FILE NAME: RT Vanderbilt (RTV)

DATE: 1975 Nov

DOC#: RTV133

DOCUMENT DESCRIPTION: Govt Report - Industrial Hygiene Study of the Gouverneur Talc Co., Number One Mine and Mill

FINAL REPORT

INDUSTRIAL HYGIENE STUDY OF THE GOUVERNEUR TALC COMPANY, NUMBER ONE MINE AND MILL

Balmat, New York

Volume I

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SURVEY DATE
November 3-7, 1975

FINAL REPORT DATE
June 8, 1977

Department of Health, Education, and Welfare
Center for Disease Control
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Division of Surveillance, Hazard Evaluations and Field Studies
Cincinnati, Ohio

CONTENTS

FIGURES

TABLES

CONTENTS

FIGURES

TABLES

CONTENTS

Tables Con't

ABSTRACT

A industrial hygiene study was undertaken at the Gouverneur Talc Company, number one mine and mill, during November 3-7, 1975. Samples were collected to evaluate exposures to respirable dust, free silica and asbestos fibers. In addition impinger samples were collected for comparison with past exposure measurements. Bulk product talc samples were also collected for mineralogical analyses by both NIOSH and independent consultant laboratories.

Results of mineralogical analyses of talc product samples by all laboratories concluded that asbestiform minerals (tremolite and anthophyllite) were present. Time-weighted-average fiber exposures in mine and mill operations were found to range from 1.7 to 9.8 fibers > 5 μm/cc and time-weighted-average respirable dust exposures were found to range from 0.25 to 2.96 mg/m^3. No free silica exposures were found to exceed the NIOSH recommended standard of 50 μg/m^3. Electron microscopic analyses of the airborne dusts showed 38 to 45% of airborne fibers to be anthophyllite with lesser quantities (12 to 19%) of tremolite. More than 90% of the airborne fibers were shorter than 5 μm in lengt

A review of historic exposure data of these operations and epidemiological data concerning health effects of exposures to tremolite and anthophyllite are included in addition to recommendations for workplace improvements to reduce exposures.

ACKNOWLEDGEMENTS

Mike Grannan and Eric Kus of NIOSH and Jim Salois of MESA assisted in collection of the industrial hygiene samples. Mike Grannan, Robert Phillips and Kenneth M. Wallingford assisted in the optical asbestos fiber analyses and Terry Boyle and Dennis Roberts assisted in reduction of the field and laboratory data. Dr. D.R. Bowes of the University of Glasgow kindly performed major element analyses of talc bulk samples.

Analyses of talc bulk samples were performed by W.C. McCrone Associates and the Mt. Sinai School of Medicine of the City University of New York.

INTRODUCTION

The term "talc" in the mineralogical sense denotes a specific rockforming mineral of the sheet silicate category [Mg_6 (Si_8O_{20}) $(OH)_4$]; however, "talc" in the industrial sense may represent a varied mixture of minerals with similar physical properties as talc.[1] Unfortunately, many past studies of the health effects of industrial talc exposures have not adequately indentified the various hazardous agents which may have been present in the talcs.

The National Institute for Occupational Safety and Health (NIOSH) has underway an industrywide study of the talc mining and milling industry. These studies include both epidemiological studies of exposed worker populations to determine health effects which may be attributed to the work environment and detailed industrial hygiene studies to characterize the various agents to which these workers have been exposed.

The "talc" mining area in the vicinity of St. Lawrence County, New York, represents a complex association of amphiboles (anthophyllite, tremolite, etc.) talc, quartz, and serpentines.[1] Proportional mortality studies by Kleinfeld et.al.[2,3] of talc miners and millers in this area have demonstrated significantly increased mortality due to both malignant and non-malignant respiratory diseases. Also, NIOSH analyses of talcs (Nytal 200) certified by the Vanderbilt Company not to contain asbestos have demonstrated significant contamination levels of both fibrous tremolite and fibrous anthophyllite.[4] However, it has been stated that these studies are not appropriate since the mineral make-up of talc deposits in this area differ substantially with each deposit; some containing asbestos while others do not. One study[16] has suggested differences in toxicity among these minerals.

DESCRIPTION OF THE FACILITIES

R.T. Vanderbilt began talc operations at the Gouverneur Talc Company in 1947 with one mine (#1) and one mill (#1). In 1974, the Vanderbilt Corporatic acquired all talc operations of the International Talc Company. From this purchase, Vanderbilt was operating two mills (#3 and #6), one underground mine (#3 mine) and one open pit (Arnold Pit) at the time of this study. Only the #3 mine contains what the Vanderbilt Corporation considers to be fibrous anthophyllite and this ore is processed in the #3 mill.

The total employment at all R.T. Vanderbilt New York talc operations at the time of the present study was approximately 170 persons. These are broken down as follows:

Underground	- 41
Open Pit	- 13
Mills	- 67
Salaried	- 49
	170

Employees of these operations are represented by Local #4979 of United Steel Workers which organized in these talc operations in 1954. All operations were on a 5½ day per week schedule with the mine operating only during the day shift while the mill operates three shifts. A list of jobs and a description of related duties in the number one mine and mill are given in Appendix II.

Approximately 19 talc products from all of the Company's New York talc operations are marketed. Mineral Product Safety Data Sheets for these products (supplied by R.T. Vanderbilt), are shown in Appendix I. These talcs are used in numerous products. Some typical uses are as follows:

1. Ceramic wall tile
2. Pottery artware
3. Electrical insulators
4. Ceramic tile glaze and flux
5. Paint filler and carrier for extenders
6. Putties and spackling compounds
7. Die castings (fibrous grades)

DESCRIPTION OF OPERATIONS AND CONTROLS

GOUVERNEUR TALC CO. MINE AND MILL (#1 MINE, ARNOLD PIT AND #1 MILL)

Surface facilities include the main office, mine office, quality control laboratory, change room, crusher building and packer building.

Underground hard rock mining methods are employed using jackleg drills to make holes for blasting the ore in open stopes. The number one mine consists of one main shaft 1250 feet in depth with three main working levels branching off. During the present survey, ore was being mined from approximately 6 of 26 active stopes. According to Company personnel, mining follows a typical cycle: blasting is done with gelatin dynamite and ANFO; time is allowed for dust and gases to dissipate; stoping operations are begun including drilling for the next shifts, blasting, and removal of ore. However, some secondary blasting is done during the work shift.

Ore (muck) from the stoping areas is loaded into 2 ton rail cars using either gravity drawpoint loading or scraper (slusher) loading. Ore from these cars is discharged into a central jaw crusher located at the 700 ft. level although some crushing is also done on the 1110 ft. level. The crushed ore is loaded into a skip and carried to the mine headframe where a gyratory crusher reduces the ore to approximately 3/4 inch screen size. The ore is then transported by conveyor belt to one of four wet ore storage bins in the mill.

Approximately 40,000 cfm of mining ventilation is provided to this mine. In addition, the ore may be quite moist, thereby further reducing dust exposures. Drilling is usually done using wet methods. At the 700 ft. level crusher, water sprays are also used for dust suppression.

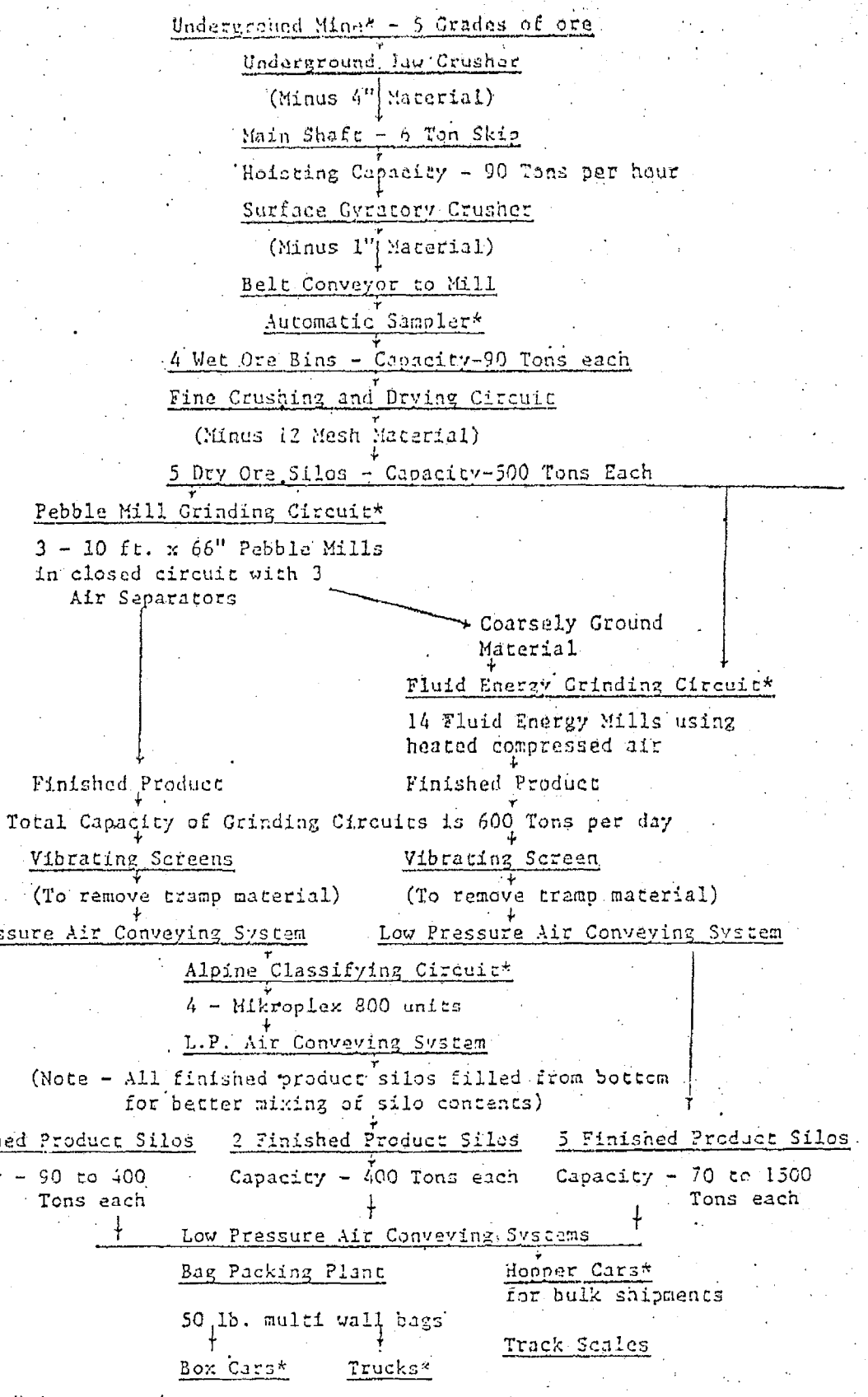
In addition to ores from the number one mine, the number one mill also receives ores for first stage crushing from the Arnold Pit located approximately one mile from the mill. Ores are mined from the Arnold Pit using traditional hard rock open pit mining methods by drilling blastholes then blasting to break the ore. A front loader is used to load ore into trucks by which the ore is transported to the primary crushers which are located at the open pit. There are no dust collectors on the open pit crusher.

In the number one mill, various grade talc products are produced by dry grinding operations. A simplified flow sheet for the milling operations is given in Figure 1.

Ores from the wet ore storage bins are periodically sampled by the quality control lab to determine appropriate product grade. The ores are first ground in a cone crusher followed by drying in a rotary dryer. The dry ore is next further reduced using a gyratory disc crusher to produce a minus 12 to 14 mesh product. The product is next screened on vibratory screens and transported to one of six dry ore silos. Fine grind products are made from these ores using either Hardinge pebble mills in closed circuit with Raymond separators or impact crushers in closed circuit with fluid energy mills.

The fine ground powder is stored in one of several concrete silos. These silos are filled using a bottom filling technique patented by R.T. Vanderbilt. Material from these silos is withdrawn by air slides and pumped to the packaging and shipping areas.

SIMPLIFIED FLOW SHEET



* = Sampling Point

Talc may be either sold in bulk or packaged in 50 lb. valve type Kraft paper bags. Bag packaging is done using pneumatic packing machines.

In general, ventilation systems within the mill are quite good. Most material transfer points are provided with local exhaust ventilation and bucket elevators and conveyors are maintained under negative pressure. At the bagging machines, local exhaust ventilation is provided at the filling spout in addition to downdraft ventilation at the bag hopper. For bulk car loading, the telescopic loading spout is provided with a local exhaust ventilation collar.

Air pollution controls consist largely of baghouse dust collectors, although a cyclone is used on the mine headframe gyratory crushers. Much of the collected material is recycled to the product streams. No products from the number one mine or Arnold Pit were being labeled with the OSHA asbestos warning at the time of this study.

OTHER MINES AND MILLS

The #3 mine was not observed during this study. The #3 and #6N mills were observed during a previous visit. The #3 mill produces products considered by the Company to contain anthophyllite asbestos. These products are labeled with the OSHA asbestos warning label. Milling operations at these mills are basically the same as those previously described for the #1 mill with minor variations. Dust control measures are not, however, as effective as those observed in the #1 mine and are being further improved.

MEDICAL, INDUSTRIAL HYGIENE AND SAFETY PROGRAMS

Only first-aid medical facilities are available at the Gouverneur Talc Co. New employees are given a pre-employment examination consisting of a work history, medical history, physical examination, and chest x-ray. Periodic examinations including a chest x-ray have been given at yearly intervals. All examinations are given by a local physician who consults with the Plant.

Plant safety is handled by a Plant Safety Director (Floyd Robinson). Monthly departmental safety inspections are conducted by Union and Plant personnel in addition to monthly safety meetings. Personnel protective equipment presently used in the mine includes hard hats, mine lights, personnel rescuers, safety glasses, and safety boots all of which are provided by the Company. In the mill, safety glasses are encouraged and workers at talc bagging operations are provided with dust masks which, according to observations made during this study, are only sporadically used. Hearing protection is provided for specific operations in the mill and mine. In 1974, there were 9 reported (lost time) accidents in the mine and 2 in the mill.

The Company presently does not maintain the services of a full time industria hygienist. Some sampling is conducted by the Plant Safety Director in additi to yearly sampling by the insurance carrier. Air sampling in these operation has also been conducted by the New York Division of Industrial Hygiene and the Mining Enforcement and Safety Administration (MESA).

INSPECTION OF MINE AND MILL OPERATIONS

POTENTIAL HEALTH HAZARDS

The following are potential health hazards noted during this visit:

1. Respiratory exposures to mineral dusts (fibrous and non-fibrous tremolite and anthophyllite, talc, serpentine, quartz, etc.) in mining and milling operations.
2. Excessive noise exposures in selected plant operations.
3. Exposures to blasting gases in mining operations during secondary blasting.

HOUSEKEEPING

In general, housekeeping in these operations was judged to be acceptable. Some loose talc was, however, noted on the floors in the talc bagging operations. Numerous leaks at material transfer points were noted in the mill.

BULK SAMPLE COLLECTION AND ANALYSIS

Bulk samples of products being produced and bagged during the industrial hygiene study were collected for laboratory mineralogical assay. In addition, seven talc samples produced at this mine and mill were collected from independent talc suppliers (Table 1) for mineralogical assay. Several ore samples were also collected during mine sampling.

Analyses of collected bulk samples were performed by both NIOSH and independent consultant laboratories. The seven talc bulk samples collected from talc suppliers were submitted to both Walter C. McCrone Associates Incorporated and to the Mount Sinai School of Medicine for independent analysis by x-ray diffraction, optical microscopy and electron microscopy. These same samples were also analyzed by NIOSH for the presence of asbestiform fibers by electron microscopy using electron diffraction and energy dispersive x-ray analysis for fiber identification.(7)

Bulk samples collected during the industrial hygiene study were submitted to Walter C. McCrone Associates Incorporated for mineralogical analyses by x-ray diffraction (using step scanning methods) and optical microscopic analyses. These same samples were analyzed by NIOSH for selected trace metals by atomic absorption spectroscopy (after acid digestion).

In addition to the above analyses, several products produced at the number one mine and mill and submitted to NIOSH by Vanderbilt were analyzed for chemical composition by Dr. D.R. Bowes of the Department of Geology, the

Table 1

Sources of R.T. Vanderbilt Talcs Produced at the Gouverneur Talc Company, Number One Mine and Mill and Obtained from Suppliers

Product Name	Source	NIOSH #
Nytal 300	Crone Chemical P.O. Box 14042 Houston, Texas 77021	001
Nytal 400		002
5X	Paul Crazier Company 1115 Silver St. Houston, Texas 77007	003
325		004
X		005
FT		006
3X		007

University of Glasgow. For these analyses, Dr. Dowse used spectrophotometry for SiO_2, TiO_2, Al_2O_3, total Fe (Fe_2O_3 by difference from FeO) and P_2O_5 determinations. Atomic absorption analysis was used for Mno, MgO and CaO. Flame photometry was used for Na_2O and K_2O and wet chemical assay was used fo FeO.[10]

AIR SAMPLING AND ANALYSIS

Personal air samples were collected from the breathing zone (miners and mille to determine time-weighted-average exposures to respirable dust, free silica, and asbestos fibers. Personal samples for respirable dust and free silica were collected at a flow rate of 1.7 lpm using 37 mm diameter polyvinyl chloride filters (pre-weighed) preceeded by 10 mm nylon cycone separators. Samples for asbestos fiber analysis were collected on open faced 37 mm diamet Millipore Type AA filters (0.8 µm pore size) at a flow rate of 1.7 lpm. Respirable samplers were allowed to operate for the full work shift while asbestos samples were changed periodically during the work shift as needed to prevent overloading of filters.

Free silica concentrations were determined using x-ray diffraction as specified in the NIOSH Silica Criteria Document.[5] All asbestos samples were analyzed using the NIOSH phase contrast counting technique.[6] In addition, a representative portion of the asbestos samples were randomly chosen and analyzed by electron microscopy using selected area electron diffraction and energy dispersive x-ray analysis for fiber identification. Electron microscopy was also used to determine airborne fiber concentrations, and size (diameter and length) distributions.[7] Samples for electron microscopic analysis were prepared using a modification of methods described by Ortiz.[9]

In order to relate results of the present industrial hygiene study to past studies in these operations, midget impinger samples also were taken in a manner identical to past sampling techniques. Breathing zone impinger samples were collected in ethyl alcohol at a flow rate of 0.1 cfm with sampling periods ranging from 15 to 30 minutes. These samples were counted at the end of each work shift using Dunn counting cells and bright field optical microscopy (100X). Two preparations were made for each sample and allowed to settle for 30 minutes and counts made by two counters. When counts differed by more than 10%, new preparations were made and recounted.

In addition to personal sampling, stationary samples were taken to further attempt correlations between impinger counts, respirable mass concentrations, total mass concentrations, and asbestos fiber concentrations. Midget impingers were collected as described above using a sequential sampler (24 samplers) such that the entire work shift was sampled. Simultaneously, respirable and total mass samples were collected at flow rates of 10 lpm using 37 mm diameter polyvinyl chloride filters (pre-weighed). The respirable samples were collected using stainless steel cyclone and free silica analyses of the respirable dust performed using x-ray diffraction.[5] Asbestos count samples were collected and analyzed as described above for personal samples.

STUDY RESULTS

BULK SAMPLE ANALYSES

Results of analyses of the seven talc samples obtained from suppliers are shown in Tables 2 and 3. Copies of the reports submitted by McCrone and Mt. Sinai and analytical data obtained by NIOSH are given in Volume II of this report. These reports all concluded that asbestiform tremolite and anthophyllite were present in these samples. In addition, Mt. Sinai and NIOSH reported trace quantities of chrysotile in some samples. The only major discrepancy notable is a higher quartz content for each sample reported by Mt. Sinai. NIOSH analyses tend to support the lower McCrone results which is substantiated by the air sample results.

Results of NIOSH electron microscopic analyses of these talcs, given in Table 3, show that a majority of the fibrous particles in these samples are anthophyllite (67 to 88%) with smaller quantities of tremolite (4 to 12%). A large majority of the tremolite identified by x-ray diffraction is not fibrous. Anthophyllite fibers with very large aspect ratios (1000/1) were observed. A close association between talc and tremolite has been demonstrated by Stemple and Brindley.[15]

Results of further x-ray diffraction and petrographic microscopic analyses (McCrone) of product samples collected during the study are shown in Table 4. These results are in basic agreement with previous results given in Table 2. As can be seen in Table 5, all trace metals for which analyses were performed, with the exception of iron and manganese, were essentially absent. Only insignificant quantities of iron and manganese were detected.

Table 2

Summary of Independent Analyses of
Talcs Produced at the Gouverneur Talc
Company Number One Mine and Mill.
Samples Obtained From Talc Suppliers

Mineral Phase	Percent Composition By Weight						
	Nytal 400	Nytal 300	5X	X	3X	FT	325
Tremolite							
McCrone	50-60	40-50	40-50	>50-60	50-60	50-60	~60
Mt. Sinai	24	18	27	50-60	32	17	24
Anthophyllite							
McCrone	Present	*	Present	Present	*	*	*
Mt. Sinai	2-3	4-5	7-9	---	*	*	5-7
Quartz							
McCrone	0.5-1.0	2	~1.5	<0.5	0.5-1.0	**	~1.5
Mt. Sinai	7-10	9-10	8-9	9-10	7-8	**	3-4
Serpentines							
McCrone	10-15	10-15	10-12	~15	~30	~20	10-12
Mt. Sinai	14-18	14-18	14-18	26-30	31-35	26-30	19-23

* Below detection limits using x-ray diffraction (line scan by McCrone, step scanning by Mt. Sinai).

** Below detection limits by step scanning.

Table 2

Summary of Independent Analyses of
Talcs Produced at the Gouverneur Talc
Company Number One Mine and Mill.
Samples Obtained From Talc Suppliers

Mineral Phase	Percent Composition By Weight						
	Nytal 400	Nytal 300	5X	X	3X	FT	325
Tremolite							
McCrone	50-60	40-50	40-50	>50-60	50-60	50-60	∿60
Mt. Sinai	24	18	27	50-60	32	17	24
Antigorite							
McCrone	Present	*	Present	Present	*	*	*
Mt. Sinai	2-3	4-5	7-9	---	*	*	5-7
Quartz							
McCrone	0.5-1.0	2	∿1.5	<0.5	0.5-1.0	**	∿1.5
Mt. Sinai	7-10	9-10	8-9	9-10	7-8	**	3-4
Serpentines							
McCrone	10-15	10-15	10-12	∿15	∿30	∿20	10-12
Mt. Sinai	14-18	14-18	14-18	26-30	31-35	26-30	19-23

* Below detection limits using x-ray diffraction (line scan by McCrone, step scanning by Mt. Sinai).

