SPECIAL ASBESTOS DUST

&

PRELIMINARY INDUSTRIAL HYGIENE SURVEY

ABEX CORPORATION
American Brakeblok Division
Winchester, Virginia

Survey Conducted By:

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Asbestos exposures at the American Brakeblok Division of the Abex Corporation in Winchester, Virginia, are evaluated on February 7 to 11, 1972. Facility design and operations are described together with sampling procedures. Tabulated data on ventilation measurements and individual worker exposures to asbestos is provided based on findings of an earlier survey. Housekeeping practices and use of personal protective equipment are reviewed. The authors conclude that excessive asbestos exposures occur in the mixing and performing areas. Recommendations include development of mechanical asbestos loading method for the mixers, use of approved respirators, improved ventilation, and welding of blast gates once new ventilation systems are installed. ---

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INTRODUCTION

During the week of February 7-11, 1972, a special asbestos dust survey and a preliminary industrial hygiene were conducted at the American Brakeblok Division of the Abex Corporation, Winchester, Virginia. The main purpose of the asbestos dust survey was to evaluate the asbestos sampling technique used by the U.S. Public Health Service.

To date, the samples which were collected have not been analyzed; however, from past U.S.P.H.S. surveys and the present industrial hygiene survey, several conclusions can be drawn. The following paragraphs discuss plant operations and industrial hygiene practices along with conclusions and recommendations.

DESCRIPTION OF THE PLANT

The plant is located south of the city of Winchester and employs approximately 655 blue collar workers and 119 white collar workers. There is a doctor employed by Abex Corporation but he only visits this facility once or twice a year. A nurse is on duty full time however. A complete pre-employment physical is given and is repeated every two years. Chest X-rays are taken every year. Blood and urine samples are taken twice a year from those in the mixing area to check for lead. Abex employs an industrial hygienist full time. The Personnel Manager acts as the Safety Director and works through the foremen to implement safety programs.

The plant was constructed by Abex in 1947 for the purpose of manufacturing asbestos friction products. The total plant site consists of 44 acres with four main buildings amounting to 440,000 square feet. The buildings are two story structures with the mixing operations and dust collectors being located on the upper level.

Products of the plant include automotive, aircraft and industrial braking materials, ABK industrial bearings, and sintered metallic material for production of metallic friction products. Approximately 50 different braking material mixes are made by the company in order to comply with varying customer needs and specifications.

DESCRIPTION OF THE PROCESSES

Both extruded and dry process brake linings are made along with ABK bearing material. Sintered metallic materials are made in a separate building

and does not involve the use of asbestos. The following paragraphs give a brief description of the operations which make use of asbestos fibers.

A. Dry Process Brake Linings

The process by which dry process brake linings are made consists of the following steps:

1. Mixing
2. Preforming and Blending
3. Hot Pressing
4. Cutting and Trimming
5. Curing
6. Final Grinding and Drilling

Raw material mixing is done on the second floor. The various raw materials used in each mixture are dumped into a "Nauta" type mixer which thoroughly mixes the materials and empties to conveying carts on the first floor.

After the materials are mixed they are taken to preform stations where initial forming takes place. Preforming consists of placing a prescribed amount of mix into a mold and pressing with a hydraulic press until the materials cling together as one mass.

Following the preforming operations, the brake blocks are placed in a hot press for a period of approximately two hours. Hot pressing serves the purpose of allowing the resins to further bond the materials into a rigid body.

Finally, the blocks are ground to the proper thickness, drilled with the proper holes, inspected and packaged for shipment. Blocks are labeled with a brander machine.

B. Extruded Brake Linings

Extruded brake linings are made in the following steps:

1. Raw Material Mixing & Grinding
2. Extruding
3. Baking
4. Cutting
5. Final Curing
6. Final Grinding and Drilling

Raw material mixing is done in a manner similar to dry process lining productions, the only difference being that oils are added to form a damp paste. After the materials are mixed, they are emptied into conveying carts on the ground floor.

After mixing, the raw materials are extruded in the form of a tape which is wound into a coil. The coil is then placed in an oven for initial curing.

Following the initial curing operation, the coils are surface ground and cut to length on band saws. Depending on customer specifications, the lining may undergo another curing operation.

Finally the linings are drilled with the proper holes, finish ground, inspected, and packaged for shipment.

C. ABK Industrial Bearings

ABK industrial bearings are special wear and heat resistant bearing made by the company. The bearings are made by first impregnating a cloth with various resins and then winding this cloth or hot pressing it to form the product. These bearings are used quite extensively in iron and steel foundries.

SURVEY PROCEDURES

The main purpose of the asbestos dust survey conducted at the plant was to evaluate the asbestos sampling technique currently used by the U.S. Public Health Service. To do this, simultaneous samples were taken (85 pairs on the same side of the man and 23 sets on opposite sides) to check the reproducibility of the asbestos sampling under field conditions with relatively low concentrations. The majority of the sampling was conducted at the same machines in the cutting, grinding and drilling of auto linings for three consecutive days on the first and second shift in order to also supply data on variations of concentration of asbestos with the shift and day of week. The remainder of the samples came from the preforming and hot press areas. A special study was done to determine the effect of heavy background on sample results.

A preliminary industrial hygiene survey of the plant was also conducted to try to evaluate general housekeeping and ventilation systems.

INSPECTION OF THE PLANT

Potential Health Hazards: The major potential health hazards encountered were:

1. Exposure to asbestos dust
2. Exposure to lead from mixing operations

Caution needs to be exercised toward some of the raw materials (see Table 1) that are encountered. Indiscriminate use of such things as carbon black, litharge, and hexamethylenetetramine would be hazardous. Also, noise levels could be excessive in some areas.

Personal Protection: The only worker in the plant seen wearing a respirator was in the hot press area. Safety clothing such as rubber aprons and ear protection are provided where appropriate. Safety glasses are required of everyone inside the manufacturing area. There is a program to finance the purchase of safety shoes, but this is voluntary.

Ventilation: Local exhaust ventilation is used quite extensively with ductwork at almost all operations. The contaminated air is vented to 22 American Air Filter "Roto-Clone" type "N" wet dust collectors with a total design capacity of 314,740 cfm. Design specifications are given in Table 3. None of this air is recycled. The sludge from the wet collectors is taken through a series of three settling ponds to clear the water. A pumping station is located at the last pond to recycle some water. The water is evaporated and absorbed so none of it is allowed outside company property. Sludge is cleaned from the ponds about once a year and piled in mounds on company property.

Make-up air is provided, but not enough to prevent a noticeable negative pressure inside the plant. The total capacity of the make-up air is 155,000 cfm from 10 units.

Ventilation layouts of areas sampled during the special survey are shown in diagrams 2 and 3. Table 4 gives the results of the ventilation survey.

