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Report of Results: MVA1810

FRICTION PRODUCT FIBER RELEASE STUDIES

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Microanalysis

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FRICTION PRODUCT FIBER RELEASE STUDIES

INTRODUCTION

Asbestos fiber was used as a component in some friction products such as brake linings, brake disc pads, and clutch friction parts. Some studies have shown that work performed by mechanics and other individuals have caused asbestos fibers to be released into the air. This study was designed to determine if asbestos fibers are released when certain types of activities are performed with friction products.

STUDY DESIGN

According to information collected, in some instances when a new brake lining was installed it would be ground or sanded with coarse sand paper to scuff down the high spots and bevel the edges. With brake discs that had a lot of squealing they might be treated by chamfering the edges or cutting grooves into the lining with either a file, hacksaw or grinder.

This study for possible fiber release involved sanding new brake linings in a controlled area while air samples were collected. A second test involved cutting grooves in brake disc pads with similar controls and air monitoring. The grooves were cut with a file and then in a separate test by a pneumatic hand-held muffler grinder.

Air samples were collected while the cleanup activity of sweeping was performed following the sanding test.

STUDY SITE

The study was conducted in a warehouse in Norcross, Georgia. An asbestos abatement type enclosure was built for the study to isolate the testing from any other source of asbestos and to prevent any fiber release from contaminating the building. The containment barriers in the area consisted of two layers of 4-mil polyethylene plastic sheets on a wooden frame and three layers of 4-mil polyethylene plastic on the floor. The containment work area (approximately 8 ft high by 8 ft wide by 7 ft high) was completely contained within a larger containment area. The study area had a High Efficiency Particulate Absolute (HEPA) air filtration device (AFD) which is used to clean the area of particulate including asbestos before and after the activity. In the outer area, the AFD operated throughout the test to prevent any contamination if there was a fiber release.

All personnel inside the study area were protected by air purifying respirators and complete head and body coverings. The decontamination system consisted of an enclosed changing room outside the testing area, and a clean suit-up room.

STUDY PROCEDURES

The study consisted of the collection of air samples before and during the activities with 4 brake shoes and 3 brake disc pads manufactured by Ford.

Prior to starting the study, three (3) area air samples were collected to determine the background level of asbestos in the air of the study area. The sampling cassettes were located on the walls at the breathing zone, approximately five feet from the floor. During the studies the person doing the activity was fitted with two personal air sampling devices. Two area air samples were collected during each activity. A sample was also collected outside the containment. Samples were collected from the surface of the worker's hand before and after the activities. Photographs were taken to document the activity.

ANALYTICAL METHODS

Stereomicroscopy was used to examine the friction materials prior to testing. Polarized light microscopy (PLM) was used to determine the type and amount of asbestos in the friction product materials.

Personal air samples were analyzed by the standard phase contrast microscopy (PCM) Method: NIOSH 7400.

Although the phase contract microscope enhances the analyst's ability to see fibers over other types of light microscopes, the standard procedure does not involve identification steps which specifically determine how many of the fibers counted are actually asbestos. PCM also only counts those fibers longer than 5 µm. The samples were prepared for further study by transmission electron microscopy (TEM). The samples were prepared and analyzed using a direct preparation and counting procedure. This TEM analysis method identifies asbestos fibers on the basis of morphology, crystal structure and x-ray elemental analysis. All asbestos fibers longer than 0.5 µm are counted by TEM so that a total asbestos concentration could be determined. Information about those fibers longer than 5 µm can also be determined to give an asbestos count equivalent to the PCM data.

The hand surface test was examined by scanning electron microscopy with x-ray analysis.

A friability test was performed on the sample of friction material before cutting and on the residue after the activity. The EPA friability test is a field test in which an attempt is made to crumble the asbestos-containing material (ACM) by hand. If the material produces dust when crumbled by hand, it is considered friable.

RESULTS

Stereomicroscopy showed that white fibers were protruding from the surfaces of the friction materials. See figures. These fibers were tested and found to be chrysotile asbestos.

Polarized light microscopy (PLM) bulk analysis showed all the friction materials to contain approximately 50% chrysotile asbestos. As received, the friction materials were not friable. However, they produced dust when scratched or rubbed. The residue materials from sanding, filing and grinding were dusty. The hand surface sample collected after the worker filed the brake disc pad showed very high levels of asbestos.

The PCM results of the air monitoring are summarized in Table 1. The TEM data are presented in Table 2.

During sanding, which lasted approximately 10 minutes, the asbestos fiber level for the person sanding was 2.2 fibers/cc (PCM). TEM analyses of the airborne fiber concentration during sanding showed a level of 54 chrysotile asbestos structures per cc.

During sweeping of the sanding dust and debris with a broom, which lasted approximately 5 minutes, the asbestos fiber level for the person sweeping was 2 fibers/cc (PCM). TEM analyses of the airborne fiber concentration during sweeping showed an average level of 28 chrysotile asbestos structures per cc.

During filing grooves with a steel file, which lasted approximately 5 minutes, the asbestos fiber level for the person filing was 0.3 fibers/cc (PCM). TEM analyses of the airborne fiber concentration during filing showed a level of about 7 chrysotile asbestos structures per cc.

During the making of grooves in the brake disc pad with a power grinder, which lasted approximately 2 minutes, the asbestos fiber level for the person grinding was 8 fibers/cc (PCM). TEM analyses of the airborne fiber concentration during grinding showed a level of 230 chrysotile asbestos structures per cc.

CONCLUSIONS

Sanding an asbestos-containing brake shoe friction product with a coarse sandpaper released high levels of asbestos fibers in the breathing zone of the sander. Sweeping the asbestos-containing dust and debris following sanding can release significant levels of asbestos fibers into the air (over 1 f/cc). Filing grooves into a brake disc pad also releases asbestos fibers into the air in the vicinity of the filer, but at a lower level than sanding. Using a power muffler grinder to cut the grooves in an asbestos containing brake disc pad causes high levels of asbestos to be released. High levels of asbestos fibers were found on the hand surface after work with filing the asbestos-containing brake disc pad.

TABLE 1

Summary of Average Personal PCM Air Sampling Results for Sanding and Sweeping, Filing, and Grinding

Activity	PCM* (f/cc)
Sanding of the Brake Shoes	2.2
Sweeping of Dust & Debris	1.7
Filing Grooves in Brake Pad	0.3
During Grinding Grooves in Brake Pad	8.5

TABLE 2

Summary of Personal TEM Air Sampling Results for Sanding and Sweeping, Filing, and Grinding of Brake Friction Materials

Activity	TEM (asbestos str/cc)
Background Before Sanding Brake Shoes	BDL (0.003)
Sanding of the Brake Shoes	54
Sweeping of Dust & Debris	28
Background Before Filing Brake Pad	0.04
During Filing Grooves in Brake Pad	6.7
Background Before Grinding	0.05
During Grinding Grooves in Brake Pad	230

Figure 1. Ford Brake Shoe Used in Study.

