY	2.0	38	1.7	1.5	0.1	DO 38	1.7	0.940	YYY	10	10	C	4140	64	3000	60	3	90.0	3	50.0
4002704	0010	CONVEN	48	120	116	23	YY	1.7	38	1.8	0.1	0.0	DO 38	1.8	0.667	Y	10	10	B	3330	102	3000	60	-9	-9.0	-9	-9.0
4002775	0010	CON	400	-9	-9	-9	NN	1.3	36	7.6	-9.0	-9.0	DO 36	7.6	4.800	YYY	20	20	E	5460	91	4500	60	15	80.0	15	80.0
4002831	0010	CONVEN	99	80	98	21	YY	2.0	38	0.4	1.5	1.1	NDO 54	1.1	0.660	YYY	10	10	C	4305	-9	3000	60	3	60.0	3	50.0
4002839	0010	CONVEN	125	200	188	8	YY	2.0	38	0.4	1.3	0.2	NDO 43	2.2	0.933	YYY	10	10	C	3356	66	3000	60	8	65.0	1	50.0
4002875	0010	CONVEN	91	225	149	5	NN	2.0	38	1.4	1.2	0.1	NDO 34	9.3	2.480	Y	10	10	B	3916	-9	3000	60	-9	-9.0	-9	-9.0
4002912	0020	CON	640	400	360	102	NN	2.0	36	10.2	0.8	1.1	DO 36	10.2	3.550	YYY	20	20	E	4680	69	4500	60	22	100.0	22	100.0
4002971	0010	CON >20	600	675	827	213	NY	2.0	36	-9.0	2.2	1.7	NDO 46	3.0	2.050	YYY	40	40	C	4830	83	4500	60	24	103.0	22	100.0
4002971	0020	CON >20	630	900	701	135	NN	1.7	36	7.1	0.7	0.4	DO 36	7.1	3.483	YYY	20	40	C	4736	74	4500	60	28	110.0	26	100.0
4002996	0010	CON	375	700	342	55	YY	2.0	36	1.7	0.1	0.1	DO 36	1.7	0.750	YYY	20	20	E	4640	72	4500	60	36	85.0	36	85.0
4003011	0010	CON	230	125	238	15	YY	2.0	36	1.4	1.4	1.1	DO 36	1.4	0.720	YYY	20	20	E	4832	75	4500	60	18	125.0	18	70.0
4200093	0030	CON	133	-9	273	88	NY	2.0	36	2.7	0.6	0.7	NDO 35	3.8	1.960	YYY	20	20	E	10500	87	10000	60	39	280.0	39	150.0
4200093	0160	LNGWALL	2550	1150	1380	622	NY	2.0	44	2.5	4.3	1.9	NDO 64	3.1	2.020	YYY	-9	-9	B	64320	240	50000	230	77	221.3	77	89.6
4200121	0490	CON >20	516	-9	682	188	YY	2.0	36	1.1	1.3	0.4	NDO **	1.7	1.400	NYY	40	40	E	7942	60	10688	106	37	120.0	37	100.0
4200121	0500	CON >20	96	-9	814	173	YY	2.0	36	1.6	2.1	1.4	NDO 35	1.7	1.560	YYY	40	40	E	10033	60	8000	60	37	210.0	37	121.9
4200171	0130	CON >20	510	2381	865	122	NN	2.0	36	1.2	0.9	0.3	NDO 50	3.3	2.160	YYY	-9	15	E	10950	83	10000	60	62	185.0	62	185.0
4200171	0140	CON >20	850	2381	623	172	NY	2.0	36	1.1	1.3	0.6	NDO 46	2.8	1.640	YYY	-9	15	E	10920	84	10000	60	62	195.0	62	150.0
4200171	0220	LNGWALL	2150	2902	1990	923	NN	0.9	44	1.0	1.4	0.2	NDO 40	1.4	1.240	YYY	-9	-9	E	62932	565	60000	300	108	159.1	108	100.0
4201280	0050	CON (?)	1045	870	1099	188	YY	2.0	36	0.5	1.0	0.6	DO 36	0.5	0.420	YYY	-9	-9		15876	98	8000	60	47	100.0	46	100.0
4201280	0070	CON >20	713	665	940	238	YY	2.0	36	1.5	1.5	1.4	DO 36	1.5	0.975	YYY	40	40	B	8910	-9	7000	-9	40	110.0	40	100.0
4201435	0060	LNGWALL	6000	5200	5990	1665	NY	2.0	44	2.1	1.9	0.4	NDO 41	3.0	2.020	YYY	-9	-9	B	44160	405	30000	105	72	115.0	72	80.0

SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	--DO-- DUST CONC OCC	SIP	OPER	SD	--SIP-- HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
4201435	0090	CON >20	792	744	678	303	YY	2.0	36	2.0	1.1	0.3	DO 36	2.0	1.260	YYY	-9	20	B	7717	-9	7200	-9	35	120.0	35	80.0
4201566	0010	CON >20	690	500	746	278	NN	1.5	36	2.2	1.0	0.5	DO 36	2.2	1.680	YY	40	40	B	10290	-9	-9	-9	23	98.0	23	80.0
4201566	0100	LNGWALL	2750	-9	-9	-9	YY	2.0	44	2.2	-9.0	-9.0	DO 44	2.2	1.600	YY	-9	-9	B	344880	175	-9	-9	65	155.0	60	80.0
4201697	0020	CON	100	470	690	135	YY	2.0	36	1.0	0.7	0.4	NDO 35	1.3	0.980	YYY	15	15	E	10080	96	6000	60	26	130.0	22	80.0
4201697	0050	CON	400	650	699	262	NY	2.0	36	2.0	0.7	0.5	NDO 35	4.1	2.025	YYY	15	15	E	10760	71	6000	60	23	170.0	23	80.0
4400246	0020	LNGWALL	2044	3537	2004	471	YY	2.0	44	0.8	0.9	0.3	NDO 41	1.0	0.780	YYY	-9	-9	E	187675	1001	75000	-9	69	103.2	35	64.0
4400246	0080	CON >20	243	400	284	40	YY	2.0	36	1.0	1.4	0.6	DO 36	1.0	0.760	YYY	10	10	C	12288	113	5000	60	27	210.0	27	80.0
4400269	0120	CON >20	211	200	422	133	YY	2.0	36	0.5	1.5	1.2	NDO 14	1.1	0.700	YYY	30	30	E	5600	93	5500	60	20	85.0	20	65.0
4400294	0010	CON	350	550	300	0	YY	2.0	36	0.7	1.0	1.1	NDO 46	1.2	0.740	YYY	10	10	E	10300	107	3000	60	26	100.0	26	70.0
4400302	0320	CON	311	320	323	47	YY	2.0	36	0.4	1.5	0.7	NDO 14	0.7	0.520	YYY	16	20	C	8145	75	3000	60	20	80.0	17	80.0
4400304	0210	CON	300	450	451	98	YY	1.3	36	1.1	1.4	0.5	DO 36	1.1	0.800	YYY	10	10	E	7704	91	3000	60	34	100.0	34	90.0
4400304	0330	LNGWALL	4500	3750	1790	913	NN	2.0	44	4.7	1.4	0.5	DO 44	4.7	3.160	YYY	-9	-9		37800	530	30000	-9	98	90.8	94	50.0
4401246	0010	CONVEN	200	200	161	36	YY	2.0	38	1.1	0.1	0.0	NDO 46	2.2	1.660	Y	10	10	E	6900	98	3000	60	-9	-9.0	-9	-9.0
4401520	0030	CON >20	327	425	311	69	YY	2.0	36	0.4	0.5	0.4	NDO 74	0.5	0.420	YNY	10	10	E	17200	175	5000	60	19	220.0	29	80.0
4401520	0120	LNGWALL	2176	3870	1884	477	YY	2.0	44	0.7	0.9	0.2	NDO 41	0.8	0.620	YYY	-9	-9	E	178699	1018	75000	-9	64	165.3	46	90.0
4401689	0160	CON	200	320	477	121	YY	2.0	36	0.4	0.5	0.2	NDO 12	0.8	0.480	YYY	20	20	E	7087	65	4000	60	28	105.7	27	75.0
4401717	0040	CON	192	280	193	17	YY	2.0	36	1.1	0.4	0.3	NDO 46	1.7	1.040	YYY	10	10	E	8640	144	3000	60	16	65.0	16	40.0
4401873	0010	CON	300	250	200	0	NN	1.7	36	8.0	0.2	0.3	NDO 35	8.3	4.400	YYY	10	10		3900	80	3000	60	15	65.0	10	60.0
4402253	0050	CON >20	260	420	311	51	YY	2.0	36	0.8	1.6	0.7	DO 36	0.8	0.520	YNY	10	10	E	12096	75	3000	60	28	260.0	33	110.0
4403264	0060	CON	500	300	284	12	NN	2.0	36	2.9	0.2	0.1	NDO 35	7.3	2.720	YYY	8	10	E	6314	119	3000	60	27	60.0	25	60.0
4403465	0010	CON	180	250	428	18	YY	2.0	36	1.1	0.5	0.2	DO 36	1.1	0.800	YYY	10	10	E	8344	160	3000	60	16	60.0	16	50.0
4403524	0010	CON	90	240	168	27	YY	1.5	36	0.4	0.5	0.3	NDO 47	0.5	0.380	YYY	10	10	E	4116	73	3000	60	24	50.0	18	40.0
4403600	0020	CON	200	425	370	33	YY	2.0	36	0.2	0.8	0.6	NDO 14	0.7	0.400	YYY	4	10	E	6282	87	3000	60	13	55.0	9	50.0
4403707	0020	CON	330	340	412	14	YY	2.0	36	1.3	1.0	1.2	DO 36	1.3	0.700	YY	10	10	E	6964	82	-9	-9	20	70.0	12	60.0
4403795	0050	CON >20	543	360	355	90	YY	2.0	36	0.7	1.8	2.2	DO 36	0.7	0.660	YYY	5	10	C	29926	328	5000	60	74	275.7	71	80.0
4403795	0080	LNGWALL	1414	2050	2366	948	YY	2.0	44	0.8	1.1	0.2	NDO 41	1.0	0.700	YYY	-9	-9	E	176926	960	75000	-9	73	242.9	73	100.0
4403808	0010	CON	400	400	208	12	YY	1.7	36	0.7	1.4	1.7	NDO 47	1.0	0.740	YYY	10	10	E	6202	110	3000	60	30	60.0	24	60.0
4403926	0010	CON	750	1000	661	199	YY	2.0	36	1.0	0.5	0.2	DO 36	1.0	0.500	YYY	10	10	E	12320	205	3000	60	15	60.0	14	50.0
4404040	0010	CON	620	430	637	25	YY	1.7	36	1.7	1.6	3.1	DO 36	1.7	1.080	YYY	20	20	E	8200	117	3000	60	19	75.0	14	75.0
4404197	0110	LNGWALL	900	-9	3015	1467	YY	2.0	60	1.0	1.6	1.1	NDO 44	1.8	1.200	YYY	-9	-9		37730	-9	35000	-9	113	109.3	85	45.9
4404197	0120	CON	350	600	419	56	YY	2.0	36	1.8	1.6	0.5	DO 36	1.8	1.360	YYY	10	10	E	10512	88	3000	60	43	110.0	43	110.0
4404248	0010	CON	405	600	556	118	NY	2.0	36	1.2	0.5	0.3	NDO 46	1.7	1.180	YYY	10	10	E	4046	74	3000	60	27	55.0	18	50.0
4404251	0070	CON	430	-9	252	130	YY	2.0	36	1.4	1.8	0.5	DO 36	1.4	0.980	YYY	10	10	E	7904	87	4000	60	37	130.0	38	80.0
4404251	0090	LNGWALL	1800	1000	1308	346	YY	1.7	60	1.7	1.3	0.9	DO 60	1.7	1.140	YYY	-9	-9		100716	742	70000	-9	87	80.0	87	75.0
4404300	0010	CON	400	300	218	103	YY	1.3	36	0.5	0.1	0.0	NDO 73	0.7	0.500	YYY	10	10	E	20800	260	3000	60	26	75.0	24	50.0
4404481	0010	CON	1050	1000	1195	183	YY	2.0	36	0.4	1.3	1.2	NDO 46	0.8	0.500	YYY	10	10	E	7398	77	3000	60	40	100.0	30	65.0
4404517	0080	CON >20	300	395	278	42	YY	2.0	36	2.1	1.0	0.2	DO 36	2.1	1.160	YYY	10	10	C	26202	218	5000	60	34	315.3	27	80.0
4404517	0090	LNGWALL	1680	1170	1610	399	YY	2.0	41	0.8	1.2	0.5	NDO 44	0.8	0.660	YYY	-9	-9	E	196800	960	75000	-9	45	80.0	43	71.9
4404517	0100	LNGWALL	68	1755	1691	498	YY	2.0	41	0.5	0.8	0.3	DO 41	0.5	0.260	YYY	-9	-9	E	237943	895	75000	-9	99	96.2	78	80.0
4404703	0010	CON >20	360	400	418	18	NY	1.7	36	2.0	0.4	0.1	NDO 46	2.6	1.720	YNY	10	10	E	11655	88	3000	60	27	60.0	35	60.0
4404828	0010	OTHER	75	150	166	26	YY	1.5	34	0.8	0.1	0.0	DO 34	0.8	0.300	Y	10	10	E	3555	79	3000	60	-9	-9.0	-9	-9.0
4404856	0020	CON >20	540	500	647	121	YY	2.0	36	0.7	0.9	0.3	NDO 14	0.8	0.680	YYY	10	-9	C	23858	248	5000	60	52	100.0	27	100.0
4404856	0090	LNGWALL	2625	1125	2050	960	YY	2.0	44	0.8	1.4	0.4	NDO 41	1.1	0.840	YYY	-9	-9	E	197486	840	70000	-9	127	97.2	127	70.0

SIP DATA TABULATION

MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST AVG STD	DO DUST CONC OCC	SIP	OPER	SD	SIP HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
4404862	0010	CON	300	250	339	47	YY	1.2	36	0.7	0.6	0.2	NDO 50	1.3	0.760	YYY	10	10	E	8560	142	3000	60	16	50.0	16	50.0
4404871	0010	CON	420	300	644	256	YY	1.2	36	0.4	0.9	0.7	NDO 46	1.2	0.660	YYY	10	10	E	6144	102	3000	60	48	69.0	48	50.0
4404946	0020	CON	300	300	675	100	YY	2.0	36	0.5	0.8	0.5	DO 36	0.5	0.360	YYY	10	10	E	13470	112	4500	60	27	125.0	23	60.0
4405090	0010	CON	400	450	283	113	NN	0.9	36	1.5	0.9	1.4	NDO 12	2.1	1.050	YYY	20	20	E	7920	88	3000	60	15	80.0	14	50.0
4405182	0010	CON >20	400	520	367	36	YY	0.7	36	0.7	0.4	0.2	NDO 73	0.8	0.520	YYY	10	-9	C	5600	-9	4500	60	32	55.0	32	50.0
4405186	0010	CON	300	300	315	42	YY	2.0	36	0.4	0.5	0.5	NDO 35	0.5	0.380	YYY	10	10	E	16075	60	3000	60	26	50.0	24	30.0
4405210	0010	CON	450	400	278	44	YY	2.0	36	0.5	1.6	0.7	NDO 46	1.0	0.560	YYY	10	10		5200	86	3000	60	24	65.0	24	65.0
4405385	0010	CONVEM	150	250	130	21	YY	2.0	38	1.1	1.1	0.6	NDO 54	1.5	1.020	Y	10	10	C	3420	76	3000	60	-9	-9.0	-9	-9.0
4405415	0010	CON	320	450	499	251	YY	1.7	36	1.0	1.4	1.2	DO 36	1.0	0.600	YYY	10	10	E	11568	129	3000	60	26	48.2	24	60.0
4405654	0010	CON	300	350	321	20	NN	1.0	36	7.1	0.5	0.2	DO 36	7.1	2.675	YYY	10	10	E	5100	85	3000	60	30	80.0	28	60.0
4405668	0040	CON	300	300	236	23	YY	2.0	36	1.7	0.2	0.1	DO 36	1.7	0.960	YYY	10	10	E	5104	91	3000	60	12	60.0	12	60.0
4405696	0010	CON	575	700	707	234	YY	1.2	36	0.5	0.3	0.1	NDO 46	1.0	0.620	YYY	10	10	E	7860	87	3000	60	24	60.0	24	40.0
4405759	0010	CON	700	625	294	4	NY	1.5	36	2.5	0.2	0.3	DO 36	2.5	1.060	YYY	10	10	E	8820	118	3000	60	46	184.3	46	85.0
4405770	0010	CON	180	425	417	23	YY	2.0	36	2.1	0.9	0.7	DO 36	2.1	1.100	YYY	8	10	E	22952	174	4000	60	23	110.0	23	75.0
4405772	0020	CON	643	720	625	132	NN	2.0	36	2.7	3.9	2.1	NDO 46	9.4	3.380	YYY	10	10	E	5760	61	3000	60	20	100.0	19	65.0
4405800	0010	CON	560	400	272	89	NY	1.0	36	0.7	0.8	0.3	NDO 35	2.2	0.920	YYY	10	10	E	7975	75	6000	60	16	50.0	19	50.0
4405815	0010	CON	400	370	400	0	YY	2.0	36	1.1	0.9	0.6	DO 36	1.1	0.540	YYY	10	10	E	10525	151	3000	60	37	50.0	32	40.0
4405831	0010	CON	500	400	350	0	NY	1.0	36	0.8	0.7	0.4	NDO 35	1.4	0.900	YY	10	10	C	7056	156	-9	-9	26	60.0	22	50.0
4405874	0020	CON	360	400	369	38	NY	1.5	36	0.7	1.1	0.9	NDO 46	1.2	0.660	YYY	20	20	E	6336	88	3000	60	26	83.8	23	42.0
4406036	0010	CON	800	600	393	78	YY	2.0	36	0.8	0.9	0.3	NDO 73	1.3	0.900	YYY	10	10	E	8217	105	-9	60	18	200.0	18	30.0
4406101	0010	CON	500	500	300	0	NY	2.0	36	1.1	0.5	0.6	NDO 14	2.5	1.220	YYY	10	10	E	8515	163	3000	60	24	150.0	20	100.0
4406170	0010	CON	150	250	475	50	YY	2.0	46	0.8	0.7	0.5	DO 46	0.8	0.550	YYY	10	10	E	5697	98	3000	60	24	40.0	24	40.0
4406206	0050	CON	500	700	512	114	YY	2.0	36	0.8	0.9	0.4	NDO 53	1.7	1.200	YYY	10	10	E	9336	97	3000	60	36	125.0	36	70.0
4406227	0010	CON	610	800	456	121	NY	1.7	36	2.4	1.7	1.7	DO 36	2.4	1.260	YY	10	10	E	-9	-9	-9	-9	83	74.3	27	24.6
4406239	0020	CON	576	350	395	11	YY	1.7	36	1.0	0.9	0.5	DO 36	1.0	0.500	YYY	10	10	E	4032	63	3000	60	20	90.0	22	35.0
4406243	0010	CON	60	480	364	84	YY	2.0	36	0.4	0.7	0.4	NDO 35	0.7	0.320	YYY	8	10	E	10816	169	3000	60	16	50.0	16	45.0
4406293	0010	CON	1	350	314	29	NY	1.3	36	0.2	0.8	0.3	NDO 46	4.3	1.060	YYY	10	10	E	4020	95	3000	60	31	72.9	29	48.6
4406323	0010	CON	325	275	271	32	YY	2.0	36	1.1	0.9	0.4	DO 36	1.1	0.360	YYY	10	10	E	8710	83	3000	60	33	90.0	21	80.0
4406326	0010	CON	200	350	187	29	YY	2.0	36	0.8	0.3	0.2	NDO 46	1.3	0.760	YYY	10	10	E	5320	95	3000	60	15	60.0	14	50.0
4406364	0020	CON >20	700	-9	687	132	YY	2.0	36	1.2	0.8	0.5	DO 36	1.2	0.800	YYY	10	10	E	5008	83	3000	60	28	80.0	28	100.0
4406368	0010	CON	360	280	421	105	YY	2.0	36	2.3	1.0	0.6	DO 36	2.3	1.000	YYY	8	10	E	6040	75	3000	60	13	40.0	13	40.0
4406375	0010	CON	450	350	455	139	YY	1.5	36	0.5	1.1	0.4	NDO 12	1.0	0.580	YYY	20	20	E	12684	117	3000	60	22	60.0	16	60.0
4406395	0010	CON	240	262	415	20	YY	2.0	36	0.2	0.5	0.1	NDO 46	1.3	0.400	YYY	10	10	E	7763	161	-9	60	16	50.0	16	50.0
4406397	0010	CON	200	325	308	16	YY	1.7	36	0.8	1.1	0.7	NDO 12	1.5	1.000	YYY	10	10	C	3682	68	3000	60	16	65.0	16	60.0
4406423	0030	CON	400	800	488	168	YY	2.0	36	1.1	1.5	1.3	DO 36	1.1	0.840	YYY	10	10	E	6280	112	4500	60	18	187.0	15	150.0
4406435	0010	CON	490	600	307	24	YY	2.0	36	1.0	0.8	0.3	NDO 46	1.2	0.820	YYY	8	10	E	5620	76	3000	60	20	60.0	20	40.0
4406444	0020	CON	400	400	478	136	YY	2.0	36	0.7	1.8	0.6	NDO 35	1.7	1.060	YYY	10	10	E	6768	80	3000	60	28	100.0	20	68.5
4406446	0020	CON	311	-9	-9	-9	NN	2.0	36	4.5	-9.0	-9.0	DO 36	4.5	2.320	YYY	20	20	E	4320	77	3000	60	40	65.0	32	50.0
4406473	0010	CON	750	600	645	180	YY	2.0	36	0.5	0.2	0.1	DO 36	0.5	0.300	YYY	20	20	E	24000	240	3000	60	27	160.0	23	60.0
4406483	0010	CON	310	350	303	47	NY	2.0	36	1.0	0.7	0.4	NDO 46	3.1	1.200	YNY	10	10	E	3552	74	3000	60	30	60.0	35	60.0
4406485	0020	CON	250	350	250	0	YY	1.5	36	0.7	1.3	2.7	NDO 46	1.2	0.880	YYY	10	10	E	4100	83	3000	60	14	100.0	12	50.0
4406497	0010	CON	260	500	270	48	NN	0.6	36	2.5	0.1	0.1	DO 36	2.5	1.440	YYY	10	10	E	5628	100	3000	60	24	55.0	21	50.0
4406498	0010	CON >20	20	400	512	117	YY	1.2	36	0.4	0.5	0.5	NDO 46	0.4	0.300	YYY	10	10	E	7220	103	3000	60	26	66.2	26	70.0

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AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	DO DUST CONC OCC	SIP	OPER	SD	SIP HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
4406500	0010	CON >20	600	600	412	104	YY	2.0	36	0.5	1.3	1.5	NDO 46	1.5	0.680	YYY	10	10	E	9120	114	3000	60	56	75.0	56	75.0
4406505	0010	CON	770	801	353	294	NN	1.3	36	14.7	2.2	0.6	DO 36	14.7	5.840	YYY	20	20	C	5976	62	3000	60	28	130.0	22	75.0
4406520	0010	CON	400	350	591	68	YY	1.2	36	1.1	1.1	0.5	DO 36	1.1	0.660	YYY	10	10	E	15960	120	5000	60	30	75.0	30	75.0
4406529	0010	CON >20	1005	500	797	200	YY	2.0	36	0.7	0.6	0.5	NDO 50	0.8	0.640	YYN	-9	25	E	22500	250	3000	60	23	24.3	21	60.0
4406531	0010	CON	560	500	427	20	NY	0.8	36	1.0	1.2	1.4	NDO 46	1.4	0.760	YYY	10	10	E	13208	206	3000	60	26	55.0	24	45.0
4406533	0010	CON	450	275	395	65	NN	1.2	36	3.4	1.1	0.7	DO 36	3.4	1.640	YYY	10	10	C	6346	140	3000	60	44	60.0	40	60.0
4406534	0010	CON	625	900	458	161	YY	1.7	36	1.1	0.5	0.2	NDO 46	1.3	0.760	YYY	10	10	E	22734	249	3000	60	24	70.0	22	40.0
4406537	0020	CON	325	-9	-9	-9	YY	2.0	12	0.4	-9.0	-9.0	NDO 14	0.5	0.420	YYY	10	10	E	4460	85	3000	60	21	95.7	21	71.4
4406542	0010	CON	250	300	304	6	YY	2.0	36	2.0	1.7	0.8	DO 36	2.0	1.340	YYY	10	10	E	5890	66	3000	60	23	40.0	19	40.0
4406557	0010	CON	275	700	468	212	YY	1.7	36	0.7	0.9	0.9	NDO 72	1.0	0.700	YYY	10	10	C	8876	153	3000	60	43	70.0	43	70.0
4406568	0010	CON	880	800	300	0	YY	2.0	36	1.2	1.8	1.2	DO 36	1.2	0.700	YYY	30	-9	B	11500	115	3000	60	21	140.0	18	100.0
4406577	0010	CON	750	500	643	252	YY	1.5	36	0.7	1.0	0.2	NDO 46	0.8	0.540	YYY	10	10	E	19771	222	3000	60	25	60.0	23	60.0
4406583	0010	CON	550	-9	496	256	YY	2.0	36	0.7	1.3	0.5	NDO 14	0.7	0.560	YYY	10	10	E	8470	103	3000	60	30	95.0	29	65.0
4406585	0010	CON	405	470	593	16	NN	1.0	36	2.2	0.9	0.2	DO 36	2.2	1.120	YYY	20	20	E	6288	98	3000	60	19	70.0	19	50.0
4406594	0010	CON	425	800	622	21	NY	2.0	36	0.5	0.7	0.3	NDO 46	1.0	0.600	YYY	10	10	E	11421	118	3000	60	24	150.0	20	60.0
4406595	0010	CON	500	-9	581	140	YY	2.0	36	1.2	1.2	0.9	DO 36	1.2	0.760	YYY	20	10	E	11400	120	5848	60	35	80.0	35	80.0
4406599	0010	CON	830	-9	763	347	YY	2.0	36	1.0	0.8	0.2	NDO 14	1.4	0.800	YYY	18	20	E	20960	201	3000	60	21	60.0	20	50.0
4406612	0010	CON	300	300	455	64	YY	2.0	36	0.8	0.3	0.2	NDO 1	1.2	0.840	YYY	10	10	E	5525	122	3000	60	16	80.0	16	40.0
4406624	0010	CON	700	600	367	65	YY	2.0	36	1.1	1.1	0.7	DO 36	1.1	0.780	YYY	10	10	E	10848	83	3000	60	32	60.0	25	50.0
4406628	0010	CON	150	425	357	115	YY	2.0	36	0.6	0.7	0.6	DO 36	0.6	0.440	YYY	10	10	E	6500	92	3000	60	23	75.0	23	60.0
4406634	0010	CON	250	-9	189	7	NY	2.0	36	1.0	0.6	0.4	NDO 46	3.4	1.200	YYY	10	-9	E	5740	102	3000	60	16	50.0	16	50.0
4406636	0010	CON	250	-9	-9	-9	NN	2.0	36	18.1	-9.0	-9.0	DO 36	18.1	6.700	YYY	10	10	E	4320	96	3000	60	21	110.0	21	100.0
4406638	0010	CON	400	-9	430	55	YY	2.0	36	0.5	0.6	0.3	NDO 53	0.8	0.500	YYY	10	10	E	10240	90	3000	60	24	60.0	18	55.0
4601270	0520	CON >20	612	420	412	136	YY	2.0	36	1.1	0.8	0.5	NDO 46	1.2	1.000	YYY	50	50	E	4970	41	4000	37	19	70.0	19	60.0
4601270	0560	LNGWALL	1530	-9	1621	567	YY	2.0	44	1.0	0.5	0.3	NDO 41	1.1	0.840	YY	-9	-9	E	23058	560	19000	180	42	-9.0	39	-9.0
4601271	0470	CON >20	225	425	426	124	YY	2.0	36	0.8	1.1	0.4	DO 36	0.8	0.550	YYY	50	50	E	4620	41	3500	35	19	65.0	19	60.0
4601271	0520	LNGWALL	100	3800	2099	663	NN	2.0	44	5.7	1.9	0.6	NDO 41	10.0	3.983	YYY	-9	-9	E	52000	400	40000	135	56	175.0	56	175.0
4601271	0530	CON >20	620	-9	409	163	YY	2.0	36	2.1	1.0	0.2	DO 36	2.1	1.250	NYY	50	50	E	52	85	5000	35	23	104.6	20	60.0
4601286	0370	CON	450	513	521	162	YY	2.0	36	0.7	1.4	1.2	DO 36	0.7	0.340	YYY	10	10	E	7120	68	5200	60	36	142.0	18	55.0
4601286	0410	LNGWALL	520	4000	4923	1151	YY	2.0	44	1.3	1.3	0.4	DO 44	1.3	0.600	YYY	-9	-9	E	33082	369	24000	300	78	174.4	32	53.1
4601309	0520	LNGWALL	1510	2115	3867	1246	YY	2.0	44	0.7	1.0	0.3	NDO 64	1.7	1.060	YYY	-9	-9	E	42700	352	30000	-9	125	152.6	100	110.0
4601318	0720	CON (?)	253	-9	95	48	YY	2.0	36	0.2	0.2	0.2	NDO 43	0.4	0.283	YYY	10	10	E	13520	130	6000	60	38	150.0	25	40.0
4601318	0760	LNGWALL	2212	1730	2203	437	YY	2.0	44	1.5	1.7	1.1	NDO 41	1.5	1.067	YY	-9	-9	E	-9	490	-9	-9	68	90.0	62	80.0
4601318	0840	LNGWALL	1723	1481	963	454	YY	2.0	44	1.4	1.5	1.1	NDO 64	1.8	1.200	YY	-9	-9	E	-9	414	-9	-9	85	90.0	62	80.0
4601413	0010	CON	292	604	549	136	YY	2.0	36	0.2	0.3	0.4	NDO 35	0.4	0.180	YYY	20	20	C	5400	69	3000	45	12	80.0	14	50.0
4601419	0170	CON	224	496	647	128	YY	2.0	36	0.1	0.5	0.4	NDO 35	0.1	0.100	YYY	10	10	E	5460	52	3000	30	17	75.0	17	75.0
4601433	0530	LNGWALL	3132	3710	4511	1267	YY	2.0	44	1.0	1.7	0.5	NDO 41	1.6	1.300	YYY	-9	-9	E	35000	385	30000	-9	145	105.0	68	50.0
4601436	0050	LNGWALL	4494	3150	3784	868	NY	2.0	44	2.8	1.1	0.3	DO 44	2.8	1.160	YYY	-9	-9	E	36400	288	25000	-9	62	200.0	49	100.0
4601436	0320	CON (?)	408	450	402	136	YY	2.0	36	0.7	0.2	0.2	DO 36	0.7	0.400	YYY	10	-9	E	9001	81	6600	60	30	240.0	23	60.0
4601437	0060	CON (?)	432	448	618	110	YY	2.0	36	0.7	0.7	0.4	DO 36	0.7	0.380	YYY	10	-9	E	8715	70	6600	60	49	150.0	23	40.0
4601437	0840	LNGWALL	3696	3920	3610	801	NY	2.0	44	1.8	1.8	0.4	NDO 41	3.7	1.600	YYY	-9	-9		36000	311	24000	300	69	100.0	64	100.0
4601438	0050	LNGWALL	2125	3100	2698	695	YY	2.0	44	1.7	0.9	0.2	DO 44	1.7	0.940	YYY	-9	-9	E	64960	350	24000	300	53	100.0	33	81.8
4601438	0080	CON (?)	410	311	323	112	YY	2.0	36	0.6	0.3	0.1	NDO 43	1.5	0.880	YYY	-9	10	E	7795	70	6600	60	47	150.0	23	40.0

SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	--DO-- DUST CONC OCC	SIP	OPER	SD	--SIP-- HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
4601452	0320	LNGWALL	3520	2505	2897	784	YY	2.0	44	2.4	1.0	0.2	DO 44	2.4	1.100	YY	-9	-9	E	54184	240	-9	-9	77	120.0	65	50.0
4601452	0330	CON (?)	300	220	389	179	YY	2.0	36	-9.0	0.8	0.3	NDO 48	0.8	0.475	YYY	10	10	E	6725	67	6000	60	39	70.0	25	35.0
4601453	0380	CON (?)	156	225	321	116	YY	2.0	36	0.7	0.5	0.1	NDO 48	1.4	0.571	YYY	10	10	E.	6834	65	6000	60	40	60.0	28	45.4
4601453	0430	LNGWALL	4455	1976	2036	420	YY	2.0	44	1.4	1.7	0.8	DO 44	1.4	0.700	YY	-9	-9	E	58904	386	-9	-9	133	72.4	51	50.0
4601455	0330	LNGWALL	2070	2475	2435	554	YY	2.0	44	0.8	1.4	0.5	NDO 41	0.8	0.560	YY	-9	-9	E	49098	488	-9	-9	84	144.5	80	70.0
4601455	0360	CON (?)	378	432	313	103	YY	2.0	36	1.1	0.8	0.7	NDO 43	2.0	1.240	YYY	-9	10	E	7312	73	6000	60	49	108.2	20	40.0
4601456	0540	LNGWALL	4520	3000	4031	688	YY	2.0	44	0.8	1.6	0.5	NDO 40	0.8	0.650	YYY	-9	-9	E	64870	709	30000	-9	124	293.5	58	20.0
4601474	0390	CON >20	660	390	457	118	YY	2.0	36	0.7	1.8	1.1	DO 36	0.7	0.400	YY	-9	35	E	-9	-9	4000	50	29	150.0	27	140.0
4601474	0420	CON >20	573	450	372	87	YY	2.0	36	0.8	2.7	2.1	DO 36	0.8	0.500	YYY	30	50	E	7191	99	4300	46	22	168.2	22	50.0
4601495	0630	LNGWALL	2346	5440	3213	920	NN	2.0	44	3.1	0.7	0.4	DO 44	3.1	2.233	YYY	-9	-9	E	47630	490	40000	250	67	100.0	67	80.0
4601537	0390	LNGWALL	2160	1470	2187	511	YN	2.0	44	2.2	1.9	0.4	NDO 41	2.4	2.240	YYY	-9	-9	B	46038	334	25000	180	53	610.0	53	250.0
4601602	0210	CON	450	600	1113	114	YY	2.0	36	0.7	1.0	0.8	NDO 46	1.2	0.800	YNY	-9	25	B	5400	-9	4000	-9	6	76.7	44	60.0
4601616	0360	CON >20	135	-9	218	37	YY	2.0	36	0.8	0.3	0.1	NDO 46	1.0	0.740	NNN	40	50	E	1980	33	3000	45	20	25.0	33	50.0
4601756	0020	CONVEN	500	400	494	78	NN	2.0	38	1.4	0.8	1.0	NDO 50	3.5	2.340	Y	10	10	C	5067	112	3000	51	-9	-9.0	-9	-9.0
4601816	0470	LNGWALL	772	-9	2589	163	YY	2.0	52	0.1	1.1	1.5	NDO 40	1.0	0.440	YYY	-9	-9	B	81000	-9	70000	-9	84	100.0	80	100.0
4601822	0030	CON	299	240	406	99	YY	2.0	36	1.0	1.0	0.3	NDO 12	1.1	0.817	YYY	18	18	E	6192	107	4000	60	17	260.0	14	70.0
4601903	0010	CONVEN	80	100	118	17	YY	2.0	38	0.4	0.7	-9.0	DO 38	0.4	0.233	YYY	10	-9	E	3408	53	3000	45	6	50.0	6	30.0
4601968	0560	LNGWALL	3140	3188	3319	453	NY	2.0	44	2.8	0.8	0.2	DO 44	2.8	1.220	YY	-9	-9	E	52416	220	-9	-9	94	110.0	70	40.0
4601968	0600	LNGWALL	2000	2600	3364	719	NY	2.0	44	1.2	1.6	0.2	NDO 41	3.8	1.300	YY	-9	-9	E	37072	282	-9	-9	94	130.0	70	70.0
4601968	0640	CON (?)	540	338	541	100	YY	2.0	36	1.1	0.6	0.3	NDO 19	1.6	0.960	YYY	8	-9	E	6236	62	5000	60	46	53.0	28	30.0
4601977	0180	CON (?)	400	450	601	123		2.0	36	-9.0	1.9	0.6	-9	-9.0	-9.000	YYY	50	-9	B	6664	-9	6000	-9	22	57.0	22	55.0
4602052	0160	CON >20	1020	-9	1248	128	YY	2.0	36	1.1	1.7	0.5	DO 36	1.1	0.540	YYY	30	50	E	6240	60	-9	50	21	78.6	24	60.0
4602054	0020	CON	400	450	411	89	YY	2.0	36	1.7	1.3	1.4	NDO 35	2.4	1.383	YYY	20	20	E	3200	52	3000	50	15	25.0	15	25.0
4602143	0180	CON >20	1382	700	1543	377	NY	1.3	36	1.4	0.3	0.2	NDO 35	1.7	1.014	YYY	50	50	B	8640	-9	6000	-9	28	95.0	28	50.0
4603307	0100	CON >20	560	-9	413	66	YY	2.0	36	1.1	0.8	-9.0	DO 36	1.1	0.525	YYY	50	50	B	6737	-9	6000	25	22	60.0	22	55.0
4603307	0140	CON >20	1152	600	584	173	YY	2.0	36	0.2	0.2	0.1	NDO 16	0.2	0.150	YYY	50	50	B	16480	-9	5500	-9	32	80.0	22	80.0
4603374	0020	CON	130	-9	239	84	YY	2.0	36	1.0	1.9	1.4	DO 36	1.0	0.417	YYY	10	10	E	9000	112	6000	60	33	215.5	33	121.8
4603374	0170	CON	450	400	634	128	YY	2.0	36	0.1	1.5	1.0	NDO 2	1.1	0.433	YYY	10	10	E	14300	130	6000	60	33	150.0	33	150.0
4603467	0040	CON >20	520	370	413	92	YY	1.3	36	0.5	0.9	0.7	NDO 35	0.7	0.386	YYY	20	50	B	4536	-9	4200	-9	24	90.0	27	50.0
4603787	0010	CON	288	180	173	26	YY	2.0	36	0.5	0.1	0.1	DO 36	0.5	0.300	YYY	10	10	E	3981	88	3000	60	19	30.0	15	25.0
4603805	0210	LNGWALL	1328	1075	1426	509	YY	2.0	44	1.1	1.2	0.2	NDO 41	1.8	1.143	YYY	-9	-9		23192	350	18000	-9	86	110.0	86	70.0
4603805	0410	LNGWALL	1221	1817	1959	783	YY	2.0	50	1.7	1.6	0.6	DO 50	1.7	0.850	YYY	-9	-9	E	24940	371	18000	310	98	132.7	91	75.0
4603805	0440	CON >20	168	-9	157	40	YY	2.0	36	2.0	1.0	0.5	NDO 35	2.0	0.857	YY	40	40	C	5814	-9	-9	-9	17	71.5	14	80.0
4603805	0450	CON >20	417	-9	259	79	YY	2.0	36	1.7	1.2	0.8	DO 36	1.7	0.914	NY	40	40	B	7018	-9	-9	60	19	66.6	28	70.0
4603887	0100	LNGWALL	928	1350	1600	370	NN	2.0	44	7.0	2.5	1.8	DO 44	7.0	2.650	YYY	-9	-9	E	33400	240	22000	-9	77	100.0	74	80.0
4604130	0040	CON	840	530	600	152	YY	2.0	36	0.8	2.1	1.4	NDO 54	1.4	0.700	YYY	20	20	E	5000	45	5000	45	29	100.0	26	100.0
4604130	0140	CON	500	550	633	191	YY	1.0	36	1.2	1.2	1.0	DO 36	1.2	0.400	YYY	20	20	E	9890	90	5700	40	36	120.0	30	100.0
4604168	0060	CON >20	135	270	618	350	YY	2.0	36	0.7	0.8	0.4	NDO 50	1.1	0.543	YYY	40	40	B	8400	-9	8000	-9	22	98.2	20	53.0
4604200	0020	CONVEN	600	840	690	44	NN	2.0	38	3.3	1.7	0.3	NDO 34	4.3	2.440	YYY	10	10	E	8085	-9	3000	28	6	150.0	6	150.0
4604332	0240	LNGWALL	3000	3760	1970	554	NY	2.0	44	3.0	1.8	0.1	DO 44	3.0	1.400	YYY	-9	-9		50950	625	25500	-9	52	300.0	52	275.0
4604370	0080	CON	280	-9	418	111	YY	2.0	36	0.1	1.8	1.0	DO 36	0.1	0.100	YYY	20	20	E	9310	-9	4000	45	27	80.0	25	80.0
4604387	0010	CON	360	350	319	104	YY	2.0	36	0.5	0.7	0.5	NDO 47	1.0	0.520	YYY	18	19	E	4815	68	3000	60	29	101.0	10	100.0
4604421	0070	CON >20	90	375	367	143	YY	2.0	36	0.2	1.1	0.5	NDO 35	0.2	0.140	YYY	12	45	C	7437	52	4300	45	62	100.0	62	100.0

SIP DATA TABULATION

MINE_ID	MMU	TYPE OF MINING	AVG MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	DO DUST CONC OCC	SIP	OPER	SD	SIP HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
4604421	0100	CON >20	338	150	330	91	YY	1.5	36	0.2	1.3	0.4	NDO 54	0.4	0.200	YYY	29	45	E	4621	45	4300	45	39	150.0	39	100.0
4604758	0030	CON	308	-9	468	46	YY	2.0	36	1.0	0.5	0.3	NDO 46	1.8	1.140	YYY	20	20	E	6489	144	4000	50	20	55.0	20	50.0
4604789	0170	LNGWALL	3000	2000	3008	182	YY	2.0	44	2.1	2.1	1.4	NDO 41	2.2	1.667	YYY	-9	-9	B	23370	345	22000	185	146	130.0	146	75.0
4605195	0120	CON (?)	528	-9	517	182	YY	2.0	36	1.0	1.8	0.5	NDO 46	1.4	0.920	YNY	40	-9	E	4224	68	3800	62	6	70.0	28	50.0
4605248	0010	CONVEN	250	340	397	69	YY	2.0	38	1.0	0.3	0.2	DO 38	1.0	0.750	Y	10	10	E	3580	43	3000	45	-9	-9.0	-9	-9.0
4605284	0020	CON	315	312	359	74	NY	1.7	36	2.1	0.2	0.1	DO 36	2.1	0.920	YYY	-9	10	E	4692	69	3000	45	44	70.0	40	50.0
4605480	0060	LNGWALL	5016	4860	6231	1656	YY	2.0	44	1.4	1.9	0.9	NDO 41	1.5	1.180	NY	-9	-9	E	-9	594	-9	-9	55	100.0	91	100.0
4605480	0070	CON	363	815	795	208	YY	2.0	36	0.8	1.2	0.5	NDO 35	1.4	0.950	YYN	10	10	E	10225	61	-9	60	16	70.0	14	100.0
4605624	0030	CON >20	820	-9	525	122	YY	2.0	36	1.5	2.4	1.9	DO 36	1.5	0.767	YYY	44	44	E	4603	48	4000	45	35	110.0	35	80.0
4605625	0070	CON >20	469	455	430	115	YY	2.0	36	0.1	1.1	0.4	NDO 50	0.5	0.217	YYY	44	44	E	7200	120	4000	45	35	85.0	35	80.0
4605738	0010	CON	380	380	399	79	YY	2.0	36	2.1	0.8	0.7	DO 36	2.1	1.120	YYY	19	19	C	6750	100	3000	60	36	75.0	28	25.0
4605801	0020	CON	372	420	460	52	NN	1.0	36	5.0	0.2	0.2	NDO 50	11.3	3.800	YNY	20	20	E	4140	65	3400	60	10	50.0	19	50.0
4605907	0090	CON	320	405	366	73	YY	2.0	36	0.7	1.2	0.5	NDO 46	1.2	0.760	YYY	10	10	C	12375	140	7000	50	64	200.0	40	100.0
4605972	0010	CON	400	450	465	213	YY	2.0	36	0.4	0.2	0.1	NDO 50	0.5	0.257	YYY	-9	20	E	8550	75	3000	45	18	65.0	17	50.0
4605978	0200	CON >20	1560	-9	-9	-9	YY	2.0	36	0.8	-9.0	-9.0	DO 36	0.8	0.600	YY	10	50	E	7264	56	6200	50	37	-9.0	37	60.0
4606051	0100	CON >20	984	-9	1068	143	YY	2.0	36	0.4	0.5	0.2	NDO 35	0.4	0.240	YYY	50	50	B	20160	-9	5100	-9	34	80.0	34	85.0
4606171	0040	CON >20	350	720	346	39	YY	2.0	36	1.0	0.5	0.8	DO 36	1.0	0.300	YYY	20	50	B	7525	-9	4500	-9	23	50.0	19	50.0
4606179	0020	CON >20	900	800	762	139	YY	2.0	36	0.7	0.8	0.4	NDO 54	2.0	0.743	YYY	50	50	B	6650	-9	6000	-9	40	60.0	16	55.0
4606242	0020	CON	250	260	348	88	NY	0.4	36	0.7	0.5	0.5	DO 36	0.7	0.386	YYY	20	20	E	6930	130	6000	60	25	180.0	25	120.0
4606291	0010	CON >20	450	475	854	80	YY	2.0	36	1.2	0.4	0.3	NDO 50	2.0	1.050	YYN	45	50	E	6900	98	5800	40	28	35.0	28	50.0
4606412	0020	CON >20	1000	840	410	261	YY	2.0	36	2.4	0.1	0.0	DO 36	2.4	1.333	Y	50	50	B	5550	-9	3500	45	25	75.0	-9	-9.0
4606478	0050	CON >20	1200	1000	662	75	YY	2.0	36	0.8	1.4	0.8	NDO 35	1.1	0.850	YYY	50	50	B	8808	-9	6500	-9	24	95.0	24	50.0
4606530	0010	CON	128	330	271	22	YY	2.0	36	0.5	0.5	0.2	NDO 46	2.2	0.750	YYY	20	20	E	4298	89	3000	45	20	50.0	15	50.0
4606638	0030	CON >20	280	520	679	61	YY	2.0	36	0.2	1.8	0.5	NDO 50	0.8	0.533	YNY	50	50	B	4686	-9	4000	-9	19	60.0	28	50.0
4606642	0010	CON	480	240	326	55	YY	1.5	36	1.5	0.3	-9.0	DO 36	1.5	0.580	YY	-9	20	E	-9	-9	3000	45	40	82.5	38	60.3
4606647	0010	CON	250	280	299	35	YY	2.0	36	0.4	0.1	0.0	NDO 12	1.1	0.660	YYY	1	19	E	4560	81	3000	60	36	80.0	22	50.0
4606686	0040	CON	325	425	335	53	YY	2.0	36	0.4	0.5	0.2	NDO 73	0.5	0.350	YYY	20	20	E	5625	75	4000	45	27	45.0	23	60.0
4606789	0010	CON >20	260	400	552	84	YY	1.7	36	0.2	0.6	0.6	NDO 4	0.2	0.133	YYY	38	35	E	3840	71	3000	60	24	150.0	24	100.0
4606807	0010	CON	169	300	285	16	NY	2.0	36	0.4	0.7	0.5	NDO 47	2.5	0.720	YYY	20	20	E	3200	66	3000	60	21	75.0	17	50.0
4606850	0020	CON	128	160	150	0	YY	2.0	36	0.4	0.5	0.3	NDO 74	1.1	0.420	YYN	20	20	E	4792	66	3500	60	19	35.0	18	50.0
4606898	0140	CON	400	393	339	67	NN	1.7	36	11.3	1.5	1.0	DO 36	11.3	3.867	YYY	20	35	B	6968	67	6000	-9	33	100.0	33	50.0
4606911	0020	CON >20	512	477	535	128	NY	1.7	36	1.7	0.9	-9.0	NDO 50	2.4	1.414	YYY	50	50	B	5100	-9	4000	-9	28	60.0	28	50.0
4606936	0030	CON >20	800	750	805	93	NY	2.0	36	2.7	1.4	0.8	DO 36	2.7	1.583	YY	40	50	C	10632	110	4000	60	15	-9.0	10	50.0
4606988	0010	CON	315	350	253	39	NY	2.0	36	0.5	1.4	1.0	NDO 50	2.8	0.980	YYY	20	20	E	3400	60	3000	60	21	50.7	14	50.0
4607018	0020	CONVEN	300	300	410	22	YY	1.7	38	0.4	1.1	0.6	NDO 34	0.8	0.488	YYY	10	10	C	3186	44	3000	30	4	47.5	4	40.0
4607032	0010	CON	273	220	277	67	YY	1.5	36	0.2	0.1	0.1	NDO 53	1.2	0.560	YYY	-9	10	E	7280	104	3000	40	19	100.0	18	40.0
4607047	0020	CON	650	570	256	30	NN	0.9	36	2.8	0.1	0.0	DO 36	2.8	1.333	YYY	20	20	E	5500	80	3000	45	21	80.0	18	50.0
4607082	0050	CON	240	-9	312	149	YY	2.0	36	0.2	1.5	0.6	NDO 46	0.8	0.483	YYY	20	20	E	4100	59	3600	45	30	69.5	29	50.0
4607111	0010	CON	429	360	300	14	YY	1.5	36	0.7	0.6	0.5	DO 36	0.7	0.283	YYY	-9	20	C	10350	-9	3000	60	14	90.0	12	60.0
4607121	0030	CON	420	200	313	-9	YY	2.0	36	1.0	0.8	-9.0	DO 36	1.0	0.580	NY	-9	50	E	-9	-9	4000	50	15	50.0	35	50.0
4607129	0020	CON	172	185	242	32	NN	2.0	36	4.3	0.7	0.3	DO 36	4.3	2.183	YYY	10	10	E	4646	82	3500	50	16	23.0	16	20.0
4607139	0020	CON	200	500	519	128	YY	2.0	36	1.0	0.8	0.1	DO 36	1.0	0.583	YYY	20	20	E	6320	105	4000	60	26	60.0	22	50.0
4607146	0030	CON	192	350	388	31	YY	1.7	36	1.8	1.3	2.4	DO 36	1.8	1.140	YYY	10	10	E	5320	83	3500	50	25	60.0	25	55.0

SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	-DO- DUST CONC OCC	SIP	OPER	SD	-SIP- HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
4607260	0010	CON >20	420	288	541	102	YY	2.0	36	0.5	0.7	0.5	NDO 46	0.7	0.400	YYY	25	28	E	8120	80	3000	60	26	53.1	16	50.0
4607266	0050	CON >20	940	1400	-9	-9	YY	2.0	36	1.5	-9.0	-9.0	NDO 46	1.8	1.271	YYY	50	50	E	4632	41	4000	33	24	70.0	23	70.0
4607273	0210	CON	325	-9	256	38	YY	2.0	36	1.7	0.4	0.3	DO 36	1.7	0.533	YYY	20	20	E.	4400	57	4000	45	28	110.0	28	100.0
4607284	0040	CON	250	600	248	47	NN	2.0	36	9.7	0.3	0.4	DO 36	9.7	3.900	YY	10	10	E	4605	96	-9	50	19	-9.0	19	50.0
4607288	0040	CON >20	520	320	542	79	NY	1.7	36	1.8	0.9	0.8	NDO 73	2.5	1.514	YY	50	50	B	-9	-9	4000	-9	28	55.0	28	50.0
4607296	0020	CON >20	588	615	569	240	YY	2.0	36	0.4	1.4	0.3	NDO 72	1.7	0.867	YYY	20	20	E	7353	131	3000	45	23	60.0	20	50.0
4607320	0010	CON	56	155	137	28	YY	1.7	36	0.5	0.8	0.8	NDO 46	0.7	0.475	YYY	20	20	E	3555	73	3000	60	16	65.0	16	50.0
4607344	0010	CON	350	-9	416	22	NY	2.0	36	0.7	0.6	0.3	NDO 73	4.7	1.986	YYY	20	20	E	4440	46	3000	45	32	100.0	21	50.0
4607352	0030	CON	288	-9	455	54	NN	2.0	36	4.7	0.8	0.5	DO 36	4.7	2.760	YYY	20	20	E	3412	71	3000	47	31	90.0	20	50.0
4607353	0010	CON	486	300	621	106	NY	2.0	36	3.0	10.5	7.0	DO 36	3.0	1.550	YYY	20	20	E	4050	66	3000	60	22	50.0	21	50.0
4607357	0010	CON	144	200	301	60	NN	0.9	36	2.6	0.1	0.0	NDO 46	4.7	1.517	YYY	10	10	E	3976	76	3000	60	18	70.0	15	50.0
4607421	0020	CON >20	225	212	284	82	YY	2.0	36	0.4	0.1	0.1	NDO 54	1.2	0.733	YYY	33	50	E	7620	170	4000	60	18	100.0	18	100.0
4607430	0020	CON >20	1260	450	992	56	YY	2.0	36	1.1	0.2	0.3	DO 36	1.1	0.420	YYY	50	50	B	23650	-9	9200	-9	32	50.0	28	50.0
4607441	0020	CON >20	396	1600	693	70	YY	0.8	36	0.4	0.7	0.3	NDO 35	0.8	0.371	YNY	30	50	E	8480	151	3000	50	28	70.0	33	70.0
4607445	0020	CON >20	1680	-9	1274	176	NY	2.0	36	1.0	2.4	1.3	NDO 46	2.7	1.000	YYY	50	50	B	8293	-9	6000	-9	45	50.0	33	50.0
4607451	0090	CON	250	320	211	21	NY	2.0	36	3.8	0.6	0.2	DO 36	3.8	1.257	YYY	20	20	E	4290	47	3000	45	15	50.0	15	50.0
4607456	0020	CON	600	720	303	13	YY	1.3	36	1.4	1.3	0.3	DO 36	1.4	0.533	YYY	10	10	E	3300	51	3000	50	44	50.0	44	50.0
4607467	0020	CON	640	-9	-9	-9	YY	2.0	36	2.1	-9.0	-9.0	NDO 8	2.2	1.320	YYY	10	10	E	11952	186	3000	46	42	50.0	42	50.0
4607470	0020	CON	404	200	267	48	NN	0.8	36	0.8	0.9	0.9	NDO 35	4.5	1.133	YYY	-9	20	E	13680	180	3000	45	27	40.0	13	50.0
4607474	0020	CONVEN	154	195	239	34	YY	2.0	38	0.7	0.8	0.8	NDO 34	1.7	0.800	N	10	10	C	2565	41	3000	60	-9	-9.0	-9	-9.0
4607479	0030	CON >20	790	510	662	97	YY	2.0	36	0.8	1.5	1.7	NDO 35	1.2	0.820	YYY	20	50	B	6480	-9	6000	-9	19	86.3	16	50.0
4607519	0010	CONVEN	588	430	425	23	NN	2.0	38	0.8	0.4	0.6	NDO 46	6.1	2.100	Y	10	10	C	3840	62	3000	60	-9	-9.0	-9	-9.0
4607522	0010	CONVEN	352	577	422	21	YY	2.0	38	1.0	0.8	1.1	NDO 42	2.0	0.983	Y	10	10	E	3800	50	3000	47	-9	-9.0	-9	-9.0
4607546	0010	CON	70	500	402	6	YY	2.0	36	0.2	0.1	0.0	NDO 2	1.0	0.450	YYY	20	20	E	3094	63	3000	60	21	50.0	20	50.0
4607554	0010	CON	280	220	293	18	YY	2.0	36	1.7	4.5	3.9	DO 36	1.7	0.920	YYY	10	10	E	3080	63	3000	60	16	100.0	12	25.0
4607562	0010	CON	213	312	282	14	YY	2.0	36	1.4	0.1	0.1	DO 36	1.4	0.667	YY	20	20	E	-9	-9	3400	65	24	60.0	24	40.0
4607565	0020	CON	544	640	483	64	NY	1.3	36	0.5	0.2	0.1	NDO 49	2.2	0.700	YYY	20	20	E	4860	50	3000	45	23	55.0	21	50.0
4607567	0010	CON	194	300	-9	-9	NN	2.0	36	4.7	-9.0	-9.0	DO 36	4.7	2.700	YYY	18	20	E	3680	54	3000	45	27	60.0	15	60.0
4607572	0040	CON	200	360	225	58	YY	2.0	36	2.2	1.2	1.0	DO 36	2.2	1.233	YYY	20	20	E	3300	55	3000	55	28	50.0	13	50.0
4607578	0010	CON	264	120	191	15	NY	2.0	36	3.4	0.4	-9.0	DO 36	3.4	1.850	YYY	20	20	E	4050	81	4000	45	18	125.0	13	50.0
4607596	0030	CON	264	400	295	8	YY	2.0	36	1.2	0.3	0.1	NDO 35	2.4	0.950	YYY	-9	20	E	3622	75	3160	65	16	150.0	16	45.0
4607621	0010	CONVEN	510	500	450	46	NY	2.0	38	1.2	0.1	-9.0	NDO 43	3.8	1.267	Y	10	10	E	3168	36	3000	-9	-9	-9.0	-9	-9.0
4607622	0040	CON	500	-9	-9	-9	NY	2.0	36	2.0	-9.0	-9.0	NDO 50	3.1	1.780	YY	10	10	E	3704	66	3000	47	16	-9.0	16	50.0
4607642	0010	CON	329	400	471	107	YY	2.0	36	0.8	3.1	2.9	DO 36	0.8	0.360	YYY	10	10	E	7500	65	5800	60	27	130.0	24	35.0
4607667	0010	CON >20	780	911	1056	199	YY	1.5	36	1.1	1.3	0.7	DO 36	1.1	0.700	YYY	30	50	E	6300	70	3000	30	44	90.0	48	70.0
4607673	0010	CON	400	800	909	24	YY	2.0	36	1.0	0.8	0.3	DO 36	1.0	0.567	YYY	20	20	E	5700	64	4000	55	52	57.1	52	56.8
4607674	0020	CON	182	420	371	22	YY	2.0	36	0.4	1.1	0.8	NDO 35	1.1	0.517	YYY	20	50	E	5460	81	4500	60	48	75.0	48	75.0
4607678	0010	CON >20	700	760	634	204	NY	1.7	36	2.5	1.4	0.4	NDO 73	3.4	1.757	YYY	20	50	B	4459	-9	4000	-9	33	55.0	30	55.0
4607684	0020	CON >20	700	1190	795	44	YY	0.8	36	0.4	0.6	0.3	NDO 73	0.7	0.433	YYY	50	50	B	7884	-9	6500	50	24	70.0	24	60.0
4607688	0020	CON	220	150	335	12	YY	2.0	36	2.1	0.7	0.7	DO 36	2.1	0.929	YYY	20	20	E	3060	50	3000	45	15	180.0	15	50.0
4607693	0020	CON	393	-9	-9	-9	NN	2.0	36	12.0	-9.0	-9.0	DO 36	12.0	5.040	YYY	10	10	C	3360	60	3000	54	22	50.0	20	50.0
4607696	0020	CON	420	317	288	17	YY	2.0	36	1.4	1.5	1.9	DO 36	1.4	1.067	YYY	-9	20	E	10578	155	3000	53	25	100.0	21	50.0
4607699	0010	CONVEN	40	126	189	45	YY	2.0	38	0.1	1.1	1.6	NDO 34	0.5	0.280	Y	10	10	E	3480	58	3000	60	-9	-9.0	-9	-9.0

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SIP DATA TABULATION

AVG MINE_ID	MMU	TYPE OF MINING	MEAS. PROD1	LAST BAB PROD	OPERATOR AVERAGE PROD2	SD	DUST COMP SA	DO DUST STD	--DO-- DUST CONC OCC	SIP	OPER	SD	--SIP-- HIGHEST EXPOSURE OCC	CONC	AVG CONC	DCP COMP A#P	LINE CURTAIN MEA	SPE	M F V	AIR QUANTITY MEASURED CFM	FPM	SPECIFIED CFM	FPM	WATER PRESSURE MEASURED TOTAL SPRAY	WTD AVG PSI	SPECIFIED TOTAL SPRAY	WTD PSI
4607711	0020	CON (?)	200	-9	-9	-9	NN	2.0	36	5.6	-9.0	-9.0	NDO 35	5.7	3.400	YYY	20	-9		5500	-9	4000	-9	31	120.0	31	120.0
4607713	0010	CONVEN	350	-9	465	47	NY	2.0	38	2.7	0.6	0.3	DO 38	2.7	1.640	Y	10	10	E	4625	61	3000	38	-9	-9.0	-9	-9.0
4607722	0010	CON	210	360	183	16	YY	2.0	36	0.4	0.9	0.5	NDO 73	1.7	0.633	YYY	20	20	E	3591	61	3000	60	18	50.0	14	50.0
4607730	0010	CON	450	561	734	127	YY	1.7	36	0.5	0.5	0.5	NDO 53	0.7	0.500	YYY	-9	20	E	10240	-9	3000	46	23	70.0	23	70.0
4607733	0010	CON	211	320	261	26	YY	2.0	36	0.5	1.8	1.4	NDO 46	1.4	0.900	YYY	20	20	E	9378	197	3000	60	32	60.0	25	50.0
4607734	0010	CON	210	280	284	32	YY	2.0	36	0.4	0.6	0.5	DO 36	0.4	0.250	YYY	-9	20	E	10200	160	3000	45	23	50.0	16	50.0
4607764	0010	CON	200	200	281	27	NY	2.0	36	1.5	1.1	1.7	NDO 35	2.4	0.971	YYY	20	20	E	3200	60	3000	60	32	50.0	32	50.0
4607781	0010	CON	672	774	245	13	YY	1.7	36	1.1	0.3	0.2	NDO 46	1.5	0.757	YYY	20	20	E	3990	45	3600	45	43	57.4	34	50.0
4607801	0010	CON >20	760	775	356	33	YY	1.3	36	1.1	1.1	0.8	NDO 35	1.4	0.917	YYY	26	50	B	6300	-9	5000	-9	24	100.0	24	100.0
4607802	0020	CON >20	425	475	867	315	YY	1.3	36	0.7	1.5	1.0	NDO 50	0.8	0.514	YYY	40	50	B	16550	-9	6000	-9	30	90.0	24	80.0
4607803	0020	CON	1020	1200	815	119	YY	1.7	36	0.1	0.3	0.1	NDO 35	0.4	0.233	YYY	20	20	E	8100	55	4300	39	22	130.0	21	100.0
4607819	0030	CON	400	-9	-9	-9	NN	2.0	36	6.7	-9.0	-9.0	DO 36	6.7	2.200	YY	20	20	E	5292	82	3000	55	22	-9.0	22	50.0
4607831	0010	CON	144	300	285	12	NY	2.0	36	0.8	0.3	0.2	NDO 1	3.4	0.960	YYY	10	-9	E	4000	75	3000	45	15	60.0	11	50.0
4607833	0020	CON	1100	700	713	82	NY	2.0	36	1.4	0.7	0.4	NDO 54	2.7	1.833	YY	20	20	E	3000	37	3300	45	19	-9.0	19	50.0
4607848	0010	CON	306	420	312	51	NY	2.0	36	1.8	0.3	0.2	NDO 46	4.0	1.800	YYY	18	20	E	3806	63	3000	60	16	80.0	16	50.0
4607850	0010	CON	350	275	294	27	YY	2.0	36	0.4	1.0	0.4	DO 36	0.4	0.183	YYY	20	20		9215	-9	3000	45	21	95.0	13	50.0
4607861	0010	CON	453	-9	316	141	YY	2.0	36	1.4	0.8	0.8	DO 36	1.4	0.717	YYY	-9	20	E	17010	210	3000	45	19	65.0	16	50.0
4607862	0010	CON >20	1163	885	988	223	YY	2.0	36	1.0	0.6	0.6	NDO 73	1.2	0.633	YYY	50	50	B	5390	-9	5000	-9	22	70.7	22	50.0
4607866	0010	CON >20	900	672	1176	305	YY	0.9	36	0.5	0.4	0.1	NDO 73	1.1	0.817	YYY	50	50	B	7560	-9	7000	-9	25	100.0	23	50.0
4607877	0010	CON	76	140	243	33	NY	2.0	17	1.5	0.4	0.4	NDO 46	2.5	1.360	YYY	10	10	E	3240	-9	3000	45	17	50.0	19	50.0
4607898	0010	CON >20	336	-9	279	115	YY	2.0	36	0.7	0.2	0.1	NDO 47	2.0	1.129	YYY	50	50	E	4508	80	4000	50	20	120.0	20	100.0
4607899	0030	CON >20	250	-9	400	61	NY	2.0	36	4.3	3.5	2.3	NDO 35	4.3	2.000	YYY	50	50	E	10350	207	4000	71	29	100.0	20	100.0
4607903	0010	CON >20	350	510	348	75	NY	1.0	36	2.1	0.5	0.3	DO 36	2.1	0.957	YYY	50	50	E	12870	170	3000	45	16	90.0	16	90.0
4607908	0040	CON >20	1036	1533	1458	296	YY	2.0	36	2.0	1.0	0.7	DO 36	2.0	0.886	YYY	50	50	B	7790	-9	6000	-9	36	99.2	36	80.0
4607919	0040	CON	210	-9	163	28	YY	2.0	36	2.0	0.3	0.3	DO 36	2.0	0.667	YYY	20	20	E	3108	46	3000	45	15	60.0	15	50.0
4607920	0010	CON	544	250	310	8	YY	2.0	36	1.5	0.1	0.0	DO 36	1.5	0.580	YYY	20	20	E	7924	75	4500	45	36	105.0	34	50.0
4607921	0010	CON	400	-9	534	112	NN	2.0	36	4.4	2.4	-9.0	DO 36	4.4	2.600	YYN	20	20	B	4228	-9	3000	-9	18	35.0	18	100.0
4607930	0010	CON >20	733	-9	1198	330	YY	2.0	36	2.2	2.4	2.6	NDO 50	2.4	1.820	YYY	50	50	B	4300	-9	4500	-9	22	57.3	22	50.0
4607932	0030	CON	700	-9	570	45	NN	2.0	36	4.8	0.1	0.0	NDO 35	6.9	3.233	YYY	20	20	E	4192	50	4000	50	22	100.0	22	75.0
4607952	0010	CON >20	312	296	372	36	NY	0.6	36	-9.0	0.3	0.3	NDO 46	1.2	0.500	YYY	30	30	E	3300	72	3000	60	20	50.0	20	50.0
4607967	0010	CONVEN	324	250	518	113	YY	2.0	38	0.7	1.5	1.9	NDO 54	1.4	0.825	Y	10	10	E	3433	49	3000	48	-9	-9.0	-9	-9.0
4608007	0010	CON >20	780	-9	556	135	YY	2.0	36	1.2	1.6	1.9	NDO 50	1.5	1.171	YYY	50	50	B	4560	-9	4000	-9	28	100.0	28	100.0
4608079	0010	CON	1604	-9	-9	-9	NN	2.0	36	3.3	-9.0	-9.0	DO 36	3.3	2.760	YNY	20	40	B	11880	-9	5700	-9	3	183.3	37	50.0
4801186	0070	CON	371	483	722	159	YY	2.0	36	1.5	0.9	0.3	DO 36	1.5	1.000	YYY	35	35	E	12000	60	12000	60	43	150.0	43	70.0
4801186	0080	LNGWALL	2800	1600	5080	1426	YY	2.0	44	1.2	1.6	0.3	NDO 64	1.7	1.340	YYY	-9	-9	E	44800	281	30000	200	78	50.0	78	50.0

TOTAL MMUS PRINTED: 723

Appendix A10. Interview Tabulations for Designated Occupation

Please see Section 2.6 of Appendix B for codes and wording of interview questions.

Designated Occupation Interview, #3 (Correct Answer: 1)

Total of all responses		721
Disregarded responses		15
Total useable responses		706
Small mines with less than 50 employees	[1]	116/359 = 32.31%
	[2]	226/359 = 62.95%
	[D]	17/359 = 4.74%
Large mines with at least 50 employees	[1]	114/347 = 32.85%
	[2]	214/347 = 61.67%
	[D]	19/347 = 5.48%
Mines with DCP compliance	[1]	213/648 = 32.87%
	[2]	400/648 = 61.73%
	[D]	35/648 = 5.40%
Mines with DCP noncompliance	[1]	17/ 58 = 29.31%
	[2]	40/ 58 = 68.97%
	[D]	1/ 58 = 1.72%
Mines with dust standard compliance	[1]	152/503 = 30.22%
	[2]	325/503 = 64.61%
	[D]	26/503 = 5.17%
Mines with dust standard noncompliance	[1]	78/203 = 38.42%
	[2]	115/203 = 56.65%
	[D]	10/203 = 4.93%

Designated Occupation Interview, #4 (Correct Answer: 1)

Total of all responses		721			
Disregarded responses		89			
Total useable responses		632			
Small mines with less than 50 employees	[1]	193/285	=	67.72%	
	[2]	90/285	=	31.58%	
	[D]	2/285	=	0.70%	
Large mines with at least 50 employees	[1]	236/347	=	68.01%	
	[2]	102/347	=	29.39%	
	[D]	9/347	=	2.59%	
Mines with DCP compliance	[1]	399/576	=	69.27%	
	[2]	166/576	=	28.82%	
	[D]	11/576	=	1.91%	
Mines with DCP noncompliance	[1]	30/ 56	=	53.57%	
	[2]	26/ 56	=	46.43%	
	[D]	0/ 56	=	0.00%	
Mines with dust standard compliance	[1]	311/449	=	69.27%	
	[2]	130/449	=	28.95%	
	[D]	8/449	=	1.78%	
Mines with dust standard noncompliance	[1]	118/183	=	64.48%	
	[2]	62/183	=	33.88%	
	[D]	3/183	=	1.64%	

Designated Occupation Interview, #5 (Correct Answer: 1)

Total of all responses		721
Disregarded responses		88
Total useable responses		633
Small mines with less than 50 employees	[1]	188/285 = 65.96%
	[2]	92/285 = 32.28%
	[D]	5/285 = 1.75%
Large mines with at least 50 employees	[1]	216/348 = 62.07%
	[2]	123/348 = 35.34%
	[D]	9/348 = 2.59%
Mines with DCP compliance	[1]	373/578 = 64.53%
	[2]	191/578 = 33.04%
	[D]	14/578 = 2.42%
Mines with DCP noncompliance	[1]	31/ 55 = 56.36%
	[2]	24/ 55 = 43.64%
	[D]	0/ 55 = 0.00%
Mines with dust standard compliance	[1]	283/451 = 62.75%
	[2]	158/451 = 35.03%
	[D]	10/451 = 2.22%
Mines with dust standard noncompliance	[1]	121/182 = 66.48%
	[2]	57/182 = 31.32%
	[D]	4/182 = 2.20%

Designated Occupation Interview, #6 (Correct Answer: 1)

Total of all responses 721
Disregarded responses 78
Total useable responses 643

Small mines with less than 50 employees	[1]	290/360	=	80.56%
	[2]	69/360	=	19.17%
	[D]	1/360	=	0.28%
Large mines with at least 50 employees	[1]	242/283	=	85.51%
	[2]	33/283	=	11.66%
	[D]	8/283	=	2.83%
Mines with DCP compliance	[1]	491/590	=	83.22%
	[2]	90/590	=	15.25%
	[D]	9/590	=	1.53%
Mines with DCP noncompliance	[1]	41/ 53	=	77.36%
	[2]	12/ 53	=	22.64%
	[D]	0/ 53	=	0.00%
Mines with dust standard compliance	[1]	385/456	=	84.43%
	[2]	62/456	=	13.60%
	[D]	9/456	=	1.97%
Mines with dust standard noncompliance	[1]	147/187	=	78.61%
	[2]	40/187	=	21.39%
	[D]	0/187	=	0.00%

Designated Occupation Interview, #7 (Correct Answer: 6)

Total of all responses 721
Disregarded responses 82
Total useable responses 639

Category	Answer	Count	Percent
Small mines with less than 50 employees	[1]	12/358 =	3.35%
	[2]	23/358 =	6.42%
	[3]	47/358 =	13.13%
	[4]	25/358 =	6.98%
	[5]	45/358 =	12.57%
	[6]	206/358 =	57.54%
	[D]	0/358 =	0.00%
Large mines with at least 50 employees	[1]	8/281 =	2.85%
	[2]	17/281 =	6.05%
	[3]	35/281 =	12.46%
	[4]	32/281 =	11.39%
	[5]	34/281 =	12.10%
	[6]	149/281 =	53.02%
	[D]	6/281 =	2.14%
Mines with DCP compliance	[1]	18/586 =	3.07%
	[2]	37/586 =	6.31%
	[3]	75/586 =	12.80%
	[4]	47/586 =	8.02%
	[5]	72/586 =	12.29%
	[6]	331/586 =	56.48%
	[D]	6/586 =	1.02%
Mines with DCP noncompliance	[1]	2/ 53 =	3.77%
	[2]	3/ 53 =	5.66%
	[3]	7/ 53 =	13.21%
	[4]	10/ 53 =	18.87%
	[5]	7/ 53 =	13.21%
	[6]	24/ 53 =	45.28%
	[D]	0/ 53 =	0.00%
Mines with dust standard compliance	[1]	12/454 =	2.64%
	[2]	23/454 =	5.07%
	[3]	51/454 =	11.23%
	[4]	45/454 =	9.91%
	[5]	52/454 =	11.45%
	[6]	265/454 =	58.37%
	[D]	6/454 =	1.32%
Mines with dust standard noncompliance	[1]	8/185 =	4.32%
	[2]	17/185 =	9.19%
	[3]	31/185 =	16.76%
	[4]	12/185 =	6.49%
	[5]	27/185 =	14.59%
	[6]	90/185 =	48.65%
	[D]	0/185 =	0.00%

Designated Occupation Interview, #8 (Correct Answer: 6)

Total of all responses 721
Disregarded responses 97
Total useable responses 624

Category	Response	Count	Percent
Small mines with less than 50 employees	[1]	10/277 =	3.61%
	[2]	14/277 =	5.05%
	[3]	27/277 =	9.75%
	[4]	25/277 =	9.03%
	[5]	58/277 =	20.94%
	[6]	141/277 =	50.90%
	[D]	2/277 =	0.72%
Large mines with at least 50 employees	[1]	18/347 =	5.19%
	[2]	22/347 =	6.34%
	[3]	34/347 =	9.80%
	[4]	29/347 =	8.36%
	[5]	74/347 =	21.33%
	[6]	169/347 =	48.70%
	[D]	1/347 =	0.29%
Mines with DCP compliance	[1]	25/569 =	4.39%
	[2]	31/569 =	5.45%
	[3]	57/569 =	10.02%
	[4]	48/569 =	8.44%
	[5]	119/569 =	20.91%
	[6]	286/569 =	50.26%
	[D]	3/569 =	0.53%
Mines with DCP noncompliance	[1]	3/ 55 =	5.45%
	[2]	5/ 55 =	9.09%
	[3]	4/ 55 =	7.27%
	[4]	6/ 55 =	10.91%
	[5]	13/ 55 =	23.64%
	[6]	24/ 55 =	43.64%
	[D]	0/ 55 =	0.00%
Mines with dust standard compliance	[1]	21/445 =	4.72%
	[2]	20/445 =	4.49%
	[3]	39/445 =	8.76%
	[4]	36/445 =	8.09%
	[5]	87/445 =	19.55%
	[6]	239/445 =	53.71%
	[D]	3/445 =	0.67%
Mines with dust standard noncompliance	[1]	7/179 =	3.91%
	[2]	16/179 =	8.94%
	[3]	22/179 =	12.29%
	[4]	18/179 =	10.06%
	[5]	45/179 =	25.14%
	[6]	71/179 =	39.66%
	[D]	0/179 =	0.00%

Designated Occupation Interview, #9 (Correct Answer: 6)

Total of all responses 721
Disregarded responses 64
Total useable responses 657

Small mines with less than 50 employees	[1]	8/354 =	2.26%
	[2]	10/354 =	2.82%
	[3]	38/354 =	10.73%
	[4]	23/354 =	6.50%
	[5]	72/354 =	20.34%
	[6]	203/354 =	57.34%
	[D]	0/354 =	0.00%
Large mines with at least 50 employees	[1]	14/303 =	4.62%
	[2]	13/303 =	4.29%
	[3]	18/303 =	5.94%
	[4]	28/303 =	9.24%
	[5]	50/303 =	16.50%
	[6]	174/303 =	57.43%
	[D]	6/303 =	1.98%
Mines with DCP compliance	[1]	19/602 =	3.16%
	[2]	19/602 =	3.16%
	[3]	53/602 =	8.80%
	[4]	47/602 =	7.81%
	[5]	109/602 =	18.11%
	[6]	350/602 =	58.14%
	[D]	5/602 =	0.83%
Mines with DCP noncompliance	[1]	3/ 55 =	5.45%
	[2]	4/ 55 =	7.27%
	[3]	3/ 55 =	5.45%
	[4]	4/ 55 =	7.27%
	[5]	13/ 55 =	23.64%
	[6]	27/ 55 =	49.09%
	[D]	1/ 55 =	1.82%
Mines with dust standard compliance	[1]	12/466 =	2.58%
	[2]	12/466 =	2.58%
	[3]	32/466 =	6.87%
	[4]	40/466 =	8.58%
	[5]	80/466 =	17.17%
	[6]	285/466 =	61.16%
	[D]	5/466 =	1.07%
Mines with dust standard noncompliance	[1]	10/191 =	5.24%
	[2]	11/191 =	5.76%
	[3]	24/191 =	12.57%
	[4]	11/191 =	5.76%
	[5]	42/191 =	21.99%
	[6]	92/191 =	48.17%
	[D]	1/191 =	0.52%

Designated Occupation Interview, #10 (Correct Answer: 6)

Total of all responses 721
Disregarded responses 105
Total useable responses 616

Small mines with less than 50 employees	[1]	7/274 =	2.55%
	[2]	2/274 =	0.73%
	[3]	17/274 =	6.20%
	[4]	12/274 =	4.38%
	[5]	59/274 =	21.53%
	[6]	175/274 =	63.87%
	[D]	2/274 =	0.73%
Large mines with at least 50 employees	[1]	9/342 =	2.63%
	[2]	10/342 =	2.92%
	[3]	15/342 =	4.39%
	[4]	18/342 =	5.26%
	[5]	67/342 =	19.59%
	[6]	220/342 =	64.33%
	[D]	3/342 =	0.88%
Mines with DCP compliance	[1]	13/562 =	2.31%
	[2]	9/562 =	1.60%
	[3]	30/562 =	5.34%
	[4]	24/562 =	4.27%
	[5]	116/562 =	20.64%
	[6]	366/562 =	65.12%
	[D]	4/562 =	0.71%
Mines with DCP noncompliance	[1]	3/ 54 =	5.56%
	[2]	3/ 54 =	5.56%
	[3]	2/ 54 =	3.70%
	[4]	6/ 54 =	11.11%
	[5]	10/ 54 =	18.52%
	[6]	29/ 54 =	53.70%
	[D]	1/ 54 =	1.85%
Mines with dust standard compliance	[1]	9/440 =	2.05%
	[2]	9/440 =	2.05%
	[3]	18/440 =	4.09%
	[4]	19/440 =	4.32%
	[5]	87/440 =	19.77%
	[6]	295/440 =	67.05%
	[D]	3/440 =	0.68%
Mines with dust standard noncompliance	[1]	7/176 =	3.98%
	[2]	3/176 =	1.70%
	[3]	14/176 =	7.95%
	[4]	11/176 =	6.25%
	[5]	39/176 =	22.16%
	[6]	100/176 =	56.82%
	[D]	2/176 =	1.14%

Designated Occupation Interview, #11 (Correct Answer: 1)

Total of all responses 721
Disregarded responses 17
Total useable responses 704

Small mines with less than 50 employees	[1]	230/359 =	64.07%
	[2]	103/359 =	28.69%
	[3]	23/359 =	6.41%
	[D]	3/359 =	0.84%
Large mines with at least 50 employees	[1]	160/345 =	46.38%
	[2]	159/345 =	46.09%
	[3]	24/345 =	6.96%
	[D]	2/345 =	0.58%
Mines with DCP compliance	[1]	367/645 =	56.90%
	[2]	233/645 =	36.12%
	[3]	40/645 =	6.20%
	[D]	5/645 =	0.78%
Mines with DCP noncompliance	[1]	23/ 59 =	38.98%
	[2]	29/ 59 =	49.15%
	[3]	7/ 59 =	11.86%
	[D]	0/ 59 =	0.00%
Mines with dust standard compliance	[1]	274/500 =	54.80%
	[2]	187/500 =	37.40%
	[3]	34/500 =	6.80%
	[D]	5/500 =	1.00%
Mines with dust standard noncompliance	[1]	116/204 =	56.86%
	[2]	75/204 =	36.76%
	[3]	13/204 =	6.37%
	[D]	0/204 =	0.00%

Designated Occupation Interview, #12 (Correct Answer: 2)

Total of all responses 721
Disregarded responses 15
Total useable responses 706

Small mines with less than 50 employees	[1]	20/358 =	5.59%
	[2]	258/358 =	72.07%
	[3]	60/358 =	16.76%
	[4]	20/358 =	5.59%
	[D]	0/358 =	0.00%
Large mines with at least 50 employees	[1]	16/348 =	4.60%
	[2]	229/348 =	65.80%
	[3]	68/348 =	19.54%
	[4]	35/348 =	10.06%
	[D]	0/348 =	0.00%
Mines with DCP compliance....................	[1]	33/647 =	5.10%
	[2]	452/647 =	69.86%
	[3]	118/647 =	18.24%
	[4]	44/647 =	6.80%
	[D]	0/647 =	0.00%
Mines with DCP noncompliance	[1]	3/ 59 =	5.08%
	[2]	35/ 59 =	59.32%
	[3]	10/ 59 =	16.95%
	[4]	11/ 59 =	18.64%
	[D]	0/ 59 =	0.00%
Mines with dust standard compliance	[1]	31/503 =	6.16%
	[2]	347/503 =	68.99%
	[3]	86/503 =	17.10%
	[4]	39/503 =	7.75%
	[D]	0/503 =	0.00%
Mines with dust standard noncompliance	[1]	5/203 =	2.46%
	[2]	140/203 =	68.97%
	[3]	42/203 =	20.69%
	[4]	16/203 =	7.88%
	[D]	0/203 =	0.00%

Designated Occupation Interview, #13 (Correct Answer: 1 or 2)

Total of all responses 721
Disregarded responses 16
Total useable responses 705

Category	Answer	Count	Percent
Small mines with less than 50 employees	[1]	157/356	44.10%
	[2]	135/356	37.92%
	[3]	7/356	1.97%
	[4]	56/356	15.73%
	[5]	0/356	0.00%
	[D]	1/356	0.28%
Large mines with at least 50 employees	[1]	249/349	71.35%
	[2]	68/349	19.48%
	[3]	0/349	0.00%
	[4]	25/349	7.16%
	[5]	4/349	1.15%
	[D]	3/349	0.86%
Mines with DCP compliance	[1]	375/646	58.05%
	[2]	179/646	27.71%
	[3]	7/646	1.08%
	[4]	78/646	12.07%
	[5]	4/646	0.62%
	[D]	3/646	0.46%
Mines with DCP noncompliance	[1]	31/ 59	52.54%
	[2]	24/ 59	40.68%
	[3]	0/ 59	0.00%
	[4]	3/ 59	5.08%
	[5]	0/ 59	0.00%
	[D]	1/ 59	1.69%
Mines with dust standard compliance	[1]	301/501	60.08%
	[2]	138/501	27.54%
	[3]	5/501	1.00%
	[4]	49/501	9.78%
	[5]	4/501	0.80%
	[D]	4/501	0.80%
Mines with dust standard noncompliance	[1]	105/204	51.47%
	[2]	65/204	31.86%
	[3]	2/204	0.98%
	[4]	32/204	15.69%
	[5]	0/204	0.00%
	[D]	0/204	0.00%

Designated Occupation Interview, #14 (Correct Answer: 1)

Total of all responses 721
Disregarded responses 15
Total useable responses 706

Small mines with less than 50 employees	[1]	332/358 =	92.74%
	[2]	14/358 =	3.91%
	[3]	7/358 =	1.96%
	[4]	5/358 =	1.40%
	[D]	0/358 =	0.00%
Large mines with at least 50 employees	[1]	305/348 =	87.64%
	[2]	25/348 =	7.18%
	[3]	14/348 =	4.02%
	[4]	4/348 =	1.15%
	[D]	0/348 =	0.00%
Mines with DCP compliance	[1]	583/647 =	90.11%
	[2]	37/647 =	5.72%
	[3]	19/647 =	2.94%
	[4]	8/647 =	1.24%
	[D]	0/647 =	0.00%
Mines with DCP noncompliance	[1]	54/ 59 =	91.53%
	[2]	2/ 59 =	3.39%
	[3]	2/ 59 =	3.39%
	[4]	1/ 59 =	1.69%
	[D]	0/ 59 =	0.00%
Mines with dust standard compliance	[1]	451/503 =	89.66%
	[2]	31/503 =	6.16%
	[3]	15/503 =	2.98%
	[4]	6/503 =	1.19%
	[D]	0/503 =	0.00%
Mines with dust standard noncompliance	[1]	186/203 =	91.63%
	[2]	8/203 =	3.94%
	[3]	6/203 =	2.96%
	[4]	3/203 =	1.48%
	[D]	0/203 =	0.00%

Designated Occupation Interview, #15 (Correct Answer: 3)

Total of all responses 721
Disregarded responses 16
Total useable responses 705

Small mines with less than 50 employees	[1]	49/357 = 13.73%
	[2]	42/357 = 11.76%
	[3]	163/357 = 45.66%
	[4]	18/357 = 5.04%
	[5]	85/357 = 23.81%
Large mines with at least 50 employees	[1]	56/348 = 16.09%
	[2]	33/348 = 9.48%
	[3]	146/348 = 41.95%
	[4]	21/348 = 6.03%
	[5]	92/348 = 26.44%
Mines with DCP compliance	[1]	99/647 = 15.30%
	[2]	70/647 = 10.82%
	[3]	282/647 = 43.59%
	[4]	34/647 = 5.26%
	[5]	162/647 = 25.04%
Mines with DCP noncompliance	[1]	6/ 58 = 10.34%
	[2]	5/ 58 = 8.62%
	[3]	27/ 58 = 46.55%
	[4]	5/ 58 = 8.62%
	[5]	15/ 58 = 25.86%
Mines with dust standard compliance	[1]	74/501 = 14.77%
	[2]	47/501 = 9.38%
	[3]	229/501 = 45.71%
	[4]	29/501 = 5.79%
	[5]	122/501 = 24.35%
Mines with dust standard noncompliance	[1]	31/204 = 15.20%
	[2]	28/204 = 13.73%
	[3]	80/204 = 39.22%
	[4]	10/204 = 4.90%
	[5]	55/204 = 26.96%

Designated Occupation Interview, #19 (Correct Answer: 2)

Total of all responses 721
Disregarded responses 15
Total useable responses 706

Small mines with less than 50 employees	[1]	16/358 =	4.47%
	[2]	320/358 =	89.39%
	[3]	20/358 =	5.59%
	[4]	2/358 =	0.56%
	[D]	0/358 =	0.00%
Large mines with at least 50 employees	[1]	19/348 =	5.46%
	[2]	303/348 =	87.07%
	[3]	24/348 =	6.90%
	[4]	0/348 =	0.00%
	[D]	2/348 =	0.57%
Mines with DCP compliance	[1]	31/647 =	4.79%
	[2]	571/647 =	88.25%
	[3]	41/647 =	6.34%
	[4]	2/647 =	0.31%
	[D]	2/647 =	0.31%
Mines with DCP noncompliance	[1]	4/ 59 =	6.78%
	[2]	52/ 59 =	88.14%
	[3]	3/ 59 =	5.08%
	[4]	0/ 59 =	0.00%
	[D]	0/ 59 =	0.00%
Mines with dust standard compliance	[1]	22/503 =	4.37%
	[2]	447/503 =	88.87%
	[3]	31/503 =	6.16%
	[4]	1/503 =	0.20%
	[D]	2/503 =	0.40%
Mines with dust standard noncompliance	[1]	13/203 =	6.40%
	[2]	176/203 =	86.70%
	[3]	13/203 =	6.40%
	[4]	1/203 =	0.49%
	[D]	0/203 =	0.00%

Designated Occupation Interview, #21 (Correct Answer: 2)

Total of all responses 721
Disregarded responses 17
Total useable responses 704

Small mines with less than 50 employees	[1]	12/358 =	3.35%
	[2]	336/358 =	93.85%
	[3]	1/358 =	0.28%
	[4]	9/358 =	2.51%
	[D]	0/358 =	0.00%
Large mines with at least 50 employees	[1]	3/346 =	0.87%
	[2]	328/346 =	94.80%
	[3]	0/346 =	0.00%
	[4]	13/346 =	3.76%
	[D]	2/346 =	0.58%
Mines with DCP compliance	[1]	12/645 =	1.86%
	[2]	612/645 =	94.88%
	[3]	0/645 =	0.00%
	[4]	19/645 =	2.95%
	[D]	2/645 =	0.31%
Mines with DCP noncompliance	[1]	3/ 59 =	5.08%
	[2]	52/ 59 =	88.14%
	[3]	1/ 59 =	1.69%
	[4]	3/ 59 =	5.08%
	[D]	0/ 59 =	0.00%
Mines with dust standard compliance	[1]	7/501 =	1.40%
	[2]	475/501 =	94.81%
	[3]	0/501 =	0.00%
	[4]	17/501 =	3.39%
	[D]	2/501 =	0.40%
Mines with dust standard noncompliance	[1]	8/203 =	3.94%
	[2]	189/203 =	93.10%
	[3]	1/203 =	0.49%
	[4]	5/203 =	2.46%
	[D]	0/203 =	0.00%

Designated Occupation Interview, #22 (Correct Answer: 1)

Total of all responses 721
Disregarded responses .... [6] 20 ✓
Total useable responses 701

Small mines with less than 50 employees	[1]	291/350 = 83.14%	
	[2]	42/350 = 12.00%	14.29 %
	[3]	5/350 = 1.43%	
	[4]	3/350 = 0.86%	
	[5]	5/350 = 1.43%	
	[D]	0/350 = 0.00%	1.14 %
[ ] or	[R]	4/350 = 1.14%	
Large mines with at least 50 employees	[1]	251/351 = 71.51%	
	[2]	62/351 = 17.66%	23.07 %
	[3]	8/351 = 2.28%	
	[4]	11/351 = 3.13%	
	[5]	8/351 = 2.28%	
	[D]	0/351 = 0.00%	3.13 %
[ ] or	[R]	11/351 = 3.13%	
Mines with DCP compliance	[1]	504/640 = 78.75%	
	[2]	91/640 = 14.22%	17.82 %
	[3]	11/640 = 1.72%	
	[4]	12/640 = 1.88%	
	[5]	9/640 = 1.41%	
	[D]	0/640 = 0.00%	2.03 %
[ ] or	[R]	13/640 = 2.03%	
Mines with DCP noncompliance	[1]	38/ 61 = 62.30%	
	[2]	13/ 61 = 21.31%	27.87 %
	[3]	2/ 61 = 3.28%	
	[4]	2/ 61 = 3.28%	
	[5]	4/ 61 = 6.56%	
	[D]	0/ 61 = 0.00%	3.28 %
[ ] or	[R]	2/ 61 = 3.28%	
Mines with dust standard compliance	[1]	386/500 = 77.20%	
	[2]	76/500 = 15.20%	18.2 %
	[3]	8/500 = 1.60%	
	[4]	7/500 = 1.40%	
	[5]	9/500 = 1.80%	
	[D]	0/500 = 0.00%	2.80 %
[ ] or	[R]	14/500 = 2.80%	
Mines with dust standard noncompliance	[1]	156/201 = 77.61%	
	[2]	28/201 = 13.93%	19.9 %
	[3]	5/201 = 2.49%	
	[4]	7/201 = 3.48%	
	[5]	4/201 = 1.99%	
	[D]	0/201 = 0.00%	0.5 %
[ ] or	[R]	1/201 = 0.50%	

Designated Occupation Interview, #24 (Correct Answer: 3)

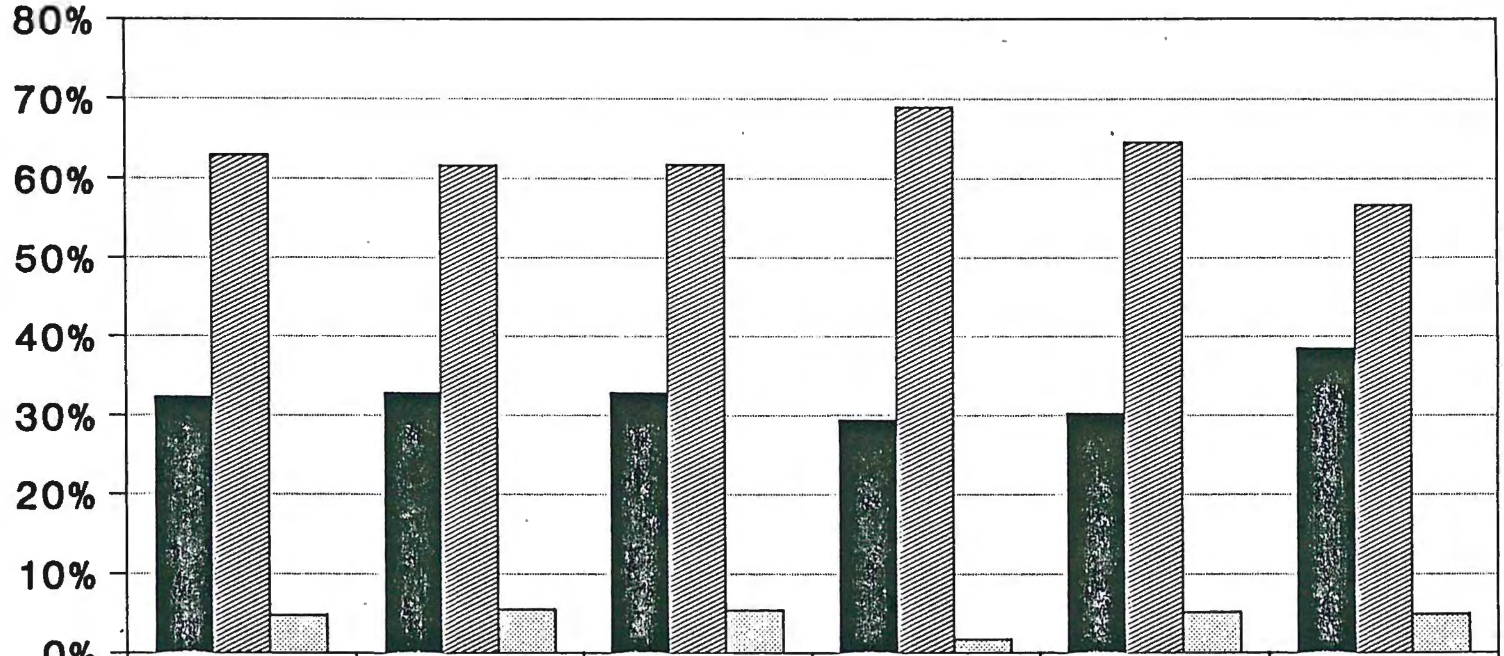
Total of all responses 721
Disregarded responses 21
Total useable responses 700

Small mines with less than 50 employees	[1]	34/358 =	9.50%
	[2]	33/358 =	9.22%
	[3]	234/358 =	65.36%
	[4]	48/358 =	13.41%
	[D]	9/358 =	2.51%
Large mines with at least 50 employees	[1]	10/342 =	2.92%
	[2]	21/342 =	6.14%
	[3]	236/342 =	69.01%
	[4]	43/342 =	12.57%
	[D]	32/342 =	9.36%
Mines with DCP compliance	[1]	40/642 =	6.23%
	[2]	49/642 =	7.63%
	[3]	433/642 =	67.45%
	[4]	82/642 =	12.77%
	[D]	38/642 =	5.92%
Mines with DCP noncompliance	[1]	4/ 58 =	6.90%
	[2]	5/ 58 =	8.62%
	[3]	37/ 58 =	63.79%
	[4]	9/ 58 =	15.52%
	[D]	3/ 58 =	5.17%
Mines with dust standard compliance	[1]	26/497 =	5.23%
	[2]	41/497 =	8.25%
	[3]	336/497 =	67.61%
	[4]	65/497 =	13.08%
	[D]	29/497 =	5.84%
Mines with dust standard noncompliance	[1]	18/203 =	8.87%
	[2]	13/203 =	6.40%
	[3]	134/203 =	66.01%
	[4]	26/203 =	12.81%
	[D]	12/203 =	5.91%

Designated Occupation Interview, #25 (Correct Answer: 2)

Total of all responses	721		
Disregarded responses	14		
Total useable responses	707		
Small mines with less than 50 employees	[1]	217/360	60.28%
	[2]	135/360	37.50%
	[3]	8/360	2.22%
	[D]	0/360	0.00%
Large mines with at least 50 employees	[1]	213/347	61.38%
	[2]	121/347	34.87%
	[3]	12/347	3.46%
	[D]	1/347	0.29%
Mines with DCP compliance	[1]	394/648	60.80%
	[2]	233/648	35.96%
	[3]	20/648	3.09%
	[D]	1/648	0.15%
Mines with DCP noncompliance	[1]	36/ 59	61.02%
	[2]	23/ 59	38.98%
	[3]	0/ 59	0.00%
	[D]	0/ 59	0.00%
Mines with dust standard compliance	[1]	304/503	60.44%
	[2]	184/503	36.58%
	[3]	14/503	2.78%
	[D]	1/503	0.20%
Mines with dust standard noncompliance	[1]	126/204	61.76%
	[2]	72/204	35.29%
	[3]	6/204	2.94%
	[D]	0/204	0.00%

What is the respirable dust standard for this section?