The method used to make the mixes is good in that raw materials are not handled by hand. A cart goes down a rail and under a series of hoppers each containing a part of the mix. The mixer stops the cart at the appropriate hopper and puts in that chemical. Each hopper is ventilated individually. The nice part about this system is that the chemicals are loaded by vacuum lines into the hoppers. Unfortunately asbestos cannot be included in this method since it is not a loose powder and is broken into the mix cart at the end by hand.

It appeared that the collection and disposal part of the ventilation system is adequate and performing as designed, but improvements could be made in the duct work and especially the hooding. The duct velocities are quite high, but more emphasis should be placed on using enclosed or flanged hooding as near the source of dust evolution as possible.

Housekeeping: In general the housekeeping was good. There is usually sufficient space in the aisleways. Painting and a general cleanup was in progress during the time of the survey. Brooms and a large vacuum floorsweeper were used for cleaning. The major problem in housekeeping was the frequent use of compressed air to blow off machinery.

CONCLUSIONS AND RECOMMENDATIONS

From this and past surveys, it appears that the areas of potentially excessive asbestos dust exposures are the mixing and preforming areas. The following are recommendations for some changes which are necessary to improve conditions at the plant:

1. A method needs to be developed for loading asbestos into the mixers which would eliminate hand loading. Until such a method is developed, asbestos mixers should wear Bureau of Mines approved respirators.
2. Ventilation improvements are indicated at the preforming stations. One such improvement would be to place hoods closer to the area of dust generation and use a more enclosing type hood. Another method would be to automate the block preforming operation as has been done for disc brake preforming.
3. More make-up air should be provided to prevent ventilation systems from being starved for air.
4. Once the modifications have been done on the ventilation systems and the systems are balanced, all blast gates should be welded in position to prevent them from being altered.

A P P E N D I X

TABLE #	*TITLE*
1	Potentially Hazardous Raw Materials
2	Abbreviations Used in Ventilation Diagrams
3	Dust Collector Design Data
4	Results of Ventilation Survey
5	Results of Past Surveys

FIGURE #	*TITLE*
1	Diagram of Plant Layout
2	Ventilation in Preform Area
3	Ventilation in Finishing Area

AMERICAN BRAKEBLOK
WINCHESTER VA. PLANT

FIGURE I

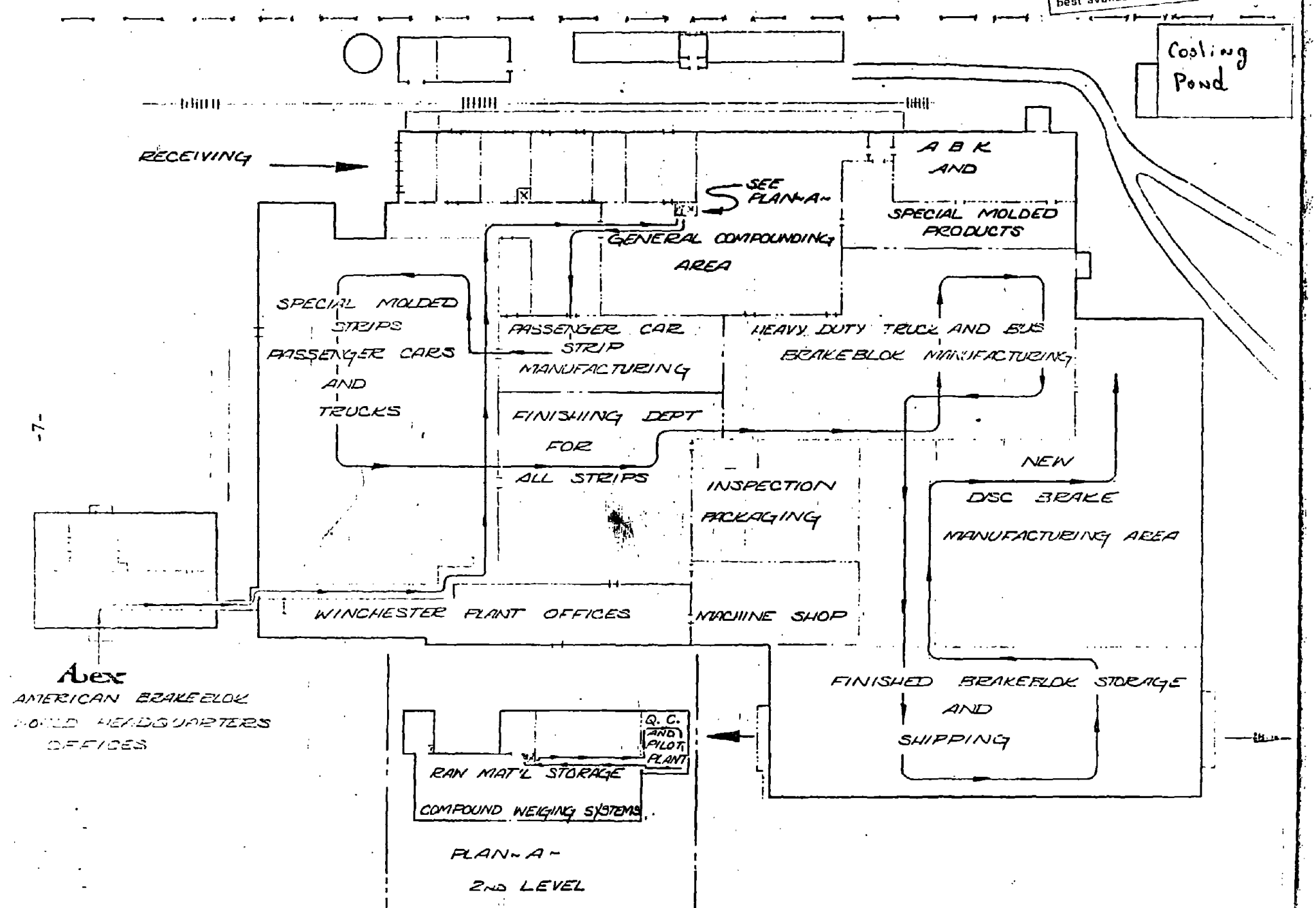
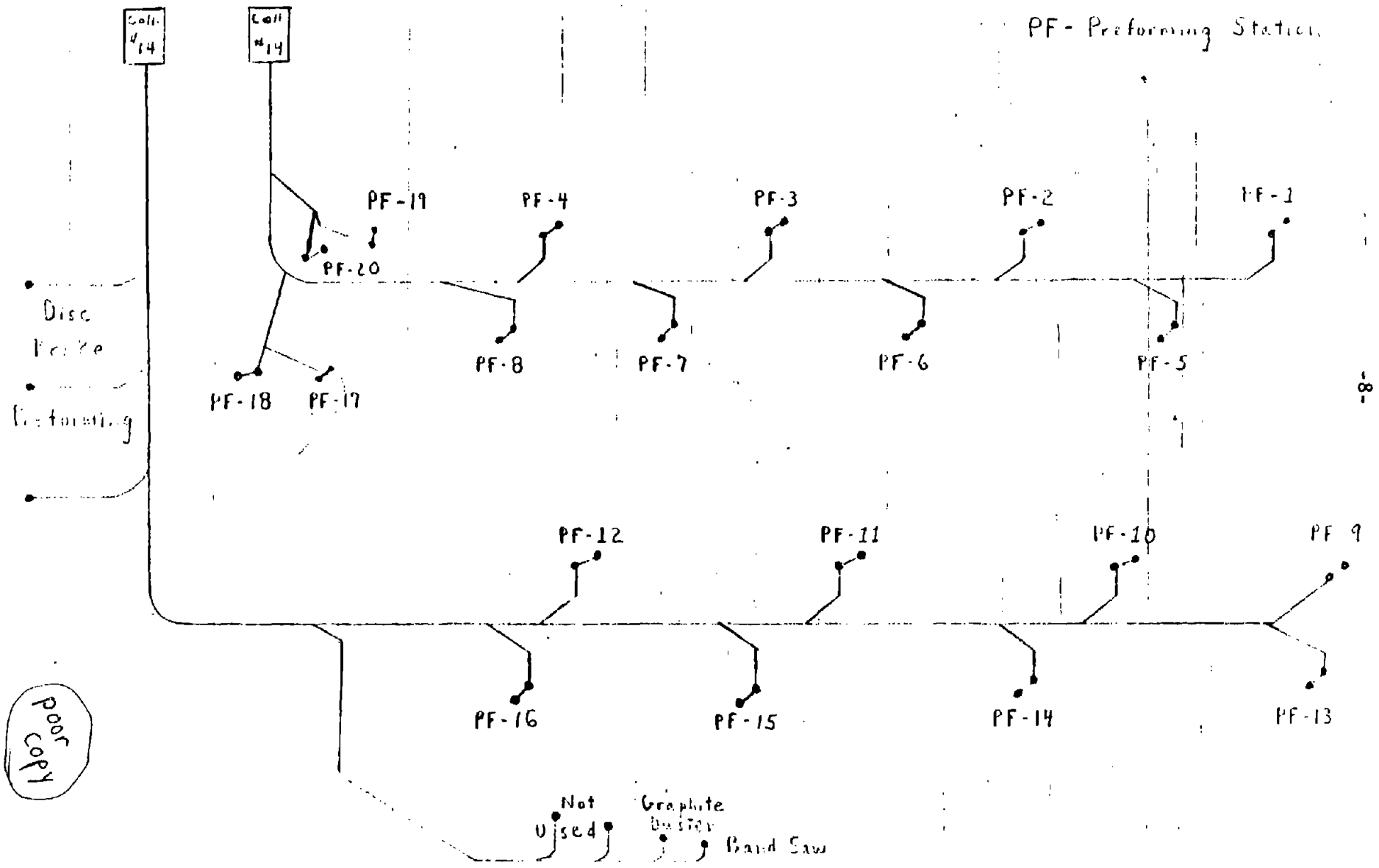