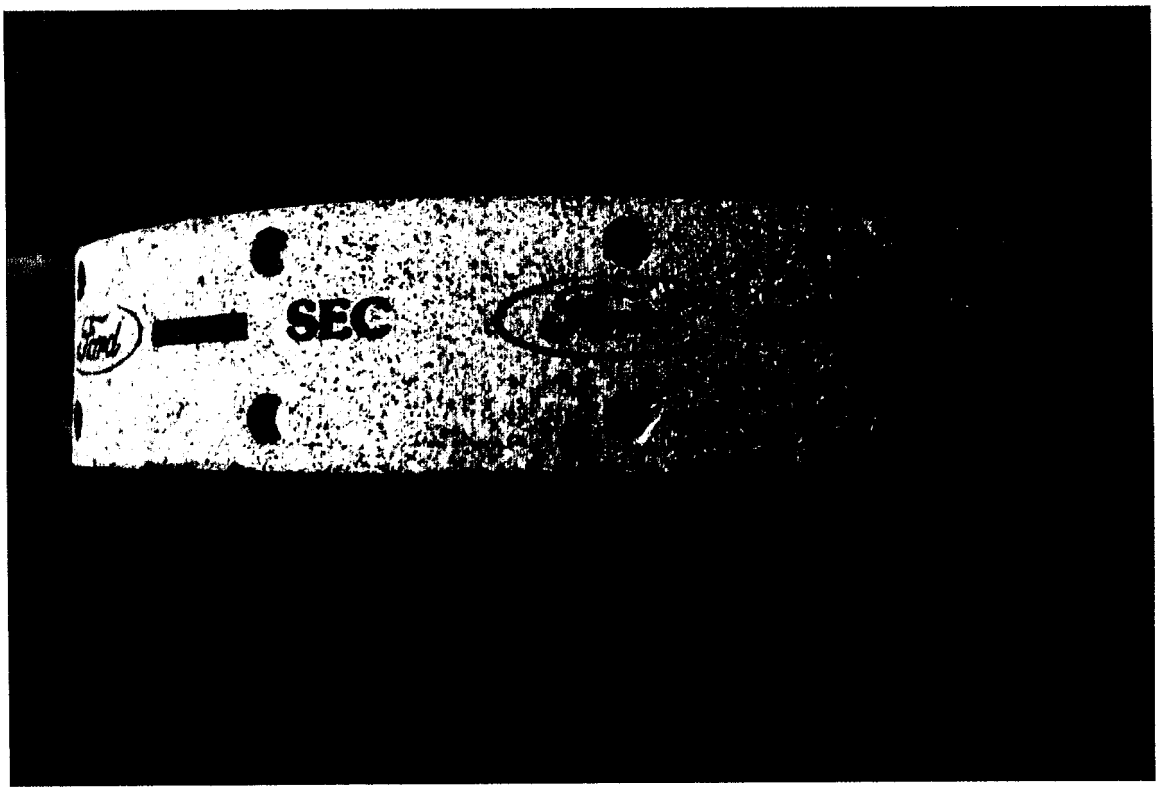

Figure 2. View of the top of a Ford brake shoe used in the study.

Figure 3. Closer View of the Surface of Brake Shoe. Protruding Fibers are Visible.

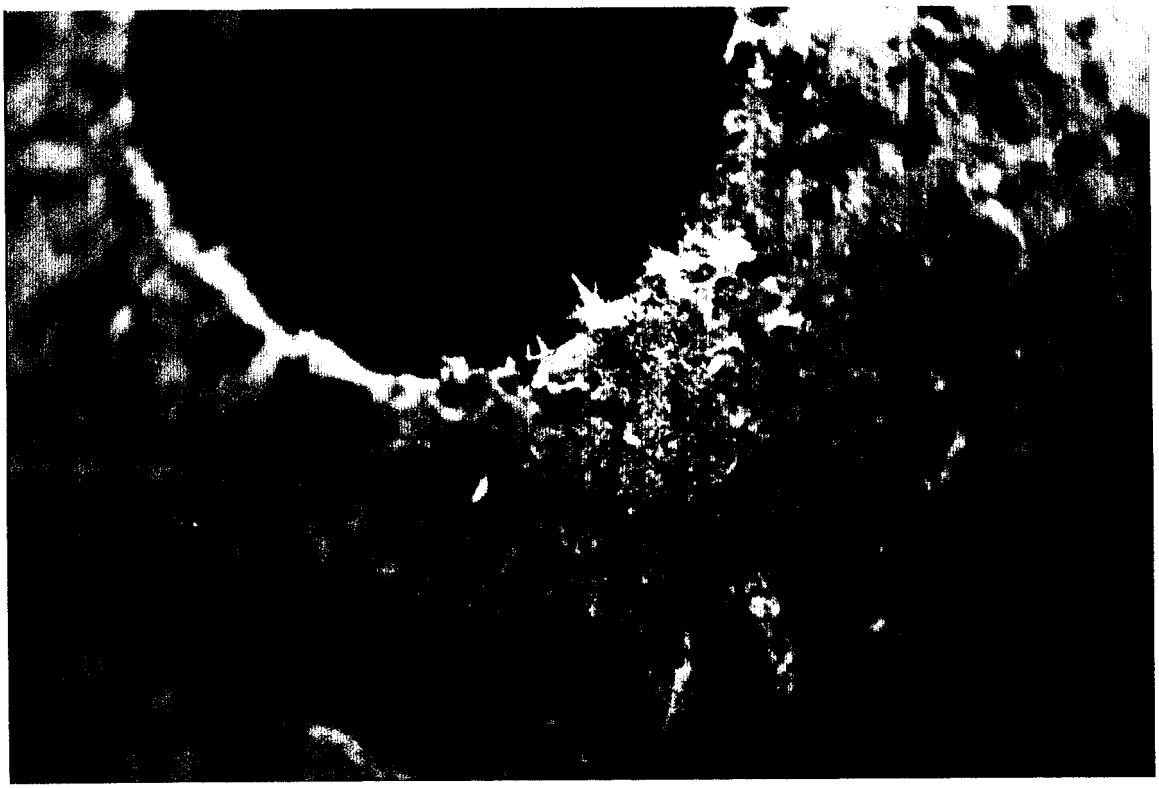

Figure 4. Magnified View of Protruding Fibers in Figure 3.

Figure 5. Closer View of the Edge of Brake Shoe. Protruding Fibers are Visible.

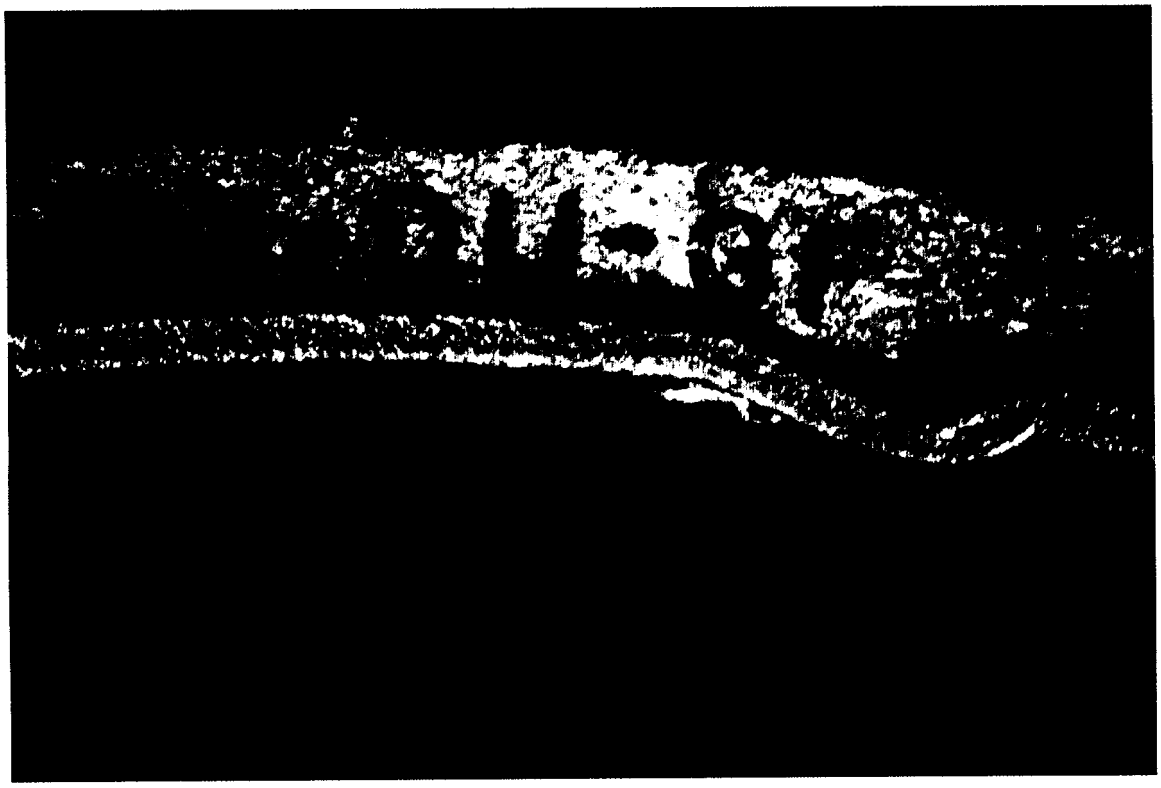

Figure 6. Magnified View of Protruding Fibers in Figure 5.