** Below detection limits by step scanning.

Table 3

Summary of NIOSH Electron Microscopic
Analyses of Talc Produced at the
Gouverneur Talc Company
Number One Mine and Mill
Samples Obtained From Talc Suppliers

Talc Sample	Range of Fiber Aspect Ratios	Fiber Identification (Percent)**				
		Positive Amphiboles		Positive Chrysotile	Non Asbestos	Not* Identified
		Tremolite	Anthophyllite			
Yeal 400	3/1 to 1000/1	8	88	N.D.	4	---
Yeal 300	3/1 to 100/1	12	72	N.D.	4	12
5X	5/1 to 100/1	11	80	Trace	4	5
X	8/1 to 80/1	6	80	N.D.	2	12
5X	5/1 to 100/1	12	67	N.D.	4	16
IT	3/1 to 50/1	16	72	N.D.	4	8
335	3/1 to 50/1	4	88	Trace	7	---

* Selected area diffraction patterns not sufficient for positive identification
** Percent - % of all fibers analyzed by count and not by mass. All fiber lengths analyzed
--- None Detected

Table 4

Results of X-Ray Diffraction and Petrographic Microscopic Analyses of Bulk Talc Samples Collected During Study Converneur Talc Company, Number One Mine and Mill

Mineral Component	Sample Analyses, % By Weight					
	Talc FT	Nytal 100	Ceramatalc HDT	Nytal 200	Nytal 300	Nytal 200
Talc	31-36	43-48	30-35	33-38	35-40	∿14
Tremolite	∿40	∿37	∿49	∿43	∿38	∿59
Anthophyllite	∿10	∿4.5	∿5	∿8	10	15
Quartz	2.6	<0.25	<0.25	0.7	0.8	1.1
Calcite	1	<0.5	0	0	<0.5	<1
Dolomite	1	<0.5	<0.5	<0.5	<0.5	<0.5
Serpentines *	10-15	10-15	10-15	10-15	10-15	∿10

* Includes lizardite and antigorite.

Table 5

Results of Trace Metal Analyses of Bulk Talc
Samples Collected During Study
Gouverneur Talc Company, Number One Mine and Mill

Product Name	Date Collected	Trace Metal, PPM*						
		Cr	Co	Fe	Mn	Ni	Zn	Cd
Talc FT	11/4/75	3	1	1100	1700	7	20	<1
Nytal 100	11/4/75	3	<1	1000	840	5	19	<1
[illegible] HDP	11/4/75	2	2	880	1000	6	17	<1
Nytal 200	11/4/75	3	2	970	1300	7	20	<1
Nytal 300	11/3/75	2	3	1000	1700	5	23	<1
Nytal 200	11/3/75	3	2	900	1400	5	22	<1

* Trace metals determined by atomic absorption spectroscopy

Results of Major Element Analyses of Gouverneur Talc Company, Number One Mill, Product Samples*

Major Element	Sample Analyses, % By Weight*							
	Nytal 100	Nytal 200	Nytal 400	Ceramitalc 1	Ceramitalc 10A	Ceramitalc 10AC	Ceramitalc HDT	Talc Stds**
SiO_2	54.85	54.52	56.11	56.14	52.81	52.47	55.47	61.49
TiO_2	0.04	0.15	0.07	0.03	0.08	0.04	0.07	0.01
Al_2O_3	0.38	0.32	0.13	0.13	0.16	0.11	0.13	1.20
Fe_2O_3	0.10	0.13	0.08	0.11	0.08	0.06	0.11	0.38
FeO	0.04	0.03	0.05	0.03	0.03	0.01	0.03	1.07
MnO	0.21	0.20	0.22	0.15	0.12	0.10	0.12	0.00
MgO	28.40	28.78	29.40	29.56	30.20	30.56	29.10	30.54
CaO	8.02	8.53	7.50	7.40	8.15	8.30	8.25	0.46
Na_2O	0.28	0.44	0.18	0.25	0.38	0.16	0.18	--
K_2O	0.10	0.17	0.10	0.10	0.10	0.10	0.13	--
P_2O_5	0.03	0.03	0.03	0.03	0.03	0.03	0.03	--
H_2O	5.37	5.07	5.00	5.56	6.07	6.67	5.24	5.00
CO_2	1.35	1.15	1.03	0.96	1.30	0.98	0.84	5.00
Total	100.17	99.52	99.90	100.45	99.51	99.59	99.59	

*Samples submitted to NIOSH by R.T. Vanderbilt, Analyses performed by Dr. D.R. Bowes, University of Glasgow.

**From talc standard analyses in reference 10.

Results of major element analyses by Dr. Bowes are shown in Table 6. The high CaO content of these talcs correlates reasonably well with the observe high tremolite content. Other carbonates except traces of calcite are abse or negligible in these talcs as demonstrated by low CO_2 values.[13] The Fe and Mn analyses are consistent with the results shown in Table 5. These major element analyses are in basic agreement with results obtained by Ross et.al.[14] for talcs in the Arnold Pit and by Dreessen[18] for talcs in thi Ross et.al. also suggested that an additional manganese-rich amphibole, tirodite, may be found in trace quantities in these deposits. Also, the major element analyses shown in Table 6 do show 0.12 to 0.22% MnO; however, no manganese-rich amphiboles were detected by the electron microscope analy using selected area electron diffraction and microchemical analysis.

AIR SAMPLES

A brief description of each job, sampling and analytical methods used, results of all individual samples and appropriate summary statistics are shown in Appendix II. Jobs are identified by 4 digit job codes. Tabular summaries of time-weighted-average exposures by job category for the mine and mill are given in Tables 7 and 8, respectively.

Tables 7 and 8 show free silica exposures to be very low. The highest time-weighted-average free silica exposure observed was 0.040 mg/m^3 which is below the 8 hour time-weighted-average exposure value of 0.05 mg/m^3 recommended by NIOSH for this material.[5] Respirable dust exposures ranged from 0.25 to 2.96 mg/m^3. No respirable dust standard has been determined for the mineral talc or talc containing fibrous tremolite or anthophyllite.

Breathing zone impinger concentrations ranged from 0.5 to 15.8 million particles per cubic foot of air (mppcf) with highest concentrations being observed in the mine. The present OSHA and MESA standard for "talc" containing < 1% free silica and no asbestos fibers is 20 mppcf.[8]

Due to its fiber content, the occupational asbestos exposure standard must be applied to exposures to materials from these mining and milling operations. Time-weighted-average asbestos fiber exposures in excess of five fibers > 5 μm/cc were observed for the following job categories:

(1) Mine Crusher Operator

(2) Trammer

(3) Mine Cageman

Table 7

Summary of Time-Weighted-Average Exposures
By Job, Gouverneur Talc Co. Number One Mine

Job Code	Job Title	Asbestos fibers > 5 μm/cc (Optical Microscopy)	Resp. Mass mg/m^3	Impinger mppcf	Free Si mg/m^3
0102	Crusher Operator	9.8 (4)	--	--	--
0103	Trammer	5.6 (25)	0.64 (3)	10.1 (3)	0.020 (
0104	Scrapper Man	--	1.29 (3)	11.8 (5)	0.012 (
0105	Underground Laborer	--	0.58 (1)	--	0.006 (
0106	Driller	3.0 (5)	0.98 (3)	00.7 (1)	0.014 (
0114	Mucker	--	--	15.8 (1)	--
0115	Cageman	9.5 (5)	0.23 (1)	2.0 (1)	--
0301	Repairman	--	1.14 (1)	--	--
0302	Repairman's Helper	--	0.86 (1)	3.6 (1)	0.000 (
0303	Blacksmith	2.6 (3)	--	--	--
0304	Maintenance Mechanic	1.7 (12)	0.42 (1)	1.5 (1)	0.000 (

( ) = Number of samples used for calculation of time-weighted-average values for each job catagory. Samples for respirable mass and free SiO_2 were full shift samples.

Table 8

Summary of Time-Weighted-Average Exposures
By Job, Gouverneur Talc Co. Number One Mill

Job Code	Job Title	Asbestos fibers > 5 μm/cc (Optical Microscopy)	Resp. Mass mg/m^3	Impinger mppcf	Free SiO_2 mg/m^3
0201	Mill Foreman	5.3 (9)	0.58 (2)	2.9 (2)	0.013 (2)
0203	General Laborer	5.6 (5)	1.14 (1)	0.5 (1)	0.014 (1)
0204	Crusher Operator	5.1 (16)	0.85 (2)	2.6 (4)	0.020 (2)
0206	Hardinge Operator	7.9 (14)	1.09 (2)	3.4 (2)	0.012 (1)
0208	Wheeler Operator	8.4 (14)	1.56 (2)	3.1 (2)	0.012 (1)
0209	Packer	5.1 (48)	0.59 (9)	3.6 (6)	0.010 (7)
0211	Packer Serviceman	3.6 (11)	0.42 (2)	2.1 (1)	0.007 (2)
0212	Packhouse Foreman	1.5 (5)	0.25 (2)	--	0.014 (2)
0213	Fork Lift Operator	4.0 (15)	0.35 (3)	1.6 (2)	0.000 (1)
0214	Car Liner	3.4 (4)	0.31 (1)	--	0.000 (1)
0220	Bulk Car Loader	2.0 (3)	0.25 (1)	--	0.016 (1)
0401	Millwright	1.9 (3)	2.37 (2)	--	0.040 (2)
0402	Instrument Repairman	2.8 (6)	0.59 (2)	--	0.000 (1)
0403	Machinist	1.8 (3)	0.40 (1)	--	0.016 (1)
0405	Millwright Helper	4.0 (2)	2.96 (1)	--	0.000 (1)
0406	Sheet Metal Worker	1.7 (3)	0.50 (1)	--	0.013 (1)
0410	Oiler	4.0 (4)	0.72 (1)	--	0.016 (1)
0411	Welder	1.9 (3)	0.75 (1)	--	

( ) = Number of samples used for calculation of time-weighted-average values for each job catagory. Samples for respirable mass and free SiO_2 were full shift samples.

Table 7

Summary of Time-Weighted-Average Exposures
By Job, Gouverneur Talc Co. Number One Mine

Job Code	Job Title	Asbestos fibers > 5 µm/cc (Optical Microscopy)	Resp. Mass mg/m^3	Impinger mppcf	Fre m
0102	Crusher Operator	9.8 (4)	--	--	--
0103	Trammer	5.6 (25)	0.64 (3)	10.1 (3)	0.(
0104	Scrapper Man	--	1.29 (3)	11.8 (5)	0.(
0105	Underground Laborer	--	0.58 (1)	--	0.(
0106	Driller	3.0 (5)	0.98 (3)	00.7 (1)	0.(
0114	Mucker	--	--	15.8 (1)	--
0115	Cageman	9.5 (5)	0.23 (1)	2.0 (1)	--
0301	Repairman	--	1.14 (1)	--	--
0302	Repairman's Helper	--	0.86 (1)	3.6 (1)	0.(
0303	Blacksmith	2.6 (3)	--	--	--
0304	Maintenance Mechanic	1.7 (12)	0.42 (1)	1.5 (1)	0.(

( ) = Number of samples used for calculation of time-weighted-average values for each job catagory. Samples for respirable mass and free SiO_2 were full shift samples.

(4) Mill Foreman

(5) Mill Laborer

(6) Crusher Operator

(7) Hardinge Operator

(8) Wheeler Operator

(9) Packer

In addition, 17 of the 24 job catagories samples had time-weighted-average exposures exceeding the current OSHA standard of 2.0 fibers > 5 µm/cc[8] and all operations exceeded the OSHA proposed standard of 0.5 fibers > 5 µm/cc.[12]

The following job catagories had exposures in excess of the OSHA and MESA allowable ceiling value of 10 fibers > 5 µm/cc:

(1) Mine Crushers Operator

(2) Trammer

(3) Mine Cageman

(4) Mill Foreman

(5) Mill Laborer

(6) Crushers Operator

(7) Hardinge Operator

(8) Wheeler Operator

(9) Packer

Individual sample results, as determined by electron microscopy, are shown in Table 9 and time-weighted-average fiber concentrations by job are shown in Table 14 of Appendix II. In these tables, "positive asbestos" means only those identified by electron diffraction; therefore these concentrations

represent minimum estimates of true total airborne asbestos concentrations. As shown in Appendix II, time-weighted-average positive asbestos fiber exposures as determined by electron microscopy ranged from 9.5 to 70.6 fibers/cc (all lengths) with concentrations in the mill tending to be slightly higher. As shown in Table 9, total fiber concentrations (all types and lengt for individual samples ranged from 11.6 to 189.5 fibers/cc.

A summary of airborne fiber types as determined by electron microscopy is shown in Table 10. In the mine, 38% of the airborne fibers were identified as anthophyllite while 19% were tremolite and 39% were unidentified. In the mill, 45% of the fibers were anthophyllite, 12% tremolite and 38% unidentifie Three percent of the fibers in the mine and 2% in the mill gave chrysotile electron diffraction patterns. The presence of chrysotile in the air samples is consistent with the results of bulk sample analyses by Mt. Sinai and NIOSH where trace quantities of chrysotile were noted in some samples. All chrysotile fibers observed in the air samples were less than 1 μm in length. Nearly all of the serpentine minerals identified in the bulk samples is lizardite.

Results of airborne fiber size determinations (diameter and length) for tremolite and anthophyllite fibers are shown in Tables 11 and 12 with appropriate summary statistics. As was expected, tremolite fibers tended to be larger in diameter and shorter in length than anthophyllite fibers with size distributions for these minerals being similar for the mine and mill. Median fiber diameters of 0.19 and 0.13 μm were observed for tremolite and anthophyllite, respectively. In the mine, median fiber lengths of 1.6 μm for tremolite and 1.5 μm for anthophyllite were observed. Similar lengths

Table 9

Comparison of Optical and Electron Microscopic Fiber Concentrations, Gouverneur Talc Company, Number One Mine and Mill

Sample #	Job Code	Job Title	Fibers/cc			
			Electron Microscopy			Optical
			Post. Asbestos*	Total Fibers	All >5μm	>5μm
G194	0103	Trammer	20.2	42.1	1.2	3.5
G156	0103	Trammer	22.6	29.8	5.9	2.7
G149	0103	Trammer	13.2	27.8	2.4	4.2
G237	0103	Trammer	8.9	19.1	2.0	4.7
G240	0106	Driller	9.5	14.4	1.3	No cou
G223	0115	Cageman	17.5	30.3	2.2	6.0
G04	0201	Mill Foreman	18.4	28.8	5.8	5.8
G42	0201	Mill Foreman	33.7	70.0	7.0	5.3
G98	0203	General Laborer	36.6	64.9	9.3	5.9
G146	0203	General Laborer	9.0	14.9	1.3	2.9
G77	0204	Crusher Operator	9.0	45.5	2.8	3.8
G38	0204	Crusher Operator	15.6	27.2	4.4	2.2
G101	0206	Hardinge Operator	102.7	189.5	6.2	8.9
G22	0206	Hardinge Operator	33.6	51.5	4.2	5.5
G144	0208	Wheeler Operator	18.2	31.8	4.1	6.8
G02	0208	Wheeler Operator	25.5	37.4	4.0	6.0
G96	0209	Packer	31.9	57.5	4.8	1.2
G47	0209	Packer	41.8	73.5	8.5	3.2
G85	0211	Packer Serviceman	7.3	11.6	0.5	1.6
G10	0211	Packer Serviceman	26.7	34.7	4.4	4.2
G113	0212	Packhouse Foreman	13.6	18.4	1.4	1.6
G05	0212	Packhouse Foreman	16.2	28.4	5.7	1.1
G31	0213	Fork Lift Operator	36.0	71.9	8.7	3.3
G197	0304	Maintenance Mechanic	16.7	26.6	1.7	2.3
G180	0403	Machinist	24.9	42.5	3.6	3.6
G197	0411	Welder	9.9	14.6	2.1	3.1

* Includes only those giving identifiable electron diffraction patterns; therefore, represents a conservatively low estimate.

Table 10

Summary of Airborne Fiber Types Determined By
Analytical Electron Microscopy
Gouverneur Talc Company, Number One Mine and Mill

Operation	Percent of Airborne Fibers (All Lengths)				
	Positive Amphiboles*		Positive Chrysotile	Non Asbestos	Not Identified***
	Tremolite**	Anthophyllite**			
Mine	19	38	3	1	39
Mill	12	45	2	2	38

* Airborne fibers were identified as positive amphiboles by selected area electron diffraction.

** Amphiboles differentiated by energy dispersive microchemical analysis.

*** Electron diffraction patterns not sufficient for identification; however, many had x-ray spectra identical to tremolite.

Table 11

Summary of Airborne Fiber Diameters for Positive Amphiboles
Gouverneur Talc Company, Number One Mine and Mill

Operation and Fiber Type	Median Diameter µm	Geo. Std. Deviation	95% Conf. Interval for Median Diameter µm	% ≤ 0.5 µm in Diameter
Mine*				
Tremolite (N=83)	0.19	2.3	0.16-0.23	88
Anthophyllite (N=164)	0.13	2.4	0.12-0.15	93
Mill*				
Tremolite (N=160)	0.19	2.4	0.17-0.22	87
Anthophyllite (N=687)	0.13	2.9	0.12-0.14	90

* Results of all samples combined for distribution analysis.

N = Number of individual fibers analyzed.

Table 12

Summary of Airborne Fiber Lengths for Positive Amphiboles
Couverneur Talc Company, Number One Mine and Mill

Operation and Fiber Type	Median Length µm	Geo. Std. Deviation	95% Conf. Interval for Median Length µm	% ≤ 5 µm in Length
Mine*				
Tremolite (N=83)	1.6	1.8	1.4-1.8	97
Anthophyllite (N=164)	1.5	2.6	1.3-1.7	90-92
Mill*				
Tremolite (N=160)	1.5	1.9	1.4-1.7	97
Anthophyllite (N=687)	1.4	2.9	1.3-1.5	90

* Results of all samples combined for distribution analysis.

N = Number of individual fibers analyzed.

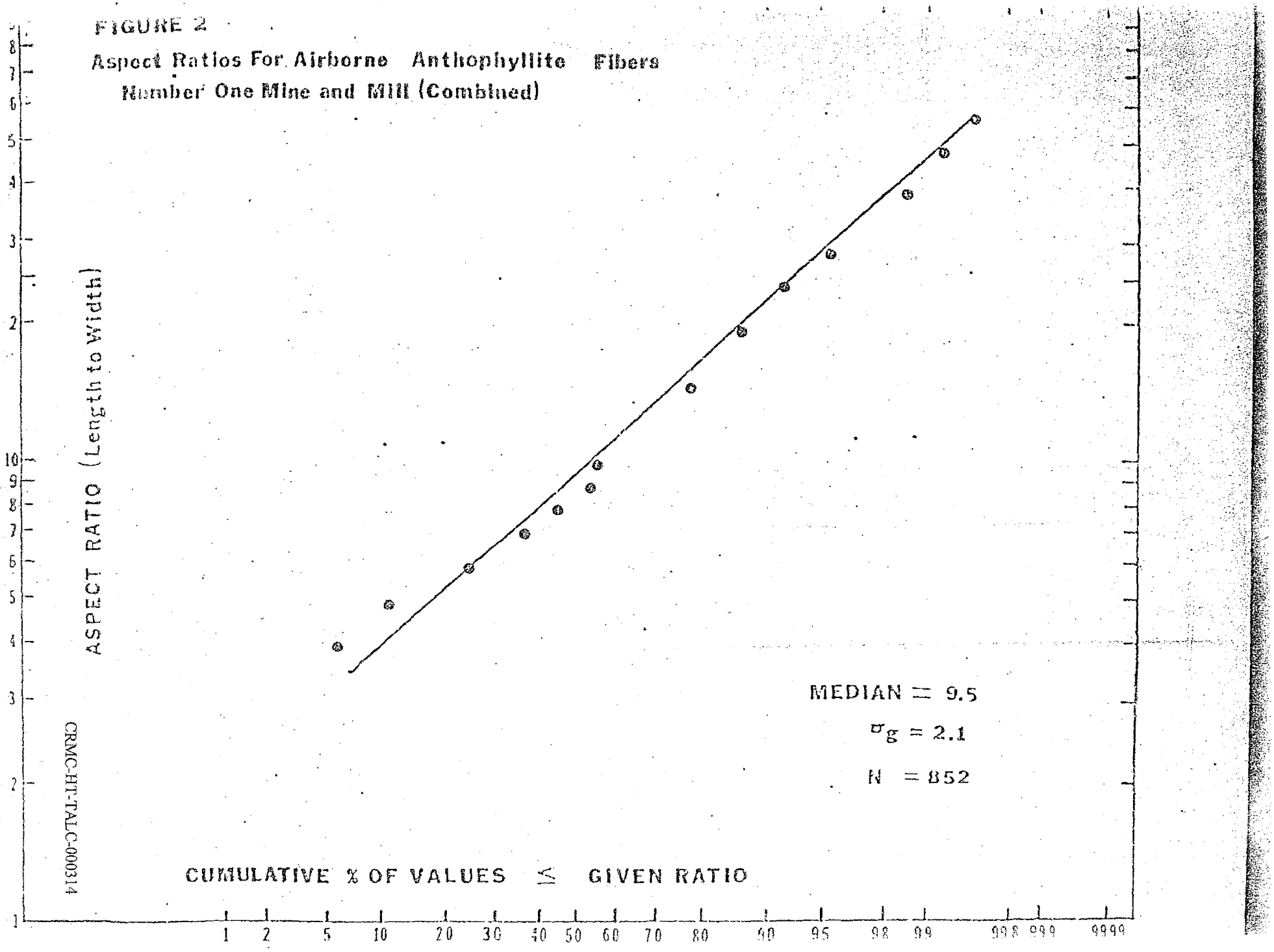
were seen in the mill. In the mine and mill, only 3% of the tremolite fibers were longer than 5 μm whereas 8-10% of the anthophyllite fibers were longer than this length.

The trend for airborne anthophyllite fibers to have larger aspect ratios can be observed by inspection of Figures 2 and 3 and Table 13. Median aspect ratios of 9.5 and 7.5 were observed for anthophyllite and tremolite, respectively. Only 30% of the tremolite fibers had aspect ratios greater than 10 to 1 whereas 48% of the anthophyllite fibers had aspect ratios greater than this value.

Typical electron photomicrographs of airborne particulates from the mine and mill are shown in Figures 4,5 and 6. In addition to large amounts of analytical data already presented, the asbestiform nature of these fibers may be further appreciated by observation of their "fibril" structures.