FIGURE II

Ventilation in Preforming Area



Ventilation in Finishing Area

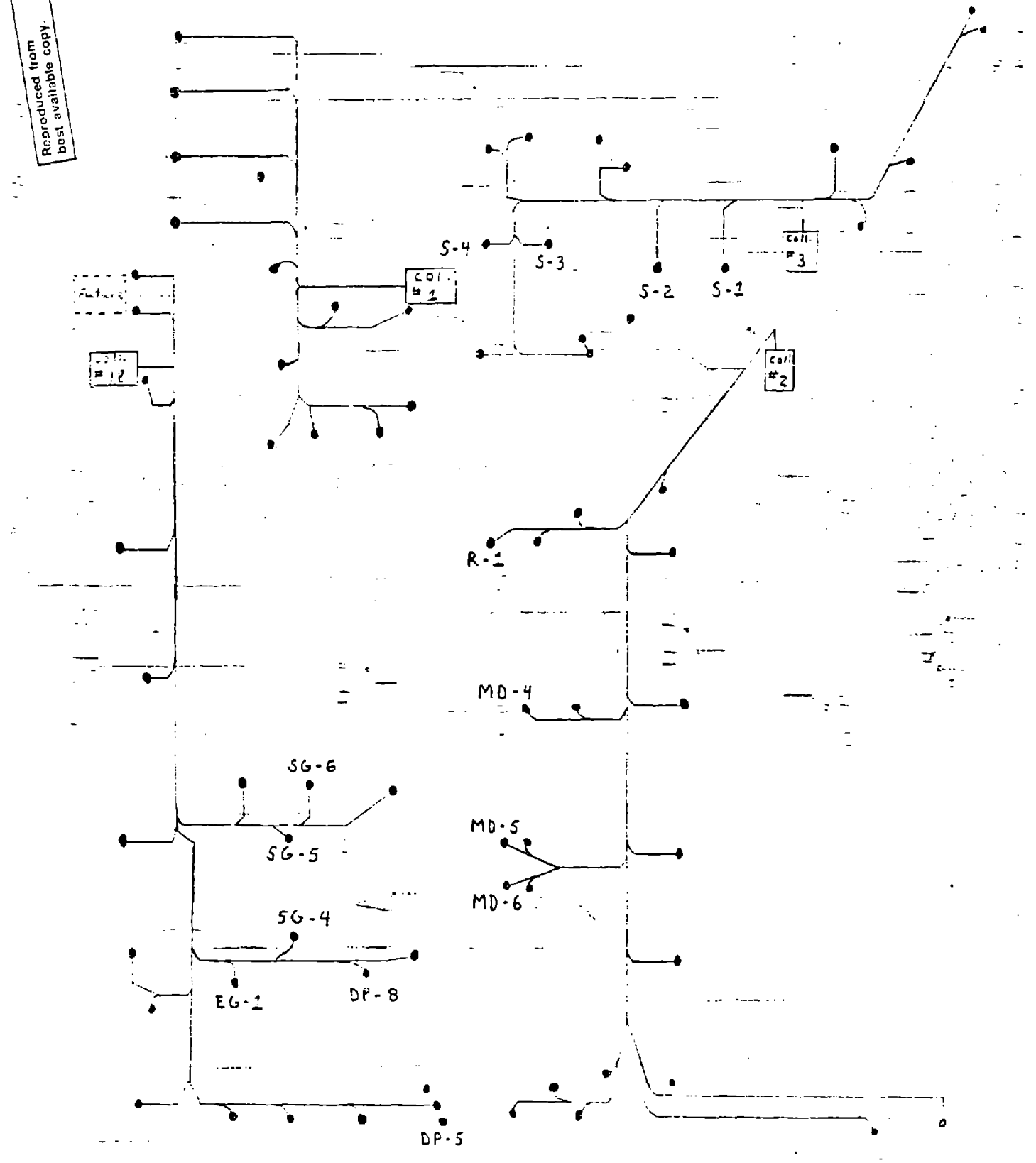


TABLE I

POTENTIALLY HAZARDOUS RAW MATERIALS
USED BY
ABEX CORPORATION
AMERICAN BRAKEBLOK DIVISION

1. Asbestos Fiber
2. Litharge
3. Lead Powder
4. Hexamethylenetetramine
5. Phenolic Resin & Polyrez Resin
6. Paints
7. Carbon Black
8. Coal
9. Zinc Dust & Zinc Powder
10. Nuisance Dusts