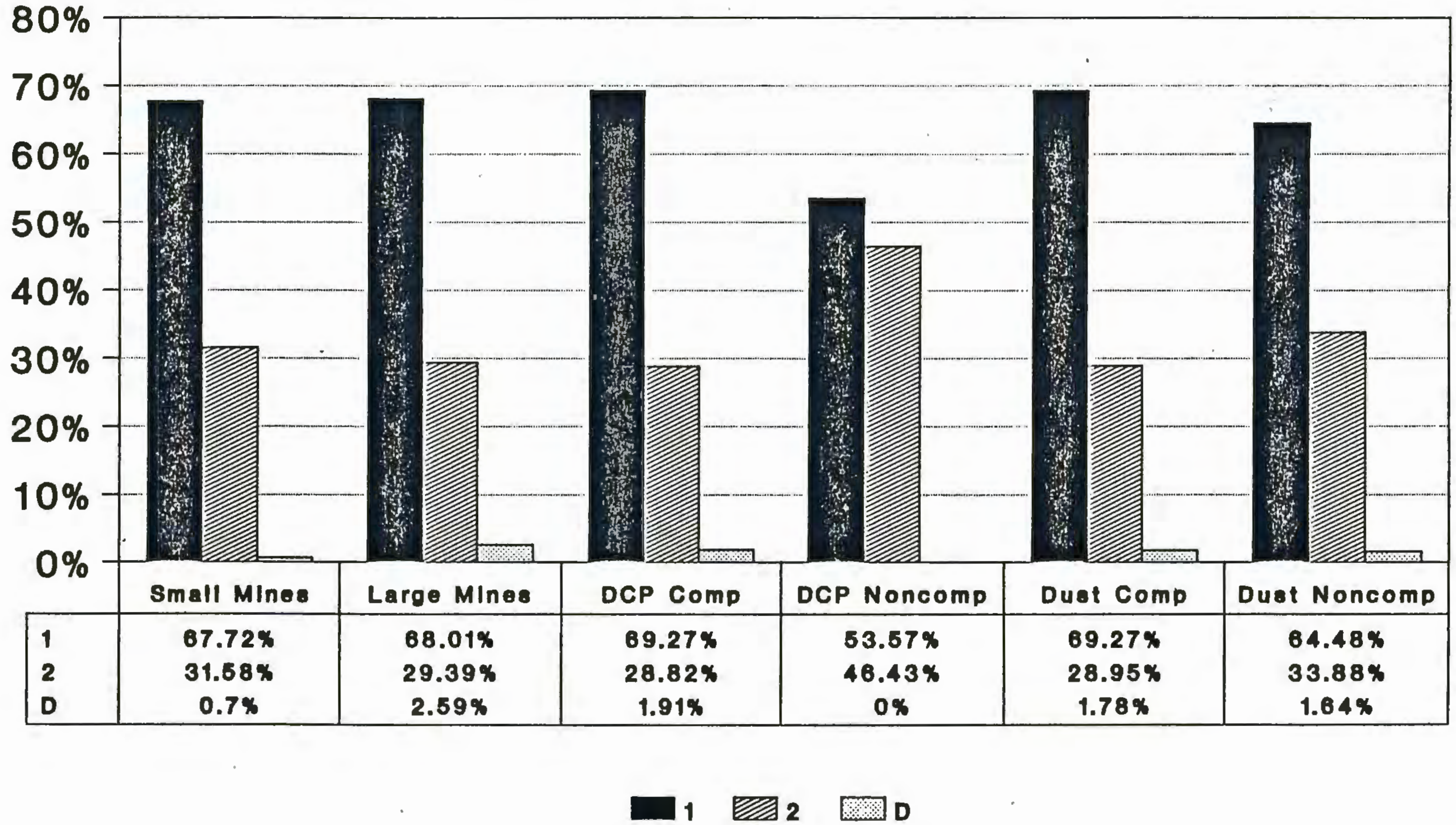


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	32.31%	32.85%	32.87%	29.31%	30.22%	38.42%
2	62.95%	61.67%	61.73%	68.97%	64.61%	56.65%
D	4.74%	5.48%	5.4%	1.72%	5.17%	4.93%

1 2 D

Designated Occupation Interview, #3
Answer: 1) Correct.

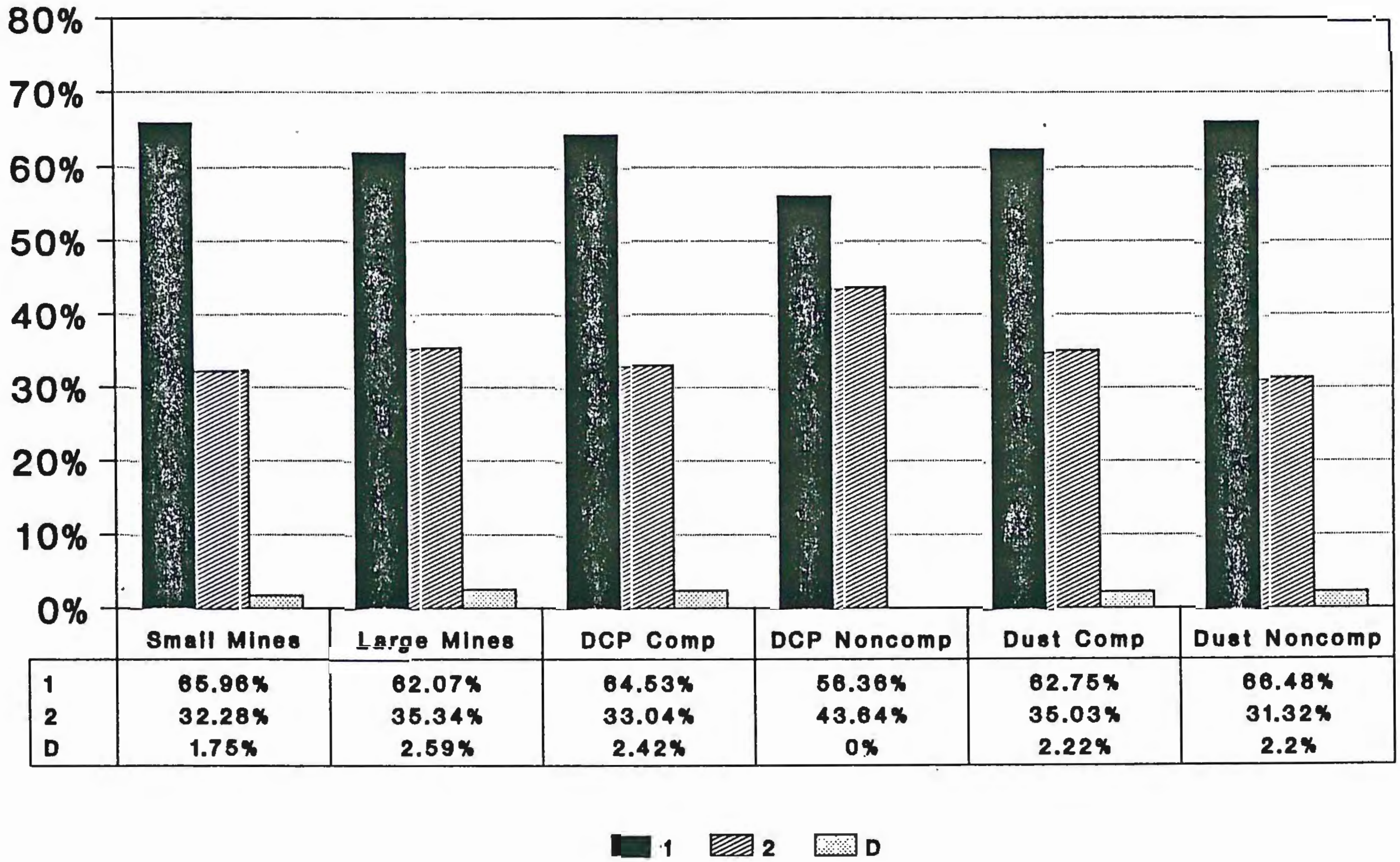
How many water sprays must be operating on this machine while you are loading coal?



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	67.72%	68.01%	69.27%	53.57%	69.27%	64.48%
2	31.58%	29.39%	28.82%	46.43%	28.95%	33.88%
D	0.7%	2.59%	1.91%	0%	1.78%	1.64%

Designated Occupation Interview, #4
Answer: 1) Correct according to plan.

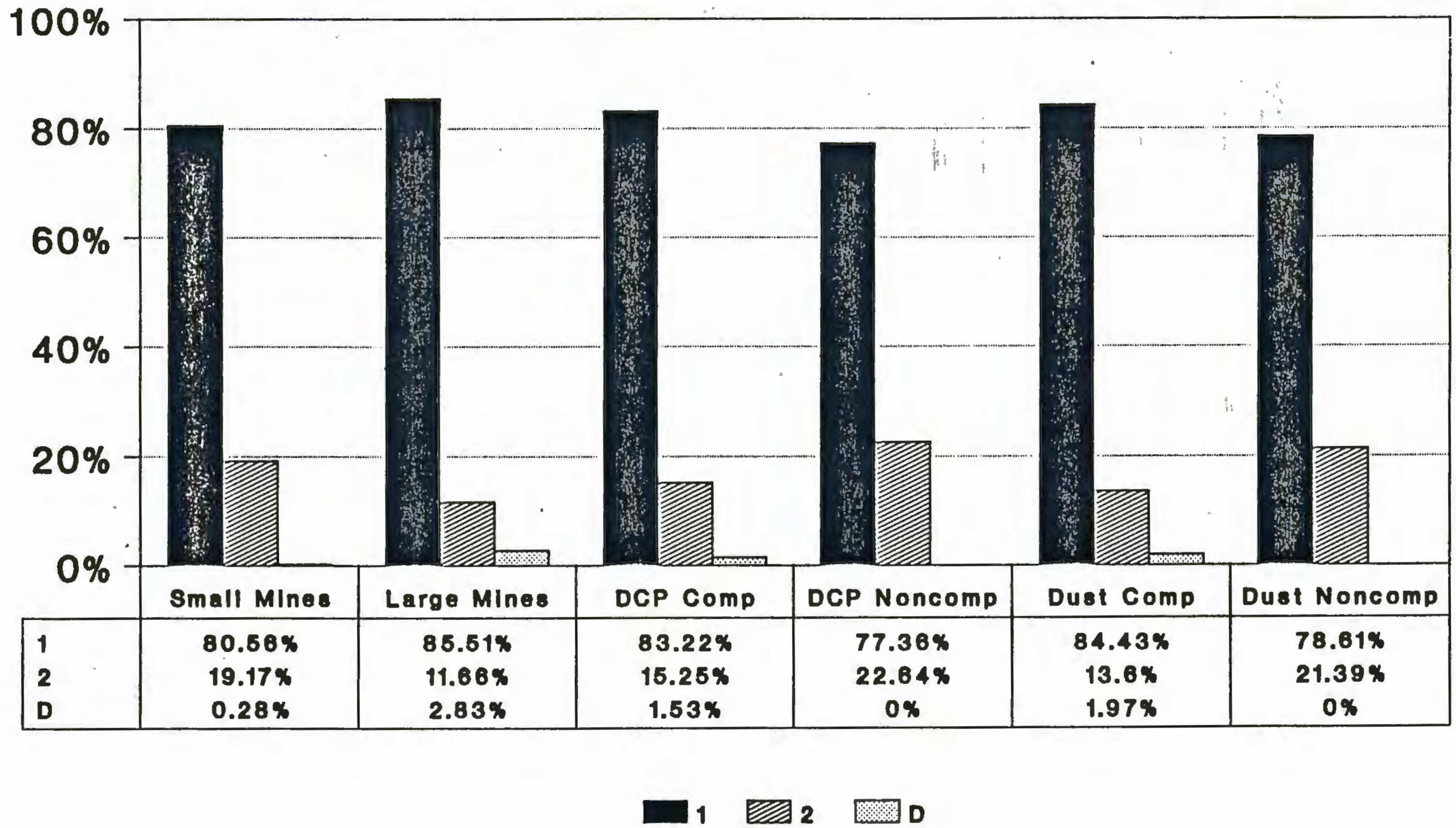
How much water pressure is required on this machine while mining coal?



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	65.96%	62.07%	64.53%	56.36%	62.75%	66.48%
2	32.28%	35.34%	33.04%	43.64%	35.03%	31.32%
D	1.75%	2.59%	2.42%	0%	2.22%	2.2%

Designated Occupation Interview, #5
Answer: 1) Correct according to plan

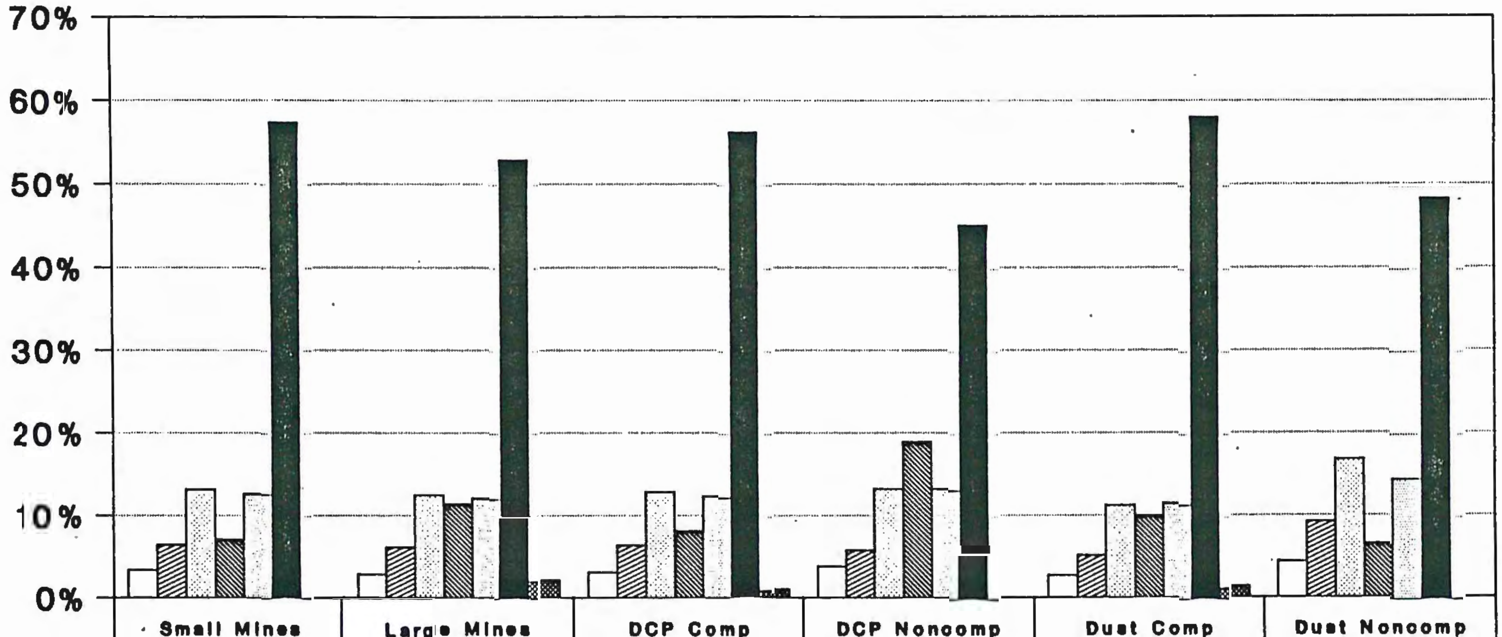
How far back from the face can the end of the line curtain/tubing be in this section?



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	80.56%	85.51%	83.22%	77.36%	84.43%	78.61%
2	19.17%	11.66%	15.25%	22.64%	13.6%	21.39%
D	0.28%	2.83%	1.53%	0%	1.97%	0%

Designated Occupation Interview, #6
Answer: 1) Correct according to plan.

During the mining of coal the curtain/ tubing is too far back from the face...

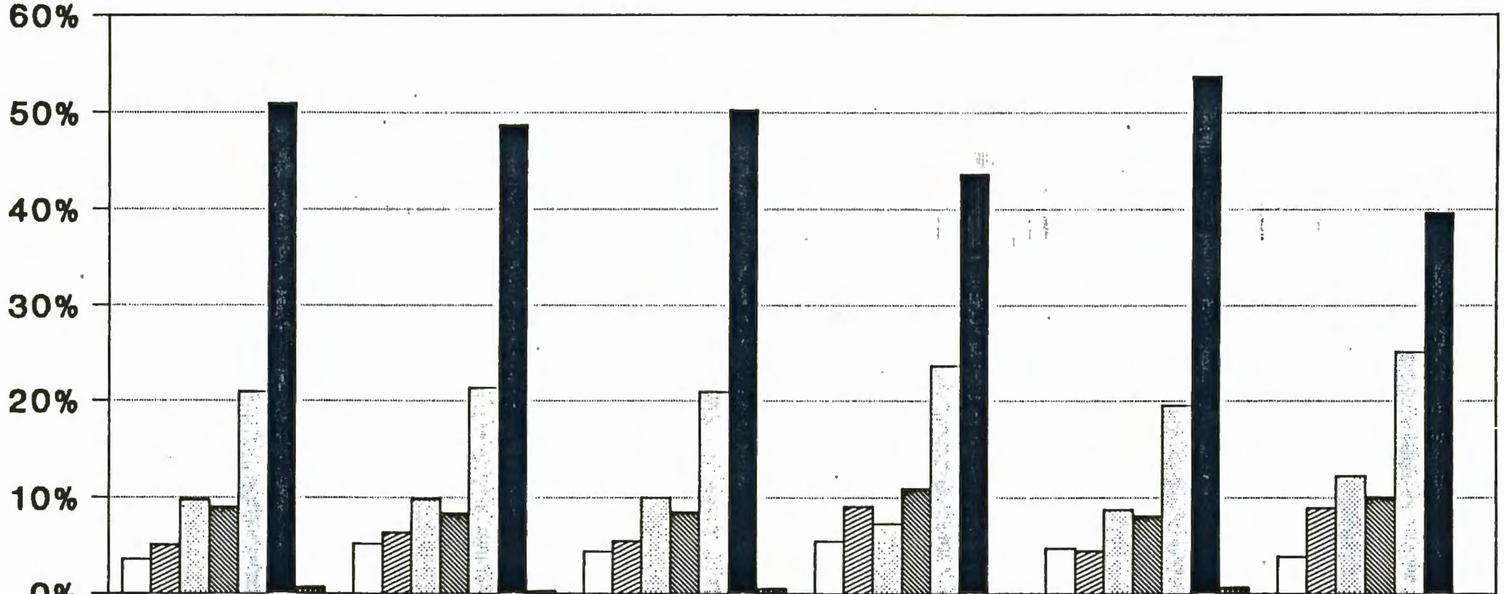


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	3.35%	2.85%	3.07%	3.77%	2.64%	4.32%
2	6.42%	6.05%	6.31%	5.66%	5.07%	9.19%
3	13.13%	12.46%	12.8%	13.21%	11.23%	16.76%
4	6.98%	11.39%	8.02%	18.87%	9.91%	6.49%
5	12.57%	12.1%	12.29%	13.21%	11.45%	14.59%
6	57.54%	53.02%	56.48%	45.28%	58.37%	48.65%
D	0%	2.14%	1.02%	0%	1.32%	0%

1 2 3 4 5 6 D

Designated Occupation Interview, #7
Answer: 6) Never.

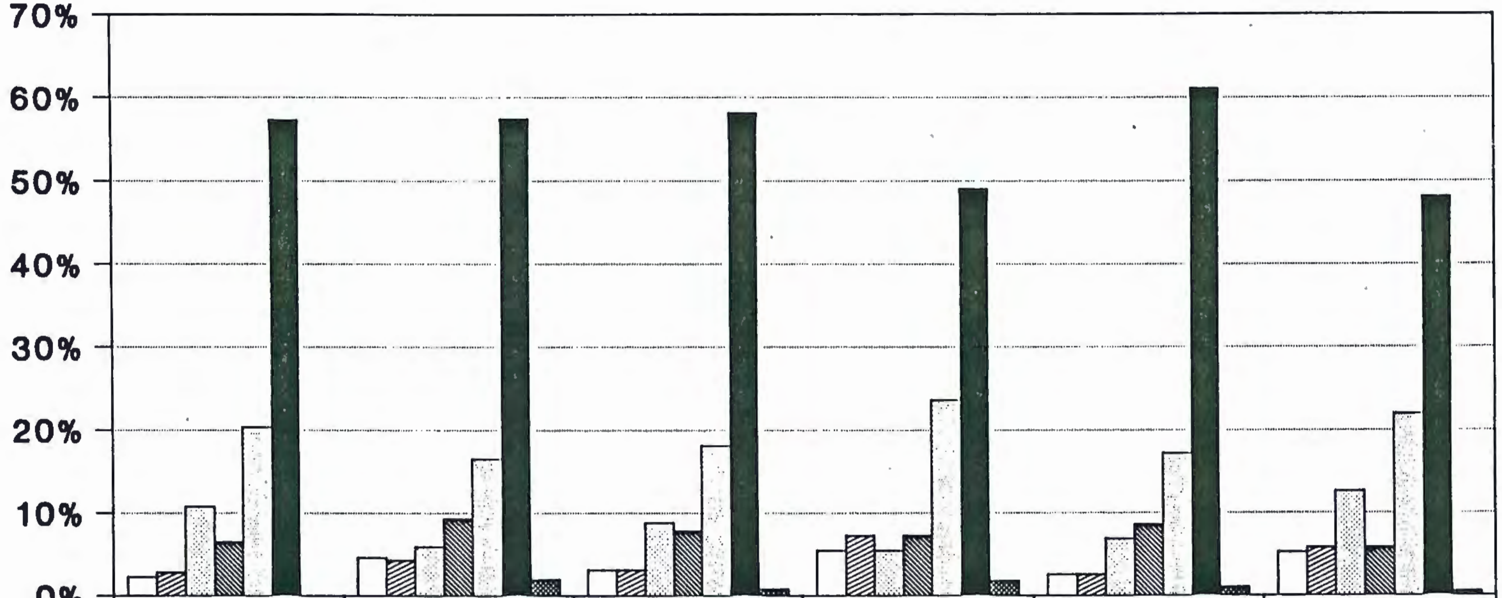
During the mining of coal the required water sprays are not working...



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	3.61%	5.19%	4.39%	5.45%	4.72%	3.91%
2	5.05%	6.34%	5.45%	9.09%	4.49%	8.94%
3	9.75%	9.8%	10.02%	7.27%	8.76%	12.29%
4	9.03%	8.36%	8.44%	10.91%	8.09%	10.06%
5	20.94%	21.33%	20.91%	23.64%	19.55%	25.14%
6	50.9%	48.7%	50.26%	43.64%	53.71%	39.66%
D	0.72%	0.29%	0.53%	0%	0.67%	0%

Designated Occupation Interview, #8
Answer: 6) Never.

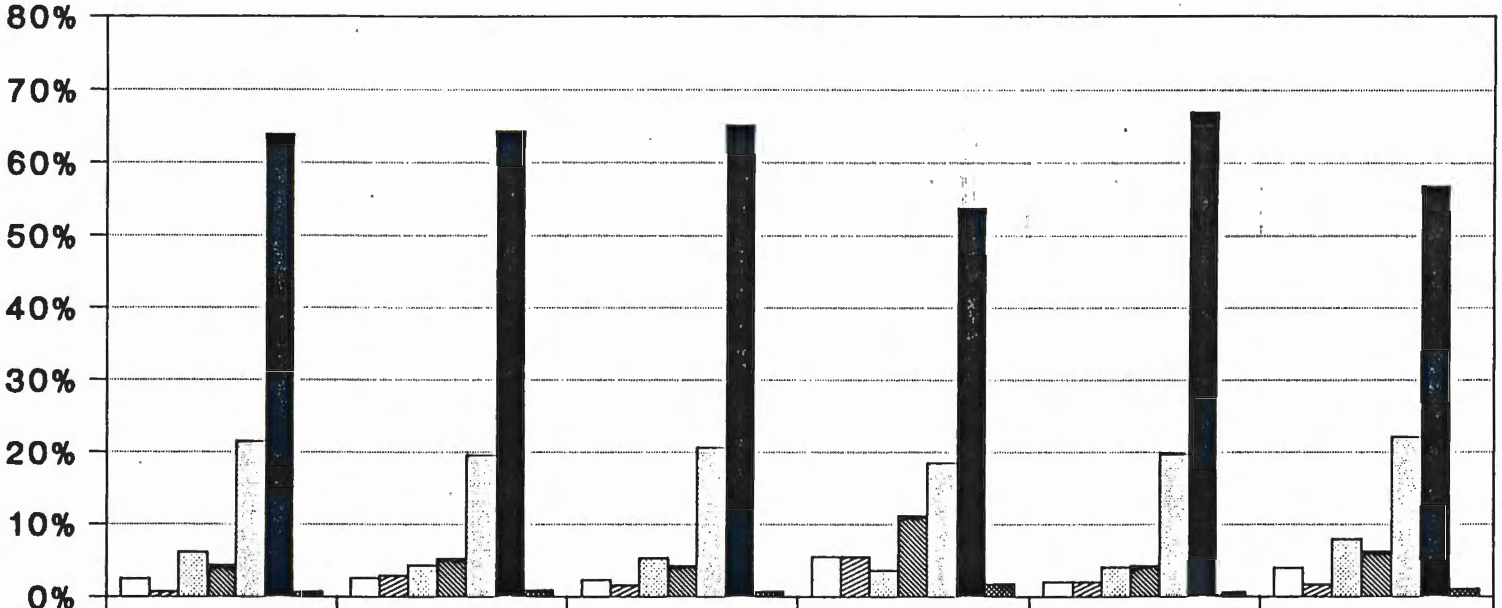
During the mining of coal there is not enough air behind the line curtain...



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	2.26%	4.62%	3.16%	5.45%	2.58%	5.24%
2	2.82%	4.29%	3.16%	7.27%	2.58%	5.76%
3	10.73%	5.94%	8.8%	5.45%	6.87%	12.57%
4	6.5%	9.24%	7.81%	7.27%	8.58%	5.76%
5	20.34%	16.5%	18.11%	23.64%	17.17%	21.99%
6	57.34%	57.43%	58.14%	49.09%	61.16%	48.17%
D	0%	1.98%	0.83%	1.82%	1.07%	0.52%

Designated Occupation Interview, #9
Answer: 6) Never.

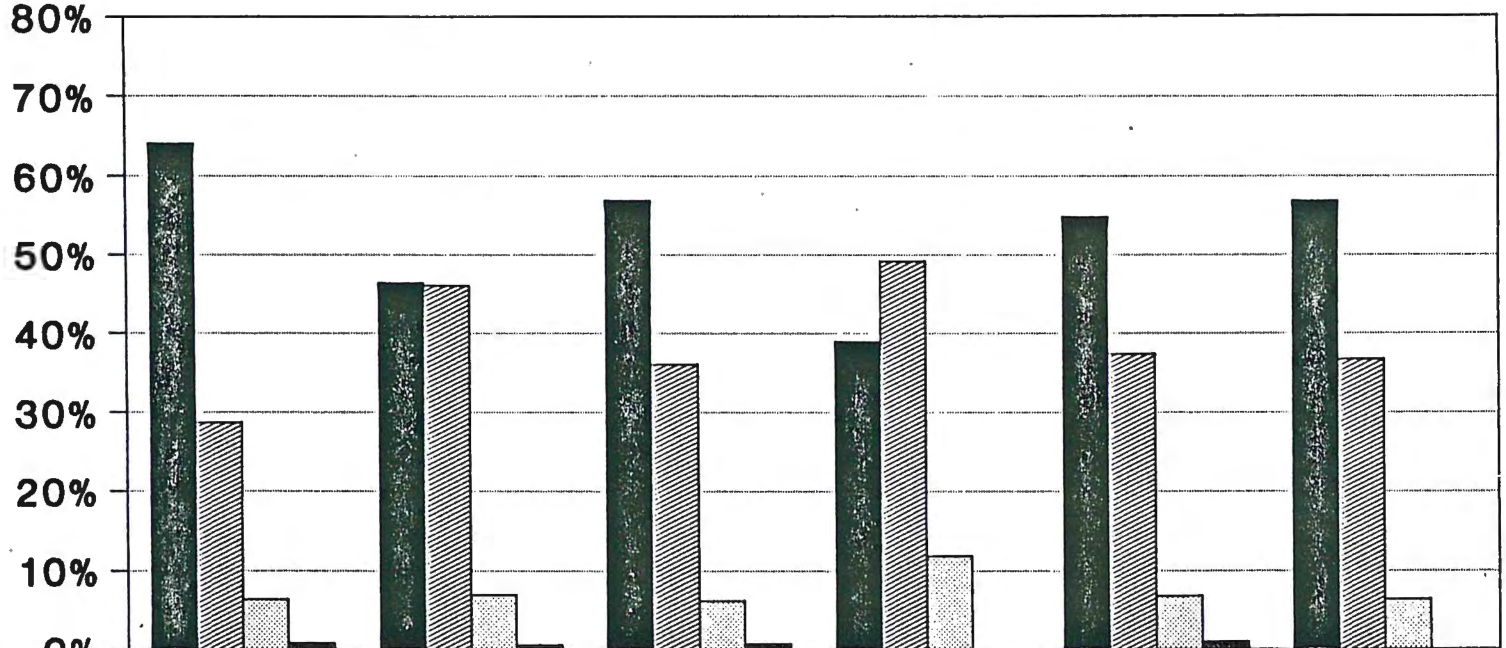
During the mining of coal there is not enough water pressure on the machine...



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	2.55%	2.63%	2.31%	5.56%	2.05%	3.98%
2	0.73%	2.92%	1.6%	5.56%	2.05%	1.7%
3	6.2%	4.39%	5.34%	3.7%	4.09%	7.95%
4	4.38%	5.26%	4.27%	11.11%	4.32%	6.25%
5	21.53%	19.59%	20.64%	18.52%	19.77%	22.16%
6	63.87%	64.33%	65.12%	53.7%	67.05%	56.82%
D	0.73%	0.88%	0.71%	1.85%	0.68%	1.14%

Designated Occupation Interview, #10
Answer: 6) Never.

When dust samples are collected, they measure miners' exposure to dust...

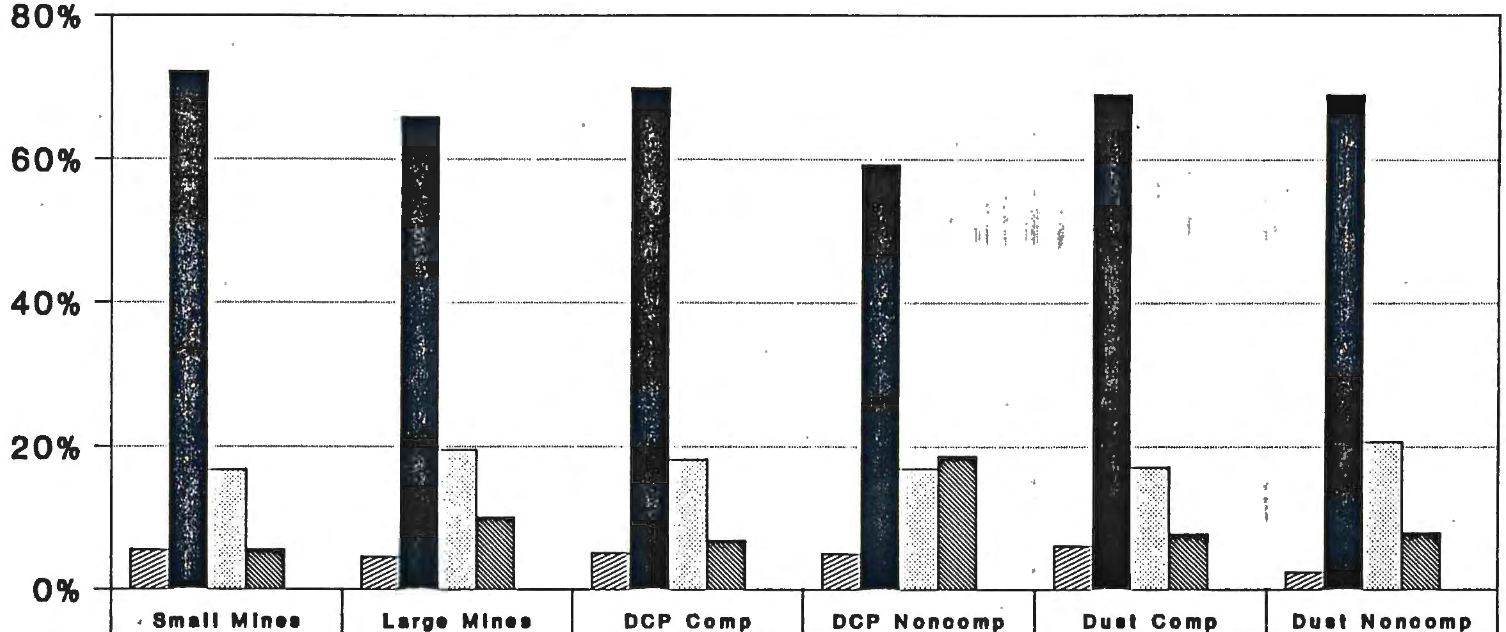


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	64.07%	46.38%	56.9%	38.98%	54.8%	56.86%
2	28.69%	46.09%	36.12%	49.15%	37.4%	36.76%
3	6.41%	6.96%	6.2%	11.86%	6.8%	6.37%
D	0.84%	0.58%	0.78%	0%	1%	0%

1 2 3 D

Designated Occupation Interview, #11
Answer: 1) Accurately.

When a dust sample is being collected on my occupation...

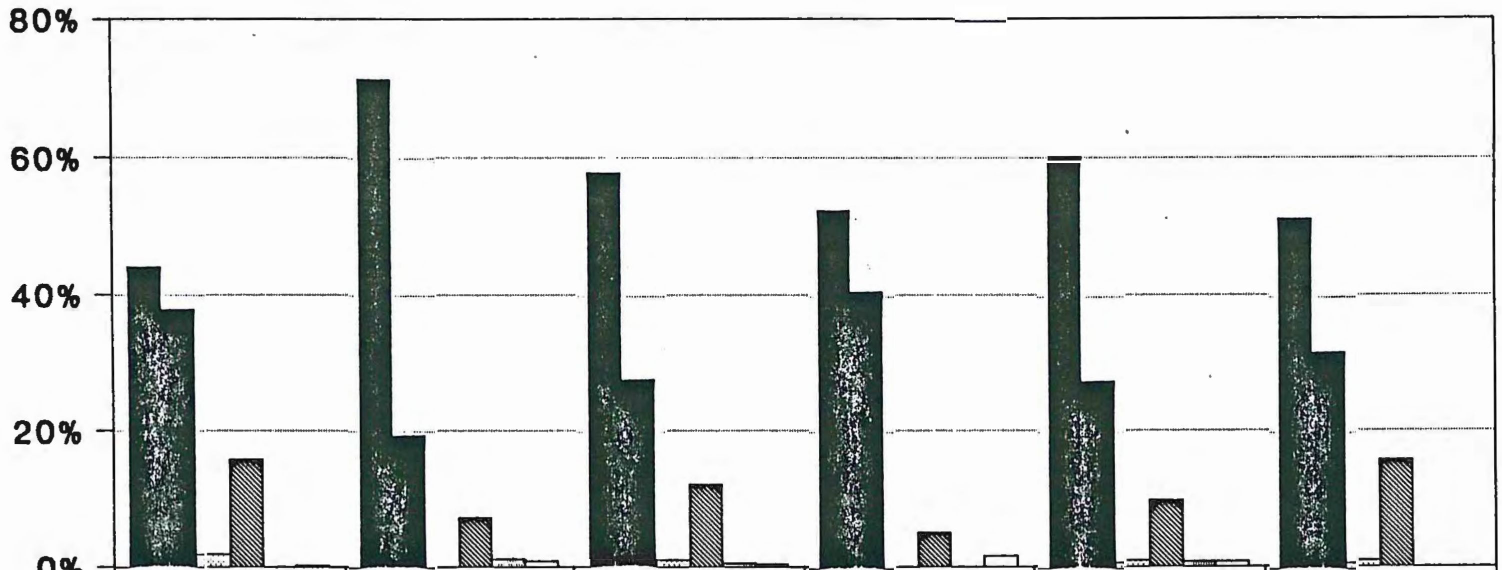


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	5.59%	4.6%	5.1%	5.08%	6.16%	2.46%
2	72.07%	65.8%	69.86%	59.32%	68.99%	68.97%
3	16.76%	19.54%	18.24%	16.95%	17.1%	20.69%
4	5.59%	10.06%	6.8%	18.64%	7.75%	7.88%
D	0%	0%	0%	0%	0%	0%

1 2 3 4 D

Designated Occupation Interview, #12
Answer: 2) I mine the same way I always do.

When dust samples are being collected on this occupation/machine...

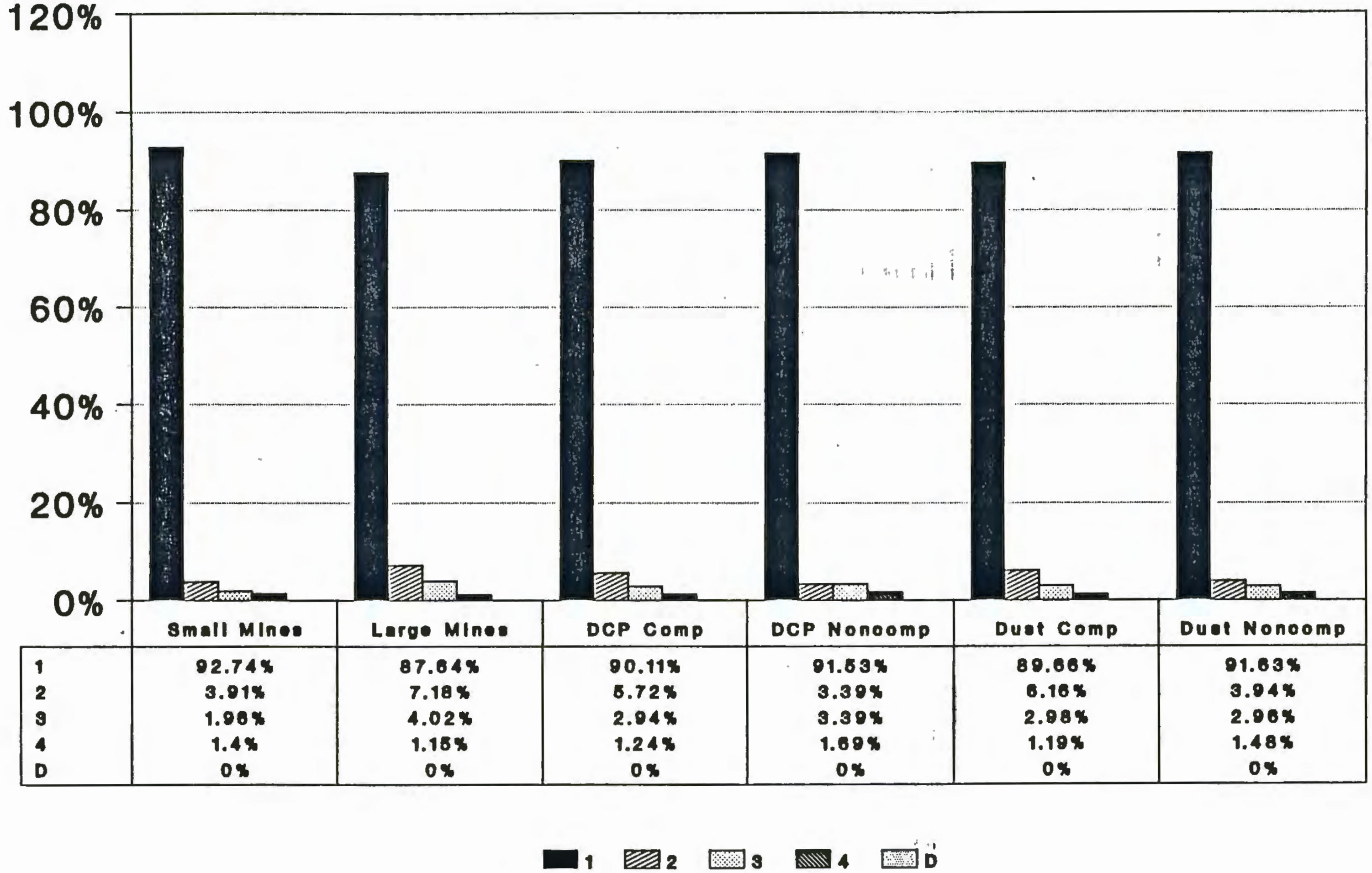


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	44.1%	71.35%	58.05%	52.54%	60.08%	51.47%
2	37.92%	19.48%	27.71%	40.68%	27.54%	31.86%
3	1.97%	0%	1.08%	0%	1%	0.98%
4	15.73%	7.16%	12.07%	5.08%	9.78%	15.69%
5	0%	1.15%	0.62%	0%	0.8%	0%
D	0.28%	0.86%	0.46%	1.69%	0.8%	0%

1 2 3 4 5 D

Designated Occupation Interview, #13
Answer: 1) I wear the dust pump (or)
2) The dust pump is placed on the....

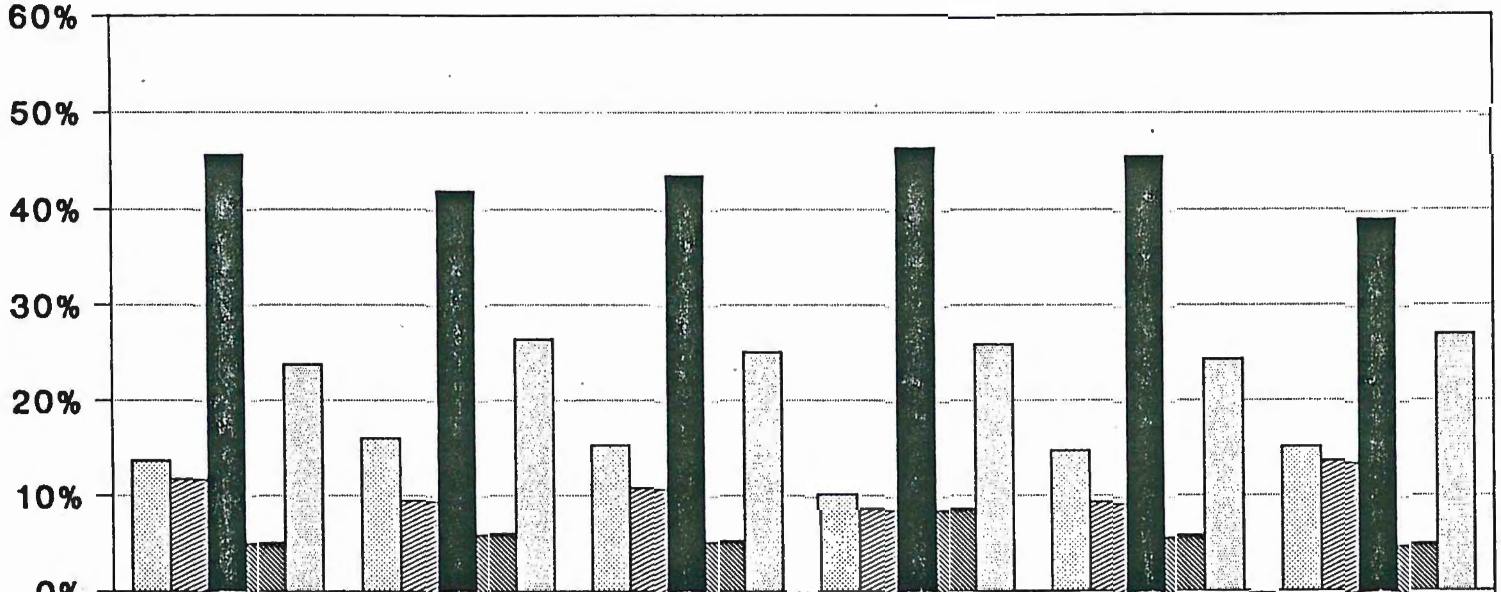
During sampling, dust pumps are...



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	92.74%	87.64%	90.11%	91.53%	89.66%	91.63%
2	3.91%	7.18%	5.72%	3.39%	6.16%	3.94%
3	1.96%	4.02%	2.94%	3.39%	2.98%	2.96%
4	1.4%	1.15%	1.24%	1.69%	1.19%	1.48%
D	0%	0%	0%	0%	0%	0%

Designated Occupation Interview, #14
Answer: 1) Operated 8 hours from the
time they enter the mine until they...

During sampling, dust pump flow rates are checked...