FIGURE 2

Aspect Ratios For Airborne Anthophyllite Fibers
Number One Mine and Mill (Combined)



CRMC-HT-TALC-000314

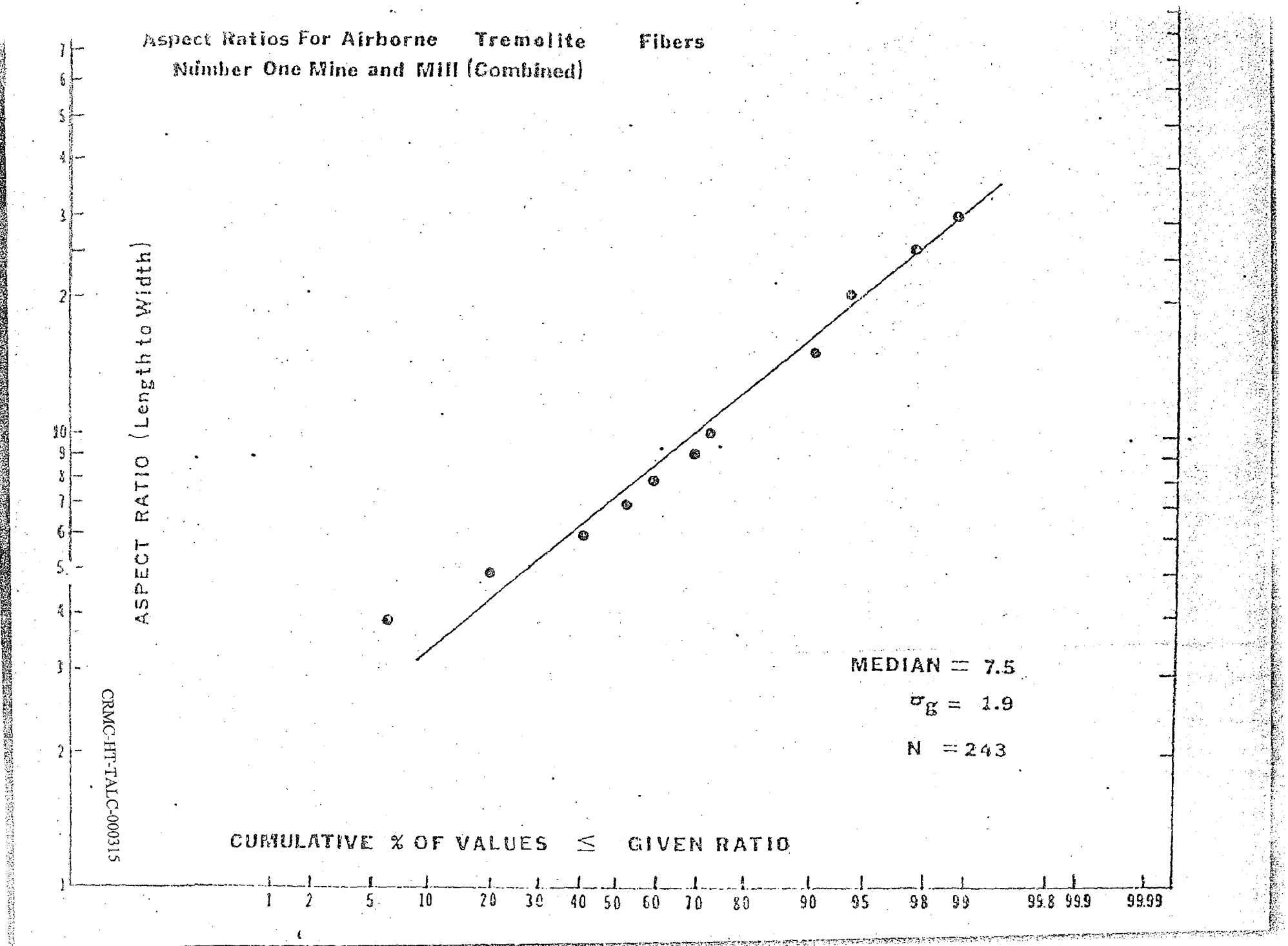

Aspect Ratios For Airborne Tremolite Fibers
Number One Mine and Mill (Combined)
ASPECT RATIO (Length to Width)
CUMULATIVE % OF VALUES ≤ GIVEN RATIO
MEDIAN = 7.5
σ_g = 1.9
N = 243
1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
CRMC-HT-TALC-000315

Figure. 4: Electron Photomicrograph of Airborne Particulates from number one Mill and Mine

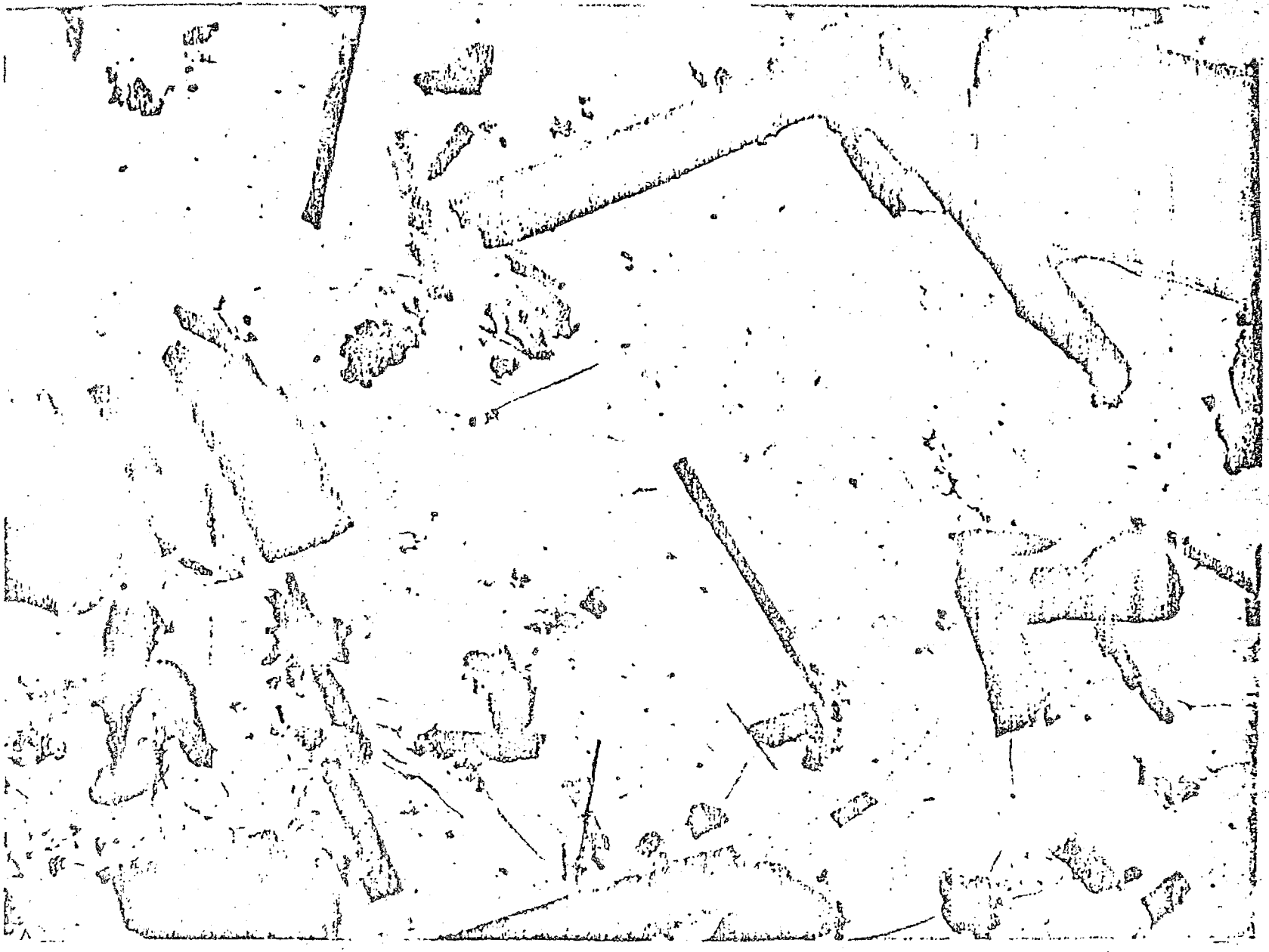


Figure 5: Electron Photomicrograph of Airborne Particulates from Number one Mine and Mill

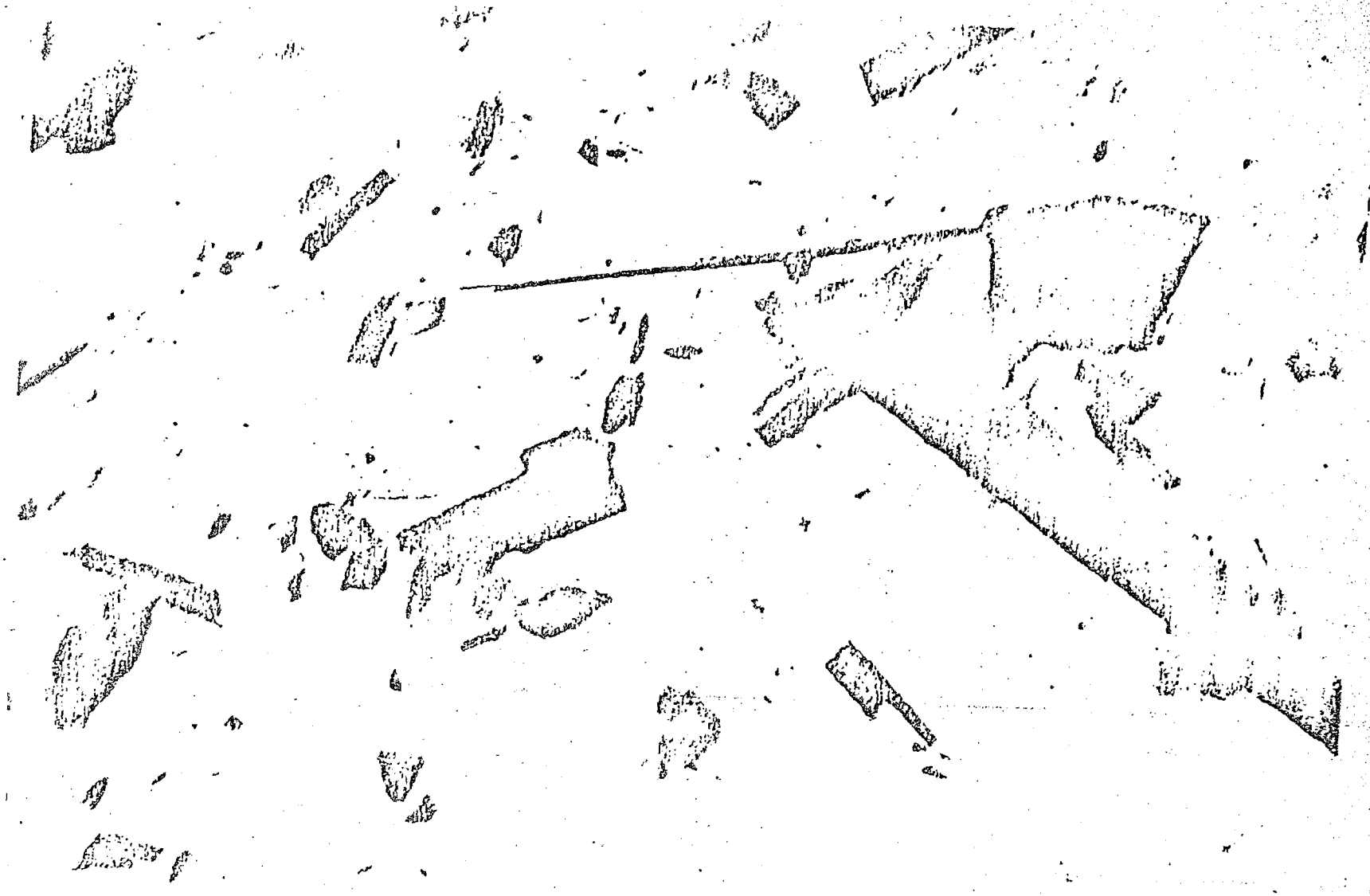


Figure 6: Electron Photomicrograph of Airborne Particulates from number one Mine and Mill

Table 13

Aspect Ratios for Positive Amphiboles Determined by Electron Microscopy
Gouverneur Talc Company, Number One Mine and Mill

Aspect Ratio Measurement	Tremolite*		Anthophyllite*	
	Mine	Mill	Mine	Mill
Median Aspect Ratio	7.5	7.5	9.5	9.5
Aspect Ratio				
≤ 5/1	23%	24%	17%	15%
≤ 10/1	70%	70%	52%	52%
≤ 20/1	96%	96%	85%	88%
≤ 50/1	>99%	>99%	99%	>99%

* Data shown are for all fiber lengths

COMPARISON OF SAMPLING AND ANALYTICAL METHODS

In order to compare results of the present study with historic dust measurements, several comparisons were made. Results of the stationary samples for correlation of sampling and analysis methods are shown in Table 14. Based on these limited data, the following average relationships were calculated:

Ratio	Average	Range
resp. dust, mg/m^3/mppcf	0.22	0.12-0.2
fibers > 5 μm/cc/resp. dust mg/m^3	6.7	3.1-11.9
fibers > 5 μm/cc/mppcf	1.2	0.9-1.4

These data also show that an average of 28 percent of the airborne dust in the mill is respirable.

A further comparison of fiber concentrations determined by optical microscopy and respirable dust concentrations is afforded by the paired personnal dust measurements made in the mill. A linear regression analysis of these time-weighted-average values is shown in Figure 7. The regression line was forced through the null points after this null hypothesis was tested[11] and could not be rejected. A good correlation (r=0.73) was found between these two sampling methods. The results of this analysis demonstrated the following relationship:

$$\text{fibers} > 5\ \mu m/cc/\text{resp. dust}, mg/m^3 = 6.3$$

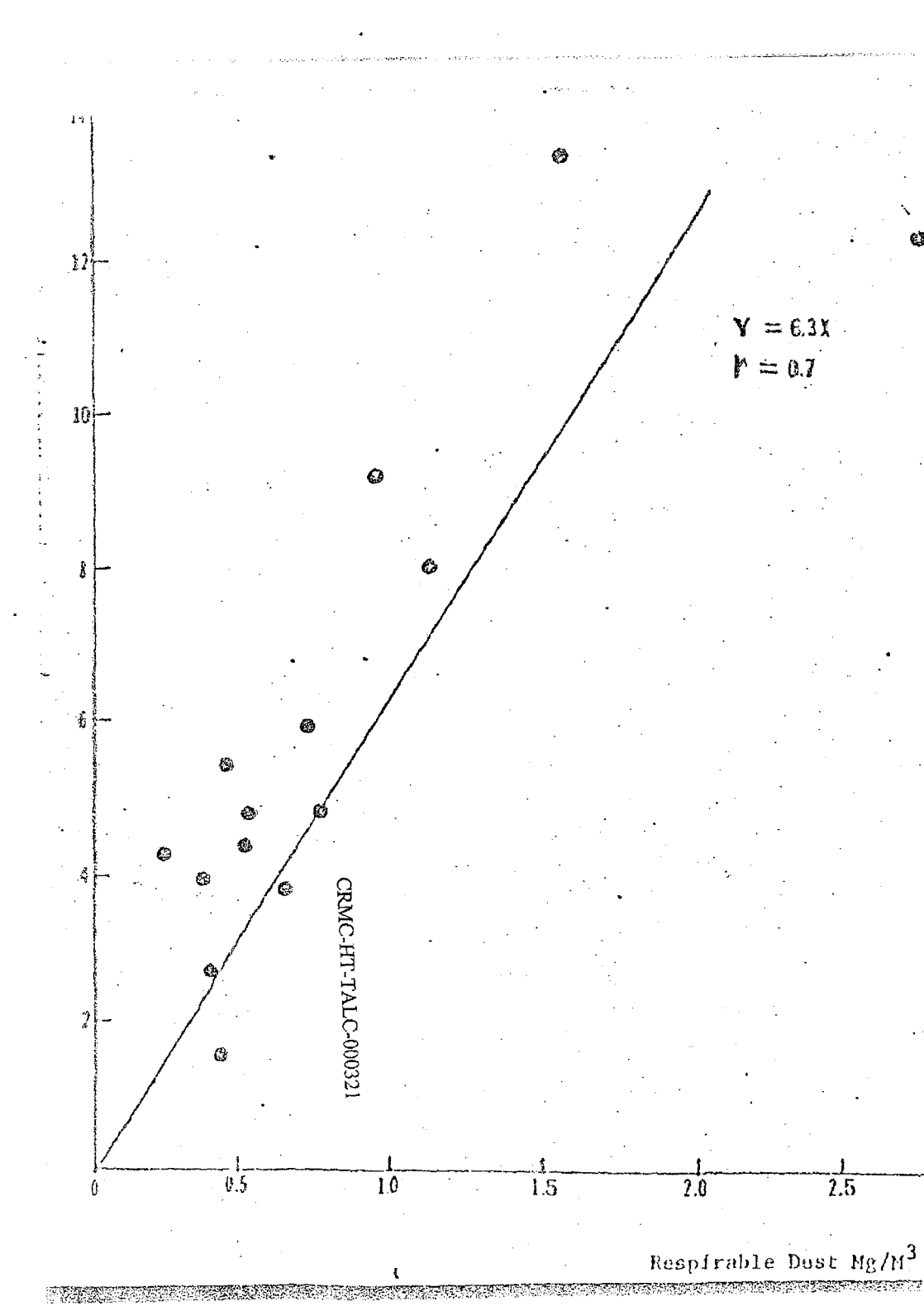

Y = 6.3X
r = 0.7
CRMC-HT-TALC-000321
12
10
8
6
4
2
0
0.5
1.0
1.5
2.0
2.5
Respirable Dust Mg/M3

FIGURE 7

Comparison of Time Weighted Average Fiber and Respirable Dust Exposures, Mill Samples

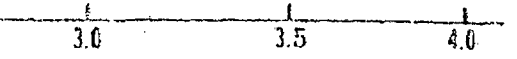


Table 14

Summary of Stationary Samples for Correlation of Sampling Methods
Gouverneur Talc Company, Number One Mill

Sample Station	Time-Weighted-Average Concentrations			
	Total Dust mg/m^3	Resp. Dust mg/m^3	Impinger mppcf	Asbestos Fibers > 5um/cc
1	2.44 (N=1)	0.88 (N=1)	3.5 (N=12)	4.4 (N=3)
2	1.47 (N=1)	0.36 (N=1)	3.0 (N=5)	4.3 (N=3)
3	8.81 (N=1)	2.14 (N=1)	7.2 (N=6)	6.7 (N=2)

N = Number of individual samples collected.

The 95% confidence interval for this ratio was calculated to be 4.1 to 8.5. These results are consistent with those shown in Table 14 for the stationary mill samples.

A comparison was also made between time-weighted-average fiber exposures (fibers > 5 μm/cc) and impinger dust exposures (mppcf) for individuals in the mine and mill. These results are shown in Table 15. As can be seen, no consistent conversion between these sampling methods was obtained although some differences in conversion values in the mine and mill are evident. A median conversion ratio (fibers > 5 μm/cc/mppcf) of 0.5 was obtained for mine samples whereas a median ratio of 1.7 was obtained for the mill. These differences are statistically significant ($p<0.001$). Several possible explainations exist for this difference; however, the most plausible is that fine grinding, which takes place in the mill, liberates greater numbers of "free" fibers from the host rock. In addition, finer dust particles in the mill are less efficiently collected and counted by the impinger method.

A graphical comparison between total fiber concentrations by electron microscopy and fibers > 5 μm by optical microscopy is shown in Figure 8. These data were found to be highly scattered with no consistent correlation. These data are summarized in Table 16 and show a significantly different ratio of total fibers by electron microscopy to fibers > 5 μm by optical microscopy between mine and mill samples although no single predictive values can be estimated.

Table 15

Comparison of Impinger and Optical Fiber Count Results
Gouverneur Talc Company, Number One Mine and Mill

Summary Statistic	Ratio (fibers > 5 μm/cc/mppcf)	
	Mine	Mill
Median Ratio	0.5	1.7
Range of Ratios	0.2-1.2	0.6-3.4
Number of Comparisons	6	15
95% Conf. Interval for Median Ratio*	0.3-0.8	1.3-2.2

* Based on log - normal distribution model.

FIGURE 8

Comparison of Fiber Concentrations
by Optical and Electron Microscopy

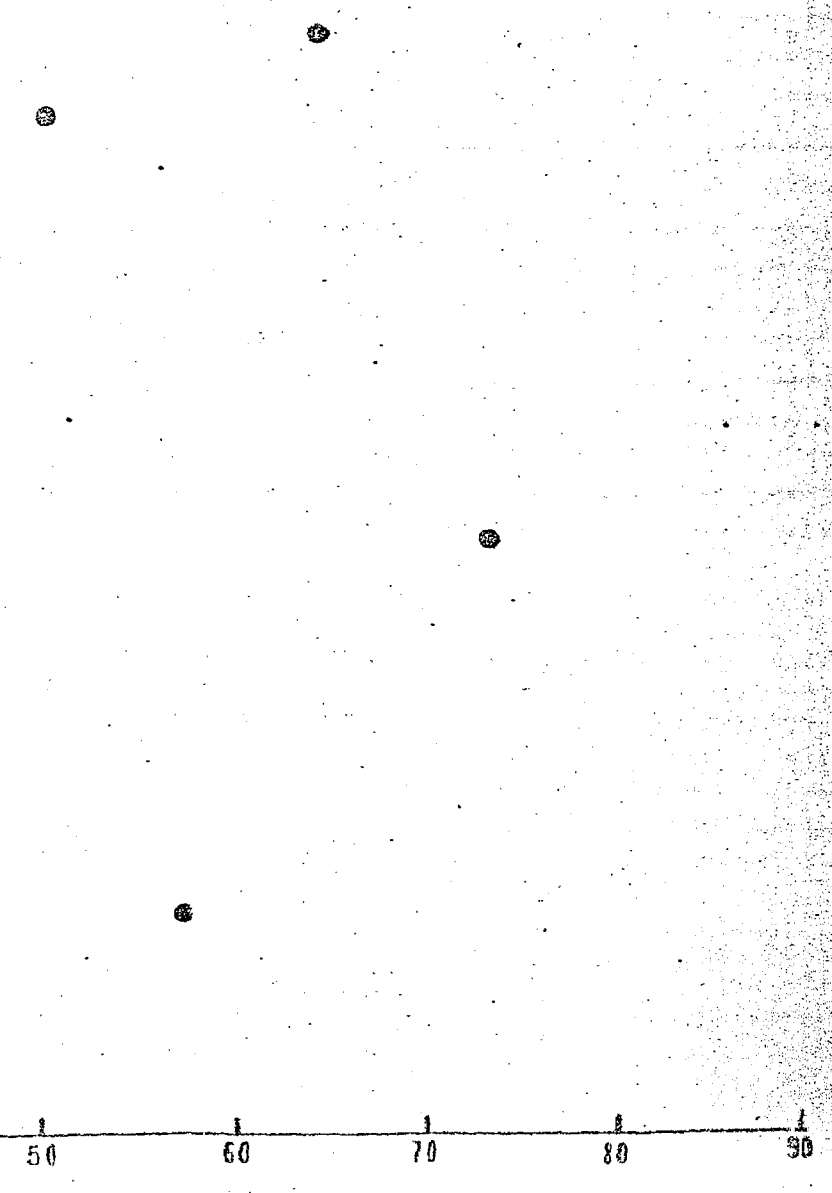


Table 16

Comparison of Optical and Electron Microscopic Fiber Concentrations
Gouverneur Talc Company, Number One Mine and Mill

Summary Statistic	Ratio (EM total fiber/cc/Opt. fiber > 5 μm/cc	
	Mine	Mill
Median Ratio	7.1	11.0
Range of Ratios	4.1-12.0	4.7-47.9
Number of Comparisons	5	17
95% Conf. Interval* for Median Ratio	6.7-7.5	10.7-11.3

* Based on log - normal distribution model.

COMPARISON OF PRESENT AND PAST EXPOSURES

The present studies demonstrate elevated exposures to asbestiform minerals in nearly all mine and mill process operations. Comparisons between present dust (mppcf) and fiber (fibers > 5 μm/cc) exposures and historic exposure measurements are shown in Tables 17 and 18, respectively. These data were gathered from a number of sources.

Trends in dust concentrations as a function of calendar time are difficult to intrepret for several reasons. First and most important is the relative pausity of data on some operations prior to approximately 1970. Secondly, very few samples were taken in any given year and the representativeness of these samples is unknown.

