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ADMINISTRATIVE RECORD

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W.R. GRACE VERMICULITE MINE CLOSURE WATER QUALITY DATA REPORT NO. 2 MARCH, 1991

Submitted to:

Montana Department of State Lands
Hard Rock Mining Bureau
Helena, Montana

Submitted by:

Schafer and Associates
Bozeman, Montana

May 6, 1992

Schafer

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Waste Management
Land Reclamation
Resource Inventory
Agricultural Consulting

May 6, 1991

Mr. Pat Plantenberg
Department of State Lands
Hardrock Mining Bureau
1625 Eleventh Avenue
Helena, Montana 59620

RECEIVED
MAY 11 1992
STATE LANDS

Dear Pat:

Enclosed are two copies of Water Quality Data Report No. 2 summarizing the results of the second round of water sampling at the W.R. Grace vermiculite mine near Libby. Data for this report was collected March 25, 1992. Please forward one copy to Tom Reid at the Water Quality Bureau.

There is little of interest in the water chemistry data. Most sample points showed analyses which were slightly lower than those in November. We attribute this to dilution with surface runoff. The asbestiform fiber analyses were somewhat different in that both Lower Carney Creek and the tailings pond had considerably higher fiber counts than in November. Lower Rainy Creek continues to show high asbestos fiber counts.

We did not sample pore water installations this time since our earlier sampling produced the information we were looking for regarding the source of water in the toe drains. Nor did we sample Upper Rainy Creek at SW-1 because the Rainy Creek diversion was not being used. Instead, we sampled the entire Rainy Creek flow at SW-11 just upstream of the tailings impoundment.

Let me know if you have any questions or comments regarding the data. I'm looking forward to our meeting on tailings impoundment flood routing May 19th.

Sincerely,

Tom Hudson

Tom Hudson
Project Manager

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1.0 BACKGROUND

The W.R. Grace vermiculite mine near Libby, Montana was closed in the fall of 1990. As part of the reclamation and closure, particularly as it applies to areas around the tailings impoundment, W.R. Grace submitted to the Water Quality Bureau a proposed Water Quality Monitoring Plan in September, 1991 (Schafer and Associates, 1991). The purpose of the Plan was to establish post-closure water quality data as a means of monitoring the performance of facility reclamation measures.

The plan calls for water sampling at several locations in the Rainy Creek drainage as shown on Figure 1.1. Contingent sampling on the Kootenai was proposed if initial data on Rainy Creek indicated any potential health concerns. Four sampling campaigns were proposed for the first year to assess seasonal variations in water quality. Additional annual sampling campaigns for a minimum of three years following closure were also proposed. The first sampling event took place in mid-November, 1991. This report presents the data from the second sampling event performed on March 25, 1991.

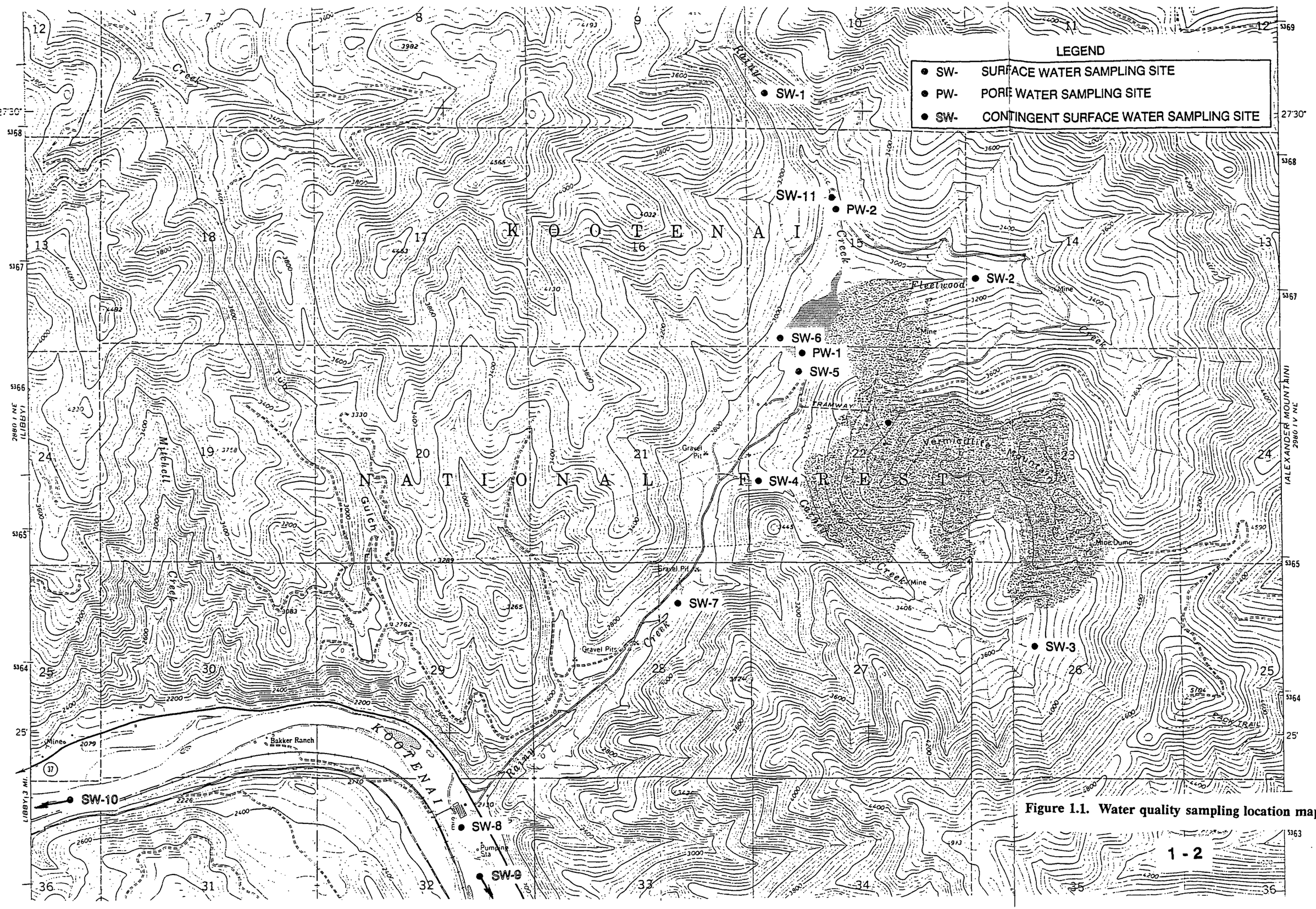

Figure 1.1. Water quality sampling location map.

2.0 METHODS

Conditions at the time of sampling were sunny and very mild with a high during the day of nearly 70° F. There was still some snow at the higher elevations but it was apparent that there would be no significant spring runoff this year. The Rainy Creek diversion was not in use; all of Rainy Creek flowed in the natural drainage into the tailings pond. The impoundment was free of ice unlike our November sampling. The decant tower was still not overflowing nor had it done so all winter long in spite of the fact that the impoundment was receiving the entire flow from both Rainy Creek and Fleetwood Creek.

Sampling methods were outlined in the Water Quality Monitoring Plan (Schafer and Associates, 1991) submitted in September, 1991 and modified slightly in the field as described in Water Quality Data Report No. 1 (Schafer and Associates, 1992). Site SW-1, Upper Rainy Creek above the diversion dam, was not sampled this time. In November, Upper Rainy Creek was being fully diverted around the tailings impoundment, however flow was reestablished in the natural channel before the tailings impoundment and this necessitated an additional unplanned sample at SW-11. In March the diversion was not being used and all flow was down the natural stream channel. W.R. Grace does this in the coldest part of winter because of operational problems that are sometimes created by cold weather. For this report we collected a single sample at SW-11 which is the total flow for Upper Rainy Creek.

The preservation techniques and analytical methods used are summarized in Table 2.1. All samples were stored and shipped on ice. Two samples in glass containers (for TPH analysis only) were broken in transit. Metals were analyzed as the "total recoverable" form according to procedures outlined in Standard Methods for Examination of Water and Wastewater (APHA, 1985).

Table 2.1. Summary of sampling and analytical methods for water samples.

Unpreserved Samples		Preserved Samples			Field Parameters	
Component	Analytical Method[1]	Component	Preservation/ Container[2]	Analytical Method[1]	Param.	Method
TDS	EPA 160.1	TPH	H_2SO_4/Glass	EPA 418.1	Flow	Pygmy current meter/ Baski
TSS	EPA 160.2	Cu	HNO_3/PE	EPA 220.1/200.7	pH	Field pH meter
Asbest. Fibers	EPA-600/4-83-043	Zn	HNO_3/PE	EPA 289.1/200.7	EC	Field EC meter
Hardness	EPA 130.2	Cd	HNO_3/PE	EPA 213.1/200.7	DO	Field D.O. meter
Alkalinity	EPA 310.1	Pb	HNO_3/PE	EPA 239.2/200.7	Temp.	Field meter
NO_3^-	EPA 353.2	Hg	HNO_3/PE	EPA 245.2		
SO_4^{-2}	EPA 375.3	Fe	HNO_3/PE	EPA 236.1/200.7		
Cl^-	EPA 325.3	As	HNO_3/PE	EPA 206.3		
F^-	EPA 340.2	Ni	HNO_3/PE	EPA 249.1/200.7		
Ca	EPA 215.1/200.7	Cr	HNO_3/PE	EPA 218.1/200.7		
Mg	EPA 242.1/200.7					
Na	EPA 273.1/200.7					
K	EPA 258.1/200.7					
CO_3^{-2}/HCO_3^-	EPA 310.1					

1 EPA procedures are described in 40 CFR Part 136, Table B. Procedures for asbestiform fibers are described in "Analytical Procedures for Determination of Asbestos Fibers in Water" (EPA-600/4-83-043).

2 Samples were acidified to a value less than 2.0. The TPH sample was collected in a 1 L glass bottle; metals were collected in 500 ml polyethylene (PE) bottles.

3.0 PRESENTATION OF DATA

Results of the March 25, 1992 sampling event are summarized in tabular form as follows:

- Table 3.1 is a summary of field parameters including pH, electric conductivity (EC), temperature and flow. Our dissolved oxygen meter was not available at the time of this sampling trip, hence this data was not obtained.
- Table 3.2 is a summary of metal analyses including selected heavy metals and major cations.
- Table 3.3 is a summary of miscellaneous analyses for various anions, petroleum hydrocarbons, hardness, etc.
- Table 3.4 is a summary of asbestiform fiber analyses.

Raw analytical data from Energy Laboratories and EMS Laboratories used to prepare Tables 3.2, 3.3 and 3.4, are included in Appendix A and B, respectively.

Table 3.1. Field data summary.

SITE NO.	DESCRIPTION	pH (su)	EC (mmhos/cm)	TEMP (°C)	FLOW (cfs)	D.O.[3] (ppm)
SW-1	Upper Rainy Creek above diversion dam	Not Sampled				
SW-2	Fleetwood Creek above coarse tails	8.50	0.45	6.8	0.34[1]	
SW-3	Upper Carney Creek at Zook's Dump	8.06	0.70	10.8	<.01[2]	
SW-4	Lower Carney Creek above Rainy Creek	8.61	0.58	4.6	0.51[2]	
SW-5	Tailings dam toe drains	7.26	0.68	9.8	1.26[1]	
SW-6	Tailings pond outfall (surface water sample, only)	8.66	0.36	8.9	0.00	
SW-7	Lower Rainy Creek leaving mine property	7.87	0.58	6.5	2.59[1]	
SW-8	Lower Rainy Creek above Kootenai River	7.98	0.57	5.3	2.92[1]	
SW-9	Kootenai River above Rainy Creek	Not Sampled[4]				
SW-10	Kootenai River below Rainy Creek	Not Sampled[4]				
SW-11[5]	Rainy Creek flow into tailings pond	8.18	0.32	4.6	1.46[1]	
PW-1	Tailings Pond pore water	Not Sampled				
PW-2	Groundwater near SW-11	Not Sampled				

1 Flow measurement was made with a Pygmy current meter.
2 Flow measurement was made with a Baski cutthroat flume.
3 The dissolved oxygen meter was not available.
4 Samples of the Kootenai River were not taken as discussed in the Water Quality Monitoring Plan.
5 The Water Quality Monitoring Plan did not include this site. Rainy Creek reestablishes itself between the diversion dam and the tailings impoundment.

Table 3.2. Laboratory data summary for metals.

SITE NO.	DESCRIPTION	As (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Pb (mg/l)	Hg (mg/l)	Ni (mg/l)	Zn (mg/l)	K (mg/l)	Na (mg/l)	Ca (mg/l)	Mg (mg/l)
SW-1	Upper Rainy Creek above diversion dam	Not Sampled												
SW-2	Fleetwood Creek above coarse tails	<0.005	<0.001	<0.02	<0.01	0.03	<0.01	<0.001	<0.03	<0.01	8	5	79	15
SW-3	Upper Carney Creek at Zook's Dump	<0.005	<0.001	<0.02	<0.01	0.53	<0.01	<0.001	<0.03	<0.01	9	8	106	26
SW-4	Lower Carney Creek above Rainy Creek	<0.005	<0.001	<0.02	<0.01	0.11	<0.01	<0.001	<0.03	<0.01	12	9	85	26
SW-5	Tailings dam toe drains	0.005	<0.001	<0.02	<0.01	0.06	<0.01	<0.001	<0.03	<0.01	12	7	93	25
SW-0	Blind Control (Replicate of SW-5)	0.005	<0.001	<0.02	<0.01	0.06	<0.01	<0.001	<0.03	<0.01	12	7	93	25
SW-6	Tailings pond surface water	<0.005	<0.001	<0.02	<0.01	0.19	<0.01	<0.001	<0.03	0.01	6	4	51	13
SW-7	Lower Rainy Creek leaving mine property	<0.005	<0.001	<0.02	<0.01	0.15	<0.01	<0.001	<0.03	0.02	10	7	87	22
SW-8	Lower Rainy Creek above Kootenai River	<0.005	<0.001	<0.02	<0.01	0.11	<0.01	<0.001	<0.03	<0.01	10	6	87	21
SW-9	Kootenai River above Rainy Creek	Not Sampled												
SW-10	Kootenai River below Rainy Creek	Not Sampled												
SW-11	Rainy Creek flow into tailings pond	<0.005	<0.001	<0.02	<0.01	0.24	<0.01	<0.001	<0.03	0.01	4	3	64	11
PW-1	Pore water from tailings	Not Sampled												
PW-2	Groundwater near SW-11	Not Sampled												

Table 3.3. Laboratory data summary for miscellaneous constituents.

SITE NO.	DESCRIPTION	SO_4^{-2} (mg/l)	Cl (mg/l)	CO_3^{-2} (mg/l)	HCO_3^{-1} (mg/l)	TDS (mg/l)	TSS (mg/l)	Hardness (mg/l)	Alkalinity (mg/l)	NO_3^- (mg/l)	F (mg/l)	TPH (mg/l)
SW-1	Upper Rainy Creek above diversion dam	Not Sampled										
SW-2	Fleetwood Creek above coarse tails	18	4	0	293	291	1	258	240	<0.05	0.26	<0.1
SW-3	Upper Carney Creek at Zook's Dump	11	2	0	452	431	6	371	370	0.06	0.21	<0.1
SW-4	Lower Carney Creek above Rainy Creek	21	3	0	370	349	4	316	303	0.23	0.20	<0.1
SW-5	Tailings dam toe drains	12	7	0	397	383	3	335	325	0.06	3.0	No Data[1]
SW-0	Blind Control (Replicate of SW-5)	12	7	0	392	375	<1	334	321	0.07	3.2	<0.1
SW-6	Tailings pond surface water	9	3	0	206	191	12	182	169	<0.05	0.29	<0.1
SW-7	Lower Rainy Creek leaving mine property	11	7	0	350	329	6	308	287	<.05	1.7	<0.1
SW-8	Lower Rainy Creek above Kootenai River	11	7	0	345	293	5	303	282	<0.05	1.5	<0.1
SW-9	Kootenai River above Rainy Creek	Not Sampled										
SW-10	Kootenai River below Rainy Creek	Not Sampled										
SW-11	Rainy Creek flow into tailings pond	5	<1	0	236	196	36	205	193	<0.05	0.13	No Data[1]
PW-1	Pore water from tailings	Not Sampled										
PW-2	Groundwater near SW-11	Not Sampled										

[1] Sample bottles broke during shipment.

Table 3.4. Laboratory data summary for asbestiform fibers.

SITE NO.	DESCRIPTION	DETECTION LIMIT (MFL)*	FIBERS <5μm (MFL)*	FIBERS >5μm (MFL)*	FIBERS >10μm (MFL)*	FIBER MASS (μg/l)
SW-1	Upper Rainy Creek above diversion dam	Not Sampled				
SW-2	Fleetwood Creek above coarse tails	0.8	8.9	3.1	2.3	47
SW-3	Upper Carney Creek at Zook's Dump	0.3	20.7	5.3	1.6	50
SW-4	Lower Carney Creek above Rainy Creek	1	65	55	19	950
SW-5	Tailings dam toe drains	1.6	<1.6	<1.6	<1.6	BDL*
SW-0	Blind Control (Replicate of SW-5)	0.2	<0.2	<0.2	<0.2	BDL*
SW-6	Tailings pond surface water	8.2	500	270	120	1800
SW-7	Lower Rainy Creek leaving mine property	1	66	34	9.2	180
SW-8	Lower Rainy Creek above Kootenai River	0.8	51	30	9	270
SW-9	Kootenai River above Rainy Creek	Not Sampled				
SW-10	Kootenai River below Rainy Creek	Not Sampled				
SW-11	Rainy Creek flow into tailings pond	2	1.9	2	2	1.6

* MFL = Million fibers per liter; BDL = Below detection limit

4.0 DATA ANALYSIS

The significant findings of this sampling event are as follows:

- Streamflow was about 50 percent higher than in November. This appears to have resulted in a dilution of dissolved solids in most samples. Predictably, the tailings impoundment toe drain water chemistry is virtually unchanged because it receives little or no direct surface runoff. The stability of this sample location is also reflected in the volumetric flow which was about the same as in November. The tailings pond surface water showed substantially higher dissolved solids than in November when ice was on the pond surface. This observation reinforces our theory that successive freeze/thaw cycles may purify the water at the surface of the pond.

- The elevated zinc concentrations encountered on the earlier sampling event appear to be much lower on this round of sampling but the samples showing detectable levels are generally at the same locations as in November.

- Higher asbestiform fiber counts were measured at SW-4 (Lower Carney Creek) and SW-6 (tailings pond surface water). The Carney Creek fiber count can probably be attributed to higher runoff. The high impoundment fiber counts may be due to the absence of an ice layer on the pond. It was breezy the day of sampling and the wind may have caused suspension of particles near the shore. SW-11 (Rainy Creek above the tailings pond) also had a slight showing of asbestiform fibers whereas in November there was none detected. We attribute this to the overall heavy suspended solids load in this particular sample. The sample was taken in mid- to late-afternoon when the temperature was highest and runoff appeared to be high as well. The sediment loading in Upper Rainy Creek was clearly visible at the time of sampling. Extensive clear-cutting in the Upper Rainy Creek drainage may be a contributing factor.

