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HEALTH HAZARD EVALUATION REPORT 71-21-22
HAZARD EVALUATION SERVICES BRANCH
DIVISION OF TECHNICAL SERVICES

Establishment	:	Raybestos-Manhattan, Inc. Crawfordsville, Indiana
Evaluation Conducted By	:	Raymond L. Hervin, Industrial Hygienist Raymond L. Ruhe, Industrial Hygienist Richard S. Kramkowski, Industrial Hygienist Steven K. Shama, M.D., Medical Officer Robert N. Ligo, M.D., Medical Director
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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

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HEALTH HAZARD EVALUATION REPORT 71-21
RAYBESTOS-MANHATTAN, INC.
CRAWFORDSVILLE, INDIANA

DECEMBER 1972

I. SUMMARY DETERMINATION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees to evaluate the potential health hazards associated with the grinding, drilling, milling-slotting and grooving operations of iron and copper based sintered metals at the Raybestos-Manhattan, Inc., Plant at 1204 Darlington Avenue, Crawfordsville, Indiana.

NIOSH investigators conducted an observational survey of these facility operations on December 15, 1971. It was concluded based upon information obtained at that time that the potential hazards to which workers were exposed were (1) dusts containing iron, copper, lead, magnesium, zinc, tin, antimony, molybdenum, graphite and silica, and (2) noise.

Follow-up environmental surveys conducted on February 29, March 3, and April 25-27, 1972 determined that none of the above contaminant dust air concentration levels exceeded any of the associated health standards promulgated by the U.S. Department of Labor (Federal Register, Part II, §1910.93, Tables G-1 and G-3). Sixty-one (61) air samples were obtained producing three hundred and thirty-seven (337) individual contaminant determinations. The only contaminant levels which approached the Federal standard were for silica, with a maximum level of approximately 75% of the standard. Levels of airborne lead were approximately 10% of the standard, 0.2 milligrams per cubic meter. All other contaminants were less than 10% of the associated standards.

Medical interviews with employees were conducted on May 18, 1972. A majority of workers reported symptoms previous to recent ventilation improvements which ranged from nose and throat irritation and morning cough to coughing up black colored material. All worked noted recent marked improvement or cessation of their symptoms. No employees were found to be symptomatic during the time of this survey.

Based upon the results of the environmental-medical study reported above, it is our determination that a hazard to the health of workers did not exist from exposure to the metallic substances or dusts investigated in operations at the time of our survey. However, in view of the reported symptomatology prior to ventilation changes, a number of recommendations have been submitted to management to provide for medical monitoring of employees for exposure to silica and for a more desirable working environment for all employees.

Sound levels measured in a number of drilling, slotting and grooving operations exceeded the standard for noise exposure (Federal Register, Part II, §1910.95, Table G-16). Exposure to excessive noise levels can produce permanent hearing loss in man. Recommendations in the area of noise have been suggested to management to obviate the observed hazard to the affected employees.

Copies of this Summary Determination as well as the Full Report of the evaluation are available to employees upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Bldg., Room 508, 5th & Walnut Streets, Cincinnati, Ohio 45202. Copies of both have been sent to:

a) Raybestos-Manhattan, Inc.
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region V

For purposes of informing the approximately fifty (50) "affected employees", the employer will promptly "post" the Summary Determination in a prominent place(s) near where affected employees work for a period of 30 calendar days.

II. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees of the Raybestos-Manhattan, Inc., at 1204 Darlington Avenue, Crawfordsville, Indiana.

The hazards evaluated concerned the exposure of employees to dusts from the grinding, drilling-punch press, milling-slotting and grooving operations involving sintered metallic materials. The preformed part is received from another department in the plant and is machined to the basic specifications of the customer. The final product is primarily sintered metal parts for use as gears and clutch plates in large equipment such as dozers and caterpillars. Operations involve approximately 50 machines (primarily grinders, drills, slotting and grooving equipment) in 10,000 square feet of plant space.

About 50 persons are employed in the grinding, drilling, slotting and grooving operations at the plant. The operations are currently conducted on a 3 shift-24 hours a day and 5 days a week basis. There are about 330 additional persons employed at the plant in other operations.