For visual inspection of trends in dust concentrations, average values for mine and mill operations by year were calculated and are shown in Figures 9 and 10, respectively. Inspection of Figure 9 shows no consistent trends in dust concentrations when all mine operations are considered. On the other hand, the mine exposures for such operations as drilling, dragline loading, tramming and mucking show relatively consistent exposure levels over the years with only slight deviations. This might be expected as wet drilling has been a routine practice. In addition, ores being mined are relatively wet. Primary crushing and hoist loading operations show somewhat of a decreasing trend. Such controls as water sprays for dust suppression at the primary crusher are the most probable explaination for this trend.

Table 17

Summary of Historic Impinger Dust Measurements at the Couverneur Talc Company, Number One Mine and Mill

Job or Operation	Mean Dust Concentration (mppcf)									
	1954	1958	1963	1964	1969	(1) 1970	(2) 1972	(2) 1973	(2) 1975	NIOSH 1975
Mine										
Drilling	5		5		13	7	4	5	3	12
Dragline Loading			7			10	8	3	5	12
Tramming & Hucking					29	11	10	3	5	10-15
Primary Crushing	2	26	23	18	13	48	11	5	18	
Hoist Loading				70	140	14	18	10	15	2
Mill										
Secondary Crushing	12	23	8	10	12	13	3	8	3	3
Wheeler Grinding	15	13	5	3	11	19		4	10	3
Hardinge Grinding	18	14	4	7		8			10	3
Bagging	25	15	5	9	4	8		8	9	4
Palletizing	40			25	10	6		8	15	2
Bulk Loading						10				
Loading Bags		109	39	31		62				
Other										
Millwright								4		4
Maintenance								12		2

(1) Values for 1954 - 1970 taken from reference 16.
(2) Calculated from MESA reports references 33-42

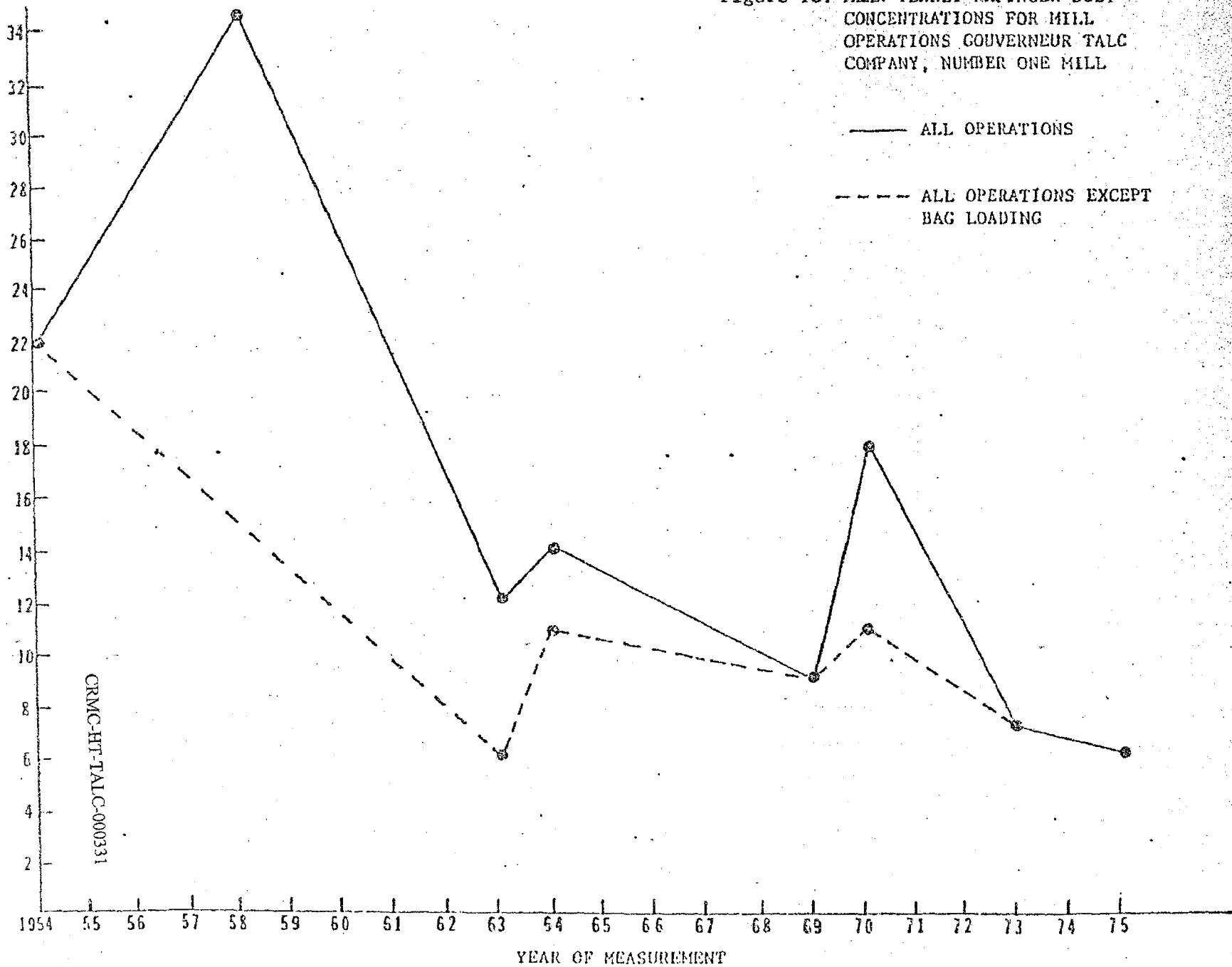
Table 18

Summary of Historic Fiber Exposure Measurements at the Gouverneur Talc Company, Number One Mine and Mill

Job or Operation	Mean Fiber Concentration (fiber > 5 μm/cc)						
	(1) 1970	(2) 1972	(2) 1973	(2) 1974	(2) 1975	NIOSH 1975	(2) 1976
Mine							
Drilling	8	4	1	1	1	3	24
Dragline Loading	16	6	1	2		6	
Tramming & Mucking	22	6	1		3	6	8
Primary Crushing	260	22	5	9	20	10	25
Hoist Loading	29	5	10	13	3	10	12
Mill							
Secondary Crushing	13	5	14	6	9	5	18
Wheeler Grinding	30		14	13	17	8	14
Hardinge Grinding	33			13	10	8	14
Bagging	30		11	15	6	5	14
Palletizing	27		8	15		4	
Bulk Loading	8					2	
Loading Bags						3	
Other							
Millwright			9			2	
Maintenance			14			2-4	38

(1) Taken from reference 16
(2) Calculated from MESA reports, references 33-43

Figure 10: MEAN YEARLY IMPINGER DUST CONCENTRATIONS FOR MILL OPERATIONS GOUVERNEUR TALC COMPANY, NUMBER ONE MILL



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A greater trend for decreasing dust concentrations in mill operations is demonstrated in Figure 10 for all mill operations combined. Figure 10 also shows a greater decreasing trend in exposure when the uncontrolled operation of loading bagged talc into box cars is excluded from the calculated yearly averages. Engineering controls for talc milling operations have improved with time.

As shown in Table 18, fiber exposure measurements have only been made since 1970. Results of the NIOSH 1975 survey tend to show a reduction in fiber exposure when contrasted with earlier data for most operations.

Radon daughter measurements have been made in the number one mine by the Mining Enforcement and Safety Administration (MESA). Measurements taken in 1973 and 1976 showed only nil to trace levels.[44,45]

DISCUSSION

Results of the present industrial hygiene study and past surveys demonstrate significant exposures to airborne fibers in both mine and mill operations at this facility. Electron microscopic analyses of both bulk talcs and airborne dust samples have shown that these airborne fibers are largely asbestiform tremolite and anthophyllite with airborne fibers sizes (length and diameter) consistent with those found for industrial processes using asbestos.[17] By any reasonable mineralogical or physiological definition of "fiber", one must consider tremolite and anthophyllite fibers in these talcs to be asbestiform.

More than four decades have elapsed since the first epidemiological data were published demonstrating adverse health effects of tremolite talc exposure. In 1933, Dreessen[18] published the results of a chest x-ray study of 57 workers engaged in the mining and milling of talcs containing up to 45% tremolite and little free silica. This study showed that all workers with greater than 10 years exposure had increased lung markings ranging from increased fibrosis to what was termed "second stage" pneumoconiosis. Among these 17 workers, no cases of active tuberculosis were observed. Dreessen stated that the observed pneumoconiosis had not led to disability.

The respiratory effects of exposures to talc containing 10% "bladed" tremolite in two Georgia talc mines and mills were reported by Dreessen and Dalla Valle in 1935.[19] A total of 66 workers were given physical examinations and chest x-rays of which 19 were exposed for more than 10 years with only 2 having 20 or more years of exposure. Twenty two of these workers demonstrated pneumoconiosis with varying severity. Approximately half of the mill workers exposed to an average dust concentration of 300 mppcf

were diagnosed as having pneumoconiosis with 8 having frank symptoms such as dyspnea, cough, chest pain, rales, and finger clubbing. Examination of 9 former talc workers who had been separated from exposure more than 3 years demonstrated pneumoconiosis in all cases with 4 cases in advanced stages causing these authors to conclude that the lung changes were permanent.

Additional case studies of New York tremolite talc workers were reported by Porro et.al.[20] Fifteen pneumoconiosis deaths in talc workers were studied in addition to 5 autopsy studies. Thirteen of these deaths were considered to be directly attributable to the pneumoconiosis confirming the disabling character of this exposure. These authors concluded that the disabling tissue changes were due to tremolite talc exposure. Some calcifications were noted.

Siegal et.al.[21,22] reported a study of roentgenological findings among New Y talc workers in addition to an assessment of their exposures. These talcs were described as containing fibrous tremolite and anthophyllite and less than 1% free SiO_2. A total of 221 talc workers in three mines and five mills were given chest x-ray examinations. Of the 221 men examined, 32 showed marked fibrosis. Those workers with 10 or more years employment demonstrated an incidence of fibrosis of 29.9% whereas those employed for more than 30 years had a fibrosis incidence of 74%. This fibrosis was described as disabling and often accompanied by dyspnea, cough and fatigue. "Talc plaques" were identified in 6.3% of the workers examined. These authors described the fibrosis observed as resembling that seen among ashestos workers.

The 32 cases of pneumoconiosis identified by Siegal et.al.[21,22] were followed prospectively by Kleinfeld et.al.[23] In the 14 year period after the Siegal study, 19 of the 32 workers died with the ages at death ranging from 48 to 84 years. Four of these 19 deaths were believed to be directly attributable to talc pneumoconiosis. One death due to pleural mesothelioma was reported. Medical examinations of the 13 living workers were performed including a physical examination, chest x-ray, EKG and peripheral blood studies (Hgb, RBC, WBC, Diff Count). Dyspnea was found in all workers of such severity as to limit ordinary physical activity. Moderate to severe progression of lung x-ray findings were seen in 10 of these workers and "talc plaques" were seen in all but one worker. Six out of 11 demonstrated an abnormal electrocardiogram. Peripheral blood findings were not considered of significance. These authors also reported the presence of "asbestos bodies" histologically. Similar findings were reported in a latter study of six pneumoconiosis with autopsy studies.[25]

A comparative clinical and environmental study of workers exposed to fibrous and non-fibrous talcs in New York State was reported by Messite et.al.[24] Three talc operations in St. Lawrence County (fibrous) and one operation in Lewis County (non-fibrous) were selected for study and a total of 299 workers were given physical examinations and chest x-rays. Among miners, the incidence of pulmonary fibrosis was low for both the St. Lawrence and Lewis County cohorts; however, the mean duration of exposure was only 12.7 and 10.3 years, respectively. Among millers, the incidence of fibrosis was 12.2% and 4.3% respectively for the St. Lawrence and Lewis cohorts. Exposure levels in the plants were described as being similar with all talcs

having a low free silica content. These authors concluded that both types of talc were capable of producing pulmonary fibrous although the tremolite (fibrous) variety was more pathogenic. In addition, these investigators stated that no cases of fibrosis was found in millers of either talc variety whose average exposure was less than 20 mppcf or whose duration of exposure was less than 10 years.

In a follow-up study, Kleinfeld et.al.[28] made additional comparisons, incl lung function, between the St. Lawrence and Lewis County New York cohorts described above. Thirty workers exposed to fibrous and 13 exposed to non-fibrous talcs were given chest x-rays and pulmonary function tests. Dyspnea was present in 16 of 30 workers in the fibrous talc exposed group and 6 of 13 in the non-fibrous talc exposed group. Abnormal auscultatory findings (rales, rhonchi, wheezing) were found in 8 of the 30 workers and 6 of 13 workers exposed to fibrous and non-fibrous talc, respectively. The incidence of pulmonary infiltration as seen in chest films was 13 of 30 for the fibrous group and 3 of 13 for the non-fibrous group. Both groups showed pulmonary function changes with 4 of 13 workers in the group exposed to non-fibrous tal and 14 of 30 workers in the group exposed to fibrous talc showing significantl reduced vital capacity. Exposures to both groups were considerably in excess of 20 mppcf.

Several additional studies of lung function have been conducted among talc workers in New York State.[26,27,29] Kleinfeld et.al.[26] studied the lung function of sixteen tremolite talc workers who ranged from 39 to 69 years of age (mean age 54.8 years). All had been exposed to talc dust in milling operations for 10 or more years and had no previous occupational dust

exposures. The clinical examinations showed 14 of the 16 workers studied to have dyspnea on exertion, 10 had rales or wheezing and clubbing of the fingers was found in 6 workers. Increased lung pulmonary infiltration was noted in the chest x-rays of all workers studied and cardiac enlargement was noted in 5 of these 16 workers. The lung function studies showed 7 of 16 to have reduced vital capacities and one worker was found to have a lung function consistent with restrictive lung disease. The mean duration of exposure for these 16 workers was 20.4 years and the mean weighted average exposure was 68.9 mppcf. Thirteen of the 16 workers studied gave a positive smoking history (30 cigarettes per day for a minimum of 5 years).

In a subsequent study Kleinfeld[27] performed similar studies as those descri above among a group of 43 tremolite talc workers and 41 controls of similar age and smoking history. In the talc cohort, 29 had dyspnea versus only 2 in the control population. Eleven talc workers gave a history of chronic cough and none in the controls and 8 talc workers showed finger clubbing whereas no clubbing was noted among controls. Sixteen of 43 talc workers had positive x-ray findings of pulmonary infiltration and none in controls and, in addition, reduced vital capacity was found in 13 talc workers and one control. These talc workers had a mean exposure duration of 19 years and a weighted average exposure of 62.3 mppcf.

A study of chest x-ray findings and clinical symptoms among miners and millers at the Gouverneur Talc Company, number one mine and mill has been reported by Kleinfeld et.al.[16] Thirty nine workers with a mean exposure of 16.2 years (range 11-22 years) were studied in addition to 41 controls who lived

in the same geographic area and who were of the same sex and mean age but having no occupational dust exposure. Dyspnea was present in 23.1% of the talc workers versus 7.3% for controls, a finding similar to that seen in anthophyllite asbestos workers.[33] One worker studied was said to have radiologic findings compatible with pneumoconiosis whereas no cases were found among controls. These authors suggested that talc containing tremolite and anthophyllite may be less fibrogenic than chrysotile or amosite asbestos at similar exposure levels and exposure duration; however, these authors did not preclude the possible existance of pneumoconiosis among these workers as no lung function studies were conducted.

Although the above studies have demonstrated the presence of pneumoconiosis among tremolite talc miners in New York, these study designs were insensitive for detection of carcinogenic risks. However, two retrospective proportional mortality studies have demonstrated an increased risk of cancer of the lung and pleura among these workers.[2,3] The initial study by Kleinfeld et.al.[3] included 220 talc miners and millers employed in 1940 who had 15 or more years of exposure to talc dust in addition to those who achieved a minimum of 15 years of exposure between 1940 and 1965. Among this cohort there were 91 deaths of which 10 (11%) were due to malignacies of the lung or pleura whereas only 2.9 (3.2%) were expected. In addition, 28 deaths were due to pneumoconiosis or its complications. One of the respiratory cancers was a fibrosarcoma of the pleura.

In a subsequent follow-up study, Kleinfeld et.al.[2] extended the observation o the previous cohort from 1960 to 1969. This cohort consisted of 260 workers.

among which there were 108 deaths. Thirteen of these deaths (12%) were due to respiratory cancer whereas only 4 (3.7%) were expected. Twenty nine deaths were due to pneumoconiosis or its complications. These authors analyzed mortality patterns by 5 year intervals between 1940 and 1969 and concluded that the respiratory cancer risk approached expected values after the period 1960-64. The validity of this conclusion must be questioned as an analysis of mortality in relation to cancer latency was not undertaken. In addition, the limitations of proportional mortality studies in the presence of an elevated pneumoconiosis risk are now well known.

An excess cancer risk has been demonstrated among workers exposed to anthophyllite asbestos.[30,31,32] Kiviluoto and Meurman[30] studied 1,092 anthophyllite asbestos workers who had worked for more than 3 months between 1936 and 1967 and compared cause specific mortality with rates for Finland. In addition, chest x-rays where read for 252 living workers. Twenty one lung cancers were observed whereas only 12 were expected which was statistically significant. Thirteen of these lung cancer victims had been exposed less than 10 years and only one of these cases was known to have asbestosis. No pleural or peritoneal mesotheliomas were observed.

Nurminen[31] has also reported on the mortality experience of anthophyllite asbestos workers in Finland. This study included 1030 workers who had been employed for three months or more from 1936 to 1966 and followed until 1968. Expected cause specific deaths were calculated using Finland national rates for 1951-1964. There were 224 deaths in this cohort whereas 204 were expected with a mean age at death of 53.4 years. Twenty five deaths (12%)

had asbestosis as an underlying cause and, in addition, there was a highly significant excess risk of respiratory cancer (13 obs. versus 6 exp., $p<0.01$). No mesotheliomas were detected. The mean latency between first exposure and death due to asbestosis was 19 years.

One of the most comprehensive studies of mortality and morbidity among anthophyllite asbestos workers was reported by Meurman et.al.[32] A cohort of 1092 workers who had worked at least 3 months between January 1936 and June 1967 was obtained from two mining operations; one of which produced anthophyllite asbestos and the other produced mainly tremolite talc. For calculation of expected age, cause specific deaths, proportional rates for Finland were used for 1958 which was the median year of death for these workers. In addition, a control group matched for date of birth and sex was chosen from a local population registry.

Of the 1092 employees, 248 deaths were observed. Thirteen deaths due to asbestosis were observed for the cohort and none in the controls. Twenty one lung cancers were observed in the worker cohort versus 13 in the control group. The most significant cancer risk was observed in those with ten or more years of exposure. These authors adjusted lung cancer rates for smoking habits and concluded that a non-smoking asbestos worker had a relative risk of 1.4 whereas the smoking asbestos worker had a relative risk of 17.0. No cases of mesothelioma were reported.

All of the above epidemiological studies of workers exposed to fibrous tremolite or anthophyllite have demonstrated an excess risk of both pneumoconiosis and lung and pleural cancer. No evidence of an excessive risk of mesothelioma

among such exposed workers has yet been demonstrated; however, an excessive incidence of pleural changes including pleural calcifications have been observed in chest films.

CONCLUSIONS AND RECOMMENDATIONS

Results of the present industrial hygiene study show numerous operations in both the number one mine and mill to have excessive exposures to airborne fibers. Analyses of both bulk talcs samples and airborne dust samples by analytical electron microscopy have shown that a majority of these fibers are asbestiform tremolite and anthophyllite. Based on these studies and on exhaustive review of the epidemiological literature concerning health effects of such exposures, it is concluded that immediate corrective actions to reduce exposures must be taken as recommended in the Progress Report issued on May 25, 1976. Specific actions include the following:

1. Mine ventilation should be evaluated with considerations for increasing air volume and distribution. Water sprays should be installed at the ore pockets.
2. During the present study, numerous leaks were observed at material transfer points within the mill. More emphasis should be placed on maintaining equipment in proper working order.
3. At the packing stations, ventilation improvements are needed. Local exhaust hoods at these machines are located too far from the filling spout to be effective. Hood designs at these machines should be further evaluated. In addition, bursting bags at these stations are a significant source of exposure; therefore, use of bags with a greater bursting strength should be considered.
4. Until ventilation and work practice improvements are made and asbestos fiber exposures reduced to acceptable levels, employees should be provided with respiratory protection as specified in the OSHA asbestos standard.[8]

5. All provisions for medical examinations specified in the OSHA asbestos standard[8] should be followed.

The asbestiform mineral content of products from the number one mine and mill make it imperative that these talcs be labeled with the OSHA warning label.[8]

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APPENDIX I

Mineral Product Safety Data Sheets
For R.T. Vanderbilt Products
(Supplied by R.T. Vanderbilt)

R.T. Vanderbilt Company, Inc.

MINERAL PRODUCT SAFETY DATA SHEE

NOTE: Exposure to all airborne mineral dusts is subject to OSHA regulations in accordance with Section 1910.93 of the Occupational Health and Safety Administration Standard as published in the Federal Register of October 18, 1972, starting on page 22139.

SECTION I		
TRADE NAME AND SYNONYMS	IT FIBER No. 1, IT Fiber 6N	Industrial Fibrous Talc
MINERAL FAMILY	Hydrous silicates	
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates	

SECTION II INGREDIENTS	
MATERIAL	% RANGE
Asbestiform talc and/or asbestiform anthophyllite	20 - 40
Talc - non-asbestiform	5 - 15
Non-asbestiform tremolite and/or anthophyllite	40 - 60
Quartz	1 - 5
Serpentine	10 - 20

SECTION III PHYSICAL DATA			
COLOR	White	SPECIFIC GRAVITY (H_2O=1)	±2.7
APPEARANCE	Fibrous		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA	
MATERIAL	*TLV
Asbestiform talc and asbestiform anthophyllite	5 fibers/cc>5μm. in length
Talc - non-asbestiform	20 Mppcf
Non-asbestiform tremolite and anthophyllite	20 Mppcf
Serpentine	50 Mppcf
Quartz 30 mg./cu.m. ÷ % Quartz +2	

SECTION V SPECIAL PRECAUTIONS
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid breathing dust. Use respirator if TLV's exceeded.

CRMC-HT-TALC-000349

DATE May 1, 1975

OVER FOR FURTHER INFORMATION

[illegible] Vermont Minerals Inc.

MINERAL PRODUCT
SAFETY DATA SHEET

NOTE. Exposure to all airborne mineral dusts is subject to OSHA regulations in accordance with Section 1910.93 of the Occupational Health and Safety Administration Standard as published in the Federal Register of October 18, 1972, starting on page 22130.

SECTION I

TRADE NAME AND SYNONYMS	MOULDENE, IT FIBER No. 2 — Industrial Fibrous Talc
MINERAL FAMILY	Hydrous silicates
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates

SECTION II INGREDIENTS

MATERIAL	% RANGE
Asbestiform talc and/or asbestiform anthophyllite	40 - 60
Talc - non-asbestiform	5 - 15
Non-asbestiform tremolite and/or anthophyllite	30 - 60
Quartz	1 - 5
Serpentine	5 - 10

SECTION III PHYSICAL DATA

COLOR	White	SPECIFIC GRAVITY (H_2O = 1)	±2.7
APPEARANCE	Fibrous		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA

MATERIAL	*TLV
Asbestiform talc and asbestiform anthophyllite	5 fibers/cc > 5 µm. in length
Talc - non-asbestiform	20 Mppcf
Non-asbestiform	20 Mppcf
Serpentine	50 Mppcf
Quartz — 30 mg./cu.m. ÷ % Quartz + 2	

SECTION V SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid breathing dust. Use respirator if TLV's exceeded.