- We have assembled a mass flow schematic diagram for the sampling area in Figure 4.1 as we did in the prior data report. Lower Rainy Creek again appears to be a major source of asbestiform fibers but Carney Creek is a significant factor in the overall fiber loading, accounting for 61 percent of the total load discharged at the mouth of Rainy Creek. This is a result substantially different than seen in November. The Lower Carney Creek sample has a higher average fiber mass than other samples. This suggests a possible transport mechanism to explain variations in data observed to date. During periods of high flow, relatively coarse material may wash out of the Carney Creek drainage and settle out in the Rainy Creek drainage. It is probable

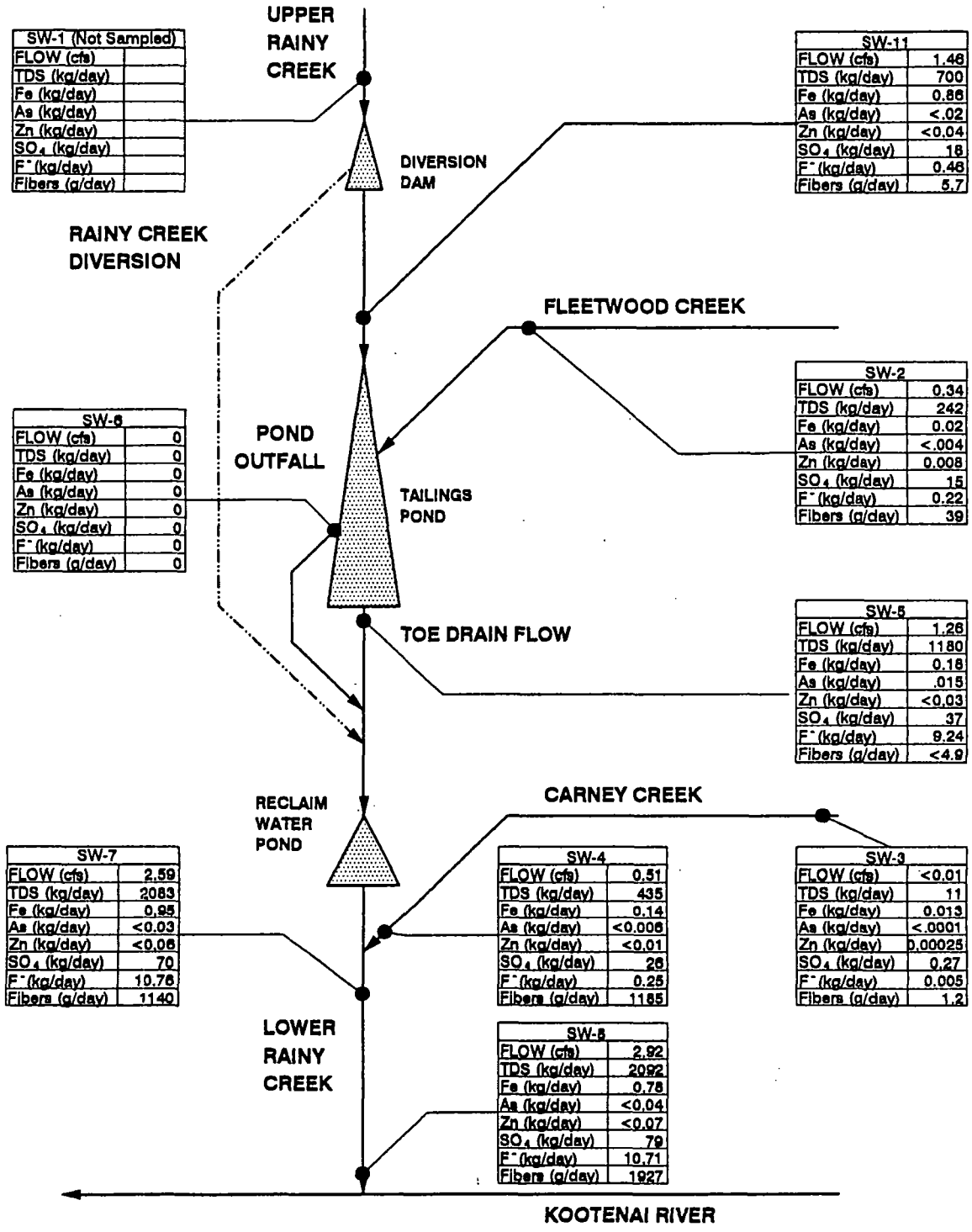

Figure 4.1 Schematic flow diagram of the Rainy Creek drainage with mass flow measurements for selected components.

that our sampling does not measure a significant portion of material transport in which material shifts in the stream bed without ever becoming fully entrained. These larger particles may be attrited into smaller more readily transportable particles which are carried out at a more uniform rate. Interestingly, on this round of sampling at least, the tailings impoundment was actually working to reduce asbestiform fibers in stream flows entering it. Both Upper Rainy Creek and Fleetwood Creek had detectable levels of asbestiform fibers but the toe drains, which were the only points of discharge from the pond, did not.

- Table 4.1 compares measured water quality values to existing standards. Once again, fluoride and asbestiform fibers appear to be the primary areas of concern. One sample (SW-3, Upper Carney Creek at Zook's dump) was slightly above the drinking water standard for Fe. Lower Carney Creek is within that standard, however.

Table 4.1 A comparison of measured water quality data with drinking water standards.

Constituent	Measured Concentration Range	Primary Drinking Water Standard	Secondary Drinking Water Standard	Location of Sample with Maximum Concentration
	(mg/l except as noted)			
As	<0.005 to 0.005	0.05		SW-5
Cd	<.001	0.005[1]		All
Cr	<.02	0.1[1]		All
Cu	<.01		1.0	All
Fe	0.03 to 0.53		0.3	SW-3
Pb	<.01	0.05		All
Hg	<.001	0.005		All
Ni	<.03			All
Zn	<0.01 to 0.02	5.0		SW-7
Asbestos (MFL)	<0.2 to 120	7.0[1,2]		SW-6
SO_4^{-2}	3 to 21		250.	SW-4
Cl^-	<1 to 7		250.	SW-5, -7 and -8
NO_3^-	<0.05 to 0.23	10.0		SW-4
F^-	0.13 to 3.0		2.0	SW-5
pH (su)	7.26 to 8.66		6.5 to 8.5	SW-5(min); SW-6(max)
TDS	191 to 431		500.	SW-3

1 These standards are added or revised effective July 1992.

2 Fiber counts are based on fibers greater than 10 microns in length with an aspect ratio greater than 3:1.

REFERENCES

American Public Health Association, 1985. Standard Methods for the Examination of Water and Wastewater, Part 300: Determination of Metals.

Schafer and Associates, 1991. W.R. Grace Vermiculite Mine Closure Water Quality Monitoring Plan, submitted to Montana Department of Health and Environmental Sciences, Water Quality Bureau.

Schafer and Associates, 1992. W.R. Grace Vermiculite Mine Closure Water Quality Data Report No. 1, November 1991, submitted to Montana Department of State Lands, Hard Rock Mining Bureau.

APPENDIX A

ENERGY LABORATORIES DATA REPORTS

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ENERGY LABORATORIES

ENERGY LABORATORIES, INC.
P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325
FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11554
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW0
Sampled 03/25/92 @ 1455
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	12
Sodium	7
Calcium	93
Magnesium	25
Sulfate	12
Chloride	7
Carbonate	0
Bicarbonate	392
Total Dissolved Solids @ 180° C	375
Total Suspended Solids	<1
Total Hardness as $CaCO_3$	334
Total Alkalinity as $CaCO_3$	321
Nitrate plus Nitrite as N	0.07
Fluoride	3.2
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons*	<0.1

Total Recoverable Metals

Arsenic	0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.06
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	<0.01

* Analysis done by EPA Method 418.1.

ENERGY LABORATORIES, INC.
P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325
FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11555
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW2
Sampled 03/25/92 @ 1435
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	8
Sodium	5
Calcium	79
Magnesium	15
Sulfate	18
Chloride	4
Carbonate	0
Bicarbonate	293
Total Dissolved Solids @ 180° C	291
Total Suspended Solids	1
Total Hardness as $CaCO_3$	258
Total Alkalinity as $CaCO_3$	240
Nitrate plus Nitrite as N	<0.05
Fluoride	0.26
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons*	<0.1

Total Recoverable Metals

Arsenic	<0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.03
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	<0.01

* Analysis done by EPA Method 418.1.

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FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11556
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW3
Sampled 03/25/92 @ 1315
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	9
Sodium	8
Calcium	106
Magnesium	26
Sulfate	11
Chloride	2
Carbonate	0
Bicarbonate	452
Total Dissolved Solids @ 180° C	431
Total Suspended Solids	6
Total Hardness as $CaCO_3$	371
Total Alkalinity as $CaCO_3$	370
Nitrate plus Nitrite as N	0.06
Fluoride	0.21
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons*	<0.1

Total Recoverable Metals

Arsenic	<0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.53
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	<0.01

* Analysis done by EPA Method 418.1.

ENERGY LABORATORIES, INC.
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LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11557
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW4
Sampled 03/25/92 @ 0945
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	12
Sodium	9
Calcium	85
Magnesium	26
Sulfate	21
Chloride	3
Carbonate	0
Bicarbonate	370
Total Dissolved Solids @ 180° C	349
Total Suspended Solids	4
Total Hardness as $CaCO_3$	316
Total Alkalinity as $CaCO_3$	303
Nitrate plus Nitrite as N	0.23
Fluoride	0.20
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons*	<0.1

Total Recoverable Metals

Arsenic	<0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.11
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	<0.01

* Analysis done by EPA Method 418.1.

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LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11558
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW5
Sampled 03/25/92 @ 1100
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	12
Sodium	7
Calcium	93
Magnesium	25
Sulfate	12
Chloride	7
Carbonate	0
Bicarbonate	397
Total Dissolved Solids @ 180° C	383
Total Suspended Solids	3
Total Hardness as $CaCO_3$	335
Total Alkalinity as $CaCO_3$	325
Nitrate plus Nitrite as N	0.06
Fluoride	3.0
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons	*

Total Recoverable Metals

Arsenic	0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.06
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	<0.01

* The total petroleum hydrocarbon sample froze and broke during shipping.

ENERGY LABORATORIES, INC.
P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325
FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11559
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW6
Sampled 03/25/92 @ 1130
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	6
Sodium	4
Calcium	51
Magnesium	13
Sulfate	9
Chloride	3
Carbonate	0
Bicarbonate	206
Total Dissolved Solids @ 180° C	191
Total Suspended Solids	12
Total Hardness as $CaCO_3$	182
Total Alkalinity as $CaCO_3$	169
Nitrate plus Nitrite as N	<0.05
Fluoride	0.29
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons*	<0.1

Total Recoverable Metals

Arsenic	<0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.19
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	0.01

* Analysis done by EPA Method 418.1.

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FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11560
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW7
Sampled 03/25/92 @ 0900
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	10
Sodium	7
Calcium	87
Magnesium	22
Sulfate	11
Chloride	7
Carbonate	0
Bicarbonate	350
Total Dissolved Solids @ 180° C	329
Total Suspended Solids	6
Total Hardness as $CaCO_3$	308
Total Alkalinity as $CaCO_3$	287
Nitrate plus Nitrite as N	<0.05
Fluoride	1.7
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons*	<0.1

Total Recoverable Metals

Arsenic	<0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.15
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	0.02

* Analysis done by EPA Method 418.1.

ENERGY LABORATORIES, INC.
P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325
FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11560 dup
DATE: 04/13/92 rh

QUALITY ASSURANCE - DUPLICATE ANALYSIS

W.R. Grace Mine
SW7
Sampled 03/25/92 @ 0900
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	10
Sodium	6
Calcium	86
Magnesium	22
Sulfate	11
Chloride	7
Carbonate	0
Bicarbonate	351
Total Dissolved Solids @ 180° C	277
Total Suspended Solids	7
Total Hardness as $CaCO_3$	305
Total Alkalinity as $CaCO_3$	288
Nitrate plus Nitrite as N	<0.05
Fluoride	1.8
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons	N/A

Total Recoverable Metals

Arsenic	<0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.15
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	0.02

ENERGY LABORATORIES, INC.
P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325
FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11561
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW8
Sampled 03/25/92 @ 0730
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	10
Sodium	6
Calcium	87
Magnesium	21
Sulfate	11
Chloride	7
Carbonate	0
Bicarbonate	345
Total Dissolved Solids @ 180° C	293
Total Suspended Solids	5
Total Hardness as $CaCO_3$	303
Total Alkalinity as $CaCO_3$	282
Nitrate plus Nitrite as N	<0.05
Fluoride	1.5
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons*	<0.1

Total Recoverable Metals

Arsenic	<0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.11
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	<0.01

* Analysis done by EPA Method 418.1.

ENERGY LABORATORIES, INC.
P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325
FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11561 spi
DATE: 04/13/92 rh

QUALITY ASSURANCE - SPIKED ANALYSIS

W.R. Grace Mine
SW8
Sampled 03/25/92 @ 0730
Submitted 03/27/92

Constituent	% Recovery
Potassium	100
Sodium	102
Calcium	99
Magnesium	103
Sulfate	100
Chloride	99
Nitrate plus Nitrite as N	106
Fluoride	108
Total Recoverable Metals	
Arsenic	104
Cadmium	105
Chromium	96
Copper	105
Iron	103
Lead	100
Mercury	96
Nickel	97
Zinc	96

ENERGY LABORATORIES, INC.
P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325
FAX (406) 252-6069 • 1-800-735-4489

LABORATORY REPORT

TO: Schafer & Associates
ADDRESS: P.O. Box 6186
Bozeman, MT 59715

LAB NO.: 92-11562
DATE: 04/13/92 rh

WATER ANALYSIS

W.R. Grace Mine
SW11
Sampled 03/25/92 @ 1535
Submitted 03/27/92

Constituent	mg/l(ppm)
Potassium	4
Sodium	3
Calcium	64
Magnesium	11
Sulfate	5
Chloride	<1
Carbonate	0
Bicarbonate	236
Total Dissolved Solids @ 180° C	196
Total Suspended Solids	36
Total Hardness as $CaCO_3$	205
Total Alkalinity as $CaCO_3$	193
Nitrate plus Nitrite as N	<0.05
Fluoride	0.13
Total Acidity as $CaCO_3$	0
Total Petroleum Hydrocarbons	*

Total Recoverable Metals

Arsenic	<0.005
Cadmium	<0.001
Chromium	<0.02
Copper	<0.01
Iron	0.24
Lead	<0.01
Mercury	<0.001
Nickel	<0.03
Zinc	0.01

* The total petroleum hydrocarbon sample froze and broke during shipping.

APPENDIX B

EMS LABORATORIES DATA REPORTS

DATE:	April 15, 1992
CLIENT:	Schafer and Associates P.O. Box 6186 Bozeman, MT 59715
ATTENTION:	Tom Hudson
REFERENCE:	Letter dated March 26, 1992.
REPORT NO.:	24142
SUBJECT:	ANALYSIS OF WATER SAMPLES BY TRANSMISSION ELECTRON MICROSCOPY
ACCREDITED:	National Institute of Standards and Technology through NVLAP (Laboratory No. 1218)
CERTIFIED:	California Dept. of Health Services for Asbestos by TEM (ELAP E719)

Nine water samples were submitted for TEM analysis of asbestos structures. The sample was analyzed according to the U.S. EPA method EPA-600/4-83-043.

The samples were identified as surface water from W.R. Grace mine:

SW6-4
SW3-4
SW0-4
SW11-4
SW8-4
SW2-4
SW5-4
SW7-4

The test reports are enclosed.

Respectfully submitted,

EMS LABORATORIES, INC.

B.M. Kolk
Laboratory Director

BMK/kat

A U.S. Dept. of Commerce, Nat'l Institute of Standards and Technology accredited lab.
Airborne Asbestos
Asbestos Bulk Sample
Analyses
NVLAP
EMS Laboratories, Inc.
Lab Code: 1218

This report, from a NIST accredited laboratory through NVLAP, must not be used by the client to claim product endorsement by NVLAP or any agency of the Government.

ANALYSIS OF WATER BY TEM (EPA-600/4-83-043)

LAR NO: 24142
CLIENT: SCHAFER & ASSOC.

Laboratory I.D.	Client I.D.	FILTER MEDIA DATA Type	Diameter mm	Effective Area mm^2	No. of G.O.	Analyzed Area, mm^2	Sample Volume (ml)
24142.0-4	SW 0-4	MCE	47	1017	21	0.1302	50
24142.2-4	SW 2-4	MCE	47	1017	21	0.1302	10
24142.3-4	SW 3-4	MCE	47	1017	21	0.1302	25
24142.4-4	SW 4-4	MCE	47	1017	8	0.0496	20
24142.5-4	SW 5-4	MCE	47	1017	21	0.1302	5
24142.6-4	SW 6-4	MCE	47	1017	4	0.0248	5
24142.7-4	SW 7-4	MCE	47	1017	8	0.0496	20
24142.8-4	SW 8-4	MCE	47	1017	8	0.0496	25
24142.11-4	SW 11-4	MCE	47	1017	21	0.1302	4

INDIVIDUAL ANALYTICAL RESULTS

Laboratory I.D.	Client I.D.	No. of Asbestos Str	>5	>10	Detection Limit (MFL)	CONCENTRATION (MFL) Str	Str >5um	Str >10um
24142.0-4	SW 0-4	N.D.	N.D.	N.D.	0.2	N.D.	N.D.	N.D.
24142.2-4	SW 2-4	15	4	3	0.8	12	3.1	2.3
24142.3-4	SW 3-4	52	17	5	0.3	16	5.3	1.6
24142.4-4	SW 4-4	116	53	18	1	120	55	19
24142.5-4	SW 5-4	N.D.	N.D.	N.D.	1.6	N.D.	N.D.	N.D.
24142.6-4	SW 6-4	94	33	15	8.2	770	270	120
24142.7-4	SW 7-4	101	33	9	1	100	34	9.2
24142.8-4	SW 8-4	99	37	11	0.8	81	30	9
24142.11-4	SW 11-4	2	1	1	2	3.9	0	2

The analysis was carried out to the approved TEM method. This laboratory is in compliance with the quality specified by the method.

B M Kolk
Authorized Signature

EMS ran duplicate preparations on the following samples for QC:

Sample No.	Original Result	Duplicate Result
SW 3-4	16 MFL	14 MFL
SW 5-4	BDL (DL 1.6 MFL)	BDL (DL 1.2 MFL)
SW 6-4	770 MFL	750 MFL
SW 4-4 (Replicate Preparation)	120 MFL	220 MFL

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No. 24142 Client SCHAFER & ASSOC.

Sample No. SW 0-4

Date 4/6/92

Total Asbestos Fibers	*BDL	MFL
Chrysotile Fibers	*BDL	MFL
Amphibole Fibers	*BDL	MFL
> 5 Micron length (chrysotile)	*BDL	MFL
> 5 Micron length (amphibole)	*BDL	MFL
Mass (Chrysotile)	*BDL	µg/L
Mass (amphibole)	*BDL	µg/L
More/Less than 5 Chrysotile Fibers in Sample	LESS	
More/Less than 5 Amphibole Fibers in Sample	LESS	
Poisson 95% Confidence Interval	0 to 0.6	MFL
Detection Limit	0.2	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Size Distribution (Chrysotile and Amphibole)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 & UP
0	0	0	0	0	0

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 & UP
0	0	0	0	0	0

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 & UP
0	0	0	0	0	0

TEM ASBESTOS ANALYSIS

MS Lab No. 24142
Client Schafer & Assoc
Sample No. SWO-4

RECEIVING

METHOD OF ANALYSIS
EPA Yamate Level I ☐
Level II ☐
Level III ☐
AHERA ☐

ASPECT RATIO 3:1 ☑ 5:1 ☐

LENGTHS
All Sizes (EPA) ☑
(µm):≥0.5 ☐
≥1.0 ☐
≥5.0 ☐
≥10.0 ☐
PCM Range* ☐
*(≥0.25 µm width, ≥5.0 µm length)

Approved By _____ Date _____

FILTER TYPE/AREA (mm²)
MCE/385 ☐
MCN/960 ☐
MCE/960 ☐
1017 Other ☑

TYPE OF SAMPLE
Air ☐ Water ☑
Soil ☐ Wipe ☐
Bulk ☐ Other ☐
Dust/Microvac ☐

PORE SIZE
0.45 µm ☐
0.8 µm ☐
.1 µm ☒
.22 µm ☐
Other ☐

G.O. Area (mm²) 0.0 062
No. of G.O. to Analyze 21
Filter Lot No. _____

PREP

DIRECT PREP ☑
INDIRECT PREP ☐

Volume _____ liters
Working Volume 50 ml
Weight _____ grams
Ashed Area _____ %

Prepared By FG

ANALYSIS

GRID
1 ☑ 3 ☐
2 ☐ 4 ☐

Grid Address 1A
Screen Magnification 10130D x
Camera Constant 27.7
Accelerating Voltage 100 KV
Beam Current 10 µa

Analyst S. Ahmed Date 4/6/92

MICROSCOPE
600A ☐
600B ☑
HU11E ☐
HU12SE ☐

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	Fiber Classification NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	NSD																									
3	NSD																									
4	NSD																									
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:

Clean ☐
Debris: ☑ Very Light ☐ Light ☑ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

EM ASBESTOS ANALYSIS

MS Lab No. 24142

mple No. SWO-4

50 ml.