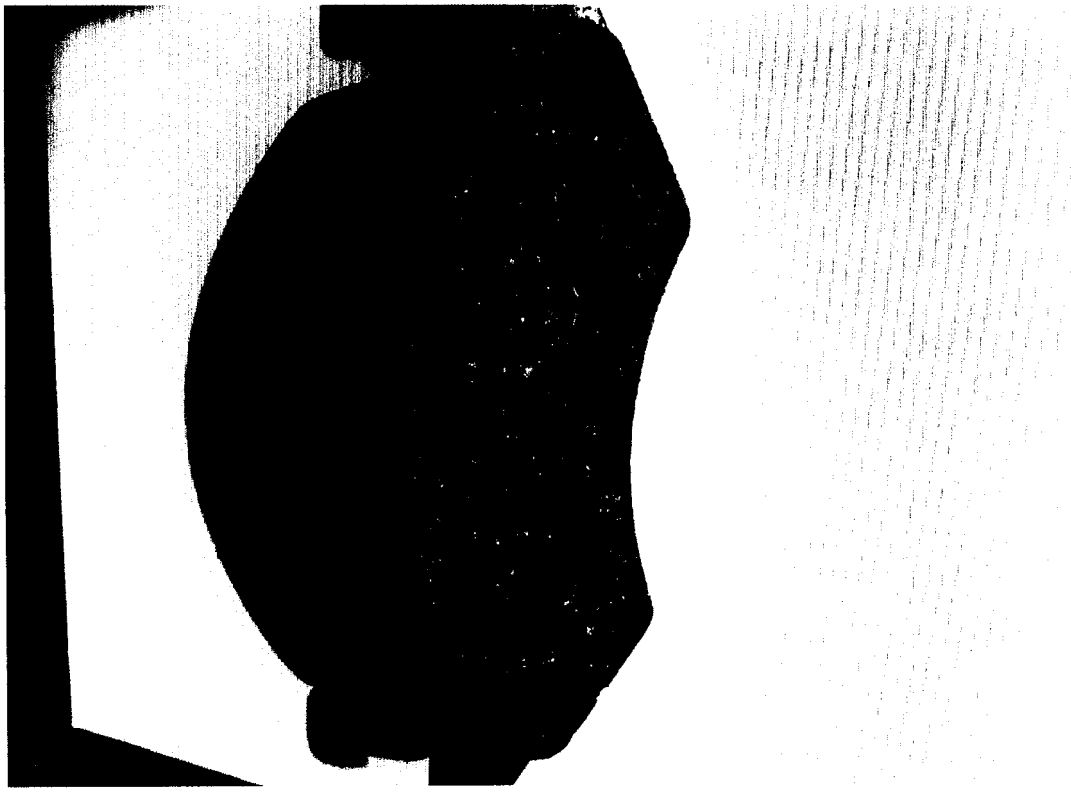

Figure 7. Ford Brake Disc Pad Used in Study.

Figure 8. Close View of the side of Ford brake disc pad used in the study.

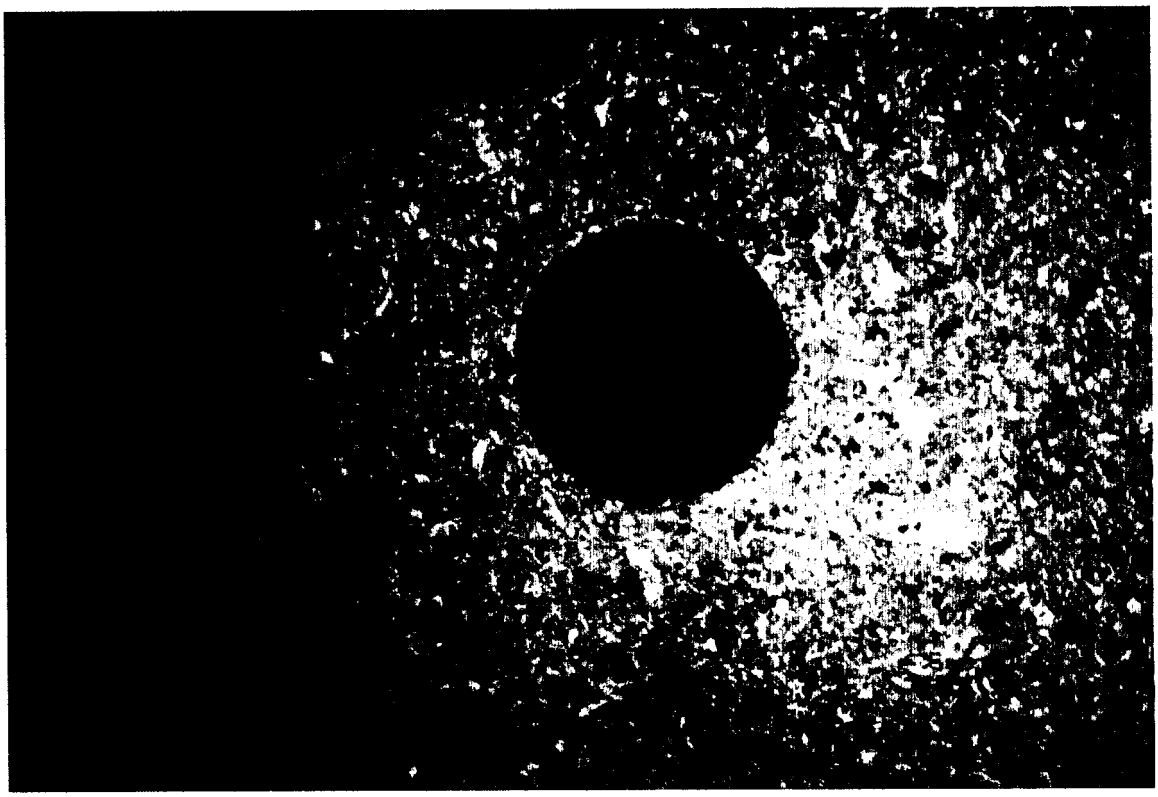

Figure 9. Closer View of the Surface of Brake Pad. Protruding Fibers are Visible.

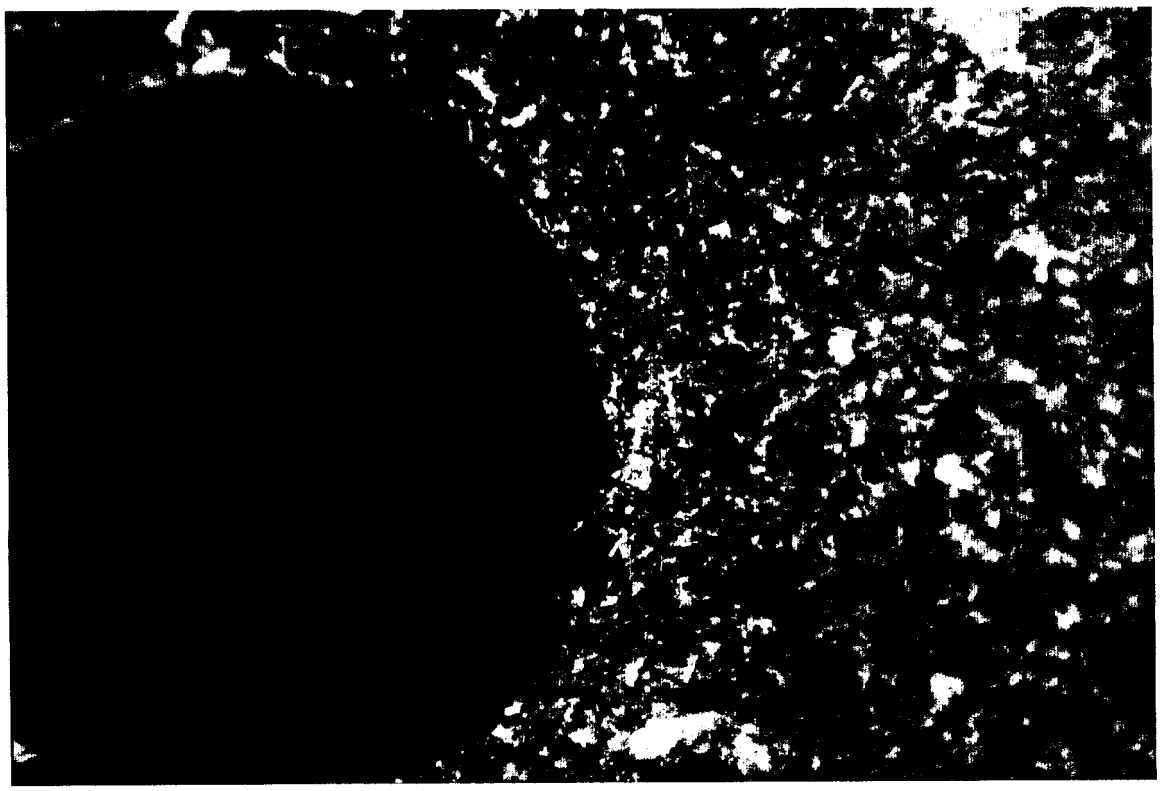

Figure 10. Magnified View of Protruding Fibers in Figure 9.