TABLE II

ABBREVIATIONS USED IN VENTILATION DIAGRAMS

Abbreviation	*Meaning*
DP	Drill Press
EG	Edge Grinder
MD	Multipress Drill
PF	Preforming Station
R	Ripper
S	Band Saw
SG	Surface Grinder

The following ventilation diagrams use the above codes and denote where the sampling was done during the special survey at Winchester in the preforming and finishing area.

TABLE III

WINCHESTER DUST COLLECTORS

ENGINEERING BULLETIN - #49

APR 15 1971

See PE-W404

Collector #	Location	Department Served	Type & Size	Motor			Timer Purch for Coll. #	Fan			Interlocked w/ heater #	Pump			JRS File # W-10	Control Drawing PE-	Blowpipe Drawing PE-	Blowpipe Installed	Collector Installed	Collector
				H.P.	R.P.M.	Oper'g Amps		R.P.M.	C.F.M.	Design Inlet Static		Style	H.P.	R.P.M.						
1	5JG7 Balcony	Strip Finishing	16N	60	1200	75	18	1042	16,000	6.15		2L6-CDQ	5	1200	-11B		W405 Sh 283	'70	'61	1
	5JK6 2nd	"	"	60	1200	70		1042	16,000	6.34		B-6-6	5	950	-11C		W405 Sh 2	'70	'60	2
3	6JK7 2nd	"	"	50	1800	66		1039	16,000	6.0	1	2L6-CDQ	5	1800	-11D		W405 Sh 3	'70	'55	3
4	8JK9 2nd	Wet Compounding	"	50	1800	60		1015	15,000	3.5		B-6-6	3	1800	-11		W214 Sh 1	'55	"	4
5	8JK9 2nd	(Idle)	20W	40	1200			1430	9,200	5.4		Gravity			-11		W219 Sh 2	'55	'55	5
6	8JK9 2nd	Dry Compounding	16N	50	1200	65		1074	15,000	6.0		B-6-6	5	950	-11			'55	'55	6
7	10QR11 Balcony	Block Compounding	16N	60	1200	65	8	1160	15,940	5.2		K	2	1200	-11	W228 Sh 6	W405 Sh 19	'55	'60	7
8	10QR11 Balcony	Block Preforming	16N	60	1200	65	8	1008	16,500	3.6	4	B-6-6	5	1200	-11F	"	W405 Sh 13	'67	'55	8
9	6ZZA7	Block Finishing	16N	50	1750	63	17	1060	16,000	7.2	5	Gravity			-11E	W228 Sh 3	W405 Sh 14	'67	'64	9
	16R17	A.B.K.	20N	75	1750	90		1121	22,000	6.17	8	Drag Out			-11A	W228 Sh 4	W405 Sh 16	'67	'66	10
12	13PQ14 2nd	Pilot Plant	12W	10	1160	12		2150	3,000	4.1		Gravity			-9		W266 Sh 7	'55	'55	12
13	13LM14	Coal Grinding	6N	15	1725	14		1480	5,500	6.0		2L6-CDQ	5	1800	-10			'59	'59	13
14	12ADAE15	Blanket Preforming	16N	50	1750	65	16	1042	16,000	4.86	7	2L6-CDQ	5	1200	-14	W228 Sh 3	W405 Sh 7	'67	'63	14
15	7ZZA8	Block Finishing	16N	50	865	52	17	1039	16,000	3.88	9	Gravity			-15	"	W405 Sh 14	'67	'63	15
16	6ZZA7	Block Finishing	20N	60	1750	68	17	1071	20,000	5.84	16	Gravity			-16	"	"	'67	'66	16
17	7ZZA8	Block Finishing	20N	60	1750	58	17	1073	20,300	5.04	6	Gravity			-16A	W228 Sh 5	"	'67	'66	17
18	9CD7 Balcony	Strip Finishing	20N	60	1800		18	1073	20,300	6.42	1/7	2L6-CDQ	5	1200	-16B	"	W405 Sh 2	'70	'70	18
	12ABAF15	Blanket															W405			

TABLE III (continued)

Collector #	*Location*	*Type*	*Motor H.P.*	*Fan C.F.M.*	*Design Inlet Static*
20	New Addition	16 N	50	16,000	4.69
21	Metallic Sintering Building	4 N		4,000	2.50
22	New Addition	20 N	60	20,000	4 - 6

Total Designed Exhuast Volume - 314,740 cfm

TABLE IV

RESULTS OF VENTILATION SURVEY

Machine	Machine Code	Hood Type	Volume CFM	Duct Diameter	Vented to Collector
Multiple Drill #4	MD- 4	Underneath	315	5"	2
Multiple Drill #5	MD- 5	Underneath	438	5"	2
Multiple Drill #6	MD- 6	Underneath	411	5"	2
Drill Press #5	DP- 5	At Drill	151	4"	18
Drill Press #8	DP- 8	At Drill	151	4"	18
Surface Grinder #4	SG- 4	Wheel Underneath	223 751	4" 6"	18
Edge Grinder #1	EG- 1	Underneath	771	6"	18
Surface Grinder #5	SG- 5	At Wheel & Underneath	680	7"	18
Surface Grinder #6	SG- 6	At Wheel & Underneath	---	7"	18
Lining Ripper #1	R - 1	Underneath	818	5"	2
Cut-Off Saw #1	S - 1	Blade & Underneath	1297	5"	3
Cut-Off Saw #3	S - 3	Blade & Underneath	522	5"	3
Cut-Off Saw #4	S - 4	Blade & Underneath	1269	5"	3
Preform Station #1	PF- 1				
Weigh Station		Slot	166	1 " x 15"	19
Overhead		Grate	416	10" x 15"	
Preform Station #20	PF-20				
Weigh Station		Slot	250	1 " x 15"	19
Overhead		Grate	700	10" x 15"	

TABLE V

American Drake Shoe Company
Results of Air Samples of September, 1965
Winchester, Virginia
Friction