RECEIVING

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☑ 4 ☐

Grid Address 1-B
Screen Magnification 14,300 x
Camera Constant 210.1
Accelerating Voltage 100 KV
Beam Current 60 μa

Analyst Radley Date 4/6/92

MICROSCOPE
600A ☑
600B ☐
HU11E ☐
HU125E ☐

B

Grid opening	Str #	Str	Dimensions (mm) Width	Length	Fiber Classification NAM	TM	CM	CD	CQ	CMQ	CDQ	LF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	NSD																									
3	NSD																									
4	NSD																									
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

M DI TC ANALYSIS

EMS Lab No. 24142

Sample No. SW0-4

RECEIVING

ANALYSIS

GRID
1 ☐ 3 ☑
2 ☐ 4 ☐

MICROSCOPE
600A ☐
600B ☑
HU11E ☐
HU125E ☐

Grid Address 1C
Screen Magnification 19300 x
Camera Constant 27.7
Accelerating Voltage 100 KV
Beam Current 10 μa

Analyst S. Ahmed

Date 4/6/92

C

Grid opening	Str #	Str	Dimensions (mm) Width	Length	Fiber Classification NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	NSD																									
3	NSD																									
4	NSD																									
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:

Clean ☐
Debris: ☑ Very Light ☐ Light ☑ Moderate ☐ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

TABLE 3. CLASSIFICATION OF FIBERS WITH TUBULAR MORPHOLOGY

TM	-	Tubular Morphology not sufficiently characteristic for classification as chrysotile
CM	-	Characteristic Chrysotile Morphology
CD	-	Chrysotile SAED pattern
CQ	-	Chrysotile composition by Quantitative EDXA
CMQ	-	Chrysotile Morphology and composition by Quantitative EDXA
CDQ	-	Chrysotile SAED pattern and composition by Quantitative EDXA
NAM	-	Non-Asbestos Mineral

TABLE 4. CLASSIFICATION OF FIBERS WITHOUT TUBULAR MORPHOLOGY

UF	-	Unidentified Fiber
AD	-	Amphibole by random orientation SAED (shows layer pattern of 0.53 nm spacing)
AX	-	Amphibole by qualitative EDXA. Spectrum has elemental components consistent with amphibole
ADX	-	Amphibole by random orientation SAED and Qualitative EDXA
AQ	-	Amphibole by Quantitative EDXA
AZ	-	Amphibole by one Zone Axis SAED
ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No.	24142	Client	SCHAFER & ASSOC.
Sample No.	SW 2-4		
Date	3/31/92		

Total Asbestos Fibers	12	MFL
Chrysotile Fibers	*BDL	MFL
Amphibole Fibers	12	MFL
> 5 Micron length (chrysotile)	*BDL	MFL
> 5 Micron length (amphibole)	3.1	MFL
Mass (Chrysotile)	*BDL	µg/L
Mass (amphibole)	47	µg/L
More/Less than 5 Chrysotile Fibers in Sample	LESS	
More/Less than 5 Amphibole Fibers in Sample	MORE	
Poisson 95% Confidence Interval	6.6 to 19	MFL
Detection Limit	0.8	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Size Distribution (Chrysotile and Amphibole)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 & UP
0	0	2	1	1	11

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 & UP
0	1	0	3	3	8

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 & UP
4	6	4	0	0	1

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142
Client Schafer + Assoc
Sample No. SW2-4

RECEIVING

METHOD OF ANALYSIS
EPA Yamate Level I ☐
Level II ☑
Level III ☐
AHERA ☐

ASPECT RATIO 3:1 ☐ 5:1 ☐

LENGTHS
All Sizes (EPA) ☐
(µm): ≥0.5 ☐
≥1.0 ☐
≥5.0 ☐
≥10.0 ☐
PCM Range* ☐
*(≥0.25 µm width, ≥5.0 µm length)

Approved By _____ Date _____

FILTER TYPE/AREA (mm²)
MCE/385 ☐
MCN/960 ☐
MCE/960 ☐
1017 Other ☐

TYPE OF SAMPLE
Air ☐ Water ☑
Soil ☐ Wipe ☐
Bulk ☐ Other ☐
Dust/Microvac ☐

PORE SIZE
0.45 µm ☐
0.8 µm ☐
.1 µm ☒
.22 µm ☐
Other ☐

G.O. Area (mm²) 0.0062
No. of G.O. to Analyze 21
Filter Lot No. _____

PREP

DIRECT PREP ☑
INDIRECT PREP ☐

Volume _____ liters
Working Volume 10 ml
Weight _____ grams
Ashed Area _____ %

Prepared By _____

ANALYSIS

GRID
1 ☑ 3 ☐
2 ☐ 4 ☐

Grid Address 1A
Screen Magnification 19300x
Camera Constant 28.0
Accelerating Voltage 100 KV
Beam Current 10 µa

Analyst S. Ahmed Date 3/31/92

MICROSCOPE
600A ☐
600B ☑
HU11E ☐
HU12SE ☐

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	EDS Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	1	F	15	420											✓	✓										EDS #1 possible Tremoli
3	2	F	1	10	✓																					
	3	F	7	140											✓	✓										EDS #3, Tremolite
	4	F	13	260	✓										✓											EDS #4 Tremolite
4	5	MD	1	24																						
5	6	F	3	80											✓	✓										EDS #6 Tremolite
6	7	MD	8	220											✓											EDS #7 Tremoli
7	NSD																									

OBSERVATIONS:

Clean ☐
Debris: ☑ Very Light ☐ Light ☑ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

31-Mar-1992 09:04:05 24142-SW2-4,A,#01,SA

ENERGY	COUNTS	X-RAY LINES
0.51	7238.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
0.99	149.	Zn LA1, Zn LA2, Zn LB1
1.25	5383.	Mg KA1, Mg KA2, Mg KB1
1.74	16643.	Si KA1, Si KA2
2.29	134.	S KA1, S KA2
2.64	80.	Cl KA1, Cl KA2
3.31	393.	K KA1, K KA2
3.69	3961.	Ca KA1, Ca KA2
4.02	495.	Ca KB1, Ca KB3
5.91	344.	Mn KA1, Mn KA2
6.40	1739.	Fe KA1, Fe KA2
7.06	257.	Fe KB1, Fe KB3

31-Mar-1992 09:13:35 24142-SW2-4,A,#03,SA

ENERGY	COUNTS	X-RAY LINES
0.51	1453.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.26	780.	Mg KA1, Mg KA2, Mg KB1
1.73	2930.	Si KA1, Si KA2
3.29	115.	K KA1, K KA2
3.69	564.	Ca KA1, Ca KA2
4.01	79.	Ca KB1, Ca KB3
6.39	342.	Fe KA1, Fe KA2
7.01	52.	Fe KB1, Fe KB3

31-Mar-1992 09:15:16 24142-SW2-4,A,#04 SA

ENERGY	COUNTS	X-RAY LINES
0.51	4927.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.00	254.	Na KA1, Na KA2, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	2945.	Mg KA1, Mg KA2, Mg KB1
1.74	10423.	Si KA1, Si KA2
3.31	325.	K KA1, K KA2
3.69	1804.	Ca KA1, Ca KA2
4.01	236.	Ca KB1, Ca KB3
5.91	160.	Mn KA1, Mn KA2
6.39	1490.	Fe KA1, Fe KA2
7.05	191.	Fe KB1, Fe KB3

31-Mar-1992 09:22:16
Execution time = 8 seconds
24142-SW2-4,A,#06 SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 42 secs

Energy	Counts	X-Ray Lines
0.52	585.	O K , O K , V L , V L , V L , V L
1.25	310.	Mg K , Mg K , Mg K
1.74	1088.	Si K , Si K
2.60	114.	Cl K , Cl K
3.69	247.	Ca K , Ca K
6.38	206.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 283

31-Mar-1992 09:26:55
Execution time = 15 seconds
24142-SW2-4,A,#07,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 31 secs

Energy	Counts	X-Ray Lines
0.51	731.	O K , O K , V L , V L , V L , V L
0.99	156.	Zn L , Zn L , Zn L
1.25	319.	Mg K , Mg K , Mg K
1.73	1432.	Si K , Si K
3.30	103.	K K , K K
3.69	133.	Ca K , Ca K
6.39	419.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 308

EM ASBESTOS ANALYSIS

S Lab No. 24142

10 ml.

ple No. Schafer SW2-4

Page ___ of ___

MICROSCOPE
600A [X]
600B [ ]
HU11E [ ]
HU125E [ ]

ANALYSIS

GRID
1 [ ] 3 [ ]
2 [X] 4 [ ]

Grid Address 1-B
Screen Magnification 19300x
Camera Constant 30.1
Accelerating Voltage 100 KV
Beam Current 10 pa

B

Analyst Radha Date 3/31

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1	F	2	70	✓																					
2	NSD																									
3	NSD																									
4	2	F	3	38													✓				2	10	1	2		Tremolite
	3	MD	4	25													✓				3	10	3	1		Tremolite
	4	MD	3	45													✓				3	10	3	1		Tremolite
	5		12	70													✓				3	10	3	0		Tremolite
5	6	MD	4	60													✓				1	10	1	4		Tremolite
	7	F	5	20													✓				3	10	1	3		
6	8	F	12	62													✓				1	10	4	2		Tremolite
7	NSD																									

OBSERVATIONS:

Clean [ ]					
Debris: [ ]	Very Light [ ]	Light [X]	Moderate [X]	Heavy [ ]	Very Heavy [ ]
Gypsum: [ ]	Very Light [ ]	Light [ ]	Moderate [ ]	Heavy [ ]	Very Heavy [ ]
Other [ ]					

31-Mar-1992 09:25:31
Execution time = 8 seconds
24142-SW2-4,B,#02,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 48 secs

Energy	Counts	X-Ray Lines
1.26	338.	Mg K , Mg K , Mg K
1.74	1405.	Si K , Si K
3.70	192.	Ca K , Ca K
6.39	217.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 259

31-Mar-1992 09:29:59
Execution time = 8 seconds
24142-SW2-4,B,#03,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 30 secs

Energy	Counts	X-Ray Lines
1.25	218.	Mg K , Mg K , Mg K
1.74	840.	Si K , Si K
3.67	277.	Ca K , Ca K
6.38	87.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 162

31-Mar-1992 09:32:16
Execution time = 6 seconds
24142-SW2-4,B,#04,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 25 secs

Energy	Counts	X-Ray Lines
1.25	502.	Mg K , Mg K , Mg K
1.74	1796.	Si K , Si K
3.70	502.	Ca K , Ca K
6.37	156.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 278

31-Mar-1992 09:34:47
Execution time = 7 seconds
24142-SW2-4,B,#05,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 30 secs

Energy	Counts	X-Ray Lines
1.25	886.	Mg K , Mg K , Mg K
1.74	2553.	Si K , Si K
3.69	740.	Ca K , Ca K
4.02	81.	Ca K , Ca K

31-Mar-1992 09:43:44 24142-SW2-4,B,#06,RS

ENERGY	COUNTS	X-RAY LINES
1.01	152.	Na KA1, Na KA2, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	567.	Mg KA1, Mg KA2, Mg KB1
1.74	6919.	Si KA1, Si KA2
3.32	223.	K KA1, K KA2
3.69	519.	Ca KA1, Ca KA2
6.39	2553.	Fe KA1, Fe KA2
7.03	326.	Fe KB1, Fe KB3

31-Mar-1992 09:45:46
Execution time = 7 seconds
24142-SW2-4,B,#07,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 34 secs

Energy	Counts	X-Ray Lines
1.74	402.	Si K , Si K
3.69	1317.	Ca K , Ca K
4.03	116.	Ca K , Ca K
6.40	335.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 206

31-Mar-1992 09:49:08
Execution time = 7 seconds
24142-SW2-4,B,#08,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 18 secs

Energy	Counts	X-Ray Lines
1.26	290.	Mg K , Mg K , Mg K
1.74	1973.	Si K , Si K
3.69	884.	Ca K , Ca K
4.03	110.	Ca K , Ca K
6.39	468.	Fe K , Fe K
7.05	68.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 325

EMS ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW2-1

RECEIVING

ANALYSIS

GRID 1 ☐ 2 ☐ 3 ☑ 4 ☐

Grid Address 1C

Screen Magnification 19300 x

Camera Constant 27.6

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst S. Ahmed Date 3/31/92

MICROSCOPE 600A ☐ 600B ☑ HU11E ☐ HU125E ☐

C

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CQ	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
1	1	F	4	60											✓											EDS #1, Tremolite
2	2	F	1	24	✓																					
	3	MD	6	90											✓											EDS #3, Tremolite
	4		7	85	✓																					EDS #4
3	5	F	1	112	✓																					
4	NSD																									
5	6	MD	1	70											✓											EDS #6
6	NSD																									
7	7	F	1	15	✓																					

OBSERVATIONS:

Clean ☐

Debris: ☑ Very Light ☐ Light ☑ Moderate ☑ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

```
31-Mar-1992 10:11:45
Execution time =     7 seconds
24142-SW2-4,C,#01,SA                                  Preset=  Off
Vert=      200 counts  Disp= 1                        Elapsed=        32 secs
   Energy  Counts     X-Ray Lines

   0.51     1255.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.25      760.    Mg K  , Mg K  , Mg K

   1.73     2333.    Si K  , Si K

   3.31       91.    K  K  , K  K

   3.70      368.    Ca K  , Ca K

   6.38      331.    Fe K  , Fe K


Quantex>
      0.240     Range=    10.230 keV                          10.230
                                                Integral 8  =          405
31-Mar-1992 10:18:37
Execution time =     7 seconds
24142-SW2-4,C,#03,SA                                  Preset=  Off
Vert=      200 counts  Disp= 1                        Elapsed=        28 secs
   Energy  Counts     X-Ray Lines

   0.51     2462.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.24     1625.    Mg K  , Mg K

   1.74     4774.    Si K  , Si K

   3.69     1416.    Ca K  , Ca K

   4.01      154.    Ca K  , Ca K

   6.39      424.    Fe K  , Fe K


Quantex>
      0.240     Range=    10.230 keV                          10.230
                                                Integral 8  =          864
```

31-Mar-1992 10:21:03 24142-SW2-4,C,#04,SA

ENERGY	COUNTS	X-RAY LINES
0.51	2592.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.02	127.	Na KA1, Na KA2, Na KB1, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	1280.	Mg KA1, Mg KA2, Mg KB1
1.47	152.	Al KA1, Al KA2
1.73	5250.	Si KA1, Si KA2
3.32	170.	K KA1, K KA2
3.69	888.	Ca KA1, Ca KA2
4.04	82.	Sc KA2, Ca KB1, Ca KB3
5.88	101.	Mn KA1, Mn KA2
6.39	911.	Fe KA1, Fe KA2

31-Mar-1992 10:41:20
Execution time = 6 seconds
24142-SW2-4,C,#06,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 46 secs

Energy	Counts	X-Ray Lines
0.51	1476.	O K , O K , V L , V L , V L , V L
1.24	962.	Mg K , Mg K
1.74	2742.	Si K , Si K
3.69	610.	Ca K , Ca K
6.39	432.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 533

TABLE 3. CLASSIFICATION OF FIBERS WITH TUBULAR MORPHOLOGY

TM	-	Tubular Morphology not sufficiently characteristic for classification as chrysotile
CM	-	Characteristic Chrysotile Morphology
CD	-	Chrysotile SAED pattern
CQ	-	Chrysotile composition by Quantitative EDXA
CMQ	-	Chrysotile Morphology and composition by Quantitative EDXA
CDQ	-	Chrysotile SAED pattern and composition by Quantitative EDXA
NAM	-	Non-Asbestos Mineral

TABLE 4. CLASSIFICATION OF FIBERS WITHOUT TUBULAR MORPHOLOGY

UF	-	Unidentified Fiber
AD	-	Amphibole by random orientation SAED (shows layer pattern of 0.53 nm spacing)
AX	-	Amphibole by qualitative EDXA. Spectrum has elemental components consistent with amphibole
ADX	-	Amphibole by random orientation SAED and Qualitative EDXA
AQ	-	Amphibole by Quantitative EDXA
AZ	-	Amphibole by one Zone Axis SAED
ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No.	24142	Client	SCHAFER & ASSOC.
Sample No.	SW 3-4		
Date	3/31/92		

Total Asbestos Fibers	16	MFL
Chrysotile Fibers	0.3	MFL
Amphibole Fibers	16	MFL
> 5 Micron length (chrysotile)	*BDL	MFL
> 5 Micron length (amphibole)	5.3	MFL
Mass (Chrysotile)	0.002	µg/L
Mass (amphibole)	50	µg/L
More/Less than 5 Chrysotile Fibers in Sample	LESS	
More/Less than 5 Amphibole Fibers in Sample	MORE	
Poisson 95% Confidence Interval	12 to 21	MFL
Detection Limit	0.3	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Size Distribution (Chrysotile and Amphibole)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 & UP
0	1	9	4	5	33

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 & UP
0	3	1	9	8	31

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 & UP
17	18	11	3	1	2

EM ASBESTOS ANALYSIS

IS Lab No. 24142
ent Schafer + Assoc
mple No. SW3-4

METHOD OF ANALYSIS
EPA Yamate Level I ☐
Level II ☐
Level III ☐
AHERA ☐

LENGTHS
All Sizes (EPA) ☑
(µm)≥20.5 ☐
≥1.0 ☐
≥5.0 ☐
≥10.0 ☐
PCM Range* ☐
*[illegible]

ASPECT RATIO 3:1 ☑ 5:1 ☐

Approved By _____ Date _____

FILTER TYPE/AREA (mm²)
MCE/385 ☐
MCN/960 ☐
MCE/960 ☐
Other ☑ 1017

TYPE OF SAMPLE
Air ☐ Water ☑
Soil ☐ Wipe ☐
Bulk ☐ Other ☐
Dust/Microvac ☐

PORE SIZE
0.45 µm ☐
0.8 µm ☐
.1 µm ☒
.22 µm ☐
Other ☐

G.O. Area (mm²) 0.0062
No. of G.O. to Analyze 21
Fiber Lot No. _____

PREP

DIRECT PREP ☑
INDIRECT PREP ☐
Volume _____ liters
Working Volume 25 ml
Weight _____ grams
Ashed Area _____ %
Prepared By PG

ANALYSIS

GRID
1 ☒ 3 ☐
2 ☐ 4 ☐
Grid Address 1-A
Screen Magnification 19350
Camera Constant 38.1
Accelerating Voltage 100 KV
Beam Current 10 µa
Analyst Radla Date 3/31

MICROSCOPE
600A ☑
600B ☐
HU11E ☐
HU12E ☐

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	EDS Na	Mg	Si	Ca	Fe	Id	Comments
1		1	1	22			✓	✓																		Chrysotile.
		2	10	180											✓						3	10	2	2		Tremolite
		3	15	175											✓						3	10	2	1		Tremolite
		4	8	68											✓						3	10	2	2		Tremolite
		5	3	50											✓						3	10	2	2		Tremolite
		6	7	22											✓						3	10	3	1		Tremolite
2		7	1	15	✓																					
		8	6	20									✓													Tremolite
		9	14	65	✓																					
3		10	1	20	✓																					
		11	4	16											✓						3	10	2	1		Tremo.
		12	1	35	✓																					
		13	5	175									✓													Tremolite
4		14	5	28									✓													Tremolite
		15	3	28									✓													Tremolite
		16	5	120									✓													Tremolite
		17	4	40									✓													Tremolite
		18	5	25									✓													Tremolite
5		19	5	42									✓													Tremolite
6		20	3	40									✓													Tremolite
		21	5	66									✓													Tremolite
		22	14	165									✓													Tremolite
		23	3	35									✓													"
		24	1.5	42									✓													"

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☒ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

SAMPLE PREPARATION ANALYSIS

MS Lab No. 24142

Sample No. Schafad A850 SW3-4

RECEIVING

ANALYSIS

GRID 1 ☐ 2 ☐ 3 ☐ 4 ☐

Grid Address _____

Screen Magnification _____ x

Camera Constant _____

Accelerating Voltage 100 KV

Beam Current _____ μa

Analyst _____ Date _____

MICROSCOPE 600A ☐ 600B ☐ HU11E ☐ HU125E ☐

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
6		25	6	45									/													Tremolite
		26	3	55									/													"
		27	5	66									/													"
7		28	8	28									/													"
		29	12	50									/													"
		30	3	55									/													"
		31	4	20									/													"
		32	3	38+									/													"

OBSERVATIONS:

Clean ☐

Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

EMS LABORATORIES 117 West Bellevue Drive / Pasadena CA 91105-2503 / 818-441-2393

31-Mar-1992 10:26:09
Execution time = 6 seconds
24142-SW3-4,A,#02,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 15 secs

Energy	Counts	X-Ray Lines
0.98	88.	Zn L , Zn L
1.25	1180.	Mg K , Mg K , Mg K
1.74	4136.	Si K , Si K
3.28	82.	K K , K K
3.69	727.	Ca K , Ca K
3.99	39.	Ca K , Ca K
6.40	622.	Fe K , Fe K
Quantex)	127.	Fe K , Fe K

0.240 Range= 10.230 keV 10.230
Integral 8 = 651

31-Mar-1992 10:28:59
Execution time = 7 seconds
24142-SW3-4,A,#03,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 19 secs

Energy	Counts	X-Ray Lines
1.25	1768.	Mg K , Mg K , Mg K
1.74	6811.	Si K , Si K
3.32	87.	K K , K K
3.69	1424.	Ca K , Ca K
4.02	132.	Ca K , Ca K
6.39	930.	Fe K , Fe K
7.07	111.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 981

31-Mar-1992 10:30:26
Execution time = 7 seconds
24142-SW3-4,A,#04,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 22 secs

Energy	Counts	X-Ray Lines
1.25	1540.	Mg K , Mg K , Mg K
1.74	5731.	Si K , Si K
3.30	390.	K K , K K
3.69	979.	Ca K , Ca K
4.03	113.	Ca K , Ca K
4.49	65.	Ti K , Ti K
6.40	1134.	Fe K , Fe K
Quantex)	157.	Fe K , Fe K

0.240 Range= 10.230 keV 10.230
Integral 8 = 893

31-Mar-1992 10:44:27
Execution time = 7 seconds
24142-SW3-4,A,#05,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 44 secs

Energy	Counts	X-Ray Lines
1.25	497.	Mg K , Mg K , Mg K
1.73	1891.	Si K , Si K
3.29	113.	K K , K K
3.69	306.	Ca K , Ca K
6.40	351.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 325

31-Mar-1992 10:46:40
Execution time = 7 seconds
24142-SW3-4,A,#06,RS Preset= Off
Vert= 1000 counts Disp= 1 Elapsed= 24 secs

Energy	Counts	X-Ray Lines
1.25	2416.	Mg K , Mg K , Mg K
1.74	7485.	Si K , Si K
3.30	114.	K K , K K
3.69	2053.	Ca K , Ca K
4.02	178.	Ca K , Ca K
6.40	685.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 1111

31-Mar-1992 11:06:25
Execution time = 7 seconds
24142-SW3-4,A,#11,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 27 secs

Energy	Counts	X-Ray Lines
1.25	1043.	Mg K , Mg K , Mg K
1.74	3796.	Si K , Si K
3.30	101.	K K , K K
3.69	741.	Ca K , Ca K
6.37	293.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 515

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW3-4

25 ml.