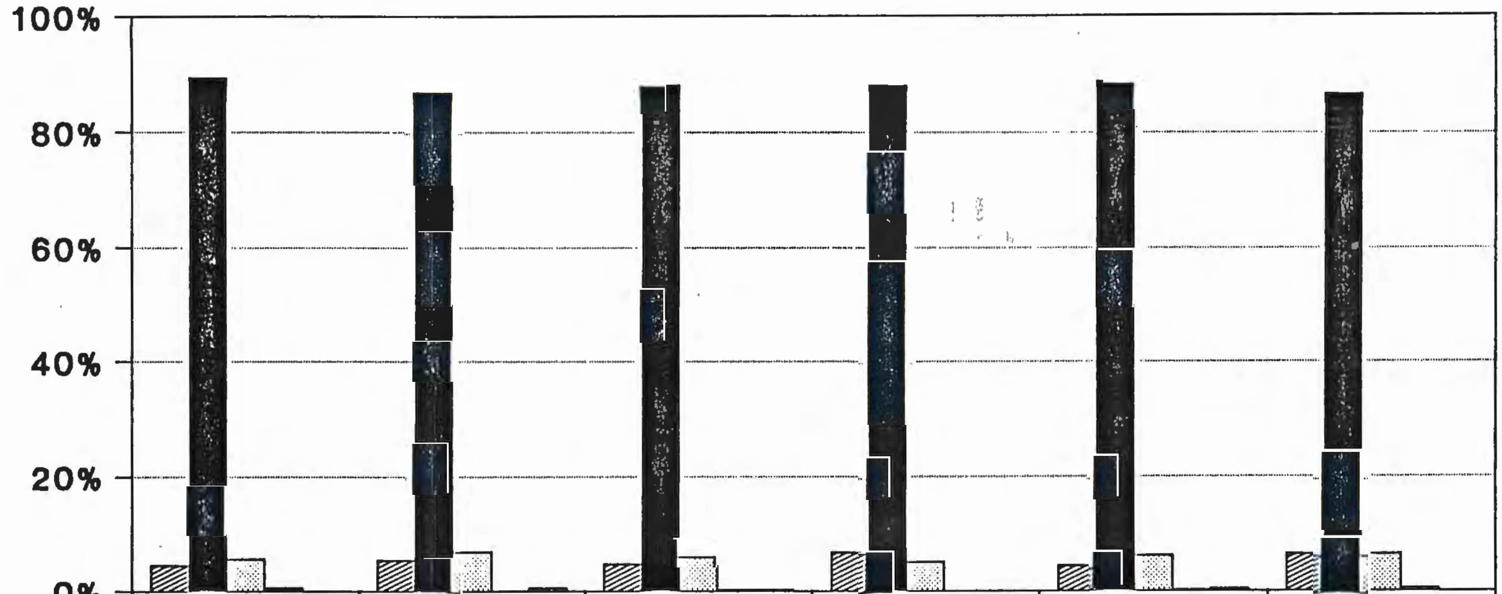


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	13.73%	16.09%	15.3%	10.34%	14.77%	15.2%
2	11.76%	9.48%	10.82%	8.62%	9.38%	13.73%
3	45.66%	41.95%	43.59%	46.55%	45.71%	39.22%
4	5.04%	6.03%	5.26%	8.62%	5.79%	4.9%
5	23.81%	26.44%	25.04%	25.86%	24.35%	26.96%

1 2 3 4 5

Designated Occupation Interview, #15
Answer: 3) An hour or 2 after the shift starts and at the end of the shift.

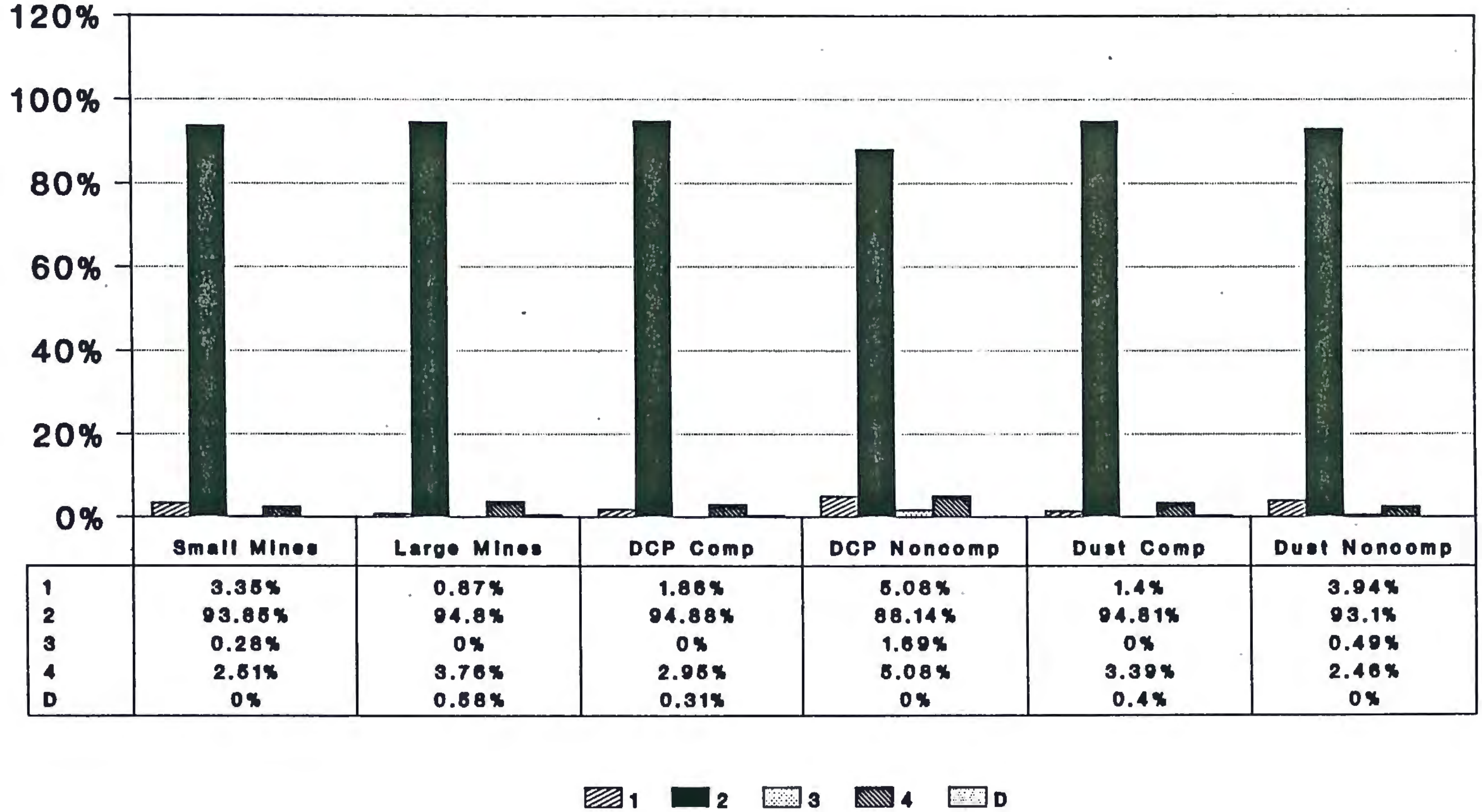
The major health concern with respirable dust is...



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	4.47%	5.46%	4.79%	6.78%	4.37%	6.4%
2	89.39%	87.07%	88.25%	88.14%	88.87%	86.7%
3	5.59%	6.9%	6.34%	5.08%	6.16%	6.4%
4	0.56%	0%	0.31%	0%	0.2%	0.49%
D	0%	0.57%	0.31%	0%	0.4%	0%

Designated Occupation Interview, #19
Answer: 2) Permanent lung damage that cannot be reversed.

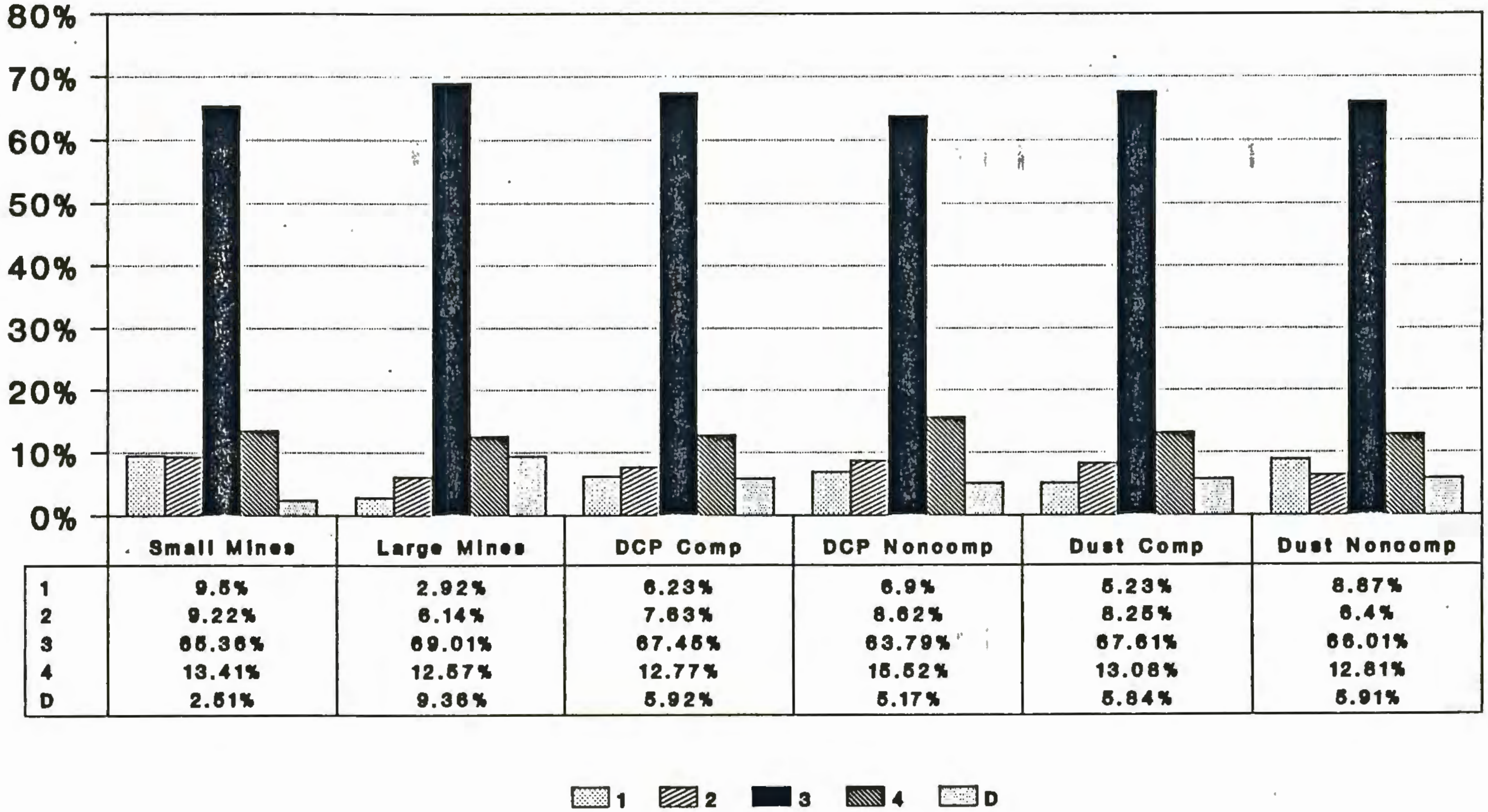
If you observe the conditions that may increase respirable dust, what should you do?



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	3.35%	0.87%	1.86%	5.08%	1.4%	3.94%
2	93.85%	94.8%	94.88%	88.14%	94.81%	93.1%
3	0.28%	0%	0%	1.69%	0%	0.49%
4	2.51%	3.76%	2.95%	5.08%	3.39%	2.46%
D	0%	0.58%	0.31%	0%	0.4%	0%

Designated Occupation Interview, #21
Answer: 2) Correct the conditions immediately or report them.

The maximum penalty a person could be given if convicted of tampering with dust samples is...



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp
1	9.5%	2.92%	6.23%	6.9%	5.23%	8.87%
2	9.22%	6.14%	7.63%	8.62%	8.25%	6.4%
3	65.36%	69.01%	67.45%	63.79%	67.61%	66.01%
4	13.41%	12.57%	12.77%	15.52%	13.08%	12.81%
D	2.51%	9.36%	5.92%	5.17%	5.84%	5.91%

Designated Occupation Interview, #24
Answer: 3) Five years in jail and a $10,000 fine.

Certified Dust Sampler Interview, #9 (Correct Answer: 1 or 2)

Total of all responses 681
Disregarded responses 56
Total useable responses 625

Small mines with less than 50 employees	[1]	192/348	=	55.17%
	[2]	79/348	=	22.70%
	[3]	6/348	=	1.72%
	[4]	67/348	=	19.25%
	[5]	0/348	=	0.00%
	[D]	4/348	=	1.15%
Large mines with at least 50 employees	[1]	210/277	=	75.81%
	[2]	29/277	=	10.47%
	[3]	0/277	=	0.00%
	[4]	27/277	=	9.75%
	[5]	0/277	=	0.00%
	[D]	11/277	=	3.97%
Mines with DCP compliance	[1]	372/573	=	64.92%
	[2]	96/573	=	16.75%
	[3]	6/573	=	1.05%
	[4]	88/573	=	15.36%
	[5]	0/573	=	0.00%
	[D]	11/573	=	1.92%
Mines with DCP noncompliance	[1]	30/ 52	=	57.69%
	[2]	12/ 52	=	23.08%
	[3]	0/ 52	=	0.00%
	[4]	6/ 52	=	11.54%
	[5]	0/ 52	=	0.00%
	[D]	4/ 52	=	7.69%
Mines with dust standard compliance	[1]	288/445	=	64.72%
	[2]	82/445	=	18.43%
	[3]	6/445	=	1.35%
	[4]	55/445	=	12.36%
	[5]	0/445	=	0.00%
	[D]	14/445	=	3.15%
Mines with dust standard noncompliance	[1]	114/180	=	63.33%
	[2]	26/180	=	14.44%
	[3]	0/180	=	0.00%
	[4]	39/180	=	21.67%
	[5]	0/180	=	0.00%
	[D]	1/180	=	0.56%
Interviewee has been retrained	[1]	131/187	=	70.05%
	[2]	22/187	=	11.76%
	[3]	3/187	=	1.60%
	[4]	21/187	=	11.23%
	[5]	0/187	=	0.00%
	[D]	10/187	=	5.35%
Interviewee has not been retrained	[1]	265/431	=	61.48%
	[2]	86/431	=	19.95%
	[3]	3/431	=	0.70%
	[4]	72/431	=	16.71%
	[5]	0/431	=	0.00%
	[D]	5/431	=	1.16%

Retraining status of interviewee unknown ...	[1]	6
	[2]	0
	[3]	0
	[4]	1
	[5]	0
	[D]	0

Certified Dust Sampler Interview, #10 (Correct Answer: 2)

Total of all responses 681
Disregarded responses 55
Total useable responses 626

Category	Response	Count	Percent
Small mines with less than 50 employees	[1]	50/347	14.41%
	[2]	296/347	85.30%
	[3]	1/347	0.29%
	[4]	0/347	0.00%
	[D]	0/347	0.00%
Large mines with at least 50 employees	[1]	18/279	6.45%
	[2]	250/279	89.61%
	[3]	7/279	2.51%
	[4]	0/279	0.00%
	[D]	4/279	1.43%
Mines with DCP compliance	[1]	64/575	11.13%
	[2]	501/575	87.13%
	[3]	6/575	1.04%
	[4]	0/575	0.00%
	[D]	4/575	0.70%
Mines with DCP noncompliance	[1]	4/ 51	7.84%
	[2]	45/ 51	88.24%
	[3]	2/ 51	3.92%
	[4]	0/ 51	0.00%
	[D]	0/ 51	0.00%
Mines with dust standard compliance	[1]	49/446	10.99%
	[2]	387/446	86.77%
	[3]	7/446	1.57%
	[4]	0/446	0.00%
	[D]	3/446	0.67%
Mines with dust standard noncompliance	[1]	19/180	10.56%
	[2]	159/180	88.33%
	[3]	1/180	0.56%
	[4]	0/180	0.00%
	[D]	1/180	0.56%
Interviewee has been retrained	[1]	16/188	8.51%
	[2]	168/188	89.36%
	[3]	2/188	1.06%
	[4]	0/188	0.00%
	[D]	2/188	1.06%
Interviewee has not been retrained	[1]	49/431	11.37%
	[2]	374/431	86.77%
	[3]	6/431	1.39%
	[4]	0/431	0.00%
	[D]	2/431	0.46%
Retraining status of interviewee unknown ...	[1]	3	
	[2]	4	
	[3]	0	
	[4]	0	
	[D]	0	

Certified Dust Sampler Interview, #11 (Correct Answer: 1, 2 or 3)

Total of all responses	681
Disregarded responses	53
Total useable responses	628

Small mines with less than 50 employees	[1]	40/349 = 11.46%
	[2]	10/349 = 2.87%
	[3]	201/349 = 57.59%
	[4]	4/349 = 1.15%
	[5]	94/349 = 26.93%
Large mines with at least 50 employees	[1]	16/279 = 5.73%
	[2]	4/279 = 1.43%
	[3]	210/279 = 75.27%
	[4]	2/279 = 0.72%
	[5]	47/279 = 16.85%
Mines with DCP compliance	[1]	53/576 = 9.20%
	[2]	13/576 = 2.26%
	[3]	373/576 = 64.76%
	[4]	6/576 = 1.04%
	[5]	131/576 = 22.74%
Mines with DCP noncompliance	[1]	3/ 52 = 5.77%
	[2]	1/ 52 = 1.92%
	[3]	38/ 52 = 73.08%
	[4]	0/ 52 = 0.00%
	[5]	10/ 52 = 19.23%
Mines with dust standard compliance	[1]	40/447 = 8.95%
	[2]	3/447 = 0.67%
	[3]	305/447 = 68.23%
	[4]	5/447 = 1.12%
	[5]	94/447 = 21.03%
Mines with dust standard noncompliance	[1]	16/181 = 8.84%
	[2]	11/181 = 6.08%
	[3]	106/181 = 58.56%
	[4]	1/181 = 0.55%
	[5]	47/181 = 25.97%
Interviewee has been retrained	[1]	14/188 = 7.45%
	[2]	2/188 = 1.06%
	[3]	131/188 = 69.68%
	[4]	3/188 = 1.60%
	[5]	38/188 = 20.21%
Interviewee has not been retrained	[1]	41/433 = 9.47%
	[2]	12/433 = 2.77%
	[3]	278/433 = 64.20%
	[4]	3/433 = 0.69%
	[5]	99/433 = 22.86%
Retraining status of interviewee unknown	[1]	1
	[2]	0
	[3]	2
	[4]	0
	[5]	4

Certified Dust Sampler Interview, #14

Total of all responses		681	
Disregarded responses	[N]	3	
Total useable responses		678	
Small mines with less than 50 employees	[1]	62/357	= 17.37%
	[2]	283/357	= 79.27%
	[D]	0/357	= 0.00%
	[ ] or [R]	12/357	= 3.36%
Large mines with at least 50 employees	[1]	128/321	= 39.88%
	[2]	150/321	= 46.73%
	[D]	0/321	= 0.00%
	[ ] or [R]	43/321	= 13.40%
Mines with DCP compliance	[1]	168/620	= 27.10%
	[2]	403/620	= 65.00%
	[D]	0/620	= 0.00%
	[ ] or [R]	49/620	= 7.90%
Mines with DCP noncompliance	[1]	22/ 58	= 37.93%
	[2]	30/ 58	= 51.72%
	[D]	0/ 58	= 0.00%
	[ ] or [R]	6/ 58	= 10.34%
Mines with dust standard compliance	[1]	148/485	= 30.52%
	[2]	295/485	= 60.82%
	[D]	0/485	= 0.00%
	[ ] or [R]	42/485	= 8.66%
Mines with dust standard noncompliance	[1]	42/193	= 21.76%
	[2]	138/193	= 71.50%
	[D]	0/193	= 0.00%
	[ ] or [R]	13/193	= 6.74%
Interviewee has been retrained	[1]	190/190	= 100.0%
	[2]	0/190	= 0.00%
	[D]	0/190	= 0.00%
	[ ] or [R]	0/190	= 0.00%
Interviewee has not been retrained	[1]	0/433	= 0.00%
	[2]	433/433	= 100.0%
	[D]	0/433	= 0.00%
	[ ] or [R]	0/433	= 0.00%
Retraining status of interviewee unknown	[1]	0	
	[2]	0	
	[D]	0	
	[ ] or [R]	55	

Certified Dust Sampler Interview, #15

```
Total of all responses ........................ 681
Disregarded responses ...................... [N]   2
Total useable responses ....................... 679

Small mines with less than 50 employees .... [1] 258/357 = 72.27%
                                             [2]  88/357 = 24.65%
                                             [D]   0/357 =  0.00%
                                      [ ] or [R]  11/357 =  3.08%

Large mines with at least 50 employees ..... [1] 228/322 = 70.81%
                                             [2]  52/322 = 16.15%
                                             [D]   0/322 =  0.00%
                                      [ ] or [R]  42/322 = 13.04%

Mines with DCP compliance .................. [1] 441/621 = 71.01%
                                             [2] 133/621 = 21.42%
                                             [D]   0/621 =  0.00%
                                      [ ] or [R]  47/621 =  7.57%

Mines with DCP noncompliance ............... [1]  45/ 58 = 77.59%
                                             [2]   7/ 58 = 12.07%
                                             [D]   0/ 58 =  0.00%
                                      [ ] or [R]   6/ 58 = 10.34%

Mines with dust standard compliance ........ [1] 344/486 = 70.78%
                                             [2] 102/486 = 20.99%
                                             [D]   0/486 =  0.00%
                                      [ ] or [R]  40/486 =  8.23%

Mines with dust standard noncompliance ..... [1] 142/193 = 73.58%
                                             [2]  38/193 = 19.69%
                                             [D]   0/193 =  0.00%
                                      [ ] or [R]  13/193 =  6.74%

Interviewee has been retrained ............. [1] 164/190 = 86.32%
                                             [2]  26/190 = 13.68%
                                             [D]   0/190 =  0.00%
                                      [ ] or [R]   0/190 =  0.00%

Interviewee has not been retrained ......... [1] 320/433 = 73.90%
                                             [2] 113/433 = 26.10%
                                             [D]   0/433 =  0.00%
                                      [ ] or [R]   0/433 =  0.00%

Retraining status of interviewee unknown ... [1]   2
                                             [2]   1
                                             [D]   0
                                      [ ] or [R]  53
```

Certified Dust Sampler Interview, #17 (Correct Answer: 1)

Total of all responses 681
Disregarded responses .... [N] 3
Total useable responses .... 678 ✓

Group	Answer	Count	Percent	Handwritten
Small mines with less than 50 employees	[1]	337/357	94.40%	
	[2]	5/357	1.40%	2.24 %
	[3]	3/357	0.84%	
	[4]	0/357	0.00%	
	[D]	0/357	0.00%	3.36 %
[ ] or	[R]	12/357	3.36%	
Large mines with at least 50 employees	[1]	266/321	82.87%	
	[2]	6/321	1.87%	3.43 %
	[3]	5/321	1.56%	
	[4]	0/321	0.00%	
	[D]	1/321	0.31%	13.71 %
[ ] or	[R]	43/321	13.40%	
Mines with DCP compliance	[1]	553/620	89.19%	
	[2]	11/620	1.77%	2.9 %
	[3]	7/620	1.13%	
	[4]	0/620	0.00%	
	[D]	1/620	0.16%	7.90 %
[ ] or	[R]	48/620	7.74%	
Mines with DCP noncompliance	[1]	50/ 58	86.21%	
	[2]	0/ 58	0.00%	1.72 %
	[3]	1/ 58	1.72%	
	[4]	0/ 58	0.00%	
	[D]	0/ 58	0.00%	12.07 %
[ ] or	[R]	7/ 58	12.07%	
Mines with dust standard compliance	[1]	436/487	89.53%	
	[2]	6/487	1.23%	2.05 %
	[3]	4/487	0.82%	
	[4]	0/487	0.00%	
	[D]	1/487	0.21%	8.42 %
[ ] or	[R]	40/487	8.21%	
Mines with dust standard noncompliance	[1]	167/191	87.43%	
	[2]	5/191	2.62%	4.71 %
	[3]	4/191	2.09%	
	[4]	0/191	0.00%	
	[D]	0/191	0.00%	7.85 %
[ ] or	[R]	15/191	7.85%	
Interviewee has been retrained	[1]	184/189	97.35%	
	[2]	2/189	1.06%	2.12 %
	[3]	2/189	1.06%	
	[4]	0/189	0.00%	
	[D]	0/189	0.00%	0.53 %
[ ] or	[R]	1/189	0.53%	
Interviewee has not been retrained	[1]	413/431	95.82%	
	[2]	9/431	2.09%	3.48 %
	[3]	6/431	1.39%	
	[4]	0/431	0.00%	
	[D]	1/431	0.23%	0.69 %
[ ] or	[R]	2/431	0.46%	

Retraining status of interviewee unknown ...	[1]	6
	[2]	0
	[3]	0
	[4]	0
	[D]	0
	[ ] or [R]	52

Certified Dust Sampler Interview, #19 (Correct Answer: 3)

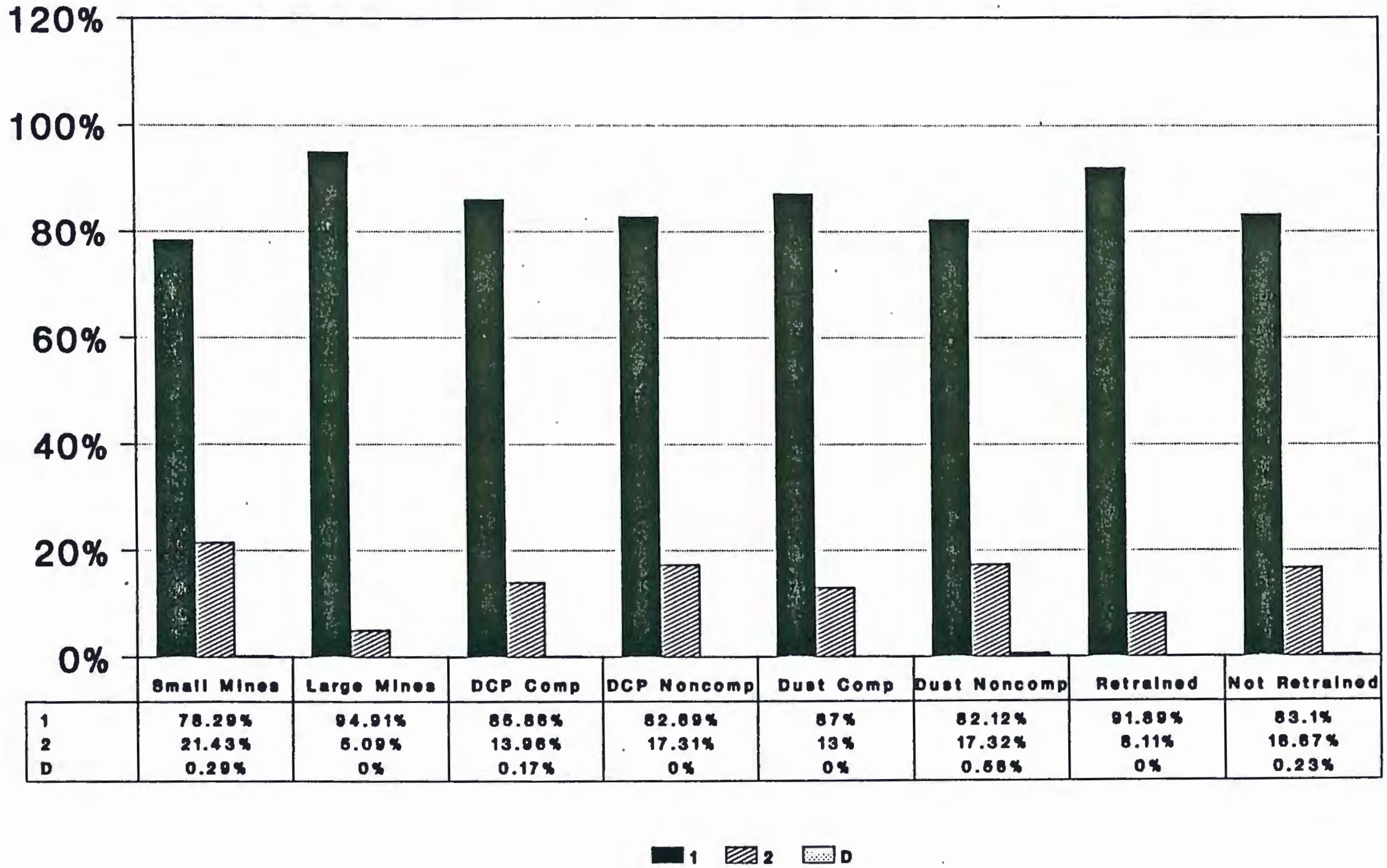
Total of all responses 681
Disregarded responses 59
Total useable responses 622

Small mines with less than 50 employees	[1]	10/345 =	2.90%
	[2]	17/345 =	4.93%
	[3]	295/345 =	85.51%
	[4]	21/345 =	6.09%
	[D]	2/345 =	0.58%
Large mines with at least 50 employees	[1]	1/277 =	0.36%
	[2]	7/277 =	2.53%
	[3]	253/277 =	91.34%
	[4]	7/277 =	2.53%
	[D]	9/277 =	3.25%
Mines with DCP compliance	[1]	11/570 =	1.93%
	[2]	22/570 =	3.86%
	[3]	500/570 =	87.72%
	[4]	26/570 =	4.56%
	[D]	11/570 =	1.93%
Mines with DCP noncompliance	[1]	0/ 52 =	0.00%
	[2]	2/ 52 =	3.85%
	[3]	48/ 52 =	92.31%
	[4]	2/ 52 =	3.85%
	[D]	0/ 52 =	0.00%
Mines with dust standard compliance	[1]	6/443 =	1.35%
	[2]	16/443 =	3.61%
	[3]	392/443 =	88.49%
	[4]	20/443 =	4.51%
	[D]	9/443 =	2.03%
Mines with dust standard noncompliance	[1]	5/179 =	2.79%
	[2]	8/179 =	4.47%
	[3]	156/179 =	87.15%
	[4]	8/179 =	4.47%
	[D]	2/179 =	1.12%
Interviewee has been retrained	[1]	1/187 =	0.53%
	[2]	5/187 =	2.67%
	[3]	168/187 =	89.84%
	[4]	6/187 =	3.21%
	[D]	7/187 =	3.74%
Interviewee has not been retrained	[1]	8/429 =	1.86%
	[2]	19/429 =	4.43%
	[3]	377/429 =	87.88%
	[4]	21/429 =	4.90%
	[D]	4/429 =	0.93%
Retraining status of interviewee unknown ...	[1]	2	
	[2]	0	
	[3]	3	
	[4]	1	
	[D]	0	

Certified Dust Sampler Interview, #21 (Correct Answer: 2)

Total of all responses	681		
Disregarded responses	56		
Total useable responses	625		
Small mines with less than 50 employees	[1]	170/347	48.99%
	[2]	174/347	50.14%
	[3]	2/347	0.58%
	[D]	1/347	0.29%
Large mines with at least 50 employees	[1]	113/278	40.65%
	[2]	160/278	57.55%
	[3]	2/278	0.72%
	[D]	3/278	1.08%
Mines with DCP compliance	[1]	259/573	45.20%
	[2]	306/573	53.40%
	[3]	4/573	0.70%
	[D]	4/573	0.70%
Mines with DCP noncompliance	[1]	24/ 52	46.15%
	[2]	28/ 52	53.85%
	[3]	0/ 52	0.00%
	[D]	0/ 52	0.00%
Mines with dust standard compliance	[1]	200/446	44.84%
	[2]	241/446	54.04%
	[3]	2/446	0.45%
	[D]	3/446	0.67%
Mines with dust standard noncompliance	[1]	83/179	46.37%
	[2]	93/179	51.96%
	[3]	2/179	1.12%
	[D]	1/179	0.56%
Interviewee has been retrained	[1]	71/187	37.97%
	[2]	113/187	60.43%
	[3]	1/187	0.53%
	[D]	2/187	1.07%
Interviewee has not been retrained	[1]	209/431	48.49%
	[2]	217/431	50.35%
	[3]	3/431	0.70%
	[D]	2/431	0.46%
Retraining status of interviewee unknown	[1]	3	
	[2]	4	
	[3]	0	
	[D]	0	

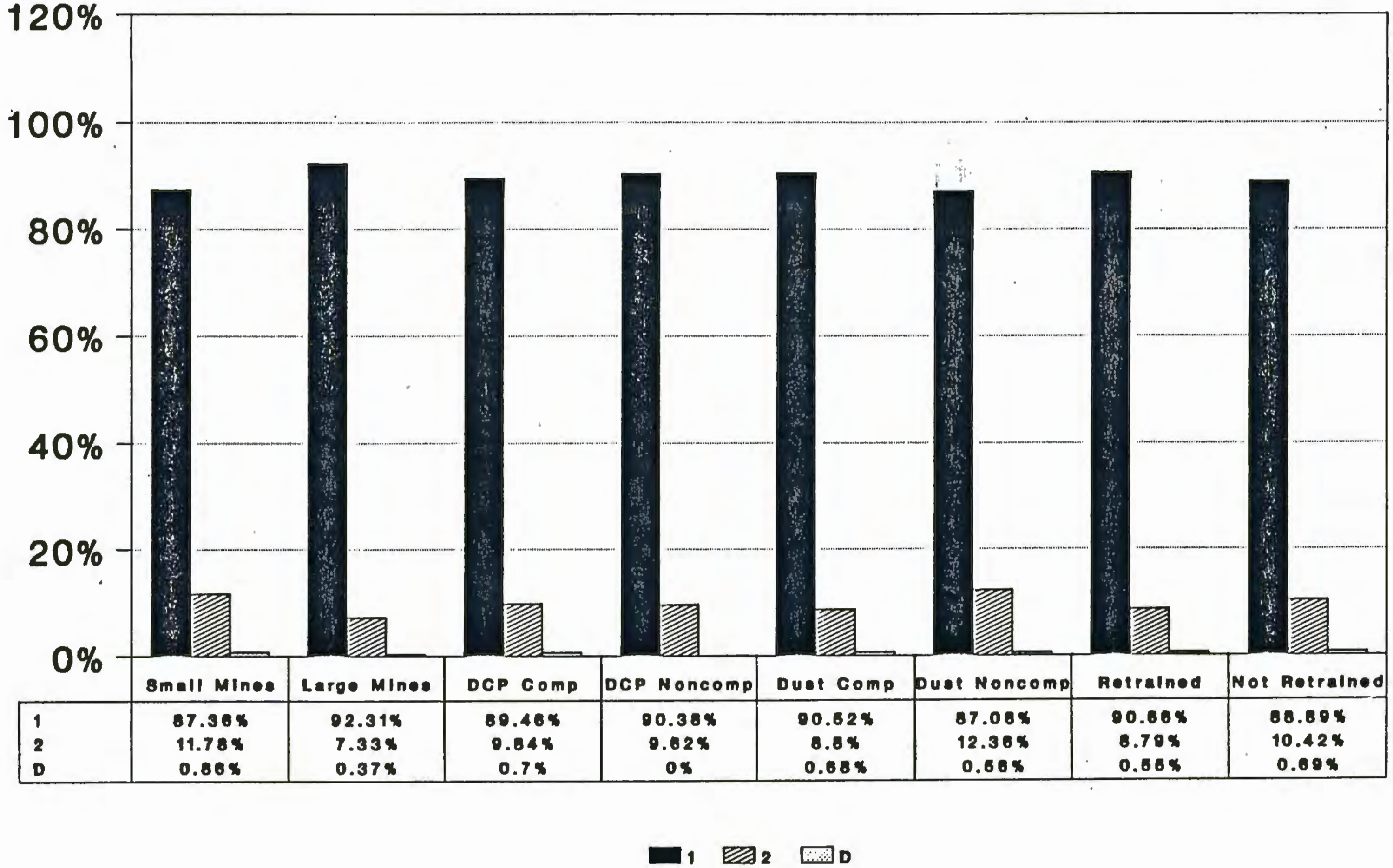
What is the respirable dust standard in coal mines?



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	78.29%	94.91%	85.86%	82.69%	87%	82.12%	91.89%	83.1%
2	21.43%	5.09%	13.96%	17.31%	13%	17.32%	8.11%	16.67%
D	0.29%	0%	0.17%	0%	0%	0.56%	0%	0.23%

Certified Dust Sampler Interview, #3
Answer: 1) Correct.

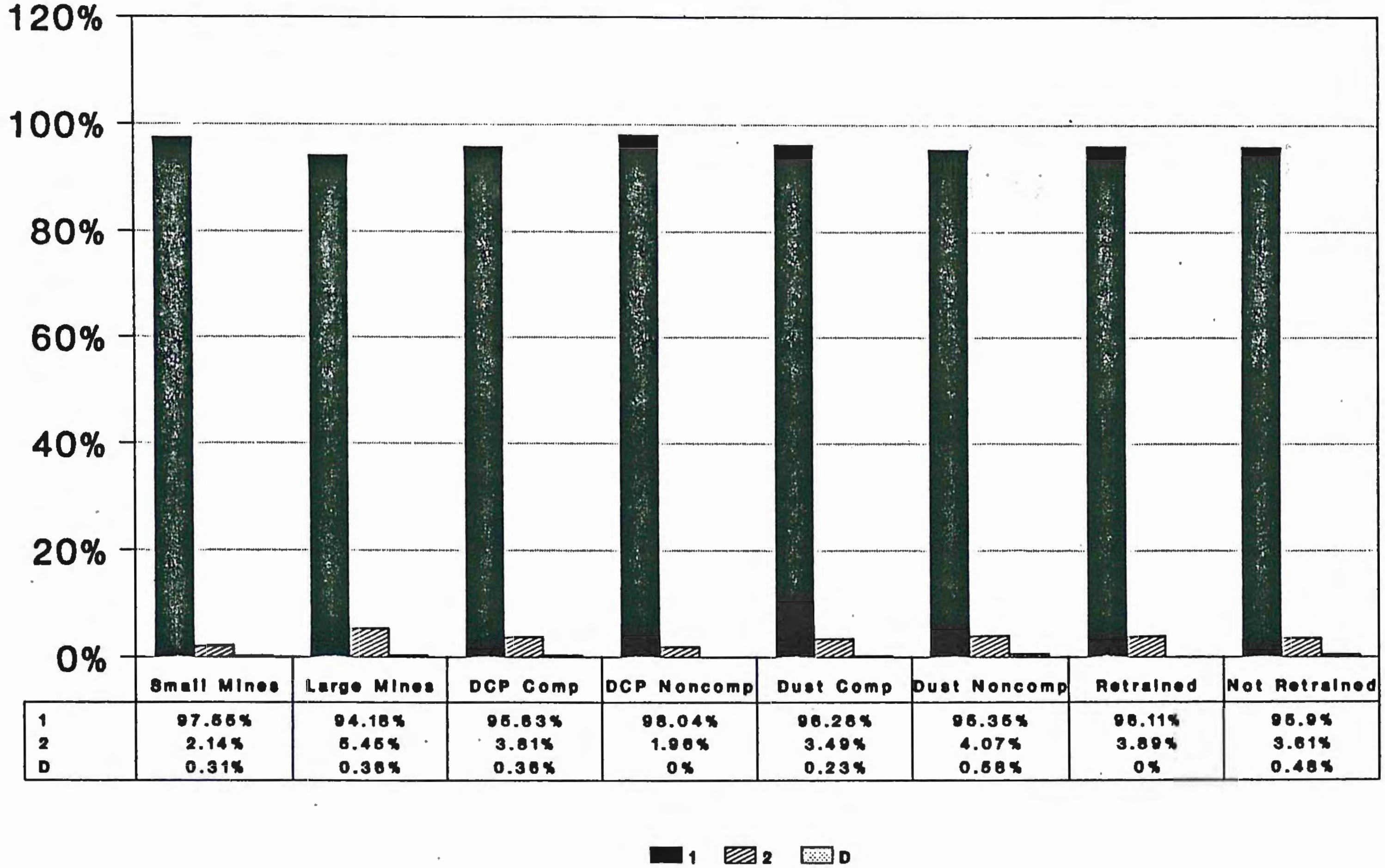
Does this mine have any sections or occupations on a reduced standard?



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	87.36%	92.31%	89.46%	90.38%	90.52%	87.06%	90.66%	88.89%
2	11.78%	7.33%	9.84%	9.62%	8.8%	12.38%	8.79%	10.42%
D	0.86%	0.37%	0.7%	0%	0.68%	0.56%	0.55%	0.69%

Certified Dust Sampler Interview, #4
Answer: 1) Correct.

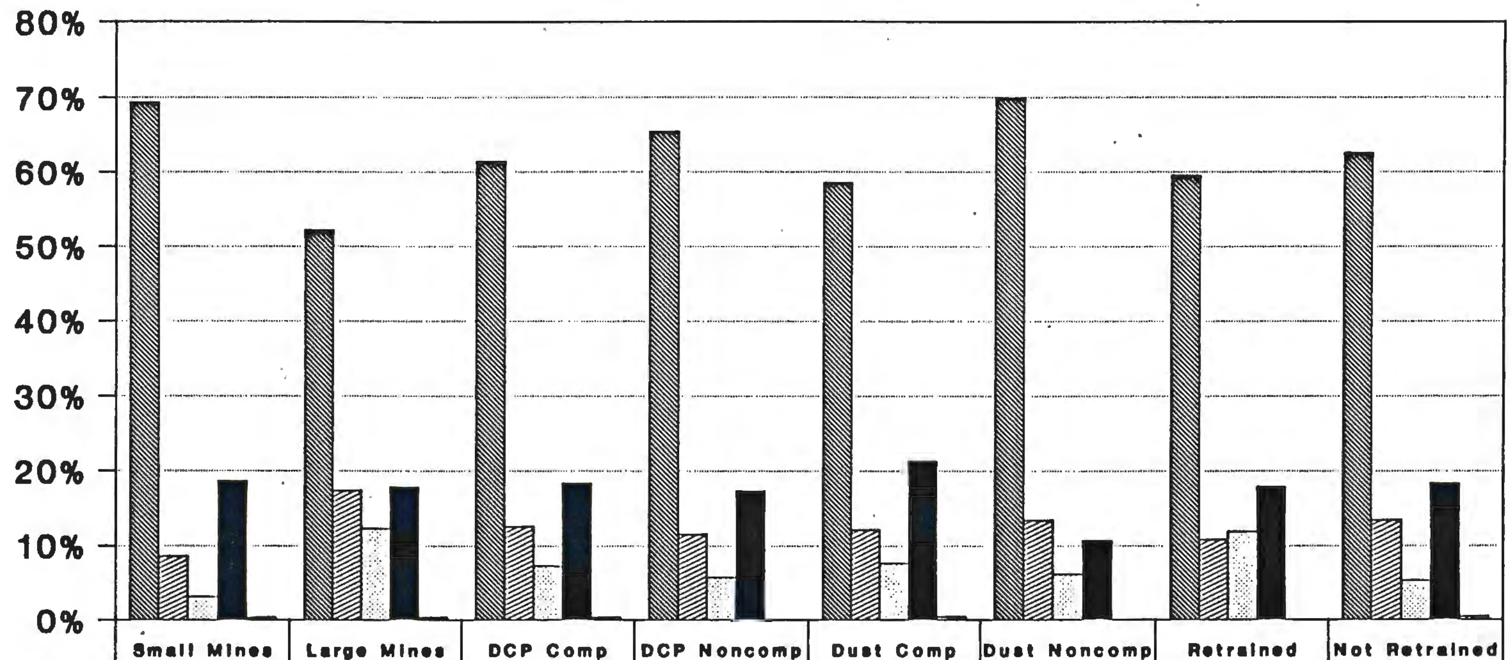
Are the dust control plans for all your MMUs exactly the same?



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	97.55%	94.18%	95.83%	98.04%	96.28%	95.35%	96.11%	95.9%
2	2.14%	5.45%	3.81%	1.96%	3.49%	4.07%	3.89%	3.61%
D	0.31%	0.36%	0.36%	0%	0.23%	0.58%	0%	0.48%

Certified Dust Sampler Interview, #5
Answer: 1) Correct.

When company dust sampling is being conducted...

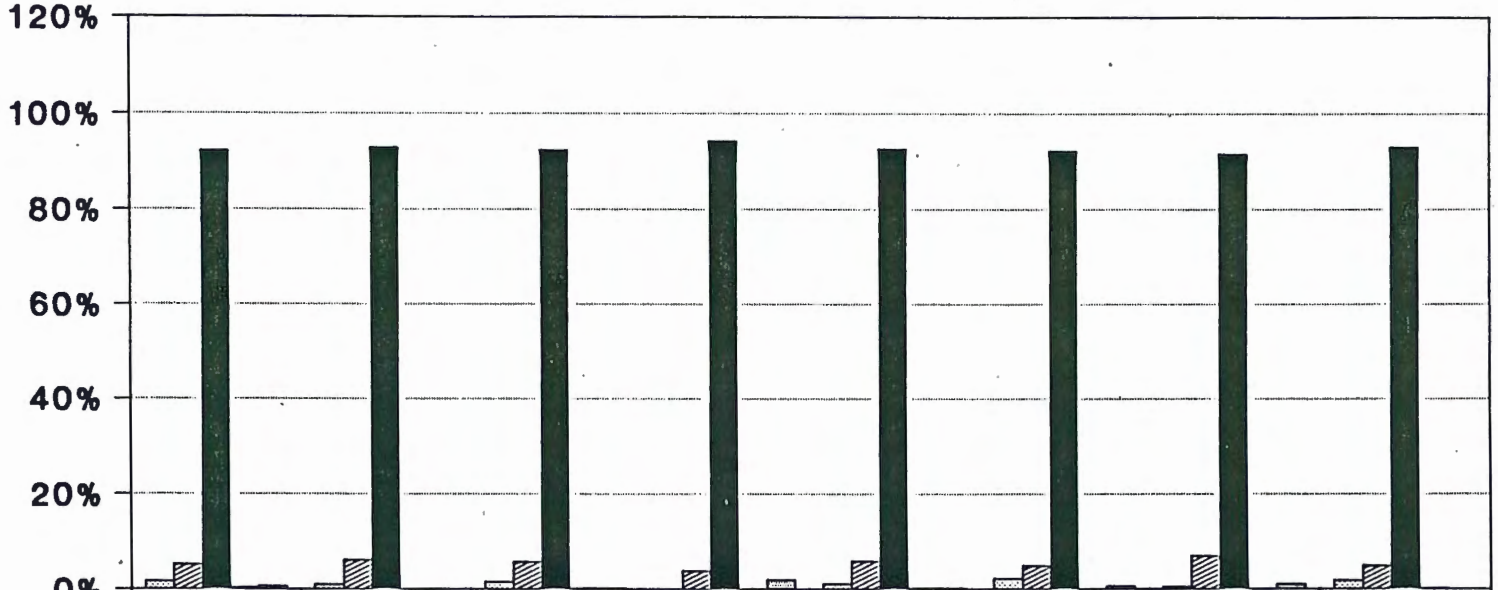


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	69.34%	52.17%	61.43%	65.38%	58.52%	69.83%	59.46%	62.5%
2	8.6%	17.39%	12.57%	11.54%	12.11%	13.41%	10.81%	13.43%
3	3.15%	12.32%	7.33%	5.77%	7.62%	6.15%	11.89%	5.32%
4	18.62%	17.75%	18.32%	17.31%	21.3%	10.61%	17.84%	18.29%
D	0.29%	0.36%	0.35%	0%	0.45%	0%	0%	0.46%

1 2 3 4 D

Certified Dust Sampler Interview, #6
Answer: 4) Samples are taken the way we normally mine, without consideration...