Operation	Impinger		Membrane Filter			
	Sample #	mppcf	Sample #	Total	>5μ	
Mixing & Coating						
Compounder—ZZ	116	0.7				
	107	0.2	108	0		0
	202	0.2	203	0		0
	129	0.3	130	1.9		0.5
Personal			2	0.6	0.5	0.4
			29	9.2	7.0	3.1
			30	0.6	0.5	0.2
			205	1.6	1.2	0.5
			206	0.3	0.2	0.1
			209	0.2	0.1	0.1
Weigher—ZZ	10	0.4	11	0		0
	200	0.7	201	6.8		2.5
Personal			1	0.7	0.7	0.7
			3	1.1	1.4	0.6
			8	0.2	0.6	0.2
			207	3.0	2.5	1.4
Auto Roller Oper.—ZZ	43	0.3	44	11.0		0.0
	45	0.3				
Personal			22	1.5	1.2	0.4
			25	1.3	1.0	0.5
			26	0.5	0.4	0.2
			27	2.9	2.4	0.8
			28	0.7	0.6	0.4

NOTES ON ABBREVIATIONS

"Personal" refers to personal samples on membrane filters
"ZZ" refers to breathing zone samples by companion impinger & membrane filter
"Seq." refers to unattended samples taken by a sequential sampler
"Gen." refers to sample of general plant air in the particular department

American Brake Shoe Company

Operation	Impinger		Membrane Filter		
	Sample #	mppcf	Sample #	Total >5μ	10 μ +
Mixing & Coating - Continued					
Auto Roller Oper. — Personal (Contd.)			158	0.1	0.3 0.0
			159	0	0.0 0
			210	25.0	0.9 0.1
			211	8.9	1.6 0.4
			212	2.4	0.5 0.0
Hand Roller--Personal			213	3.7	0.5 0.1
			214	35.8	1.1 0.1
Sweeper--Personal			19	0.6	0.6 0.2
Service Man--Personal			20	0.7	0.6 0.4
Quality Control--Personal			21	1.3	1.0 0.3
Preform--Personal			7	1.4	1.0 0.6
Forming					
Hand Roll Operator--BE	139	0.4	140	2.5	0.6
Radius Roll--BE	353	0.4	354	12.9	3.3
	291	0.6	292	3.1	0.4
Personal			293	2.7	2.0 1.0
			297	4.2	1.4 0.7
			348	1.5	0.5 0.3
Preform Operator--BE	51	1.3	52	3.1	1.0
	137	1.2	138	7.6	1.6

American Brake Shoe Company

Operation	Impinger		Membrane Filter		
				fibers/cc	
	Sample #	mppcf	Sample #	Total	10-μ-F >5μ
Forming (Continued)					
Preform Operator--BZ (Cont'd.)	147	1.9	148	11.5	4.5
	162	0.4	163	0	0
	176	3.9	177	3.5	1.0
Personal			142	16.9 9.6	3.9
			144	7.7 5.4	3.2
			145	4.8 3.5	2.5
			146	4.6 3.1	1.6
			153	8.4 7.0	2.9
			154	6.3 5.5	3.0
			155	7.1 6.1	2.7
			157	1.5 1.7	1.0
			160	10.8 9.5	4.6
			161	7.5 6.3	2.9
Hand Roll Operator--BZ	139	0.4	140	2.5	0.6
Radius Roll--BZ	353	0.4	354	12.9	3.3
	291	0.6	292	3.1	0.4
Personal			293	2.7 2.0	1.0
			297	4.2 1.4	0.7
			348	1.5 0.5	0.3
Preform Operator--BZ	51	1.3	52	3.1	1.0
	137	1.2	138	7.6	1.6
	147	1.9	148	11.5	4.5
	162	0.4	163	0	0
	176	3.9	177	3.6	1.0

American Drake Shoe Company

Operation	Impinger		Membrane Filter			
	Sample #	mppcf	Sample #	Total	mppcc 10 μ +	>5μ
Forming (Continued)						
Preform Operator--Personal			142	16.9	9.6	3.9
			144	7.7	5.4	3.2
			145	4.8	3.5	2.5
			146	4.8	3.1	1.6
			153	8.4	7.0	2.9
			154	6.3	5.5	3.0
			155	7.1	6.1	2.7
			157	1.5	1.7	1.0
			160	10.8	9.5	4.6
			161	7.5	6.3	2.9
Hot Pressing						
Sweeper--Personal			60	0	0.1	0.0
Serviceman--Personal			89	2.6	1.0	0.7
			180	2.8		1.0
Cinching Forms--Personal (Form Fitter)			402	1.4	1.2	0.7
AMK & Press Oper.--DZ	84	0.1	83	0		0
Book Press Oper.--DZ (Hot)	185	1.1	186	1.6		0.9
Personal			181	5.3	4.0	1.5
Service Man, Hot Press			141	2.7	1.4	0.6
			143	3.9	1.4	0.5

American Brake Shoe Company

Operation	Impinger		Membrane Filter		
				mg/cc	
	Sample #	mppcf	Sample #	Total	10 μ +
					>5μ
Hot Pressing (Continued)					
Hot Press Oper.—BZ	63	1.0	04	0	0
	73	0.1	74	0.6	0.4
Personal			58	1.8 1.5	1.8
			59	3.4 2.5	0.7
			61	2.5 1.8	0.5
			62	0 0.1	0.0
			65	7.9 5.0	2.0
			66	2.9 2.1	0.9
			68	1.4 1.3	0.5
			70	2.6 2.2	0.9
			71	1.6 0.7	0.3
			72	3.3 1.6	1.2
			79	4.4 3.8	1.6
			80	4.3 3.6	2.2
			81	1.3 1.4	0.6
			82	0.2 0.1	0
			183	3.1 2.2	0.8
Baking					
Oven Oper.—BZ Conveyor	221	0.4	220	0.4	0.0
Personal			193	1.4 1.2	0.6
Oven Oper.—Personal			194	1.9 1.4	0.5
			403	5.4 3.1	1.2
			434	0.5 0.3	0.1

American Radiator Steel Company

Operation	Sample #	Type	Sample #	Total	>5μ
Grinding & Sanding					
Radius Roll—3E	245	0.5	227 244	0.0 3.5	0 1.4
Back Grinder—3E	241 243	0.3 0.4	242 243	1.3 8.2	0.2 4.3
Strip Grinder—3E	332	0.3	333	1.6	0.2
Auto Grinder—3E	431	1.9	432	5.5	1.4
Stock Grinder—3E	339	0.6	340	2.1	0.0
Double Disk Knock Grinder — 3E	489	1.7	490	0.6	0.2
Rough Grind—3E	611	1.2	610	1.6	0.2
Radius Grind—3E	612	1.9	613	3.9	0.3
Belt Grinder	703	3.7	704	9.0	3.4
Auto Grinder DP Block	705	0.8	706	5.8	1.9
Coil Grinder—3E	351	0.4	352	3.1	0.3
Personal			268	1.3	0.9 0.7
Strip Finish—Personal			269	6.9	3.5 1.3
Turner Oper.—Personal			334 336	12.9 3.0	3.5 2.1 1.0 0.3