RECEIVING

ANALYSIS

GRID 1 ☐ 2 ☑ 3 ☐ 4 ☐

MICROSCOPE 600A ☐ 600B ☑ HU11E ☐ HU125E ☐

Grid Address 1B

Screen Magnification 19300 x

Camera Constant 24.6

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst S. Ahmed

Date 3/31/92

B

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CQ	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1			5	65											✓											EDS #1 Tremolite
			4	55											✓											EDS #2 "
			4	50											✓											EDS #3 "
2		F	15	380											✓											EDS #4 "
			5	300 x											✓											EDS #5 "
			20	300 x											✓											EDS #6 "
			6	180											✓											Tremolite
3			5	85											✓											"
4		F	10	55											✓											"
		F	4	75												✓										"
5		F	12	500												✓										"
6			3	24												✓										"
			12	75												✓										"
			4	100												✓										"
7			3	85												✓										

OBSERVATIONS:

Clean ☐

Debris: ☑ Very Light ☐ Light ☐ Moderate ☑ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

31-Mar-1992 11:02:28
Execution time = 7 seconds
24142-SW3-4,B,#01,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 32 secs

Energy	Counts	X-Ray Lines
0.51	1723.	O K , O K , V L , V L , V L , V L
1.24	918.	Mg K , Mg K
1.73	3305.	Si K , Si K
3.68	616.	Ca K , Ca K
4.04	95.	Sc K , Ca K , Ca K
6.38	804.	Fe K , Fe K
7.04	128.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 644

31-Mar-1992 13:19:40 24142-SW3-4,B,#02,SA

ENERGY	COUNTS	X-RAY LINES
0.51	2704.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.01	100.	Na KA1, Na KA2, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	1663.	Mg KA1, Mg KA2, Mg KB1
1.74	5411.	Si KA1, Si KA2
2.62	67.	Cl KA1, Cl KA2
3.32	165.	K KA1, K KA2
3.69	1046.	Ca KA1, Ca KA2
4.02	112.	Ca KB1, Ca KB3
5.92	91.	Mn KA1, Mn KA2
6.40	880.	Fe KA1, Fe KA2
7.03	97.	Fe KB1, Fe KB3

31-Mar-1992 13:20:32
Execution time = 7 seconds
24142-SW3-4,B,#03,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 22 secs

Energy	Counts	X-Ray Lines
0.52	1184.	O K , O K , V L , V L , V L , V L
1.25	663.	Mg K , Mg K , Mg K
1.73	2095.	Si K , Si K
3.31	59.	K K , K K
3.69	428.	Ca K , Ca K
6.39	380.	Fe K , Fe K
7.04	83.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 426

31-Mar-1992 13:21:23 24142-SW3-4,B,#04,SA

ENERGY	COUNTS	X-RAY LINES
0.51	3890.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.01	222.	Na KA1, Na KA2, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	2362.	Mg KA1, Mg KA2, Mg KB1
1.47	95.	Al KA1, Al KA2
1.74	8608.	Si KA1, Si KA2
3.32	190.	K KA1, K KA2
3.69	811.	Ca KA1, Ca KA2
4.01	123.	Ca KB1, Ca KB3
4.48	63.	Ti KA1, Ti KA2
5.39	80.	Cr KA1, Cr KA2
5.88	191.	Mn KA1, Mn KA2
6.38	2005.	Fe KA1, Fe KA2
7.04	226.	Fe KB1, Fe KB3
7.51	39.	Ni KA1

31-Mar-1992 13:23:40 24142-SW3-4,B,#05,SA

ENERGY	COUNTS	X-RAY LINES
0.51	1898.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.01	88.	Na KA1, Na KA2, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	1249.	Mg KA1, Mg KA2, Mg KB1
1.73	3890.	Si KA1, Si KA2
3.31	142.	K KA1, K KA2
3.69	703.	Ca KA1, Ca KA2
4.03	67.	Ca KB1, Ca KB3
5.90	58.	Mn KA1, Mn KA2
6.40	596.	Fe KA1, Fe KA2
7.04	74.	Fe KB1, Fe KB3

31-Mar-1992 13:28:33 24142-SW3-4,B,#06,SA

ENERGY	COUNTS	X-RAY LINES
0.51	3056.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.00	101.	Na KA1, Na KA2, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	2042.	Mg KA1, Mg KA2, Mg KB1
1.73	6749.	Si KA1, Si KA2
3.31	150.	K KA1, K KA2
3.69	1509.	Ca KA1, Ca KA2
4.00	162.	Ca KB1, Ca KB3
5.84	83.	Mn KA2
6.39	1023.	Fe KA1, Fe KA2
7.04	121.	Fe KB1, Fe KB3

TEM ASBESTOS ANALYSIS

EMS Lab No. 34142 (Schafer)

Sample No. S W 3-4

RECEIVING

ANALYSIS

GRID 1 ☐ 2 ☐ 3 ☑ 4 ☐

Grid Address 1-C

Screen Magnification 9,300 x

Camera Constant 30

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst Gal

Date 3-31-92

MICROSCOPE 600A ☐ 600B ☐ HU11E ☐ HU125E ☐

C

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CQ	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	01	F	1	32										N							2	10	2	3		Tremolite
	02	F	10	220																	2	10	2	1		"
	03	F	10	105																	3	10	2	1		"
2	04	F	6	155																	3	10	3	2		"
	05	F	5	105																	2	10	1	3		"
3	06	F	5	100																	2	10	1	3		"
4	07	F	3	70																	2	10	1	3		"
5	N/A																									
6	N/A																									
	08	F	5	35																	2	10	2	4		tremolite
	09	F	4	110																	3	10	2	2		"

OBSERVATIONS: Clean ☐

Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

31-Mar-1992 15:09:36
Execution time = 6 seconds
24142,SW3-4,1C,01,GA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 39 secs

Energy	Counts	X-Ray Lines
1.25	334.	Mg K , Mg K , Mg K
1.74	1419.	Si K , Si K
3.69	261.	Ca K , Ca K
6.41	377.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 206

31-Mar-1992 15:17:29
Execution time = 6 seconds
24142,SW3-4,1C,02,GA Preset= Off
Vert= 1000 counts Disp= 1 Elapsed= 31 secs

Energy	Counts	X-Ray Lines
1.25	3090.	Mg K , Mg K , Mg K
1.74	12494.	Si K , Si K
3.33	357.	K K , K K
3.69	2624.	Ca K , Ca K
4.03	281.	Ca K , Ca K
6.40	1721.	Fe K , Fe K
7.04	280.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 1840

31-Mar-1992 15:18:45
Execution time = 6 seconds
24142,SW3-4,1C,03,GA Preset= Off
Vert= 1000 counts Disp= 1 Elapsed= 35 secs

Energy	Counts	X-Ray Lines
1.25	3566.	Mg K , Mg K , Mg K
1.74	14219.	Si K , Si K
3.33	391.	K K , K K
3.69	2963.	Ca K , Ca K
4.03	296.	Ca K , Ca K
6.40	2012.	Fe K , Fe K
7.04	348.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 2080

31-Mar-1992 15:42:16
Execution time = 7 seconds
24142,SW3-4,1C,04 GA Preset= Off
Vert= 1000 counts Disp= 1 Elapsed= 180 secs

Energy	Counts	X-Ray Lines
1.25	4835.	Mg K , Mg K , Mg K
1.74	17846.	Si K , Si K
3.69	4086.	Ca K , Ca K
6.40	3083.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 2636

31-Mar-1992 15:52:37
Execution time = 7 seconds
24142,SW3-4,1C,05 GA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 30 secs

Energy	Counts	X-Ray Lines
1.25	496.	Mg K , Mg K , Mg K
1.74	2149.	Si K , Si K
3.33	91.	K K , K K
3.69	247.	Ca K , Ca K
6.40	569.	Fe K , Fe K
7.01	86.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 318

31-Mar-1992 16:01:43
Execution time = 6 seconds
24142,SW3-4,1C,06 GA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 33 secs

Energy	Counts	X-Ray Lines
0.98	110.	Zn L , Zn L
1.26	525.	Mg K , Mg K , Mg K
1.74	2459.	Si K , Si K
3.32	130.	K K , K K
3.68	272.	Ca K , Ca K
6.40	703.	Fe K , Fe K
7.06	115.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 355

31-Mar-1992 16:04:22
Execution time = 6 seconds
24142,SW3-4,1C,09 GA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 41 secs

Energy	Counts	X-Ray Lines
0.98	137.	Zn L , Zn L
1.25	654.	Mg K , Mg K , Mg K
1.74	2929.	Si K , Si K
3.32	172.	K K , K K
3.69	341.	Ca K , Ca K
6.40	834.	Fe K , Fe K
7.06	144.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 465

31-Mar-1992 16:16:57
Execution time = 7 seconds
24142,SW3-4,1C,08 GA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 27 secs

Energy	Counts	X-Ray Lines
1.25	446.	Mg K , Mg K , Mg K
1.74	2091.	Si K , Si K
2.03	89.	P K , P K
3.70	471.	Ca K , Ca K
4.03	84.	Ca K , Ca K
6.41	788.	Fe K , Fe K
7.07	76.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 369

31-Mar-1992 16:22:35
Execution time = 6 seconds
24142,SW3-4,1C,09 GA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 28 secs

Energy	Counts	X-Ray Lines
1.25	413.	Mg K , Mg K , Mg K
1.74	1624.	Si K , Si K
3.69	396.	Ca K , Ca K
6.40	249.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 230

TABLE 3. CLASSIFICATION OF FIBERS WITH TUBULAR MORPHOLOGY

TM	-	Tubular Morphology not sufficiently characteristic for classification as chrysotile
CM	-	Characteristic Chrysotile Morphology
CD	-	Chrysotile SAED pattern
CQ	-	Chrysotile composition by Quantitative EDXA
CMQ	-	Chrysotile Morphology and composition by Quantitative EDXA
CDQ	-	Chrysotile SAED pattern and composition by Quantitative EDXA
NAM	-	Non-Asbestos Mineral

TABLE 4. CLASSIFICATION OF FIBERS WITHOUT TUBULAR MORPHOLOGY

UF	-	Unidentified Fiber
AD	-	Amphibole by random orientation SAED (shows layer pattern of 0.53 nm spacing)
AX	-	Amphibole by qualitative EDXA. Spectrum has elemental components consistent with amphibole
ADX	-	Amphibole by random orientation SAED and Qualitative EDXA
AQ	-	Amphibole by Quantitative EDXA
AZ	-	Amphibole by one Zone Axis SAED
ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No.	24142	Client	SCHAFER & ASSOC.
Sample No.	SW 4-4		
		Date	4/13/92

Total Asbestos Fibers	120	MFL
Chrysotile Fibers	*BDL	MFL
Amphibole Fibers	120	MFL
> 5 Micron length (chrysotile)	*BDL	MFL
> 5 Micron length (amphibole)	55	MFL
Mass (Chrysotile)	*BDL	µg/L
Mass (amphibole)	950	µg/L
More/Less than 5 Chrysotile Fibers in Sample	LESS	
More/Less than 5 Amphibole Fibers in Sample	MORE	
Poisson 95% Confidence Interval	97 to 140	MFL
Detection Limit	1	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Size Distribution (Chrysotile and Amphibole)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 & UP
0	3	12	7	14	80

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 & UP
0	5	12	20	16	63

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 & UP
27	37	25	13	4	10

ASBESTOS ANALYSIS

EMS Lab No. 24142
Client Schafer
Sample No. SW4-4

RECEIVING

METHOD OF ANALYSIS: EPA Yamate Level I ☐ Level II ☐ Level III ☐ AHERA ☐

LENGTHS: All Sizes (EPA) ☐ (µm)≥20.5 ☐ ≥1.0 ☐ ≥5.0 ☐ ≥10.0 ☐ PCM Range* ☐

ASPECT RATIO 3:1 ☐ 5:1 ☐

Approved By _____ Date _____

FILTER TYPE/AREA (mm²): MCE/385 ☐ MCN/960 ☐ MCE/960 ☐ 6017 Other ☑

TYPE OF SAMPLE: Air ☐ Water ☑ Soil ☐ Wipe ☐ Bulk ☐ Other ☐ Dust/Microvac ☐

PORE SIZE: 0.45 µm ☐ 0.8 µm ☐ .1 µm ☑ .22 µm ☐ Other ☐

G.O. Area (mm²) 0.0 062
No. of G.O. to Analyze 10
Filter Lot No. HOEM90194C

PREP

DIRECT PREP ☑ INDIRECT PREP ☐

Volume _____ liters
Working Volume 20 ml
Weight _____ grams
Ashed Area _____ %
Prepared By SH/FG

ANALYSIS

Clean 1 ☑ 2 ☐ 3 ☐ 4 ☐

Grid Address 1-A
Screen Magnification 9,300 x
Camera Constant 20
Accelerating Voltage 100 KV
Beam Current 10 µa

Analyst _____ Date 4-29

MICROSCOPE: 600A ☐ 600B ☐ HU11E ☐ HU12SE ☐

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
01	01	F	2	60										✓												Tremolite
02	02	F	2	110										✓												tremolite
	03	F	1.5	20										✓												Tremolite
	04	F	1.5	17										✓							2					tremolite
	05	F	16	220										✓												Tremolite
	06	F	1	30										✓												"
	07	F	3	110										✓												"
	08	F	4	120 X										✓												"
	09	F	10	130										✓												"
	10	F	5	30										✓												"
	11	F	5	50										✓												"
(3)	12	F	10	320										✓												"
	13	F	1	22										✓												"
	14	F	3	80										✓												"
	15	F	2	65										✓												"
	16	F	2	40										✓												"
	17	F	1	40										✓												"
(4)	18	F	4	950										✓												"
	19	F	3	175										✓												"
	20	F	5	1,220 X										✓												"
	21	F	2	230										✓												"
	22	F	5	75										✓												"
	23	F	5	30										✓												"

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

2-Apr-1992 14:51:53
Execution time = 7 seconds
24142,SW4-4,1A,01,GA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 45 secs

Energy	Counts	X-Ray Lines
1.25	176.	Mg K , Mg K , Mg K
1.74	756.	Si K , Si K
3.70	186.	Ca K , Ca K
6.41	186.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 0 = 6609

2-Apr-1992 14:54:39
Execution time = 6 seconds
24142,SW4-4,1A,02,GA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 59 secs

Energy	Counts	X-Ray Lines
1.26	243.	Mg K , Mg K , Mg K
1.73	990.	Si K , Si K
3.69	192.	Ca K , Ca K
6.39	218.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 0 = 7525

2-Apr-1992 14:58:09
Execution time = 6 seconds
24142,SW4-4,1A,03,GA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 66 secs

Energy	Counts	X-Ray Lines
1.25	273.	Mg K , Mg K , Mg K
1.73	1116.	Si K , Si K
3.69	232.	Ca K , Ca K
6.39	247.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 0 = 8327

2-Apr-1992 14:59:34
Execution time = 5 seconds
24142,SW4-4,1A,04,GA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 74 secs

Energy	Counts	X-Ray Lines
1.25	317.	Mg K , Mg K , Mg K
1.73	1257.	Si K , Si K
3.70	258.	Ca K , Ca K
6.40	282.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 0 = 9439

2-Apr-1992 14:52:02
Execution time = 7 seconds
24142,SW4-4,1A,01,GA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 45 secs

Energy	Counts	X-Ray Lines
1.25	176.	Mg K , Mg K , Mg K
1.74	756.	Si K , Si K
3.70	186.	Ca K , Ca K
6.41	186.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 0 = 6609

2-Apr-1992 14:55:14
Execution time = 6 seconds
24142,SW4-4,1A,02,GA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 59 secs

Energy	Counts	X-Ray Lines
1.26	243.	Mg K , Mg K , Mg K
1.73	990.	Si K , Si K
3.69	192.	Ca K , Ca K
6.39	218.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 0 = 7525

2-Apr-1992 14:58:12
Execution time = 6 seconds
24142,SW4-4,1A,03,GA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 66 secs

Energy	Counts	X-Ray Lines
1.25	273.	Mg K , Mg K , Mg K
1.73	1116.	Si K , Si K
3.69	232.	Ca K , Ca K
6.39	247.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 0 = 8327

2-Apr-1992 14:59:31
Execution time = 5 seconds
24142,SW4-4,1A,04,GA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 74 secs

Energy	Counts	X-Ray Lines
1.25	317.	Mg K , Mg K , Mg K
1.73	1257.	Si K , Si K
3.70	258.	Ca K , Ca K
6.40	282.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 0 = 9439

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142

20 M1

Sample No. Schafer SW4-4

RECEIVING

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☒ 4 ☐

Grid Address 1-B
Screen Magnification 19,400 x
Camera Constant 30.2
Accelerating Voltage 400 KV
Beam Current 10 μa

MICROSCOPE
600A ☒
600B ☐
HU11E ☐
HU125E ☐

B

Analyst Radha Date 4-13-9

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CQ	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1	F	15	800													✓				3	10	2	1		Tremolite
	2	1/2	3	16													✓				3	10	1	2		"
	3		50	440													✓				3	10	3	1		Tremolite
	4		8	200													✓				3	10	0.2	1		"
	5		25	320													✓				3	10	1	1		"
	6		22	110												✓										"
	7		3	110												✓										"
	8		15	100	✓																					"
	9		3	25												✓										"
	10		15	185													✓				3	10	3	1		Tremolite
	11		4	70												✓										"
	12		5	28												✓										"
	13		5	330												✓										"
	14		5	28												✓										"
	15		10	115												✓										"
	16		5	42												✓										"
	17		3	60												✓										"
	18		3	45												✓										"
	19		5	28												✓										"
	20		5	120												✓	✓				3	10	2	1		Tremolite
	21		1.5	125												✓										
	22		3	18												✓										
	23		7	115												✓										
	24		5	110												✓										

OBSERVATIONS:

Clean ☐					
Debris: ☐	Very Light ☐	Light ☐	Moderate ☒	Heavy ☒	Very Heavy ☐
Gypsum: ☐	Very Light ☐	Light ☐	Moderate ☐	Heavy ☐	Very Heavy ☐
Other ☐					

:M ASBESTOS ANALYSIS

; Lab No. 24142

20 ml

ıple No. Schafer SW4-4

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☒ 4 ☐

Grid Address 1-B
Screen Magnification 19,400 x
Camera Constant 30.2
Accelerating Voltage 100 KV
Beam Current 10 µa

MICROSCOPE
600A ☒
600B ☐
HU11E ☐
HU125E ☐

Analyst Radha Date 4-13-92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	25		20	85													✓				2	10	2	2		Tremolite
2	26		10	195												✓										"
	27		4	115												✓										"
	28		5	35	✓																					
	29		5	165												✓										Tremo
	30		3	45												✓										"
	31		10	115												✓										"
	32		4	100												✓										"
	33		5	150												✓										"
	34		3	42												✓										"
	35		3	65												✓	✓				2	10	2	2		Tremolite
	36		3	68												✓										Tremo
	37		4	65												✓										"
	38		3	50												✓										"
	39		5	165												✓										"
	40		8	90	✓																					
	41		5	150												✓	✓									Tremo
	42		10	44												✓										"
	43		3	45												✓										"
	44		5	38												✓										"
	45		8	40												✓										"
	46		5	38												✓										"
	47		10	48												✓										"

OBSERVATIONS: Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

13-Apr-1992 09:32:43
Execution time = 6 seconds
24142,SW4-4,B,#01,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 31 secs

Energy	Counts	X-Ray Lines
1.25	1004.	Mg K , Mg K , Mg K
1.74	3366.	Si K , Si K
3.69	838.	Ca K , Ca K
4.05	107.	Sc K , Sc K , Ca K , Ca K
6.39	371.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 464

13-Apr-1992 09:35:56
Execution time = 6 seconds
24142,SW4-4,B,#02,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 33 secs

Energy	Counts	X-Ray Lines
1.25	244.	Mg K , Mg K , Mg K
1.74	957.	Si K , Si K
3.67	112.	Ca K , Ca K
6.40	153.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 143

13-Apr-1992 09:37:36 24142,SW4-4,B,#02,RS

ENERGY	COUNTS	X-RAY LINES
1.25	1477.	Mg KA1, Mg KA2, Mg KB1
1.74	5400.	Si KA1, Si KA2
2.65	45.	Cl KA1, Cl KA2
3.30	126.	K KA1, K KA2
3.69	1490.	Ca KA1, Ca KA2
4.04	127.	Sc KA2, Ca KB1, Ca KB3
6.40	428.	Fe KA1, Fe KA2
7.07	67.	Fe KB1, Fe KB3
8.58	48.	Zn KA2

13-Apr-1992 09:39:20
Execution time = 6 seconds
24142,SW4-4,B,#04,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 12 secs

Energy	Counts	X-Ray Lines
1.26	1277.	Mg K , Mg K , Mg K
1.74	4506.	Si K , Si K
3.31	60.	K K , K K
3.70	1220.	Ca K , Ca K
4.02	126.	Ca K , Ca K
6.40	338.	Fe K , Fe K
7.07	84.	Fe K , Fe K

Quantex)
0.000 Range= 10.230 keV 10.070
Integral 8 = 638

13-Apr-1992 09:40:14
Execution time = 7 seconds
24142,SW4-4,B,#05,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 12 secs

Energy	Counts	X-Ray Lines
1.25	1604.	Mg K , Mg K , Mg K
1.74	5700.	Si K , Si K
3.33	80.	K K , K K
3.69	1547.	Ca K , Ca K
4.04	181.	Sc K , Ca K , Ca K
4.45	43.	Sc K , Sc K
6.40	452.	Fe K , Fe K