The MSHA requirement for persons who conduct any portion of respirable dust sampling is that they...

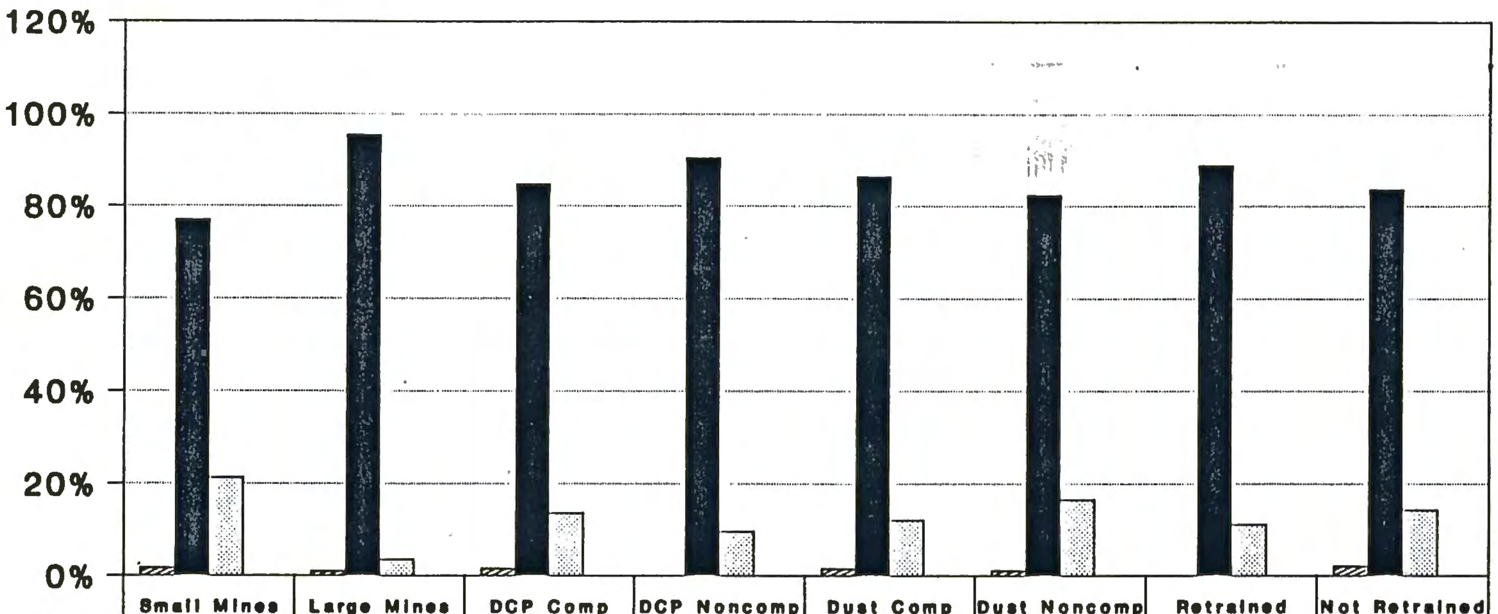


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	1.72%	1.07%	1.56%	0%	1.12%	2.21%	0.53%	1.85%
2	5.16%	6.07%	5.72%	3.85%	5.8%	4.97%	6.88%	4.85%
3	92.26%	92.86%	92.37%	94.23%	92.63%	92.27%	91.53%	93.07%
4	0.29%	0%	0.17%	0%	0.22%	0%	0%	0.23%
D	0.57%	0%	0.17%	1.92%	0.22%	0.55%	1.06%	0%

1 2 3 4 D

Certified Dust Sampler Interview, #7
Answer: 3) Must be certified.

If you were told by someone that a pump did not operate the full eight hours, you would...

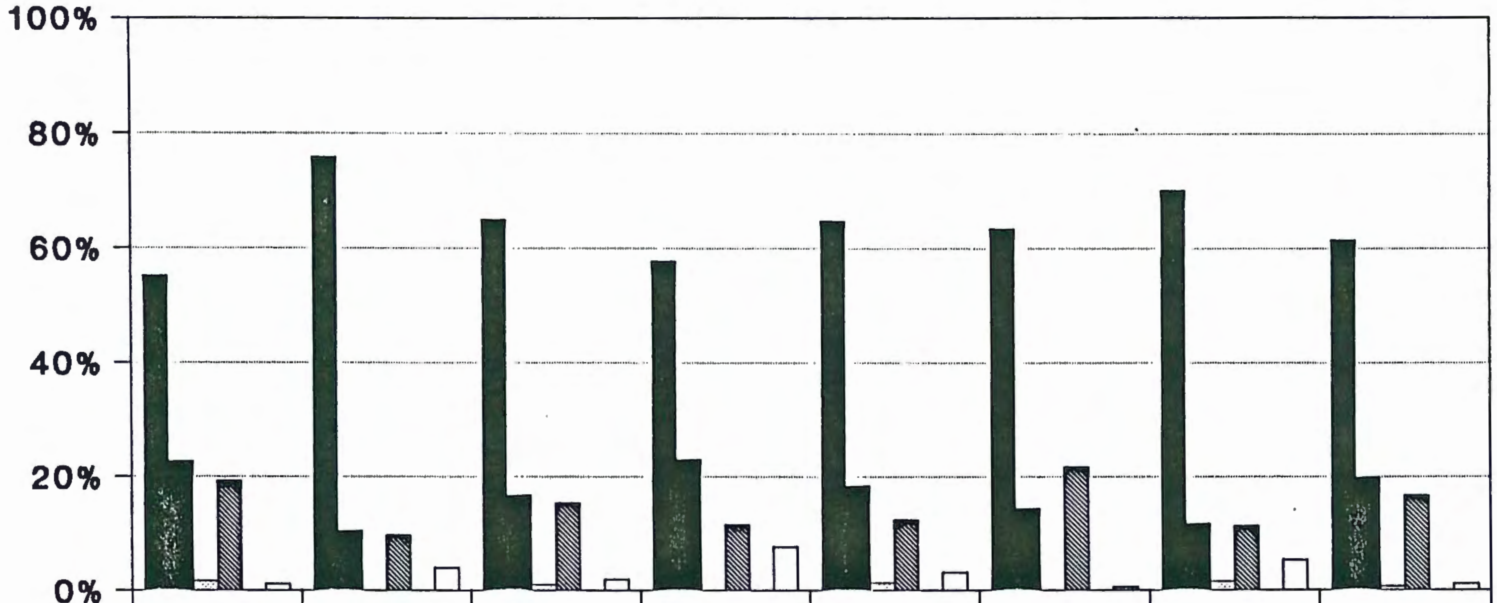


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	1.72%	1.07%	1.56%	0%	1.57%	1.1%	0%	2.08%
2	77.01%	95.36%	84.72%	90.38%	86.35%	82.32%	88.89%	83.56%
3	21.26%	3.57%	13.72%	9.62%	12.08%	16.57%	11.11%	14.36%
D	0%	0%	0%	0%	0%	0%	0%	0%

1 2 3 D

Certified Dust Sampler Interview, #8
Answer: 2) Send the sample to MSHA with a notation on the data card that the...

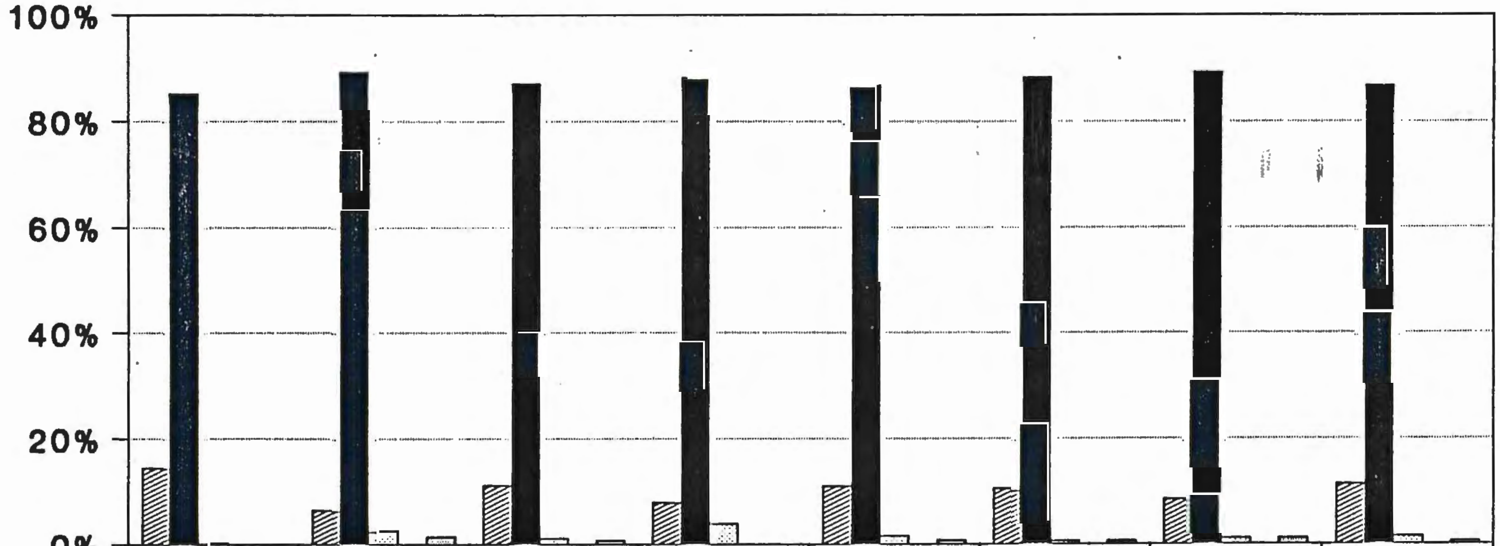
When dust samples are being conducted on a designated occupation or area...



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	55.17%	75.81%	64.92%	57.69%	64.72%	63.33%	70.05%	61.48%
2	22.7%	10.47%	16.75%	23.08%	18.43%	14.44%	11.76%	19.95%
3	1.72%	0%	1.05%	0%	1.35%	0%	1.6%	0.7%
4	19.25%	9.75%	15.36%	11.54%	12.35%	21.67%	11.23%	16.71%
5	0%	0%	0%	0%	0%	0%	0%	0%
D	1.15%	3.97%	1.92%	7.69%	3.15%	0.56%	5.35%	1.16%

Certified Dust Sampler Interview, #9
Answer: 1) The person wears the dust pump (or) 2) The dust pump is placed...

If a dust pump is placed on a designated occupation/area and the person changes jobs for the day, he/she...

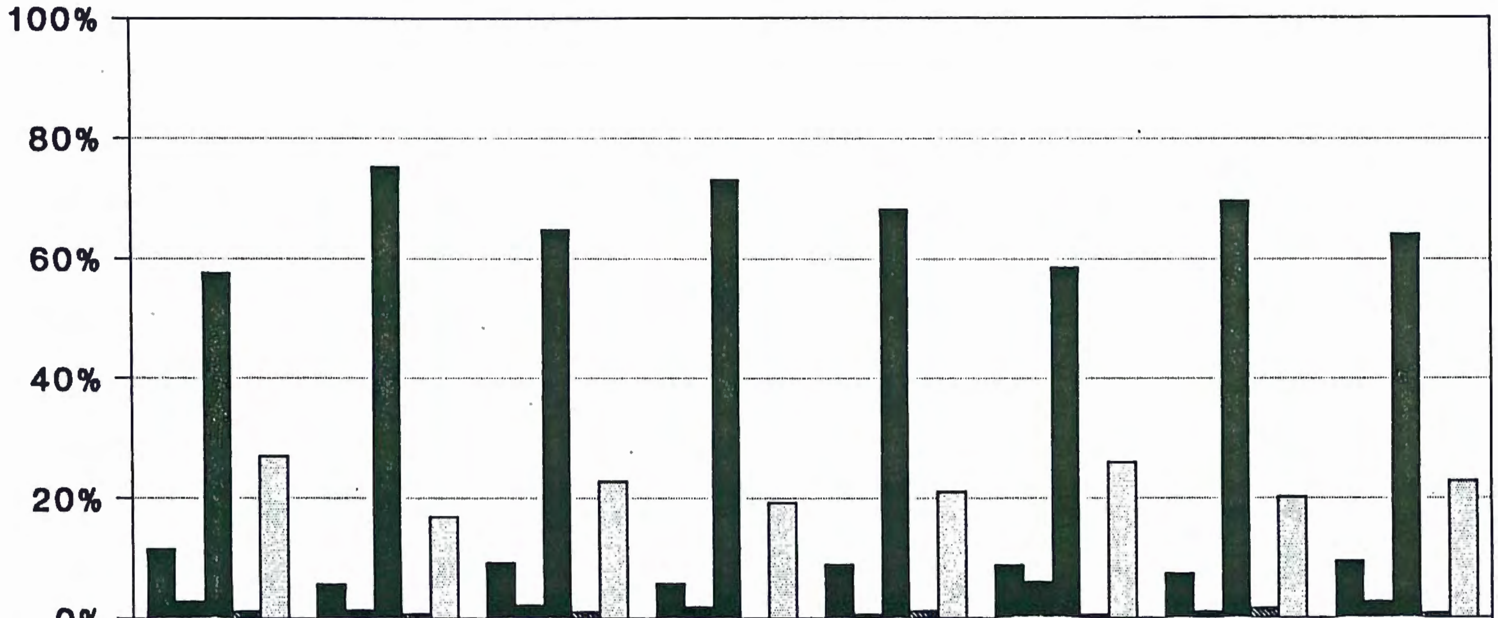


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	14.41%	6.45%	11.13%	7.84%	10.99%	10.56%	8.51%	11.37%
2	85.3%	89.61%	87.13%	88.24%	86.77%	88.33%	89.36%	86.77%
3	0.29%	2.51%	1.04%	3.92%	1.57%	0.56%	1.06%	1.39%
4	0%	0%	0%	0%	0%	0%	0%	0%
D	0%	1.43%	0.7%	0%	0.67%	0.56%	1.06%	0.46%

Legend: 1, 2, 3, 4, D

Certified Dust Sampler Interview, #10
Answer: 2) Leaves the pump on the machine or gives it to the new operator.

Dust pumps are required to be calibrated every...

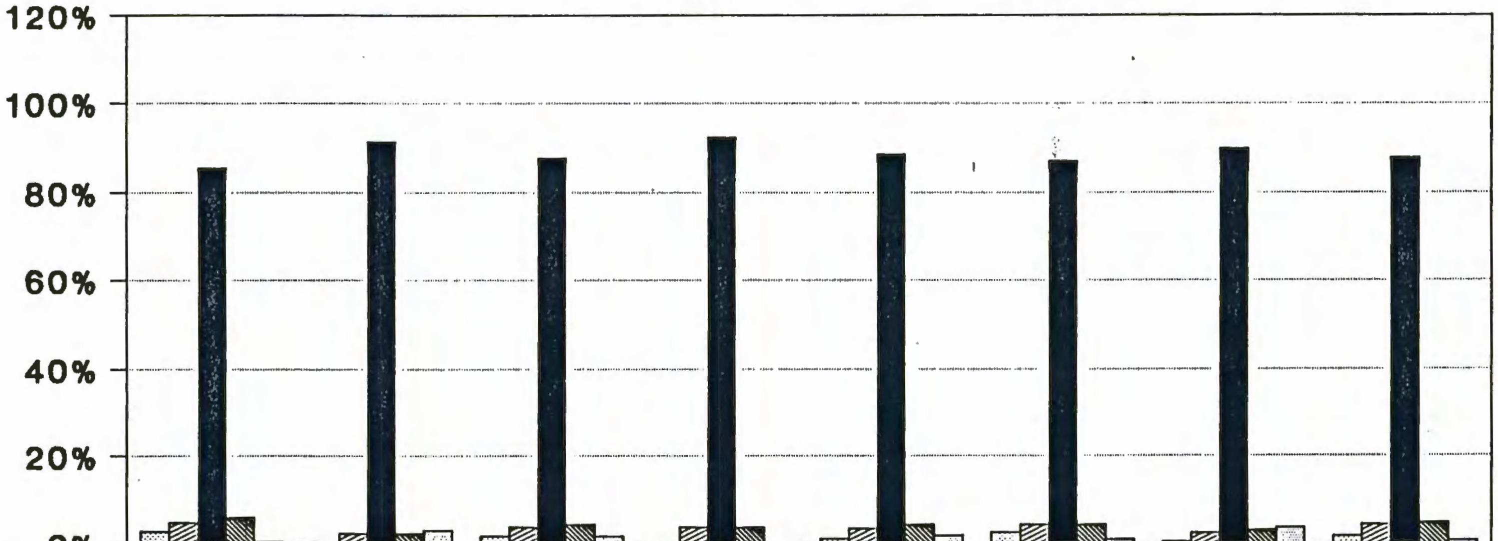


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	11.46%	5.73%	9.2%	5.77%	8.95%	8.84%	7.45%	9.47%
2	2.87%	1.43%	2.26%	1.92%	0.67%	6.08%	1.06%	2.77%
3	57.59%	75.27%	64.76%	73.08%	68.23%	58.56%	69.68%	64.2%
4	1.15%	0.72%	1.04%	0%	1.12%	0.55%	1.6%	0.69%
5	26.93%	16.85%	22.74%	19.23%	21.03%	25.97%	20.21%	22.86%

1 2 3 4 5

Certified Dust Sampler Interview, #11
Answer: 1) 100 hours (or) 2) 150 hours
(or) 3) 200 hours.

The maximum penalty a person could be given if convicted of tampering with dust samples is...

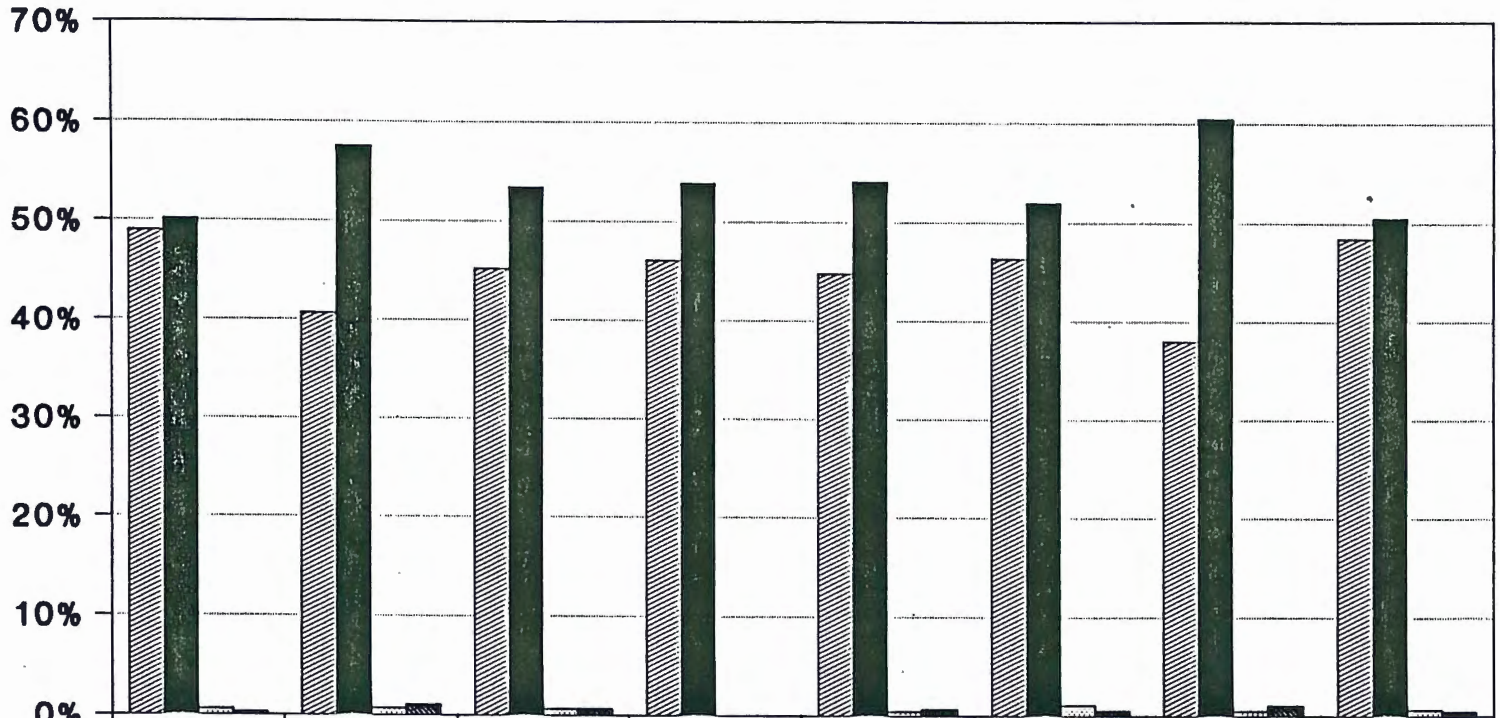


	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	2.9%	0.36%	1.93%	0%	1.35%	2.79%	0.53%	1.86%
2	4.93%	2.53%	3.86%	3.85%	3.61%	4.47%	2.67%	4.43%
3	85.51%	91.34%	87.72%	92.31%	88.49%	87.15%	89.84%	87.88%
4	6.09%	2.53%	4.56%	3.85%	4.51%	4.47%	3.21%	4.9%
D	0.56%	3.25%	1.93%	0%	2.03%	1.12%	3.74%	0.93%

1 2 3 4 D

Certified Dust Sampler Interview, #19
Answer: 3) Five years in jail and a $10,000 fine.

Which kills more miners each year?



	Small Mines	Large Mines	DCP Comp	DCP Noncomp	Dust Comp	Dust Noncomp	Retrained	Not Retrained
1	48.99%	40.65%	45.2%	46.15%	44.84%	46.37%	37.97%	48.49%
2	50.14%	57.55%	53.4%	53.85%	54.04%	51.95%	60.43%	50.53%
3	0.58%	0.72%	0.7%	0%	0.45%	1.12%	0.53%	0.7%
D	0.29%	1.08%	0.7%	0%	0.67%	0.56%	1.07%	0.48%

Certified Dust Sampler Interview, #21
Answer: 2) Black lung and its side effects.

Appendix B. Database Descriptions

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Section 1. GENERAL DESCRIPTION

Section 1.1 Introduction

The purpose of this handbook is to provide the information necessary to understand and use the data contained in the Spot Inspection and Monitoring databases. This data was collected as a result of a two part program initiated by Coal Mine Safety and Health Administration (CMS&H) to evaluate respirable dust exposure levels, dust control programs, sampling procedures, and training. This system contains some Privacy Act data; the privacy act data is not available.

The spot inspection and monitoring packages used by the CMS&H inspectors to collect this data contained several forms. Tables 8 and 9 contain these complete packages. After completion of the forms by the inspectors and prior to data entry, these packages were reviewed, coded, and arranged in their correct sequence.

A computer system was developed using dBASE IV version 1.1 to store and analyze the data. The descriptions of the databases in this document reflect the dBASE IV conventions including field names and database names. Each database description contains a list of all the fields in the database, the number of records, the field type, length of each field, and a detail explanation of each field. The files created for use by the public are MS-DOS "text" files.

All figures for a section are located at the end of the section.

Section 1.2 Diskette Information

All the data described in this document is available on four 3.5 inch IBM formatted diskettes. These 4 diskettes contain thirteen text files. Diskette 1 contains 12 files embedded in a file named PMAIN.EXE; diskettes 2-4 contain one file named POPERAT.EXE which spans 3 diskettes. Each diskette data file is in a compressed mode and are self-extracting files.

A minimum of 30 megabytes of disk space will be needed to expand all the files. The following is a break down of the estimated disk space needed:

	Megabytes
Spot Inspection Databases	2
Monitoring Inspection Databases	2
Other Databases	26
	--
Total	30

To expand all files contained in file PMAIN.EXE on Diskette 1 into MS-DOS ASCII text files, use the following procedure:

a. Insert the 3.5 inch diskette labeled PMAIN into the appropriate drive.

b. Copy (either using MS-DOS COPY command or other utility that is available) the file PMAIN.EXE to a drive that has the capacity to hold the expanded file plus the compressed file. Listed above is an estimate of the amount of disk space needed.

c. The PMAIN.EXE file is a self-extracting file. To extract the original MS-DOS ASCII text files, enter PMAIN at the MS-DOS prompt. Note that approximately 7 megabytes of disk space will be required to store PMAIN.EXE and the resulting text files.

d. From this compressed file, twelve (12) MS-DOS ASCII text files (all files other than POPERAT) will be created. The exact number of records that should be on each expanded file is contained in each file's description in Section 2, 3, and 4.

e. PMAIN.EXE can be deleted from the drive containing the expanded files, if desired. The original diskette should be retained.

To expand POPERAT.EXE file which spans 3 diskettes, use the following procedure:

a. Insert the 3.5 inch diskette labeled POPERAT.1 into the appropriate drive.

b. Copy POPERAT.1 (using MS-DOS COPY command or an available utility that can perform a binary copy) to a drive that has the capacity to hold the expanded file plus the compressed files POPERAT.1, POPERAT.2, POPERAT.3, and POPERAT.EXE. Listed above is an estimate of the amount of disk space needed. Repeat steps a. and b. for POPERAT.2 and POPERAT.3.

c. The following MS-DOS COPY command can be used to create the self-extracting POPERAT.EXE file:

```
COPY POPERAT.1/B+POPERAT.2+POPERAT.3 POPERAT.EXE
```

d. The POPERAT.EXE file is a self-extracting file. To extract the original MS-DOS ASCII text file, enter POPERAT at the MS-DOS prompt. Note that approximately 22 megabytes of disk space will be required to store POPERAT.1, POPERAT.2, POPERAT.3, POPERAT.EXE and the resulting text file.

e. The exact number of records that should be on this expanded file is contained in the file's description in Section 4.

f. POPERAT.1, POPERAT.2, POPERAT.3, and POPERAT.EXE can be deleted from the drive containing the expanded files, if desired. The original diskettes should be retained.

Section 1.3 Cost and Billing

The following contains the charges for the four diskettes and documentation. Some requestors may have the fees waived in the interest of the public as outlined in section 70.41 of 29 CFR.

	Cost
Four Diskettes containing 13 files:	$23
Complete Respirable Dust Documentation Package:	$20
Total:	$43

Section 2. SPOT INSPECTION DATABASES

The information contained in the eight spot inspection databases was collected by CMS&H inspectors using the forms in Table 8 from July, 1991 through October, 1991. Only seven of these databases are available to the public due to the privacy act data contained in the List of Certified Persons Database.

All dates in the spot inspection databases are in "YYYYMMDD" format. This means, for example, that June 30, 1991 would be represented as "19910630".

Section 2.1 Mine Data Sheet/Methane and Dust Control Database

Name of database: PA_SHEET

Number of data records: 723

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU_NUMBER	Numeric	4		8	11
3	DTCOMP	Date	8		12	19
4	MINE_METHO	Character	1		20	20
5	C_PRODUCTN	Numeric	5		21	25
6	C_CONC_DO	Numeric	4	1	26	29
7	C_CONC_DA	Numeric	4	1	30	33
8	C_DATE	Date	8		34	41
9	A_MS_TYPE	Numeric	2		42	43
10	A_DRUM_TYP	Character	1		44	44
11	A_CUT_SEQ	Character	1		45	45
12	B_METHOD	Character	1		46	46
13	B_DEVICE	Character	1		47	47
14	B_BELT_AIR	Character	1		48	48
15	B_FAN_SPRA	Character	1		49	49
16	B_DEPTH	Numeric	3		50	52
17	B_LINE_CUR	Numeric	2		53	54
18	B_INTK_CFM	Numeric	6		55	60
19	B_INTK_FPM	Numeric	4		61	64
20	B_VELOCITY	Numeric	4		65	68
21	B_TAIL_CFM	Numeric	6		69	74
22	B_TAIL_FPM	Numeric	4		75	78
23	B_FACE	Numeric	5		79	83
24	B_MEAV	Character	3		84	86
25	B_LAST_OPN	Numeric	6		87	92
26	B_SCRUBBER	Numeric	5		93	97
27	C1_TYPE	Numeric	3		98	100
28	C1_MANUFAC	Numeric	4		101	104
29	C1_MODEL	Character	10		105	114
30	C1_APPROVA	Character	12		115	126
31	C1_LOC1	Numeric	2		127	128
32	C1_NUMBER1	Numeric	3		129	131

Name of database: PA_SHEET (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
33	C1_PSI1	Numeric	3		132	134
34	C1_LOC2	Numeric	2		135	136
35	C1_NUMBER2	Numeric	3		137	139
36	C1_PSI2	Numeric	3		140	142
37	C1_LOC3	Numeric	2		143	144
38	C1_NUMBER3	Numeric	3		145	147
39	C1_PSI3	Numeric	3		148	150
40	C1_LOC4	Numeric	2		151	152
41	C1_NUMBER4	Numeric	3		153	155
42	C1_PSI4	Numeric	3		156	158
43	C1_LOC5	Numeric	2		159	160
44	C1_NUMBER5	Numeric	3		161	163
45	C1_PSI5	Numeric	3		164	166
46	C1_LOC6	Numeric	2		167	168
47	C1_NUMBER6	Numeric	3		169	171
48	C1_PSI6	Numeric	3		172	174
49	C2_TYPE	Numeric	3		175	177
50	C2_MANUFAC	Numeric	4		178	181
51	C2_MODEL	Character	10		182	191
52	C2_APPROVA	Character	12		192	203
53	C2_LOC1	Numeric	2		204	205
54	C2_NUMBER1	Numeric	3		206	208
55	C2_PSI1	Numeric	3		209	211
56	C2_LOC2	Numeric	2		212	213
57	C2_NUMBER2	Numeric	3		214	216
58	C2_PSI2	Numeric	3		217	219
59	C2_LOC3	Numeric	2		220	221
60	C2_NUMBER3	Numeric	3		222	224
61	C2_PSI3	Numeric	3		225	227
62	C2_LOC4	Numeric	2		228	229
63	C2_NUMBER4	Numeric	3		230	232
64	C2_PSI4	Numeric	3		233	235
65	C2_LOC5	Numeric	2		236	237
66	C2_NUMBER5	Numeric	3		238	240
67	C2_PSI5	Numeric	3		241	243
68	C2_LOC6	Numeric	2		244	245
69	C2_NUMBER6	Numeric	3		246	248
70	C2_PSI6	Numeric	3		249	251
71	C3_TYPE	Numeric	3		252	254
72	C3_MANUFAC	Numeric	4		255	258
73	C3_MODEL	Character	10		259	268
74	C3_APPROVA	Character	12		269	280
75	C3_LOC1	Numeric	2		281	282
76	C3_NUMBER1	Numeric	3		283	285
77	C3_PSI1	Numeric	3		286	288
78	C3_LOC2	Numeric	2		289	290
79	C3_NUMBER2	Numeric	3		291	293
80	C3_PSI2	Numeric	3		294	296

Name of database: PA_SHEET (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
81	C3_LOC3	Numeric	2		297	298
82	C3_NUMBER3	Numeric	3		299	301
83	C3_PSI3	Numeric	3		302	304
84	C3_LOC4	Numeric	2		305	306
85	C3_NUMBER4	Numeric	3		307	309
86	C3_PSI4	Numeric	3		310	312
87	C3_LOC5	Numeric	2		313	314
88	C3_NUMBER5	Numeric	3		315	317
89	C3_PSI5	Numeric	3		318	320
90	C3_LOC6	Numeric	2		321	322
91	C3_NUMBER6	Numeric	3		323	325
92	C3_PSI6	Numeric	3		326	328
93	D1	Numeric	2		329	330
94	D2	Numeric	2		331	332
95	D3	Numeric	2		333	334
96	D4	Numeric	2		335	336
97	D5	Numeric	2		337	338
98	D6	Numeric	2		339	340
99	D7	Numeric	2		341	342
100	D8	Numeric	2		343	344
101	D9	Numeric	2		345	346
102	D10	Numeric	2		347	348
103	D11	Numeric	2		349	350
104	D12	Numeric	2		351	352
105	D13	Numeric	2		353	354
106	D14	Numeric	2		355	356
107	D15	Numeric	2		357	358
108	E_DISTANCE	Numeric	2		359	360
109	E_AIR_QUAL	Numeric	5		361	365
** Total **			365			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the Spot Inspection was conducted.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Mine ID

2. MMU_NUMBER - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: MMU ID

3. DTCOMP - Date of Spot Inspection
Description: Date that the Spot Inspection took place.
Valid Entries: 07/03/91 to 10/31/91
Default: Required
Input Form Field: Date from B-1 Sheet

4. MINE_METHO - Mining Method
Description: Mining Method employed by the Mine.
Valid Entries: 1 (Advancing), 2 (Retreating), or 3 (Other)
Default: Required
Input Form Field: Mining Method

5. C_PRODUCTN - Production from last inspection
Description: Production in tons of last MSHA Respirable Dust Technical Inspection (BAB).
Valid Entries: -9 (no entry recorded by inspector) or 1 to 99999
Default: -9
Input Form Field: Production________tons

6. C_CONC_DO - Concentration for Designated Occupation
Description: Concentration, measured in mg/mg3, during last MSHA Respirable Dust Technical Inspection (BAB) for Designated Occupation.
Valid Entries: -9 (no entry recorded by inspector) or 0.00 to 99.9; this field contains an explicit decimal point.
Default: -9
Input Form Field: Concentration for DO________mg/m3

7. C_CONC_DA - Concentration for Designated Area
Description: Concentration, measured in mg/mg3, during last MSHA Respirable Dust Technical Inspection (BAB) for Designated Area (Roof Bolter).
Valid Entries: -9 (no entry recorded by inspector) or 0.00 to 99.9; this field contains an explicit decimal point.
Default: -9
Input Form Field: Concentration for DA (Roof Bolter)___mg/m3

8. C_DATE - Date of last Inspection
Description: Date of the last MSHA Respirable Dust Technical Inspection (BAB).
Valid Entries: Spaces (no entry recorded by inspector) or any valid date before the Date of Completion from the B-1 Sheet
Default: Spaces
Input Form Field: This field was not explicitly defined on the form; if there was information on a previous inspection, the date was recorded by the inspector somewhere in the C. section.

9. A_MS_TYPE - Mining System Type
Description: A code that describes which type of equipment for this MMU.
Valid Entries: Valid entries are contained in Table 2
Default: Required
Input Form Field: Mining System

10. A_DRUM_TYP - Drum Type
Description: A description of the type of drum used if A_MS_TYPE has a value of 01 (Longwall Shear).
Valid Entries: Spaces (no entry recorded by inspector), 1 (Single Drum), or 2 (Double Drum)
Default: Spaces
Input Form Field:
[ ] Longwall Type: [ ] Single Drum [ ] Double Drum

11. A_CUT_SEQ - Cut Sequence
Description: A description of the type of cut sequence used if A_MS_TYPE has a value of 01 (Longwall Shear) or 02 (Longwall Plow).
Valid Entries: Spaces (no entry recorded by inspector), 1 (Bidirectional), 2 (Head-Tail), or 3 (Tail-Head)
Default: Spaces
Input Form Field:
Cut Sequence: [ ] Bidirectional [ ] Head-Tail [ ] Tail-Head

12. B_METHOD - Method of Face Ventilation
Description: A code to indicate the type of face ventilation.
Valid Entries: Space (no entry recorded by inspector), 1 (Blowing), 2 (Exhaust), or 3 (Combined)
Default: Space
Input Form Field:
Method of Face Ventilation: [ ] Blowing [ ] Exhaust [ ] Combined

13. B_DEVICE - Face Ventilation Device
Description: A code to indicate the type of face of ventilation device used.
Valid Entries: Space (no entry recorded by inspector), 1 (Curtain), 2 (Tubing), or 3 (Combined)
Default: Space
Input Form Field:
Face Ventilation Device: [ ] Curtain [ ] Tubing [ ] Combined

14. B_BELT_AIR - Dust Control Parameter - Ventilation; Section B
Description: Answer to the question: Is belt air used to ventilate working faces?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

15. B_FAN_SPRA - Dust Control Parameter - Ventilation; Section B
Description: Answer to the question: Is fan spray system used?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

16. B_DEPTH - Depth of Cut
Description: Depth of the cut in feet.
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999
Default: -9
Input Form Field: Depth of Cut: ________ ft

17. B_LINE_CUR - Line Curtain Distance
Description: Distance of the line curtain in feet.
Valid Entries: -9 (no entry recorded by inspector), -1 (response not in feet), or 0 to 99
Default: -9
Input Form Field: Line Curtain Distance: __________ ft

18. B_INTK_CFM - Longwall Air Quantity Intake
Description: Longwall intake air quantity in cubic feet per minute (cfm).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field:
Longwall Air Quantity: Intake__________cfm

19. B_INTK_FPM - Longwall Air Quantity Intake
Description: Longwall intake air quantity in feet per minute (fpm).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Intake_________fpm

20. B_VELOCITY - Longwall Air Quantity Velocity
Description: Longwall air quantity velocity at mid-face in fpm.
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Velocity (mid-face)__________ fpm

21. B_TAIL_CFM - Longwall Air Quantity Tailgate
Description: Tailgate air quantity in cfm.
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Tailgate________cfm

22. B_TAIL_FPM - Longwall Air Quantity Tailgate
Description: Tailgate air quantity in fpm.
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Tailgate_________fpm

23. B_FACE - Conventional/Continuous Air Quantity
Description: Air quantity at the face in cfm for conventional/continuous mining machines.
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Conventional/Continuous: Face_________cfm

24. B_MEAV - Air Quantity of Mean Entry Air Velocity in fpm
Valid Entries: Spaces (no entry recorded by inspector), 0 to 999, N (No Perceptible Air Movement), or P (Perceptible Air Movement). This is a right justified character field.
Default: Spaces
Input Form Field: Mean Entry Air Velocity________fpm

25. B_LAST_OPN - Air Quantity of Last Open Crosscut in cfm
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Last Open Crosscut: ________cfm

26. B_SCRUBBER - Air Quantity of Scrubber in cfm
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Scrubber: ________cfm

NOTE: The inspector form allowed for information to be collected on two types of machines for the Dust Control Parameters - Water, but the automated system allowed for <u>three</u> sets of information. Fields 27 through 48 contain information for the first machine; fields 49 through 70 contain information on the second machine; fields 71 through 92 contain information on the third machine.

27. C1_TYPE 49. C2_TYPE 71. C3_TYPE
Dust Control Parameters-Water; Type of Machine
Description: A coded number for the type of machine in an MMU.
Valid Entries: -9 (no entry recorded by inspector) or 001 to 100 (a coded numeric field; Table 3 contains a list of the most frequently used codes with descriptions)
Default: -9
Input Form Field: Type of Machine___________________

28. C1_MANUFAC 50. C2_MANUFAC 72. C3_MANUFAC
Manufacturer of the Machine
Description: A coded number for the Manufacturer of a machine in an MMU.
Valid Entries: -9 (no entry recorded by inspector) or 0001 to 9999 (a coded numeric field; Table 4 contains a list of the most frequently used codes with descriptions)
Default: -9
Input Form Field: Manufacturer________________________

29. C1_MODEL 51. C2_MODEL 73. C3_MODEL
Model Number of Machine
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: Model Number________________________

30. C1_APPROVA 52. C2_APPROVA 74. C3_APPROVA
Approval Number of the Machine
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: Approval Number_____________________

NOTE: The inspector form allowed only three locations with associated data for each machine, but the automated system allowed for six locations with associated data per machine.

31. C1_LOC1 53. C2_LOC1 75. C3_LOC1
Location of water spray for the machine
Valid Entries: -9 (no entry recorded by inspector) or 01 to 10 (a coded numeric field; Table 5 contains a list of the codes with descriptions)
Default: -9
Input Form Field:

	Location	Number	PSI
1.	______________________	_____	_____
2.	______________________	_____	_____
3.	______________________	_____	_____
4.	______________________	_____	_____
5.	______________________	_____	_____
6.	______________________	_____	_____

32. C1_NUMBER1 54. C2_NUMBER1 76. C3_NUMBER1
Number of water sprays
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999
Default: -9
Input Form Field: Number, See item 31 above

33. C1_PSI1 55. C2_PSI1 77. C3_PSI1
Water Pressure (Pounds per Square Inch) for water sprays
Valid Entries: -9 (no entry recorded by inspector) or
0 to 999
Default: -9
Input Form Field: PSI, See item 31 above

34. C1_LOC2 56. C2_LOC2 78. C3_LOC2
35. C1_NUMBER2 57. C2_NUMBER2 79. C3_NUMBER2
36. C1_PSI2 58. C2_PSI2 80. C3_PSI2
Location code, number of water sprays and water pressure for the second location for the machine

37. C1_LOC3 59. C2_LOC3 81. C3_LOC3
38. C1_NUMBER3 60. C2_NUMBER3 82. C3_NUMBER3
39. C1_PSI3 61. C2_PSI3 83. C3_PSI3
Location code, number of water sprays and water pressure for the third location for the machine

40. C1_LOC4 62. C2_LOC4 84. C3_LOC4
41. C1_NUMBER4 63. C2_NUMBER4 85. C3_NUMBER4
42. C1_PSI4 64. C2_PSI4 86. C3_PSI4
Location code, number of water sprays and water pressure for the fourth location for the machine

43. C1_LOC5 65. C2_LOC5 87. C3_LOC5
44. C1_NUMBER5 66. C2_NUMBER5 88. C3_NUMBER5
45. C1_PSI5 67. C2_PSI5 89. C3_PSI5
Location code, number of water sprays and water pressure for the fifth location for the machine

46. C1_LOC6 68. C2_LOC6 90. C3_LOC6
47. C1_NUMBER6 69. C2_NUMBER6 91. C3_NUMBER6
48. C1_PSI6 70. C2_PSI6 92. C3_PSI6
Location code, number of water sprays and water pressure for the sixth location for the machine

93. D1 - Other Parameter #1
Valid Entries: -9 (no entry recorded by inspector) or 10 to 39 (a coded numeric field; Table 6 contains a list of these codes with descriptions)
Default: -9
Input Form Field: Other Parameters (i.e., dust collectors, wetting agent, variance, wetting roadways and/or faces, etc.):

94. D2 - Other Parameter #2
95. D3 - Other Parameter #3
96. D4 - Other Parameter #4
97. D5 - Other Parameter #5
98. D6 - Other Parameter #6
99. D7 - Other Parameter #7

100. D8 - Other Parameter #8
101. D9 - Other Parameter #9
102. D10 - Other Parameter #10
103. D11 - Other Parameter #11
104. D12 - Other Parameter #12
105. D13 - Other Parameter #13
106. D14 - Other Parameter #14
107. D15 - Other Parameter #15
Valid Entries, Default, and Input Form Field correspond to D1 for fields 94 through 107

108. E_DISTANCE - Distance of Line Curtain From Machine Head in feet
Valid Entries: -9 (no entry recorded by inspector), -1 (response not in feet), or 0 to 99
Default: -9
Input Form Field:
Distance of Line curtain From Machine Head: ____________ ft

109. E_AIR_QUAL - Air Quantity (face) in cfm
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Air Quantity (face): ______________ cfm

Section 2.2 In-Mine Sampling Sheet Database

Name of database: PB_SHEET

Number of data records: 723

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU_NUMBER	Numeric	4		8	11
3	DTCOMP	Date	8		12	19
4	A_TONS	Numeric	5		20	24
5	B_FACE	Character	1		25	25
6	B_ROADWAYS	Character	1		26	26
7	B_COMPACTE	Character	1		27	27
8	C_DEPTH	Numeric	3		28	30
9	C_LINE	Numeric	2		31	32
10	C_IN1_CFM	Numeric	6		33	38
11	C_IN1_FPM	Numeric	4		39	42
12	C_IN2_CFM	Numeric	6		43	48
13	C_IN2_FPM	Numeric	4		49	52
14	C_VEL1	Numeric	4		53	56
15	C_VEL2	Numeric	4		57	60
16	C_TAIL1CFM	Numeric	6		61	66
17	C_TAIL1FPM	Numeric	4		67	70
18	C_TAIL2CFM	Numeric	6		71	76
19	C_TAIL2FPM	Numeric	4		77	80
20	C_FACE1CFM	Numeric	5		81	85
21	C_FACE2CFM	Numeric	5		86	90
22	C_MEAV1	Character	3		91	93
23	C_MEAV2	Character	3		94	96
24	C_LOC1_CFM	Numeric	6		97	102
25	C_LOC2_CFM	Numeric	6		103	108
26	C_SCRUB1	Numeric	5		109	113
27	C_SCRUB2	Numeric	5		114	118
28	D1_TYPE	Numeric	3		119	121
29	D1_MANUFAC	Numeric	4		122	125
30	D1_MODEL	Character	10		126	135
31	D1_APPROV	Character	12		136	147
32	D1_LOCATN1	Numeric	2		148	149
33	D1_NUMBER1	Numeric	3		150	152
34	D1_PSI1	Numeric	3		153	155
35	D1_LOCATN2	Numeric	2		156	157
36	D1_NUMBER2	Numeric	3		158	160
37	D1_PSI2	Numeric	3		161	163
38	D1_LOCATN3	Numeric	2		164	165
39	D1_NUMBER3	Numeric	3		166	168
40	D1_PSI3	Numeric	3		169	171
41	D1_LOCATN4	Numeric	2		172	173
42	D1_NUMBER4	Numeric	3		174	176
43	D1_PSI4	Numeric	3		177	179

Name of database: PB_SHEET (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
44	D1_LOCATN5	Numeric	2		180	181
45	D1_NUMBER5	Numeric	3		182	184
46	D1_PSI5	Numeric	3		185	187
47	D1_LOCATN6	Numeric	2		188	189
48	D1_NUMBER6	Numeric	3		190	192
49	D1_PSI6	Numeric	3		193	195
50	D2_TYPE	Numeric	3		196	198
51	D2_MANUFAC	Numeric	4		199	202
52	D2_MODEL	Character	10		203	212
53	D2_APPROV	Character	12		213	224
54	D2_LOCATN1	Numeric	2		225	226
55	D2_NUMBER1	Numeric	3		227	229
56	D2_PSI1	Numeric	3		230	232
57	D2_LOCATN2	Numeric	2		233	234
58	D2_NUMBER2	Numeric	3		235	237
59	D2_PSI2	Numeric	3		238	240
60	D2_LOCATN3	Numeric	2		241	242
61	D2_NUMBER3	Numeric	3		243	245
62	D2_PSI3	Numeric	3		246	248
63	D2_LOCATN4	Numeric	2		249	250
64	D2_NUMBER4	Numeric	3		251	253
65	D2_PSI4	Numeric	3		254	256
66	D2_LOCATN5	Numeric	2		257	258
67	D2_NUMBER5	Numeric	3		259	261
68	D2_PSI5	Numeric	3		262	264
69	D2_LOCATN6	Numeric	2		265	266
70	D2_NUMBER6	Numeric	3		267	269
71	D2_PSI6	Numeric	3		270	272
72	D3_TYPE	Numeric	3		273	275
73	D3_MANUFAC	Numeric	4		276	279
74	D3_MODEL	Character	10		280	289
75	D3_APPROVA	Character	12		290	301
76	D3_LOCATN1	Numeric	2		302	303
77	D3_NUMBER1	Numeric	3		304	306
78	D3_PSI1	Numeric	3		307	309
79	D3_LOCATN2	Numeric	2		310	311
80	D3_NUMBER2	Numeric	3		312	314
81	D3_PSI2	Numeric	3		315	317
82	D3_LOCATN3	Numeric	2		318	319
83	D3_NUMBER3	Numeric	3		320	322
84	D3_PSI3	Numeric	3		323	325
85	D3_LOCATN4	Numeric	2		326	327
86	D3_NUMBER4	Numeric	3		328	330
87	D3_PSI4	Numeric	3		331	333
88	D3_LOCATN5	Numeric	2		334	335
89	D3_NUMBER5	Numeric	3		336	338
90	D3_PSI5	Numeric	3		339	341
91	D3_LOCATN6	Numeric	2		342	343