III. BACKGROUND HAZARD INFORMATION

A. Standards

The Occupational Health Standards as promulgated by the U.S. Department of Labor (Title 29 Code of Federal Regulations, Chapter XVII, Part 1910, subpart 1910.93 entitled Air Contaminants) applicable to substances of this evaluation are as follows:

Substance	Standard
Lead - Pb (as Pb)	0.2 mg/M^3 *
Copper - Cu (as Cu dusts, mists)	1.0 mg/M^3
Iron - Fe (as Iron Oxide)	10.0 mg/M^3
Zinc - Zn (as Zinc oxide fume)	5.0 mg/M^3
Magnesium - Mg (Magnesium oxide fume)	15.0 mg/M^3
Antimony and Compounds - (as Sb)	0.5 mg/M^3
Molybdenum - Mo (Soluble Compounds)	5.0 mg/M^3
Tin - (inorganic compounds, except oxides)	2.0 mg/M^3

*mg/M^3--milligrams of substance per cubic meter of air.

Silica **	
Respirable Dust	1.9 mg/M^3
Total Dust	5.7 mg/M^3
Graphite (natural)	15 millions of particles per cubic foot of air (Mppcf) based on impinger samples counted by light - field techniques.
Noise	90 dBA ***

** The following formulas were used in calculating the above health standards for dusts containing free silica:

$$\text{Respirable Dust} = \frac{10 \text{ mg/M}^3}{\% \text{ Free Silica} + 2}$$

$$\text{Total Dust} = \frac{30 \text{ mg/M}^3}{\% \text{ Free Silica} + 2}$$

The percentage of free silica used in the formulas was 3.2% as determined by respirable airborne samples.

***See Table II

B. Toxic Effects

Since other elements measured in the environmental survey were found to be in only trace amount, one may consider the inhalation of dusts contains copper, iron, graphite, silica and lead as the possible potential hazards. Inhalation of copper dusts is an irritant to mucosal membranes of the nose and pharynx and can lead to metal fume fever under certain conditions.[1] Both iron[2] and graphite[3] may lead to a benign pneumoconiosis which is a low order of severity and may take years to develop. The danger in graphite exposure is in its silica content which may be as high as 11 percent free silica.[3] Significant exposures to silica can lead to a permanent, disabling pulmonary disease. Symptoms of excessive lead absorption run the gamut from mild weakness and abdominal discomfort to severe weakness of muscles, abdominal pain and brain disturbances. Permanent kidney damage can be an end result.[4]

Prolonged exposure to noise encountered in industrial environments can produce permanent hearing loss. There is no known treatment for this type of injury. Hearing loss due to noise is insidious and generally requires an exposure over a period of years for damage to occur.

IV. HEALTH HAZARD EVALUATION

A. Initital Visit - Observational Survey

An initial hazard evaluation survey of the Raybestos-Manhattan, Inc., plant was made on December 15, 1971, by NIOSH representatives, Messrs. Raymond L. Hervin and Raymond L. Ruhe. The function of the National Institute for Occupational Safety and Health and its relation to Section 20(a)(6) of the Occupational Safety and Health Act of 1970 and the purpose of the visit was explained to Messrs. [redacted], Personnel Director; [redacted], Project Supervisor; and [redacted], Safety Director. The National Surveillance Network Part I questionnaire was completed with their assistance.

Mr. [redacted], an authorized representative of employees, joined Messrs. [redacted], and the NIOSH representatives during the walk-through evaluation survey of the plant. The following is a brief description of the process. The preformed sintered metal parts are received in the machining area from other departments and are machined, drilled, milled, grooved and slotted to the customers' specifications. There are many different metallic alloys of different composition involved in the operation but are primarily iron or copper based alloys with various amounts of copper, iron, lead, graphite, silica and other minor ingredients. There

are approximately 50 fairly large machines capable of machining thin flat gear and clutch parts of a few inches to around 2 feet in diameter, With a few exceptions, all machines appeared to have adequate local ventilation at the point of operation. The major exceptions noted were the two punch presses which had no ventilation.