Quantex)
0.000 Range= 10.230 keV 10.070
Integral 8 = 844

```
13-Apr-1992 09:58:11
Execution time =     7 seconds
2142,SW4-4.B,#10,RS                                  Preset=  Off
Vert=      500 counts  Disp= 1                       Elapsed=        45 secs
   Energy  Counts     X-Ray Lines

   1.26     1510.    Mg K  , Mg K  , Mg K

   1.74     5012.    Si K  , Si K

   3.70     1323.    Ca K  , Ca K

   4.03      137.    Ca K  , Ca K

   6.39      383.    Fe K  , Fe K



Quantex>
      0.000     Range=    10.230 keV                          10.070
                                                Integral 8  =          720
13-Apr-1992 09:59:32
Execution time =     6 seconds
2142,SW4-4.B,#20,RS                                  Preset=  Off
Vert=      500 counts  Disp= 1                       Elapsed=        31 secs
   Energy  Counts     X-Ray Lines

   1.25     1236.    Mg K  , Mg K  , Mg K

   1.74     3991.    Si K  , Si K

   3.30       86.    K  K  , K  K

   3.70      997.    Ca K  , Ca K

   4.03      108.    Ca K  , Ca K

   6.41      344.    Fe K  , Fe K


Quantex>
      0.000     Range=    10.230 keV                          10.070
                                                Integral 8  =          597
13-Apr-1992 10:05:38
Execution time =     1 seconds
91T019-3,B,F2-3,#2,EG                                Preset=  Off
Vert=      500 counts  Disp= 1                       Elapsed=        34 secs
Quantex>ID/AU/PR
```

13-Apr-1992 10:11:03
Execution time = 6 seconds
24142,SW4-4,B,#25,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 53 secs

Energy	Counts	X-Ray Lines
1.25	1247.	Mg K , Mg K , Mg K
1.74	5241.	Si K , Si K
3.68	1087.	Ca K , Ca K
6.40	712.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 701

13-Apr-1992 10:12:11
Execution time = 6 seconds
24142,SW4-4,B,#35,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 26 secs

Energy	Counts	X-Ray Lines
1.26	587.	Mg K , Mg K , Mg K
1.73	2441.	Si K , Si K
3.30	76.	K K , K K
3.69	488.	Ca K , Ca K
6.40	367.	Fe K , Fe K
7.06	73.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 346

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW4-4

20ml

RECEIVING

ANALYSIS

GRID: 1 ☐ 2 ☐ 3 ☑ 4 ☐

Grid Address 1C

Screen Magnification 19400x

Camera Constant 30-2

Accelerating Voltage 100 KV

Beam Current 10 µa

MICROSCOPE: 600A ☑ 600B ☐ HU11E ☐ HU125E ☐

C

Analyst S. Ahmed Date 4/13/92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CQ	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	EDS Na	Mg	Si	Ca	Fe	Id	Comments
1	1		5	38												✓	✓				3	10	2	1		EDS #1
	2		12	220													✓				3	10	3	2		EDS #2
	3		8	110													✓				3	10	2	1		EDS #3
	4		6	115													✓				3	10	2	1		EDS #4
	5		4	65													✓				3	10	2	2		EDS #5
	6		4	100												✓	✓									
	7		5	110												✓	✓									
	8		5	100												✓	✓									
	9		25	440												✓	✓									
	10		2	40												✓	✓									
	11		3	65												✓	✓									
	12	MD	2	55												✓	✓									
	13		5	55	✓																					
	14		5	60												✓	✓				3	10	2	1		EDS #15
	15		4	150												✓	✓									
	16	MD	5	90												✓	✓									
	17		5	45												✓	✓									
	18		24	165												✓	✓									
	19		5	25												✓	✓									
	20		11	120												✓	✓									
	21		10	89												✓	✓									
	22		15	110												✓	✓									
	23		5	115												✓	✓									
2			4	80												✓	✓									

OBSERVATIONS:

Clean ☐

Debris: ☑ Very Light ☐ Light ☐ Moderate ☑ Heavy ☑ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW4-4

RECEIVING

ANALYSIS

GRID: 1 ☐ 2 ☐ 3 ☑ 4 ☐

MICROSCOPE: 600A ☑ 600B ☐ HU11E ☐ HU125E ☐

Grid Address 1C

Screen Magnification 19400 x

Camera Constant 30-2

Accelerating Voltage 100 KV

Beam Current 10 μa

Analyst S. Ahmed

Date 4/13/92

C

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CQ	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
2	25		15	270 X													✓	✓			3	10	3	2		EDS #25
		MD	4	35												✓	✓									
		F	1.5	55	✓																					
			4	25												✓										
			5	62												✓										
			4	65												✓										
			2	50												✓										
			2	22												✓										
			3	45												✓										
			4	55												✓										
			2	20												✓										
			12	330												✓										
			3	130												✓										
			5	175												✓										
			10	110												✓										
		MD	3	65												✓					~~2~~	~~10~~	~~1~~	2		
			5	375													✓				2	10	~~1~~	2		EDS #41
			4	24												✓										
			5	150												✓										
			18	1100 X												✓										
			6	385												✓										
			3	40												✓										
			12	550													✓				3	10	3	1		EDS #47
			4	110 X												✓										

OBSERVATIONS: Clean ☐

Debris: ☑	Very Light ☐	Light ☐	Moderate ☐	Heavy ☑	Very Heavy ☐
Gypsum: ☐	Very Light ☐	Light ☐	Moderate ☐	Heavy ☐	Very Heavy ☐
Other ☐					

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW4-4

RECEIVING

ANALYSIS

GRID: 1 ☐ 2 ☐ 3 ☑ 4 ☐

MICROSCOPE: 600A ☑ 600B ☐ HU11E ☐ HU125E ☐

Grid Address 1C

Screen Magnification 19400x

Camera Constant 30.2

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst S. Ahmed Date 6/13/9

Grid opening	Str #	Str	Dimensions (mm) Width	Dimensions (mm) Length	NAM	TM	CM	CD	CQ	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
2	49		5	45									✓			✓										
	50		3	24												✓										
	51		5	55												✓										

OBSERVATIONS:

Clean ☑

Debris: ☐ Very Light ☐ Light ☑ Moderate ☑ Heavy ☑ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

13-Apr-1992 13:58:40
Execution time = 6 seconds
24142-SW4-4,C,#01,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 28 secs

Energy	Counts	X-Ray Lines
1.25	2370.	Mg K , Mg K , Mg K
1.74	7478.	Si K , Si K
3.31	157.	K K , K K
3.69	1921.	Ca K , Ca K
6.40	488.	Fe K , Fe K

Quantex)
0.000 Range= 10.230 keV 10.070
Integral 8 = 1132

13-Apr-1992 14:22:47
Execution time = 6 seconds
24142-SW4-4,C,#02,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 14 secs

Energy	Counts	X-Ray Lines
1.24	679.	Mg K , Mg K
1.74	2258.	Si K , Si K
3.70	567.	Ca K , Ca K
4.05	45.	Sc K , Sc K , Ca K , Ca K
6.41	215.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 309

13-Apr-1992 14:23:25
Execution time = 6 seconds
24142-SW4-4,C,#03,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 20 secs

Energy	Counts	X-Ray Lines
1.25	915.	Mg K , Mg K , Mg K
1.74	3214.	Si K , Si K
3.29	58.	K K , K K
3.69	799.	Ca K , Ca K
6.39	270.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 433

13-Apr-1992 14:24:01
Execution time = 6 seconds
24142-SW4-4,C,#03,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 21 secs

Energy	Counts	X-Ray Lines
1.25	961.	Mg K , Mg K , Mg K
1.74	3194.	Si K , Si K
3.70	773.	Ca K , Ca K
4.03	104.	Ca K , Ca K

6.42	268.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 429
13-Apr-1992 14:24:14
Execution time = 6 seconds
24142-SW4-4,C,#04,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 21 secs

Energy	Counts	X-Ray Lines
1.25	961.	Mg K , Mg K , Mg K
1.74	3194.	Si K , Si K
3.70	773.	Ca K , Ca K
4.03	104.	Ca K , Ca K
6.42	268.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 429
13-Apr-1992 14:24:51
Execution time = 7 seconds
24142-SW4-4,C,#05,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 19 secs

Energy	Counts	X-Ray Lines
1.25	851.	Mg K , Mg K , Mg K
1.74	2552.	Si K , Si K
3.69	671.	Ca K , Ca K
4.04	75.	Sc K , Ca K , Ca K
6.38	233.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 397

13-Apr-1992 14:27:54
Execution time = 7 seconds
24142-SW4-4,C,#15,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 41 secs
Quantex> ID/AU/TY

0.000 Range= 10.230 keV 10.070
Integral 8 = 373

13-Apr-1992 14:28:15
Execution time = 6 seconds
24142-SW4-4,C,#15,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 41 secs

Energy	Counts	X-Ray Lines
1.26	790.	Mg K , Mg K , Mg K
1.74	2854.	Si K , Si K
3.69	615.	Ca K , Ca K
6.40	208.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 351

13-Apr-1992 14:32:28
Execution time = 7 seconds
24142-SW4-4,C,#25,SA Preset= Off
Vert= 1000 counts Disp= 1 Elapsed= 37 secs

Energy	Counts	X-Ray Lines
1.25	1591.	Mg K , Mg K , Mg K
1.74	6351.	Si K , Si K
3.30	245.	K K , K K
3.69	1101.	Ca K , Ca K
4.03	108.	Ca K , Ca K
6.39	950.	Fe K , Fe K
7.05	142.	Fe K , Fe K

Quantex)
0.000 Range= 10.230 keV 10.070
Integral 8 = 954

13-Apr-1992 14:39:11
Execution time = 6 seconds
24142-SW4-4,C,#41,SA Preset= Off
Vert= 1000 counts Disp= 1 Elapsed= 30 secs

Energy	Counts	X-Ray Lines
1.25	583.	Mg K , Mg K , Mg K
1.74	2751.	Si K , Si K
3.31	103.	K K , K K
3.68	314.	Ca K , Ca K
6.40	566.	Fe K , Fe K
7.05	110.	Fe K , Fe K

Quantex)
0.000 Range= 10.230 keV 10.070
Integral 8 = 375

13-Apr-1992 14:47:22
Execution time = 7 seconds
24142-SW4-4,C,#47,SA Preset= Off
Vert= 1000 counts Disp= 1 Elapsed= 16 secs

Energy	Counts	X-Ray Lines
1.26	803.	Mg K , Mg K , Mg K
1.74	2886.	Si K , Si K
3.34	162.	K K , K K
3.69	767.	Ca K , Ca K
4.03	79.	Ca K , Ca K
6.40	272.	Fe K , Fe K

Quantex>
0.000 Range= 10.230 keV 10.070
Integral 8 = 651

TABLE 3. CLASSIFICATION OF FIBERS WITH TUBULAR MORPHOLOGY

TM	-	Tubular Morphology not sufficiently characteristic for classification as chrysotile
CM	-	Characteristic Chrysotile Morphology
CD	-	Chrysotile SAED pattern
CQ	-	Chrysotile composition by Quantitative EDXA
CMQ	-	Chrysotile Morphology and composition by Quantitative EDXA
CDQ	-	Chrysotile SAED pattern and composition by Quantitative EDXA
NAM	-	Non-Asbestos Mineral

TABLE 4. CLASSIFICATION OF FIBERS WITHOUT TUBULAR MORPHOLOGY

UF	-	Unidentified Fiber
AD	-	Amphibole by random orientation SAED (shows layer pattern of 0.53 nm spacing)
AX	-	Amphibole by qualitative EDXA. Spectrum has elemental components consistent with amphibole
ADX	-	Amphibole by random orientation SAED and Qualitative EDXA
AQ	-	Amphibole by Quantitative EDXA
AZ	-	Amphibole by one Zone Axis SAED
ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No. 24142 | Client SCHAFER & ASSOC.

Sample No. SW 5-4

Date Analyzed 4/13/92

Fibers (chrysotile)	BDL*	MFL
Fibers > 5 µm in length (chrysotile)	BDL*	MFL
Fibers > 10 µm in length (chrysotile)	BDL*	MFL
Mass (chrysotile)	0	ug/L
More/Less than 5 Fibers in Sample (chrysotile)	LESS	
Poisson 95% Confidence Interval	0 to 5.8	MFL
Detection Limit	1.6	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Particle Size Distribution (Chrysotile)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 - 4.99	5.00 - 9.99	10 & UP
0	0	0	0	0	0	0	0

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 - .49	.50 - .99	1 & UP
0	0	0	0	0	0	0	0

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 - 99	100 - 199	200 & UP
0	0	0	0	0	0	0	0

EMS ASBESTOS ANALYSIS

EMS Lab No. 24142
Client Schafer
Sample No. SW5-4

RECEIVING

METHOD OF ANALYSIS
- EPA Yamate Level I ☐
- Level II ☐
- Level III ☐
- AHERA ☐

LENGTHS
- All Sizes (EPA) ☐
- (µm):≥0.5 ☐
- ≥1.0 ☐
- ≥5.0 ☐
- ≥10.0 ☐
- PCM Range* ☐ *(≥0.25 µm width, 25.0 µm length)

ASPECT RATIO 3:1 ☐ 5:1 ☐

Approved By _____ Date _____

FILTER TYPE/AREA (mm²)
- MCE/385 ☐
- MCN/960 ☐
- MCE/960 ☐
- 1017 Other ☑

TYPE OF SAMPLE
- Air ☐ Water ☑
- Soil ☐ Wipe ☐
- Bulk ☐ Other ☐
- Dust/Microvac ☐

PORE SIZE
- 0.45 µm ☐
- 0.8 µm ☐
- .1 µm ☑
- .22 µm ☐
- Other ☐

G.O. Area (mm²) 0.0 062
No. of G.O. to Analyze 20
Filter Lot No. HOEM90194C

PREP

DIRECT PREP ☑
INDIRECT PREP ☐

Volume _____ liters
Working Volume 5 ml
Weight _____ grams
Ashed Area _____ %

Prepared By Sh/FG

ANALYSIS

GRID
1 ☑ 3 ☐
2 ☐ 4 ☐

Grid Address 1A
Screen Magnification 1920D x
Camera Constant 27.7
Accelerating Voltage 100 KV
Beam Current 10 µa

Analyst S. Ahmed Date 4/13/

MICROSCOPE
- 600A ☐
- 600B ☑
- HU11E ☐
- HU125E ☐

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	Fiber Classification NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	NSD																									
3	NSD																									
4	NSD																									
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:
- Clean ☐
- Debris: ☑ Very Light ☐ Light ☑ Moderate ☑ Heavy ☐ Very Heavy ☐
- Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
- Other ☐

EM ASBESTOS ANALYSIS

MS Lab No. 24142

ample No. SW5 4

RECEIVING

Page ___ of ___

MICROSCOPE

600A ☐
600B ☑
HU11E ☐
HU125E ☐

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☑ 4 ☐

Grid Address 1B
Screen Magnification 19200 x
Camera Constant 27.7
Accelerating Voltage 100 KV
Beam Current 10 μa

B

Analyst S. Ahmed Date 4/13/92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	Fiber Classification NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	NSD																									
3	NSD																									
4	NSD																									
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:

Clean ☐
Debris: ☑ Very Light ☐ Light ☑ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

EM ASBESTOS ANALYSIS

MS Lab No. 24142

5ml

mple No. SW5-4

RECEIVING

ANALYSIS

GRID
1 [ ] 3 [X]
2 [ ] 4 [ ]

Grid Address 1-C
Screen Magnification 19400
Camera Constant 30.2
Accelerating Voltage 100 KV
Beam Current 10 μa

MICROSCOPE
600A [X]
600B [ ]
HU11E [ ]
HU125E [ ]

C

Analyst Radla Date 4/13

Grid opening	Str #	Str	Dimensions (mm) Width	Length	Fiber Classification NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	NSD																									
3	NSD																									
4	NSD																									
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:

Clean [ ]
Debris: [ ] Very Light [ ] Light [X] Moderate [X] Heavy [ ] Very Heavy [ ]
Gypsum: [ ] Very Light [ ] Light [ ] Moderate [X] Heavy [ ] Very Heavy [ ]
Other [ ]

TABLE 3. CLASSIFICATION OF FIBERS WITH TUBULAR MORPHOLOGY

TM	-	Tubular Morphology not sufficiently characteristic for classification as chrysotile
CM	-	Characteristic Chrysotile Morphology
CD	-	Chrysotile SAED pattern
CQ	-	Chrysotile composition by Quantitative EDXA
CMQ	-	Chrysotile Morphology and composition by Quantitative EDXA
CDQ	-	Chrysotile SAED pattern and composition by Quantitative EDXA
NAM	-	Non-Asbestos Mineral

TABLE 4. CLASSIFICATION OF FIBERS WITHOUT TUBULAR MORPHOLOGY

UF	-	Unidentified Fiber
AD	-	Amphibole by random orientation SAED (shows layer pattern of 0.53 nm spacing)
AX	-	Amphibole by qualitative EDXA. Spectrum has elemental components consistent with amphibole
ADX	-	Amphibole by random orientation SAED and Qualitative EDXA
AQ	-	Amphibole by Quantitative EDXA
AZ	-	Amphibole by one Zone Axis SAED
ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No.	24142	Client	SCHAFER & ASSOC.
Sample No.	SW 6-4		
Date	4/8/92		

Total Asbestos Fibers	770	MFL
Chrysotile Fibers	*BDL	MFL
Amphibole Fibers	770	MFL
> 5 Micron length (chrysotile)	*BDL	MFL
> 5 Micron length (amphibole)	270	MFL
Mass (Chrysotile)	*BDL	µg/L
Mass (amphibole)	1800	µg/L
More/Less than 5 Chrysotile Fibers in Sample	LESS	
More/Less than 5 Amphibole Fibers in Sample	MORE	
Poisson 95% Confidence Interval	620 to 940	MFL
Detection Limit	8.2	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Size Distribution (Chrysotile and Amphibole)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 & UP
0	2	8	7	12	65

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 & UP
0	1	15	13	10	55

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 & UP
18	36	21	8	5	6

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142
Client Schaffer
Sample No. SW6-4

RECEIVING

METHOD OF ANALYSIS
EPA Yamate Level I ☐
Level II ☐
Level III ☐
AHERA ☐

LENGTHS
All Sizes (EPA) ☐
(µm): ≥0.5 ☐
≥1.0 ☐
≥5.0 ☐
≥10.0 ☐
PCM Range* ☐
*(≥0.25 µm width, 25.0 µm length)

ASPECT RATIO 3:1 ☐ 5:1 ☐

Approved By _____ Date _____

FILTER TYPE/AREA (mm²)
MCE/385 ☐
MCN/960 ☐
MCE/960 ☐
1017 Other ☑

TYPE OF SAMPLE
Air ☐ Water ☑
Soil ☐ Wipe ☐
Bulk ☐ Other ☐
Dust/Microvac ☐

PORE SIZE
0.45 µm ☐
0.8 µm ☐
.1 µm ☑
.22 µm ☐
Other ☐

G.O. Area (mm²) 0.062
No. of G.O. to Analyze 20
Filter Lot No. HCEM90194C

PREP

DIRECT PREP ☑
INDIRECT PREP ☐

Volume _____ liters
Working Volume 5 ml
Weight _____ grams
Ashed Area _____ %

Prepared By FG

ANALYSIS

GRID
1 ☒ 3 ☐
2 ☐ 4 ☐

Grid Address 1-A
Screen Magnification 19,300 x
Camera Constant 30.4
Accelerating Voltage 100 KV
Beam Current 70 µa

Analyst Radla Date 4/7

MICROSCOPE
600A ☒
600B ☐
HU11E ☐
HU12SE ☐

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1		12	50	✓																					EDS
	2		12	240												✓					2	10	1	1		Tremo.
	3		8	110												✓					3	10	3	1		"
	4		5	300												✓					2	10	4	2		"
	5		8	75												✓					3	10	3	1		"
	6		2	85	✓																					
	7		5	55									✓													
	8		4	125									✓													Tremo.
	9		3	75									✓													Tremo.
	10		5	80												✓					3	10	2	1		Tremo.
	11		6	60									✓													"
	12		5	100									✓													"
	13		8	250									✓													
	14		6	110									✓													"
	15		8	55									✓													"
	16		8	160									✓													
	17		8	80									✓													
	18		4	42									✓													
	19		5	165									✓													
	20		8	1100												✓					3	10	2	1		
	21		5	100									✓													
	22		6	160									✓													
	23		5	700									✓													
	24		5	250									✓													

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

EM ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW6-4

Page [redacted]

MICROSCOPE
- 600A ☑
- 600B ☐
- HU11E ☐
- HU125E ☐

ANALYSIS

GRID
- 1 ☑
- 2 ☐
- 3 ☐
- 4 ☐

Grid Address 1A

Screen Magnification 4300 x

Camera Constant 301

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst Rach

Date 4/7

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CQ	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	25		3	65									✓													Tremo.
	26		2.5	70									✓													
	27		3	40									✓													
	28		5	130									✓													
2	29		3	18									✓													
	30		4	275													✓				3	10	3	1		Tremolite
	31		3	22									✓													
	32		5	70									✓													
	33		4	55									✓													
	34		5	55									✓													
	35		1.5	48	✓																					
	36		2	40									✓													
	37		3	70									✓													
	38		3	30									✓													
	39		5	35									✓													
	40		3	50									✓													
	41		4	70									✓													
	42		1	22	✓																					
	43		3	38									✓													
	44		5	65									✓													
	45		8	60									✓													
	46		4	25									✓													
	47		12	200									✓													
	48		13	40									✓													

OBSERVATIONS:

Clean ☐

Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

ASBESTOS ANALYSIS

AS Lab No. 24142

mple No. SW6-4

[redacted]