Name of database: PB_SHEET (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
92	D3_NUMBER6	Numeric	3		344	346
93	D3_PSI6	Numeric	3		347	349
94	E1	Numeric	2		350	351
95	E2	Numeric	2		352	353
96	E3	Numeric	2		354	355
97	E4	Numeric	2		356	357
98	E5	Numeric	2		358	359
99	E6	Numeric	2		360	361
100	E7	Numeric	2		362	363
101	E8	Numeric	2		364	365
102	E9	Numeric	2		366	367
103	E10	Numeric	2		368	369
104	E11	Numeric	2		370	371
105	E12	Numeric	2		372	373
106	E13	Numeric	2		374	375
107	E14	Numeric	2		376	377
108	E15	Numeric	2		378	379
109	F	Character	1		380	380
110	G_BOLTER	Character	1		381	381
111	G_AIR_QUAL	Numeric	5		382	386
112	G_DISTANCE	Numeric	2		387	388
113	H1A	Numeric	2		389	390
114	H1B	Character	15		391	405
115	H2A	Numeric	2		406	407
116	H2B	Character	15		408	422
117	H3A	Numeric	2		423	424
118	H3B	Character	15		425	439
119	H4A	Numeric	2		440	441
120	H4B	Character	15		442	456
121	H5A	Numeric	2		457	458
122	H5B	Character	15		459	473
123	H6A	Numeric	2		474	475
124	H6B	Character	15		476	490
125	H7A	Numeric	2		491	492
126	H7B	Character	15		493	507
127	H8A	Numeric	2		508	509
128	H8B	Character	15		510	524
129	H9A	Numeric	2		525	526
130	H9B	Character	15		527	541
131	H10A	Numeric	2		542	543
132	H10B	Character	15		544	558
133	I	Character	1		559	559
134	J	Character	1		560	560
135	COMFLG	Character	1		561	561
136	COMMENTS1	Numeric	3		562	564
137	COMMENTS2	Numeric	3		565	567
138	COMMENTS3	Numeric	3		568	570
139	COMMENTS4	Numeric	3		571	573

Name of database: PB_SHEET (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
140	COMMENTS5	Numeric	3		574	576
141	COMMENTS6	Numeric	3		577	579
142	COMMENTS7	Numeric	3		580	582
143	COMMENTS8	Numeric	3		583	585
144	COMMENTS9	Numeric	3		586	588
145	COMMENTS10	Numeric	3		589	591
** Total **			591			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the Spot Inspection was conducted.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Mine ID

2. MMU_NUMBER - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: MMU Number

3. DTCOMP - Date of Spot Inspection
   Description: Date that the Spot Inspection took place.
   Valid Entries: 07/03/91 to 10/31/91
   Default: Required
   Input Form Field: Date

4. A_TONS - Estimated production during inspection
   Description: Estimated actual production in tons during spot inspection.
   Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
   Default: -9
   Input Form Field: Estimate Actual Production for Shift During Spot Sampling Visit _______tons

5. B_FACE - Face of MMU
   Description: Physical condition of the face of the MMU
   Valid Entries: Space (no entry recorded by inspector), 1 (Wet), 2 (Damp), or 3 (Dry)
   Default: Space
   Input Form Field: Face: [ ] wet [ ] damp [ ] dry

6. B_ROADWAYS - Roadways of an MMU
Description: Physical condition of the roadways of the MMU
Valid Entries: Space (no entry recorded by inspector), 1 (Wet), 2 (Damp), or 3 (Dry)
Default: Space
Input Form Field: Roadways: [ ] wet [ ] damp [ ] dry

7. B_COMPACTE - Compaction
Description: Answer to the question: Are Roadways Compacted?
Valid Entries: Space (no entry recorded by inspector) or Y (Yes)
Default: Space
Input Form Field: Roadways: [ ] compacted

8. C_DEPTH - Depth of Cut in feet
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999
Default: -9
Input Form Field: Depth of Cut ________ ft

9. C_LINE - Line Curtain Distance in feet
Valid Entries: -9 (no entry recorded by inspector), -1 (response not in feet), or 0 to 99
Default: -9
Input Form Field: Line Curtain Distance __________ ft

10. C_IN1_CFM - Longwall Air Quantity Intake in Cubic Feet per Minute (cfm) (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Air Quantity Observed Longwall Intake__________cfm

11. C_IN1_FPM - Longwall Air Quantity Intake in Feet per Minute (fpm) (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Intake_________fpm

12. C_IN2_CFM - Longwall Air Quantity Intake in Cubic Feet per Minute (cfm) (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_IN1_CFM

13. C_IN2_FPM - Longwall Air Quantity Intake in Feet per Minute (fpm) (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_IN1_FPM

14. C_VEL1 - Longwall Air Quantity Velocity at Mid-face fpm (1st Reading)
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Vel (mid-face)__________ fpm

15. C_VEL2 - Longwall Air Quantity Velocity at Mid-face fpm (2nd Reading)
Valid Entries, Default, and Input Form Field correspond to C_VEL1

16. C_TAIL1CFM - Longwall Air Quantity Tailgate in Cubic Feet per Minute (cfm) (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Tailgate________cfm

17. C_TAIL1FPM - Longwall Air Quantity Tailgate in fpm. (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Tailgate_________fpm

18. C_TAIL2CFM - Longwall Air Quantity Tailgate in cfm. (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_TAIL1CFM

19. C_TAIL2FPM - Longwall Air Quantity Tailgate in fpm. (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_TAIL1FPM

20. C_FACE1CFM - Conventional/Continuous Air Quantity at the Face in cfm (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Face_________cfm

21. C_FACE2CFM - Conventional/Continuous Air Quantity at the Face in Cubic Feet per Minute (cfm) (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_FACE1CFM

22. C_MEAV1 - Air Quantity of Mean Entry Air Velocity in fpm (1st Reading)
Valid Entries: Spaces (no entry recorded by inspector), 0 to 999, N (No Perceptible Air Movement), or P (Perceptible Air Movement). This is a right justified character field.
Default: Spaces
Input Form Field: Mean Entry Air Velocity________fpm

23. C_MEAV2 - Air Quantity of Mean Entry Air Velocity in fpm (2nd Reading)
Valid Entries, Default, and Input Form Field correspond to C_MEAV1

24. C_LOC1_CFM - Air Quantity of Last Open Crosscut in cfm (1st Reading)
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Last Open Crosscut ________cfm

25. C_LOC2_CFM - Air Quantity of Last Open Crosscut in cfm (2nd Reading)
Valid Entries, Default, and Input Form Field correspond to C_LOC1_CFM

26. C_SCRUB1 - Air Quantity of Scrubber in cfm (1st Reading)
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Scrubber ________cfm

27. C_SCRUB2 - Air Quantity of Scrubber in cfm (2nd Reading)
Valid Entries, Default, and Input Form Field correspond to C_SCRUB1

NOTE: The inspector form allowed for information to be collected on two types of machines for the Dust Control Parameters Observed - Water, but the automated system allowed for <u>three</u> sets of information. Fields 28 through 49 contain information for the first machine; fields 50 through 71 contain information on the second machine; fields 72 through 93 contain information on the third machine.

28. D1_TYPE 50. D2_TYPE 72. D3_TYPE
Type of Machine
Description: A coded number for the type of machine in an MMU.
Valid Entries: -9 (no entry recorded by inspector) or 001 to 100 (a coded numeric field; Table 3 contains a list of the most frequently used codes with descriptions)
Default: -9
Input Form Field: Type of Machine:___________________

29. D1_MANUFAC 51. D2_MANUFAC 73. D3_MANUFAC
Manufacturer of the Machine
Description: A coded number for the Manufacturer of a machine in an MMU.
Valid Entries: -9 (no entry recorded by inspector) or 0001 to 9999 (a coded numeric field; Table 4 contains a list of the most frequently used codes with descriptions)
Default: -9
Input Form Field: Manufacturer:______________________

30. D1_MODEL 52. D2_MODEL 74. D3_MODEL
Model Number of Machine
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: Model Number:______________________

31. D1_APPROV 53. D2_APPROVA 75. D3_APPROVA
Approval Number of the Machine
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: Approval Number:___________________

NOTE: The inspector form allowed only three locations with associated data for each machine, but the automated system allowed for six locations with associated data per machine.

32. D1_LOCATN1 54. D2_LOCATN1 76. D3_LOCATN1
Location of water spray for the machine
Valid Entries: -9 (no entry recorded by inspector) or 01 to 10 (a coded numeric field; Table 5 contains a list of the codes with descriptions)
Default: -9
Input Form Field:

	Location	Number	PSI
1.	____________________	______	_____
2.	____________________	______	_____
3.	____________________	______	_____
4.	____________________	______	_____
5.	____________________	______	_____
6.	____________________	______	_____

33. D1_NUMBER1 55. D2_NUMBER1 77. D3_NUMBER1
Number of water sprays
Valid Entries: -9 (no entry recorded by inspector) or
0 to 999
Default: -9
Input Form Field: Number, See item 32 above

34. D1_PSI1 56. D2_PSI1 78. D3_PSI1
Water pressure (Pounds per Square Inch) for water sprays
Valid Entries: -9 (no entry recorded by inspector) or
0 to 999
Default: -9
Input Form Field: PSI, See item 32 above

35. D1_LOCATN2 57. D2_LOCATN2 79. D3_LOCATN2
36. D1_NUMBER2 58. D2_NUMBER2 80. D3_NUMBER2
37. D1_PSI2 59. D2_PSI2 81. D3_PSI2
Location code, number of water sprays and water pressure for the second location for the machine

38. D1_LOCATN3 60. D2_LOCATN3 82. D3_LOCATN3
39. D1_NUMBER3 61. D2_NUMBER3 83. D3_NUMBER3
40. D1_PSI3 62. D2_PSI3 84. D3_PSI3
Location code, number of water sprays and water pressure for the third location for the machine

41. D1_LOCATN4 63. D2_LOCATN4 85. D3_LOCATN4
42. D1_NUMBER4 64. D2_NUMBER4 86. D3_NUMBER4
43. D1_PSI4 65. D2_PSI4 87. D3_PSI4
Location code, number of water sprays and water pressure for the fourth location for the machine

44. D1_LOCATN5 66. D2_LOCATN5 88. D3_LOCATN5
45. D1_NUMBER5 67. D2_NUMBER5 89. D3_NUMBER5
46. D1_PSI5 68. D2_PSI5 90. D3_PSI5
Location code, number of water sprays and water pressure for the fifth location for the machine

47. D1_LOCATN6 69. D2_LOCATN6 91. D3_LOCATN6
48. D1_NUMBER6 70. D2_NUMBER6 92. D3_NUMBER6
49. D1_PSI6 71. D2_PSI6 93. D3_PSI6
Location code, number of water sprays and water pressure for the sixth location for the machine

94. E1 - Other Parameter #1
Valid Entries: -9 (no entry recorded by inspector) or 10 to 39 (a coded numeric field; Table 6 contains a list of these codes with descriptions)
Default: -9
Input Form Field: Other Parameters (i.e., dust collectors, wetting agent, variance, wetting roadways and/or faces, etc.):

95. E2 - Other Parameter #2
96. E3 - Other Parameter #3
97. E4 - Other Parameter #4
98. E5 - Other Parameter #5
99. E6 - Other Parameter #6
100. E7 - Other Parameter #7
101. E8 - Other Parameter #8
102. E9 - Other Parameter #9
103. E10 - Other Parameter #10
104. E11 - Other Parameter #11
105. E12 - Other Parameter #12
106. E13 - Other Parameter #13
107. E14 - Other Parameter #14
108. E15 - Other Parameter #15
Valid Entries, Default, and Input Form Field correspond to E1 for fields 95 through 108

109. F - In-Mine Monitoring Question #F-1
Description: Answer to the question: Is miner operator always located on intake air during cutting and loading operations?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

110. G_BOLTER - In-Mine Monitoring Question #G-1
Description: Answer to the question: Are the roof bolter operations conducted on the intake side of the continuous miner?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

111. G_AIR_QUAL - Air Quantity (face) cfm
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Air Quantity (face) ______________cfm

112. G_DISTANCE - Distance of Line Curtain From Machine Head in feet
Valid Entries: -9 (no entry recorded by inspector), -1 (response not in feet), or 0 to 99
Default: -9
Input Form Field: Distance of line curtain from machine head ______________ft

113. H1A - Quantity of Violation #1
Description: Number of citations that were issued for H1B standard.
Valid Entries: -9 (no entry recorded by inspector) or 01 to 99
Default: -9
Input Form Field: Violations cited: (Indicate Quantity and Standard #'s violated)_______________

114. H1B - Standard of Violation #1
Description: Standard # of the violation that has been cited in the inspection.
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: See H1A

115. H2A - Quantity of Violation #2
Valid Entries, Default, and Input Form Field correspond to H1A

116. H2B - Standard of Violation #2
Valid Entries, Default, and Input Form Field correspond to H1B

117. H3A - Quantity of Violation #3
Valid Entries, Default, and Input Form Field correspond to H1A

118. H3B - Standard of Violation #3
Valid Entries, Default, and Input Form Field correspond to H1B

119. H4A - Quantity of Violation #4
Valid Entries, Default, and Input Form Field correspond to H1A

120. H4B - Standard of Violation #4
Valid Entries, Default, and Input Form Field correspond to H1B

121. H5A - Quantity of Violation #5
Valid Entries, Default, and Input Form Field correspond to H1A

122. H5B - Standard of Violation #5
Valid Entries, Default, and Input Form Field correspond to H1B

123. H6A - Quantity of Violation #6
Valid Entries, Default, and Input Form Field correspond to H1A

124. H6B - Standard of Violation #6
Valid Entries, Default, and Input Form Field correspond to H1B

125. H7A - Quantity of Violation #7
Valid Entries, Default, and Input Form Field correspond to H1A

126. H7B - Standard of Violation #7
Valid Entries, Default, and Input Form Field correspond to H1B

127. H8A - Quantity of Violation #8
Valid Entries, Default, and Input Form Field correspond to H1A

128. H8B - Standard of Violation #8
Valid Entries, Default, and Input Form Field correspond to H1B

129. H9A - Quantity of Violation #9
Valid Entries, Default, and Input Form Field correspond to H1A

130. H9B - Standard of Violation #9
Valid Entries, Default, and Input Form Field correspond to H1B

131. H10A - Quantity of Violation #10
Valid Entries, Default, and Input Form Field correspond to H1A

132. H10B - Standard of Violation #10
Valid Entries, Default, and Input Form Field correspond to H1B

133. I - In-Mine Monitoring Question #I
Description: Answer to the question: Were dust control parameters changed during sampling?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

134. J - In-Mine Monitoring Question #J
Description: Answer to the question: Did the spot inspection meet the criteria for a BAB?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

135. COMFLG - Comment Flag
Description: Answer to the question: Are there any comment codes to be entered?
Valid Entries: Y (Yes), or N (No)
Default: N

136. COMMENTS1 - Comment #1
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999 (NOTE: These codes were never used.)
Default: -9
Input Form Field: Comments:

137. COMMENTS2 - Comment #2
138. COMMENTS3 - Comment #3
139. COMMENTS4 - Comment #4
140. COMMENTS5 - Comment #5
141. COMMENTS6 - Comment #6
142. COMMENTS7 - Comment #7
143. COMMENTS8 - Comment #8
144. COMMENTS9 - Comment #9

145. COMMENTS10 - Comment #10
Valid Entries, Default, and Input Form Field correspond to COMMENTS1 for fields 137 through 145

Section 2.3 Respirable Dust Laboratory Report Database

Name of database: PRDLR

Number of data records: 4,450

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU	Numeric	4		8	11
3	DATE	Date	8		12	19
4	CASSETTE	Numeric	8		20	27
** Total **			27			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the Spot Inspection was conducted.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Mine ID Number

2. MMU - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: MMU/DA/SA ID Number

3. DATE - Date of Spot Inspection
   Description: Date that the Spot Inspection took place.
   Valid Entries: 07/03/91 to 10/31/91
   Default: Required
   Input Form Field: Date from B-1 Sheet

4. CASSETTE - Dust Cassette Number
   Description: Dust cassette number of sample taken by MSHA inspector for a particular mine id and MMU.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Cassette

Section 2.4 Equipment and Certification Database

Name of database: PC_SHEET

Number of data records: 722

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU	Numeric	4		8	11
3	DATE	Date	8		12	19
4	C_1	Character	1		20	20
5	C_2_PUMP1	Character	1		21	21
6	C_2_PUMP2	Character	1		22	22
7	C_2_PUMP3	Character	1		23	23
8	C_3	Character	1		24	24
9	C_4A	Character	1		25	25
10	C_4B	Character	1		26	26
11	C_4C	Character	1		27	27
12	C_4D	Character	1		28	28
13	C_4E	Character	1		29	29
14	C_5	Character	1		30	30
15	C_5_HOW	Character	1		31	31
16	C_6A	Character	1		32	32
17	C_6A_CMNTS	Character	1		33	33
18	C_6BYES	Character	1		34	34
19	C_6BNO	Character	1		35	35
20	C_6B_CMNTS	Character	1		36	36
21	C_7A	Character	1		37	37
22	C_7A_CMNTS	Character	1		38	38
23	C_7B	Character	1		39	39
24	C_7B_CMNTS	Character	1		40	40
25	C_9	Numeric	5		41	45
26	C_10	Numeric	5		46	50
27	C_10_CMNTS	Character	1		51	51
28	C_11A	Character	24		52	75
29	C_11D	Character	3		76	78
** Total **			78			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the Spot Inspection was conducted.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Mine ID

2. MMU - Mechanized Mining Unit
Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit.
Valid Entries: Numeric
Default: Required
Input Form Field: MMU ID from A Sheet

3. DATE - Date of Spot Inspection
Description: Date that the Spot Inspection took place.
Valid Entries: 07/03/91 to 10/31/91
Default: Required
Input Form Field: Date from B-1 Sheet

4. C_1 - Equipment and Certification Question #1
Description: Answer to the question: Are the sampling devices approved?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

5. C_2_PUMP1 - Equipment and Certification Question #2 - Pump 1
Description: Answer to the question: Verify sampling device calibration and if available, check the calibration of approximately three of the operator's/contractor's pumps with a soap film calibrator. Calibrated:
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

6. C_2_PUMP2 - Equipment and Certification Question #2 - Pump 2
Description: See description for C_2_PUMP1.
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

7. C_2_PUMP3 - Equipment and Certification Question #2 - Pump 3
Description: See description for C_2_PUMP1.
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

8. C_3 - Equipment and Certification Question #3
Description: Answer to the question: Are pump calibration records available?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

9. C_4A - Equipment and Certification Question #4 - Part A
Description: Answer to the question: Calibration mark on pump flowmeter?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

10. C_4B - Equipment and Certification Question #4 - Part B
Description: Answer to the question: Is the condition of external tubing good?
Valid Entries: Space (no entry recorded by inspector), Y (Good), or N (Bad)
Default: Space

11. C_4C - Equipment and Certification Question #4 - Part C
Description: Answer to the question: Is the condition of cyclone good?
Valid Entries: Space (no entry recorded by inspector), Y (Good), or N (Bad)
Default: Space

12. C_4D - Equipment and Certification Question #4 - Part D
Description: Answer to the question: Is the condition of pump and batteries good?
Valid Entries: Space (no entry recorded by inspector), Y (Good), or N (Bad)
Default: Space

13. C_4E - Equipment and Certification Question #4 - Part E
Description: Answer to the question: Is a functional voltmeter available to test the battery voltage?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

14. C_5 - Equipment and Certification Question #5 - Part 1
Description: Answer to the question: Can the operator verify that preshift pump checks and calibrations are done when dust sampling is conducted by a contractor?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

15. C_5_HOW - Equipment and Certification Question #5 - Part 2
Description: Answer to the question: HOW?
Valid Entries: Space (no entry recorded by inspector) or Y (entry recorded by inspector)
Default: Space

16. C_6A - Equipment and Certification Question #6 - Part 1
Description: Answer to the question: Check certification(s) for certified person; sampling. Certified?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

17. C_6A_CMNTS - Equipment and Certification Question #6 - Part 2
Description: Answer to the question: Comments:
Valid Entries: Space (no entry recorded by inspector) or Y (entry recorded by inspector)
Default: Space

18. C_6BYES - Equipment and Certification Question #6 - Part 3
Description: Answer to the question: Have a representative number of certified person(s) (1-5) demonstrate proficiency. Pump assembly and preshift checks. Proficiency demonstrated?
Valid Entries: Space (no entry recorded by inspector) or 1 to 5 (number entered into Yes column)
Default: Space

19. C_6BNO - Equipment and Certification Question #6 - Part 4
Description: See description for C_6BYES.
Valid Entries: Space (no entry recorded by inspector) or 1 to 5 (number entered into No column)
Default: Space

20. C_6B_CMNTS - Equipment and Certification Question #6 - Part 5
Description: Answer to the question: Comments:
Valid Entries: Space (no entry recorded by inspector), Y (entry recorded by inspector)
Default: Space

21. C_7A - Equipment and Certification Question #7 - Part 1
Description: Answer to the question: Check certification(s) for certified person; maintenance and calibration. Certified?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

22. C_7A_CMNTS - Equipment and Certification Question #7 - Part 2
Description: Answer to the question: Comments:
Valid Entries: Space (no entry recorded by inspector) or Y (entry recorded by inspector)
Default: Space

23. C_7B - Equipment and Certification Question #7 - Part 3
Description: Answer to the question: Have certified person demonstrate proficiency or verify that pumps are calibrated by a certified person (if done by contractor). Proficiency demonstrated?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

24. C_7B_CMNTS - Equipment and Certification Question #7 - Part 4
Description: Answer to the question: Comments:
Valid Entries: Space (no entry recorded by inspector), Y (entry recorded by inspector)
Default: Space

25. C_9 - Equipment and Certification Question #9
Description: Answer to the question: Estimate the maximum MMU shift production rate for the last bimonthly period for this MMU. _____ tons
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9

26. C_10 - Equipment and Certification Question #10 - Part 1
Description: Answer to the question: The average MMU shift production rate during the last bimonthly period while samples were not being collected was _____ tons.
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9

27. C_10_CMNTS - Equipment and Certification Question #10 - Part 2
Description: Answer to the question: How was this information obtained?
Valid Entries: Space (no entry recorded by inspector), 1 (Documentation Examined), 2 (Verbal from Mine Management), or 3 (Refused)
Default: Space

28. C_11A - Contractor Company Name
Description: Name of the contractor responsible for sampling for a particular mine id and MMU.
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: Company/contractor trade name:

29. C_11D - Contractor I.D. Number

Description: Contractor Identification Number of the contractor responsible for sampling for a particular mine id and MMU.

Valid Entries: Alphanumeric

Default: Spaces

Input Form Field: I.D. Number:

Section 2.5 List of Certified Persons Database

This database is not available for distribution due to the privacy act data contained in it.

Name of database: PD_SHEETS

Number of data records: 6,880

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU	Numeric	4		8	11
3	DATE	Date	8		12	19
4	CONTONSITE	Character	1		20	20
5	SSN	Character	11		21	31
6	S_MC	Character	1		32	32
** Total **			32			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the Spot Inspection was conducted.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Mine ID

2. MMU - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: MMU ID from A Sheet

3. DATE - Date of Spot Inspection
   Description: Date that the Spot Inspection took place.
   Valid Entries: 07/03/91 to 10/31/91
   Default: Required
   Input Form Field: Date from B-1 Sheet

4. CONTONSITE - Contractor
   Description: Answer to the question: Is the Certified Person a contractor?
   Valid Entries: Y(Yes) or N(No)
   Default: N (No)
   Input Form Field: If the information is for a contractor, the word Contractor was written on the form.

5. SSN - Social Security Number
   Description: The social security number of the certified person.
   Valid Entries: 0 to 999999999
   Default: Required
   Input Form Field: SOCIAL SECURITY NUMBER

6. S_MC - Sampler or Maintenance & Calibration
   Description: The status of the certification of the individual, i.e., Is the person certified for sampling or for maintenance & calibration or both?
   Valid Entries: space (no entry recorded by inspector), 1 (Sampler), 2 (Maintenance & Calibration), or 3 (Both)
   Default: Space
   Input Form Field: S/MC

Section 2.6 Designated Occupation Interview Database

Name of database: PDOI_SHT

Number of data records: 721

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	PRIVATE	Character	1		1	1
2	DO_1	Numeric	3		2	4
3	DO_2	Character	1		5	5
4	DO_3	Character	1		6	6
5	DO_4	Character	1		7	7
6	DO_5	Character	1		8	8
7	DO_6	Character	1		9	9
8	DO_7	Character	1		10	10
9	DO_8	Character	1		11	11
10	DO_9	Character	1		12	12
11	DO_10	Character	1		13	13
12	DO_11	Character	1		14	14
13	DO_12	Character	1		15	15
14	DO_13	Character	1		16	16
15	DO_14	Character	1		17	17
16	DO_15	Character	1		18	18
17	DO_16	Character	1		19	19
18	DO_17	Character	1		20	20
19	DO_18	Character	1		21	21
20	DO_19	Character	1		22	22
21	DO_20	Character	1		23	23
22	DO_21	Character	1		24	24
23	DO_22	Character	1		25	25
24	DO_23	Character	1		26	26
25	DO_24	Character	1		27	27
26	DO_25	Character	1		28	28
** Total **			28			

Field by Field Explanation:

1. PRIVATE - Private Interview
   Description: Answer to the question: Was the interview conducted in private?
   Valid Entries: Space (no entry recorded by inspector), Y (Yes) or N (No)
   Default: Space
   Input Form Field: The word PRIVATE or NOT PRIVATE was written at the top of the sheet.

2. DO_1 - Designated Occupation Question #1
Description: Answer to the question: What is your regular job title?
Valid Entries: -9 (no entry recorded by inspector) or 0 to 499 (a coded numeric field; Table 1 contains a list of the occupation codes with descriptions)
Default: -9

3. DO_2 - Designated Occupation Question #2
Description: Answer to the question: How long have you been doing this job?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Less than 1 year), or 2 (1 year or more)
Default: Space

4. DO_3 - Designated Occupation Question #3
Description: Answer to the question: What is the respirable dust standard for this section?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct), or 2 (Not Correct)
Default: Space

5. DO_4 - Designated Occupation Question #4
Description: Answer to the question: How many water sprays must be operating on this machine while you are loading coal?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct according to plan), or 2 (Incorrect according to plan)
Default: Space

6. DO_5 - Designated Occupation Question #5
Description: Answer to the question: How much water pressure is required on this machine while mining coal?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct according to plan), or 2 (Incorrect according to plan)
Default: Space

7. DO_6 - Designated Occupation Question #6
Description: Answer to the question: How far back from the face can the end of the line curtain/tubing be in this section?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct according to plan), or 2 (Incorrect according to plan)
Default: Space

8. DO_7 - Designated Occupation Question #7
Description: Answer to the question: During the mining of coal the curtain/tubing is too far back from the face
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Continuously), 2 (Several times a shift), 3 (Once a shift), 4 (Several times a week), 5 (Once a week) or 6 (Never)
Default: Space

9. DO_8 - Designated Occupation Question #8
Description: Answer to the question: During the mining of coal all the required water sprays are not working
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Continuously), 2 (Several times a shift), 3 (Once a shift), 4 (Several times a week), 5 (Once a week) or 6 (Never)
Default: Space

10. DO_9 - Designated Occupation Question #9
Description: Answer to the question: During the mining of coal there is not enough air behind the line curtain
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Continuously), 2 (Several times a shift), 3 (Once a shift), 4 (Several times a week), 5 (Once a week) or 6 (Never)
Default: Space

11. DO_10 - Designated Occupation Question #10
Description: Answer to the question: During the mining of coal there is not enough water pressure on the machine
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Continuously), 2 (Several times a shift), 3 (Once a shift), 4 (Several times a week), 5 (Once a week) or 6 (Never)
Default: Space

12. DO_11 - Designated Occupation Question #11
Description: Answer to the question: When dust samples are collected, they measure miners' exposure to dust
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Accurately), 2 (Somewhat Accurately), or 3 (Inaccurately)
Default: Space

13. DO_12 - Designated Occupation Question #12
Description: Answer to the question: When a dust sample is being collected on my occupation
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (I mine more coal than I usually do), 2 (I mine the same way I always do), 3 (I mine the same way I always do but I make sure my air is up and my sprays are working right), or 4 (I mine less coal than I usually do)
Default: Space

14. DO_13 - Designated Occupation Question #13
Description: Answer to the question: When dust samples are being collected on this occupation/machine
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (I wear the dust pump), 2 (The dust pump is placed on the machine inby me), 3 (The dust pump is placed on the machine outby me), 4 (The dust pump is placed where I work most of the time), or 5 (The dust pump is placed away from where I work)
Default: Space

15. DO_14 - Designated Occupation Question #14

Description: Answer to the question: During sampling, dust pumps are

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Operated eight hours from the time they enter the mine until they are taken out of the mine), 2 (Sometimes shutoff for short periods), 3 (Sometimes shutoff for long periods, such as lunch), or 4 (Operated for short periods of time)

Default: Space

16. DO_15 - Designated Occupation Question #15

Description: Answer to the question: During sampling, dust pump flow rates are checked

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), 1 (At the beginning of the shift before mining is started), 2 (Every hour during the shift), 3 (An hour or two after the shift starts and at the end of the shift), 4 (An hour or two after the shift starts), or 5 (I don't know)

Default: Space

17. DO_16 - Designated Occupation Question #16

Description: Answer to the question: If a dust pump is placed on my occupation/machine and I change jobs for the day, I

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Take the pump with me), 2 (Leave the pump on the machine or give it to the new operator), 3 (Shut the pump off), or 4 (Would do something else with the pump)

Default: Space

18. DO_17 - Designated Occupation Question #17

Description: Answer to the question: If a dust pump is placed on my occupation/machine and it does not run all day,

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (I notify the person that placed or gave me the pump), 2 (I notify the foreman), 3 (I notify MSHA), or 4 (I do not notify anyone)

Default: Space

19. DO_18 - Designated Occupation Question #18

Description: Answer to the question: I wear a dust respirator

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Always), 2 (Very Often), 3 (Often), 4 (Sometimes), or 5 (Never)

Default: Space

20. DO_19 - Designated Occupation Question #19

Description: Answer to the question: The major health concern with respirable dust is:

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Temporary shortness of breath and increased allergic reaction), 2 (Permanent lung damage that cannot be reversed), 3 (Lung damage that can be reversed with reduced exposure to dust), or 4 (Adverse affects on hearing and eyesight)

Default: Space

21. DO_20 - Designated Occupation Question #20

Description: Answer to the question: Do you check for the date, time and initials (preshift) of a supervisor when you enter a work area?

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Always), 2 (Very Often), 3 (Often), 4 (Sometimes), or 5 (Never)

Default: Space

22. DO_21 - Designated Occupation Question #21

Description: Answer to the question: If you observe conditions that may increase respirable dust, what should you do?

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Nothing; that would not be my responsibility), 2 (Correct the conditions immediately or report them), 3 (Notify MSHA), or 4 (Report the conditions to the work crew on the next shift)

Default: Space

23. DO_22 - Designated Occupation Question #22

Description: Answer to the question: When you have reported a condition that could increase respirable dust, what action was taken?

Valid Entries: Space (no entry recorded by inspector), R (Refused), D (Don't Know), 1 (Addressed immediately), 2 (Addressed as time permitted), 3 (Addressed before the next shift), 4 (Addressed before the next time to sample), 5 (Not addressed), or 6 (Question does not apply)

Default: Space

24. DO_23 - Designated Occupation Question #23

Description: Answer to the question: Have you seen the MSHA poster concerning tampering with dust samples?

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Yes), or 2 (No)

Default: Space

25. DO_24 - Designated Occupation Question #24

Description: Answer to the question: The maximum penalty a person could be given if convicted of tampering with dust samples is

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Six months probation), 2 (Five years in jail), 3 (Five years in jail and a $10,000 fine), or 4 (Nothing (but the company could be fined))

Default: Space

26. DO_25 - Designated Occupation Question #25

Description: Answer to the question: Which kills more miners each year?

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Roof falls), 2 (Black lung and its side effects), or 3 (Electrical accidents)

Default: Space

Section 2.7 Roof Bolter Interview Database

Name of database: PRBI_SHT

Number of data records: 610

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	PRIVATE	Character	1		1	1
2	RB_1	Numeric	3		2	4
3	RB_2	Character	1		5	5
4	RB_3	Character	1		6	6
5	RB_4	Character	1		7	7
6	RB_5	Character	1		8	8
7	RB_6	Character	1		9	9
8	RB_7	Character	1		10	10
9	RB_8	Character	1		11	11
10	RB_9	Character	1		12	12
11	RB_10	Character	1		13	13
12	RB_11	Character	1		14	14
13	RB_12	Character	1		15	15
14	RB_13	Character	1		16	16
15	RB_14	Character	1		17	17
16	RB_15	Character	1		18	18
17	RB_16	Character	1		19	19
18	RB_17	Character	1		20	20
19	RB_18	Character	1		21	21
20	RB_19	Character	1		22	22
21	RB_20	Character	1		23	23
22	RB_21	Character	1		24	24
** Total **			24			

Field by Field Explanation:

1. PRIVATE - Private Interview
   Description: Answer to the question: Was the interview conducted in private?
   Valid Entries: Space (no entry recorded by inspector), Y (Yes) or N (No)
   Default: Space
   Input Form Field: The word PRIVATE or NOT PRIVATE was written at the top of the sheet.

2. RB_1 - Roof Bolter Question #1
   Description: Answer to the question: What is your regular job title?
   Valid Entries: -9 (no entry recorded by inspector) or 0 to 499 (a coded numeric field; Table 1 contains a list of occupation codes with descriptions)
   Default: -9

3. RB_2 - Roof Bolter Question #2

Description: Answer to the question: How long have you been doing this job?

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Less than 1 year), or 2 (1 year or more)

Default: Space

4. RB_3 - Roof Bolter Question #3

Description: Answer to the question: What is the respirable dust standard for this section?

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct), or 2 (Not Correct)

Default: Space

5. RB_4 - Roof Bolter Question #4

Description: Answer to the question: What are the requirements for face ventilation/air while you are roof bolting?

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct), or 2 (Not Correct)

Default: Space

6. RB_5 - Roof Bolter Question #5

Description: Answer to the question: The major sources of respirable dust affecting the roof bolter operator are:

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Dull bits and the depth of the holes being drilled), 2 (Defective dust collection system and working on the return side of the miner (or DO)), 3 (Defective dust collection system and excessive hydraulic pressure) or 4 (Dull bits and excessive vacuum pressure)

Default: Space

7. RB_6 - Roof Bolter Question #6

Description: Answer to the question: Bolts are installed with the roof bolting machine in the return air from the miner (or DO)

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Continuously), 2 (Several times a shift), 3 (Once a shift), 4 (Several times a week), 5 (Once a week) or 6 (Never)

Default: Space

8. RB_7 - Roof Bolter Question #7
Description: Answer to the question: When dust samples are collected, they measure miners' exposure to dust
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Accurately), 2 (Somewhat Accurately), or 3 (Inaccurately)
Default: Space

9. RB_8 - Roof Bolter Question #8
Description: Answer to the question: When a dust sample is being collected on my occupation
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (I install more bolts than I usually do), 2 (I bolt the same way I always do), 3 (I bolt the same way I always do but I make sure my air is up, empty my dust box carefully and do not bolt in the return air off of the miner (or DO)), or 4 (I install less bolts than I usually do)
Default: Space

10. RB_9 - Roof Bolter Question #9
Description: Answer to the question: When dust samples are being collected on this occupation/machine
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (I wear the dust pump), 2 (The dust pump is placed on the machine inby me), 3 (The dust pump is placed on the machine outby me), 4 (The dust pump is placed where I work most of the time), or 5 (The dust pump is placed away from where I work)
Default: Space

11. RB_10 - Roof Bolter Question #10
Description: Answer to the question: During sampling, dust pumps are
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Operated eight hours from the time they enter the mine until they are taken out of the mine), 2 (Sometimes shutoff for short periods), 3 (Sometimes shutoff for long periods, such as lunch), or 4 (Operated for short periods of time)
Default: Space

12. RB_11 - Roof Bolter Question #11

Description: Answer to the question: During sampling, dust pump flow rates are checked

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), 1 (At the beginning of the shift before mining is started), 2 (Every hour during the shift), 3 (An hour or two after the shift starts and at the end of the shift), 4 (An hour or two after the shift starts), or 5 (I don't know)

Default: Space

13. RB_12 - Roof Bolter Question #12

Description: Answer to the question: If a dust pump is placed on my occupation/machine and I change jobs for the day, I

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Take the pump with me), 2 (Leave the pump on the machine or give it to the new operator), 3 (Shut the pump off), or 4 (Would do something else with the pump)

Default: Space

14. RB_13 - Roof Bolter Question #13

Description: Answer to the question: If a dust pump is placed on my occupation/machine and it does not run all day,

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (I notify the person that placed or gave me the pump), 2 (I notify the foreman), 3 (I notify MSHA), or 4 (I do not notify anyone)

Default: Space

15. RB_14 - Roof Bolter Question #14

Description: Answer to the question: I wear a dust respirator

Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Always), 2 (Very Often), 3 (Often), 4 (Sometimes), or 5 (Never)

Default: Space

16. RB_15 - Roof Bolter Question #15
Description: Answer to the question: The major health concern with respirable dust is:
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Temporary shortness of breath and increased allergic reaction), 2 (Permanent lung damage that cannot be reversed), 3 (Lung damage that can be reversed with reduced exposure to dust), or 4 (Adverse affects on hearing and eyesight)
Default: Space

17. RB_16 - Roof Bolter Question #16
Description: Answer to the question: Do you check for the date, time and initials (preshift) of a supervisor when you enter a work area?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Always), 2 (Very Often), 3 (Often), 4 (Sometimes), or 5 (Never)
Default: Space

18. RB_17 - Roof Bolter Question #17
Description: Answer to the question: If you observe conditions that may increase respirable dust, what should you do?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Nothing; that would not be my responsibility), 2 (Correct the conditions immediately or report them), 3 (Notify MSHA), or 4 (Report the conditions to the work crew on the next shift)
Default: Space

19. RB_18 - Roof Bolter Question #18
Description: Answer to the question: When you have reported a condition that could increase respirable dust, what action was taken?
Valid Entries: Space (no entry recorded by inspector), R (Refused), D (Don't Know), 1 (Addressed immediately), 2 (Addressed as time permitted), 3 (Addressed before the next shift), 4 (Addressed before the next time to sample), 5 (Not addressed), or 6 (Question does not apply)
Default: Space

20. RB_19 - Roof Bolter Question #19
Description: Answer to the question: Have you seen the MSHA poster concerning tampering with dust samples?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Yes), or 2 (No)
Default: Space

21. RB_20 - Roof Bolter Question #20
Description: Answer to the question: The maximum penalty a person could be given if convicted of tampering with dust samples is
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Six months probation), 2 (Five years in jail), 3 (Five years in jail and a $10,000 fine), or 4 (Nothing (but the company could be fined))
Default: Space

22. RB_21 - Roof Bolter Question #21
Description: Answer to the question: Which kills more miners each year?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Roof falls), 2 (Black lung and its side effects), or 3 (Electrical accidents)
Default: Space

Section 2.8 Certified Dust Sampler Interview Database

Name of database: PCDS_SHT

Number of data records: 681

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	PRIVATE	Character	1		1	1
2	CDS_1	Numeric	3		2	4
3	CDS_2	Character	1		5	5
4	CDS_3	Character	1		6	6
5	CDS_4	Character	1		7	7
6	CDS_5	Character	1		8	8
7	CDS_6	Character	1		9	9
8	CDS_7	Character	1		10	10
9	CDS_8	Character	1		11	11
10	CDS_9	Character	1		12	12
11	CDS_10	Character	1		13	13
12	CDS_11	Character	1		14	14
13	CDS_12	Character	1		15	15
14	CDS_13	Character	1		16	16
15	CDS_14	Character	1		17	17
16	CDS_15	Character	1		18	18
17	CDS_16	Character	1		19	19
18	CDS_17	Character	1		20	20
19	CDS_18	Character	1		21	21
20	CDS_19	Character	1		22	22
21	CDS_20	Character	1		23	23
22	CDS_21	Character	1		24	24
** Total **			24			

Field by Field Explanation:

1. PRIVATE - Private Interview?
   Description: Answer to the question: Was the interview conducted in private?
   Valid Entries: Space (no entry recorded by inspector), Y (Yes) or N (No)
   Default: Space
   Input Form Field: The word PRIVATE or NOT PRIVATE was written at the top of the sheet.

2. CDS_1 - Certified Dust Sampler Question #1
   Description: Answer to the question: What is your position with this company?
   Valid Entries: -9 (no entry recorded by inspector) or 0 to 499 (a coded numeric field; Table 1 contains a list of the occupation codes with descriptions)
   Default: -9

3. CDS_2 - Certified Dust Sampler Question #2
Description: Answer to the question: How long have you been collecting dust samples?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Less than 1 year), or 2 (1 year or more)
Default: Space

4. CDS_3 - Certified Dust Sampler Question #3
Description: Answer to the question: What is the respirable dust standard in coal mines?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct), or 2 (Not Correct)
Default: Space

5. CDS_4 - Certified Dust Sampler Question #4
Description: Answer to the question: Does this mine have any sections or occupations on a reduced standard?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct), or 2 (Not Correct)
Default: Space

6. CDS_5 - Certified Dust Sampler Question #5
Description: Answer to the question: Are the dust control plans for all your MMUs exactly the same?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Correct), or 2 (Incorrect)
Default: Space

7. CDS_6 - Certified Dust Sampler Question #6
Description: Answer to the question: When company dust sampling is being conducted
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (All the minimum requirements of the plan are followed), 2 (Some of the minimum requirements of the plan are exceeded), 3 (All of the minimum requirement of the plan are exceeded), or 4 (Samples are taken the way we normally mine, without consideration of the dust control plan)
Default: Space

8. CDS_7 - Certified Dust Sampler Question #7
Description: Answer to the question: The MSHA requirement for persons who conduct any portion of respirable dust sampling is that they
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Must be trained), 2 (Must be qualified), 3 (Must be certified), or 4 (Must be designated by the superintendent)
Default: Space

9. CDS_8 - Certified Dust Sampler Question #8
Description: Answer to the question: If you were told by someone that a pump did not operate the full eight hours, you would
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Send the sample to MSHA), 2 (Send the sample to MSHA with a notation on the data card that the pump did not operate eight hours), or 3 (Discard the sample)
Default: Space

10. CDS_9 - Certified Dust Sampler Question #9
Description: Answer to the question: When dust samples are being collected on a designated occupation or area
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (The person wears the dust pump), 2 (The dust pump is placed on the machine inby the person), 3 (The dust pump is placed on the machine outby the person), 4 (The dust pump is placed where the person works most of the time), or 5 (The dust pump is placed away from where the person works)
Default: Space

11. CDS_10 - Certified Dust Sampler Question #10
Description: Answer to the question: If a dust pump is placed on a designated occupation/area and the person changes jobs for the day, he/she
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Takes the pump to the new job), 2 (Leaves the pump on the machine or gives it to the new operator), 3 (Shuts the pump off), or 4 (Would do something else with the pump)
Default: Space

12. CDS_11 - Certified Dust Sampler Question #11
Description: Answer to the question: Dust pumps are required to be calibrated every
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), 1 (100 hours), 2 (150 hours), 3 (200 hours), 4 (250 hours), or 5 (Don't Know)
Default: Space

13. CDS_12 - Certified Dust Sampler Question #12
Description: Answer to the question: Concerning records of calibration on pumps used by a contractor,
Valid Entries: Space (no entry recorded by inspector), R (Refused), D (Don't Know), 1 (I have asked for a record), 2 (I have not asked for a record), or 3 (The question does not apply)
Default: Space

14. CDS_13 - Certified Dust Sampler Question #13
Description: Answer to the question: Before taking the test to be a certified dust sampler,
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (I attended a formal training course conducted by MSHA), 2 (I attended a formal training course conducted by a contract trainer), 3 (I attended a formal training course conducted by the company), 4 (I attended a formal training course conducted by a school or university), 5 (I attended a formal training course conducted by some other organization), or 6 (I did not attend a formal training course)
Default: Space

15. CDS_14 - Certified Dust Sampler Question #14
Description: Answer to the question: Since receiving initial certification, I
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Have had formal retraining), or 2 (Have not had formal retraining)
Default: Space

16. CDS_15 - Certified Dust Sampler Question #15
Description: Answer to the question: In order to do my job as a dust sampler better,
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (A retraining course would be helpful), or 2 (A retraining course would not be helpful)
Default: Space

17. CDS_16 - Certified Dust Sampler Question #16
Description: Answer to the question: Have any miners reported, to you within the last year, conditions that could increase respirable dust?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Yes), or 2 (No)
Default: Space

18. CDS_17 - Certified Dust Sampler Question #17
Description: Answer to the question: The policy at this mine regarding the correction of conditions that could increase respirable dust which have been observed or reported is to
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Address them immediately), 2 (Address them as time permits), 3 (Address them before the next shift), or 4 (Address them before the next time to sample)
Default: Space

19. CDS_18 - Certified Dust Sampler Question #18
Description: Answer to the question: Have you seen the MSHA poster concerning tampering with dust samples?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Yes), or 2 (No)
Default: Space

20. CDS_19 - Certified Dust Sampler Question #19
Description: Answer to the question: The maximum penalty a person could be given if convicted of tampering with dust samples is
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Six months probation), 2 (Five years in jail), 3 (Five years in jail and a $10,000 fine), or 4 (Nothing (but the company could be fined))
Default: Space

21. CDS_20 - Roof Bolter Question #20
Description: Answer to the question: I wear a dust respirator
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Always), 2 (Very Often), 3 (Often), 4 (Sometimes), or 5 (Never)
Default: Space

22. CDS_21 - Certified Dust Sampler Question #21
Description: Answer to the question: Which kills more miners each year?
Valid Entries: Space (no entry recorded by inspector), R (Refused), N (Not Applicable), D (Don't Know), 1 (Roof falls), 2 (Black lung and its side effects), or 3 (Electrical accidents)
Default: Space

Section 3. MONITORING PROGRAM DATABASE

The information contained in the monitoring inspection databases was collected by MSHA inspectors using the forms in Table 9 from July, 1991 through December, 1991.

All dates in the monitor databases are in "YYYYMMDD" format. This means, for example, that June 30, 1991 would be represented as "19910630".