One of the main potential health hazards appeared to be metal dust exposure from machining operations. Noise was considered the other main potential health hazard in the machining operations or areas.

A review of findings of the initial visit was made with Mr. [redacted], General Manager of Raybestos-Manhattan, Incorporated. As a result of this initial visit, it was determined that environmental measurements for appropriate metallic and nuisance dusts, exhaust ventilation, and for noise levels were needed in order to evaluate the required determinations of exposure levels to the alleged hazards involved in the machining operations of sintered metals. Also it was concluded that a medical evaluation of employees would be necessary to complete the evaluation.

B. Environmental Evaluation

1. Procedure

On February 29, and March 3, 1972, an environmental sampling survey was conducted by Messrs. Raymond L. Hervin and Raymond L. Ruhe to determine environmental exposures of employees during grinding, drilling-punch press, milling-slotting and grooving operations involving cooper and iron based metallic alloys. On April 25, 26, and 27, 1972, a follow-up sampling survey was conducted by Messrs. Richard S. Kramkowski and Raymond L. Hervin to obtain additional supporting information involving the machining operations of the iron compound which was in very little use during the first sampling survey. Samples involving the copper compound were taken on both sampling campaigns. There were only a few operations involving other compounds (e.g., graphitics, etc.) used during the survey, and only operations involving copper and iron based alloys could be adequately evaluated at the time. Ventilation measurements of local exhaust systems were made using an Alnor Jr. Velometer.

2. Methods

A total of 35 personal samples (breathing zone) and 26 general area samples were collected and analyzed for the contaminants of concern. Air was drawn through the collection filters at 1.7 liters per minute for an average period of four hours. Samples were collected on an HA or AA (pore size of .45 or .8 microns) - 37 mm diameter esters of cellulose membrane filters. Samples obtained for respirable dusts utilized a Dorr-Oliver 10 mm cyclone exhausting through the filter held in a

Millipore Field Monitor or Mine Safety Appliance Cassette with a Casella flow pulsation device between the pump and sampling head to minimize any flow pulsation from the MSA Model G battery operated vacuum pump. Total dust sampling consisted of similar cassettes (open face) attached with tygon to the vacuum pump. The general area air sampling devices were located in specific fixed locations in the working environment. Personal air sampling devices were worn by the employees.

Some areas of high noise level were observed during the survey. It has been determined that "substances" as presently defined in Section 20(a)(6) of the Act do not include physical agents. However, for completeness of our overall responsibilities for acknowledging any occupational hazards encountered during an evaluation of a place of employment, noise levels are measured and reported.

3. Survey Results

There were a total of 61 air samples obtained during the survey and 337 analytical determinations made by the Division of Laboratories and Criteria Development, NIOSH, Cincinnati, Ohio. Atomic absorption methods were used for analysis of Pb, Cu, Fe, Zn, Mg, Sb, Sn, and Mo, with a minimum detection limit in mg/filter of 0.0003, 0.0001, 0.002, 0.0001, 0.0003, 0.005, 0.001, and 0.005 respectively. Gravimetric methods were used for analysis of total dust and respirable dusts with a minimum detection limit of 0.1 mg/filter. Colorimetric methods (N.A. Talvitie) were used for the determination of free silica with a minimum detection limit 0.01 mg/filter. Antimony, molybdenum and tin were not detected in any of the samples, and only trace amounts (less than 0.40 mg/M^3) of zinc and magnesium were found in the samples. The low results for these elements show them to be less than two percent of the appropriate health standards. Hence, the above elements are not considered as a health hazard and are not discussed further in this report.