MICROSCOPE
600A ☐
600B ☐
HU11E ☐
HU12SE ☐

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☐ 4 ☐

Grid Address _____
Screen Magnification _____ x
Camera Constant _____
Accelerating Voltage 100 KV
Beam Current _____ µa

Analyst _____ Date _____

Grid opening	Str #	Str	Dimensions (mm) Width	Length	Fiber Classification NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
22	1		1	15	✓																					

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

7-Apr-1992 09:27:28
Execution time = 7 seconds
24142,6-4,A,#01,RS
Vert= 200 counts Disp= 1

Preset= Off
Elapsed= 30 secs

Energy	Counts	X-Ray Lines
1.24	268.	Mg K , Mg K
1.47	88.	Al K , Al K
1.74	932.	Si K , Si K
3.32	200.	K K , K K
6.40	244.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV

Integral 8 = 10.230 168

7-Apr-1992 09:29:01
Execution time = 6 seconds
24142,6-4,A,#02,RS
Vert= 500 counts Disp= 1

Preset= Off
Elapsed= 23 secs

Energy	Counts	X-Ray Lines
0.98	65.	Zn L , Zn L
1.26	989.	Mg K , Mg K , Mg K
1.74	4081.	Si K , Si K
3.33	242.	K K , K K
3.68	359.	Ca K , Ca K
6.40	515.	Fe K , Fe K
7.04	78.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV

Integral 8 = 10.230 569

7-Apr-1992 09:32:48
Execution time = 6 seconds
24142,6-4,A,#03,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 47 secs

Energy	Counts	X-Ray Lines
1.25	615.	Mg K , Mg K , Mg K
1.73	2225.	Si K , Si K
3.69	569.	Ca K , Ca K
6.41	189.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 329

7-Apr-1992 09:34:05
Execution time = 7 seconds
24142,6-4,A,#04,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 24 secs

Energy	Counts	X-Ray Lines
1.00	118.	Na K , Na K , Zn L , Zn L , Zn L , Zn L
1.25	696.	Mg K , Mg K , Mg K
1.73	3552.	Si K , Si K
3.30	107.	K K , K K
3.69	150.	Ca K , Ca K
6.41	832.	Fe K , Fe K
7.06	117.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 526

7-Apr-1992 09:56:46
Execution time = 6 seconds
24142,6-4,A,#05,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 38 secs

Energy	Counts	X-Ray Lines
1.25	551.	Mg K , Mg K , Mg K
1.74	1945.	Si K , Si K
3.69	532.	Ca K , Ca K
6.39	184.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 292

7-Apr-1992 09:57:42
Execution time = 6 seconds
24142,6-4,A,#10,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 34 secs

Energy	Counts	X-Ray Lines
1.26	499.	Mg K , Mg K , Mg K
1.74	1878.	Si K , Si K
3.69	427.	Ca K , Ca K
6.41	158.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 288

7-Apr-1992 09:58:57
Execution time = 6 seconds
24142,6-4,A,#20,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 32 secs

Energy	Counts	X-Ray Lines
1.25	286.	Mg K , Mg K , Mg K
1.75	1092.	Si K , Si K
3.69	262.	Ca K , Ca K
6.40	85.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 154

7-Apr-1992 10:00:03
Execution time = 6 seconds
24142,6-4,A,#30,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 25 secs

Energy	Counts	X-Ray Lines
1.25	275.	Mg K , Mg K , Mg K
1.74	1067.	Si K , Si K
3.68	275.	Ca K , Ca K
6.41	96.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 155

EMS ASBESTOS ANALYSIS

S Lab No. 24142

nple No. SW6-4

MICROSCOPE
600A ☑
600B ☐
HU11E ☐
HU12SE ☐

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☑ 4 ☐

Grid Address 1-13
Screen Magnification 19,300x
Camera Constant 30.1
Accelerating Voltage 100 KV
Beam Current 10 µa

B

Analyst F. M. Date 4-8-92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	01	F	5	100												✓					2	10	2	1		EDS Tremolite
	02	F	10	100												✓					3	10	2	1		EDS Tremolite
	03	F	2	60												✓										in debris
	04	F	5	175												✓					2	10	2	2		EDS Tremolite
	05	F/D	2	30												✓					3	10	2	1		EDS Tremolite
	06	F	7	24												✓					3	10	2	1		EDS Tremolite
	07	F	2.5	15												✓										Tremolite
	08	F/D	10	75												✓										Tremolite
	09	F	4	25												✓										"
	10	F	6	200												✓										"
	11	F/D	10	100												✓										"
	12	F/D	5	90												✓										"
	13	F	10	40												✓										"
	14	F	7	140												✓										Tremolite
	15	F	5	115												✓										"
	16	F	2.5	40												✓					3	10	2	1		EDS Tremolite
	17	F	2	20												✓										"
	18	F	2.5	30												✓										
	19	F	8	380												✓					2	10	1	1		EDS "
	20	F	5	25												✓										"
	21	F/D	10	400												✓										"
	22	F/D	8	50												✓										"
	23	F	1.5	165												✓										"
	24	F	3	90												✓										"

OBSERVATIONS:

Clean ☐
Debris: ☑ Very Light ☐ Light ☐ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

FIBER ASBESTOS ANALYSIS

MS Lab No. 24142

mple No. SW6-4

[redacted]

MICROSCOPE
600A ☐
600B ☐
HUTE ☐
HU125E ☐

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☐ 4 ☐

Grid Address _____
Screen Magnification _____ x
Camera Constant _____
Accelerating Voltage 100 KV
Beam Current _____ µa

Analyst _____ Date _____

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	25	F	7	95												✓					3	10	2	1		EDS Tremolite
	26	F	5	40												✓										

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

7-Apr-1992 10:26:28
Execution time = 6 seconds
24242,SW6-4,1B,01,FM Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 47 secs

Energy	Counts	X-Ray Lines
0.58	436.	Cr L , Cr L , Cr L , Cr L
1.25	665.	Mg K , Mg K , Mg K
1.74	2771.	Si K , Si K
2.28	328.	S K , S K
3.69	579.	Ca K , Ca K
6.40	411.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 448

7-Apr-1992 10:28:52
Execution time = 6 seconds
24242,SW6-4,1B,02,FM Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 34 secs

Energy	Counts	X-Ray Lines
1.26	1964.	Mg K , Mg K , Mg K
1.74	7102.	Si K , Si K
3.31	188.	K K , K K
3.69	1312.	Ca K , Ca K
6.39	705.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 969

8-Apr-1992 11:32:55
Execution time = 6 seconds
24242,SW6-4,1B,04,FM Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 45 secs

Energy	Counts	X-Ray Lines
1.25	568.	Mg K , Mg K , Mg K
1.74	2458.	Si K , Si K
3.68	397.	Ca K , Ca K
6.39	339.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 322

7-Apr-1992 11:19:51
Execution time = 6 seconds
24242,SW6-4,1B,05,FM
Vert= 500 counts Disp= 1

Preset= Off
Elapsed= 40 secs

Energy	Counts	X-Ray Lines
1.25	1239.	Mg K , Mg K , Mg K
1.74	4457.	Si K , Si K
3.69	1027.	Ca K , Ca K
6.39	420.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 590

7-Apr-1992 10:41:35
Execution time = 7 seconds
24242,SW6-4,1B,06,FM Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 26 secs

Energy	Counts	X-Ray Lines
1.25	1969.	Mg K , Mg K , Mg K
1.74	7288.	Si K , Si K
3.29	99.	K K , K K
3.69	1472.	Ca K , Ca K
4.03	141.	Ca K , Ca K
6.40	782.	Fe K , Fe K
7.06	125.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 1019

```
 7-Apr-1992 10:54:15
Execution time =     8 seconds
24242,SW6-4,1B,16,FM                                  Preset=  Off
Vert=      200 counts  Disp= 1                        Elapsed=        54 secs
   Energy  Counts     X-Ray Lines

   1.25      950.    Mg K  , Mg K  , Mg K

   1.74     3333.    Si K  , Si K

   3.69      732.    Ca K  , Ca K

   6.40      381.    Fe K  , Fe K



Quantex>
      0.240     Range=    10.230 keV                          10.230
                                                Integral 8  =          576


 7-Apr-1992 10:57:49
Execution time =     6 seconds
24242,SW6-4,1B,19,FM                                  Preset=  Off
Vert=      200 counts  Disp= 1                        Elapsed=        45 secs
   Energy  Counts     X-Ray Lines

   1.26      678.    Mg K  , Mg K  , Mg K

   1.74     3441.    Si K  , Si K

   3.69      338.    Ca K  , Ca K

   6.40      429.    Fe K  , Fe K



Quantex>
      0.240     Range=    10.230 keV                          10.230
                                                Integral 8  =          451
```

7-Apr-1992 11:05:56
Execution time = 6 seconds
24242,SW6-4,1B,25,FM Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 33 secs

Energy	Counts	X-Ray Lines
1.25	1180.	Mg K , Mg K , Mg K
1.74	4193.	Si K , Si K
3.69	972.	Ca K , Ca K
4.01	91.	Ca K , Ca K
6.38	372.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 545

EMS ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW8-4

5ml.

RECEIVING

ANALYSIS

GRID: 1 ☐ 3 ☑ 2 ☐ 4 ☐

SCOI: 600A ☐ 600B ☑ HU11E ☐ HU125E ☐

Grid Address: 1C

Screen Magnification: 19300 x

Camera Constant: 27.7

Accelerating Voltage: 100 KV

Beam Current: 10 pa

Analyst: S. Ahmed

Date: 4/8/92

C

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1	F	2	24													✓				3	10	2	1		EDS#1 Tremolite
	2		6	285													✓				3	10	2	1		EDS#2 Tremolite
	3		2	55													✓				3	10	2	1		EDS#3 "
	4		4	65													✓				3	10	2	1		EDS#4 "
	5		2	40													✓				3	10	2	1		EDS#5 "
	6		6	45												✓										Tremolite
	7		7	200												✓										"
	8		15	70												✓										"
	9	MD	5	90												✓										"
	10	F	3	30												✓										"
	11		2	90												✓										"
	12		6	68												✓										"
	13		2	42												✓										"
	14		4	30												✓										"
	15		10	480 X													✓				3	10	2	1		EDS#15 Tremolite
	16		2	40												✓										Tremolite
	17		5	190												✓										"
	18		3	60												✓										"
	19		15	64												✓										"
	20		12	1000 X												✓										"
	21		5	80												✓										"
	22	MD	6	120												✓										"
	23	F	2	40												✓										"
	24	F	4	55												✓										"

OBSERVATIONS:

Clean ☐

Debris: ☒ Very Light ☐ Light ☐ Moderate ☒ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

```
 7-Apr-1992 10:47:22
Execution time =     6 seconds
24242,SW6-4,1C,03,SA                                  Preset=  Off
Vert=      500 counts  Disp= 1                        Elapsed=        46 secs
   Energy  Counts     X-Ray Lines

   0.52     1401.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.25      839.    Mg K  , Mg K  , Mg K

   1.74     2512.    Si K  , Si K

   3.69      488.    Ca K  , Ca K

   6.40      245.    Fe K  , Fe K



Quantex>
      0.240     Range=    10.230 keV                          10.230
                                          Integral 8  =          424
 7-Apr-1992 10:48:29
Execution time =     8 seconds
24242,SW6-4,1C,04,SA                                  Preset=  Off
Vert=      500 counts  Disp= 1                        Elapsed=        35 secs
   Energy  Counts     X-Ray Lines

   0.51     1553.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.00       80.    Na K  , Na K  , Zn L  , Zn L  , Zn L  ,
                     Zn L

   1.25      870.    Mg K  , Mg K  , Mg K

   1.73     3077.    Si K  , Si K

   3.31      143.    K  K  , K  K

   3.69      516.    Ca K  , Ca K

Quantex>     278.    Fe K  , Fe K
      0.240     Range=    10.230 keV                          10.230
                                          Integral 8  =          707
```

7-Apr-1992 10:49:48
Execution time = 6 seconds
24242,SW6-4,1C,05,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 34 secs

Energy	Counts	X-Ray Lines
0.51	831.	O K , O K , V L , V L , V L , V L
1.25	531.	Mg K , Mg K , Mg K
1.74	1597.	Si K , Si K
3.69	427.	Ca K , Ca K
6.39	249.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 305

07-Apr-1992 10:51:02 24242,SW6-4,1C,15,SA

ENERGY	COUNTS	X-RAY LINES
0.52	2089.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.25	1533.	Mg KA1, Mg KA2, Mg KB1
1.73	4433.	Si KA1, Si KA2
3.33	77.	K KA1, K KA2
3.68	1115.	Ca KA1, Ca KA2
4.00	100.	Ca KB1, Ca KB3
5.91	89.	Mn KA1, Mn KA2
6.39	379.	Fe KA1, Fe KA2

7-Apr-1992 10:45:22
Execution time = 5 seconds
24242,SW6-4,1C,01,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 59 secs

Energy	Counts	X-Ray Lines
0.51	857.	O K , O K , V L , V L , V L , V L
1.25	606.	Mg K , Mg K , Mg K
1.73	1878.	Si K , Si K
3.68	321.	Ca K , Ca K
6.37	202.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 353

7-Apr-1992 10:46:08
Execution time = 6 seconds
24242,SW6-4,1C,02,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 32 secs

Energy	Counts	X-Ray Lines
0.51	924.	O K , O K , V L , V L , V L , V L
1.24	549.	Mg K , Mg K
1.73	1999.	Si K , Si K
3.69	304.	Ca K , Ca K
6.39	162.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 334

TABLE 3. CLASSIFICATION OF FIBERS WITH TUBULAR MORPHOLOGY

TM	-	Tubular Morphology not sufficiently characteristic for classification as chrysotile
CM	-	Characteristic Chrysotile Morphology
CD	-	Chrysotile SAED pattern
CQ	-	Chrysotile composition by Quantitative EDXA
CMQ	-	Chrysotile Morphology and composition by Quantitative EDXA
CDQ	-	Chrysotile SAED pattern and composition by Quantitative EDXA
NAM	-	Non-Asbestos Mineral

TABLE 4. CLASSIFICATION OF FIBERS WITHOUT TUBULAR MORPHOLOGY

UF	-	Unidentified Fiber
AD	-	Amphibole by random orientation SAED (shows layer pattern of 0.53 nm spacing)
AX	-	Amphibole by qualitative EDXA. Spectrum has elemental components consistent with amphibole
ADX	-	Amphibole by random orientation SAED and Qualitative EDXA
AQ	-	Amphibole by Quantitative EDXA
AZ	-	Amphibole by one Zone Axis SAED
ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No.	24142	Client	SCHAFER & ASSOC.
Sample No.	SW 7-4		
Date	4/9/92		

Total Asbestos Fibers	100	MFL
Chrysotile Fibers	*BDL	MFL
Amphibole Fibers	100	MFL
> 5 Micron length (chrysotile)	*BDL	MFL
> 5 Micron length (amphibole)	34	MFL
Mass (Chrysotile)	*BDL	µg/L
Mass (amphibole)	180	µg/L
More/Less than 5 Chrysotile Fibers in Sample	LESS	
More/Less than 5 Amphibole Fibers in Sample	MORE	
Poisson 95% Confidence Interval	83 to 120	MFL
Detection Limit	1	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Size Distribution (Chrysotile and Amphibole)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 & UP
0	4	10	5	9	73

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 & UP
0	2	14	22	15	48

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 & UP
26	34	26	4	5	6

ASBESTOS ANALYSIS

Lab No. 24142
Client Schafer
Sample No. Siv 7-4

RECEIVING

METHOD OF ANALYSIS
EPA Yamate Level I ☐
Level II ☐
Level III ☐
AHERA ☐

LENGTHS
All Sizes (EPA) ☐
(µm): ≥0.5 ☐
≥1.0 ☐
≥5.0 ☐
≥10.0 ☐
PCM Range* ☐
*[illegible] µm width, 25.0 µm length

ASPECT RATIO 3:1 ☐ 5:1 ☐

Approved By _____ Date _____

FILTER TYPE/AREA (mm²)
MCE/385 ☐
MCN/960 ☐
MCE/960 ☐
1017 Other ☑

TYPE OF SAMPLE
Air ☐ Water ☑
Soil ☐ Wipe ☐
Bulk ☐ Other ☐
Dust/Microvac ☐

PORE SIZE
0.45 µm ☐
0.8 µm ☐
.1 µm ☑
.22 µm ☐
Other ☐

G.O. Area (mm²) 0.0062
No. of G.O. to Analyze 20
Filter Lot No. HOEM90194C

PREP

DIRECT PREP ☑
INDIRECT PREP ☐

Volume _____ liters
Working Volume 20 ml
Weight _____ grams
Ashed Area _____ %

Prepared By FG

ANALYSIS

GRID
1 ☑ 3 ☐
2 ☐ 4 ☐

Grid Address 1A
Screen Magnification 10300 x
Camera Constant 27.7
Accelerating Voltage 100 KV
Beam Current 10 µa

Analyst S. Ahmed Date 4/8/92

MICROSCOPE
600A ☐
600B ☑
HU11E ☐
HU12SE ☐

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1	F	5	55													✓				3	10	2	1		EDS #1 Tremolite
	2	F	4	110													✓				3	10	2	1		EDS #2 "
	3	F	3	61													✓				2	10	3	1		EDS #3 "
	4		8	70													✓				3	10	2	1		EDS #4 "
	5		5	70													✓				3	10	2	2		EDS #5 "
	6		5	140												✓										Tremolite
	7		8	195												✓										"
	8		5	50												✓										"
	9		5	90												✓										"
	10		2	70												✓										"
	11		1.5	65												✓										"
2	12		12	195												✓										"
	13	MO	3	140												✓										"
	14	F	2.5	55												✓										"
	15		5	55												✓	✓				3	10	2	2		EDS #15 Tremolite
	16		5	140												✓										Tremolite
	17		4	130												✓										"
	18		4	80												✓										"
	19		3	60												✓										"
	20		3	40												✓										"
	21	✓	2	165												✓										"
	22	F	10	55												✓										"
	23		3	24												✓										"
	24	✓	2	40												✓										"

OBSERVATIONS:

Clean ☐
Debris ☑ Very Light ☐ Light ☐ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

08-Apr-1992 11:44:45 24242,SW7-4,1A,01,SA

ENERGY	COUNTS	X-RAY LINES
0.51	5136.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.02	320.	Na KA1, Na KA2, Na KB1, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	3639.	Mg KA1, Mg KA2, Mg KB1
1.74	10625.	Si KA1, Si KA2
3.31	547.	K KA1, K KA2
3.69	1211.	Ca KA1, Ca KA2
4.04	141.	Sc KA2, Ca KB1, Ca KB3
4.49	143.	Ti KA1, Ti KA2, Sc KB1, Sc KB3
5.89	96.	Mn KA1, Mn KA2
6.39	1343.	Fe KA1, Fe KA2
7.02	176.	Fe KB1, Fe KB3

8-Apr-1992 11:46:13
Execution time = 8 seconds
24242,SW7-4,1A,02,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 30 secs

Energy	Counts	X-Ray Lines
0.51	1185.	O K , O K , V L , V L , V L , V L
1.25	798.	Mg K , Mg K , Mg K
1.73	2520.	Si K , Si K
3.69	514.	Ca K , Ca K
6.40	272.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 650

```
 8-Apr-1992 11:47:37
Execution time =     6 seconds
24242,SW7-4,1A,03,SA                                  Preset=  Off
Vert=      500 counts  Disp= 1                        Elapsed=        38 secs
   Energy  Counts     X-Ray Lines

   0.51      659.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.26      395.    Mg K  , Mg K  , Mg K

   1.74     1512.    Si K  , Si K

   3.68      305.    Ca K  , Ca K

   6.39      165.    Fe K  , Fe K



Quantex>
      0.240     Range=    10.230 keV                          10.230
                                          Integral 8  =          251
 8-Apr-1992 11:49:09
Execution time =     6 seconds
24242,SW7-4,1A,04,SA                                  Preset=  Off
Vert=      500 counts  Disp= 1                        Elapsed=        27 secs
   Energy  Counts     X-Ray Lines

   0.51     1496.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.25     1114.    Mg K  , Mg K  , Mg K

   1.73     3303.    Si K  , Si K

   3.32       97.    K  K  , K  K

   3.68      597.    Ca K  , Ca K

   4.02       78.    Ca K  , Ca K

   6.39      254.    Fe K  , Fe K
Quantex>
      0.240     Range=    10.230 keV                          10.230
                                          Integral 8  =          669
```

8-Apr-1992 11:50:16
Execution time = 6 seconds
24242,SW7-4,1A,05,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 21 secs

Energy	Counts	X-Ray Lines
0.52	1063.	O K , O K , V L , V L , V L , V L
1.01	173.	Na K , Na K , Zn L , Zn L , Zn L , Zn L
1.25	789.	Mg K , Mg K , Mg K
1.74	2351.	Si K , Si K
3.68	374.	Ca K , Ca K
6.38	367.	Fe K , Fe K
Quantex)	55.	Zn K , Zn K

0.240 Range= 10.230 keV 10.230
Integral 8 = 446

8-Apr-1992 13:04:07
Execution time = 6 seconds
24242,SW7-4,1A,15,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 39 secs

Energy	Counts	X-Ray Lines
0.51	1105.	O K , O K , V L , V L , V L , V L
1.25	676.	Mg K , Mg K , Mg K
1.73	2434.	Si K , Si K
3.31	120.	K K , K K
3.69	368.	Ca K , Ca K
6.39	296.	Fe K , Fe K