Section 3.1 In-Mine Monitoring Database

Name of database: PE1_SHT

Number of data records: 717

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU_NUMBER	Numeric	4		8	11
3	DTCOMP	Date	8		12	19
4	MINE_METHO	Character	1		20	20
5	A_MS_TYPE	Numeric	2		21	22
6	A_DRUM_TYP	Character	1		23	23
7	A_CUT_SEQ	Character	1		24	24
8	B_METHOD	Character	1		25	25
9	B_DEVICE	Character	1		26	26
10	B_BELT_AIR	Character	1		27	27
11	B_FAN_SPRA	Character	1		28	28
12	B_DEPTH	Numeric	3		29	31
13	B_LINE_CUR	Numeric	2		32	33
14	B_INTK_CFM	Numeric	6		34	39
15	B_INTK_FPM	Numeric	4		40	43
16	B_VELOCITY	Numeric	4		44	47
17	B_TAIL_CFM	Numeric	6		48	53
18	B_TAIL_FPM	Numeric	4		54	57
19	B_FACE	Numeric	5		58	62
20	B_MEAV	Character	3		63	65
21	B_LAST_OPN	Numeric	6		66	71
22	B_SCRUBBER	Numeric	5		72	76
23	C1_TYPE	Numeric	3		77	79
24	C1_MANUFAC	Numeric	4		80	83
25	C1_MODEL	Character	10		84	93
26	C1_APPROVA	Character	12		94	105
27	C1_LOC1	Numeric	2		106	107
28	C1_NUMBER1	Numeric	3		108	110
29	C1_PSI1	Numeric	3		111	113
30	C1_LOC2	Numeric	2		114	115
31	C1_NUMBER2	Numeric	3		116	118
32	C1_PSI2	Numeric	3		119	121
33	C1_LOC3	Numeric	2		122	123

Name of database: PE1_SHT (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
34	C1_NUMBER3	Numeric	3		124	126
35	C1_PSI3	Numeric	3		127	129
36	C1_LOC4	Numeric	2		130	131
37	C1_NUMBER4	Numeric	3		132	134
38	C1_PSI4	Numeric	3		135	137
39	C1_LOC5	Numeric	2		138	139
40	C1_NUMBER5	Numeric	3		140	142
41	C1_PSI5	Numeric	3		143	145
42	C1_LOC6	Numeric	2		146	147
43	C1_NUMBER6	Numeric	3		148	150
44	C1_PSI6	Numeric	3		151	153
45	C2_TYPE	Numeric	3		154	156
46	C2_MANUFAC	Numeric	4		157	160
47	C2_MODEL	Character	10		161	170
48	C2_APPROVA	Character	12		171	182
49	C2_LOC1	Numeric	2		183	184
50	C2_NUMBER1	Numeric	3		185	187
51	C2_PSI1	Numeric	3		188	190
52	C2_LOC2	Numeric	2		191	192
53	C2_NUMBER2	Numeric	3		193	195
54	C2_PSI2	Numeric	3		196	198
55	C2_LOC3	Numeric	2		199	200
56	C2_NUMBER3	Numeric	3		201	203
57	C2_PSI3	Numeric	3		204	206
58	C2_LOC4	Numeric	2		207	208
59	C2_NUMBER4	Numeric	3		209	211
60	C2_PSI4	Numeric	3		212	214
61	C2_LOC5	Numeric	2		215	216
62	C2_NUMBER5	Numeric	3		217	219
63	C2_PSI5	Numeric	3		220	222
64	C2_LOC6	Numeric	2		223	224
65	C2_NUMBER6	Numeric	3		225	227
66	C2_PSI6	Numeric	3		228	230
67	C3_TYPE	Numeric	3		231	233
68	C3_MANUFAC	Numeric	4		234	237
69	C3_MODEL	Character	10		238	247
70	C3_APPROVA	Character	12		248	259
71	C3_LOC1	Numeric	2		260	261
72	C3_NUMBER1	Numeric	3		262	264
73	C3_PSI1	Numeric	3		265	267
74	C3_LOC2	Numeric	2		268	269
75	C3_NUMBER2	Numeric	3		270	272
76	C3_PSI2	Numeric	3		273	275
77	C3_LOC3	Numeric	2		276	277
78	C3_NUMBER3	Numeric	3		278	280
79	C3_PSI3	Numeric	3		281	283
80	C3_LOC4	Numeric	2		284	285
81	C3_NUMBER4	Numeric	3		286	288

Name of database: PE1_SHT (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
82	C3_PSI4	Numeric	3		289	291
83	C3_LOC5	Numeric	2		292	293
84	C3_NUMBER5	Numeric	3		294	296
85	C3_PSI5	Numeric	3		297	299
86	C3_LOC6	Numeric	2		300	301
87	C3_NUMBER6	Numeric	3		302	304
88	C3_PSI6	Numeric	3		305	307
89	D1	Numeric	2		308	309
90	D2	Numeric	2		310	311
91	D3	Numeric	2		312	313
92	D4	Numeric	2		314	315
93	D5	Numeric	2		316	317
94	D6	Numeric	2		318	319
95	D7	Numeric	2		320	321
96	D8	Numeric	2		322	323
97	D9	Numeric	2		324	325
98	D10	Numeric	2		326	327
99	D11	Numeric	2		328	329
100	D12	Numeric	2		330	331
101	D13	Numeric	2		332	333
102	D14	Numeric	2		334	335
103	D15	Numeric	2		336	337
104	E_DISTANCE	Numeric	2		338	339
105	E_AIR_QUAL	Numeric	5		340	344
** Total **			344			

<u>Field by Field Explanation:</u>

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the monitoring observation was conducted.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Mine ID

2. MMU_NUMBER - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: MMU ID

3. DTCOMP - Date of Monitoring Observation
Description: Date that the monitoring observation took place.
Valid Entries: 07/24/91 to 12/19/91
Default: Required
Input Form Field: Date from E-2 Sheet

4. MINE_METHO - Mining Method
Description: Mining Method employed by the mine.
Valid Entries: 1 (Advancing), 2 (Retreating), or 3 (Other)
Default: Required
Input Form Field: Mining Method:

5. A_MS_TYPE - Mining System Type
Description: A code that describes which type of equipment for this MMU.
Valid Entries: Valid entries are contained in Table 2
Default: Required
Input Form Field: Mining System

6. A_DRUM_TYP - Drum Type
Description: A description of the type of drum used if A_MS_TYPE has a value of 01 (Longwall Shear).
Valid Entries: Spaces (no entry recorded by inspector), 1 (Single Drum), or 2 (Double Drum)
Default: Spaces
Input Form Field:
[ ] Longwall Type: [ ] Single Drum [ ] Double Drum

7. A_CUT_SEQ - Cut Sequence
Description: A description of the type of cut sequence used if A_MS_TYPE has a value of 01 (Longwall Shear) or 02 (Longwall Plow).
Valid Entries: Spaces (no entry recorded by inspector), 1 (Bidirectional), 2 (Head-Tail), or 3 (Tail-Head)
Default: Spaces
Input Form Field:
Cut Sequence: [ ] Bidirectional [ ] Head-Tail [ ] Tail-Head

8. B_METHOD - Method of Face Ventilation
Valid Entries: Space (no entry recorded by inspector), 1 (Blowing), 2 (Exhaust), or 3 (Combined)
Default: Space
Input Form Field: [ ] Blowing [ ] Exhaust [ ] Combined

9. B_DEVICE - Face Ventilation Device
Valid Entries: Space (no entry recorded by inspector), 1 (Curtain), 2 (Tubing), or 3 (Combined)
Default: Space
Input Form Field:
Face Ventilation Device: [ ] Curtain [ ] Tubing [ ] Combined

10. B_BELT_AIR - Dust Control Parameter Question B - Part 3
    Description: Answer to the question: Is belt air used to ventilate working faces?
    Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
    Default: Space

11. B_FAN_SPRA - Dust Control Parameter Question B - Part 4
    Description: Answer to the question: Is fan spray system used?
    Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
    Default: Space

12. B_DEPTH - Depth of Cut in feet
    Valid Entries: -9 (no entry recorded by inspector) or 0 to 999
    Default: -9
    Input Form Field: Depth of Cut: ________ ft

13. B_LINE_CUR - Line Curtain Distance in feet
    Valid Entries: -9 (no entry recorded by inspector), -1 (response not in feet), or 0 to 99
    Default: -9
    Input Form Field: Line Curtain Distance: __________ ft

14. B_INTK_CFM - Longwall Air Quantity Intake in Cubic Feet per Minute (cfm).
    Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
    Default: -9
    Input Form Field: Longwall Air Quantity: Intake__________cfm

15. B_INTK_FPM - Longwall Air Quantity Intake in Feet per Minute (fpm).
    Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
    Default: -9
    Input Form Field: Intake_________fpm

16. B_VELOCITY - Longwall Air Quantity Velocity at Mid-face in fpm
    Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
    Default: -9
    Input Form Field: Velocity (mid-face)__________ fpm

17. B_TAIL_CFM - Longwall Air Quantity Tailgate in cfm.
    Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
    Default: -9
    Input Form Field: Tailgate________cfm

18. B_TAIL_FPM - Longwall Air Quantity Tailgate in fpm.
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Tailgate________fpm

19. B_FACE - Conventional/Continuous Air Quantity at the Face in cfm.
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Conventional/Continuous: Face________cfm

20. B_MEAV - Air Quantity of Mean Entry Air Velocity in fpm
Valid Entries: Spaces (no entry recorded by inspector), 0 to 999, N (No Perceptible Air Movement), or P (Perceptible Air Movement). This is a right justified character field.
Default: Spaces
Input Form Field: Mean Entry Air Velocity________fpm

21. B_LAST_OPN - Air Quantity of Last Open Crosscut in cfm
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Last Open Crosscut: ________cfm

22. B_SCRUBBER - Air Quantity of Scrubber in cfm
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Scrubber: ________cfm

NOTE: The inspector form allowed for information to be collected on two types of machines for the Dust Control Parameters - Water, but the automated system allowed for three sets of information. Fields 23 through 44 contain information for the first machine; fields 45 through 66 contain information on the second machine; fields 67 through 88 contain information on the third machine.

23. C1_TYPE 45. C2_TYPE 67. C3_TYPE
Type of Machine
Description: A coded number for the type of machine in an MMU.
Valid Entries: -9 (no entry recorded by inspector) or 001 to 100 (a coded numeric field; Table 3 contains a list of the most frequently used codes with descriptions)
Default: Required
Input Form Field: Type of Machine__________________

24. C1_MANUFAC 46. C2_MANUFAC 68. C3_MANUFAC
Manufacturer of the Machine
Description: A coded number for the manufacturer of a machine in an MMU.
Valid Entries: -9 (no entry recorded by inspector) or 0001 to 9999 (a coded numeric field; Table 4 contains a list of the most frequently used codes with descriptions)
Default: Required
Input Form Field: Manufacturer______________________

25. C1_MODEL 47. C2_MODEL 69. C3_MODEL
Model Number of the Machine
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: Model Number______________________

26. C1_APPROVA 48. C2_APPROVA 70. C3_APPROVA
Approval Number of the Machine
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: Approval Number___________________

NOTE: The inspector form allowed only three locations with associated data for each machine, but the automated system allowed for six locations with associated data per machine.

27. C1_LOC1 49. C2_LOC1 71. C3_LOC1
Location of water spray for the machine
Valid Entries: -9 (no entry recorded by inspector) or 01 to 10 (a coded numeric field; Table 5 contains a list of the codes with descriptions)
Default: -9
Input Form Field:

	Location	Number	PSI
1.	____________________	______	______
2.	____________________	______	______
3.	____________________	______	______
4.	____________________	______	______
5.	____________________	______	______
6.	____________________	______	______

28. C1_NUMBER1 50. C2_NUMBER1 72. C3_NUMBER1
Number of water sprays
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999
Default: -9
Input Form Field: Number, See item 27 above

29. C1_PSI1 51. C2_PSI1 73. C3_PSI1
Water Pressure (Pounds per Square Inch) for the water sprays
Valid Entries: -9 (no entry recorded by inspector) or
0 to 999
Default: -9
Input Form Field: PSI, See item 27 above

30. C1_LOC2 52. C2_LOC2 74. C3_LOC2
31. C1_NUMBER2 53. C2_NUMBER2 75. C3_NUMBER2
32. C1_PSI2 54. C2_PSI2 76. C3_PSI2
Location code, number of water sprays and water pressure for the second location for the machine

33. C1_LOC3 55. C2_LOC3 77. C3_LOC3
34. C1_NUMBER3 56. C2_NUMBER3 78. C3_NUMBER3
35. C1_PSI3 57. C2_PSI3 79. C3_PSI3
Location code, number of water sprays and water pressure for the third location for the machine

36. C1_LOC4 58. C2_LOC4 80. C3_LOC4
37. C1_NUMBER4 59. C2_NUMBER4 81. C3_NUMBER4
38. C1_PSI4 60. C2_PSI4 82. C3_PSI4
Location code, number of water sprays and water pressure for the fourth location for the machine

39. C1_LOC5 61. C2_LOC5 83. C3_LOC5
40. C1_NUMBER5 62. C2_NUMBER5 84. C3_NUMBER5
41. C1_PSI5 63. C2_PSI5 85. C3_PSI5
Location code, number of water sprays and water pressure for the fifth location for the machine

42. C1_LOC6 64. C2_LOC6 86. C3_LOC6
43. C1_NUMBER6 65. C2_NUMBER6 87. C3_NUMBER6
44. C1_PSI6 66. C2_PSI6 88. C3_PSI6
Location code, number of water sprays and water pressure for the sixth location for the machine

89. D1 - Other Parameter #1
Valid Entries: -9 (no entry recorded by inspector) or 10 to 39
(a coded numeric field; Table 6 contains a list of these codes with descriptions)
Default: -9
Input Form Field: Other Parameters (i.e., dust collectors, wetting agent, variance, wetting roadways and/or faces, etc.):

90. D2 - Other Parameter #2
91. D3 - Other Parameter #3
92. D4 - Other Parameter #4
93. D5 - Other Parameter #5
94. D6 - Other Parameter #6
95. D7 - Other Parameter #7

96. D8 - Other Parameter #8
97. D9 - Other Parameter #9
98. D10 - Other Parameter #10
99. D11 - Other Parameter #11
100. D12 - Other Parameter #12
101. D13 - Other Parameter #13
102. D14 - Other Parameter #14
103. D15 - Other Parameter #15
Valid Entries, Default, and Input Form Field correspond to D1 for fields 90 through 103

104. E_DISTANCE - Distance of Line Curtain From Machine Head in feet
Valid Entries: -9 (no entry recorded by inspector), -1 (response not in feet), or 0 to 99
Default: -9
Input Form Field: Distance of Line curtain From Machine Head: __________________ft

105. E_AIR_QUAL - Air Quantity (face)
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Air Quantity (face): ______cfm

Section 3.2 In-Mine Observations Database

Name of database: PE2_SHT

Number of data records: 717

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU_NUMBER	Numeric	4		8	11
3	DTCOMP	Date	8		12	19
4	A_TONS	Numeric	5		20	24
5	B_FACE	Character	1		25	25
6	B_ROADWAYS	Character	1		26	26
7	B_COMPACTE	Character	1		27	27
8	C_DEPTH	Numeric	3		28	30
9	C_LINE	Numeric	2		31	32
10	C_IN1_CFM	Numeric	6		33	38
11	C_IN1_FPM	Numeric	4		39	42
12	C_IN2_CFM	Numeric	6		43	48
13	C_IN2_FPM	Numeric	4		49	52
14	C_VEL1	Numeric	4		53	56
15	C_VEL2	Numeric	4		57	60
16	C_TAIL1CFM	Numeric	6		61	66
17	C_TAIL1FPM	Numeric	4		67	70
18	C_TAIL2CFM	Numeric	6		71	76
19	C_TAIL2FPM	Numeric	4		77	80
20	C_FACE1CFM	Numeric	5		81	85
21	C_FACE2CFM	Numeric	5		86	90
22	C_MEAV1	Character	3		91	93
23	C_MEAV2	Character	3		94	96
24	C_LOC1_CFM	Numeric	6		97	102
25	C_LOC2_CFM	Numeric	6		103	108
26	C_SCRUB1	Numeric	5		109	113
27	C_SCRUB2	Numeric	5		114	118
28	D1_TYPE	Numeric	3		119	121
29	D1_MANUFAC	Numeric	4		122	125
30	D1_MODEL	Character	10		126	135
31	D1_APPROV	Character	12		136	147
32	D1_LOCATN1	Numeric	2		148	149
33	D1_NUMBER1	Numeric	3		150	152
34	D1_PSI1	Numeric	3		153	155
35	D1_LOCATN2	Numeric	2		156	157
36	D1_NUMBER2	Numeric	3		158	160
37	D1_PSI2	Numeric	3		161	163
38	D1_LOCATN3	Numeric	2		164	165
39	D1_NUMBER3	Numeric	3		166	168
40	D1_PSI3	Numeric	3		169	171
41	D1_LOCATN4	Numeric	2		172	173
42	D1_NUMBER4	Numeric	3		174	176
43	D1_PSI4	Numeric	3		177	179
44	D1_LOCATN5	Numeric	2		180	181

Name of database: PE2_SHT (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
45	D1_NUMBER5	Numeric	3		182	184
46	D1_PSI5	Numeric	3		185	187
47	D1_LOCATN6	Numeric	2		188	189
48	D1_NUMBER6	Numeric	3		190	192
49	D1_PSI6	Numeric	3		193	195
50	D2_TYPE	Numeric	3		196	198
51	D2_MANUFAC	Numeric	4		199	202
52	D2_MODEL	Character	10		203	212
53	D2_APPROV	Character	12		213	224
54	D2_LOCATN1	Numeric	2		225	226
55	D2_NUMBER1	Numeric	3		227	229
56	D2_PSI1	Numeric	3		230	232
57	D2_LOCATN2	Numeric	2		233	234
58	D2_NUMBER2	Numeric	3		235	237
59	D2_PSI2	Numeric	3		238	240
60	D2_LOCATN3	Numeric	2		241	242
61	D2_NUMBER3	Numeric	3		243	245
62	D2_PSI3	Numeric	3		246	248
63	D2_LOCATN4	Numeric	2		249	250
64	D2_NUMBER4	Numeric	3		251	253
65	D2_PSI4	Numeric	3		254	256
66	D2_LOCATN5	Numeric	2		257	258
67	D2_NUMBER5	Numeric	3		259	261
68	D2_PSI5	Numeric	3		262	264
69	D2_LOCATN6	Numeric	2		265	266
70	D2_NUMBER6	Numeric	3		267	269
71	D2_PSI6	Numeric	3		270	272
72	D3_TYPE	Numeric	3		273	275
73	D3_MANUFAC	Numeric	4		276	279
74	D3_MODEL	Character	10		280	289
75	D3_APPROVA	Character	12		290	301
76	D3_LOCATN1	Numeric	2		302	303
77	D3_NUMBER1	Numeric	3		304	306
78	D3_PSI1	Numeric	3		307	309
79	D3_LOCATN2	Numeric	2		310	311
80	D3_NUMBER2	Numeric	3		312	314
81	D3_PSI2	Numeric	3		315	317
82	D3_LOCATN3	Numeric	2		318	319
83	D3_NUMBER3	Numeric	3		320	322
84	D3_PSI3	Numeric	3		323	325
85	D3_LOCATN4	Numeric	2		326	327
86	D3_NUMBER4	Numeric	3		328	330
87	D3_PSI4	Numeric	3		331	333
88	D3_LOCATN5	Numeric	2		334	335
89	D3_NUMBER5	Numeric	3		336	338
90	D3_PSI5	Numeric	3		339	341
91	D3_LOCATN6	Numeric	2		342	343

Name of database: PE2_SHT (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
92	D3_NUMBER6	Numeric	3		344	346
93	D3_PSI6	Numeric	3		347	349
94	E1	Numeric	2		350	351
95	E2	Numeric	2		352	353
96	E3	Numeric	2		354	355
97	E4	Numeric	2		356	357
98	E5	Numeric	2		358	359
99	E6	Numeric	2		360	361
100	E7	Numeric	2		362	363
101	E8	Numeric	2		364	365
102	E9	Numeric	2		366	367
103	E10	Numeric	2		368	369
104	E11	Numeric	2		370	371
105	E12	Numeric	2		372	373
106	E13	Numeric	2		374	375
107	E14	Numeric	2		376	377
108	E15	Numeric	2		378	379
109	F	Character	1		380	380
110	G_BOLTER	Character	1		381	381
111	G_AIR_QUAL	Numeric	5		382	386
112	G_DISTANCE	Numeric	2		387	388
113	H1A	Numeric	2		389	390
114	H1B	Character	15		391	405
115	H2A	Numeric	2		406	407
116	H2B	Character	15		408	422
117	H3A	Numeric	2		423	424
118	H3B	Character	15		425	439
119	H4A	Numeric	2		440	441
120	H4B	Character	15		442	456
121	H5A	Numeric	2		457	458
122	H5B	Character	15		459	473
123	H6A	Numeric	2		474	475
124	H6B	Character	15		476	490
125	H7A	Numeric	2		491	492
126	H7B	Character	15		493	507
127	H8A	Numeric	2		508	509
128	H8B	Character	15		510	524
129	H9A	Numeric	2		525	526
130	H9B	Character	15		527	541
131	H10A	Numeric	2		542	543
132	H10B	Character	15		544	558
** Total **			558			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the Monitoring observation was conducted.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Mine ID

2. MMU_NUMBER - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: MMU Number

3. DTCOMP - Date of Monitoring observation
   Description: Date that the Monitoring observation took place.
   Valid Entries: 07/24/91 to 12/19/91
   Default: Required
   Input Form Field: Date

4. A_TONS - Production during inspection
   Description: Estimated actual production in tons during Monitoring observation.
   Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
   Default: -9
   Input Form Field: Production for Shift During Monitoring Visit _______tons

5. B_FACE - Face of MMU
   Description: Condition of the Face of an MMU
   Valid Entries: Space (no entry recorded by inspector), 1 (Wet), 2 (Damp), or 3 (Dry)
   Default: Space
   Input Form Field:
   Face: [ ] wet [ ] damp [ ] dry

6. B_ROADWAYS - Roadways of an MMU
   Description: Condition of the Roadways of an MMU
   Valid Entries: Space (no entry recorded by inspector), 1 (Wet), 2 (Damp), or 3 (Dry)
   Default: Space
   Input Form Field:
   Roadways: [ ] wet [ ] damp [ ] dry

7. B_COMPACTE - Compaction
Description: Answer to the question: Are Roadways Compacted?
Valid Entries: Space (no entry recorded by inspector) or Y (Yes)
Default: Space
Input Form Field: [ ] compacted

8. C_DEPTH - Depth of Cut in feet
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999
Default: -9
Input Form Field: Depth of Cut ________ ft

9. C_LINE - Line Curtain Distance in feet
Valid Entries: -9 (no entry recorded by inspector), -1 (response not in feet), or 0 to 99
Default: -9
Input Form Field: Line Curtain Distance __________ ft

10. C_IN1_CFM - Longwall Air Quantity Intake in Cubic Feet per Minute (cfm) (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Intake__________cfm

11. C_IN1_FPM - Longwall Air Quantity Intake in Feet per Minute (fpm) (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Intake_________fpm

12. C_IN2_CFM - Longwall Air Quantity Intake in cfm (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_IN1_CFM

13. C_IN2_FPM - Longwall Air Quantity Intake in fpm (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_IN1_FPM

14. C_VEL1 - Longwall Air Quantity Velocity at Mid-face (1st Reading)
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Vel (mid-face)__________ fpm

15. C_VEL2 - Longwall Air Quantity Velocity at Mid-face (2nd Reading)
Valid Entries, Default, and Input Form Field correspond to C_VEL1

16. C_TAIL1CFM - Longwall Air Quantity Tailgate in cfm (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Tailgate________cfm

17. C_TAIL1FPM - Longwall Air Quantity Tailgate in fpm (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 9999
Default: -9
Input Form Field: Tailgate_________fpm

18. C_TAIL2CFM - Longwall Air Quantity Tailgate in cfm (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_TAIL1CFM

19. C_TAIL2FPM - Longwall Air Quantity Tailgate in fpm (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_TAIL1FPM

20. C_FACE1CFM - Conventional/Continuous Air Quantity at the Face in cfm (1st Reading).
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Face_________cfm

21. C_FACE2CFM - Conventional/Continuous Air Quantity at the Face in cfm (2nd Reading).
Valid Entries, Default, and Input Form Field correspond to C_FACE1CFM

22. C_MEAV1 - Air Quantity of Mean Entry Air Velocity in fpm (1st Reading)
Valid Entries: Spaces (no entry recorded by inspector), 0 to 999, N (No Perceptible Air Movement), or P (Perceptible Air Movement). This is a right justified character field.
Default: Spaces
Input Form Field: Mean Entry Air Velocity________fpm

23. C_MEAV2 - Air Quantity of Mean Entry Air Velocity in fpm (2nd Reading)
Valid Entries, Default, and Input Form Field correspond to C_MEAV1

24. C_LOC1_CFM - Air Quantity of Last Open Crosscut in cfm (1st Reading)
Valid Entries: -9 (no entry recorded by inspector) or 0 to 999999
Default: -9
Input Form Field: Last Open Crosscut: ________cfm

25. C_LOC2_CFM - Air Quantity of Last Open Crosscut in cfm (2nd Reading)
Valid Entries, Default, and Input Form Field correspond to C_LOC1_CFM

26. C_SCRUB1 - Air Quantity of Scrubber in cfm (1st Reading)
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Scrubber: ________cfm

27. C_SCRUB2 - Air Quantity of Scrubber in cfm (2nd Reading)
Valid Entries, Default, and Input Form Field correspond to C_SCRUB1

NOTE: The inspector form allowed for information to be collected on two types of machines for the Dust Control Parameters Observed - Water, but the automated system allowed for three sets of information. Fields 28 through 49 contain information for the first machine; fields 50 through 71 contain information on the second machine; fields 72 through 93 contain information on the third machine.

28. D1_TYPE 50. D2_TYPE 72. D3_TYPE
Type of Machine
Description: A coded number for the type of machine in an MMU.
Valid Entries: -9 (no entry recorded by inspector) or 001 to 100 (a coded numeric field; Table 3 contains a list of the most frequently used codes with descriptions)
Default: -9
Input Form Field: Type of Machine:____________________

29. D1_MANUFAC 51. D2_MANUFAC 73. D3_MANUFAC

Manufacturer of the Machine

Description: A coded number for the manufacturer of a machine in an MMU.

Valid Entries: -9 (no entry recorded by inspector) or 0001 to 9999 (a coded numeric field; Table 4 contains a list of the most frequently used codes with descriptions)

Default: -9

Input Form Field: Manufacturer:______________________

30. D1_MODEL 52. D2_MODEL 74. D3_MODEL

Model Number of the Machine

Valid Entries: Alphanumeric

Default: Spaces

Input Form Field: Model Number:______________________

31. D1_APPROV 53. D2_APPROV 75. D3_APPROV

Approval Number of the Machine

Valid Entries: Alphanumeric

Default: Spaces

Input Form Field: Approval Number:___________________

NOTE: The inspector form allowed only three locations with associated data for each machine, but the automated system allowed for six locations with associated per machine.

32. D1_LOCATN1 54. D2_LOCATN1 76. D3_LOCATN1

Location of water spray for the machine

Valid Entries: -9 (no entry recorded by inspector) or 01 to 10 (a coded numeric field; Table 5 contains a list of the codes with descriptions)

Default: -9

Input Form Field:

	Location	Number	PSI
1.	___________	______	______
2.	___________	______	______
3.	___________	______	______
4.	___________	______	______
5.	___________	______	______
6.	___________	______	______

33. D1_NUMBER1 55. D2_NUMBER1 77. D3_NUMBER1

Number of water sprays

Valid Entries: -9 (no entry recorded by inspector) or 0 to 999

Default: -9

Input Form Field: PSI, See item 32 above

34. D1_PSI1 56. D2_PSI1 78. D3_PSI1
Water Pressure (Pounds per Square Inch) for the water sprays
Valid Entries: -9 (no entry recorded by inspector) or
0 to 999
Default: -9
Input Form Field: PSI, See item 32 above

35. D1_LOCATN2 57. D2_LOCATN2 79. D3_LOCATN2
36. D1_NUMBER2 58. D2_NUMBER2 80. D3_NUMBER2
37. D1_PSI2 59. D2_PSI2 81. D3_PSI2
Location code, number of water sprays and water pressure for the second location for the machine

38. D1_LOCATN3 60. D2_LOCATN3 82. D3_LOCATN3
39. D1_NUMBER3 61. D2_NUMBER3 83. D3_NUMBER3
40. D1_PSI3 62. D2_PSI3 84. D3_PSI3
Location code, number of water sprays and water pressure for the third location for the machine

41. D1_LOCATN4 63. D2_LOCATN4 85. D3_LOCATN4
42. D1_NUMBER4 64. D2_NUMBER4 86. D3_NUMBER4
43. D1_PSI4 65. D2_PSI4 87. D3_PSI4
Location code, number of water sprays and water pressure for the fourth location for the machine

44. D1_LOCATN5 66. D2_LOCATN5 88. D3_LOCATN5
45. D1_NUMBER5 67. D2_NUMBER5 89. D3_NUMBER5
46. D1_PSI5 68. D2_PSI5 90. D3_PSI5
Location code, number of water sprays and water pressure for the fifth location for the machine

47. D1_LOCATN6 69. D2_LOCATN6 91. D3_LOCATN6
48. D1_NUMBER6 70. D2_NUMBER6 92. D3_NUMBER6
49. D1_PSI6 71. D2_PSI6 93. D3_PSI6
Location code, number of water sprays and water pressure for the sixth location for the machine

94. E1 - Other Parameter #1
Valid Entries: -9 (no entry recorded by inspector) or 10 to 39 (a coded numeric field; Table 6 contains a list of these codes with descriptions)
Default: -9
Input Form Field: Other parameters (i.e., dust collectors, wetting agent, variance, wetting roadways and/or faces, etc.):________

95. E2 - Other Parameter #2
96. E3 - Other Parameter #3
97. E4 - Other Parameter #4
98. E5 - Other Parameter #5
99. E6 - Other Parameter #6
100. E7 - Other Parameter #7

101. E8 - Other Parameter #8
102. E9 - Other Parameter #9
103. E10 - Other Parameter #10
104. E11 - Other Parameter #11
105. E12 - Other Parameter #12
106. E13 - Other Parameter #13
107. E14 - Other Parameter #14
108. E15 - Other Parameter #15
Valid Entries, Default, and Input Form Field correspond to E1 for fields 95 through 108

109. F - In-Mine Monitoring Question #F-1
Description: Answer to the question: Is miner operator always located on intake air during cutting and loading operations?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

110. G_BOLTER - In-Mine Monitoring Question #G-1
Description: Answer to the question: Are the roof bolter operations conducted on the intake side of the continuous miner?
Valid Entries: Space (no entry recorded by inspector), Y (Yes), or N (No)
Default: Space

111. G_AIR_QUAL - Air Quantity (face)
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999
Default: -9
Input Form Field: Air Quantity (face) ______________cfm

112. G_DISTANCE - Distance of Line Curtain From Machine Head in feet
Valid Entries: -9 (no entry recorded by inspector), -1 (response not in feet), or 0 to 99
Default: -9
Input Form Field: Distance of line curtain from machine head: ______________ft

113. H1A - Quantity of Violation #1
Description: Number of citations that were issued for H1B standard.
Valid Entries: -9 (no entry recorded by inspector) or 01 to 99
Default: -9
Input Form Field: Violations cited: (Indicate Quantity & Standard #'s violated)______________

114. H1B - Standard of Violation #1
Description: Standard # of the violation that has been cited in the inspection.
Valid Entries: Alphanumeric
Default: Spaces
Input Form Field: See H1A

115. H2A - Quantity of Violation #2
Valid Entries, Default, and Input Form Field correspond to H1A

116. H2B - Standard of Violation #2
Valid Entries, Default, and Input Form Field correspond to H1B

117. H3A - Quantity of Violation #3
Valid Entries, Default, and Input Form Field correspond to H1A

118. H3B - Standard of Violation #3
Valid Entries, Default, and Input Form Field correspond to H1B

119. H4A - Quantity of Violation #4
Valid Entries, Default, and Input Form Field correspond to H1A

120. H4B - Standard of Violation #4
Valid Entries, Default, and Input Form Field correspond to H1B

121. H5A - Quantity of Violation #5
Valid Entries, Default, and Input Form Field correspond to H1A

122. H5B - Standard of Violation #5
Valid Entries, Default, and Input Form Field correspond to H1B

123. H6A - Quantity of Violation #6
Valid Entries, Default, and Input Form Field correspond to H1A

124. H6B - Standard of Violation #6
Valid Entries, Default, and Input Form Field correspond to H1B

125. H7A - Quantity of Violation #7
Valid Entries, Default, and Input Form Field correspond to H1A

126. H7B - Standard of Violation #7
Valid Entries, Default, and Input Form Field correspond to H1B

127. H8A - Quantity of Violation #8
Valid Entries, Default, and Input Form Field correspond to H1A

128. H8B - Standard of Violation #8
Valid Entries, Default, and Input Form Field correspond to H1B

129. H9A - Quantity of Violation #9
Valid Entries, Default, and Input Form Field correspond to H1A

130. H9B - Standard of Violation #9
Valid Entries, Default, and Input Form Field correspond to H1B

131. H10A - Quantity of Violation #10
Valid Entries, Default, and Input Form Field correspond to H1A

132. H10B - Standard of Violation #10
Valid Entries, Default, and Input Form Field correspond to H1B

Section 3.3 Information Completed with the Report Database

Name of database: PE3_SHT

Number of data records: 717

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU_NUMBER	Numeric	4		8	11
3	DTCOMP	Date	8		12	19
4	DUSTCONPAR	Character	1		20	20
5	DUSTCONCOM	Character	1		21	21
6	VIODSTCTPL	Character	1		22	22
7	VIOQ1	Numeric	2		23	24
8	VIOS1	Character	15		25	39
9	VIOQ2	Numeric	2		40	41
10	VIOS2	Character	15		42	56
11	VIOQ3	Numeric	2		57	58
12	VIOS3	Character	15		59	73
13	VIOQ4	Numeric	2		74	75
14	VIOS4	Character	15		76	90
15	VIOQ5	Numeric	2		91	92
16	VIOS5	Character	15		93	107
17	VIOQ6	Numeric	2		108	109
18	VIOS6	Character	15		110	124
19	VIOQ7	Numeric	2		125	126
20	VIOS7	Character	15		127	141
21	VIOQ8	Numeric	2		142	143
22	VIOS8	Character	15		144	158
23	VIOQ9	Numeric	2		159	160
24	VIOS9	Character	15		161	175
25	VIOQ10	Numeric	2		176	177
26	VIOS10	Character	15		178	192
27	ADJCONPAR	Character	1		193	193
28	SAMPMPCHK	Character	1		194	194
29	TOTVOLBAT	Numeric	5	2	195	199
30	TYPSAMUSED	Character	1		200	200
31	PROPDESSMP	Character	1		201	201
32	OCPSAMP	Numeric	3		202	204
33	CASSETTE	Numeric	8		205	212
34	OCPCODE	Numeric	3		213	215
35	SAMUNTREMN	Character	1		216	216
36	TIMECHK1	Character	1		217	217
37	TIMECHK2	Character	1		218	218
38	TIMECHK3	Character	1		219	219
39	PERSCERT	Character	1		220	220
40	LENNRMSHFT	Numeric	3		221	223
41	SAMOPPORT	Character	1		224	224
42	SHIFTPROD	Numeric	5		225	229

Name of database: PE3_SHT (Cont'd)

Field	Field Name	Type	Width	Dec	Begin Column	End Column
43	TYPICPROD	Numeric	5		230	234
44	SMPPMPSHTO	Character	1		235	235
45	FILLOCCODE	Numeric	3		236	238
46	SIGNDDCARD	Character	1		239	239
47	SMPPMPACTO	Numeric	3		240	242
48	SMPOCC	Character	1		243	243
49	RESLTSPST	Character	1		244	244
50	OPINREPR	Character	1		245	245
51	OPINCOM	Character	1		246	246
** Total **			246			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the Monitoring observation was conducted.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: Mine ID

2. MMU_NUMBER - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit.
   Valid Entries: Numeric
   Default: Required
   Input Form Field: MMU Number

3. DTCOMP - Date of Monitoring observation
   Description: Date that the Monitoring observation took place.
   Valid Entries: 07/24/91 to 12/19/91
   Default: Required
   Input Form Field: Date from E-2 Sheet

4. DUSTCONPAR - Information Completed With the Report Question #1, Part #1
   Description: Answer to the question: Were the dust control parameters during sampling the same as in the approved dust control plan?
   Valid Entries: Y (Yes) or N (No)
   Default: Required

5. DUSTCONCOM - Information Completed With the Report Question #1, Part #2

Description: Answer to the question: If no, what was the difference?

Valid Entries: Space (no entry recorded by inspector), Y (entry recorded by inspector)

Default: Space

6. VIODSTCTPL - Information Completed With the Report Question #2

Description: Answer to the question: Were any violations of the dust control plan issued during the inspection?

Valid Entries: Y (Yes) or N (No)

Default: Required

7. VIOQ1 - Quantity of Violation #1

Description: Number of citations that were issued for VIOS1 standard.

Valid Entries: -9 (no entry recorded by inspector) or 01 to 99

Default: -9

Input Form Field: Record quantity and standard(s) cited.________________

8. VIOS1 - Standard of Violation #1

Description: Standard # of the violation that has been cited in the inspection.

Valid Entries: Alphanumeric

Default: Spaces

Input Form Field: See VIOQ1

9. VIOQ2 - Quantity of Violation #2

Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

10. VIOS2 - Standard of Violation #2

Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

11. VIOQ3 - Quantity of Violation #3

Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

12. VIOS3 - Standard of Violation #3

Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

13. VIOQ4 - Quantity of Violation #4

Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

14. VIOS4 - Standard of Violation #4
Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

15. VIOQ5 - Quantity of Violation #5
Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

16. VIOS5 - Standard of Violation #5
Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

17. VIOQ6 - Quantity of Violation #6
Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

18. VIOS6 - Standard of Violation #6
Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

19. VIOQ7 - Quantity of Violation #7
Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

20. VIOS7 - Standard of Violation #7
Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

21. VIOQ8 - Quantity of Violation #8
Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

22. VIOS8 - Standard of Violation #8
Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

23. VIOQ9 - Quantity of Violation #9
Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

24. VIOS9 - Standard of Violation #9
Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

25. VIOQ10 - Quantity of Violation #10
Description, Valid Entries, Default, and Input Form Field correspond to VIOQ1

26. VIOS10 - Standard of Violation #10
Description, Valid Entries, Default, and Input Form Field correspond to VIOS1

27. ADJCONPAR - Information Completed With the Report Question #3
Description: Answer to the question: Did the operator check and/or adjust the control parameters before beginning to sample?
Valid Entries: Y (Yes) or N (No)
Default: Required

28. SAMPMPCHK - Information Completed With the Report Question #4 - Part #1
Description: Answer to the question: Was the sampling pump checked on the surface before being placed on the occupation to be sampled?
Valid Entries: Y (Yes) or N (No)
Default: Required

29. TOTVOLBAT - Information Completed With the Report Question #4 - Part #2
Description: Answer to the question: What was the total voltage of the batteries?
Valid Entries: -9 (no entry recorded by inspector) or 00.00 to 9.99; this field contains an explicit decimal point.
Default: -9

30. TYPSAMUSED - Information Completed With the Report Question #5
Description: Answer to the question: What was the type and model of the sampler used?
Valid Entries: 1 (MSA, Model G), 2 (MSA Flowlite), or 3 (unknown)
Default: Required

31. PROPDESSMP - Information Completed With the Report Question #6 - Part #1
Description: Answer to the question: Was the proper designated occupation sampled?
Valid Entries: Y (Yes) or N (No)
Default: Required

32. OCPSAMP - Occupation Sampled
Description: The code for the occupation being sampled.
Valid Entries: 001 to 999 (a coded numeric field; Table 1 contains a list of occupation codes with descriptions)
Default: Required
Input Form Field: Occupation sampled (code):_________

33. CASSETTE - Dust Cassette Number
Description: Dust cassette number of sample observed by MSHA inspector for a particular mine id and MMU.
Valid Entries: Numeric
Default: Required
Input Form Field: Cassette Number:

34. OCPCODE - Occupation Code
Description: Code of the occupation being observed.
Valid Entries: 001 to 999 (a coded numeric field; Table 1 contains a list of occupation codes with descriptions)
Default: Required
Input Form Field: Occupation Code:

35. SAMUNTREMN - Information Completed With the Report Question #8
Description: Answer to the question: Did the sampling unit remain on the designated occupation the entire shift?
Valid Entries: Y (Yes) or N (No)
Default: Required

36. TIMECHK1 - Information Completed With the Report Question #9 - Part #1
Description: Answer to the question: When was the pump flow rate checked?
Valid Entries: Space (no entry recorded by inspector) or 1 to 8; 1 = 1st hour, 2 = 2nd hour, etc.
Default: Space

37. TIMECHK2 - Information Completed With the Report Question #9 - Part #2
Description, Valid Entries, and Default correspond to TIMECHK1

38. TIMECHK3 - Information Completed With the Report Question #9 - Part #3
Description, Valid Entries, and Default correspond to TIMECHK1

39. PERSCERT - Information Completed With the Report Question #9 - Part #4
Description: Answer to the question: Is this person certified for conducting sampling?
Valid Entries: Y (Yes) or N (No)
Default: Required

40. LENNRMSHFT - Information Completed With the Report Question #10
Description: Answer to the question: What is the length of the normal working shift (minutes)?
Valid Entries: 001 to 999
Default: Required

41. SAMOPPORT - Information Completed With the Report Question #11
Description: Answer to the question: Was the sampler operated portal to portal?
Valid Entries: Y (Yes) or N (No)
Default: Required

42. SHIFTPROD - Information Completed With the Report Question #12
Description: Answer to the question: What was the actual production during the sampling shift?
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999 tons
Default: -9

43. TYPICPROD - Information Completed With the Report Question #13
Description: Answer to the question: What is the typical production when operator samples are taken?
Valid Entries: -9 (no entry recorded by inspector) or 0 to 99999 tons
Default: -9

44. SMPPMPSHTO - Information Completed With the Report Question #14
Description: Answer to the question: Was the sampling pump shut off at anytime during the shift?
Valid Entries: Y (Yes) or N (No)
Default: Required

45. FILLOCCODE - Information Completed With the Report Question #15 - Part #1
Description: Answer to the question: Who filled out dust data card?
Valid Entries: -9 (no entry recorded by inspector) , 000 (unknown), or 001 to 499 (a coded numeric field; Table 1 contains a list of occupation codes with descriptions)
Default: -9

46. SIGNDDCARD - Information Completed With the Report Question #15 - Part #2

Description: Answer to the question: Who signs it?

Valid Entries: Space (no entry recorded by inspector), 1 (miner), 2 (dust sampler), 3 (mine management), 4 (unknown), 5 (same person as the one who filled out the dust data card) or 6 (different person than the one who filled out the dust data card)

Default: Space

47. SMPPMPACTO - Information Completed With the Report Question #16

Description: Answer to the question: How long did the sampling pump actually operate?

Valid Entries: 001 to 999 minutes

Default: Required

48. SMPOCC - Information Completed With the Report Question #17

Description: Answer to the question: Does the sampling occur on consecutive shifts or on consecutive days?

Valid Entries: Space (no entry recorded by inspector), 1 (consecutive shifts), or 2 (consecutive days)

Default: Space

49. RESLTSPST - Information Completed With the Report Question #18

Description: Answer to the question: Were the results of the previous bimonthly sampling cycle posted?

Valid Entries: Y (Yes) or N (No)

Default: Required

50. OPINREPR - Information Completed With the Report Question #19 - Part #1

Description: Answer to the question: In your opinion, was the sample result representative of the operating condition observed?

Valid Entries: Space (no entry recorded by inspector), Y (Yes), N (No), or D (Don't know)

Default: Space

51. OPINCOM - Information Completed With the Report Question #19 - Part #2

Description: Answer to the question: If not, why not?

Valid Entries: Space (no entry recorded by inspector), Y (entry recorded by inspector)

Default: Space

Section 4. OTHER DATABASES

In addition to the data collected during the Spot and Monitoring Programs, three other major databases were used during the analysis. The data used to generate these databases was obtained from other MSHA computer systems.

Date fields in the Inspector database are represented in the usual "YYYYMMDD" format. However, date fields in the Operator database are represented in different formats. Please refer to the appropriate field explanations for specific details.

Section 4.1 Operator Sample Database

This database contains operator dust sample information for underground coal mines from the last sampling cycle of 1989 through the last cycle of 1991.

Name of database: POPERAT

Number of data records: 176,872

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MINE_SYS	Numeric	2		8	9
3	MMU_NUMBER	Numeric	4		10	13
4	PROC_DATE	Date (YYMMDD)	6		14	19
5	VOID_CODE	Character	3		20	22
6	INSP_IND	Character	1		23	23
7	QUARTZ	Character	1		24	24
8	CASS_NUM	Numeric	8		25	32
9	INIT_WT	Numeric	3	1	33	35
10	FINAL_WT	Numeric	3	1	36	38
11	DUST_CONC	Numeric	3	1	39	41
12	ENT_TYP	Character	1		42	42
13	SAMP_TIME	Numeric	3		43	45
14	SHFT_TONS	Numeric	4		46	49
15	SAMP_DATE	Date(YYMMDDYY)	8		50	57
16	OCC_NUM	Numeric	3		58	60
17	MINE_TYP	Character	1		61	61
18	SAMP_TYP	Numeric	2		62	63
19	FIPS_COUTY	Numeric	3		64	66
20	STANDARD	Numeric	3	1	67	69
21	STD_DATE	Date (YYMMDD)	6		70	75
22	SUC	Numeric	1		76	76
23	CYCLE_NUM	Numeric	2		77	78
24	FINAL_DET	Numeric	1		79	79
25	INIT_DET	Numeric	1		80	80
26	SEQ_NUM	Numeric	2		81	82
** Total **			82			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: 7-digit number assigned by MSHA which identifies the mine.
   Valid Entries: Numeric

2. MINE_SYS - Method of Mining System
   Description: Code to indicate the method of mining.
   Valid Entries: Space or one of the codes in Mining System Tupe Code, Table 2.

3. MMU_NUMBER - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit. The first digit identifies location of DA sample. See Section 5.0.
   Valid Entries: Numeric

4. PROC_DATE - Processing Date
   Description: Process date of the sample in YYMMDD format. For example, June 30, 1991 would be represented as 910630.
   Valid Entries: Any valid date

5. VOID_CODE - Void Code
   Description: Code issued by the operator or MSHA indicating whether the sample was voided.
   Valid Entries: Space in the field indicates a valid sample. See Table 7 for a list of void codes.

6. INSP_IND - Inspector Indicator
   Description: A code indicating whether the sample was taken by a MSHA inspector.
   Valid Entries: N = Sample not taken by MSHA inspector

7. QUARTZ - Quartz Indicator
   Description: Dust/quartz indicator.
   Valid Entries: N = Dust Sample
   B = Dust sample analyzed for 6 month quartz survey

8. CASS_NUM - Cassette Number
   Description: Pre-printed number supplied by the manufacturer identifying the filter cassette and dust data card.
   Valid Entries: Numeric

9. INIT_WT - Initial Weight
   Description: Original weight of the cassette before the sampling was done; this field contains an assumed decimal point, i.e. 005 in this field should be interpreted as 00.5.
   Valid Entries: Numeric

10. FINAL_WT - Final Weight
   Description: Weight of cassette after the respirable dust was taken; this field contains an assumed decimal point, i.e. 015 in this field should be interpreted as 01.5.
   Valid Entries: Numeric

11. DUST_CONC - Dust Concentration
   Description: Dust concentration of the sample in MRE equivalent; this field contains an assumed decimal point, i.e. 021 in this field should be interpreted as 02.1.
   Valid Entries: Numeric

12. ENT_TYP - Entity Type
   Description: Code to indicate the entity type.
   Valid Entries: M = Mechanized mining unit
   D = Designated Area (DA)
   R = Roof Bolter DA
   I = Intake Air DA

13. SAMP_TIME - Sample Time
   Description: The sampling time, in minutes, which represents the actual elapsed time between when the pump was started and when the pump was turned off.
   Valid Entries: Numeric

14. SHFT_TONS - Tons This Shift
   Description: Tons of material produced. This item is only required for samples taken on the mechanized mining unit.
   Valid Entries: Numeric

15. SAMP_DATE - Sample Date
   Description: Date sample taken by the operator in YYMMDDYY format. For example, June 30, 1991 would appear as 91063091.
   Valid Entries: Any valid date.