Table I shows the maximum and average air concentrations of each measurable contaminant for the general area and personal air samples obtained during the survey of (a) Grinding Operations, (b) Drilling and Punch Press Operations, and (c) Milling, Slotting and Grooving Operations. The following discusses the results from Table I.

a. Grinding Operations

The results show that none of the health standards were exceeded during the survey. The results ranged from a minimum of less than 5 percent (Fe) to a maximum of 74 percent (SiO_2-Respirable Dust) of appropriate health standards. Only two sample results (SiO_2-Respirable Dust) exceeded 50 percent of a health standard.

b. Drilling and Punch Press Operations

The results show that none of the health standards were exceeded during the survey. The results ranged from a minimum of less than 5 percent (Fe) to a maximum of 53 percent (SiO_2-Respirable Dust) of appropriate health standards. It should be noted that the dust load did not appear to vary as much as other locations on a short term basis since air hoses were used on a limited scale in this area.

c. Milling, Slotting and Grooving Operations

The results show that none of the health standards were exceeded during the survey. The results ranged from a minimum of less than 5 percent (Fe) to a maximum of 74 percent (SiO_2-Respirable Dust) of appropriate health standards. Only two sample results exceeded 50% of a health standard.

d. General Discussion of Air Sample Results

Graphite was not included in the above analytical results as there were no appropriate sampling or analytical techniques available to make an adequate determination for graphite under the conditions of the survey. In considering graphite as a potential hazard, it is noted from the book entitled, "Documentation of the Threshold Limit Values for Substances in Workroom Air", that the amount of free silica is a major consideration for the graphite standard.

The data from the environmental survey shows that no health standard was exceeded during machining operations of iron and copper based metallic alloys. The results of the survey indicate that dusts containing free silica are a main consideration in the evaluation of potential health hazards in these operations. Should other metallic compounds having a higher silica content be processed in the various machining operations, there is a possibility that the health standard may be exceeded.

e. Noise Measurements

The standards for occupational noise exposures as published in the Federal Register, Part II, §1910.95, Table G-16, are shown in Table II. Sound levels were measured with a General Radio Company Permissible Sound Level Meter, Type 1565-B in dBA with a slow response.

The general grinding area was 83 dBA, exposure of the grinding operators was 85 to 88 dBA with a maximum at front of machine of 90 dBA for short periods of time. There was no apparent noise level in excess of the standard as shown in Table III.

The punch press operator was exposed to 84 dBA background and up to a maximum of 93 dBA when the punch hits the metal. The standard (using formula in footnote from Table II) was not exceeded for the punch press operator.

The drill press operator was exposed from 91 dBA background to a maximum of 98 dBA and the standard was exceeded for the drill press operator.

The milling, slotting and grooving operators are exposed to levels 86 dBA of background noise and up to 98 dBA for short periods of time. Most of the operators are not exposed to noise levels in excess of the standard. However, three operators were exposed to noise levels which exceeded the referenced formula on operations involving the Roger's Groover #2, Small Groover #1, and Adcock-Shipley 425-1.

It should be noted that the company has a hearing conservation program and took action in those areas which exceeded the standard. The company has initiated procedures to control the noise by engineering methods and is having the workers wear properly fitted hearing protection until the noise is adequately controlled. The noise problems noted above were due to minor engineering problems such as a faulty bearing in the machine or a fin in the ventilation system.

f. Ventilation Measurements

The results of the ventilation systems servicing the machines are shown in Table III attached. The systems were specifically designed for the operations and the face velocity indicates they are adequate for all the operations involving the iron and copper based alloys. This is also confirmed by the dust sampling results. It is noted that the two punch presses are not ventilated. Consideration should be given to provide for some ventilation for the two punch presses particularly if the presses are used for compounds (other than Fe and Cu Compounds) which may be high in silica.

The ventilation system is "shaken down" (little or no flow) during the morning and afternoon break periods and during the lunch period on each shift. During the "shake down", the larger particles which are caught in the system but are not carried all the way, fall out of the system to the point of operation (e.g., grinder, drill, etc.) or on sides of system. This is an excellent method for assuring adequate ventilation of the machines and should, of course, be continued. However, it was noted that the dust load increases significantly at various operations during the "shake down" of the ventilation system. Employees are normally not in the area at the time due to the rest or lunch break in the work schedule. The ventilation systems and filter bags are inspected on a periodic basis to assure adequate flow.