Quantex>
0.440 Range= 10.230 keV 10.230
Integral 8 = 409

EM ASBESTOS ANALYSIS

S Lab No. 24142

ple No. SW7-4

Page [redacted]

MICROSCOPE
600A ☑
600B ☐
HU11E ☐
HU125E ☐

B

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☑ 4 ☐

Grid Address 1-B
Screen Magnification 193.00 x
Camera Constant 38.1
Accelerating Voltage 100 KV
Beam Current 10 μa

Analyst F. M. Date 4-8-92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	01	F✗	5	50												✓					3	10	2	2		EDS Tremolite
	02	F✗	6	120												✓					3	10	2	1		EDS "
	03	F	8	145												✓					2	10	2	1		EDS "
	04	F	2.5	45												✓					3	10	2	1		EDS "
	05	F	3	160												✓					3	10	2	1		EDS "
	06	F	2	45												✓										Tremolite
	07	F	5	65												✓										"
	08	F	5	20												✓										"
	09	F	1.5	20												✓										"
	10	F	2	75												✓										"
	11	F	2	17												✓										"
	12	F	4	90												✓										"
	13	F	2.5	100												✓										"
	14	F	3	20												✓										"
2	15	F✗	5	50												✓					3	10	1	2		EDS Tremolite
	16	F	3	20												✓										"
	17	F	3	17												✓										"
	18	F✗	10	100												✓										"
	19	F	1.5	70												✓										"
	20	F	3	45												✓										"
	21	F	4	95												✓										"
	22	F	8	85												✓										"
	23	F	3	25												✓										"
	24	F	2.5	27												✓										"

OBSERVATIONS:

Clean ☐
Debris: ☑ Very Light ☐ Light ☐ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

EM ASBESTOS ANALYSIS

IS Lab No. 24142

mple No. Sw 7-4

Page 9

MICROSCOPE
600A ☐
600B ☐
HU11E ☐
HU125E ☐

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☐ 4 ☐

Grid Address _____
Screen Magnification _____ x
Camera Constant _____
Accelerating Voltage 100 KV
Beam Current _____ µa

Analyst _____ Date _____

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	EDS Na	Mg	Si	Ca	Fe	Id	Comments
2	25	F	3	24												✓					3	10	2	2		EDS Tremolite
	26	F	16	60												✓										
	27	F	5	180												✓										
	28	F	5	35												✓										
	29	FX	6	80												✓										
3	30	F	5	100												✓										
	31	F/D	5	80												✓										
	32	F/D	5	30												✓										
	33	F/D	10	185												✓										
	34	F/D	3	50												✓										
	35	F	3	40												✓					3	10	2	1		EDS Tremolite
	36	F	7	135												✓										
	37	F/D	10	200												✓										
	38	F	3	85												✓										
	39	F/D	9	65												✓										
	40	F	2	17												✓										
4	41	F	4	60												✓										
	42	F	6	70	✓																					
	43	F	5	100												✓										Tremolite
	44	F	4	26												✓										
	45	F	3	50												✓					2	10	1	2		EDS
	46	F	15	85												✓										
	47	F/D	4	100												✓										
	48	F	2.5	30												✓										

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

EM ASBESTOS ANALYSIS

S Lab No. 24142

pie No. SW 7-4

MICROSCOPE
600A ☐
600B ☐
HU11E ☐
HU125E ☐

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☐ 4 ☐

Grid Address _____
Screen Magnification _____ x
Camera Constant _____
Accelerating Voltage 100 KV
Beam Current _____ µa

Analyst _____ Date _____

Grid opening	Str #	Str	Dimensions (mm) Width	Length	Fiber Classification NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
4	49	F	4	85												✓										Tremolite
	50	F	25	17	✓																					

OBSERVATIONS:

Clean ☐					
Debris: ☐	Very Light ☐	Light ☐	Moderate ☐	Heavy ☐	Very Heavy ☐
Gypsum: ☐	Very Light ☐	Light ☐	Moderate ☐	Heavy ☐	Very Heavy ☐
Other ☐					

8-Apr-1992 11:57:16
Execution time = 6 seconds
24242,SW7-4,1B,01,FM Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 38 secs

Energy	Counts	X-Ray Lines
1.25	1058.	Mg K , Mg K , Mg K
1.74	3787.	Si K , Si K
3.69	650.	Ca K , Ca K
6.40	667.	Fe K , Fe K
7.04	125.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 539

8-Apr-1992 11:59:01
Execution time = 10 seconds
24242,SW7-4,1B,02,FM Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 43 secs

Energy	Counts	X-Ray Lines
1.25	578.	Mg K , Mg K , Mg K
1.74	2007.	Si K , Si K
3.69	476.	Ca K , Ca K
6.41	194.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 300

8-Apr-1992 12:00:29
Execution time = 6 seconds
24242,SW7-4,1B,03,FM Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 36 secs

Energy	Counts	X-Ray Lines
1.25	1388.	Mg K , Mg K , Mg K
1.74	5825.	Si K , Si K
3.33	136.	K K , K K
3.69	1224.	Ca K , Ca K
4.04	95.	Sc K , Ca K , Ca K
6.40	608.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 820

8-Apr-1992 12:02:09
Execution time = 6 seconds
24242,SW7-4,1B,04,FM Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 41 secs

Energy	Counts	X-Ray Lines
1.24	634.	Mg K , Mg K
1.74	1988.	Si K , Si K
3.69	452.	Ca K , Ca K
6.38	199.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 304

8-Apr-1992 12:05:31
Execution time = 7 seconds
24242,SW7-4,1B,05,FM Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 40 secs

Energy	Counts	X-Ray Lines
1.25	934.	Mg K , Mg K , Mg K
1.74	3608.	Si K , Si K
3.32	165.	K K , K K
3.69	645.	Ca K , Ca K
6.40	509.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 523

8-Apr-1992 12:13:13
Execution time = 6 seconds
24242,SW7-4,1B,15,FM Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 62 secs

Energy	Counts	X-Ray Lines
1.26	1261.	Mg K , Mg K , Mg K
1.74	5030.	Si K , Si K
3.32	207.	K K , K K
3.70	503.	Ca K , Ca K
6.39	876.	Fe K , Fe K

Quantex>
0.440 Range= 10.230 keV 10.230
Integral 8 = 683

8-Apr-1992 12:21:27
Execution time = 7 seconds
24242,SW7-4,1B,25,FM Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 40 secs

Energy	Counts	X-Ray Lines
1.25	1398.	Mg K , Mg K , Mg K
1.74	5165.	Si K , Si K
3.69	1108.	Ca K , Ca K
6.39	733.	Fe K , Fe K
7.06	116.	Fe K , Fe K

Quantex>
0.440 Range= 10.230 keV 10.230
Integral 8 = 712

8-Apr-1992 12:35:10
Execution time = 5 seconds
24242,SW7-4,1B,35,FM Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 57 secs

Energy	Counts	X-Ray Lines
1.25	336.	Mg K , Mg K , Mg K
1.73	1253.	Si K , Si K
3.66	205.	Ca K , Ca K
6.41	164.	Fe K , Fe K

Quantex>
0.440 Range= 10.230 keV 10.230
Integral 8 = 172

8-Apr-1992 12:46:59
Execution time = 6 seconds
24242,SW7-4,1B,45,FM Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 39 secs

Energy	Counts	X-Ray Lines
1.26	499.	Mg K , Mg K , Mg K
1.74	2156.	Si K , Si K
3.68	248.	Ca K , Ca K
6.39	350.	Fe K , Fe K

Quantex>
0.440 Range= 10.230 keV 10.230
Integral 8 = 288

EMS Lab No. 24142

Sample No. SW7-4

C

RECEIVING

ANALYSIS

GRID 1 ☐ 2 ☐ 3 ☒ 4 ☐

MICROSCOPE 600A ☒ 600B ☐ HU11E ☐ HU125E ☐

Grid Address 1-C

Screen Magnification 19300x

Camera Constant 30.1

Accelerating Voltage 100 KV

Beam Current 10 pa

C

Analyst Radla

Date 4/9

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1		8	790													✓				2	10	0.4	2		Tremolite
	2		3	500													✓				2	10	0.3	2		"
	3		4	60													✓				2	10	0.3	2		"
	4		5	30													✓				3	10	1	1		"
	5		4	100												✓										"
	6		12	330												✓										"
	7		4	18												✓										"
	8		5	220												✓										"
	9		5	42												✓										"
	10		5	35													✓				3	10	2	1		Tremolite
	11		5	70												✓										"
	12		6	75												✓										"
	13		4	170												✓										"
	14		3	330												✓										"
2	15		12	82												✓										"
	16		15	260												✓										"
	17		2	42												✓										"
	18		3	70												✓										"
	19		16	110												✓										"
	20		8	75												✓										"
	21		4	65												✓										"
	22		5	125												✓										"
	23		3	25												✓										"
	24		4	120												✓										"

OBSERVATIONS:

Clean ☐

Debris: ☐ Very Light ☐ Light ☐ Moderate ☒ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW8-4

C

RECEIVING

ANALYSIS

GRID: 1 ☐ 2 ☐ 3 ☒ 4 ☐

MICROSCOPE: 600A ☒ 600B ☐ HU11E ☐ HU12SE ☐

Grid Address 1-C

Screen Magnification 19300 x

Camera Constant 30.1

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst Radha

Date 4/8/92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AQ	ADQ	AZO	AZZ	EDS Na	Mg	Si	Ca	Fe	Id	Comments
2	25		16	250												✓										Tremolite
	26		8	70												✓										"
	~~27~~		3	40												✓										"
	~~28~~		7	80												✓										"
	29		3	220												✓										"

OBSERVATIONS:

Clean ☐

Debris: ☐ Very Light ☐ Light ☐ Moderate ☒ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

```
 9-Apr-1992 09:21:29
Execution time =     7 seconds
24142,8-4,C.#01,RS                                  Preset=  Off
Vert=      500 counts  Disp= 1                      Elapsed=        25 secs
   Energy  Counts    X-Ray Lines

   1.01       62.    Na K  , Na K  , Zn L  , Zn L  , Zn L  ,
                     Zn L

   1.26      605.    Mg K  , Mg K  , Mg K

   1.75     3255.    Si K  , Si K

   3.31      181.    K  K  , K  K

   3.70      140.    Ca K  , Ca K

   6.41      674.    Fe K  , Fe K


Quantex>
      0.120     Range=    10.230 keV                          10.230
                                          Integral 8  =          526
 9-Apr-1992 09:22:20
Execution time =     6 seconds
24142,8-4,C.#02,RS                                  Preset=  Off
Vert=      500 counts  Disp= 1                      Elapsed=        24 secs
   Energy  Counts    X-Ray Lines

   1.26      782.    Mg K  , Mg K  , Mg K

   1.74     4012.    Si K  , Si K

   3.32      192.    K  K  , K  K

   3.69      144.    Ca K  , Ca K

   4.98       65.    V  K  , V  K

   6.40      921.    Fe K  , Fe K

   7.06      144.    Fe K  , Fe K

Quantex>
      0.120     Range=    10.230 keV                          10.230
                                          Integral 8  =          505
```

09-Apr-1992 09:23:29 24142,8-4,C.#03,RS

ENERGY	COUNTS	X-RAY LINES
1.00	71.	Na KA1, Na KA2, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	1011.	Mg KA1, Mg KA2, Mg KB1
1.74	4437.	Si KA1, Si KA2
3.34	187.	K KA1, K KA2
3.68	167.	Ca KA1, Ca KA2
4.96	73.	V KA1, V KA2
6.39	980.	Fe KA1, Fe KA2
7.04	127.	Fe KB1, Fe KB3

9-Apr-1992 09:25:32
Execution time = 8 seconds
24142,8-4,C.#04,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 40 secs

Energy	Counts	X-Ray Lines
1.25	347.	Mg K , Mg K , Mg K
1.74	1372.	Si K , Si K
3.70	189.	Ca K , Ca K
6.39	187.	Fe K , Fe K

Quantex)
0.120 Range= 10.230 keV 10.230
Integral 8 = 292

9-Apr-1992 09:34:35
Execution time = 6 seconds
24142,8-4,C.#10,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 22 secs

Energy	Counts	X-Ray Lines
1.25	601.	Mg K , Mg K , Mg K
1.74	2154.	Si K , Si K
3.31	72.	K K , K K
3.70	445.	Ca K , Ca K
5.41	61.	Cr K , Cr K
6.40	274.	Fe K , Fe K

Quantex)
0.120 Range= 10.230 keV 10.230
Integral 8 = 335

TABLE 3. CLASSIFICATION OF FIBERS WITH TUBULAR MORPHOLOGY

TM	-	Tubular Morphology not sufficiently characteristic for classification as chrysotile
CM	-	Characteristic Chrysotile Morphology
CD	-	Chrysotile SAED pattern
CQ	-	Chrysotile composition by Quantitative EDXA
CMQ	-	Chrysotile Morphology and composition by Quantitative EDXA
CDQ	-	Chrysotile SAED pattern and composition by Quantitative EDXA
NAM	-	Non-Asbestos Mineral

TABLE 4. CLASSIFICATION OF FIBERS WITHOUT TUBULAR MORPHOLOGY

UF	-	Unidentified Fiber
AD	-	Amphibole by random orientation SAED (shows layer pattern of 0.53 nm spacing)
AX	-	Amphibole by qualitative EDXA. Spectrum has elemental components consistent with amphibole
ADX	-	Amphibole by random orientation SAED and Qualitative EDXA
AQ	-	Amphibole by Quantitative EDXA
AZ	-	Amphibole by one Zone Axis SAED
ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No.	24142	Client	SCHAFER & ASSOC.
Sample No.	SW 8-4		
		Date	4/9/92

Total Asbestos Fibers	81	MFL
Chrysotile Fibers	*BDL	MFL
Amphibole Fibers	81	MFL
> 5 Micron length (chrysotile)	*BDL	MFL
> 5 Micron length (amphibole)	30	MFL
Mass (Chrysotile)	*BDL	µg/L
Mass (amphibole)	270	µg/L
More/Less than 5 Chrysotile Fibers in Sample	LESS	
More/Less than 5 Amphibole Fibers in Sample	MORE	
Poisson 95% Confidence Interval	66 to 99	MFL
Detection Limit	0.8	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Size Distribution (Chrysotile and Amphibole)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 & UP
0	5	11	2	13	68

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 & UP
0	7	16	11	15	50

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 & UP
23	35	20	10	3	8

TEM ASBESTOS ANALYSIS

EMS Lab No. 24142
Client Schafer
Sample No. SW8-4

RECEIVING

METHOD OF ANALYSIS
- EPA Yamate Level I ☐
- Level II ☐
- Level III ☐
- AHERA ☐

LENGTHS
- All Sizes (EPA) ☐
- (µm): ≥0.5 ☐
- ≥1.0 ☐
- ≥5.0 ☐
- ≥10.0 ☐
- PCM Range* ☐ *(≥0.25 µm width, ≥5.0 µm length)

ASPECT RATIO 3:1 ☐ 5:1 ☐

Approved By _____ Date _____

FILTER TYPE/AREA (mm²)
- MCE/385 ☐
- MCN/960 ☐
- MCE/960 ☐
- 1017 Other ☑

TYPE OF SAMPLE
- Air ☐
- Soil ☐
- Bulk ☐
- Water ☑
- Wipe ☐
- Other ☐
- Dust/Microvac ☐

PORE SIZE
- 0.45 µm ☐
- 0.8 µm ☐
- .1 µm ☑
- .22 µm ☐
- Other ☐

G.O. Area (mm²) 0.0 062
No. of G.O. to Analyze 20
Filter Lot No. H0EM90194C

PREP

- DIRECT PREP ☑
- INDIRECT PREP ☐

Volume _____ liters
Working Volume 25 ml
Weight _____ grams
Ashed Area _____ %
Prepared By FG

ANALYSIS

GRID
- 1 ☑ 3 ☐
- 2 ☑ 4 ☐

Grid Address 1A
Screen Magnification 19,300 x
Camera Constant 30.1
Accelerating Voltage 100 KV
Beam Current 10 µa

Analyst Radla Date 4/6/92

MICROSCOPE
- 600A ☑
- 600B ☐
- HU11E ☐
- HU125E ☐

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1		3	20												✓	✓				2	10	1	2		Tremolite
	2		4	18												✓	/				1	10	1	3		Tremolite
	3		3	28	✓																					
	4		3	25												✓	✓				3	10	2	1		Tremolite
	5		5	65													✓				3	10	2	1		Tremolite
	6		4	28									✓													"
	7		6	68									✓													"
	8		2	55									✓													"
	9		4	42									/													"
	10		7	78									/													"
	11		10	38									/													"
	12		4	22									/													"
2	13		2	185									✓													"
	14		2	400									✓													"
	15		5	14													✓				3	10	2	1		Tremo
	16		10	65									/													"
	17		3	68									/													"
	18		2	12									/													"
	19		4	16									/													
	20		4	42												/	/				2	10	1	2		Tremo
	21		3	98									/													"
	22		12	145									/													"
	23		4	45									/													"
	24		4	40									/													"

OBSERVATIONS:
- Clean ☐
- Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
- Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW8-4

RECEIVING

ANALYSIS

GRID 1 ☐ 2 ☐ 3 ☐ 4 ☐

MICROSCOPE 600A ☐ 600B ☐ H011E ☐ H0125E ☐

Grid Address _____

Screen Magnification _____ x

Camera Constant _____

Accelerating Voltage 100 KV

Beam Current _____ μa

Analyst Radha

Date 4/6

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	EDS Na	Mg	Si	Ca	Fe	Id	Comments
2	28		1.5	42		✓							✓													Tremo.
	29		3	80	✓																					"
	37		2	280									✓													"
	38		7	40									✓													"
	39		5	22									✓													"
	30		6	110												✓	✓				3	10	2	1		Tremolite
	34		1.5	15									✓													"
	35		4	22									✓													"
	36		3	25									✓													"

OBSERVATIONS:

Clean ☐

Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

6-Apr-1992 12:09:20
Execution time = 6 seconds
24142-SW8,A,#01,RS
Vert= 500 counts Disp= 1

Preset= Off
Elapsed= 25 secs

Energy	Counts	X-Ray Lines
1.25	648.	Mg K , Mg K , Mg K
1.74	3205.	Si K , Si K
3.69	375.	Ca K , Ca K
6.39	654.	Fe K , Fe K
7.07	71.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 429

6-Apr-1992 12:15:45
Execution time = 7 seconds
24142-SW8,A,#02,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 25 secs

Energy	Counts	X-Ray Lines
1.00	134.	Na K , Na K , Zn L , Zn L , Zn L , Zn L
1.24	592.	Mg K , Mg K
1.74	4712.	Si K , Si K
3.70	97.	Ca K , Ca K
6.40	1291.	Fe K , Fe K
7.05	183.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 636

6-Apr-1992 12:17:13
Execution time = 6 seconds
24142-SW8,A,#03,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 27 secs

Energy	Counts	X-Ray Lines
1.74	2416.	Si K , Si K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 192

6-Apr-1992 12:22:53
Execution time = 7 seconds
24142-SW8,B,#04,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 16 secs

Energy	Counts	X-Ray Lines
1.25	1387.	Mg K , Mg K , Mg K
1.74	4891.	Si K , Si K
2.27	52.	S K , S K
3.29	127.	K K , K K
3.69	839.	Ca K , Ca K
4.05	65.	Sc K , Sc K , Ca K , Ca K
6.41	488.	Fe K , Fe K
Quantex)	85.	Fe K , Fe K

0.240 Range= 10.230 keV 10.230
Integral 8 = 710

6-Apr-1992 12:24:05
Execution time = 7 seconds
24142-SW8,B,#05,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 29 secs

Energy	Counts	X-Ray Lines
1.25	1607.	Mg K , Mg K , Mg K
1.74	6061.	Si K , Si K
3.29	156.	K K , K K
3.68	932.	Ca K , Ca K
4.02	85.	Ca K , Ca K
6.38	682.	Fe K , Fe K
Quantex)		

0.240 Range= 10.230 keV 10.230
Integral 8 = 825

6-Apr-1992 12:38:52
Execution time = 6 seconds
24142-SW8,A,#15,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 19 secs

Energy	Counts	X-Ray Lines
1.25	1596.	Mg K , Mg K , Mg K
1.74	5621.	Si K , Si K
3.32	90.	K K , K K
3.69	1063.	Ca K , Ca K
4.04	149.	Sc K , Ca K , Ca K
6.40	741.	Fe K , Fe K
7.09	70.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 821

6-Apr-1992 12:41:39
Execution time = 6 seconds
24142-SW8,A,#20,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 28 secs

Energy	Counts	X-Ray Lines
1.25	216.	Mg K , Mg K , Mg K
1.74	1091.	Si K , Si K
3.71	88.	Ca K , Ca K
6.38	216.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 130

6-Apr-1992 12:49:13
Execution time = 7 seconds
24142-SW8,A,#30,RS Preset= Off
Vert= 1000 counts Disp= 1 Elapsed= 18 secs

Energy	Counts	X-Ray Lines
1.25	2762.	Mg K , Mg K , Mg K
1.74	9863.	Si K , Si K
3.31	414.	K K , K K
3.69	1938.	Ca K , Ca K
4.03	221.	Ca K , Ca K
6.39	918.	Fe K , Fe K
7.04	125.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 1391