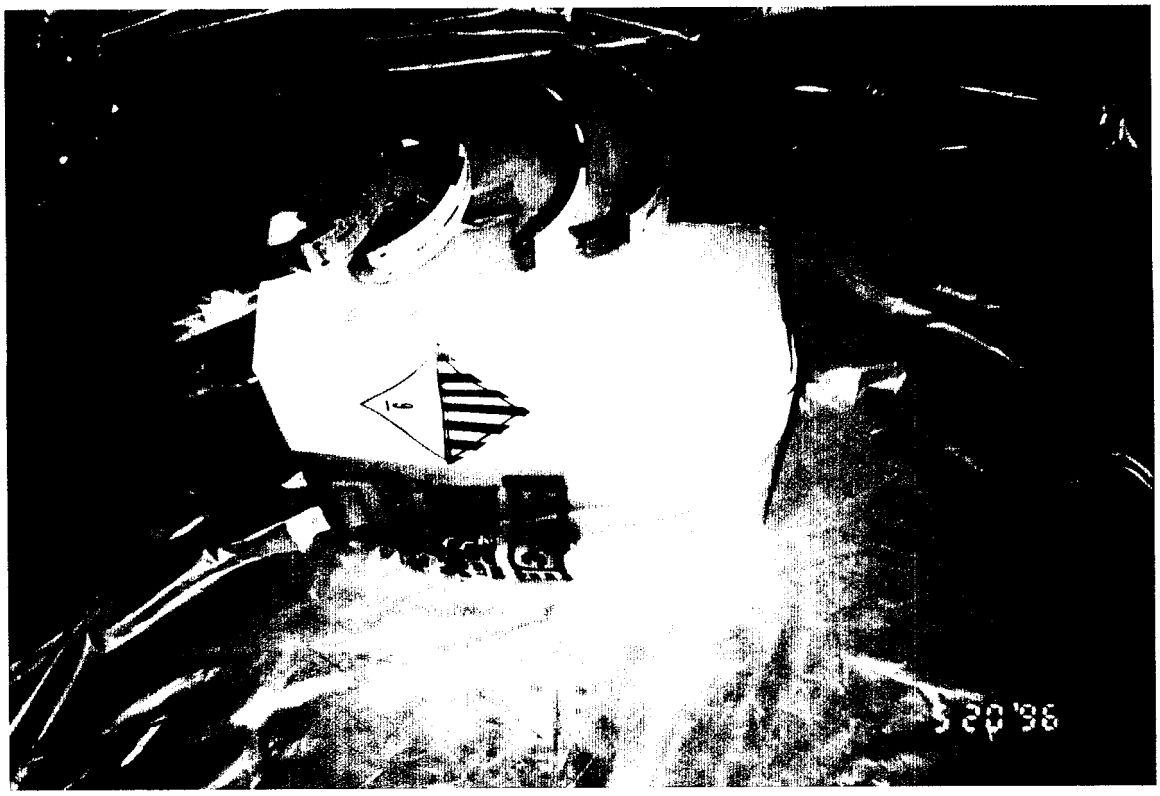

Figure 11. Brake Shoes and Coarse Sand Paper in Enclosure Before Sanding Activity.

Figure 12. Sanding the Edges of a Brake Shoe.

Figure 13. Sweeping Brake Shoe Sanding Debris and Dust.

Figure 14. Scanning Electron Microscope Image of a Sample taken directly from the Surface of a Hand of the Worker After Filing. Fibers are Chrysotile. Magnification 350x.

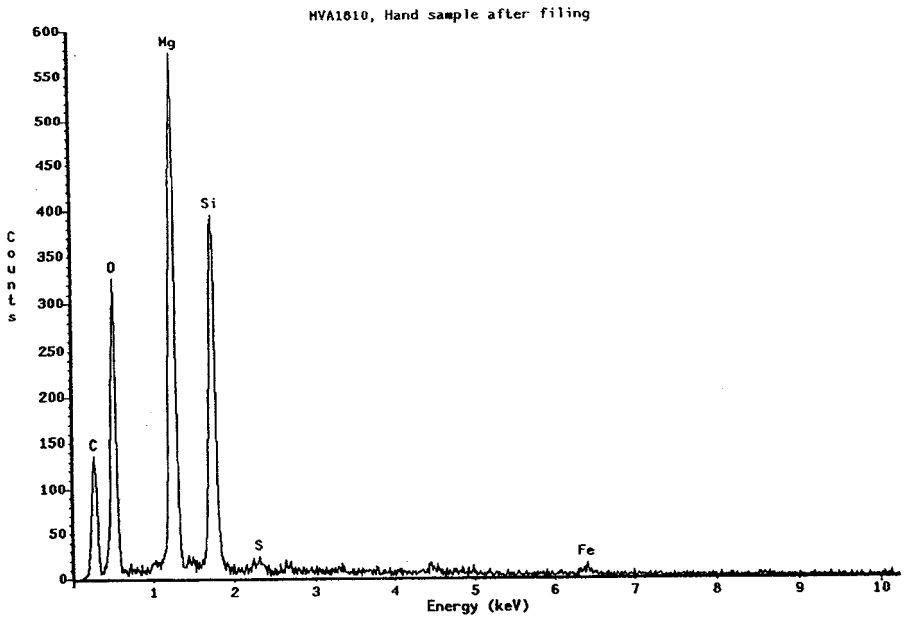

Figure 15. X-ray Spectrum of Chrysotile (above) and Scanning Electron Microscopy Image of Chrysotile Fibers among other Particles on the Hand Sample shown in Figure 14. Magnification is approximately 1,100 x.