American Brake Shoe Company

Operation	Impinger		Membrane Filter		
	Sample #	mppcf	Sample #	mppcf/cc Total	10 μ + >5μ
Grinding & Sanding (Continued)					
Coil Grinder			296	3.7	2.5 1.2
Double Disk Grinder—Personal			384	5.4	3.7 2.5
Sweeper—Personal			409	5.0	4.2 2.3
Auto Burr. Mach.—Personal			393	19.7	15.2 7.3
Printer—Personal			242	7.6	5.3 2.7
			267	23.1	2.9 0.5
			335	3.0	1.2 0.8
Back Grinder—Personal			249	7.9	3.6 1.4
			254	0.7	0.5 0.2
			255	2.3	0.6 0.2
			298	1.2	0.5 0.5
			338	4.4	2.7 2.2
			345	18.5	4.9 2.0
Finish Grind Block—Personal			497	[illegible]	6.6 [illegible]
			498	7.3	6.1 2.5
Strip Grind.—Personal			256	15.6	1.5 0.9
			257	0	0.0 0
			294	7.4	5.5 2.5
Chamfer. Oper.—Personal			243	1.7	0.7 0.3
			247	0.1	0.0 0.1
			301	14.3	2.5 1.2
			391	4.1	3.1 1.4
			270	5.6	1.2 0.8
			346	13.9	3.1 1.3

American Brake Shoe Company

Operation	Impinger		Membrane Filter		
	Sample #	mppcf	Sample #	Total mppcf	10 μ + mppcf >5μ
Grinding & Sanding (Continued)					
Face Grind--Personal			394	2.4	1.7 0.6
			395	10.2	8.1 2.9
			398	6.8	5.4 3.1
Cutting & Drilling					
Milling Mach. Oper.--Personal			387	6.8	5.6 2.4
			392	2.6	1.4 0.6
Printer--Personal			279	1.7	0.6 0.3
			389	13.3	9.8 4.6
Saw Oper.--BZ	326	0.4	327	5.1	1.4
Personal			258	1.8	1.0 0.4
			263	7.3	5.7 2.8
			266	4.3	3.2 1.1
			275	1.2	0.3 0.1
			295	1.5	0.6 0.2
			337	3.7	2.3 1.1
			340	2.4	1.5 0.7
			350	9.0	5.7 2.9
			386	6.1	4.8 2.1
Drill Operator--BZ	234	0.4	235	3.3	1.4
	306	0.2	307	6.6	3.8
	312	0.1	313	1.0	0.0
	614	1.5	615	3.5	1.0
			701	2.3	1.8
Personal			246	0.5	0.2 0.1
			247	2.0	0.2 0.1
			250	19.9	8.3 2.8

American Brake Shoe Company

Operation	Impinger		Membrane Filter		
				Fibers/cc	
	Sample #	mppcf	Sample #	Total	10 μ + >5μ
Cutting & Drilling (Continued)					
Drill Oper.—Personal (Cont'd.)			251	0.0	0.0 0
			252	1.5	0.9 0.4
			259	1.4	0.1 0
			260	48.4	1.7 0.2
			265	6.1	1.1 0.4
			269	4.4	2.0 1.1
			277	0.5	0.2 0.0
			280	3.1	2.2 1.5
			282	2.5	0.6 0.6
			396	13.0	10.2 3.1
			397	3.5	2.2 0.8
			700	6.7	4.9 1.7
Teflon — Personal Lathe Oper.			197	0.9	0.7 0.3
			198	2.1	1.4 0.6
Ball Joint Punch			395	3.2	2.1 0.7
			67	1.0	0.8 0.3
Cutter			401	3.7	2.6 0.7
Pexto Press			376	1.9	1.1 0.6
AEK Oven			199	3.5	1.2 0.6
Inspection & Packing					
Grouping—DE	368	0.3	369	4.7	1.0

American Brake Shoe Company

Operation	Impinger		Membrane Filter		
	Sample #	mppcf	Sample #	Total f/cc >5μ	10 μ +
Inspection & Packing (Continued)					
Box Segments —Personal Printer, Loader			377	1.6	1.0 0.5
			378	1.7	1.2 0.7
			380	1.4	1.2 0.6
Packer—Personal			382	1.8	0.9 0.3
			383	0.9	0.7 0.5
			470	1.8	1.4 0.5
			471	4.2	3.1 1.2
			472	2.6	2.1 0.9
			473	2.6	2.1 0.9
Inspection Dry — BX	459	0.8	460	1.2	0.2
	474	0.7	475	0.0	0.0
Personal			278	2.6	0.5
			308	19.1	14.3 5.8
			441	8.9	6.4 2.8
			447	7.2	5.1 2.1
			448	4.2	3.2 1.4
			470	5.3	4.0 1.9
			499	9.9	7.8 3.4
Wet—BX	366	0.3	367	0.6	0.0
	445	0.1	446	0	0.0
	487	0.9	488	1.6	0.0
Personal			439	1.9	1.3 0.6
			443	1.4	1.2 0.7
			444	1.2	1.0 0.5
			449	7.5	5.7 2.5
			451	3.1	2.2 0.8

American Drake Shoe Company

Operation	Impinger		Membrane Filter		
	Sample #	mppcf	Sample #	f/cc Total	f/cc 10 μ + >5μ
Inspection & Packing (Continued)					
Wet--Personal (Cont'd.)			452	5.0	3.3 1.3
			453	3.1	1.7 0.8
			461	5.4	1.7
			462	0.7	0.6 0.3
			464	4.3	3.5 1.3
[illegible]					
Leader--Personal			442	1.7	0.6
Miscellaneous					
Shipping Checker--Personal			379	0	0 0
[illegible] Slitter--Personal			204	2.7	1.0 0.8
Printer--Personal			500	2.1	1.0 0.6
PC Room--Personal			411	2.9	2.4 1.3
Electrician--Personal			405	1.4	1.3 0.8
			406	1.4	1.2 0.4
			410	1.0	0.9 0.4
Maint. Crew--Personal			400	0.6	0.4 0.1
			454	3.3	1.5 1.1
			472	1.7	0.9 0.5
			413	1.8	1.2 0.4

Results of Air Samples of December, 1960

American Brake Shoe

Winchester, Virginia

Operation		Impinger		Membrane Filter	
		Sample #	mmpf	Sample #	Fibers (>5u)/ml
Mixing, Extruding and Coating					
Preform Operator	P			102	1.92
				111	2.14
				173	6.84
				176	1.97
	B	033	1.2		
Powder Man	P			201	0.14
Weigher	P			205	0.55
	B	078	0.8		
Wet Mix Operator	P			202	0.10
	G	055	0.3		
		013	0.1		
		057	0.5		
		064	0.4		
Forming					
Auto. Roller Operator	G	071	1.0		
Hot Pressing					
Press Operator	P			114	0.29
	B			032	0.64
		031	0.1		

NOTES: B = Breathing zone simultaneous impinger-membrane filter samples.