CRMC-HT-TALC-000350

DATE May 1 1975

OVER FOR FURTHER INFORMATION

Vanderbilt Minerals, LLC

MINERAL PRODUCT SAFETY DATA SHEET

NOTE: Exposure to all airborne mineral dusts is subject to OSHA regulations in accordance with Section 1910.93 of the Occupational Health and Safety Administration Standard as published in the Federal Register of October 18, 1972, starting on page 22139

SECTION I

TRADE NAME AND SYNONYMS	NYTAL 99, NYTAL 100, NYTAL 100HR Industrial Talc
MINERAL FAMILY	Hydrous silicates
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates

SECTION II INGREDIENTS

MATERIAL	% RANGE
Talc	20 - 30
Non-asbestiform tremolite and/or anthophyllite	50 - 70
Serpentine	20 - 30
Quartz	1 - 5

SECTION III PHYSICAL DATA

COLOR	White	SPECIFIC GRAVITY (H_2O=1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA

MATERIAL	*TLV
Talc	20 Mppcf
Non-asbestiform tremolite and anthophyllite	20 Mppcf
Serpentine	50 Mppcf
Quartz 30 mg./cu.m. ÷ % Quartz + 2	

SECTION V SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid breathing dust. Use respirator if TLV's exceeded.

CRMC-HT-TALC-000351

DATE [illegible]

OVER FOR FURTHER INFORMATION

MINERAL PRODUCT
SAFETY DATA SHEE

NOTE: Exposure to all airborne mineral dusts is subject to OSHA regulations in accordance with Section 1910.93 of the Occupational Health and Safety Administration Standard as published in the Federal Register of October 18, 1972, starting on page 23109.

SECTION I	
TRADE NAME AND SYNONYMS	NYTAL 200, NYTAL 300, NYTAL 400 Industrial Talc
MINERAL FAMILY	Hydrous silicates
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates

SECTION II INGREDIENTS	
MATERIAL	% RANGE
Talc	20 - 40
Non-asbestiform tremolite and/or anthophyllite	40 - 60
Serpentine	20 - 30
Quartz	1 - 5

SECTION III PHYSICAL DATA			
COLOR	White	SPECIFIC GRAVITY (H_2O = 1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA	
MATERIAL	*TLV
Talc	20 Mppcf
Non-asbestiform tremolite and anthophyllite	20 Mppcf
Serpentine	50 Mppcf
Quartz 30 mg./cu.m. ÷ % Quartz + 2	

SECTION V SPECIAL PRECAUTIONS
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid breathing dust. Use respirator if TLV's exceeded.

CRMC-HT-TALC-000352

DATE [illegible] 1975

OVER FOR FURTHER INFORMATION

MINERAL PRODUC
SAFETY DATA SHEE

NOTE: Exposure to all airborne mineral dusts is subject to OSHA regulations in accordance with Section 1910.93 of the Occupational Health and Safety Administration Standard as published in the Federal Register of October 18, 1972, starting on page 23139

SECTION I		
TRADE NAME AND SYNONYMS	CERAMITALC 10AC, CERAMITALC HDT	Industrial Talc
MINERAL FAMILY	Hydrous silicates	
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates	

SECTION II INGREDIENTS	
MATERIAL	% RANGE
Talc	20 - 30
Non-asbestiform tremolite and/or anthophyllite	50 - 70
Serpentine	20 - 30
Quartz	1 - 5

SECTION III PHYSICAL DATA			
COLOR	White	SPECIFIC GRAVITY (H₂O=1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA	
MATERIAL	*TLV
Talc	20 Mppcf
Non-asbestiform tremolite and anthophyllite	20 Mppcf
Serpentine	50 Mppcf
Quartz — 30 mg./cu.m. ÷ % Quartz ÷ 2	

SECTION V SPECIAL PRECAUTIONS
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid breathing dust. Use respirator if TLV's exceeded.

CRMC-HT-TALC-000353

DATE: May 1, 1975

OVER FOR FURTHER INFORMATION

MINERAL PRODUCT SAFETY DATA SHEET

NOTE: Exposure to all airborne mineral dusts is subject to OSHA regulations in accordance with Section 1910.93 of the Occupational Health and Safety Administration Standard as published in the Federal Register of October 18, 1972, starting on page 23139

SECTION I	
TRADE NAME AND SYNONYMS	CERAMITALC No. 1, CERAMITALC 10-A; IT 3X Industrial Talc
MINERAL FAMILY	Hydrous Silicates
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates

SECTION II INGREDIENTS	
MATERIAL	% RANGE
Talc	20 - 40
Non-asbestiform tremolite and/or anthophyllite	40 - 60
Serpentine	20 - 30
Quartz	1 - 5

SECTION III PHYSICAL DATA			
COLOR	White	SPECIFIC GRAVITY (H_2O=1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA	
MATERIAL	*TLV
Talc	20 Mppcf
Non-asbestiform tremolite and anthophyllite	20 Mppcf
Serpentine	50 Mppcf
Quartz 30 mg./cu.m. ÷ % Quartz + 2	

SECTION V SPECIAL PRECAUTIONS
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid breathing dust. Use respirator if TLV's exceeded.

CRMC-HT-TALC-000354

[illegible] Whittaker, Clark & Daniels, Inc.

MINERAL PRODUCTS
SAFETY DATA SHEET

NOTE. Exposure to all airborne mineral dusts is subject to OSHA regulations in accordance with Section 1910.93 of the Occupational Health and Safety Administration Standard as published in the Federal Register of October 18, 1972, starting on page 22139

SECTION I		
TRADE NAME AND SYNONYMS	IT X, IT 3X, IT 5X, IT FT, IT 325, IT 625	Industrial Talc
MINERAL FAMILY	Hydrous Silicates	
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates	

SECTION II INGREDIENTS	
MATERIAL	% RANGE
Talc	20 - 40
Non-asbestiform tremolite and/or anthophyllite	40 - 60
Serpentine	20 - 30
Quartz	1 - 5

SECTION III PHYSICAL DATA			
COLOR	White	SPECIFIC GRAVITY (H_2O = 1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

SECTION IV. HEALTH HAZARD DATA	
MATERIAL	*TLV
Talc	20 Mppcf
Non-asbestiform tremolite and anthophyllite	20 Mppcf
Serpentine	50 Mppcf
Quartz 30 ma./cu.m. ÷ % Quartz ÷ 2	

SECTION V SPECIAL PRECAUTIONS
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid breathing dust. Use respirator if TLV's exceeded.

DATE May 1 1975

APPENDIX II

Results of Individual Air Samples
And Summary Statistics for
NIOSH Industrial Hygiene Study

GOUVERNEUR TALC CO.

GOUVERNEUR, N.Y.

DATE OF STUDY: 11/03/75 - 11/07/75

AGENT STUDIED: TALC

SIC CODE:1499 COUNTY:ST. LAWRENCE

1. JOB DICTIONARY

CODE	JOB TITLE
0101	MINE FOREMAN
0102	CRUSHER OPERATOR
0103	THAWER
0104	SCRAPPER MAN
0105	UNDERGROUND LABORER
0106	DRILLER
0107	DIAMOND DRILLER
0108	RAISE BORING MACHINE OPERATOR
0109	RAISE BORING MACHINE HELPER
0110	UNDERGROUND HOISTMAN
0111	HOISTMAN
0112	UNDERGROUND STOCK CLERK
0113	SUPPLY MAN
0114	EIMCO MAN(MUCKER)

DUTIES
UNDERGROUND SUPERVISOR
TO REGULATE AND CONTROL FLOW OF MATERIAL FROM CRUDE ORE PACKET THROUGH THE CRUSHING CIRCUIT TO EITHER STOCK PILES OR LOADING FACILITIES.
FILLS ORE CARS WITH BROKEN ORE OR WASTE FROM DRIFTS, RAISES OR STOPES AND TRANSPORTS TO ORE POCKETS, ORE PASSES OR OTHER PLACES AS DIRECTED.
LOAD ORE INTO TRAM CARS
PERFORMS GENERAL LABOR WORK SUCH AS DIGGING, SHOVELING, CLEANING DRIFTS, HANDLING TIMBER, MINE SUPPLIES, ETC.
OPERATES ALL REQUIRED DRILL EQUIPMENT AND MOVES EQUIPMENT IN AND OUT OF BLASTING AREA
TO OPERATE DIAMOND CORE DRILL FOR DRILLING TEST AND BLAST HOLES.
MOVE, SET UP AND OPERATE RAISE BORING MACHINE TO DRILL HOLES.
TO ASSIST RAISE BORING MACHINE OPERATOR TO MOVE, SET UP AND OPERATE MACHINE.
TO OPERATE HOIST AND RELATED EQUIPMENT DURING WINZE AND SHAFT DEVELOPMENT WORK
TO OPERATE HOIST LOWER OR RAISE CAGE AND SKIP AS SIGNALED AND OPERATE MINE AIR COMPRESSOR
RESPONSIBLE FOR RECEIVING, RECLAIMING, REPAIR, STORAGE AND CONSIGNMENT OF MINE UNDERGROUND STOCK EQUIPMENT, PARTS ETC., AND PREPARES AND CONSIGNS DAILY EXPLOSIVE SUPPLIES
PROCURES AND DISTRIBUTES THE SUPPLIES NECESSARY FOR THE OPERATION OF THE MINE SURFACE AND UNDERGROUND WORKINGS
LOADS BROKEN ORE FR. ORE POCKETS INTO TRAM CARS USING 1 MAN LOADING MACHINE

1. JOB DICTIONARY

CODE	JOB TITLE
0115	CAGEMAN
0201	MILL FOREMAN
0202	MILLER
0203	GENERAL LABORER
0204	CRUSHER OPERATOR
0205	FULLER-KINYON OPERATOR
0206	HANDIRGE OPERATOR
0207	PROCESS AIR OPERATOR
0208	SHEELER OPERATOR
0209	PACKER
0210	PACKHOUSE UTILITY MAN
0211	PACKER SERVICEMAN

DUTIES
(FIXED MACHINE)

OPERATES THE COMBINED CAGE AND SKIP TO TRANSPORT MEN, MATERIAL AND EQUIPMENT TO AND FROM SURFACE TO UNDERGROUND STATION LEVELS AND THE HAULAGE OF ORE OR WASTE FROM ORE POCKETS TO SURFACE

SUPERVISES MILL GRINDING, DRYING AND PRODUCT BLENDING

GENERAL MILL WORKER

TO PERFORM ALL TYPES OF LABOR WORK AS ASSIGNED IN AND ABOUT THE MILL YARDS, AND BUILDING

OPERATES THE DRYER, SECONDARY CRUSHERS AND ALL AUXILIARY EQUIPMENT IN THE SECONDARY CRUSHER AREA TO DRY AND REDUCE THE ORE IN SIZE FOR THEIR PROCESSING

TO SERVICE PACKAGING OPERATION BY OPERATING F-K EQUIPMENT AND TO LOAD BULK PRODUCT INTO DESIGNATED CARRIER

TO OPERATE THE HARDINGE GRINDING MILLS, SEPARATORS, ALPINE CLASSIFIERS AND ALL ASSOCIATED EQUIPMENT TO PRODUCE FINISHED PRODUCT AND AN INTERMEDIATE PRODUCT FOR USE AS FEED TO OTHER SECTIONS

OPERATES THE MILL AIR COMPRESSOR, ALCORN HEATER, AND ALL AUXILIARY EQUIPMENT IN THE PROCESS AIR AREA

OPERATES THE WHEELER MILL GRINDING EQUIPMENT, THE DUSTEX CYCLONE AND ALL ASSOCIATED EQUIPMENT

OPERATES THE SEMI-AUTOMATIC PACKER AND LOADS BAGGED, FINISHED PRODUCT TO RAILROAD CARS AND TRUCKS

TO SERVICE PACKING OPERATION BY MAINTAINING BAG SUPPLY, OPERATING LIFT TRUCK, AND ASSISTING IN OTHER SERVICE DUTIES IN THE PACKHOUSE AS DIRECTED

TO SERVICE PACKING AND CHECKING WEIGHT OF BAGGED, FINISHED PRODUCT OPERATION BY MAINTAINING AND STENCILLING BAG SUPPLY

CODE	JOB TITLE	DUTIES
0212	WAREHOUSE FOREMAN	SUPERVISES TALC BAGGING
0213	FORK LIFT OPERATOR/TOW MOTOR OPER.	OPERATES THE TOW MOTOR AND MAINTAINS WAREHOUSE INVENTORY RECORDS
0214	CAR LINER	PREPARES EMPTY RAILROAD CARS AND TRUCKS FOR LOADING AND PREPARES COMPLETED CARS FOR SHIPMENT
0215	TRUCK DRIVER	OPERATES SERVICE VEHICLE TO TRANSPORT VARIOUS MATERIALS IN OR OUTSIDE PLANT AREA, LOADS AND UNLOADS VEHICLE
0216	STOCK CLERK	RESPONSIBLE FOR RECEIVING, STORING AND CONSIGNMENT OF EQUIPMENT, SUPPLIES AND SPARE PARTS, ETC., AND ASSITS IN MAINTAINING ADEQUATE STOCK LEVELS OF SUPPLIES AND SPARE PARTS
0217	STENCIL AND CHECKWEIGH MAN	LABELS TALC BAGS-SHIPMEN
0218	SUPERVISOR OF INVENTORY CONTROL	PROPERTY CONTROL
0219	CALCINATA PROCESS OPERATOR	
0220	BULK CAR LOADER	LOADS TALC INTO RAIL BULK CARS USING PNEUMATIC FILLING SYSTEM
0301	REPAIRMAN(MINE)	TO MAINTAIN AND REPAIR MINE EQUIPMENT SUCH AS TUGGER-HOISTS, AND INSTALL, CONSTRUCT AND REPAIR VARIOUS WOOD AND CONCRETE STRUCTURES
0302	REPAIRMANS HELPER	TO ASSIST THE REPAIRMAN AND MAINTENANCE MECHANIC IN THE CONSTRUCTION, INSTALLATION, MAINTENANCE AND REPAIR OF MINE MACHINERY AND EQUIPMENT
0303	BLACKSMITH	TO FORGE, HAMMER-WELD, HEAT TREAT AND FUSE BY WELDING METAL MATERIALS REQUIRED IN THE CONSTRUCTION, MAINTENANCE AND MINE SURFACE AND UNDERGROUND MACHINERY AND EQUIPMENT
0304	MAINTENANCE MECHANIC	PERFORM THE LAYOUT, ASSEMBLY, INSTALLATION, REPAIR AND MAINTENANCE OF MINE SURFACE AND UNDERGROUND MACHINERY, EQUIPMENT AND WOOD WORK CONSTRUCTION
0305	MOBILE EQUIPMENT MECHANIC	INSPECT, TEST, ADJUST, DISMANTLE AND REPLACE UNIT ASSEMBLIES OR PARTS, AND MAKE COMPLETE REPAIRS TO GASOLINE, ELECTRIC AND DIESEL POWERED EQUIPMENT

E 1, JOB DICTIONARY

CODE	JOB TITLE
0401	MILLWRIGHT
0402	INSTRUMENT REPAIRMAN
0403	MACHINIST
0404	REPAIRMAN(MILL)
0405	MILLWRIGHT HELPER
0406	SHEET METAL WORKER
0407	QUALITY CONTROL TECH.
0408	LAB TECHNICIAN
0409	ASSISTANT LAB TECHNICIAN
0410	MILER
0411	WELDER
0501	ELECTRICIAN AND ELECTRIC APPRENTICE
0502	JANITOR
0503	WELDER

DUTIES

TO INSPECT, REPAIR, RE-
PLACE, INSTALL, ADJUST AND MAINTAIN ALL MECHANICAL
EQUIPMENT IN THE MILL

TO INSTALL, REPAIR, CAL-
IBRATE, TEST AND ADJUST ANY TYPE OF INTEGRATING,
INDICATING, OR GRAPHIC ELECTRICAL OR MECHANICAL IN-
STRUMENT

TO LAY OUT WORK, SET UP
AND OPERATE MACHINE TOOLS, AND PERFORM ANY DISMANTL-
ING, FITTING OR ASSEMBLY WORK REQUIRED FOR PLANT MAIN-
TENANCE OR CONSTRUCTION

INSPECT, REPAIR, REPLACE,
INSTALL, ADJUST AND MAINTAIN ALL MECHANICAL EQUIPMENT
IN THE MILL

ASSIST TO INSPECT, REPAIR
REPLACE, INSTALL, ADJUST AND MAINTAIN ALL MECHANICAL
EQUIPMENT IN THE MILL

TO PERFORM ANY TIN OR
SHEET METAL WORK REQUIRED FOR PLANT MAINTENANCE AND
CONSTRUCTION

TAKES TALC SAMPLES FOR
LAB ANALYSIS

ASSIST IN DC ANALYSIS

RESPONSIBLE FOR THE
PROPER LUBRICATION OF ALL MACHINERY AND EQUIPMENT

GENERAL WELDING IN MILL

TO INSPECT, REPAIR, AND
WIRE ALL ELECTRICAL APPARATUS, DEVICES, AND CIRCUITS
OF ANY VOLTAGE IN THE PLANT OR ASSIGNED AREA INCLUD-
ING POWER TRANSMISSION LINES, TRANSFORMERS, AND RELAT-
ED EQUIPMENT

TO SWEEP AND CLEAN FLOOR
OF MINE, MILL, OFFICES, LAVATORIES, CHANGE AND DINING
ROOMS AND LABORATORY

TO PERFORM ALL KINDS OF
WELDING, BRAZING AND CUTTING ON ANY TYPE OF METAL
USING GAS AND ELECTRIC WELDING EQUIPMENT

LE 8. JOB DICTIONARY -

CODE	JOB TITLE
0504	MOBILE UTILITY OPERATOR
0505	WATCHMAN
0506	MINE AND MILL ENGINEER
0601	ASSISTANT RESIDENT MANAGER
0602	MINE SUPERINTENDANT
0603	MILL SUPERINTENDANT
0604	GENERAL MANAGER
0605	PERSONNEL AND SAFETY DIRECTOR
0606	OFFICE MANAGER
0607	ENGINEER
0608	ENGINEERING TECHNICIAN(DRAFTSMAN)
0609	SHIPPING AND INVENTORY COORDINATOR
0610	INVENTORY CONTROL CLERK
0611	ACCOUNTS PAYABLE CLERK
0612	SHIPPING CLERK
0613	SECRETARY
0614	RECEPTIONIST
0615	OFFICE CLERK
0616	DRAFTSMAN

DUTIES

TO OPERATE MOBILE EQUIPMENT IN VARIOUS CAPACITIES SUCH AS CLEANING UP WASTE, DIRT AND DEBRIS, SNOW REMOVAL, ETC.

MINE AND MILL SECURITY

OFFICE DUTIES

OFFICE DUTIES

OFFICE DUTIES

OFFICE DUTIES

OFFICE DUTIES

OFFICE DUTIES

2. SAMPLING PROCEDURES

SAMPLING METHOD	ANALYTICAL TECH.
GRAVIMETRIC	POST-PRE WEIGHT
IMPINGER SAMPLE	OPTICAL MICRO.

RESPIRABLE MASS SAMPLES ARE COLLECTED ON MSA POLY-VINYL CHLORIDE FILTERS(5.0UM PORE SIZE) WITH FLOW 1.7 LITERS PER MINUTE, NYLON CYCLONES (10MM) ARE USED FOR SIZE SEPARATION. FILTERS ARE WEIGHTED TO THE NEAREST 0.1MG USING A CAHN GRAM ELECTROBALANCE AND DUST CONCENTRATIONS REPORTED AS MG/M3.

MIDGET IMPINGER SAMPLES ARE COLLECTED USING ETHYL ALCOHOL AS THE COLLECTING MEDIUM WITH FLOW 2.83 LITERS PER MINUTE. AFTER DILUTION, SAMPLES ARE PIPETTED INTO *DUNN COUNTING CELLS ALLOWING A 30 MINUTE SETTLING* TIME. PARTICLE COUNTS ARE MADE BY TWO COUNTERS USING BRIGHT FIELD OPTICAL MICROSCOPY AT 100X. CONCENTRATIONS ARE REPORTED AS MILLIONS OF PARTICLES PER CUBIC FOOT OF AIR(MPPCF).