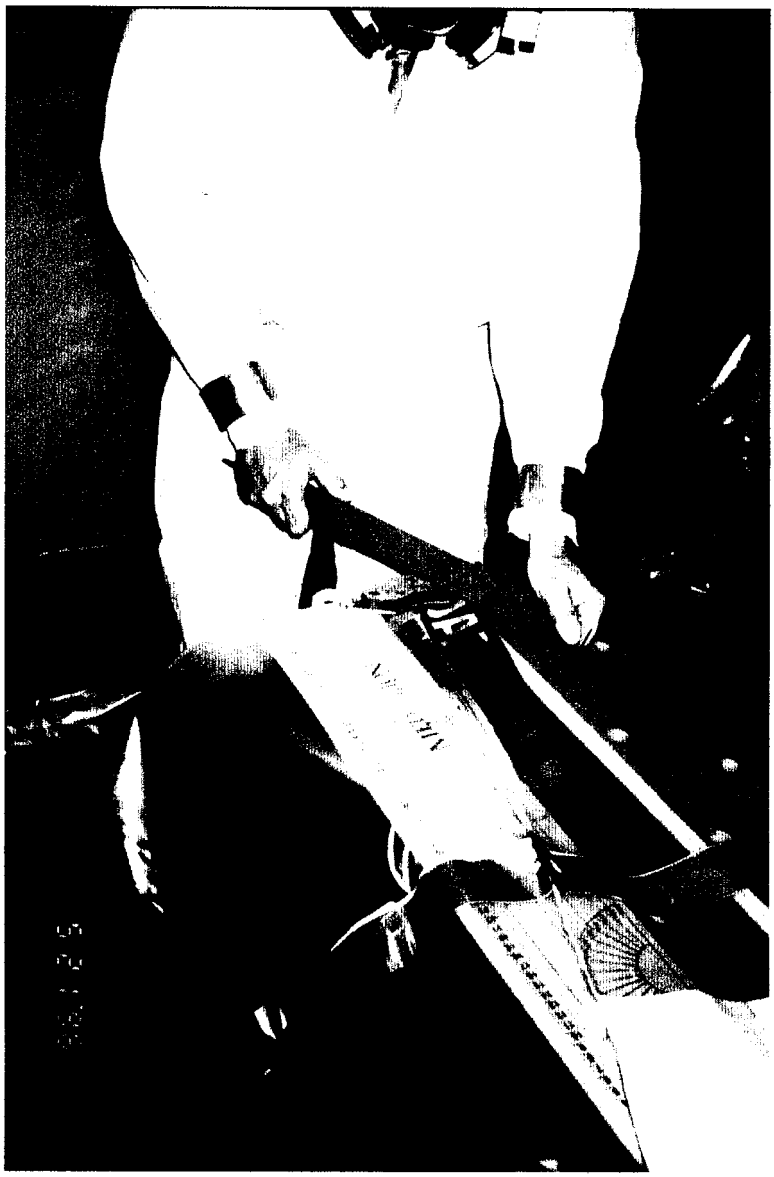

Figure 16. Cutting Grooves in A Brake Pad with a Steel File.

Figure 17. Closer View of Cutting Grooves in A Brake Pad with a Steel File.

Figure 18. Cutting Grooves in A Brake Pad with a Muffler Grinder.

Figure 19. Closer View of Cutting Grooves in A Brake Pad with a Muffler Grinder.

Figure 20. Transmission Electron Microscopy Image of an Airborne Chrysotile Fiber Collected on a Filter During Sanding.

APPENDIX A

PLM Bulk Analysis of Samples

MVA, Inc.
5500 Oakbrook Parkway, Suite 200
Norcross, Georgia 30093
(404) 662-8509

PLM ASBESTOS ANALYSIS

MVA #: 1810 **CLIENT:** Law Offices of Peter Angelos

SAMPLE ID #: G0922 **CLIENT SAMPLE ID #:** Ford SEC BX-DU-GF

Macroscopic Description: Tan pads attached to metal plates (2 pieces).

ASBESTOS MINERALS:		**OTHER FIBERS:**	
Chrysotile	~50%	Glass Fibers	- - -
Amosite	- - -	Cellulose	- - -
Crocidolite	- - -	Synthetic Fibers	- - -
Anthophyllite Asbestos	- - -	Other	- - -
Tremolite/Actinolite Asbestos	- - -		
TOTAL ASBESTOS:	~50%		
FILLERS/BINDERS/PIGMENT %:	~50%		
FILLER/BINDERS/PIGMENT IDENTIFIED (*):			
Mica/Vermiculite	- - -	Perlite/Pumice	- - -
Synthetic Foam	- - -	**Carbonate**	*
Gypsum	- - -	Pigment	- - -
Other	*		

COMMENTS:

ANALYST: Randy Boltin **DATE:** 05/13/96

MVA, Inc.
5500 Oakbrook Parkway, Suite 200
Norcross, Georgia 30093
(404) 662-8509

PLM ASBESTOS ANALYSIS

MVA #: 1810 **CLIENT:** Law Offices of Peter Angelos

SAMPLE ID #: G0923 **CLIENT SAMPLE ID #:** Ford PRIM BX-RW-FF

Macroscopic Description: Tan pads attached to metal plates (2 pieces).

ASBESTOS MINERALS:		**OTHER FIBERS:**	
Chrysotile	~50%	Glass Fibers	- - -
Amosite	- - -	Cellulose	- - -
Crocidolite	- - -	Synthetic Fibers	- - -
Anthophyllite Asbestos	- - -	Other	- - -
Tremolite/Actinolite Asbestos	- - -		
TOTAL ASBESTOS:	~50%		
FILLERS/BINDERS/PIGMENT %:	~50%		
FILLER/BINDERS/PIGMENT IDENTIFIED (*):			
Mica/Vermiculite	- - -	Perlite/Pumice	- - -
Synthetic Foam	- - -	**Carbonate**	*
Gypsum	- - -	Pigment	- - -
Other	*		

COMMENTS:

ANALYST: Randy Boltin **DATE:** 05/13/96

MVA, Inc.
5500 Oakbrook Parkway, Suite 200
Norcross, Georgia 30093
(404) 662-8509

PLM ASBESTOS ANALYSIS

MVA #: 1810 **CLIENT:** Law Offices of Peter Angelos

SAMPLE ID #: G0661 **CLIENT SAMPLE ID #:** E1FZ-2001A

Macroscopic Description: Black/brown consolidated material adhering to metal plate.

ASBESTOS MINERALS:		**OTHER FIBERS:**	
Chrysotile	~50%	Glass Fibers	- - -
Amosite	- - -	Cellulose	- - -
Crocidolite	- - -	Synthetic Fibers	- - -
Anthophyllite Asbestos	- - -	Other	- - -
Tremolite/Actinolite Asbestos	- - -		
TOTAL ASBESTOS:	~50%		
FILLERS/BINDERS/PIGMENT %:	~50%		
FILLER/BINDERS/PIGMENT IDENTIFIED (*):			
Mica/Vermiculite	- - -	Perlite/Pumice	- - -
Synthetic Foam	- - -	**Carbonate**	*
Gypsum	- - -	Pigment	- - -
Other	*		

COMMENTS: Ford disc brake pads.

ANALYST: Randy Boltin **DATE:** 05/13/96

MVA, Inc.
5500 Oakbrook Parkway, Suite 200
Norcross, Georgia 30093
(404) 662-8509

PLM ASBESTOS ANALYSIS

MVA #: 1810 **CLIENT:** Law Offices of Peter Angelos

SAMPLE ID #: G0965 **CLIENT SAMPLE ID #:** Debris & Dust After Sanding

Macroscopic Description: Brown powder.

ASBESTOS MINERALS:		**OTHER FIBERS:**	
Chrysotile	~50%	Glass Fibers	- - -
Amosite	- - -	**Cellulose**	~5%
Crocidolite	- - -	**Synthetic Fibers**	<1%
Anthophyllite Asbestos	- - -	**Hair**	<1%
Tremolite/Actinolite Asbestos	- - -		
TOTAL ASBESTOS:	~50%		
FILLERS/BINDERS/PIGMENT %:	~45%		

FILLER/BINDERS/PIGMENT IDENTIFIED (*):

Mica/Vermiculite	- - -	Perlite/Pumice	- - -
Synthetic Foam	- - -	**Carbonate**	*
Gypsum	- - -	Pigment	- - -
Other	*		

COMMENTS:

ANALYST: Randy Boltin **DATE:** 05/24/96

APPENDIX B

TEM Analysis Sheets

Summary of TEM Analysis Results

Sample #	Description	Air Vol (Liters)	Asbestos Structures / cc
G0943	Background before Sanding Brake Shoes	1800	BDL* (0.003)
G0947	Sanding of Brake Shoes	28	54.4
G0950	Nearby Area During Sanding	176	13
G0952		0	NSD**
G0958	During Sweeping	15.6	11.7
G0960	During Sweeping	15.6	44.5
G0961		0	NSD
G0964	Background before Filing Brake Pad	1230	0.039
G0969	During Filing Grooves in Brake Pad	13	6.7
G0971		0	2 str
G0975	During Grinding Grooves in Brake Pad	7.3	232
G0976		0	NSD
G0980	Background Before Grinding	1240	0.05

*BDL - Below Detection Limit (Analytical Sensitivity Given)
**NSD - No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	1800	Analyst:	PF
Lab Sample I.D.:	G0943	Amount Prepped(liters):	DIRECT	Date:	5/22/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	C7	NSD**						
	G6	NSD						
	I8	NSD						
	F7	NSD						
	D3	NSD						
2	D2	NSD						
	F4	NSD						
	H7	NSD						
	F9	NSD						
	C5	NSD						