P = Personal membrane filter samples collected by a sampling pump worn by the workers.

G = General air samples.

American Drake Shoe Co.--Winchester, Virginia (cont.)

Operation		Impinger		Membrane Filter	
		Sample #/	mmcf	Sample #/	Fibers (>5μ)/ml
Block Press Operator	P			190	2.71
				196	2.10
	G	007	<0.1		
		029	0.5		
Baking					
Oven loader	P			116	0.56
				150	0.54
Grinding and Sanding					
Radius Roller	P			121	1.39
				147	0.75
Deck Grinder	B	045	0.4		
Strip Grinder	P			137	1.68
				155	8.73
	B	047	0.6		
Grinder	P			192	1.00
Radius Sander	B	076	1.2		
Burr Grinder	P			135	2.18
				145	2.04
	G	021	0.5		
Cutting and Drilling					
Hand Driller	P			159	0.70
				182	0.12
	B	049	0.5		
Auto Driller	P			138	1.08
Coil Saw Operator	P			129	0.55
				133	0.52
				134	0.45

American Brake Shoe Co.-- Winchester, Virginia (cont.)

Operation		Impinger		Membrane Filter	
		Sample #	mmcf	Sample #	Fibers (>5μ)/ml
Emery Saw	B	074	1.9		
Lathe Operator	P			191	0.62
	G	041	0.7		
Bonding					
Pre-cementer	P			208	0.13
Inspection and Packing					
Packer	P			210	1.46
	B	226	1.1		
Duster and Printer	P			153	0.53
				139	0.57
				122	1.23
Miscellaneous					
Odd Jobs	P			168	1.39
[illegible]				[illegible]	[illegible]
[illegible]					
[illegible]					

RESULTS OF U.S.P.H.S. SURVEY

AMERICAN BRAKE SHOE

WINCHESTER VIRGINIA

SURVEY DATE: MAY 1971

	OPERATION AND JOB	PERSONAL SAMPLES SAMPLE #	CONCENTRATION FIBERS >5μ/cc
210	*Mixing, Coating & Extruding*		
	Mixer	219	1.4
	Mixer	220	0.4
	Mixer	221	1.5
	Mixer	222	0.0
	Mixer	223	0.2
	Mixer	224	0.6
	Mixer	225	0.5
	Mixer	226	0.5
	Mixer	227	0.3
	Mixer	228	0.4
	Preformer	193	1.1
	Preformer	194	8.4
	Preformer	195	2.9
	Preformer	196	5.7
	Preformer	197	1.5
	Preformer	198	3.4
	Preformer	199	6.5
	Preformer	205	1.2
	Strip former	235	0.7
	Strip former	236	0.3
	Weigher	5	1.5
	Weigher	7	1.1
	Weigher	8	0.5
	Weigher	9	0.8
	Weigher	23	0.5
	Compound Operator	2	1.6
	Compound Operator	3	0.9
	Hammer Mill Operator	21	0.7
	Scale Repairman	6	1.3
	Mix Inspector	4	0.8
	Forklift Operator	1	1.1

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American Brake Shoe
Winchester Virginia
Survey Date: May 1971

OPERATION AND JOB		PERSONAL SAMPLES SAMPLE #	CONCENTRATION FIBERS >5μ/cc
220	*Forming*		
	Strip Roller	99	5.2
	Strip Roller	100	5.0
	Strip Roller	101	2.3
	Strip Roller	105	1.7
	Strip Roller	107	0.8
	Strip Roller	239	0.3
	Strip Roller	240	0.5
	Shoe Former	27	1.5
	Shoe Former	49	1.3
	Shoe Former	51	0.0
	Shoe Former	52	3.3
	Shoe Former	53	1.4
	Shoe Former	54	1.8
	Shoe Former	55	1.3
	Shoe Former	56	0.6
	Shoe Former	58	4.7
	Serviceman	50	0.9
	Bender Operator	19	0.3
	Bender Operator	24	0.5
	Bender Operator	108	5.1
	Bender Operator	110	1.5
	Bender Operator	111	0.3
	Bender Operator	112	2.8
	Hammer Mill Operator	20	0.4
	Maintenance	18	0.5
	Hand Roll Former	97	3.0
	Hand Roll Former	106	2.8
	Quality Control	98	1.3
230	*Hot Pressing*		
	Hot Press Operator	26	0.8
	Hot Press Operator	29	7.0
	Hot Press Operator	30	0.2
	Hot Press Operator	31	0.6
	Hot Press Operator	33	3.0
	Hot Press Operator	34	0.5
	Hot Press Operator	35	0.4

American Brake Shoe
Winchester Virginia
Survey Date: May 1971

OPERATION AND JOB	PERSONAL SAMPLES SAMPLE #	CONCENTRATION FIBERS >5μ/cc
230 Hot Pressing (continued)		
Hot Press Operator	36	0.8
Hot Press Operator	37	0.5
Hot Press Operator	38	0.3
Hot Press Operator	39	0.4
Hot Press Operator	40	2.4
Hot Press Operator	43	0.6
Hot Press Operator	44	1.0
Hot Press Operator	47	0.7
Hot Press Operator	169	4.0
Hot Press Operator	176	0.1
Hot Press Operator	184	0.6
Hot Press Operator	188	0.5
Hot Press Leader	192	0.5
Hot Press Foreman	180	1.2
Hot Press Duster	28	3.0
Hot Press Service	46	0.5
Hot Press Service	177	1.1
Material Mover	41	3.6
Material Mover	42	0.5
Furnace Man	32	0.7
Hot Press Mechanic	191	0.2
Hot Press Set-Up Man	25	0.2
Sweeper	48	0.8
240 Baking		
Oven Loader	16	1.5
Oven Loader	60	1.2
Oven Loader	102	1.4
Oven Loader	104	1.1
Oven Loader	171	1.4
Oven Loader	178	1.1
Oven Loader	182	2.1
Oven Loader	186	0.8
Oven Loader	217	1.3
Oven Loader	237	0.3
Oven Loader	238	0.3
Oven Loader	241	1.4
Oven Loader	242	2.0