3. INDIVIDUAL SAMPLE RESULTS

TE TALC
LE METHOD/ANALYTICAL TECHNIQUE GRAVIMETRIC /RESPIRABLE WEIGHT

SHIFT MAN NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME M3	CONC.
18	1008	11/06/75	0655	1455	0.8159	0.846
WEIGHTED AVE.= 0.846						
1A	1004	11/06/75	0654	1456	0.8193	0.952
WEIGHTED AVE.= 0.952						
1E	1024	11/06/75	0703	1455	0.8023	0.125
WEIGHTED AVE.= 0.125						
1A	1009	11/06/75	0653	1459	0.8261	0.581
WEIGHTED AVE.= 0.581						
1E	1358	11/06/75	0659	1455	0.8091	1.569
WEIGHTED AVE.= 1.569						
17	1003	11/06/75	0700	1455	0.8006	1.723
WEIGHTED AVE.= 1.723						
13	1023	11/06/75	0700	1455	0.8074	0.582
WEIGHTED AVE.= 0.582						
1C	1010	11/06/75	0656	1405	0.7292	1.001
WEIGHTED AVE.= 1.001						
1B	1019	11/06/75	0658	1300	0.6833	1.419
WEIGHTED AVE.= 1.419						
1B	1017	11/06/75	0706	1415	0.7292	0.535
WEIGHTED AVE.= 0.535						
1E	1041	11/06/75	0659	1459	0.8159	0.233
WEIGHTED AVE.= 0.233						
1A	1049	11/06/75	0719	1420	0.7156	0.643
WEIGHTED AVE.= 0.643						
2A	1006	11/03/75	1513	2238	0.7564	0.516
WEIGHTED AVE.= 0.516						
1E	1019	11/04/75	0731	1430	0.7122	1.137

UNITS

MG/M3

MG/M3

MOVED TO 700 LEVEL AT 830

MG/M3

MG/M3

DRAGGING TO 700 FOOT LEVEL LUNCH TAKEN 1136 TO 1240

MG/M3

SCRAPPING TO 700 FOOT LEVEL

MG/M3

MG/M3

UNDERGROUND LABORER

MG/M3

LUNCH TAKEN FROM 1130 TO 1240

MG/M3

MG/M3

MG/M3

MG/M3

MG/M3

MG/M3

GENERAL LABORER

3. INDIVIDUAL SAMPLE RESULTS

T: TALC
LE METHOD/ANALYTICAL TECHNIQUE: GRAVIMETRIC /POST-PRE WEIGHT

SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME M3	CONC.	UNITS
WEIGHTED AVE.= 1.137							
13	1442	11/04/75	0719	1425	0.7241	1.132	MG/M3
WEIGHTED AVE.= 1.132							
21	1440	11/03/75	1438	2238	0.8159	0.600	MG/M3
WEIGHTED AVE.= 0.600							
12	1461	11/04/75	0708	1425	0.7428	1.561	MG/M3
WEIGHTED AVE.= 1.561							
23	1450	11/03/75	1440	2237	0.8006	0.649	MG/M3
WEIGHTED AVE.= 0.649							
11	1456	11/04/75	0707	1430	0.7530	2.735	MG/M3
WEIGHTED AVE.= 2.735							
22	1429	11/03/75	1444	2236	0.8023	0.449	MG/M3
WEIGHTED AVE.= 0.449							
15	1445	11/04/75	0740	1417	0.6748	0.756	MG/M3
WEIGHTED AVE.= 0.756							
15	1431	11/04/75	0743	1420	0.6748	0.415	MG/M3
WEIGHTED AVE.= 0.415							
16	1439	11/04/75	0745	1421	0.6731	0.728	MG/M3
WEIGHTED AVE.= 0.728							
17	1464	11/04/75	0711	1427	0.7411	0.391	MG/M3
WEIGHTED AVE.= 0.391							
18	1459	11/04/75	0711	1426	0.7394	0.460	MG/M3
WEIGHTED AVE.= 0.460							
19	1469	11/04/75	0710	1429	0.7394	0.433	MG/M3
WEIGHTED AVE.= 0.433							
27	1472	11/03/75	1520	2248	0.7615	0.499	MG/M3
WEIGHTED AVE.= 0.499							
28	1445	11/03/75	1526	2253	0.7598	0.947	MG/M3
WEIGHTED AVE.= 0.947							
29	1430	11/03/75	1520	2250	0.7649	0.719	MG/M3
WEIGHTED AVE.= 0.719							
10	1427	11/04/75	0730	1428	0.7105	0.436	MG/M3

CRMC-HT-TALC-000365

3. INDIVIDUAL SAMPLE RESULTS

TE TALC
LE METHOD/ANALYTICAL TECHNIQUE: GRAVIMETRIC /POST-PRE WEIGHT

	SHIFT	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME M3	CONC.
	WEIGHTED AVE.= 0.436						
	2A	1057	11/03/75	1525	2252	0.7598	0.395
	WEIGHTED AVE.= 0.395						
2	1I	1060	11/04/75	0810	1428	0.6825	0.218
	WEIGHTED AVE.= 0.218						
2	2S	1077	11/03/75	1521	2300	0.7802	0.282
	WEIGHTED AVE.= 0.282						
3	1D	1359	11/04/75	0737	1424	0.6918	0.231
	WEIGHTED AVE.= 0.231						
3	1G	1083	11/04/75	0715	1424	0.7292	0.439
	WEIGHTED AVE.= 0.439						
3	2A	1032	11/03/75	1524	2247	0.7530	0.372
	WEIGHTED AVE.= 0.372						
10	1C	1028	11/04/75	0737	1429	0.7003	0.314
	WEIGHTED AVE.= 0.314						
20	1H	1036	11/04/75	0755	1413	0.6425	0.249
	WEIGHTED AVE.= 0.249						
01	1I	1053	11/06/75	0654	1455	0.8176	1.137
	WEIGHTED AVE.= 1.137						
02	1J	1035	11/06/75	0655	1455	0.8159	0.858
	WEIGHTED AVE.= 0.858						
04	1S	1048	11/06/75	0701	1455	0.8057	0.422
	WEIGHTED AVE.= 0.422						
01	1A	1065	11/07/75	0715	1327	0.6323	0.158
	WEIGHTED AVE.= 0.158						
01	1D	1060	11/07/75	0723	1325	0.6153	4.047
	WEIGHTED AVE.= 4.047						
02	1G	1050	11/07/75	0729	1336	0.6238	0.593
	WEIGHTED AVE.= 0.593						
02	1H	1070	11/07/75	0746	1300	0.5337	0.581
	WEIGHTED AVE.= 0.581						

UNITS
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3
MG/M3

WORKING AT SHAFT STATION

5. INDIVIDUAL SAMPLE RESULTS

[illegible]

SHIFT	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME M3	CONC.	UNITS
3	1A 1004	11/07/75	0712	1324	0.0523	0.395	MG/M3
	WEIGHTED AVG.= 0.395						
5	1E 1344	11/07/75	0725	1331	0.0421	2.957	MG/M3
	WEIGHTED AVG.= 2.957						
9	JC 1344	11/07/75	0718	1325	0.0438	0.497	MG/M3
	WEIGHTED AVG.= 0.497						
0	1A 1002	11/07/75	0707	1427	0.1479	0.722	MG/M3
	WEIGHTED AVG.= 0.722						
1	1E 1073	11/07/75	0727	1327	0.0119	0.752	MG/M3
	WEIGHTED AVG.= 0.752						

INDIVIDUAL SAMPLE RESULTS

TALC
METHOD/ANALYTICAL TECHNIQUE: IMPINGER SAMPLE/OPTICAL MICRO.

	SHIFT	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LI	CONC.
	16	0155	11/06/75			3.0000	12.708
WEIGHTED AVE.=	12.708						
3	16	0020	11/06/75	0112	0149	1.6996	12.424
3	16	0554	11/06/75	1244	1312	2.7785	5.951
WEIGHTED AVE.=	8.596						
4	1A	0005	11/06/75	0845	0915	3.0000	4.308
WEIGHTED AVE.=	4.308						
4	1E	0495	11/06/75	0800	0850	3.0000	3.844
WEIGHTED AVE.=	3.844						
4	17	0145	11/06/75			2.0000	18.372
4	17	0215	11/06/75			3.0000	18.743
4	17	0373	11/06/75			1.0000	24.536
WEIGHTED AVE.=	19.505						
0	1C	0535	11/06/75	0938	0953	1.5017	11.670
WEIGHTED AVE.=	11.670						
4	14	0253	11/06/75			3.0000	15.774
WEIGHTED AVE.=	15.774						
15	1A	0001	11/06/75			3.0000	1.972
WEIGHTED AVE.=	1.972						
01	14	0394	11/06/75	1145	1215	3.0000	3.940
WEIGHTED AVE.=	3.940						

UNITS

MPPCF

USING A PICK AND A SLEDGE ON BIG PIECES OF ORE, NO RESPIRATOR

MPPCF

SAMPLER WAS HOOKED ONTO TRAMMER CAR FOR 17 MINUTES

MPPCF

SAMPLER HOOKED ONTO TRAMMING CAR FOR 20 MINUTES

MPPCF

SCRAPPERMAN PULLING ORE TO 700 LEVEL

MPPCF

SCRAPING ORE DOWN TO 700 FOOT LEVEL, NO RESPIRATOR

MPPCF

MPPCF

MPPCF

MPPCF

DRILLING HOLES INTO ROCK STARTING AT 800FEET AND WORK ING DOWN TO 900 FEET NO RESPIRATOR.

MPPCF

PICKING UP ORE WITH MUCKING MACHINE AND PUTTING IN CARS, RESPIRATOR WAS NOT WORN

MPPCF

MPPCF

CHECKING INSTRUMENTS, CONVEYER AND COLLECTIONS ON HOOP FOR 20 MINUTES, 10 MINUTE IN CONTROL ROOM, DOES THIS 2 TIMES PER SHIFT

4. INDIVIDUAL SAMPLE RESULTS

11 TALC
LE METHOD/ANALYTICAL TECHNIQUE IMPINGER SAMPLE/OPTICAL MICRO.

SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LF	CONC.
20	0415	11/03/75			5.0000	1.813
WEIGHTED AVE.=	1.813					
19	0291	11/04/75	1325	1355	5.0000	0.546
WEIGHTED AVE.=	0.546					
1H	0690	11/06/75	1230	1500	5.0000	2.911
1H	0980	11/06/75	0908	0930	5.0000	2.656
WEIGHTED AVE.=	2.784					
13	0783	11/04/75	0944	1014	5.0000	3.515
WEIGHTED AVE.=	3.515					
21	0374	11/03/75			5.0000	1.204
WEIGHTED AVE.=	1.204					
12	0241	11/04/75	1038	1108	5.0000	3.926
EIGHTED AVE.=	3.926					
23	0131	11/03/75			5.0000	2.884
EIGHTED AVE.=	2.884					
11	0705	11/04/75	0833	0903	5.0000	3.579
EIGHTED AVE.=	3.579					
22	0613	11/03/75			5.0000	2.540

EIGHTED AVE.= [illegible]

UNITS	
MPPCF	CHECKING INSTRUMENTS FOR 12 MINUTES, IN CONTROL ROOM FOR REMAINING 18 MINUTES, WORE RESPIRATOR
MPPCF	MOVING SCRAP IRON OUTSIDE
MPPCF	PROCESSING WET ORE FROM 1100 LEVEL
MPPCF	SECONDARY CRUSHER OPERATOR RUNNING CRUSHER AT HEAD FRAME
MPPCF	WATCHED BIN SIFT AND CHECKED CONVEYOR, STAYED IN CONTROL ROOM MOST OF TIME.
MPPCF	CHECKING INSTRUMENTS FOR 7 MINUTES, STAYED IN CONTROL ROOM FOR 23 MINUTES, NO RESPIRATOR
MPPCF	WEIGHING OUT SAMPLES AND CHECKING INSTRUMENTS FOR TOTAL TIME OF 30 MINUTES, HEAVY EXPOSURE, WORE RESPIRA.
MPPCF	TAKING HOURLY SAMPLE FOR 5 MINUTES, STAYED IN CONTROL ROOM FOR OTHER 25 MINUTES, WEARS RESPIRATOR
MPPCF	LEAK CORRECTIONS AND INSTRUMENTATION CHECK FOR 7 MINUTES, REMAINDER 23 MINUTES OUTSIDE OF CONTROL R.
MPPCF	INSPECTING SCALES, COMPRESSOR AND DUST COLLECTORS ON ROOF FOR 10 MINUTES, 20 MINUTES IN CONTROL ROOM, WORE RESPIRATOR

UNIT TALC
SAMPLE METHOD/ANALYTICAL TECHNIQUES IMPINGER SAMPLE/OPTICAL MICRO.

NO. SAMPLE NO.	SHIFT NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME CF	CONC.	UNITS	
209	12	0745	11/04/75			3.0000	6.384	MPPCF	
TIME WEIGHTED AVE.=		6.384							
209	16	0456	11/04/75			3.0000	3.735	MPPCF	
209	16	0845	11/04/75			3.0000	1.968	MPPCF	
TIME WEIGHTED AVE.=		2.851							
209	27	0516	11/03/75			3.0000	2.481	MPPCF	
TIME WEIGHTED AVE.=		2.481							
209	28	0103	11/03/75			3.0000	2.964	MPPCF	
209	28	0643	11/03/75			3.0000	3.977	MPPCF	FILLING SACKS WITH PRODUCT BY MACHINE, SEVERAL BURST DURING SAMPLING
TIME WEIGHTED AVE.=		3.471							
211	24	0836	11/03/75			3.0000	2.131	MPPCF	
TIME WEIGHTED AVE.=		2.131							
213	18	0845	11/04/75			3.0000	1.638	MPPCF	
TIME WEIGHTED AVE.=		1.638							
213	26	0143	11/03/75			3.0000	1.638	MPPCF	
TIME WEIGHTED AVE.=		1.638							
302	12	0714	11/06/75			2.3992	3.633	MPPCF	
TIME WEIGHTED AVE.=		3.633							
304	15	0204	11/06/75	1255	1325	3.0000	1.469	MPPCF	WORKING AT SHAFT STATION
TIME WEIGHTED AVE.=		1.469							

MIT TALC
PLT METHOD/ANALYTICAL TECHNIQUE: GRAVIMETRIC /POST-PRE WEIGHT

JOB CODE	NO. OF SAMPLES	RANGE MG/M3 (MIN-MAX)	MEAN MG/M3	MEDIAN MG/M3	G.M. AVE.	STANDARD DEVIATION	STANDARD ERROR	JOB TITLE
0103	003	000.952-000.125	0.641	0.840	0.644	0.450	0.260	TRAMMER
0104	003	001.723-000.581	1.291	1.509	1.205	0.820	0.358	SCRAPPER MAN
0105	001	000.582-000.582	0.582	0.582	0.582	0.000	0.000	UNDERGROUND LABORER
0106	003	001.019-000.535	0.985	1.001	0.976	0.442	0.255	DRILLER
0115	001	000.233-000.233	0.233	0.233	0.233	0.000	0.000	CAGEMAN
AREA 01	011	001.725-000.125	0.670	0.846	.	0.527	0.159	
0201	002	000.843-000.516	0.580	0.580	0.576	0.090	0.063	MILL FOREMAN
0203	001	001.137-001.137	1.137	1.137	1.137	0.000	0.000	GENERAL LABORER
0204	002	001.132-000.000	0.566	0.566	0.850	0.376	0.266	CRUSHER OPERATOR
0205	002	001.501-000.049	1.105	1.105	1.088	0.645	0.456	HARDINGE OPERATOR
0208	002	002.735-000.449	1.592	1.592	1.556	1.616	1.143	WHEELER OPERATOR
0209	009	000.947-000.391	0.594	0.499	0.594	0.197	0.066	PACKER
0211	002	000.430-000.395	0.416	0.416	0.415	0.029	0.020	PACKER SERVICEMAN
0212	002	000.282-000.218	0.250	0.250	0.253	0.045	0.032	PACKHOUSE FOREMAN
0213	003	000.483-000.231	0.347	0.372	0.350	0.106	0.061	FORK LIFT OPERATOR/TON MOTOR OPER.
0214	001	000.314-000.314	0.314	0.314	0.314	0.000	0.000	CAR LINER
0220	001	000.249-000.249	0.249	0.249	0.249	0.000	0.000	BULK CAR LOADER
AREA 02	027	002.735-000.218	0.650	0.460		0.521	0.100	
0301	001	001.137-001.137	1.137	1.137	1.137	0.000	0.000	REPAIRMAN(MINE)
0302	001	000.858-000.858	0.858	0.858	0.858	0.000	0.000	REPAIRMAN'S HELPER
0304	001	000.422-000.422	0.422	0.422	0.422	0.000	0.000	MAINTENANCE MECHANIC
AREA 03	003	001.137-000.422	0.806	0.858		0.360	0.208	
0401	002	004.647-000.158	2.403	2.403	2.372	3.174	2.244	MILLWRIGHT
0402	002	000.593-000.581	0.587	0.587	0.587	0.008	0.006	INSTRUMENT REPAIRMAN
0403	001	000.595-000.595	0.595	0.595	0.595	0.000	0.000	MACHINIST
0405	001	002.957-002.957	2.957	2.957	2.957	0.000	0.000	MILLWRIGHT HELPER
0406	001	000.497-000.497	0.497	0.497	0.497	0.000	0.000	SHEET METAL WORKER
0410	001	000.722-000.722	0.722	0.722	0.722	0.000	0.000	OILER
0411	001	000.752-000.752	0.752	0.752	0.752	0.000	0.000	WELDER
AREA 04	009	004.647-000.158	1.258	0.595		1.514	0.505	
PLANT TOTAL		[illegible]	0.820	0.582		0.790	0.112	

ENT TALC
PLE PREP/ANALYTICAL TECHNIQUE: IMPINGER SAMPLE/OPTICAL MICRO.

JOB CODE	NO. OF SAMPLES	RANGE (HI-LOW)	MEAN	MEDIAN	L.P. AVG.	STANDARD DEVIATION	STANDARD ERROR	JOB TITLE
0103	003	012.[illegible]-003.951	10.301	12.428	10.121	3.822	2.207	TRAMMER
0108	005	024.530-003.048	13.401	18.372	11.830	9.350	4.181	SCRAPPER MAN
0106	001	011.078-011.078	11.078	11.078	11.078	0.000	0.000	DRILLER
0110	001	015.774-015.774	15.774	15.774	15.774	0.000	0.000	EIMCO MAN(MUCKER)
0115	001	001.972-001.972	1.972	1.972	1.972	0.000	0.000	CAGEMAN
AREA 01	011	024.530-001.972	11.046	12.424		7.217	2.176	
0201	002	003.941-001.813	2.877	2.877	2.877	1.504	1.063	MILL FOREMAN
0203	001	000.540-000.540	0.540	0.540	0.540	0.000	0.000	GENERAL LABORER
0208	004	003.515-001.208	2.572	2.784	2.572	0.980	0.490	CRUSHER OPERATOR
0216	002	003.940-002.870	3.405	3.405	3.405	0.737	0.521	HARDINGE OPERATOR
0218	002	003.579-002.500	3.040	3.040	3.040	0.735	0.519	WHEELER OPERATOR
0219	006	006.394-001.768	3.585	3.349	3.585	1.568	0.638	PACKER
0211	001	002.131-002.131	2.131	2.131	2.131	0.000	0.000	PACKER SERVICEMAN
0213	002	001.638-001.638	1.638	1.638	1.638	0.000	0.000	FORK LIFT OPERATOR/TON MOTOR OPER.
AREA 02	020	030.384-000.546	2.821	2.770		1.287	0.288	
0302	001	003.033-003.033	3.033	3.033	3.033	0.000	0.000	REPAIRMAN'S HELPER
0334	001	001.469-001.469	1.469	1.469	1.469	0.000	0.000	MAINTENANCE MECHANIC
AREA 03	002	003.033-001.469	2.551	2.551		1.530	1.082	
PLANT TOTAL	033	024.530-000.546	5.813	3.579		6.009	1.046	

END OF REPORT

GOUVERNEUR TALC CO.

GOUVERNEUR, N.Y.

DATE OF STUDY 11/01/75 - 11/07/75

AGENT STUDIED: SILICA

SIC CODE: 1499 COUNTY(S): LAWRENCE

7. SAMPLING PROCEDURES

SAMPLING METHOD	ANALYTICAL TECH.	
GRAVIMETRIC	XRAYDIFFRACTION	RESPIRABLE MASS SAMPLES ARE COLLECTED ON MSA POLY-VINYL CHLORIDE FILTERS(5.00M PORE SIZE) AT A FLOW RATE OF 1.7 LITER PER MINUTE, NYLON CYCLONES(10MM) ARE USED FOR SIZE SEPARATION. FREE SILICA DETERMINATIONS ARE MADE USING QUANTITATIVE X-RAY DIFFRACTION AND SILICA CONCENTRATIONS REPORTED AS MG/M3.

...E B. INDIVIDUAL SAMPLE RESULTS

...: SILICA
...PLE METHOD/ANALYTICAL TECHNIQUE: GRAVIMETRIC /RESPIRABLE FRACTION

...	SHIFT	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME MJ	CONC.
0103	1H	1008	11/06/75	0455	1455	0.8159	0.025
...E WEIGHTED AVE.= 0.025							
0103	1J	1024	11/06/75	0658	1456	0.8143	0.024
...E WEIGHTED AVE.= 0.024							
0103	1G	1020	11/06/75	0703	1455	0.8023	0.012
...E WEIGHTED AVE.= 0.012							
0104	1A	1009	11/06/75	0653	1459	0.8261	0.012
...E WEIGHTED AVE.= 0.012							
0104	1E	1358	11/06/75	0659	1455	0.8091	0.012
...E WEIGHTED AVE.= 0.012							
0104	1F	1003	11/06/75	0704	1455	0.8000	0.012
...E WEIGHTED AVE.= 0.012							
0105	1F	1021	11/06/75	0659	1459	0.8159	0.012
...E WEIGHTED AVE.= 0.012							
0105	1J	1023	11/06/75	0700	1455	0.8074	0.000
...E WEIGHTED AVE.= 0.000							
0106	1C	1645	11/06/75	0656	1405	0.7292	0.000
...E WEIGHTED AVE.= 0.000							
0106	1G	1019	11/05/75	1200	1300	0.6833	0.028
...E WEIGHTED AVE.= 0.028							
0106	1B	1037	11/06/75	0700	1415	0.1919	0.000
0201	1D	1049	11/04/75	0719	1420	0.7156	0.014
...E WEIGHTED AVE.= 0.014							
0201	2A	1006	11/05/75	1513	2238	0.7568	0.013
...E WEIGHTED AVE.= 0.013							

UNITS

MG/M3 CLEANED UP AND PERFORMED DUTIES AS A TRAMMER.
PUMP TURNED OFF BETWEEN 11146 AND 12140

MG/M3 MOVED TO 700 LEVEL AT 8130

MG/M3

MG/M3 PUMP TURNED OFF BETWEEN 11136 AND 12140.
DRAGGING TO 700 FOOT LEVEL. LUNCH TAKEN 11136 TO 12[illegible]

MG/M3 SCRAPRED DOWN TO 700 FOOT LEVEL.
PUMP TURNED OFF BETWEEN 11130 AND 12140

MG/M3

MG/M3

MG/M3

MG/M3

MG/M3

MG/M3 X RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES

MG/M3

MG/M3

B. INDIVIDUAL SAMPLE RESULTS

TE SILICA
LE METHOD/ANALYTICAL TECHNIQUE: GRAVIMETRIC /XRAY DIFFRACTION

SHIFT HRS.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME M3	CONC.	UNITS	
15	1019	11/04/75	0731	1430	0.7122	0.014	MG/M3	GENERAL LABOREN
WEIGHTED AVE.=	0.014							
13	1042	11/04/75	0719	1425	0.7241	0.028	MG/M3	
WEIGHTED AVE.=	0.028							
21	1040	11/03/75	1438	2236	0.8159	0.012	MG/M3	
WEIGHTED AVE.=	0.012							
12	1001	11/04/75	0708	1425	0.8159	0.000	MG/M3	X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES
23	1059	11/03/75	1446	2237	0.8006	0.012	MG/M3	
WEIGHTED AVE.=	0.012							
11	1056	11/04/75	0707	1430	0.8006	0.000	MG/M3	X RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES
22	1029	11/03/75	1444	2236	0.8023	0.012	MG/M3	
WEIGHTED AVE.=	0.012							
1E	1045	11/04/75	0740	1417	0.6748	0.015	MG/M3	
WEIGHTED AVE.=	0.015							
16	1031	11/04/75	0743	1420	0.6748	0.000	MG/M3	
WEIGHTED AVE.=	0.000							
16	1039	11/04/75	0745	1421	0.6748	0.000	MG/M3	X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES
17	1044	11/04/75	0711	1427	0.7411	0.000	MG/M3	
WEIGHTED AVE.=	0.000							
18	1059	11/04/75	0711	1426	0.7411	0.000	MG/M3	X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES
19	1049	11/04/75	0719	1429	0.7598	0.014	MG/M3	
WEIGHTED AVE.=	0.014							
27	1072	11/03/75	1520	2248	0.7015	0.013	MG/M3	
WEIGHTED AVE.=	0.013							
28	1045	11/03/75	1525	2253	0.7598	0.013	MG/M3	
WEIGHTED AVE.=	0.013							
20	1030	11/03/75	1520	2250	0.7049	0.013	MG/M3	
WEIGHTED AVE.=	0.013							