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	28	Analyst:	PF
Lab Sample I.D.:	G0947	Amount Prepped(liters):	DIRECT	Date:	5/21/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	3		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	G6	1	B	2.9	0.24	C	C	
		2	C	19.0	14.29	C	C	
		3	C	5.0	3.81	C		
		4	B	7.6	0.48	C		
		5	B	5.7	0.48	C		
		6	C	7.1	5.24	C		
		7	C	2.4	1.19	C		
		8	C	9.5	5.71	C		
		9	M	4.3	4.29	C		
		10	B	2.9	0.95	C		
		11	B	6.7	2.38	C		
		12	F	1.0	0.10	C		
		13	C	2.4	1.43	C		
		14	M	2.1	1.90	C		
		15	C	13.3	6.19	C		
		16	M	7.6	5.71	C		
		17	B	7.4	0.24	C		
		18	C	1.0	0.48	C		
		19	C	1.1	1.05	C		
		20	B	5.7	0.62	C		
		21	C	10.5	7.14	C	C	
		22	C	5.7	3.33	C		
		23	B	7.6	0.48	C		
		24	B	8.1	0.48	C		
		25	B	5.0	0.19	C		
		26	B	2.9	0.62	C		
		27	B	0.1	0.14	C		
		28	B	2.9	1.05	C		
		29	B	9.8	0.19	C		
		30	B	0.7	0.48	C		
	C5	31	C	2.6	0.24	C		
		32	C	1.4	0.71	C		
		33	C	1.4	0.95	C		
		34	B	16.2	0.48	C	C	
		35	C	2.4	0.71	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SETTLED DUST ANALYSIS

MVA Project #:	1810	Amount Collected(liters):	28	Analyst:	PF
Lab Sample I.D.:	G0947	Amount Prepped(liters):	DIRECT	Date:	5/21/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	3		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	C5	36	M	2.9	1.90	C		
		37	M	1.4	0.95	C		
		38	C	6.2	2.38	C		
		39	C	3.8	2.38	C		
		40	C	14.3	4.76	C		
		41	B	1.0	0.24	C		
		42	B	3.1	0.48	C		
		43	M	3.8	0.95	C		
		44	B	6.7	0.95	C		
		45	C	7.1	3.33	C		
		46	B	1.2	0.19	C		
		47	B	1.9	0.29	C		
		48	B	4.8	1.43	C		
		49	B	1.8	0.33	C		
		50	M	1.2	0.71	C		
		51	C	7.6	7.14	C		
		52	B	2.4	0.14	C	C	
		53	B	0.6	0.10	C		
		54	C	9.5	1.43	C		
		55	F	1.5	0.05	C		
		56	F	0.7	0.05	C		
		57	C	15.2	1.43	C		
		58	C	16.7	0.48	C		
		59	C	1.2	0.95	C		
		60	C	12.9	10.00	C		
	D9	61	B	1.9	0.57	C		
		62	M	5.2	0.71	C		
		63	B	4.5	0.24	C		
		64	B	2.6	0.19	C		
		65	C	1.9	0.71	C		
		66	F	0.6	0.05	C		
		67	C	2.6	1.90	C		
		68	C	11.4	5.71	C	C	
		69	B	1.4	0.24	C		
		70	C	1.8	2.00	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

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MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	28	Analyst:	PF
Lab Sample I.D.:	G0947	Amount Prepped(liters):	DIRECT	Date:	5/21/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	3		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	D9	71	C	11.4	9.05	C		
		72	C	21.4	5.71	C		
		73	C	2.1	0.48	C		
		74	C	1.0	1.05	C		
		75	F	1.9	0.00	C		
		76	C	7.1	5.71	C		
		77	B	4.3	0.19	C		
		78	F	0.5	0.05	C		
		79	B	0.6	0.14	C		
		80	C	0.9	0.43	C		
		81	B	2.6	0.14	C		
		82	C	3.8	2.86	C		
		83	B	2.9	1.05	C		
		84	C	2.4	1.81	C		
		85	C	31.4	1.67	C		
		86	C	3.3	2.38	C		
		87	B	0.5	0.14	C		
		88	B	2.4	0.48	C		
		89	C	16.7	8.57	C		
		90	C	1.9	0.48	C	C	
		91	B	3.3	0.71	C	C	
		92	B	11.0	3.81	C	C	
		93	F	0.5	0.05	C		
		94	M	2.9	1.43	C		
		95	F	0.6	0.05	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	176	Analyst:	PF
Lab Sample I.D.:	G0950	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	2		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	D4	1	B	1.2	0.29	C		
		2	C	15.2	16.19	C	C	
		3	B	0.7	0.14	C		
		4	C	11.9	2.38	C		
		5	B	2.1	1.19	C		
		6	F	1.4	0.05	C		
		7	M	0.7	0.43	C		
		8	C	16.7	10.48	C		
		9	M	2.4	0.95	C		
		10	B	7.6	0.95	C		
		11	B	4.3	0.24	C		
		12	C	5.2	3.81	C		
		13	C	7.1	8.10	C		
		14	B	1.4	0.48	C		
		15	M	1.4	0.71	C		
		16	B	1.0	0.95	C		
		17	B	1.9	0.10	C		
		18	F	2.1	0.07	C		
		19	B	18.1	0.95	C	C	
		20	B	3.3	0.24	C		
		21	F	1.1	0.05	C		
		22	C	4.8	3.33	C		
		23	B	0.8	0.29	C		
		24	B	1.2	0.33	C		
		25	B	1.4	0.10	C		
		26	B	7.1	0.71	C		
		27	B	1.2	0.14	C		
		28	C	11.4	2.86	C		
		29	C	2.9	2.38	C		
		30	C	1.0	0.86	C		
	C5	31	C	8.6	5.71	C		
		32	C	1.4	1.43	C		
		33	C	4.3	2.86	C		
		34	C	6.2	2.38	C	C	
		35	C	8.1	4.76	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SETTLED DUST ANALYSIS

MVA Project #:	1810	Amount Collected(liters):	176	Analyst:	PF
Lab Sample I.D.:	G0950	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	2		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	D4	36	C	4.8	2.38	C		
		37	M	7.1	5.71	C		
		38	C	9.5	4.76	C		
		39	B	5.2	1.19	C		
		40	F	0.6	0.05	C		
		41	C	3.3	1.90	C		
		42	M	2.9	2.38	C		
		43	C	11.0	4.76	C		
		44	C	11.9	14.29	C	C	
		45	B	0.8	0.10	C		
		46	B	0.7	0.10	C		
		47	B	2.4	2.38	C		
		48	B	1.4	0.24	C		
		49	B	2.6	0.71	C		
		50	C	7.1	5.71	C	C	
		51	C	0.7	0.57	C		
	H8	52	B	1.4	0.24	C		
		53	C	7.1	4.76	C		
		54	B	2.4	0.14	C		
		55	C	15.7	5.71	C		
		56	C	2.1	0.95	C		
		57	B	2.6	0.38	C		
		58	F	0.6	0.05	C		
		59	B	2.1	0.14	C		
		60	B	7.1	0.71	C		
		61	C	0.7	0.24	C		
		62	F	3.3	0.07	C		
		63	B	1.1	0.14	C		
		64	C	3.8	1.43	C		
		65	C	8.1	3.81	C	C	
		66	B	8.1	1.43	C		
		67	C	11.0	9.52	C		
		68	C	2.4	2.38	C		
		69	C	10.5	7.14	C		
		70	B	8.1	0.48	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	176	Analyst:	PF
Lab Sample I.D.:	G0950	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	2		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	H8	71	B	1.9	0.14	C		
		72	C	0.7	0.48	C		
		73	F	1.9	0.05	C		
		74	C	1.0	0.48	C		
		75	B	1.9	0.24	C		
		76	B	2.6	1.90	C		
		77	B	4.8	3.81	C		
		78	B	0.7	0.38	C		
		79	C	2.1	0.14	C		
		80	M	2.4	2.38	C		
		81	C	2.4	1.90	C		
		82	B	6.7	0.48	C		
		83	B	1.0	0.33	C		
		84	B	7.6	0.38	C	C	
		85	C	4.8	1.43	C		
		86	M	1.4	0.95	C		
		87	B	6.2	3.33	C		
		88	C	2.1	1.43	C		
		89	C	8.6	5.71	C		
		90	B	5.7	0.38	C		
		91	F	0.6	0.05	C		
		92	F	1.2	0.33	C		
		93	B	1.4	0.95	C		
		94	C	5.0	2.86	C	C	
		95	C	1.0	0.57	C	C	