C. Medical Evaluation

Approximately fifteen workers in the grinding, drilling, slotting and grooving operation during the 7:00 a.m. - 3:30 p.m. shift were interviewed regarding any health problems they might be having while on the job by Steven Shama, M.D. and Robert Ligo, M.D. of the NIOSH Medical Services Branch on May 18, 1972. A majority of workers reported symptoms ranging from nose and throat irritation, and morning cough, to coughing up black colored material prior to the time when the ventilation system was improved. All workers noted marked improvement, or cessation of their symptoms after the ventilation systems around the machines were improved. No employees were found to be symptomatic at the time of this medical survey.

D. Conclusions

It is our conclusion that a hazardous exposure to the workers in the areas studied from the above mentioned dusts does not exist. This conclusion is reached because of the absence of significant symptomatology among the workers after improvements were made in the ventilation system and because all potentially hazardous dusts were measured at levels well below those which have been noted to produce toxic effects.

V. RECOMMENDATIONS

Taking the above environmental and medical observations into account, we are making the following recommendations to insure the continuance of a healthy environment for all workers.

1. All agents measured by environmental air sampling were found in concentrations less than their accepted exposure standards. However, one of these agents deserves special attention. Silica was measured in several locations at approximately 75% of its accepted exposure standard. Exposure levels of this magnitude are not considered hazardous in light of data currently available in the literature. It is possible that hazardous levels of silica were present before the ventilation was improved and that safe levels could be exceeded in the future if the ventilation system should decrease in efficiency or materials change in composition sufficiently.

Since exposure to levels of silica above the accepted exposure standard can lead to permanent disabling lung disease, it is recommended that all workers involved in the operations under investigation should receive a chest X-ray and have forced vital capacity and FEV_1 measured now and at yearly intervals to monitor for possible effects of exposure to silica. Workers new to these operations should have these procedures performed prior to beginning work and also at yearly intervals.

2. The current effort to maintain a clean plant is adequate and should be continued in order to maintain air concentrations at acceptable levels during machining operations of iron and copper based compounds. The following items are recommended to decrease level of exposure to air contaminants:

a. The use of forced or compressed air for cleaning methods should be strictly curtailed or preferably forbidden in order to avoid short-term exposure to high dust concentrations during such cleaning operations. Consideration should be given to the use of a vacuum cleaning system or vacuum cleaners in lieu of forced air hoses to alleviate the short-term high dust loads during cleaning operations.

b. Periodic air sampling checks should be made of the operations to assure that appropriate health standards are not exceeded, and to implement appropriate engineering and/or administrative controls if any standards are exceeded.

c. It should be emphasized to employees the potential hazards of the contaminants under discussion and to make every effort to leave the work area during short-term rest and lunch breaks to avoid the possibility of exposure to high dust loads during "shake down" of the ventilation systems.

3. An environmental survey should be made of any operation in the area involving compounds, other than iron and copper based compounds, which may have significantly higher free silica content or other contaminants which were not included in the survey. If air levels exceed appropriate health standards then the use of Bureau of Mines approved respirators for pneumoconiosis producing dusts is recommended for personnel working in areas involving such compounds until adequate engineering and/or administrative controls are implemented.

4. The current hearing conservation program should be expanded to include any of the items below which may not now be part of the program.

a. Pre-employment, periodic, and termination audiometric examinations for employees potentially exposed to high noise levels.

b. Identification of areas and periodic evaluation of noise levels where noise may be a problem.

c. Elimination of noise at its source, by engineering methods where feasible.

d. Provide and encourage workers to wear properly fitted hearing protection where it is not feasible to control high noise levels by engineering methods, or until the high level is eliminated.

VI. REFERENCES

1. Industrial Hygiene and Toxicology, Volume II, Second Revised Edition - Frank Patty, editor, 1963 (pp 1035-1037).

2. Ibid - p. 1055.

3. Documentation of the Threshold Limit Values - American Conference of Governmental Industrial Hygienists, Third Edition, 1971 (pp 122-123), P.O. Box 1937, Cincinnati, Ohio 45201.