E B. INDIVIDUAL SAMPLE RESULTS

NT: SILICA
PLE METHOD/ANALYTICAL TECHNIQUE: GRAVIMETRIC /XRAYDIFFRACTION

E	SHIFT MAN HD.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME M3	CONC.	UNITS	
1	1A	1427	11/04/75	0730	1428	0.7105	0.000	MG/M3	
	WEIGHTED AVE.= 0.000								
1	2A	1457	11/03/75	1535	2252	0.7598	0.013	MG/M3	
	WEIGHTED AVE.= 0.013								
2	1I	1400	11/04/75	0810	1428	0.6425	0.016	MG/M3	
	WEIGHTED AVE.= 0.016								
2	2S	1477	11/03/75	1521	2300	0.7002	0.013	MG/M3	
	WEIGHTED AVE.= 0.013								
3	1D	1359	11/04/75	0737	1424	0.7002	0.000	MG/M3	X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES
3	1D	1443	11/04/75	0715	1424	0.7002	0.000	MG/M3	
3	2A	1432	11/03/75	1524	2247	0.7530	0.000	MG/M3	
	WEIGHTED AVE.= 0.000								
4	1C	1428	11/04/75	0737	1429	0.7003	0.000	MG/M3	
	WEIGHTED AVE.= 0.000								
20	1A	1436	11/04/75	0755	1413	0.6425	0.016	MG/M3	
	WEIGHTED AVE.= 0.016								
501	1I	1453	11/06/75	0654	1455	0.6425	0.000	MG/M3	X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES
502	1I	1435	11/06/75	0655	1455	0.8159	0.000	MG/M3	
	WEIGHTED AVE.= 0.000								
504	1S	1448	11/06/75	0701	1455	0.8057	0.000	MG/M3	WORKING ATSHAFT STATION
	WEIGHTED AVE.= 0.000								
401	1B	1405	11/07/75	0715	1327	0.6323	0.016	MG/M3	
	WEIGHTED AVE.= 0.016								
401	1D	1300	11/07/75	0723	1325	0.6153	0.065	MG/M3	
	WEIGHTED AVE.= 0.065								
402	1G	1450	11/07/75	0729	1330	0.6153	0.000	MG/M3	X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES
402	1H	1470	11/07/75	0746	1300	0.5537	0.000	MG/M3	
	WEIGHTED AVE.= 0.000								

E.8. INDIVIDUAL SAMPLE RESULTS

SITE SILICA
PLE [illegible]/PARALLEL TECHNIQUE GRAVIMETRIC /XRAYDIFFRACTION

E	SAMPLE No.	SAMPLE No.	DATE	TIME ON	TIME OFF	VOLUME M3	CONC.	UNITS
3	1A	1044	11/07/75	0712	1324	0.6323	0.000	MG/M3
	WEIGHTED AVE.=	0.000						
5	1B	1044	11/07/75	0725	1331	0.6221	0.016	MG/M3
	WEIGHTED AVE.=	0.016						
8	1C	1046	11/07/75	0718	1325	0.6238	0.000	MG/M3
	WEIGHTED AVE.=	0.000						
0	1D	1A02	11/08/75	0707	1427	0.7479	0.013	MG/M3
	WEIGHTED AVE.=	0.013						
1	1E	1073	11/07/75	0727	1327	0.6119	0.016	MG/M3
	WEIGHTED AVE.=	0.016						

SAMPLE WAS DELETED FROM THE STATISTICAL RESULTS(TABLE4) AND THE TIME WEIGHTED AVERAGES

LE 9. STATISTICS

SILICA
MPLE METHOD/ANALYTICAL TECHNIQUES GRAVIMETRIC /XRAYDIFFRACTION

JOB CODE	NO. OF SAMPLES	RANGE MG/M3 (MIN-MAX)	MEAN MG/M3	MEDIAN MG/M3	T.W.A. AVE.	STANDARD DEVIATION
0103	003	000.025-000.012	0.020	0.024	0.020	0.007
0104	003	000.012-000.012	0.012	0.012	0.012	0.000
0105	002	000.012-000.000	0.006	0.006	0.006	0.008
0106	002	000.028-000.000	0.014	0.014	0.014	---
AREA						
01	010	000.038-000.000	0.013	0.012		0.009
0203	002	000.014-000.013	0.014	0.014	0.013	0.000
0203	001	000.014-000.014	0.014	0.014	0.014	0.000
0204	002	000.020-000.012	0.020	0.020	0.020	0.011
0206	001	000.012-000.012	0.012	0.012	0.012	0.000
0208	001	000.012-000.012	0.012	0.012	0.012	0.000
0209	007	000.015-000.000	0.010	0.013	0.010	0.007
0211	002	000.013-000.000	0.007	0.007	0.007	0.009
0212	002	000.015-000.013	0.015	0.015	0.014	0.002
0213	001	000.000-000.000	0.000	0.000	0.000	0.000
0214	001	000.000-000.000	0.000	0.000	0.000	0.000
0220	001	000.016-000.016	0.016	0.016	0.016	0.000
AREA						
02	021	000.024-000.000	0.011	0.013		0.007
0302	001	000.000-000.000	0.000	0.000	0.000	0.000
0304	001	000.000-000.000	0.000	0.000	0.000	0.000
AREA						
03	002	000.000-000.000	0.000	0.000		0.000
0401	002	000.065-000.016	0.041	0.041	0.040	0.035
0402	001	000.000-000.000	0.000	0.000	0.000	0.000
0403	001	000.000-000.000	0.000	0.000	0.000	0.000
0405	001	000.016-000.016	0.016	0.016	0.016	0.000
0406	001	000.000-000.000	0.000	0.000	0.000	0.000
0410	001	000.013-000.013	0.013	0.013	0.013	0.000
0411	001	000.016-000.016	0.016	0.016	0.016	0.000
AREA						
04	008	000.065-000.000	0.016	0.015		0.021
PLANT TOTAL						
	041	000.038-000.000	0.013	0.013		0.031

END OF REPORT

STANDARD ERROR	JOB TITLE
0.004	TRAMMER
0.000	SCRAPPER MAN
0.006	UNDERGROUND LABORER
----	DRILLER
0.019	
0.000	MILL FOREMAN
0.000	GENERAL LABORER
0.008	CRUSHER OPERATOR
0.000	HARDINGE OPERATOR
0.000	WHEELER OPERATOR
0.002	PACKER
0.006	PACKER SERVICEMAN
0.001	PACKHOUSE FOREMAN
0.000	FORK LIFT OPERATOR/TOM MOTOR-OPER.
0.000	CAR LINER
0.000	BULK CAR LOADER
0.002	
0.000	REPAIRMAN'S HELPER
0.000	MAINTENANCE MECHANIC
0.000	
0.024	MILLWRIGHT
0.000	INSTRUMENT REPAIRMAN
0.000	MACHINIST
0.000	MILLWRIGHT HELPER
0.000	SHEET METAL WORKER
0.000	OILER
0.000	WELDER
0.007	
0.005	

GOUVERNEUR TALC CO.

GOUVERNEUR, N.Y.

DATE OF STUDY: 11/03/75 - 11/07/75

AGENT STUDIED: ASBESTOS

SIC CODE: 1499

COUNTYIST. LAWRENCE

10. SAMPLING PROCEDURES

	SAMPLING METHOD	ANALYTICAL TECH.
STUB	FIBER COUNT	OPTICAL MICRO.
STUB	FIBER COUNT	ELECTON MICRO.

AIRBONE FIBERS ARE COLLECTED ON MILLIPORE TYPE AA MEMBRANE FILTERS AT A FLOW OF 1.7 LITERS PER MINUTE. FIBERS GREATER THAN 5 MICROMETERS IN LENGTH ARE COUNTED WITH PHASE CONTRAST MICROSCOPY AT 430X AS DESCRIBED IN NIOSH CRITERIA DOCUMENT FOR ASBESTOS (1972).

AIRBORNE FIBERS ARE COLLECTED ON MILLIPORE TYPE AA MEMBRANE FILTERS AT A FLOW OF 1.7 LITERS PER MINUTE. SAMPLES ARE MOUNTED ON 200 MESH(CARBON COATED) COPPER GRIDS USING THE JAFFE METHOD WITH ACETONE. ASBESTOS FIBERS ARE IDENTIFIED USING SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE XRAY ANALYSIS. ASBESTOS FIBERS ARE COUNTED AND SIZED USING THE GRID OPENING TO DEFINE THE COUNTING FIELD AND CALIBRATED MARKS ON THE MICROSCOPE SCREEN FOR FIBER SIZING.

E II. INDIVIDUAL SAMPLE RESULTS

ATE ASBESTOS
E METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL

E	SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS
2	11	G198	11/05/75	0936	1025	85.3000
2	11	G220	11/05/75	1025	1149	85.3000
2	11	G221	11/05/75	0652	0805	124.1000
2	11	G225	11/05/75	0805	0936	154.7000
2	11	G201	11/05/75	1259	1415	129.2000
E	WEIGHTED AVE.=	9.792				
3	1A	G155	11/05/75	1250	1403	124.1000
3	1A	G218	11/05/75	1112	1144	54.4000
3	1A	G220	11/05/75	0846	1112	248.2000
3	1A	G236	11/05/75	0700	0846	180.2000
E	WEIGHTED AVE.=	0.007				
3	1D	G189	11/05/75	1300	1455	127.5000
3	1D	G190	11/05/75	1144	1300	197.2000
3	1D	G195	11/05/75	1041	1144	107.1000
3	1D	G196	11/05/75	0859	1041	173.4000
3	1D	G232	11/05/75	0703	0859	197.2000
E	WEIGHTED AVE.=	5.870				
3	1E	G199	11/05/75	0900	1045	178.5000
3	1E	G211	11/05/75	1045	1151	112.2000
3	1E	G217	11/05/75	1151	1455	312.8000

MICRO, CONC,	UNITS	
14,673	FB/CC	700 FOOT CRUSHERMAN
0,000	FB/CC	1100 FT CRUSHER, TOO HIGH TO COUNT,
7,714	FB/CC	3 CHARGES SET OFF,DRILLED AND WORKED CRUSHER-DUSTY,
8,874	FB/CC	WORKING CRUSHER & DRILLING,80-90% AT CRUSHER,
9,740	FB/CC	20 MIN IN BREAK ROOM,
2,571	FB/CC	
9,625	FB/CC	
2,863	FB/CC	
5,079	FB/CC	
3,387	FB/CC	
3,511	FB/CC	TRAMMING 23 SLOPE TOOK LUNCH BREAK 1130-1215
8,096	FB/CC	
8,299	FB/CC	
6,504	FB/CC	TRAMMING #23 STOPE,
5,836	FB/CC	
10,787	FB/CC	TRAMMING 23 STOPE,
2,300	FB/CC	TRAMMING STOPE 23,TOOK 45 MIN LUNCH BREAK,

E II. ADDITIONAL SAMPLE RESULTS

TE ASBESTOS
PLE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL

SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS
03	11	G230	11/05/75	0704	0900	197.2000
E WEIGHTED AVE.= 0.000						
03	12	G214	11/05/75	0836	1021	170.5000
03	12	G219	11/05/75	1021	1141	156.0000
03	12	G222	11/05/75	0653	0836	175.1000
E WEIGHTED AVE.= 7.005						
03	17	G156	11/05/75	1240	1455	229.5000
03	17	G207	11/05/75	1019	1100	69.7000
103	17	G226	11/05/75	0659	0902	209.1000
103	17	G228	11/05/75	0902	1019	130.9000
E WEIGHTED AVE.= 4.014						
103	19	G109	11/05/75	1325	1415	85.0000
103	19	G193	11/05/75	0832	1022	187.0000
103	19	G213	11/05/75	1102	1245	73.1000
103	19	G237	11/05/75	0700	0832	156.4000
0103	19	G242	11/05/75	1022	1102	68.0000
E WEIGHTED AVE.= 7.000						
0105	16	G198	11/05/75	1340	1457	130.9000
0105	16	G240	11/05/75	0917	1040	141.1000
0105	16	G209	11/05/75	1040	1240	204.0000
0106	15	G229	11/05/75	0658	0917	236.3000
E WEIGHTED AVE.= 4.412						
0106	18	G200	11/05/75	0940	1415	467.5000

MICRO, CONC,	UNITS	
2,814	FB/CC	TRAMMER #23 STOPE,
8,703	FB/CC	DRAGGING ORE, SMALL CAVERN 700FT,
10,626	FB/CC	
3,748	FB/CC	
2,672	FB/CC	
14,599	FB/CC	
4,319	FB/CC	DRAGGING ROCK DOWN FROM 500FT LEVEL, LARGE CAVERN,
3,174	FB/CC	
4,209	FB/CC	SPENT 20 MIN IN BREAK ROOM,
9,724	FB/CC	
11,037	FB/CC	
4,697	FB/CC	DRAGGING ORE, SMALL CAVERN 700FT LEVEL,
11,157	FB/CC	
4,644	FB/CC	
6,828	FB/CC	
4,722	FB/CC	TOOK 45 MIN LUNCH BREAK,
2,574	FB/CC	DRILLER, #23 STOPE
0,876	FB/CC	TOOK LUNCH BREAK FOR 45 MIN, SPENT AFTERNOON IN LUNCH

II. INDIVIDUAL SAMPLE RESULTS

TI ASBESTOS
LE METALOGRAPHICAL TECHNIQUES FIBER COUNT /OPTICAL MICRO.

SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
14	G240	11/05/75	0659	0900	467.5000	0.000
WEIGHTED AVE = 0.876						
15	G208	11/05/75	0901	1004	107.1000	8.377
15	G215	11/05/75	1004	1100	95.2000	18.152
15	G223	11/05/75	1200	1415	161.5000	5.965
15	G233	11/05/75	1104	1240	165.2000	11.068
15	G235	11/05/75	0656	0901	212.5000	7.735
WEIGHTED AVE.= 9.518						
13	G122	11/04/75	1205	1300	93.5000	16.035
WEIGHTED AVE.= 16.035						
14	G61	11/04/75	0719	0839	136.0000	3.630
14	G76	11/04/75	0839	1046	215.9000	2.371
14	G99	11/04/75	1046	1205	134.3000	7.532
14	G143	11/04/75	1300	1420	136.0000	4.693
WEIGHTED AVE.= 4.206						
24	G04	11/03/75	1515	1755	275.4000	5.816
24	G42	11/03/75	1755	1959	210.8000	5.284
24	G43	11/03/75	1959	2129	153.0000	3.306
24	G52	11/03/75	2129	2238	117.3000	3.703
WEIGHTED AVE.= 4.432						
14	G110	11/04/75	1047	1155	117.3000	0.000
15	G08	11/04/75	0731	0840	117.3000	13.293
15	G69	11/04/75	0840	0945	110.5000	5.473

UNITS

AREA.

FB/CC

TOO HIGH TO COUNT.

FB/CC

FB/CC

FB/CC

FB/CC

HIGH CONCENTRATION, ESTIMATED COUNT ONLY.

FB/CC

FB/CC

FB/CC

USUALLY MOVES AROUND OUTSIDE WEARS RESPIRATOR ALMOST ALL THE TIME

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC Too HIGH TO COUNT

FB/CC

CONSTANTLY MOVING THROUGHOUT THE AREA WEARS RESPIRATO R ALL OF THE TIME

FB/CC

LE II. INDIVIDUAL SAMPLE RESULTS

...11 ASBESTOS
...PLE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO.

...	SHIFT	SAMPLE	DATE	TIME	TIME	VOLUME	CONC.
...E	MAN NO.	NO.		ON	OFF	LITERS	
...03	15	G98	11/04/75	0945	1047	105.4000	5.941
...03	15	G136	11/04/75	1155	1335	170.0000	1.507
...03	15	G146	11/04/75	1335	1430	93.5000	2.927
...E WEIGHTED AVE.= 5.554							
...04	14	G190	11/07/75	0746	0905	134.3000	1.686
...E WEIGHTED AVE.= 1.686							
...04	13	G115	11/04/75	1040	1150	119.0000	4.776
...E WEIGHTED AVE.= 4.776							
...04	13	G56	11/04/75	0719	0826	113.9000	7.612
204	13	G77	11/04/75	0826	0945	134.3000	3.848
204	13	G103	11/04/75	0945	1040	93.5000	8.372
204	13	G118	11/04/75	1150	1255	110.5000	8.664
204	13	G139	11/04/75	1255	1345	85.0000	11.617
204	13	G145	11/04/75	1350	1425	59.5000	11.030
...E WEIGHTED AVE.= 7.990							
204	18	G63	11/04/75	0711	0827	129.2000	9.367
...E WEIGHTED AVE.= 9.367							
0204	21	G01	11/03/75	1038	1655	232.9000	1.865
0204	21	G24	11/03/75	1655	1752	96.9000	2.368
0204	21	G26	11/03/75	1752	1852	102.0000	4.632
0204	21	G38	11/03/75	1852	1958	112.2000	2.168

UNITS

FB/CC
TOO HIGH TO COUNT

FB/CC
WORKED OUTSIDE MOVING RUSTY PIPE FOR 05 MIN.

FB/CC
OUTSIDE WORKING

FB/CC

FB/CC

FB/CC
1 RUN TO SWEEP AND BRUSH UP FOR 10 MIN.USUALLY STAYS INSIDE WEARS RESPIRATOR MOST OF THE TIME

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC
15 MIN BREAK.

FB/CC
MADE 6 CHECKS ON MACHINERY.AFTER 1900 WILL BE MAKING SAMPLE RUNS IN ADDITION TO CHECKING MACHINERY.

FB/CC
4 RUNS TO CHECK MACHINERY,6 MIN.

FB/CC
1 RUN TO DISENGAGE BY HAMMERING,HEAVY EXPOSURE,2 RUNS TO CHECK MACHINERY,8MIN.

FB/CC
5 RUNS,10 MIN.

E II. INDIVIDUAL SAMPLE RESULTS

SZI ASBESTOS
PLE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO.

E	SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
04	21	G45	11/03/75	1958	2059	103.7000	1.935
05	21	G51	11/03/75	2059	2154	93.5000	5.913
04	21	G54	11/03/75	2154	2236	71.4000	2.607
E	WEIGHTED AVE.=	2.650					
06	11	G114	11/04/75	1055	1200	110.5000	6.593
E	WEIGHTED AVE.=	6.593					
06	12	G58	11/04/75	0708	0841	158.1000	11.197
06	12	G74	11/04/75	0841	0946	110.5000	13.622
206	12	G101	11/04/75	0946	1055	117.3000	8.932
206	12	G126	11/04/75	1200	1255	93.5000	8.822
206	12	G142	11/04/75	1255	1345	85.0000	16.930
206	12	G152	11/04/75	1345	1425	68.0000	26.829
E	WEIGHTED AVE.=	13.301					
206	23	G93	11/03/75	1046	1648	207.4000	1.725
206	23	G22	11/03/75	1648	1748	102.0000	5.527
206	23	G27	11/03/75	1748	1850	105.4000	3.570
206	23	G40	11/03/75	1850	2005	127.5000	2.891
206	23	G48	11/03/75	2005	2105	102.0000	6.233
206	23	G50	11/03/75	2105	2155	85.0000	5.962

UNITS

FB/CC
5 RUNS,6 MIN.

FB/CC
1 RUN TO CLEAN UP PER SHIFT,2 SAMPLE RUNS PER SHIFT.

FB/CC
MADE 3 RUNS,10 MIN.

FB/CC

FB/CC
1 SAMPLE RUN PER HR TAKES CARE OF SPILLS TOO USUALLY STAYS OUTSIDE-WEARS RESPIRATOR-DONE OF THE TIME

FB/CC
---BLEW HIMSELF-OFF-WITH-AIR-GUN

FB/CC

FB/CC
BLEW HIMSELF OFF WITH AIR GUN.

FB/CC

FB/CC

FB/CC
2 SAMPLE RUNS,FOR 5 MIN,1 RUN PER HR,ALSO CLEANS UP 2 PILLS,ACCOUNTS FOR 2 TO 3 HRS OF TOTAL SHIFT WORK.

FB/CC
3 SAMPLE RUNS,5 MIN.

FB/CC
2 SAMPLES RUN ,3 MIN

FB/CC
2 SAMPLE RUNS,1 CLEAN UP,TOOK 15 MIN.

FB/CC
1 RUN TO SWEEP UP PER SHIFT,2 SAMPLE RUNS,15 MIN.

FB/CC
2 SAMPLE RUNS,10 MIN

E II. INDIVIDUAL SAMPLE RESULTS

ANT: ASBESTOS
PLE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO.

SITE	SHIFT	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
10	21	G55	11/03/75	2155	2237	71.4000	3.469
E WEIGHTED AVE.= 3.017							
0A	1?	G121	11/04/75	1040	1145	110.5000	5.394
E WEIGHTED AVE.= 5.394							
08	11	G57	11/04/75	0707	0820	124.1000	14.070
08	11	G75	11/04/75	0820	0930	119.0000	7.084
08	11	G100	11/04/75	0930	1040	119.0000	5.060
08	11	G125	11/04/75	1145	1220	59.5000	29.144
08	11	G144	11/04/75	1220	1330	119.0000	6.831
08	11	G148	11/04/75	1330	1408	64.6000	23.115
08	11	G159	11/04/75	1408	1430	37.4000	15.639
E WEIGHTED AVE.= 12.104							
08	22	G02	11/03/75	1408	1649	212.5000	5.979
0A	22	G23	11/03/75	1649	1749	102.0000	8.441
09	22	G25	11/03/75	1749	1848	100.3000	2.610
08	22	G29	11/03/75	2008	2108	102.0000	3.472
06	22	G39	11/03/75	1848	2008	136.0000	5.844
05	22	G53	11/03/75	2155	2236	69.7000	6.170
E WEIGHTED AVE.= 5.498							
0209	1E	G71	11/04/75	0760	0922	173.4000	4.722

UNITS

FB/CC
3 SAMPLE RUNS,5 MIN,

FB/CC

FB/CC
1 CLEANUP OF SPILL 1 SWEEP UP 1 SAMPLE RUN OUTSIDE
MOST ALL OF THE TIMEWEARS RESPIRATOR MOST OF THE TIME

FB/CC
1 RUN TO CLEAN UP SPILL,DURING SAMPLE PERIOD,

FB/CC

FB/CC
USED AIR GUN ON EQUIPMENT,HEAVY EXPOSURE

FB/CC

FB/CC

FB/CC

FB/CC
MADE 2 SAMPLE RUNS 1 RUN PER HOUR

FB/CC
3 SAMPLE RUNS,8 MIN

FB/CC
1 SAMPLE RUN,3 MIN,

FB/CC
1 RUN TO CLEAN UP,BLOWS THE MILLS WITH AIR GUN,ONE TI
ME PER SHIFT,2 SAMPLE RUNS,15 MIN,

FB/CC
2 SAMPLE RUNS,5 MIN,

FB/CC
2 SAMPLE RUNS,5 MIN,

FB/CC
WEARING RESPIRATOR,

BLE II. INDIVIDUAL SAMPLE RESULTS

ASBESTOS
SAMPLE METHOD: ANALYTICAL TECHNIQUES: FIBER COUNT / OPTICAL MICRO.

SITE TYPE	SUBJECT NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
209	1E	G97	11/04/75	0922	1031	117.3000	5.800
209	1E	G105	11/04/75	1031	1235	207.4000	4.268
SE WEIGHTED AVE.= 4.787							
209	1F	G97	11/04/75	0743	0909	146.2000	4.118
209	1F	G109	11/04/75	1235	1420	178.5000	5.195
209	1F	G109	11/04/75	1029	1235	214.2000	20.111
209	1F	G111	11/04/75	0909	1029	136.0000	5.091
209	1F	G127	11/04/75	1233	1417	176.8000	7.186
SE WEIGHTED AVE.= 9.158							
209	1G	G72	11/04/75	0745	0914	151.3000	6.208
209	1G	G110	11/04/75	1030	1145	127.5000	7.414
209	1G	G112	11/04/75	0914	1030	129.2000	5.453
209	1G	G120	11/04/75	1232	1421	185.3000	3.574
209	1G	G141	11/04/75	1145	1232	79.9000	8.968
SE WEIGHTED AVE.= 5.898							
209	1J	G59	11/04/75	0711	0811	102.0000	8.087
209	1J	G80	11/04/75	0911	1011	102.0000	9.681
209	1J	G87	11/04/75	1011	1111	102.0000	13.872
209	1J	G93	11/04/75	0811	0911	102.0000	7.733
209	1J	G124	11/04/75	1111	1230	134.3000	5.066
209	1J	G151	11/04/75	1230	1330	102.0000	7.202
209	1J	G163	11/04/75	1330	1427	96.9000	4.930
SE WEIGHTED AVE.= 7.922							

UNITS

FB/CC

FB/CC CHANGED FROM NYTAL 100 TO CERAHATAL HPT AT 11115,TOOK 30 MIN LUNCH BREAK.