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	0	Analyst:	PF
Lab Sample I.D.:	G0952	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	F3	NSD**						
	H4	NSD						
	G7	NSD						
	D5	NSD						
	B2	NSD						
2	C2	NSD						
	E4	NSD						
	G5	NSD						
	H8	NSD						
	C9	NSD						

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

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MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	15.6	Analyst:	PF
Lab Sample I.D.:	G0958	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	F7	1	B	7.6	1.90	C		
		2	B	2.9	0.24	C		
		3	B	25.7	0.71	C	C	
		4	B	1.4	0.33	C		
		5	C	1.9	0.95	C		
	D5	6	C	5.2	3.33	C		
		7	C	1.2	0.95	C		
		8	M	5.2	2.38	C		
		9	C	3.8	0.71	C		
		10	B	1.9	0.24	C		
		11	C	9.5	1.43	C		
	B6	12	C	9.5	4.76	C	C	
		13	B	5.7	0.62	C		
		14	C	7.1	5.71	C		
		15	C	1.9	0.71	C		
		16	C	4.3	2.86	C		
	C3	17	C	8.1	2.38	C		
		18	C	19.0	4.76	C		
		19	C	14.3	7.14	C	C	
	G7	20	C	1.0	0.71	C		
		21	C	1.1	0.76	C		
		22	B	3.1	0.19	C		
		23	B	3.0	0.19	C		
2	E8	24	M	1.9	1.52	C		
		25	B	0.7	0.29	C		
	G5	26	F	1.1	0.10	C		
		27	F	0.6	0.05	C		
		28	C	2.4	0.48	C		
		29	B	1.9	0.14	C		
		30	M	7.1	7.14	C		
		31	B	6.7	0.24	C		
	F3	32	B	1.2	0.48	C		
		33	C	22.9	4.76	C		
		34	C	20.0	3.81	C		
		35	B	0.7	0.10	C		
	B3	36	M	7.1	3.81	C		
		37	B	2.4	0.24	C		
	D9	38	C	5.7	4.76	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	15.6	Analyst:	PF
Lab Sample I.D.:	G0960	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	7		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	G6	1	C	3.8	2.38	C		
		2	C	2.4	1.43	C		
		3	B	1.2	0.19	C	C	
		4	C	7.1	4.76	C		
		5	C	1.9	0.95	C		
		6	C	3.3	1.43	C		
		7	M	7.1	5.24	C		
		8	C	14.8	4.76	C		
		9	M	3.8	2.62	C		
		10	C	1.2	0.48	C		
		11	M	4.8	3.81	C		
		12	B	1.1	0.14	C		
		13	M	5.0	4.76	C		
		14	B	0.6	0.24	C		
	E7	15	B	6.7	1.90	C	C	
		16	B	2.1	1.19	C		
		17	C	2.4	2.14	C		
		18	M	1.4	0.48	C		
		19	M	7.1	4.76	C		
		20	C	13.8	3.81	C		
		21	M	2.9	2.38	C		
		22	M	8.1	3.81	C		
		23	C	20.0	12.38	C		
		24	B	13.8	0.43	C		
		25	B	1.9	0.95	C		
		26	C	4.3	2.38	C		
		27	C	2.4	1.43	C		
		28	M	4.8	3.81	C		
		29	B	6.7	1.43	C		
		30	B	2.9	0.48	C	C	
		31	B	1.0	0.33	C		
	H6	32	B	3.8	1.43	C		
		33	F	2.6	0.05	C		
		34	B	0.9	0.07	C		
		35	C	3.8	3.33	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

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MVA, Inc.

SETTLED DUST ANALYSIS

MVA Project #:	1810	Amount Collected(liters):	15.6	Analyst:	PF
Lab Sample I.D.:	G0960	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	7		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	H6	36	C	1.9	1.52	C		
		37	B	10.0	2.14	C		
		38	M	5.7	3.33	C	C	
		39	C	16.7	7.14	C		
		40	M	6.2	3.81	C		
		41	M	4.8	4.29	C		
	I4	42	C	7.1	2.38	C		
		43	B	1.8	0.10	C		
		44	M	2.9	1.90	C		
		45	C	7.1	3.81	C		
		46	C	3.8	0.95	C		
		47	B	3.1	2.14	C		
		48	B	1.4	0.14	C		
		49	C	4.3	2.38	C	C	
		50	C	2.4	1.43	C		
		51	F	1.1	0.05	C		
		52	M	3.3	2.86	C		
		53	B	8.6	1.90	C		
		54	C	2.4	2.14	C		
	H9	55	B	1.2	0.24	C		
		56	M	21.4	14.29	C		
		57	M	7.6	7.62	C		
		58	B	4.3	0.38	C		
		59	B	1.0	0.14	C		
		60	C	4.8	1.43	C		
		61	M	1.4	0.48	C		
		62	C	2.9	2.38	C		
		63	C	5.2	2.38	C	C	
		64	C	3.3	3.33	C		
		65	M	4.3	0.95	C		
		66	F	3.3	0.10	C		
		67	C	9.5	5.71	C		
		68	C	1.9	1.43	C		
		69	C	8.1	7.62	C		
		70	C	17.6	7.14	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	15.6	Analyst:	PF
Lab Sample I.D.:	G0960	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	7		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	H9	71	B	2.9	0.48	C		
		72	C	2.1	0.95	C		
	C6	73	C	9.5	4.76	C	C	
		74	B	3.3	0.24	C		
		75	M	3.8	3.81	C		
		76	C	7.1	4.76	C		
		77	F	8.1	0.10	C		
		78	F	1.4	0.05	C		
		79	C	19.0	4.76	C		
		80	B	5.2	0.10	C		
		81	M	2.4	1.90	C		
		82	B	4.3	0.24	C		
		83	F	2.4	0.14	C		
		84	B	3.3	0.24	C		
		85	C	4.8	3.81	C		
		86	C	4.8	3.33	C		
	F8	87	C	3.8	0.95	C		
		88	C	23.8	23.81	C		
		89	B	10.0	0.48	C		
		90	F	1.0	0.05	C		
		91	F	1.0	0.10	C		
		92	F	1.9	0.10	C		
		93	F	5.2	0.14	C		
		94	C	7.1	4.76	C		
		95	C	9.5	4.76	C		
		96	C	2.9	1.90	C		
		97	C	1.4	1.43	C		
		98	M	7.1	2.38	C		
		99	B	38.1	0.48	C		
		100	C	9.5	4.76	C		
		101	M	1.0	0.48	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	0	Analyst:	JRM
Lab Sample I.D.:	G0961	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	G4	NSD**						
	E7	NSD						
	B3	NSD						
	F1	NSD						
	H5	NSD						
2	B7	NSD						
	A10	NSD						
	I3	NSD						
	F2	NSD						
	E9	NSD						

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	1230	Analyst:	JRM
Lab Sample I.D.:	G0964	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	B3	NSD**						
	E8	1	C	1.0	0.95	C	C	
		2	F	1.9	0.05	C		
	G1	3	B	3.3	0.24	C		
	I8	4	M	4.8	2.38	C		
	C2	NSD						
2	D9	5	F	4.3	0.10	C		
	C5	6	B	2.4	0.29	C		
	A10	7	C	7.1	4.76	C	C	
	H3	8	C	1.9	1.90	C		
		9	F	2.9	0.10	C		
	J4	10	M	8.6	2.38	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