American Brake Shoe
Winchester Virginia
Survey Date: May 1971

	OPERATION AND JOB	PERSONAL SAMPLES SAMPLE #	CONCENTRATION FIBERS >5μ/cc
240	*Baking (continued)*		
	Oven Helper	15	0.6
250	*Grinding & Sanding*		
	Surface Grinder	114	1.8
	Surface Grinder	131	2.7
	Surface Grinder	132	4.3
	Surface Grinder	133	1.9
	Surface Grinder	162	4.0
	Surface Grinder	163	1.7
	Surface Grinder	166	2.6
	Surface Grinder	168	0.2
	Edge Grinder	69	3.3
	Edge Grinder	70	2.6
	Edge Grinder	164	0.5
	Radius Grinder	88	0.7
	Radius Grinder	148	5.0
	Radius Grinder	160	0.7
	Radius Grinder	161	0.8
	Radius Grinder	167	2.6
	Bore Grinder	125	1.0
	Blanchard Grinder	159	4.1
	Grinder	61	1.1
	Grinder	93	2.2
	Grinder	103	1.5
	Grinder	134	2.7
	Grinder	135	3.6
	Grinder	141	5.1
	Finisher	71	2.8
	Finisher	72	2.2
	Finisher	212	0.5
	Sander	68	5.8
	Sander	213	1.4
	Grinding Leader	145	1.0
	Inspector	62	17.5
	Forklift Operator	136	1.4
	Forklift Operator	146	1.0
	Forklift Operator	165	1.4
	Foreman	139	2.7

American Brake Shoe
Winchester Virginia
Survey Date: May 1971

	OPERATION AND JOB	PERSONAL SAMPLES SAMPLE #	CONCENTRATION FIBERS >5μ/cc
260	*Cutting and Drilling*		
	Do-All Saw Operator	57	1.0
	Do-All Saw Operator	109	0.8
	Do-All Saw Operator	113	1.8
	Do-All Saw Operator	116	0.7
	Do-All Saw Operator	117	3.2
	Do-All Saw Operator	118	0.6
	Cutter Operator	206	1.1
	Core Saw Operator	121	1.2
	Core Saw Operator	123	3.3
	Core Saw Operator	214	0.7
	Ripper	65	5.4
	Ripper	122	3.2
	Ripper	130	2.8
	Ripper	140	4.8
	Semi-Auto Drill Operator	79	0.4
	Semi-Auto Drill Operator	80	3.6
	Automatic Drill Operator	74	0.6
	Automatic Drill Operator	83	0.9
	Automatic Drill Operator	85	0.7
	Automatic Drill Operator	87	0.6
	Automatic Drill Operator	90	0.6
	Automatic Drill Operator	147	1.6
	Automatic Drill Operator	149	4.8
	Automatic Drill Operator	150	0.4
	Drill Press Operator	67	2.0
	Drill Press Operator	152	0.6
	Drill Press Operator	157	0.3
	Drill Operator	64	3.3
	Drill Operator	143	2.8
	Drill Operator	144	3.3
	Drill Operator	158	0.2
	Drill Leader	66	0.8
	Counterbore Operator	63	0.8
	Drill Inspector	159	1.2
	Set-Up Leader	82	1.2
	Maintenance	91	0.0
	Production Helper	86	0.6

American Brake Shoe
Winchester Virginia
Survey Date: May 1971

OPERATION AND JOB		PERSONAL SAMPLES SAMPLE #	PERSONAL SAMPLES CONCENTRATION FIBERS >5μ/cc
270	*Bonding and Riveting*		
	Bonder	170	0.7
	Bonder	172	0.6
	Bonder	173	0.5
	Bonder	183	0.3
	Bonder	185	0.5
	Bonder	234	0.9
	Adhesive Applicator	230	1.7
	Adhesive Applicator	231	5.7
	Adhesive Applicator	232	2.5
	Rivetor	75	2.7
	Rivetor	81	0.8
	Rivetor	233	0.9
280	*Inspection and Packing*		
	Brander	151	1.1
	Brander	153	0.4
	Brander	154	0.7
	Brander	155	0.6
	Inspector	73	0.6
	Inspector	84	0.1
	Inspector	89	0.7
	Inspector	94	0.7
	Inspector	156	1.9
	Inspector	181	0.5
	Inspector	190	1.5
	Inspector	215	0.8
	Painter	76	1.7
	Painter	77	0.6
	Painter	78	2.0
	Painter	124	4.6
	Painter	126	0.6
	Painter	127	0.8
	Painter	128	0.7
	Painter	129	3.4
	Painter	142	3.7
	Packer	92	1.3
	Packer	95	0.4
	Packer	96	0.4

American Brake Shoe
Winchester Virginia
Survey Date: May 1971

OPERATION AND JOB		PERSONAL SAMPLES SAMPLE #	CONCENTRATION FIBERS >5μ/cc
280	*Inspection and Packing (continued)*		
	Shipping Clerk	179	0.3
	Shipping Foreman	187	0.2
	Spray Booth Operator	201	2.4
	Spray Booth Operator	202	2.2
	Spray Booth Operator	203	1.5
	Drying Oven Loader	218	1.1
	Forklift Operator	174	0.0
	Forklift Operator	175	0.4
290	*Miscellaneous*		
	ABK Lathe Operator	207	1.7
	ABK Lathe Operator	208	0.9
	ABK Lathe Operator	209	0.4
	ABK Finisher	210	1.0
	ABK Finisher	211	1.0
	ABK Pressing	216	0.7
	Die Cleaner	204	1.5
	Quality Control Lab Technician	10	1.3
	Quality Control Lab Technician	13	0.9
	Quality Control Lab Technician	14	0.3
	Pilot Plant Operator	11	1.2
	Pilot Plant Operator	12	1.6
	Pilot Plant Operator	100	1.3
	Rubber Mill Operator	17	1.0

SUMMARY TABLE

AMERICAN BRAKE SHOE

WINCHESTER VIRGINIA

SURVEY DATE: MAY 1971

OPERATION & NUMBER OF SAMPLES ( )	CONCENTRATIONS, FIBERS >5μ/cc LOW	HIGH	MEAN	% CONC. >2	% CONC. >5	% CONC. >10
Mixing, Coating, Extruding (31)	0.0	8.4	1.6	16.1	9.7	0.0
Forming (28)	0.0	5.2	1.8	32.1	10.7	0.0
Hot Pressing (30)	0.1	7.0	1.2	20.0	3.3	0.0
Baking (14)	0.3	2.1	1.2	14.3	0.0	0.0
Grinding & Sanding (35)	0.2	17.5	2.7	51.4	11.4	2.9
Cutting & Drilling (37)	0.0	5.4	1.7	32.4	2.7	0.0
Bonding & Riveting (12)	0.3	5.7	1.5	25.0	8.3	0.0
Inspection & Packing (32)	0.0	4.6	1.2	18.8	0.0	0.0
Miscellaneous (14)	0.3	1.7	1.1	0.0	0.0	0.0

12/15/71