FB/CC HEARING RESPIRATOR

FB/CC

FB/CC CHANGED FROM NYTAL 100 TO CERAHATALC HDTAT 11115,TOOK 30 MIN LUNCH BREAK.

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC TOOK 30 MIN LUNCH BREAK.

FB/CC 15 MIN BREAK AT 8:15,45 MIN LUNCH AT 11:45.

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

II. INDIVIDUAL SAMPLE RESULTS

[illegible] ASBESTOS
PLE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO,

SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
10	G49	11/04/75	1027	1136	117,3000	9,291
14	G35	11/04/75	0929	1027	98,6000	9,038
15	G46	11/04/75	0827	1027	204,0000	1,181
12	G130	11/04/75	1240	1340	102,0000	7,792
13	G133	11/04/75	1136	1240	108,8000	6,088
18	G157	11/04/75	1340	1426	78,2000	9,394
WEIGHTED AVE.=	6,220					
19	G60	11/04/75	0714	0811	96,9000	6,649
19	G61	11/04/75	0918	1014	102,0000	3,011
19	G90	11/04/75	1014	1114	102,0000	6,434
19	G92	11/04/75	0812	0914	105,4000	3,808
19	G123	11/04/75	1114	1237	141,1000	5,334
19	G129	11/04/75	1237	1337	102,0000	5,903
19	G153	11/04/75	1337	1429	88,4000	12,941
WEIGHTED AVE.=	6,110					
24	G68	11/03/75	1520	1047	1983,9000	0,202
WEIGHTED AVE.=	0,202					
27	G19	11/03/75	1647	1906	236,3000	4,306
27	G35	11/03/75	1906	2016	119,0000	6,780
27	G44	11/03/75	2141	2248	113,9000	3,420
27	G47	11/03/75	2016	2141	144,5000	3,237
WEIGHTED AVE.=	4,370					
28	G48	11/03/75	1526	1648	139,4000	2,400
28	G12	11/03/75	1648	1856	217,6000	7,499

UNITS

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

15 MIN BREAK, 45 MIN LUNCH

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

TOOK COFFEE-BREAK.

FB/CC

FB/CC

FB/CC

TOOK 15 MIN COFFEE BREAK.

FB/CC

BAG BURST AT 1600 HRS.

FB/CC

E II. INDIVIDUAL SAMPLE RESULTS

ASBESTOS
PCM/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO.

SET	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
28	G33	11/03/75	2130	2229	100.5000	15.908
28	G36	11/03/75	2005	2130	144.5000	10.063
28	G37	11/03/75	2229	2253	40.8000	20.956
WEIGHTED AVE.= 9.136						
29	G07	11/03/75	1520	1647	147.9000	3.016
29	G13	11/03/75	1645	1904	236.3000	6.013
29	G15	11/03/75	1904	2012	115.6000	6.354
29	G28	11/03/75	2144	2250	112.2000	6.037
29	G46	11/03/75	2012	2144	156.4000	3.080
WEIGHTED AVE.= 4.894						
1R	G66	11/04/75	0730	0832	105.4000	5.713
1R	G85	11/04/75	0433	1033	612.0000	1.604
1R	G86	11/04/75	1033	1138	110.5000	6.430
1R	G94	11/04/75	0832	0932	102.0000	7.438
1R	G130	11/04/75	1140	1250	85.0000	8.288
1R	G135	11/04/75	1232	1332	102.0000	7.585
1R	G158	11/04/75	1332	1428	95.2000	5.515
WEIGHTED AVE.= 4.171						
2A	G10	11/03/75	1525	1654	151.3000	4.218
2A	G14	11/03/75	1858	2031	158.1000	2.176
2A	G20	11/03/75	1654	1858	210.8000	3.142
2A	G32	11/03/75	2031	2252	239.7000	1.812

UNITS

FB/CC
BAG BURST AT 2225

FB/CC
TOOK 15 MIN COFFEE BREAK, CLEANED HIMSELF WITH COMPRESSED AIR. BAG BURST 2125.

FB/CC

FB/CC

FB/CC
TOOK DINNER BREAK 30 MIN

FB/CC

FB/CC

FB/CC
TOOK 15 MIN. COFFEE BREAK.

FB/CC
15 MIN BREAK.

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC
TOOK DINNER BREAK, 30MIN.

FB/CC
TOOK 15 MIN COFFEE BREAK.

E II. INDIVIDUAL SAMPLE RESULTS

...: ASBESTOS
...LE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT (OPTICAL MICRO...

	SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
E WEIGHTED AVE.= 2.736							
12	11	G78	11/04/75	0810	1007	196.9000	1.911
12	11	G113	11/04/75	1007	1428	443.7000	1.588
WEIGHTED AVE.= 1.688							
12	25	G05	11/03/75	1521	1810	297.5000	1.079
12	25	G16	11/03/75	1816	2030	227.8000	1.859
12	25	G41	11/03/75	2030	2300	255.0000	1.015
E WEIGHTED AVE.= 1.286							
13	14	G05	11/04/75	0715	0830	127.5000	5.478
13	14	G80	11/04/75	0930	1030	102.0000	4.722
13	14	G88	11/04/75	0830	0930	102.0000	5.420
13	14	G91	11/04/75	1030	1137	113.9000	6.284
13	14	G128	11/04/75	1235	1335	102.0000	7.261
13	14	G132	11/04/75	1137	1235	98.6000	4.614
13	14	G147	11/04/75	1335	1420	83.3000	6.592
E WEIGHTED AVE.= 5.750							
13	10	G02	11/04/75	0737	0911	159.8000	3.135
13	10	G83	11/04/75	0911	1101	187.0000	1.146
13	10	G118	11/04/75	1101	1237	163.2000	1.653
13	10	G119	11/04/75	1237	1421	176.8000	2.598
E WEIGHTED AVE.= 2.103							
13	26	G09	11/03/75	1521	1700	168.3000	2.581
13	26	G18	11/03/75	1700	1953	294.1000	3.340

UNITS

FB/CC

FB/CC

TOOK 30 MIN LUNCH BREAK.

FB/CC

WENT TO #3 HILL DURING SAMPLE FOR 10 MIN.

FB/CC

FB/CC

TOOK 15 MIN BREAK.

FB/CC

15 MIN BREAK.

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

CHANGED FROM NYTAL 100 TO CERMATALC HOT AT 1115 TOOK 30 MIN LUNCH BREAK

FB/CC

FB/CC

PACKING NYTAL 200 UNTIL 6:00PM, THEN NYTAL 300.

FB/CC

LE II. INDIVIDUAL SAMPLE RESULTS

ENT ASBESTOS
PLE METHOD/ELECTRICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO.

SITE	SHIFT MAN-HR.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
13	2A	G10	11/03/75	1953	2150	196.9000	3.814
13	2A	G11	11/03/75	2150	2247	96.9000	8.264
E WEIGHTED AVE.=		3.925					
14	1C	G10	11/04/75	0714	0918	176.8000	1.336
14	1C	G102	11/04/75	0918	1044	146.2000	5.350
14	1C	G108	11/04/75	1044	1337	294.1000	2.938
14	1C	G191	11/04/75	1337	1429	88.4000	5.558
E WEIGHTED AVE.=		3.365					
220	1M	G79	11/04/75	0655	0926	154.7000	1.573
220	1M	G92	11/04/75	0926	1245	338.3000	2.367
220	1M	G104	11/04/75	1245	1413	149.6000	1.750
E WEIGHTED AVE.=		2.032					
303	1A	G104	11/05/75	1241	1455	227.8000	4.414
303	1A	G203	11/05/75	1108	1241	158.1000	3.736
303	1A	G227	11/05/75	0701	1108	419.9000	1.195
E WEIGHTED AVE.=		2.004					
304	1A	G234	11/05/75	0655	0904	219.3000	0.763
E WEIGHTED AVE.=		0.783					
304	1C	G205	11/05/75	1110	1457	385.9000	1.447
304	1C	G231	11/05/75	0702	1112	425.0000	1.269
E WEIGHTED AVE.=		1.354					
304	1F	G183	11/05/75	1410	1455	76.5000	3.878

UNITS

TOOK DINNER BREAK.

FB/CC

TOOK 15 MIN COFFEE BREAK.

FB/CC

FB/CC

FB/CC

HAND SWEEPING DUST FROM BROKEN BAGS DURING SURVEY.

FB/CC

TOOK 30 MIN LUNCH BREAK.

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

WORKING AT SHAFT STATION, TOOK LUNCH BREAK FOR 30 MIN.

FB/CC

MAINTENANCE AT SHAFT STATION.

FB/CC

REPAIRING SLUSHER, 4FM RAMP.

FB/CC

TOOK 30 MIN LUNCH BREAK.

FB/CC

MAINTENANCE AT SHAFT STATION.

FB/CC

E II. INDIVIDUAL SAMPLE RESULTS

[illegible]: ASBESTOS
PLE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO.

E	SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
A	1F	G1A7	11/05/75	1324	1010	78.2000	1.063
A	1F	G2A6	11/05/75	1021	1137	129.2000	2.716
A	1F	G2A10	11/05/75	1137	1324	181.9000	2.786
	WEIGHTED AVE.=	2.057					
A	1J	G1A8	11/05/75	1325	1455	153.0000	2.361
A	1J	G1A9	11/05/75	0900	0959	93.5000	2.323
A	1J	G2A1	11/05/75	0959	1147	183.6000	2.454
A	1J	G2A12	11/05/75	1147	1325	166.6000	0.239
A	1J	G2A9	11/05/75	0654	0904	221.0000	1.112
	WEIGHTED AVE.=	1.608					
C	1A	G1A4	11/07/75	1132	1324	190.4000	2.580
C	1A	G1A6	11/07/75	0715	0952	266.9000	0.916
	WEIGHTED AVE.=	1.609					
C	1D	G1A1	11/07/75	1133	1324	266.9000	0.000
C	1D	G2A8	11/07/75	0955	1133	266.9000	0.000
C	1F	G1A3	11/07/75	0723	0955	258.4000	2.348
	WEIGHTED AVE.=	2.348					
C	1G	G1A1	11/07/75	0900	0937	62.9000	3.025
C	1G	G1A2	11/07/75	0729	0900	154.7000	2.912
C	1G	G1A5	11/07/75	0937	1130	192.1000	2.299
C	1G	G1A6	11/07/75	1131	1325	193.8000	1.218
	WEIGHTED AVE.=	2.165					
C	1H	G1A3	11/07/75	1145	1300	127.5000	3.148
C	1H	G1A4	11/07/75	0905	1145	272.0000	4.029

UNITS

FB/CC

FB/CC

FB/CC
MAINT.AT 4FM RAMP.TOOK LUNCH BREAK,45 MIN.

FB/CC

FB/CC

FB/CC

FB/CC
MAINTENANCE AT SLUSHER 4FM RAMP-TOOK LUNCH BREAK-AT 1130-1215

FB/CC
MAINTENANCE REPAIRING SLUSHER 4FM RAMP.

FB/CC

FB/CC

FB/CC
TOO HIGH TO COUNT.

FB/CC
TOO HIGH TO COUNT.

FB/CC

FB/CC

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E II. INDIVIDUAL SAMPLE RESULTS

ASBESTOS
PLE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO.

	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
E WEIGHTED AVE.= 3.748						
03 1A	G165	11/07/75	1133	1324	188.7000	0.542
03 1A	G174	11/07/75	0951	1133	173.4000	0.285
03 1A	G150	11/07/75	0712	0951	270.3000	3.586
E WEIGHTED AVE.= 1.773						
05 1E	G173	11/07/75	1134	1324	270.3000	0.000
05 1E	G177	11/07/75	0725	0954	253.3000	0.677
05 1E	G182	11/07/75	0954	1134	170.0000	0.855
E WEIGHTED AVE.= 3.961						
06 1C	G172	11/07/75	0950	1134	176.8000	2.197
06 1C	G191	11/07/75	0718	0950	258.4000	1.235
06 1C	G192	11/07/75	1135	1324	185.3000	1.913
E WEIGHTED AVE.= 1.712						
10 1G	G64	11/04/75	0707	0958	290.7000	4.453
10 1G	G197	11/04/75	0958	1142	176.8000	4.019
10 1G	G137	11/04/75	1142	1342	204.0000	4.339
10 1G	G147	11/04/75	1342	1427	76.5000	1.656
E WEIGHTED AVE.= 4.033						
11 1F	G150	11/07/75	0727	0957	255.0000	1.574
11 1F	G176	11/07/75	0957	1152	195.5000	3.141
11 1F	G185	11/07/75	1152	1324	156.4000	0.751
E WEIGHTED AVE.= 1.867						

UNITS

FB/CC

FB/CC

FB/CC

FB/CC TOO HIGH TO COUNT.

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC HIGH CONC. ESTIMATED CONC. ONLY

FB/CC

FB/CC WORKER TURNED OFF PUMP DURING 30 MIN FOR LUNCH.

E13. INDIVIDUAL SAMPLE RESULTS

ANT: ASBESTOS
PLE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /ELECTRON MICRO.

SE	SHIFT AND J.D.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
03	10	G194	11/05/75	1144	1340	197.2000	20.152
E	WEIGHTED AVE.= 20.152						
03	17	G156	11/05/75	1240	1455	229.5000	22.563
E	WEIGHTED AVE.= 22.563						
03	19	G149	11/05/75	1325	1415	85.8000	13.223
03	19	G237	11/05/75	0700	0832	156.4000	8.855
E	WEIGHTED AVE.= 10.393						
06	18	G240	11/05/75	0859	0940	273.7000	9.460
E	WEIGHTED AVE.= 9.460						
15	15	G223	11/05/75	1240	1415	161.5000	17.523
E	WEIGHTED AVE.= 17.523						
201	20	G04	11/03/75	1513	1755	275.4000	18.365
201	20	G42	11/03/75	1755	1959	210.8000	33.705
E	WEIGHTED AVE.= 25.016						
203	15	G98	11/04/75	0945	1047	105.4000	36.561
203	15	G146	11/04/75	1335	1430	93.5000	9.016
E	WEIGHTED AVE.= 23.812						
204	13	G17	11/04/75	0836	0945	134.3000	8.967
E	WEIGHTED AVE.= 8.967						
204	21	G19	11/03/75	1852	1958	112.2000	15.563
E	WEIGHTED AVE.= 15.563						
206	12	G101	11/04/75	0946	1055	117.3000	102.662
E	WEIGHTED AVE.=102.662						
206	23	G22	11/03/75	1648	1748	102.0000	33.647
E	WEIGHTED AVE.= 33.647						

UNITS

FB/CC

TRAMMING 23 SLOPE TOOK LUNCH BREAK 1130-1215.

FB/CC

FB/CC

SPENT 20 MIN IN BREAK ROOM.

FB/CC

DRAGGING ORE, SMALL CAVERN 700 FT LEVEL.

FB/CC

TOO HIGH TO COUNT.

FB/CC

FB/CC

FB/CC

FB/CC

TOO HIGH TO COUNT

FB/CC

OUTSIDE WORKING

FB/CC

FB/CC

5 RUNS, 10 MIN.

FB/CC

FB/CC

3 SAMPLE RUNS, 5 MIN.

3. INDIVIDUAL SAMPLE RESULTS

1 ASBESTOS
E METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /ELECTRON MICRO.

SHIFT NUM NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS	
11	G190	11/04/75	1220	1330	119.0000	18.215	FB/CC	
EIGHTED AVE.= 18.215								
22	G002	11/03/75	1004	1649	212.5000	25.501	FB/CC	MADE 2 SAMPLE RUNS 1 RUN PER HOUR
EIGHTED AVE.= 25.501								
14	G96	11/04/75	0827	1027	204.0000	31.877	FB/CC	
EIGHTED AVE.= 31.877								
27	G47	11/03/75	2016	2141	144.5000	41.752	FB/CC	TOOK 15 MIN COFFEE BREAK.
EIGHTED AVE.= 41.752								
14	G45	11/04/75	0833	1033	612.0000	7.280	FB/CC	
EIGHTED AVE.= 7.280								
24	G10	11/03/75	1525	1654	151.3000	26.663	FB/CC	
EIGHTED AVE.= 26.663								
11	G113	11/04/75	1007	1428	443.7000	13.570	FB/CC	TOOK 30 MIN LUNCH BREAK.
EIGHTED AVE.= 13.570								
25	G05	11/03/75	1521	1816	297.5000	16.191	FB/CC	WENT TO #3 MILL DURING SAMPLE FOR 10 MIN.
EIGHTED AVE.= 16.191								
26	G31	11/03/75	2150	2247	96.9000	36.040	FB/CC	
EIGHTED AVE.= 36.040								
13	G197	11/05/75	0904	0959	93.5000	16.743	FB/CC	
EIGHTED AVE.= 16.743								
14	G140	11/07/75	0712	0951	270.3000	24.949	FB/CC	
EIGHTED AVE.= 24.949								
15	G176	11/07/75	0957	1152	195.5000	9.856	FB/CC	
EIGHTED AVE.= 9.856								

PLE WAS DELETED FROM THE STATISTICAL RESULTS(TABLE4) AND THE TIME WEIGHTED AVERAGES

13. STATISTICS

TI ASBESTOS
LE METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /OPTICAL MICRO,

JOB CODE	NO. OF SAMPLES	RANGE FB/CC (MIN-MAX)	MEAN FB/CC	MEDIAN FB/CC	T.W. AVE.	STANDARD DEVIATION	STANDARD ERROR	JOB TITLE
0102	004	014,673-007,714	10,250	9,307	9,792	3,063	1,531	CRUSHER OPERATOR
0103	025	014,599-002,309	6,413	5,079	5,575	3,588	0,709	TRAMMER
0109	005	009,524-000,476	3,929	4,644	3,011	2,275	1,017	DRILLER
0115	005	018,152-005,965	10,259	8,377	9,518	4,778	2,137	CAGEMAN
AREA 01	039	018,152-000,476	6,982	6,504		3,949	0,632	
0201	009	018,055-002,371	5,819	4,673	5,305	4,128	1,376	MILL FOREMAN
0203	005	013,243-001,507	5,818	5,473	5,558	4,533	2,027	GENERAL LABORER
0204	019	011,817-001,046	5,529	4,704	5,074	3,460	0,865	CRUSHER OPERATOR
0206	010	020,824-001,725	8,736	6,413	7,901	6,783	1,802	HANDINGE OPERATOR
0208	013	029,144-002,919	9,918	6,501	8,393	7,838	2,095	WHEELER OPERATOR
0209	004	020,956-000,202	6,892	6,063	5,073	4,174	0,602	PACKER
0211	011	004,240-001,004	4,902	5,515	3,618	2,447	0,738	PACKER SERVICEMAN
0212	005	001,911-001,015	1,490	1,588	1,467	0,424	0,189	PACKHOUSE FOREMAN
0213	015	008,284-001,146	4,460	4,614	3,962	2,096	0,541	FORK LIFT OPERATOR/TON MOTOR-OPER,
0214	004	005,558-001,336	3,197	4,146	3,365	2,026	1,013	CAR LINER
0220	003	002,367-001,573	1,897	1,750	2,032	0,417	0,241	BULK CAR LOADER
AREA 02	144	029,144-000,202	6,327	5,476		4,810	0,401	
0303	003	004,414-001,195	3,115	3,736	2,604	1,697	0,980	BLACKSMITH
0304	012	005,878-000,239	1,868	1,685	1,650	1,046	0,302	MAINTENANCE MECHANIC
AREA 03	015	004,414-000,239	2,117	2,323		1,240	0,320	
0401	003	002,580-000,916	1,947	2,306	1,875	0,901	0,520	MILLWRIGHT
0402	005	004,029-001,218	2,772	2,969	2,807	0,943	0,385	INSTRUMENT REPAIRMAN
0403	003	003,506-000,285	1,871	0,542	1,773	1,836	1,060	MACHINIST
0405	002	008,855-000,677	4,766	4,766	3,961	5,783	4,089	MILLWRIGHT HELPER
0406	003	002,197-001,235	1,782	1,913	1,712	0,494	0,285	SHEET METAL WORKER
0410	004	004,951-001,056	3,617	4,179	4,033	1,320	0,660	OILER
0411	003	003,141-000,751	1,822	1,574	1,867	1,214	0,701	WELDER
AREA 04	024	008,855-000,285	2,571	2,323		1,836	0,375	
PLANT TOTAL	252	029,144-000,202	5,751	4,722		4,536	0,304	

STATISTICS

ASBESTOS
METHOD/ANALYTICAL TECHNIQUE: FIBER COUNT /ELECTRON MICRO.

JOB CODE	NO. OF SAMPLES	RANGE FB/CC (+1-LIM)	MEAN FB/CC	MEDIAN FB/CC	T.M. AVE.	STANDARD DEVIATION	STANDARD ERROR
0103	009	022.503-008.455	16.198	16.688	17.454	6.296	3.148
0106	001	009.460-009.460	9.460	9.460	9.460	0.000	0.000
0115	001	017.523-017.523	17.523	17.523	17.523	0.000	0.000
AREA 01	006	022.503-008.455	15.296	15.373		5.678	2.318
0201	002	035.185-018.385	26.785	26.785	25.016	10.847	7.670
0203	002	038.501-007.016	22.789	22.789	23.612	19.477	13.772
0204	002	015.565-008.967	12.265	12.265	11.969	4.664	3.298
0206	002	102.662-033.647	68.155	68.155	70.562	48.801	34.507
0208	002	025.501-018.215	21.858	21.858	22.886	5.152	3.643
0209	002	041.252-031.077	36.815	36.815	35.972	6.983	4.937
0211	002	026.003-017.240	16.972	16.972	11.122	13.706	9.691
0212	002	018.191-013.570	14.881	14.881	14.622	1.853	1.310
0213	001	036.040-036.040	36.040	36.040	36.040	0.000	0.000
AREA 02	011	102.662-007.280	27.975	25.501		22.124	5.366
0304	001	016.743-016.743	16.743	16.743	16.743	0.000	0.000
AREA 03	001	016.743-016.743	16.743	16.743		0.000	0.000
0403	001	024.949-024.949	24.949	24.949	24.949	0.000	0.000
0411	001	009.856-009.856	9.856	9.856	9.856	0.000	0.000
AREA 04	002	024.949-009.856	17.403	17.403		10.672	7.546
PLANT TOTAL	026	102.662-007.280	23.804	18.290		18.941	3.715

END OF REPORT

JOB TITLE

TRAMMER
DRILLER
CAGEMAN

MILL FOREMAN
GENERAL LABORER
CRUSHER OPERATOR
HARDINGE OPERATOR
WHEELER OPERATOR
PACKER
PACKER SERVICEMAN
PACKHOUSE FOREMAN
FORK LIFT OPERATOR/TOW MOTOR OPER.

MAINTENANCE MECHANIC

MACHINIST
WELDER