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MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	13	Analyst:	PF
Lab Sample I.D.:	G0969	Amount Prepped(liters):	DIRECT	Date:	5/24/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	D5	NSD**						
	F4	1	F	2.4	0.05	C	C	
		2	C	5.7	4.76	C		
	H6	3	B	1.4	0.14	C		
	G9	NSD						
	C6	NSD						
2	E7	NSD						
	G9	4	B	2.9	0.71	C		
		5	C	9.0	3.81	C		
		6	B	1.2	0.14	C		
		7	C	1.4	1.43	C		
		8	B	4.3	0.10	C		
		9	B	0.7	0.48	C		
	H4	10	C	1.7	1.43	C	C	
	C6	11	B	1.0	0.24	C		
	C9	12	B	0.6	0.10	C		
		13	C	2.4	1.90	C		
		14	B	3.3	0.71	C		
		15	C	14.3	3.33	C		
		16	B	2.1	0.71	C		
		17	F	1.0	0.05	C		
		18	B	0.7	0.14	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	0	Analyst:	PF
Lab Sample I.D.:	G0971	Amount Prepped(liters):	DIRECT	Date:	5/24/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	G8	NSD**						
	E7	NSD						
	B6	NSD						
	H4	1	F	2.1	0.05	C		
	I5	2	F	1.9	0.05	C		
2	C7	NSD						
	E8	NSD						
	D4	NSD						
	B6	NSD						
	H5	NSD						

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

**NFD or NSD = No Fibers Detected or No Structures Detected

MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	7.3	Analyst:	PF
Lab Sample I.D.:	G0975	Amount Prepped(liters):	DIRECT	Date:	5/24/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	3		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	F9	1	C	28.6	23.81	C		
		2	M	1.4	0.95	C		
		3	C	4.8	1.43	C		
		4	B	1.0	0.19	C		
		5	C	7.1	3.81	C		
		6	M	3.8	2.86	C		
		7	M	7.1	5.71	C		
		8	C	4.5	2.14	C	C	
		9	C	12.9	3.81	C		
		10	C	13.3	3.81	C		
		11	C	1.7	0.48	C		
		12	C	11.0	4.76	C		
		13	C	2.4	1.90	C		
		14	C	1.9	1.43	C		
		15	C	2.1	0.95	C		
		16	C	11.0	4.76	C	C	
		17	B	2.6	0.71	C		
		18	B	0.7	0.10	C		
		19	C	2.6	0.95	C		
		20	C	1.9	0.95	C		
		21	C	5.7	2.86	C		
		22	C	2.4	2.14	C		
		23	C	3.3	2.14	C		
		24	C	7.1	4.29	C		
		25	M	11.9	4.76	C		
		26	C	5.7	3.33	C		
		27	B	4.8	1.43	C		
		28	C	2.9	1.90	C		
		29	C	2.6	1.43	C		
		30	B	4.8	1.90	C		
		31	C	0.7	0.71	C		
		32	C	2.1	1.90	C		
		33	M	2.6	1.90	C		
		34	C	11.9	4.76	C	C	
	C7	35	C	20.0	10.95	C		

* On Screen Measure

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MVA, Inc.

SETTLED DUST ANALYSIS

MVA Project #:	1810	Amount Collected(liters):	7.3	Analyst:	PF
Lab Sample I.D.:	G0975	Amount Prepped(liters):	DIRECT	Date:	5/24/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	3		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[ς]	Comments
1	C7	36	C	18.1	17.62	C		
		37	C	2.9	1.43	C		
		38	C	9.0	5.71	C	C	
		39	C	8.1	5.24	C		
		40	B	1.5	0.14	C		
		41	F	0.9	0.07	C		
		42	B	1.5	0.38	C		
		43	C	2.9	1.19	C		
		44	C	1.0	0.71	C		
		45	C	5.2	2.38	C		
		46	C	3.3	0.71	C		
		47	C	2.1	1.90	C		
		48	C	20.5	15.24	C		
		49	C	5.7	3.33	C		
		50	C	2.4	2.14	C		
		51	B	7.6	1.43	C	C	
		52	C	3.8	2.86	C		
		53	B	1.2	0.14	C		
		54	B	1.7	0.19	C		
		55	C	1.0	0.48	C		
		56	C	6.7	6.19	C		
		57	C	2.9	2.38	C		
	E4	58	B	1.2	0.71	C		
		59	B	2.1	1.43	C		
		60	B	1.7	0.95	C		
		61	C	18.1	5.24	C		
		62	C	4.8	1.43	C		
		63	C	4.8	2.86	C		
		64	C	3.3	2.14	C		
		65	C	3.8	1.43	C		
		66	B	2.1	0.19	C	C	
		67	B	7.1	1.90	C		
		68	B	5.2	0.95	C		
		69	C	13.8	4.29	C		
		70	C	8.6	3.33	C		

* On Screen Measure

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[ς]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

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MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	7.3	Analyst:	PF
Lab Sample I.D.:	G0975	Amount Prepped(liters):	DIRECT	Date:	5/24/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	3		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	E4	71	C	14.8	6.67	C		
		72	C	1.2	0.71	C		
		73	C	5.7	0.71	C		
		74	C	9.5	5.71	C		
		75	C	12.9	6.19	C		
		76	C	2.1	0.48	C		
		77	C	6.2	4.76	C		
		78	C	4.5	4.29	C		
		79	B	13.8	1.90	C		
		80	C	11.0	5.24	C		
		81	B	2.1	0.62	C	C	
		82	C	1.9	1.43	C		
		83	C	2.1	0.95	C		
		84	C	2.0	1.43	C		
		85	C	13.3	4.29	C		
		86	F	1.5	0.05	C		
		87	C	1.9	1.19	C		
		88	C	1.4	0.95	C		
		89	C	2.6	1.43	C		
		90	C	4.8	2.38	C		
		91	C	2.6	1.90	C		
		92	C	0.7	0.48	C		
		93	C	5.0	2.86	C	C	
		94	C	18.1	7.14	C		
		95	B	2.1	0.48	C		
		96	C	8.1	2.38	C	C	
		97	C	3.3	2.38	C		
		98	C	7.1	5.71	C		
		99	C	20.0	15.71	C		
		100	F	0.6	0.05	C		
		101	B	9.0	0.95	C		
		102	B	4.5	0.48	C		
		103	C	11.0	4.76	C		
		104	C	2.9	1.19	C		
		105	C	1.2	0.33	C		
		106	C	1.9	0.71	C	C	

* On Screen Measure

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[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

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MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	0	Analyst:	PF
Lab Sample I.D.:	G0976	Amount Prepped(liters):	DIRECT	Date:	5/24/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	G4	NSD**						
	H7	NSD						
	E7	NSD						
	C5	NSD						
	D2	NSD						
2	F2	NSD						
	C4	NSD						
	A7	NSD						
	F4	NSD						
	G6	NSD						

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

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MVA, Inc.

SAMPLE ANALYSIS INFORMATION

MVA Project #:	1810	Amount Collected(liters):	1240	Analyst:	JRM
Lab Sample I.D.:	G0980	Amount Prepped(liters):	DIRECT	Date:	5/23/96
Client Sample I.D.:		Filter Area (mm^2):	385	Comments:	
Instrument I.D.:	JEOL1200	Filter Type:	PC		
Magnification:	21,000	Openings Analyzed:	10		
Acc. Voltage:	120kV	Grid Opening (mm_2):	0.008		

Grid	Opening	Structure Number	Structure Type[α]	Length* (µm)	Width* (µm)	SAED[β]	EDS[δ]	Comments
1	F1	1	C	2.4	2.38	C	C	
	G5	2	F	3.3	0.10	C		
		3	B	8.6	0.24	C		
	H8	4	M	4.8	0.33	C		
		5	B	3.8	0.48	C		
		6	C	4.8	2.38	C		
	B6	7	C	4.8	0.95	C		
	A1	8	F	1.0	0.05	C		
2	D5	9	F	2.4	0.10	C		
	A7	10	C	3.8	1.90	C		
	H2	11	C	2.4	2.38	C		
	E3	12	M	9.5	9.52	C		
	I9	13	F	1.9	0.10	C		

* On Screen Measure

[α]B = Bundle, C = Cluster, F = Fiber, M = Matrix

[β]C = Chrysotile, A = Amphibole

[δ]C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

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