TEM ASBESTOS ANALYSIS

MS Lab No. 24142

ample No. SW8-4

RECEIVING

Page ___ of ___

MICROSCOPE
600A ☐
600B ☑
HU11E ☐
HU125E ☐

ANALYSIS

GRID
1 ☐ 3 ☐
2 ☑ 4 ☐

Grid Address 1B
Screen Magnification 19300 x
Camera Constant 27.7
Accelerating Voltage 100 KV
Beam Current 10 μa

B

Analyst S. Ahmed Date 4/6/92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMQ	CDQ	UF	AD	AX	ADX	AQ	ADQ	AZQ	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1	F	10	370x											✓						3	10	2	1		EDS #1, Tremolite
	2	F	2	57											✓						3	10	2	1		EDS #2, "
	3		5	150											✓						3	10	2	2		EDS #3, "
	4		5	75											✓						3	10	2	1		EDS #4 "
	5		1.5	80											✓						3	10	2			EDS #5 "
	6		1	15	✓																					
	7		7	72	✓																					
	8		2	55											✓						2	10	1	2		EDS #8 Tremolite
	9		6	105												✓										"
	10		6	150x												✓										"
	11		15	175												✓										"
	12		1	20	✓																					
	13		8	65												✓										Tremolite
2	14		1	175	✓																					
	15		5	85												✓										Tremolite
	16	F	3	80											✓						3	10	1	1		EDS #16 "
	17		1.5	90												✓										"
	18		4	40												✓										"
	19		1	40	✓																					"
	20		2	90												✓										"
	21		14	85												✓										"
	22		9	165												✓										"
	23		2.5	75												✓										"
	24	MD	2	55												✓										"

OBSERVATIONS:

Clean ☐
Debris: ☑ Very Light ☐ Light ☐ Moderate ☑ Heavy ☑ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

EMS ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW8-4

RECEIVING

ANALYSIS

GRID: 1 ☐ 2 ☒ 3 ☐ 4 ☐

MICROSCOPE: 600A ☐ 600B ☒ HU11E ☐ HU125E ☐

Grid Address 1B

Screen Magnification 19300 x

Camera Constant 27.7

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst S. Ahmed

Date 4/6/92

B

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
2	25	F	4	115												✓										Tremolite
3	26	MO	6	280												✓										"
	27	F	13	240											✓											EDS #27 Tremo
	28	F	2	24												✓										Tremolite
	29	F	3	250												✓										"
	30	F	15	85												✓										"
	31	F	9	190												✓										"
	32	MO	6	110												✓										"
	33	F	6	110												✓										"
	34	MO	4	150												✓										"
	36	F	3	100												✓										"
	37	F	5	44												✓										"
	38	F	3	85												✓										"
	39	F	4	48												✓										"

OBSERVATIONS:

Clean ☐

Debris: ☒ Very Light ☐ Light ☐ Moderate ☒ Heavy ☒ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

6-Apr-1992 12:06:53
Execution time = 7 seconds
24142-SW8,B,#01,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 39 secs

Energy	Counts	X-Ray Lines
0.51	1766.	O K , O K , V L , V L , V L , V L
1.25	1332.	Mg K , Mg K , Mg K
1.74	4046.	Si K , Si K
3.68	874.	Ca K , Ca K
6.38	343.	Fe K , Fe K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 735

6-Apr-1992 12:10:46
Execution time = 6 seconds
24142-SW8,B,#02,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 40 secs

Energy	Counts	X-Ray Lines
0.52	604.	O K , O K , V L , V L , V L , V L
1.25	350.	Mg K , Mg K , Mg K
1.50	104.	Al K , Al K
1.74	1239.	Si K , Si K
3.68	237.	Ca K , Ca K
6.40	180.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 248

06-Apr-1992 12:11:46 24142-SW8,B,#03,SA

ENERGY	COUNTS	X-RAY LINES
0.51	2534.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.01	199.	Na KA1, Na KA2, Zn LA1, Zn LA2, Zn LB1, Zn LG1
1.25	1759.	Mg KA1, Mg KA2, Mg KB1
1.48	116.	Al KA1, Al KA2
1.74	5854.	Si KA1, Si KA2
3.30	305.	K KA1, K KA2
3.69	745.	Ca KA1, Ca KA2
6.39	741.	Fe KA1, Fe KA2
7.03	109.	Fe KB1, Fe KB3

6-Apr-1992 12:13:05
Execution time = 7 seconds
24142-SW8,B,#04,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 33 secs

Energy	Counts	X-Ray Lines
0.51	1829.	O K , O K , V L , V L , V L , V L.
1.25	1126.	Mg K , Mg K , Mg K
1.74	3874.	Si K , Si K
3.69	778.	Ca K , Ca K
6.39	370.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 653

6-Apr-1992 12:18:37
Execution time = 6 seconds
24142-SW8,B,#06,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 34 secs

Energy	Counts	X-Ray Lines
0.52	350.	O K , O K , V L , V L , V L , V L
1.25	370.	Mg K , Mg K , Mg K
1.74	917.	Si K , Si K
3.70	172.	Ca K , Ca K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 186

6-Apr-1992 12:20:54
Execution time = 7 seconds
24142-SW8,B,#08,RS Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 24 secs

Energy	Counts	X-Ray Lines
0.51	1420.	O K , O K , V L , V L , V L , V L
1.25	655.	Mg K , Mg K , Mg K
1.74	3180.	Si K , Si K
3.68	380.	Ca K , Ca K
6.39	806.	Fe K , Fe K
7.06	115.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 548

6-Apr-1992 12:30:14
Execution time = 7 seconds
24142-SW8,B,#16,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 50 secs

Energy	Counts	X-Ray Lines
0.52	1195.	O K , O K , V L , V L , V L , V L
1.25	766.	Mg K , Mg K , Mg K
1.74	2823.	Si K , Si K
3.30	154.	K K , K K
3.69	319.	Ca K , Ca K
6.39	386.	Fe K , Fe K

Quantex>
0.240 Range= 10.230 keV 10.230
Integral 8 = 506

06-Apr-1992 12:43:41 24142-SW8,B,#27,5A

ENERGY	COUNTS	X-RAY LINES
0.51	2855.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.25	2020.	Mg KA1, Mg KA2, Mg KB1
1.48	82.	Al KA1, Al KA2
1.74	6031.	Si KA1, Si KA2
3.32	109.	K KA1, K KA2
3.69	1465.	Ca KA1, Ca KA2
4.03	162.	Ca KB1, Ca KB3
5.90	128.	Mn KA1, Mn KA2
6.41	587.	Fe KA1, Fe KA2
7.02	93.	Fe KB1, Fe KB3

EMS ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW8-4

RECEIVING

ANALYSIS

GRID: 1 [ ] 2 [ ] 3 [✓] 4 [ ]

Grid Address 1C

Screen Magnification 19300 x

Camera Constant 27.7

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst S. Ahmed

MICROSCOPE: 600A [ ] 600B [✓] HU11E [ ] HU125E [ ]

C

Date 4/9/92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1	F	1	220													✓				2	10	1	1		EDS #1 Tremolite
	2		1	110													✓				4	10	3	2		EDS #2 "
	3		30	500													✓				3	10	2	1		EDS #3 "
	4	MD	5	110													✓				3	10	2	1		EDS #4 "
	5		20	115													✓				3	10	2	1		EDS #5 "
	6		3	45													✓				3	10	2	1		EDS #6 "
	7		5	150												✓										Tremolite
	8		10	50												✓										"
	9		6	155												✓										"
2	10		6	115												✓										"
	11		5	50												✓										"
	12		5	70												✓										"
	13		20	330												✓										"
	14		4	110												✓										"
	15		5	110												✓	✓				3	10	2	1		EDS #15 Tremo.
	16		2	42												✓										Tremolite
	17		6	80												✓										"
	18		6	60												✓										"
	19		1.5	65												✓										"
3			4	24												✓										"
		MD	2	24												✓										"
			10	440												✓										"
			6	80X												✓										"
			5	60												✓										"

OBSERVATIONS:

Clean [ ]

Debris: [✓] Very Light [ ] Light [ ] Moderate [✓] Heavy [ ] Very Heavy [ ]

Gypsum: [ ] Very Light [ ] Light [ ] Moderate [ ] Heavy [ ] Very Heavy [ ]

Other [ ]

M ASBESTOS ANALYSIS

Lab No. 24142

ple No. SW8-4

ICRO E

600A ☐
600B ☑
HU11E ☐
HU125E ☐

ANALYSIS

GRID
1 ☐ 3 ☑
2 ☐ 4 ☐

Grid Address 1C
Screen Magnification 19300 x
Camera Constant 27.7
Accelerating Voltage 100 KV
Beam Current 10 pa

Analyst S. Ahmed Date 4/9/92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
3	25	✓	6	70													✓									Eds #25 Tremolite
	26		2	60												✓										Tremolite
	27		2	40												✓										"
	28		2	40												✓										"
	29		3	240												✓										"
	30		5	25												✓										"
	31		5	35												✓										"
	32		7	180x												✓										"
	33		7	165												✓										"
	34		10	55												✓										"
	35	✓	8	240												✓										"

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

9-Apr-1992 11:24:16
Execution time = 7 seconds
24142-SW8-4,C,#01,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 50 secs

Energy	Counts	X-Ray Lines
0.51	2598.	O K , O K , V L , V L , V L , V L
1.00	173.	Na K , Na K , Zn L , Zn L , Zn L , Zn L
1.25	1828.	Mg K , Mg K , Mg K
1.74	5499.	Si K , Si K
3.31	238.	K K , K K
3.69	939.	Ca K , Ca K
Quantex)	437.	Fe K , Fe K

0.120 Range= 10.230 keV 10.230
Integral 8 = 960

09-Apr-1992 11:26:41 24142-SW8-4,C,#02,SA

ENERGY	COUNTS	X-RAY LINES
0.51	4554.	O KA1, O KA2, V LA1, V LA2, V LB1, V LG1
1.25	3937.	Mg KA1, Mg KA2, Mg KB1
1.73	10841.	Si KA1, Si KA2
3.29	140.	K KA1, K KA2
3.69	3071.	Ca KA1, Ca KA2
4.02	385.	Ca KB1, Ca KB3
5.88	132.	Mn KA1, Mn KA2
6.39	561.	Fe KA1, Fe KA2
7.04	69.	Fe KB1, Fe KB3

9-Apr-1992 11:31:20
Execution time = 6 seconds
24142-SW8-4,C,#03,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 33 secs

Energy	Counts	X-Ray Lines
0.51	1060.	O K , O K , V L , V L , V L , V L
1.25	632.	Mg K , Mg K , Mg K
1.74	2312.	Si K , Si K
3.68	330.	Ca K , Ca K
6.40	186.	Fe K , Fe K

Quantex)
0.120 Range= 10.230 keV 10.230
Integral 8 = 407

```
 9-Apr-1992 11:32:32
Execution time =     6 seconds
24142-SW8-4,C,#04,SA                          Preset=  Off
Vert=      500 counts  Disp= 1                Elapsed=        42 secs
   Energy  Counts     X-Ray Lines

   0.51     1312.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.25      776.    Mg K  , Mg K  , Mg K

   1.73     2580.    Si K  , Si K

   3.32      118.    K  K  , K  K

   3.69      412.    Ca K  , Ca K

   6.38      233.    Fe K  , Fe K


Quantex>
      0.120     Range=    10.230 keV                        10.230
                                          Integral 8  =          456
 9-Apr-1992 11:33:37
Execution time =     8 seconds
24142-SW8-4,C,#05,SA                          Preset=  Off
Vert=      500 counts  Disp= 1                Elapsed=        45 secs
   Energy  Counts     X-Ray Lines

   0.51      483.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.25      268.    Mg K  , Mg K  , Mg K

   1.74      928.    Si K  , Si K

   3.66      103.    Ca K  , Ca K

   6.41      122.    Fe K  , Fe K



Quantex>
      0.120     Range=    10.230 keV                        10.230
                                          Integral 8  =          166
```

9-Apr-1992 11:34:50
Execution time = 6 seconds
24142-SW8-4,C,#06,SA Preset= Off
Vert= 500 counts Disp= 1 Elapsed= 35 secs

Energy	Counts	X-Ray Lines
0.51	1104.	O K , O K , V L , V L , V L , V L
1.25	801.	Mg K , Mg K , Mg K
1.74	2448.	Si K , Si K
3.67	227.	Ca K , Ca K
6.41	262.	Fe K , Fe K

Quantex)
0.120 Range= 10.230 keV 10.230
Integral 8 = 405

```
 9-Apr-1992 11:58:58
Execution time =     7 seconds
24142-SW8-4,C,#15,SA                                  Preset=  Off
Vert=      200 counts  Disp= 1                        Elapsed=        37 secs
   Energy  Counts     X-Ray Lines

   0.51      754.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.24      477.    Mg K  , Mg K

   1.73     1542.    Si K  , Si K

   3.68      210.    Ca K  , Ca K

   6.38      142.    Fe K  , Fe K



Quantex>
      0.120     Range=    10.230 keV                          10.230
                                          Integral 8  =          279
 9-Apr-1992 12:01:08
Execution time =     7 seconds
24142-SW8-4,C,#25,SA                                  Preset=  Off
Vert=      200 counts  Disp= 1                        Elapsed=        27 secs
   Energy  Counts     X-Ray Lines

   0.51      407.    O  K  , O  K  , V  L  , V  L  , V  L  ,
                     V  L

   1.25      270.    Mg K  , Mg K  , Mg K

   1.73      786.    Si K  , Si K

   3.32       52.    K  K  , K  K

   3.70      145.    Ca K  , Ca K

   6.39       89.    Fe K  , Fe K


Quantex>
      0.120     Range=    10.230 keV                          10.230
                                          Integral 8  =          184
```

TABLE 3. CLASSIFICATION OF FIBERS WITH TUBULAR MORPHOLOGY

TM	-	Tubular Morphology not sufficiently characteristic for classification as chrysotile
CM	-	Characteristic Chrysotile Morphology
CD	-	Chrysotile SAED pattern
CQ	-	Chrysotile composition by Quantitative EDXA
CMQ	-	Chrysotile Morphology and composition by Quantitative EDXA
CDQ	-	Chrysotile SAED pattern and composition by Quantitative EDXA
NAM	-	Non-Asbestos Mineral

TABLE 4. CLASSIFICATION OF FIBERS WITHOUT TUBULAR MORPHOLOGY

UF	-	Unidentified Fiber
AD	-	Amphibole by random orientation SAED (shows layer pattern of 0.53 nm spacing)
AX	-	Amphibole by qualitative EDXA. Spectrum has elemental components consistent with amphibole
ADX	-	Amphibole by random orientation SAED and Qualitative EDXA
AQ	-	Amphibole by Quantitative EDXA
AZ	-	Amphibole by one Zone Axis SAED
ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral

Analysis of Water by Transmission Electron Microscopy
(EPA-600/4-83-043)

EMS No.	24142	Client	SCHAFER & ASSOC.
Sample No.	SW 11-4		
Date	4/6/92		

Total Asbestos Fibers	3.9	MFL
Chrysotile Fibers	*BDL	MFL
Amphibole Fibers	3.9	MFL
> 5 Micron length (chrysotile)	*BDL	MFL
> 5 Micron length (amphibole)	2	MFL
Mass (Chrysotile)	*BDL	µg/L
Mass (amphibole)	1.6	µg/L
More/Less than 5 Chrysotile Fibers in Sample	LESS	
More/Less than 5 Amphibole Fibers in Sample	LESS	
Poisson 95% Confidence Interval	0.4 to 14	MFL
Detection Limit	2	MFL

* BDL : Below Detection Limit; MFL: Million Fibers per Liter

Size Distribution (Chrysotile and Amphibole)

Particle Length - Microns

O -0.49	0.50 - 0.99	1.00 - 1.49	1.50 - 1.99	2.00 - 2.49	2.5 & UP
0	0	1	0	0	1

Particle Width - Microns

O - .04	.05 - .09	.1 - .14	.15 - .19	.2 - .24	.25 & UP
0	1	0	1	0	0

Aspect Ratio L/W

0 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 & UP
0	0	1	0	0	1

...MISBESTOS ANALYSIS

MS Lab No. 24142
Client Schafer
Sample No. SW11-4

FILTER TYPE/AREA (mm²)
MCE/385 ☐
MCN/960 ☐
MCE/960 ☐
1017 Other ☑

MICROSCOPE
600A ☒
600B ☐
HU11E ☐
HU12SE ☐

PREPARING

METHOD OF ANALYSIS
EPA Yamate Level I ☐
Level II ☐
Level III ☐
AHERA ☐

ASPECT RATIO 3:1 ☐ 5:1 ☐

LENGTHS
All Sizes (EPA) ☐
(µm): ≥0.5 ☐
≥1.0 ☐
≥5.0 ☐
≥10.0 ☐
PCM Range* ☐
*10-0.25 µm width, 25.0 µm length

Approved By _____ Date _____

TYPE OF SAMPLE
Air ☐ Water ☑
Soil ☐ Wipe ☐
Bulk ☐ Other ☐
Dust/Microvac ☐

PORE SIZE
0.45 µm ☐
0.8 µm ☐
.1 µm ☑
.22 µm ☐
Other ☐

G.O. Area (mm²) 0.062
No. of G.O. to Analyze 20
Filter Lot No. HOEM90194C

PREP

DIRECT PREP ☑
INDIRECT PREP ☐

Volume _____ liters
Working Volume 4 ml
Weight _____ grams
Ashed Area _____ %

Prepared By FG

ANALYSIS

GRID
1 ☒ 3 ☐
2 ☐ 4 ☐

Grid Address 1-A
Screen Magnification 1930x
Camera Constant 30.1
Accelerating Voltage 100 KV
Beam Current 10 µa

Analyst Radca Date 4/6/92

A

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	EDS Analysis Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	NSD																									
3			3	270													✓				2	1	1	1		Tremolite
4	NSD																									
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:

Clean ☐
Debris: ☐ Very Light ☐ Light ☐ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

6-Apr-1992 07:52:25
Execution time = 6 seconds
24142,4,A,#01,RS Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 29 secs

Energy	Counts	X-Ray Lines
1.26	250.	Mg K , Mg K , Mg K
1.74	1057.	Si K , Si K
3.68	129.	Ca K , Ca K
6.37	95.	Fe K , Fe K
8.05	779.	Cu K , Cu K
8.88	91.	Cu K , Cu K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 229

EMS ASBESTOS ANALYSIS

EMS Lab No. 24142

Sample No. SW11-4

ANALYSIS

GRID: 1 ☐ 3 ☐ 2 ☑ 4 ☐

Grid Address B

Screen Magnification 19300x

Camera Constant 27.7

Accelerating Voltage 100 KV

Beam Current 10 µa

Analyst S. Ahmed Date 4/6/92

MICROSCOPE: 600A ☐ 600B ☑ HU11E ☐ HU125E ☐

B

Grid opening	Str #	Str	Dimensions (mm) Width	Dimensions (mm) Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	1	F	9	65	✓											✓										
2	2	F	1.	20											✓		1									EDS #1
3	NSD																									
4	3	F	2	20	✓																					
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:

Clean ☐

Debris: ☑ Very Light ☐ Light ☐ Moderate ☑ Heavy ☑ Very Heavy ☐

Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐

Other ☐

EMS LABORATORIES 117 West Bellevue Drive / Pasadena CA 91105-2503 / 818-441-2393

6-Apr-1992 08:23:45
Execution time = 6 seconds
24142,4,B,#01,SA Preset= Off
Vert= 200 counts Disp= 1 Elapsed= 48 secs

Energy	Counts	X-Ray Lines
0.51	466.	O K , O K , V L , V L , V L , V L
1.25	221.	Mg K , Mg K , Mg K
1.74	1009.	Si K , Si K
3.69	135.	Ca K , Ca K
6.38	152.	Fe K , Fe K
8.03	862.	Cu K , Cu K
8.91	134.	Cu K , Cu K

Quantex)
0.240 Range= 10.230 keV 10.230
Integral 8 = 229

EM ASBESTOS ANALYSIS

S Lab No. 24142

ple No. SW11-4

MICROSCOPE
600A ☐
600B ☑
HU11E ☐
HU125E ☐

ANALYSIS

GRID
1 ☐ 3 ☑
2 ☑ 4 ☐

Grid Address 1C
Screen Magnification 19300 x
Camera Constant 27.7
Accelerating Voltage 100 KV
Beam Current 10 µa

C

Analyst S. Ahmed Date 7/6/92

Grid opening	Str #	Str	Dimensions (mm) Width	Length	NAM	TM	CM	CD	CO	CMO	CDO	UF	AD	AX	ADX	AO	ADO	AZO	AZZ	Na	Mg	Si	Ca	Fe	Id	Comments
1	NSD																									
2	NSD																									
3	NSD																									
4	NSD																									
5	NSD																									
6	NSD																									
7	NSD																									

OBSERVATIONS:

Clean ☐
Debris: ☑ Very Light ☐ Light ☐ Moderate ☑ Heavy ☐ Very Heavy ☐
Gypsum: ☐ Very Light ☐ Light ☐ Moderate ☐ Heavy ☐ Very Heavy ☐
Other ☐

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AQ	-	Amphibole by Quantitative EDXA
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ADQ	-	Amphibole by random orientation SAED and Quantitative EDXA
AZQ	-	Amphibole by one Zone Axis SAED pattern and Quantitative EDXA
AZZ	-	Amphibole by two Zone Axis SAED patterns with consistent inter-axial angle
AZZQ	-	Amphibole by two Zone Axis SAED patterns, consistent inter-axial angle and Quantitative EDXA
NAM	-	Non-Asbestos Mineral