4. See Reference 1 - Chapter XXVI - Industrial Lead Poisoning.

TABLE I

CONTAMINANT AIR LEVEL CONCENTRATIONS (mg/M^3): RESULTS BY OPERATION

OPERATION		Pb	Cu	Fe	Silica Total Dust	Silica Respirable Dust
GRINDING OPERATIONS						
General Area Samples	: Maximum	.04	.33	.183	1.7	1.4
	: Average	.018	.056	.084	1.13	0.92
	: Number of Samples	8	8	8	3	4
Personal Samples	: Maximum	.04	.172	1.034	2.8	----
	: Average	.02	.066	.21	1.51	----
	: Number of Samples	8	8	8	4	----

NOTE: There were a total of 11 General Area Air Samples and 12 Personal Air Samples. One Sample may be used for several different analyses of contaminants.

DRILLING AND PUNCH PRESS OPERATIONS						
General Area Samples	: Maximum	.017	.070	.277	2.2	1.0
	: Average	.013	.025	.096	1.47	.78
	: Number of Samples	5	5	5	2	3
Personal Samples	: Maximum	.05	.37	.96	1.3	----
	: Average	.023	.120	.19	.86	----
	: Number of Samples	7	7	7	4	----

NOTE: There were a total of 6 General Area Air Samples and 8 Personal Air Samples. One sample may be used for several different analyses of contaminants.

TABLE I

CONTAMINANT AIR LEVEL CONCENTRATIONS (mg/M^3): RESULTS BY OPERATION

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OPERATION		Pb	Cu	Fe	Silica Total Dust	Silica Respirable Dust
MILLING, SLOTTING AND GROOVING OPERATIONS						
General Area Samples	: Maximum	.04	.28	.07	1.0	1.4
	: Average	.019	.061	.034	.9	.88
	: Number of Samples	6	6	6	2	2
Personal Samples	: Maximum	.08	.18	.14	1.1	----
	: Average	.035	.115	.071	1.07	----
	: Number of Samples	10	11	10	3	----
Federal Standard		0.2	1.0	7.0	5.7	1.9

NOTE: There were a total of 9 General Area Air Samples and 15 Personal Air Samples. One sample may be used for several different analyses of contaminants.

TABLE II

PERMISSIBLE NOISE EXPOSURES*

Duration Per Day, Hours	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1-1/2	102
1	105
1/2	110
1/4 or Less	115 Ceiling Value

*When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: C1/T1+C2/T2+Cn/Tn exceeds unity, then the mixed exposure should be considered to exceed the limit value. Cn indicates the total time of exposure at a specified noise level, and Tn indicates the total time of exposure permitted at that level.

Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

Table III

Ventilation Measurements On Systems Servicing Grinding, Drilling, Milling-Slotting and Grooving Machines (Ventilation provided at point of operation and exhausted through bag filter system).

OPERATION	FACE VELOCITY - feet per minute (fpm)
Grinder No. 205-1	375-400
Grinder No. 205-2	150-200
Grinder No. 205-3	300-400
Grinder No. 205-4	300-500
Grinder No. 205-5	500-600
Grinder No. 205-6	300-400
Grinder No. 205-7	200-300
Sander	800
Arter Heald #1 opening	800
Arter Heald #1 center of wheel	100
Arter Heald #2 opening	800
Arter Heald #2 center of wheel	100
Cincinnati Milling 420-2	500 at 3" intake
Cincinnati Milling 426-1	500-600 at 3" intake
Cincinnati Milling 420-3	600 at 3" intake
Cincinnati Milling 420-4	600-700 at 3" intake
Roger's Groovers and Slotters #3	500-600
Roger's Groovers and Slotters #2	600-650
Adcock & Shipley Slotters #9	600-700
Adcock & Shipley Slotters #10	600-700
Adcock & Shipley Slotters #8	800
Adcock & Shipley Slotters #7	800
Adcock & Shipley Slotters #6	600-700

OPERATION (cont'd)	FACE VELOCITY - feet per minute (fpm)
Adcock & Shipley Slotters #5	800
Adcock & Shipley Slotters #2	800
Small Deburing Sander by Sunburst #444	600
Sunburst Groover #444	600-800
Sunburst 443-1	600-700
Sunburst 443-2	200-300

NOTE: Ventilation measurements were made only on machines in operation at time of survey.