16. OCC_NUM - Occupation Code
Description: 3-digit number to identify the occupation of the individual being sampled. The occupation code is not entered for designated area samples.
Valid Entries: See Table 2 for a list of valid codes; zeros if no occupation code.

17. MINE_TYP - Mine Type
Description: Code to indicate the type of mine.
Valid Entries: U for underground mine

18. SAMP_TYP - Sample Type
Description: A code indicating the type of dust sample taken.
Valid Entries: 00 if no sample type;
01 = Underground Designated Occupation;
02 = Underground Nondesignated Occupation;
03 = Underground Designated Area;
04 = Surface Designated Work Position
05 = Part 90 Miner
06 = Underground Nondesignated Area
07 = Underground Intake Air
08 = Surface Nondesignated Work Position

19. FIPS_COUTY - FIPS County Code
Description: FIPS county code where mine is located.
Valid Entries: Numeric

20. STANDARD - Dust Standard
Description: Quartz adjusted dust standard;this field contains an assumed decimal point, i.e. 020 in this field should be interpreted as 02.0.
Valid Entries: Numeric; zeros indicates a standard of 02.0

21. STD_DATE - Dust Standard Date
Description: Effective date in YYMMDD of the dust standard. For example, June 30, 1991 would be represented as 910630.
Valid Entries: Zeros or any valid date

22. SUC - Sample Usage Code
Description: Sample usage code.
Valid Entries: 0 = Not yet used in any determination calculation
1 = Normal sample in a bimonthly cycle whether in or out of compliance
2 = 5 additional samples (used for DA/DWP/P90), compliance not achieved
3 = Citation sample, compliance not achieved
4 = Citation sample, compliance not achieved -split cycle
5 = Void sample
6 = 5 additional samples-split cycle (used for DA/DWP/P90), compliance not achieved
7 = Citation sample/compliance achieved (in same cycle or split cycle)

23. CYCLE_NUM - Cycle Number
Description: Bimonthly cycle number
Valid Entries: Numeric values 01 to 14.

24. FINAL_DET - Final Determination
Description: Code to indicate whether one of last five valid samples of a cycle.
Valid Entries: 0 or 1; 1 = one of last five valid samples in a cycle.

25. INIT_DET - Initial Determination
Description: Code to indicate whether one of first five valid samples of a cycle.
Valid Entries: 0 or 1; 1 = one of first five valid samples in a cycle.

26. SEQ_NUM - Sequence Number
Description: Sequence number within cycle based on sample taken date.
Valid Entries: Numeric values 01 to 46

Section 4.2 MSHA Mine Inspector Sample Database

This database contains inspector dust sample information for underground coal mines from October, 1989 through July, 1992.

Name of database: PINSPECT

Number of data records: 44,071

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	MMU_NUMBER	Numeric	4		8	11
3	CASS_NUM	Numeric	8		12	19
4	VOID_CODE	Character	3		20	22
5	INIT_WT	Numeric	4	1	23	26
6	FINAL_WT	Numeric	4	1	27	30
7	DUST_CONC	Numeric	4	1	31	34
8	TIME_MIN	Numeric	3		35	37
9	TONS_SHFT	Numeric	4		38	41
10	SMP_TK_DT	Date	8		42	49
11	SMP_RC_DT	Date	8		50	57
12	SMP_PR_DT	Date	8		58	65
13	SMP_CODE	Numeric	1		66	66
14	MINE_METH	Character	1		67	67
15	OCC_CODE	Numeric	3		68	70
16	DUST_STD	Numeric	4	1	71	74
17	DST_STD_DT	Date	8		75	82
** Total **			82			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number where the Spot Inspection was conducted.
   Valid Entries: Numeric

2. MMU_NUMBER - Mechanized Mining Unit
   Description: Number used by MSHA to identify an entity for dust control purposes; the middle two digits identify a mechanized mining unit. The first digit identifies location of DA samples, see section 5.0.
   Valid Entries: Numeric

3. CASS_NUM - Cassette Number
   Description: Pre-printed number supplied by the manufacturer identifying the filter cassette and dust data card.
   Valid Entries: Numeric

4. VOID_CODE - Void Code
Description: Code issued by MSHA indicating whether the sample was voided.
Valid Entries: Space in the field indicates a valid sample. See Table 7 for a list of void codes.

5. INIT_WT - Initial Weight
Description: Original weight of the cassette before the sampling was done; this field contains an explicit decimal point. A "-9" indicates a missing value.
Valid Entries: Numeric

6. FINAL_WT - Final Weight
Description: Weight of cassette after the respirable dust was taken; this field contains an explicit decimal point. A "-9" indicates a missing value.
Valid Entries: Numeric

7. DUST_CONC - Dust Concentration
Description: Dust concentration of the sample in MRE equivalent; this field contains an explicit decimal point.
Valid Entries: Numeric

8. TIME_MIN - Sample Time
Description: The sampling time, in minutes, which represents the actual elapsed time between when the pump was started and when the pump was turned off. A "-9" indicates a missing value.
Valid Entries: Numeric

9. TONS_SHFT - Tons This Shift
Description: Tons of material produced. This item is only required for samples taken on the mechanized mining unit.
Valid Entries: Numeric

10. SMP_TK_DT - Sample Date
Description: Date sample taken by the inspector in YYYYMMDD format.
Valid Entries: Any valid date

11. SMP_RC_DT - Sample Received Date
Description: Date sample received in YYYYMMDD format.
Valid Entries: Any valid date

12. SMP_PR_DT - Sample Processed Date
Description: Date sample processed in YYYYMMDD format.

Valid Entries: Any valid date

13. SMP_CODE - Sample Type Code
Description: A code indicating the type of dust sample taken.
Valid Entries: 00 if no sample type;
01 = Underground Designated Occupation;
02 = Underground Nondesignated Occupation;
03 = Underground Designated Area;
04 = Surface Designated Work Position
05 = Part 90 Miner
06 = Underground Nondesignated Area
07 = Underground Intake Air
08 = Surface Nondesignated Work Position

14. MINE_METH - Method of Mining Code
Description: Code to indicate the method of mining.
Valid Entries: A = Longwall Shear
B = Longwall Plow
C = Continuous Ripper
D = Continuous Bore
E = Continuous Auger
F = Continuous Short Wall
G = Conventional/Cutting Machine
H = Scoop/Cutting Machine
I = Scoop Shooting of Solid (SOS)
J = Scoop SOS/LD Machine
K = Hand Load Cutting Machine
L = Hand Load SOS
M = Hand Load Anthracite
N = Other

15. OCC_CODE - Occupation Code
Description: 3-digit number to identify the occupation of the individual being sampled. The occupation code is not entered for designated area samples.
Valid Entries: See Table 2.

16. DUST_STD - Dust Standard
Description: Quartz adjusted dust standard; this field contains an explicit decimal point.
Valid Entries: Numeric; zeros indicate a 2.0 standard.

17. DST_STD_DT - Dust Standard Date
Description: Effective date in YYYYMMDD of the dust standard.
Valid Entries: Any valid date

Section 4.3 Mine Employment Database

This database contains mine employment information for 1991 underground coal mines only (subunits 1 and 2).

Name of database: PMINE_EM

Number of data records: 1,433

Field	Field Name	Type	Width	Dec	Begin Column	End Column
1	MINE_ID	Numeric	7		1	7
2	NUM_EMP	Numeric	5		8	12
** Total **			12			

Field by Field Explanation:

1. MINE_ID - Mine ID
   Description: Mine Identification Number assigned by MSHA to identify the mining operation.
   Valid Entries: Numeric

2. NUM_EMP - Number of Employees
   Description: Number of employees for the mine. This contains 1991 3rd quarter Part 50 coal employment information, if available. If the 3rd quarter information was not available, the 2nd quarter information was used; if neither the 2nd or 3rd quarter information was available, the 4th quarter information was used.
   Valid Entries: Numeric

Section 5. TABLES of CODES and FORMS

5.1 Coal Mine Occupational Titles and Codes

Underground Section Workers (Face)

001 Belt Man/Conveyor Man
002 Electrician
003 Electrician Helper
004 Mechanic
005 Mechanic Helper
006 Rock Duster
007 Blaster/Shooter/Shotfirer
008 Stopping Builder/Ventilation Man/Mason
009 Supply Man
010 Auger (Jack Setter) (Intake Side)
011 Wireman
012 Roof Bolter (Twin Head) (Intake Side)
013 Cleanup Man
014 Roof Bolter (Twin Head) (Return Side)
015 Fan Attendant
016 Laborer
017 Auger (Timberman) (Return Side)
018 Auger (Timberman) (Intake Side)
019 Roof Bolter Mounted (Intake Side)
031 Shotfirer Helper
032 Brattice Man
033 Coal Drill Helper
034 Coal Drill Operator
035 Continuous Miner Helper
036 Continuous Miner Operator
037 Cutting Machine Helper
038 Cutting Machine Operator
039 Hand Loaders
040 Headgate Operator
041 Jack Setter (Longwall)
042 Loading Machine Helper
043 Loading Machine Operator
044 Longwall Operator (Tailgate Side)
045 Rockman
046 Roof Bolter (Single Head)
047 Roof Bolter Helper (Single Head)
048 Roof Bolter Mounted (Return Side)
049 Section Foreman
050 Shuttle Car Operator
051 Stall Driver
052 Tailgate Operator
053 Utility Man
054 Scoop Car Operator
055 Auger (Jack Setter) (Return Side)
060 Longwall (Return-Side Face Worker)
061 Longwall (Return-Side Fixed Position)
064 Longwall Operator (Headgate Side)

5.1 Coal Mine Occupational Titles and Codes (Cont'd)

Underground Section Workers (Face) (Cont'd)

070 Auger Operator
071 Auger Helper
072 Mobile Bridge Operator
073 Shuttle Car Operator
074 Tractor Operator/Motorman

General Underground (Non-Face)

101 Belt Man/Conveyor Man
102 Electrician
103 Electrician Helper
104 Mechanic
105 Mechanic Helper
106 Rock Duster
108 Stopping Builder/Ventilation Man/Mason
109 Supply Man
110 Timber Man
111 Wireman
112 Belt Vulcanizer
113 Cleanup Man
114 Coal Sampler
115 Fan Attendant
116 Laborer
117 Rodman
118 Oiler/Greaser
119 Welder
122 Coal Dump Operator
123 Transit Man
146 Roof Bolter
149 Bullgang Foreman/Labor Foreman
154 Belt Cleaner
155 Chainman
156 Rock Driller
157 Pumper
158 Rock Machine Operator
159 Water Line Man
160 Shopman

Underground Transportation (Non-Face)

201 Belt Man/Conveyor Man 265 Dispatcher
216 Trackman 269 Motorman
220 Cager 273 Track Foreman
221 Hoistman 276 Driver
240 Loader Head/Roscoe Operator 277 Buggy Pusher
250 Shuttle Car Operator
261 Battery Station Operator
262 Brakeman/Roperider

Surface

301 Conveyor Operator
302 Electrician
303 Electrician Helper
304 Mechanic
305 Mechanic Helper
306 Welder (Non-Shop)
307 Blaster/Shooter/Shotfirer
308 Mason
309 Supply Man
310 Scraper Operator
311 Wireman
312 Belt Vulcanizer
313 Cleanup Man
314 Coal Sampler
315 Fan Attendant
316 Laborer/Blacksmith
317 Rodman
318 Oiler/Greaser
319 Welder (Shop)
320 Cage Attendant/Cager
321 Hoist Engineer/Operator
322 Coal Strip Operator
323 Transit Man
324 Backhoe Operator
325 Diester Table Operator
326 Forklift Operator
327 Pumper
328 Utility Man
329 Vacuum Filter Operator
331 Clam Operator
333 Coal Drill Helper
334 Coal Drill Operator
340 Boom Operator
341 Beltman/Conveyor Man
342 Bit Sharpener
343 Car Trimmer/Car Loader
344 Car Shake-Out Operator
345 Crusher Attendant
347 Froth Cell Operator
348 Machinist
349 Rotary Dump Operator
350 Shuttle Car Operator
351 Scoop Operator
352 Steel Worker
354 Sweeper Operator
355 Chairman
356 Rock Driller
357 Washer Operator
358 Water Circuit Operator
359 Self-Propelled Compactor Operator
360 Shopman Repair Cars
362 Brakeman
365 Dispatcher
366 Waterboy
367 Coal Shovel Operator
368 Bulldozer Operator
369 Motorman/Locomotive Operator
370 Auger Operator
371 Auger Helper
372 Barge Attendant
373 Car Dropper
374 Cleaning Plant
375 Road Grader
376 Coal Truck Driver
377 Road Roller Operator
378 Crane Operator
379 Dryer Operator
380 Fine Coal Plant Operator
381 Hoist Operator/Helper
382 High Lift Operator/ Front End
383 Highwall Drill
384 Highwall Drill Operator
385 Lampman
386 Driver
387 Rotary Bucket
388 Scalper-Screen
390 Silo Operator
391 Stripping Shovel Operator
392 Tipple Operator
393 Weighman
394 Carpenter
395 Water Truck
396 Watchman
397 Yard Engine Operator
398 Groundman

5.1 Coal Mine Occupational Titles and Codes (Cont'd)

Supervisory and Staff

402 Master Electrician
404 Master Mechanic
414 Dust Sampler
418 Maintenance Foreman
423 Surveyor
430 Assistant Mine Foreman/Assistant Mine Manager
449 Mine Foreman/Mine Manager
456 Engineer (Electricity/Ventilation/Mining)
462 Fire Boss Pre-Shift Examiner
464 Inspector
481 Superintendent
489 Outside Foreman
494 Preparation Plant Foreman
495 Safety Director
496 Union Representative
497 Timekeeper
497 Clerk/Timekeeper

MSHA - State

590 Education Specialist
591 Mineral Industrial Safety Officer
592 Mine Safety Instructor
593 Safety Representative
594 Training Specialist

5.2 Mining System Type Codes

Code	Description
01	Longwall Shear
02	Longwall Plow
03	Continuous Ripper
04	Continuous Bore
05	Continuous Auger
06	Continuous Short Wall
07	Conventional/Cutting Machine
08	Scoop/Cutting Machine
09	Scoop Shooting of Solid (SOS)
10	Scoop SOS/LD Machine
11	Hand Load Cutting Machine
12	Hand Load SOS
13	Hand Load Anthracite

5.3 Most Commonly Used Type of Machine Codes

Code	Description
071	Continuous
070	Continuous Miner (Auger, Boom, Roadleader, Helimer)
072	Continuous, with Integral Roof Drills & Dust Collect Systems
030	Conveyors (Feeder Breaker, Bridge Carrier, Complete System)
074	Cutting Machines
016	Face Drill (Drill Jumbo, Auger, Coal, Vertical)
026	Loading Machine
024	Longwall Component Retriever/Transporter (Chock Hauler)
073	Longwall Mining System
078	Longwall Shearer
013	Roof/Floor Drills and Roof/Floor Bolters
075	Shortwall
050	Shuttle Car (Torkar, Electrical, Ramcar)

5.4 Most Commonly Used Manufacturer Codes

Code	Description
0018	Alpine Equipment
0091	British Jeffrey
0213	Dosco
1035	Eickhoff
0224	Eimco
0840	Fairchild
0252	Fletcher
0316	Goodman Equipment Corp.
1526	Heintzmann
0164	Ingersoll-Rand (acquired by Simmons-Rand)
0396	Jeffrey
0408	Joy Technologies
0416	Kersey
0418	Kloeckner-Becorit
0444	Long-Airdox
0472	Mescher Mfg. Co., Inc.
0419	Mitsui-Miike
0663	Pettito Mine Equipment Repair
0654	Royal Machine Works, Inc.
0164	Simmons-Rand (Lee Norris)
0839	Voest-Alpine
0838	Westfalia-Lunen

5.5 Dust Control Plans - Water Spray Location Codes

Code	Description
01	Cutting Sprays (eg. head, drum, shearer, bar, etc.)
02	Conveying Sprays (eg. conveyor throat, panline, gathering arms, stage loader)
03	External Sprays (eg. fan sprays, machine mounted sprays other than cutting sprays, shearer clearer)
09	Unspecified

5.6 Other Parameter Codes

Code	Description
10	EQUIPMENT
11	Equipment - Remote Control
12	Equipment - Dust Collectors
13	Equipment - Scrubbers
14	Equipment - Other
20	WATER
21	Water - Face Wetting Agents
22	Water - Face Sprays
23	Water - Outby Wetting Agents
24	Water - Outby Sprays (eg. roadways, etc.)
30	VENTILATION
31	Ventilation - Auxiliary Fans
32	Ventilation - Curtains
33	Ventilation - Tubing
34	Ventilation - Fan Sprays
35	Ventilation - Shearer Clearer
36	Ventilation - Personnel Placement

5.7 Void Codes

VOID CODES FOR RESPIRABLE DUST SAMPLES

Code	Description
ABN	Status is Abandoned
ANP	DA Not in Producing Status
BRK	Broken
CNR	Cassette Not Received
CON	Contaminated
CPN	Invalid Certification Number
DBN	Dated Before Citation
DIS	Discarded Sample (too old)
DNP	DWP Not in Producing Status
DNR	Dust Data Card Not Received
DTE	Invalid or Missing Data
EXC	Excess Sample
HLD	Hold
IMI	Invalid Part 90 Miner
INW	Invalid Initial Weight
IWG	Insufficient Weight Gain
IWS	Invalid Work Shift
MFP	Malfunctioning Pump
MIM	Cassette Did Not Match Card
MMO	Occupation Code - Method Mining Mismatch
MNP	Mine Not in Producing Status
NDO	Nondesignated Occupation
NON	Unapproved Equipment
NSS	Part 90 Miner Not in Sampling Status
OCC	Invalid Occupation Code
OSP	Oversize Particles
OVE	Operator Void - Equipment
OVL	Operator Void - Location
OVM	Operator Void - Miscellaneous
OVP	Operator Void - Production
OVR	Operator Void - Rain
OVT	Operator Void - Time
PDT	Predated
PRO	Invalid Production
QIT	Quartz Sample Improperly Taken
QLV	Quartz Laboratory Void
QNT	Unacceptable Time Frame
SAM	Invalid Sample Type
TME	Invalid or Missing Time
UNP	MMU Not in Producing Status
UWP	Unauthorized Work Position
WPE	Invalid Work Position

5.8 Spot Inspection Forms

The following pages contain the Spot Inspection Forms completed by the MSHA inspectors.

MINE DATA SHEET

Information to be Collected at the MSHA Office Prior to Mine Visit

Coal Company: ____________ Mine Name: ____________

Mine ID: ____________ MMU ID: ____________

Dates of Review: ____________ Mining Method: ____________

MSHA District Number: ____________

Information to be Collected from Management Informational System (MIS)

A. Average Production During Previous Three Bi-Monthly Sampling Cycles

______ ______ ______
1st 2nd 3rd

B. Average Concentration for all Samples for Designated Occupations and Designated Areas (Roof Bolters) for the Previous Three Bi-Monthly Sampling Cycles (in mg/m^3).

Designated Occupation/Occupation Code: ____________

______ ______ ______
1st 2nd 3rd

Designated Area (Roof Bolter)/Occupation Code: ____________

______ ______ ______
1st 2nd 3rd

C. Production and Sample Results Reported During Last MSHA Respirable Dust Technical Inspection (BAB):

Production ____________ tons

Concentration for DO ____________ mg/m^3

Concentration for DA (Roof Bolter) ______ mg/m^3

Information to be Collected from Methane and Dust Control Plan

Mine ID:______________________ MMU Number:______________________

A. Mining System

[ ] Longwall Type: [ ] Single Drum [ ] Double Drum [ ] Plow
Cut Sequence: [ ] Bidirectional [ ] Head-Tail [ ] Tail-Head
[ ] Continuous Type: [ ] Ripper [ ] Borer [ ] Auger
[ ] Conventional
[ ] Other, Specify: ______________

B. Dust Control Parameters - Ventilation

Method of Face Ventilation: [ ] Blowing [ ] Exhaust [ ] Combined
Face Ventilation Device: [ ] Curtain [ ] Tubing [ ] Combined
Is belt air used to ventilate working faces? [ ] Yes [ ] No
Is fan spray system used? [ ] Yes [ ] No
Depth of Cut: ________ ft Line Curtain Distance: ________ ft

Longwall Air Quantity: Intake ________cfm________fpm
Velocity (mid-face)________fpm
Tailgate ________cfm________fpm

Conventional/Continuous: Face: ________ cfm
Air Quantity Mean Entry Air Velocity ________ fpm
Last Open Crosscut: ________ cfm
Scrubber: ________ cfm

C. Dust Control Parameters - Water

Type of Machine______________ Manufacturer______________
Model Number______________ Approval Number______________

	Location	Number	PSI
1.	______________	______	______
2.	______________	______	______
3.	______________	______	______

Type of Machine______________ Manufacturer______________
Model Number______________ Approval Number______________

	Location	Number	PSI
1.	______________	______	______
2.	______________	______	______
3.	______________	______	______

D. Other Parameters (i.e., dust collectors, wetting agent, variance, wetting roadways and/or faces, etc.): ______________

____

E. Roof Bolter Plan Requirements:

Distance of Line Curtain From Machine Head: ______________ ft
Air Quantity (face): ______________ cfm

IN-MINE SAMPLING SHEET

'ine ID:_______________ MMU Number:________ Date:_________

A. Estimate Actual Production for Shift During Spot Sampling Visit __________tons

B. Physical Conditions of MMU

Face: [ ] wet [ ] damp [ ] dry
Roadways: [ ] wet [ ] damp [ ] dry [ ] compacted

C. Dust Control Parameters Observed - Ventilation

Depth of Cut __________ ft Line Curtain Distance __________ ft

Air Quantity Observed Longwall

Intake_________cfm_________fpm Intake_______cfm_________fpm

Vel (mid-face)_____________fpm Vel (mid-face)___________fpm

Tailgate_______cfm_________fpm Tailgate_____cfm_________fpm

Air Quantity Observed Continuous Miner / Conventional

Face _____cfm Face ____ cfm

Mean Entry Air Velocity _____fpm Mean Entry Air Velocity _____ fpm

Last Open Crosscut ________cfm Last Open Crosscut _________cfm

Scrubber _______cfm Scrubber ______cfm

D Dust Control Parameters Observed - Water

Type of Machine:______________________ Manufacturer:_________________________

Model Number:_________________________ Approval Number:_______________________

Location	Number	PSI
1. ____________________	_____	_____
2. ____________________	_____	_____
3. ____________________	_____	_____

Type of Machine______________________ Manufacturer__________________________

Model Number_________________________ Approval Number_______________________

Location	Number	PSI
1. ____________________	_____	_____
2. ____________________	_____	_____
3. ____________________	_____	_____

Other Parameters (i.e., dust collectors, wetting agent, variance, wetting roadways and/or faces, etc.): ______________________________

____

____

____

F. Is miner operator always located on intake air during cutting and loading operations?
[ ] Yes [ ] No

G. Roof bolt operations:

Are the roof bolter operations conducted on the intake side of the continuous miner ?
[ ] Yes [ ] No

Air Quantity (face)__________cfm

Distance of line curtain from machine head____________ft

H. Violations cited: (Indicate Quantity and Standard #'s violated) ______________________

____

I. Were dust control parameters changed during sampling? [ ] Yes [ ] No

J. Did the spot inspection meet the criteria for a BAB? [ ] Yes [ ] No

Comments:

Respirable Dust Laboratory Report

U.S. Department of Labor
Mine Safety and Health Administration

A. Mine ID Number	B. Mine Name	C. Company Name	
D. MMU/DA/SA ID Number	E. Average Production (last 30 prod. shifts)	F. Survey Conducted By	G. Samples Weighed By

	Sample 1		Sample 2			Sample 3			Sample 4			Sample 5			Sample 6		
H. Sampling Dates																	
I. Production This Shift																	
J. Occupation Code	Cassette	Conc	Cassette	Conc	Avg	Cassette	Conc	Avg	Cassette	Conc	Avg	Cassette	Conc	Avg	Cassette	Conc	Avg
K.																	
L.																	
M.																	
N.																	
O.																	
P.																	
Q.																	
R.																	
S.																	
T. Totals																	
U. Section Averages																	

V. Citation/Order Issued Yes ☐ No ☐ Type ________ Number of Citation ________		W. Reason For Void Samples
X. O.S.P. Checked	Y. Date Lab Analysis Comp.	Z. Comments

Mine ID ____________

EQUIPMENT AND CERTIFICATION INFORMATION TO BE COLLECTED AT THE MINE OFFICE

1. Are the sampling devices approved? [ ] Yes [ ] No

2. Verify sampling device calibration and if available, check the calibration of approximately three of the operator's/contractor's pumps with a soap film calibrator. Calibrated:

Pump 1	[ ] Yes	[ ] No
Pump 2	[ ] Yes	[ ] No
Pump 3	[ ] Yes	[ ] No

3. Are pump calibration records available? [ ] Yes [ ] No

4. Examine condition of pump and sampling equipment.

a.	Calibration mark on pump flowmeter?	[ ] Yes	[ ] No
b.	Condition of external tubing?	[ ] Good	[ ] Bad
c.	Condition of cyclone?	[ ] Good	[ ] Bad
d.	Condition of pump and batteries?	[ ] Good	[ ] Bad
e.	Is a functional voltmeter available to test the battery voltage?	[ ] Yes	[ ] No

5. Can the operator verify that preshift pump checks and calibrations are done when dust sampling is conducted by a contractor? [ ] Yes [ ] No HOW?____________

6. Check certification(s) for certified person; sampling.
Certified? [ ] Yes [ ] No
Comments:____________

Have a representative number of certified person(s) (1-5) demonstrate proficiency. Pump assembly and preshift checks.
Proficiency demonstrated? [ ] Yes [ ] No
Comments:____________

7. Check certification(s) for certified person; maintenance and calibration.
Certified? [ ] Yes [ ] No
Comments:____________

Have certified person demonstrate proficiency or verify that pumps are calibrated by a certified person (if done by contractor).
Proficiency demonstrated? [ ] Yes [ ] No
Comments: ____________

8. List all persons certified to conduct respirable dust sampling, calibration and maintenance of respirable dust pumps for this mine. (SEE SHEET D)

9. Estimate the maximum MMU shift production rate for the last bimonthly period for this MMU.________ tons

10. The average MMU shift production rate during the last bimonthly period while samples were not being collected was ____________ tons. How was this information obtained?

____

11. Contractor information, if applicable.

a. Company/contractor trade name:

____

b. Address of record:

____

c. Telephone number:

____

d. I.D. Number:

____

e. Operating official or owner:

____

f. Certified person; sampling:

____

g. Certified person; maintenance and calibration:

____

Mine ID ______________

LIST OF CERTIFIED PERSONS

NAME	SOCIAL SECURITY NUMBER	S/MC

SAMPLER---S MAINTENANCE & CALIBRATION---MC

DESIGNATED OCCUPATION INTERVIEW

1. What is your regular job title? ____________________

2. How long have you been doing this job?

   ____ 1. Less than 1 year
   ____ 2. 1 year or more

3. What is the respirable dust standard for this section?

   ____ 1. Correct
   ____ 2. Not correct

4. How many water sprays must be operating on this machine while you are loading coal?

   ____ 1. Correct according to plan
   ____ 2. Not correct according to plan

5. How much water pressure is required on this machine while mining coal?

   ____ 1. Correct according to plan
   ____ 2. Incorrect according to plan

6. How far back from the face can the end of the line curtain/ tubing be in this section?

   ____ 1. Correct according to plan
   ____ 2. Incorrect according to plan

Complete the Following by Selecting the Most Appropriate Answer

7. During the mining of coal the curtain/tubing is too far back from the face

   ____ 1. Continuously
   ____ 2. Several times a shift
   ____ 3. Once a shift
   ____ 4. Several times a week
   ____ 5. Once a week
   ____ 6. Never

8. During the mining of coal all the required water sprays are not working

   ____ 1. Continuously
   ____ 2. Several times a shift
   ____ 3. Once a shift
   ____ 4. Several times a week
   ____ 5. Once a week
   ____ 6. Never

9. During the mining of coal there is not enough air behind the line curtain

____ 1. Continuously
____ 2. Several times a shift
____ 3. Once a shift
____ 4. Several times a week
____ 5. Once a week
____ 6. Never

10. During the mining of coal there is not enough water pressure on the machine

____ 1. Continuously
____ 2. Several times a shift
____ 3. Once a shift
____ 4. Several times a week
____ 5. Once a week
____ 6. Never

11. When dust samples are collected, they measure miners' exposure to dust

____ 1. Accurately
____ 2. Somewhat accurately
____ 3. Inaccurately

12. When a dust sample is being collected on my occupation

____ 1. I mine more coal than I usually do
____ 2. I mine the same way I always do
____ 3. I mine the same way I always do but I make sure my air is up and my sprays are working right
____ 4. I mine less coal than I usually do

13. When dust samples are being collected on this occupation/ machine

____ 1. I wear the dust pump
____ 2. The dust pump is placed on the machine inby me
____ 3. The dust pump is placed on the machine outby me
____ 4. The dust pump is placed where I work most of the time
____ 5. The dust pump is placed away from where I work

14. During sampling, dust pumps are

____ 1. Operated eight hours from the time they enter the mine until they are taken out of the mine
____ 2. Sometimes shutoff for short periods
____ 3. Sometimes shut off for long periods, such as lunch
____ 4. Operated for short periods of time

15. During sampling, dust pump flow rates are checked

____ 1. At the beginning of the shift before mining is started
____ 2. Every hour during the shift
____ 3. An hour or two after the shift starts and at the end of the shift
____ 4. An hour or two after the shift starts
____ 5. I don't know

16. If a dust pump is placed on my occupation/machine and I change jobs for the day, I

____ 1. Take the pump with me
____ 2. Leave the pump on the machine or give it to the new operator
____ 3. Shut the pump off
____ 4. Would do something else with the pump

17. If a dust pump is placed on my occupation/machine and it does not run all day,

____ 1. I notify the person that placed or gave me the pump
____ 2. I notify the foreman
____ 3. I notify MSHA
____ 4. I do not notify anyone

18. I wear a dust respirator

____ 1. Always
____ 2. Very often
____ 3. Often
____ 4. Sometimes
____ 5. Never

19. The major health concern with respirable dust is:

____ 1. Temporary shortness of breath and increased allergic reaction
____ 2. Permanent lung damage that cannot be reversed
____ 3. Lung damage that can be reversed with reduced exposure to dust
____ 4. Adverse affects on hearing and eyesight

20. Do you check for the date, time and initials (preshift) of a supervisor when you enter a work area?

____ 1. Always
____ 2. Very often
____ 3. Often
____ 4. Sometimes
____ 5. Never

21. If you observe conditions that may increase respirable dust, what should you do?

_____ 1. Nothing; that would not be my responsibility
_____ 2. Correct the conditions immediately or report them
_____ 3. Notify MSHA
_____ 4. Report the conditions to the work crew on the next shift

22. When you have reported a condition that could increase respirable dust, what action was taken?

____ 1. Addressed immediately
____ 2. Addressed as time permitted
____ 3. Addressed before the next shift
____ 4. Addressed before the next time to sample
____ 5. Not addressed
____ 6. Question does not apply

23. Have you seen the MSHA poster concerning tampering with dust samples?

____ 1. Yes
____ 2. No

24. The maximum penalty a person could be given if convicted of tampering with dust samples is

____ 1. Six months probation
____ 2. Five years in jail
____ 3. Five years in jail and a $10,000 fine
____ 4. Nothing (but the company could be fined)

25. Which kills more miners each year?

____ 1. Roof falls
____ 2. Black lung and its side effects
____ 3. Electrical accidents

ROOF BOLTER INTERVIEW

1. What is your regular job title? ____________________

2. How long have you been doing this job?

____ 1. Less than 1 year
____ 2. 1 year or more

3. What is the respirable dust standard for this section?
____ 1. Correct
____ 2. Not correct

4. What are the requirements for face ventilation/air while you are roof bolting?

____ 1. Correct
____ 2. Not correct

5. The major sources of respirable dust affecting the roof bolter operator are:

____ 1. Dull bits and the depth of the holes being drilled
____ 2. Defective dust collection system and working on the return side of the miner (or DO)
____ 3. Defective dust collection system and excessive hydraulic pressure
____ 4. Dull bits and excessive vacuum pressure

Complete the Following by Selecting the Most Appropriate Answer

6. Bolts are installed with the roof bolting machine in the return air from the miner (or DO)

____ 1. Continuously
____ 2. Several times a shift
____ 3. Once a shift
____ 4. Several times a week
____ 5. Once a week
____ 6. Never

7. When dust samples are collected, they measure miners' exposure to dust

____ 1. Accurately
____ 2. Somewhat accurately
____ 3. Inaccurately

8. When a dust sample is being collected on my occupation

____ 1. I install more bolts than I usually do
____ 2. I bolt the same way I always do
____ 3. I bolt the same way I always do but I make sure my air is up, empty my dust box carefully and do not bolt in the return air off of the miner (or DO)
____ 4. I install less bolts than I usually do

9. When dust samples are being collected on this occupation/machine

____ 1. I wear the dust pump
____ 2. The dust pump is placed on the machine inby me
____ 3. The dust pump is placed on the machine outby me
____ 4. The dust pump is placed where I work most of the time
____ 5. The dust pump is placed away from where I work

10. During sampling, dust pumps are

____ 1. Operated eight hours from the time they enter the mine until they are taken out of the mine
____ 2. Sometimes shutoff for short periods
____ 3. Sometimes shut off for long periods, such as lunch
____ 4. Operated for short periods of time

11. During sampling, dust pump flow rates are checked

____ 1. At the beginning of the shift before mining is started
____ 2. Every hour during the shift
____ 3. An hour or two after the shift starts and at the end of the shift
____ 4. An hour or two after the shift starts
____ 5. I don't know

12. If a dust pump is placed on my occupation/machine and I change jobs for the day, I

____ 1. Take the pump with me
____ 2. Leave the pump on the machine or give it to the new operator
____ 3. Shut the pump off
____ 4. Would do something else with the pump

13. If a dust pump is placed on my occupation/machine and it does not run all day,

____ 1. I notify the person that placed or gave me the pump
____ 2. I notify the foreman
____ 3. I notify MSHA
____ 4. I do not notify anyone

14. I wear a dust respirator

____ 1. Always
____ 2. Very often
____ 3. Often
____ 4. Sometimes
____ 5. Never

15. The major health concern with respirable dust is:

____ 1. Temporary shortness of breath and increased allergic reaction
____ 2. Permanent lung damage that cannot be reversed
____ 3. Lung damage that can be reversed with reduced exposure to dust
____ 4. Adverse affects on hearing and eyesight

16. Do you check for the date, time and initials (preshift) of a supervisor when you enter a work area?

____ 1. Always
____ 2. Very often
____ 3. Often
____ 4. Sometimes
____ 5. Never

17. If you observe conditions that may increase respirable dust, what should you do?

____ 1. Nothing; that would not be my responsibility
____ 2. Correct the conditions immediately or report them
____ 3. Notify MSHA
____ 4. Report the conditions to the work crew on the next shift

18. When you have reported a condition that could increase respirable dust, what action was taken?

____ 1. Addressed immediately
____ 2. Addressed as time permits
____ 3. Addressed before the next shift
____ 4. Addressed before the next time to sample
____ 5. Not addressed
____ 6. Question does not apply

19. Have you seen the MSHA poster concerning tampering with dust samples?

____ 1. Yes
____ 2. No

20. The maximum penalty a person could be given if convicted of tampering with dust samples is

____ 1. Six months probation
____ 2. Five years in jail
____ 3. Five years in jail and a $10,000 fine
____ 4. Nothing (but the company could be fined)

21. Which kills more miners each year?

____ 1. Roof falls
____ 2. Black lung and its side effects
____ 3. Electrical accidents

INTERVIEW FOR CERTIFIED DUST SAMPLER OR PERSON RESPONSIBLE FOR HEALTH AND SAFETY AT THE MINE

1. What is your position with this company?__________________

2. How long have you been collecting dust samples?

   ___ 1. Less than 1 year
   ___ 2. 1 year or more

3. What is the respirable dust standard in coal mines?

   ____ 1. Correct
   ____ 2. Not correct

4. Does this mine have any sections or occupations on a reduced standard?

   ____ 1. Correct
   ____ 2. Not correct

5. Are the dust control plans for all your MMUs exactly the same?

   ____ 1. Correct
   ____ 2. Incorrect

Complete the Following by Selecting the Most Appropriate Answer

6. When company dust sampling is being conducted

   ____ 1. All the minimum requirements of the plan are followed
   ____ 2. Some of the minimum requirements of the plan are exceeded
   ____ 3. All of the minimum requirement of the plan are exceeded
   ____ 4. Samples are taken the way we normally mine, without consideration of the dust control plan

7. The MSHA requirement for persons who conduct any portion of respirable dust sampling is that they

____ 1. Must be trained
____ 2. Must be qualified
____ 3. Must be certified
____ 4. Must be designated by the superintendent

8. If you were told by someone that a pump did not operate the full eight hours, you would

____ 1. Send the sample to MSHA
____ 2. Send the sample to MSHA with a notation on the data card that the pump did not operate eight hours
____ 3. Discard the sample

9. When dust samples are being collected on a designated occupation or area

____ 1. The person wears the dust pump
____ 2. The dust pump is placed on the machine inby the person
____ 3. The dust pump is placed on the machine outby the person
____ 4. The dust pump is placed where the person works most of the time
____ 5. The dust pump is placed away from where the person works

10. If a dust pump is placed on a designated occupation/area and the person changes jobs for the day, he/she

____ 1. Takes the pump to the new job
____ 2. Leaves the pump on the machine or gives it to the new operator
____ 3. Shuts the pump off
____ 4. Would do something else with the pump

11. Dust pumps are required to be calibrated every

____ 1. 100 hours
____ 2. 150 hours
____ 3. 200 hours
____ 4. 250 hours
____ 5. Don't know

12. Concerning records of calibration on pumps used by a contractor,

____ 1. I have asked for a record
____ 2. I have not asked for a record
____ 3. The question does not apply

13. Before taking the test to be a certified dust sampler,

____ 1. I attended a formal training course conducted by MSHA
____ 2. I attended a formal training course conducted by a contract trainer
____ 3. I attended a formal training course conducted by the company
____ 4. I attended a formal training course conducted by a school or university
____ 5. I attended a formal training course conducted by some other organization
____ 6. I did not attend a formal training course

. Since receiving initial certification, I

____ 1. Have had formal retraining
____ 2. Have not had formal retraining

15. In order to do my job as a dust sampler better,

____ 1. A retraining course would be helpful
____ 2. A retraining course would not be helpful

16. Have any miners reported, to you within the last year, conditions that could increase respirable dust?

____ 1. Yes
____ 2. No

17. The policy at this mine regarding the correction of conditions that could increase respriable dust which have been observed or reported is to

____ 1. Address them immediately
____ 2. Address them as time permits
____ 3. Address them before the next shift
____ 4. Address them before the next time to sample

18. Have you seen the MSHA poster concerning tampering with dust samples?

____ 1. Yes
____ 2. No

19. The maximum penalty a person could be given if convicted of tampering with dust samples is

____ 1. Six months probation
____ 2. Five years in jail
____ 3. Five years in jail and a $10,000 fine
____ 4. Nothing (but the company could be fined)

20. I wear a dust respirator

____ 1. Always
____ 2. Very often
____ 3. Often
____ 4. Sometimes
____ 5. Never

21. Which kills more miners each year?

____ 1. Roof falls
____ 2. Black lung and its side effects
____ 3. Electrical accidents

5-14

5.9 Monitoring Inspection Forms

The following pages contain the Monitoring Inspection Forms completed by the MSHA inspectors.

IN-MINE MONITORING

Information to be Collected at MSHA Office Prior to Mine Visit

Coal Company: ____________________ Mine Name: ____________________
Mine ID: ____________________ MMU ID: ____________________
Dates of Review: ____________________ Mining Method: ____________________
MSHA District Number: ____________ MSHA Inspector: ____________________

A. Mining System

[ ] Longwall Type: [ ] Single Drum [ ] Double Drum
[ ] Plow Cut Sequence: [ ] Bidirectional [ ] Head-Tail [ ] Tail-Head
[ ] Continuous Type: [ ] Ripper [ ] Borer [ ] Auger
[ ] Conventional, Specify: ____________________

B. Dust Control Parameters - Ventilation

Method of Face Ventilation: [ ] Blowing [ ] Exhaust [ ] Combined
Face Ventilation Device: [ ] Curtain [ ] Tubing [ ] Combined
Is belt air used to ventilate working faces? [ ] Yes [ ] No
Is fan spray system used? [ ] Yes [ ] No
Depth of Cut: __________ ft Line Curtain Distance: ____________ ft
Longwall Air Quantity: Intake ________ cfm ________ fpm
Velocity (mid-face) ________ fpm
Tailgate ________ cfm ________ fpm
Conventional/Continuous: Face: __________ cfm
Air Quantity Mean Entry Air Velocity __________ cfm
Last Open Crosscut: __________ cfm
Scrubber: __________ cfm

C. Dust Control Parameters - Water

Type of Machine ____________________ Manufacturer ____________________
Model Number ____________________ Approval Number ____________________

Location	Number	PSI
1. ____________________	______	______
2. ____________________	______	______
3. ____________________	______	______

Type of Machine ____________________ Manufacturer ____________________
Model Number ____________________ Approval Number ____________________

Location	Number	PSI
1. ____________________	______	______
2. ____________________	______	______
3. ____________________	______	______

D. Other Parameters (i.e., dust collectors, wetting agent, variance, wetting roadways and/or faces, etc.): ____
____

E. Roof Bolter Plan Requirements:

Distance of Line Curtain From Machine Head: ____________________ ft
Air Quantity (face): ____________________ cfm

IN-MINE OBSERVATIONS

Mine ID:__________________ MMU Number:__________ Date:____________
Name of Inspector Observing Sampling: ______________ AR# ____________

A. Production for Shift During Monitoring Visit ________ tons

B. Physical Conditions of MMU

Face: [ ] wet [ ] damp [ ] dry
Roadways: [ ] wet [ ] damp [ ] dry [ ] compacted

C. Dust Control Parameters Observed - Ventilation

Depth of Cut __________ ft Line Curtain Distance _________ ft
Air Quantity Observed Longwall

Intake________cfm________fpm	Intake______cfm________fpm
Vel (mid-face)____________fpm	Vel (mid-face)____________fpm
Tailgate_______cfm_________fpm	Tailgate_____cfm________fpm

Quantity Observed Continuous Miner / Conventional

Face _____cfm	Face _____ cfm
Mean Entry Air Velocity ____fpm	Mean Entry Air Velocity ____ fpm
Last Open Crosscut ________cfm	Last Open Crosscut _________cfm
Scrubber _______cfm	Scrubber ______cfm

D. Dust Control Parameters Observed - Water

Type of Machine:__________________ Manufacturer:____________________
Model Number:_____________________ Approval Number:_________________

	Location	Number	PSI
1.	________________________	_____	_____
2.	________________________	_____	_____
3.	________________________	_____	_____

Type of Machine__________________ Manufacturer____________________
Model Number_____________________ Approval Number_________________

	Location	Number	PSI
	________________________	_____	_____
	________________________	_____	_____
3.	________________________	_____	_____

E. Other Parameters (i.e., dust collectors, wetting agent, variance, wetting roadways and/or faces, etc.): ____
____

F. Is miner operator always located on intake air during cutting and loading operations?
[ ] Yes [ ] No

G. Roof Bolter Operations:

Are the roof bolter operations conducted on the intake side of the continuous miner ?
[ ] Yes [ ] No
Air Quantity (face)__________cfm
Distance of line curtain from machine head____________ft

H. Violations cited: (Indicate Quantity & Standard #'s Violated) ______________________
____

INFORMATION TO BE COMPLETED WITH THE REPORT

Mine ID:________________ MMU Number:___________ Date:___________

1. Were the dust control parameters during sampling the same as in the approved dust control plan? [ ]Yes [ ] No
   If no, what was the difference?________________________________

2. Were any violations of the dust control plan issued during the inspection? [ ] Yes [ ] No
   Record quantity and standard(s) cited.________________________
   ____

3. Did the operator check and/or adjust the control parameters before beginning to sample? [ ]Yes [ ] No

4. Was the sampling pump checked on the surface before being placed on the occupation to be sampled? [ ]Yes [ ] No
   What was the total voltage of the batteries? _______Volts

5. What was the type and model of the sampler used? _____________
   ____

6. Was the proper designated occupation sampled? [ ] Yes [ ] No
   Occupation sampled (code):__________

7. Record the cassette number assigned to the occupation sampled.

   Cassette Number: Occupation Code:

8. Did the sampling unit remain on the designated occupation the entire shift? [ ] Yes [ ] No

9. When was the pump flow rate checked? ________ ________ ________

   By whom?____

   Is this person certified for conducting sampling? [ ] Yes [ ] No

10. What is the length of the normal working shift (minutes)?_____

11. Was the sampler operated portal to portal? [ ] Yes [ ] No

12. What was the actual production during the sampling shift?

   ______________ tons

Information to be Completed with the Report (Cont.)

13. What is the typical production when operator samples are taken?
_______________ tons

14. Was the sampling pump shut off at anytime during the shift?
[ ]Yes [ ] No If so, by whom?___________________________________

15. Who filled out dust data card?___________________________________

Who signs it? ____

16. How long did the sampling pump actually operate?_______Minutes

17. Does the sampling occur on consecutive shifts or on consecutive days? [ ] Consecutive shifts [ ] Consecutive days

18. Were the results of the previous bimonthly sampling cycle posted?
[ ] Yes [ ] No

19. In your opinion, was the sample result representative of the operating condition observed? [ ] Yes [ ] No
If not, why not? ____

20. What was the concentration of the sample observed? _____mg/m^3.

21. List the individual concentrations for this designated occupation for the previous Bi-Monthly sampling cycle.

Date	Concentration (mg/m^3)
______________	______________
______________	______________
______________	______________
______________	______________
______________	______________

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Report of the Statistical Task Team of the Coal Mine Respirable Dust Task Group.

United States.

1993
English Book 244, 254 p. ; 28 cm.
[Washington, DC] : US Department of Labor, Mine Safety and Health Administration,

"In May 1991, the Secretary of Labor directed the Mine Safety and Health Administration (MSHA) to conduct a thorough review of the program to control respirable coal mine dust, and to develop recommendations on how the program could be improved. This request followed the announcement the previous month of widespread tampering with respirable dust samples taken by mine operators....

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Title: **Report of the Statistical Task Team of the Coal Mine Respirable Dust Task Group.**

Corp Author(s): United States.; Mine Safety and Health Administration.; Coal Mine Respirable Dust Task Group. ; Statistical Task Team.

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SUBJECT(S)

Descriptor: Coal mines and mining -- Dust control -- United States.
Mine dusts -- Measurement.

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Class Descriptors: **LC:** TN314

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