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

Balmat, New York

Volume I

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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 $> 5 \mu\text{m}/\text{cc}$ 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 $\mu\text{g}/\text{m}^3$. 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 length.

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.

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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 $[Mg_3 (Si_3O_{10}) (OH)_2]$; 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 identified 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 Corporation 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 5 1/2 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 tiles
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 pecker 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

Underground Mine* - 5 Grades of ore

Underground Jaw Crusher

(Minus 4" Material)

Main Shaft - 6 Ton Skip

Hoisting Capacity - 90 Tons per hour

Surface Gyratory Crusher

(Minus 1" Material)

Belt Conveyor to Mill

Automatic Sampler*

4 Wet Ore Bins - Capacity-90 Tons each

Fine Crushing and Drying Circuit

(Minus 12 Mesh Material)

5 Dry Ore Silos - Capacity-500 Tons Each

Pebble Mill Grinding Circuit*

3 - 10 ft. x 66" Pebble Mills
in closed circuit with 3
Air Separators

Coarsely Ground
Material

Fluid Energy Grinding Circuit*

14 Fluid Energy Mills using
heated compressed air

Finished Product

Finished Product

Total Capacity of Grinding Circuits is 600 Tons per day

Vibrating Screens

(To remove tramp material)

Vibrating Screen

(To remove tramp material)

Low Pressure Air Conveying System

Low Pressure Air Conveying System

Alpine Classifying Circuit*

4 - Mikroplex 800 units

L.P. Air Conveying System

(Note - All finished product silos filled from bottom
for better mixing of silo contents)

6 Finished Product Silos

Capacity - 90 to 400
Tons each

2 Finished Product Silos

Capacity - 400 Tons each

5 Finished Product Silos

Capacity - 70 to 1500
Tons each

Low Pressure Air Conveying Systems

Bag Packing Plant

50 lb. multi wall bags

Box Cars*

Trucks*

Hopper Cars*

for bulk shipments

Track Scales

* = 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 industrial hygienist. Some sampling is conducted by the Plant Safety Director in addition to yearly sampling by the insurance carrier. Air sampling in these operations 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.

STUDY METHODS

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 asbestos-form 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	001
Nytal 400	Houston, Texas 77021	002
5X		003
325		004
X	Paul Crazier Company 1115 Silver St.	005
FT	Houston, Texas 77007	006
3X		007

University of Glasgow. For these analyses, Dr. Bowas 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 for FeO. (10)

AIR SAMPLING AND ANALYSIS

Personal air samples were collected from the breathing zone (miners and millers) 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) preceded by 10 mm nylon cyclone separators. Samples for asbestos fiber analysis were collected on open faced 37 mm diameter 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
Talc 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	SX	X	3X	FT	325
Tremolite McCrone Mt. Sinai	50-60 24	40-50 18	40-50 27	>50-60 50-60	50-60 32	50-60 17	~60 24
Anthrophyllite McCrone Mt. Sinai	Present 2-3	* 4-5	Present 7-9	Present ---	* *	* *	* 5-7
Quartz McCrone Mt. Sinai	0.5-1.0 7-10	2 9-10	~1.5 8-9	<0.5 9-10	0.5-1.0 7-8	** **	~1.5 3-4
Serpentines McCrone Mt. Sinai	10-15 14-18	10-15 14-18	10-12 14-18	~15 26-30	~30 31-35	~20 26-30	10-12 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
Talc Produced at the Gouverneur Talc
Company Number One Mine and Mill.
Samples Obtained From Talc Suppliers

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

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

** Below detection limits by step scanning.

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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			
7121 400	3/1 to 1000/1	8	88	N.D.	4	---
7121 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
2X	5/1 to 100/1	12	67	N.D.	4	16
11	3/1 to 50/1	16	72	N.D.	4	8
125	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

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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	Nyral 100	Ceramatalc HDT	Nyral 200	Nyral 300	Nyral 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
Nyral 100	11/4/75	3	<1	1000	840	5	19	<1
Commercial HDP	11/4/75	2	2	890	1000	6	17	<1
Nyral 200	11/4/75	3	2	970	1300	7	20	<1
Nyral 300	11/3/75	2	3	1000	1700	5	23	<1
Nyral 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 ₂ O ₃	0.38	0.32	0.13	0.13	0.16	0.11	0.13	1.20
Fe ₂ O ₃	0.10	0.13	0.08	0.11	0.08	0.06	0.11	0.38
P ₂ O ₅	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
HgO	28.40	28.78	29.40	29.56	30.20	30.56	29.10	30.54
CaO	9.02	8.53	7.50	7.40	8.15	8.30	8.25	0.46
MgO	0.28	0.44	0.18	0.25	0.38	0.16	0.18	--
K ₂ O	0.10	0.17	0.10	0.10	0.10	0.10	0.13	--
Na ₂ O	0.03	0.03	0.03	0.03	0.03	0.03	0.03	--
H ₂ O	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.M. 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 observed high tremolite content. Other carbonates except traces of calcite are absent or negligible in these talcs as demonstrated by low CO₂ 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 the 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 analysis 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 $> 5 \text{ }\mu\text{m/cc}$ 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 $\mu\text{m}/\text{cc}$ (Optical Microscopy)	Resp. Mass mg/m^3	Impinger mppcf	Free SiO_2 mg/m^3
0102	Crusher Operator	9.8 (4)	--	--	--
0103	Trammer	5.6 (25)	0.64 (3)	10.1 (3)	0.020
0104	Scraper 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 category. 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 $\mu\text{m}/\text{cc}$ (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	Crausher 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 category. 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 $\mu\text{m}/\text{cc}$ (Optical Microscopy)	Resp. Mass mg/m^3	Impinger appcf	Free m
0102	Crusher Operator	9.8 (4)	--	--	--
0103	Trammer	5.6 (25)	0.64 (3)	10.1 (3)	0.0
0104	Scraper Man	--	1.29 (3)	11.8 (5)	0.0
0105	Underground Laborer	--	0.58 (1)	--	0.0
0106	Driller	3.0 (5)	0.98 (3)	00.7 (1)	0.0
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)	0.0
0303	Blacksmith	2.6 (3)	--	--	--
0304	Maintenance Mechanic	1.7 (12)	0.42 (1)	1.5 (1)	0.0

() = Number of samples used for calculation of time-weighted-average values for each job category. 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 categories samples had time-weighted-average exposures exceeding the current OSHA standard of 2.0 fibers > 5 $\mu\text{m}/\text{cc}$ ⁽⁸⁾ and all operations exceeded the OSHA proposed standard of 0.5 fibers > 5 $\mu\text{m}/\text{cc}$.⁽¹²⁾

The following job categories had exposures in excess of the OSHA and MESA allowable ceiling value of 10 fibers > 5 $\mu\text{m}/\text{cc}$:

- (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 length 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% unidentified. 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 μ m 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 μ m were observed for tremolite and anthophyllite, respectively. In the mine, median fiber lengths of 1.6 μ m for tremolite and 1.5 μ m 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			
			Opt. Asbestos*	Total Fibers	All >5µm	Optical >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
G248	0.06	Driller	9.5	14.4	1.3	No con
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	9.5	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	% $\leq 0.5 \mu\text{m}$ in Diameter
<u>One*</u>				
Tremolite (N=83)	0.19	2.3	0.16-0.23	88
Anthophyllite (N=164)	0.13	2.4	0.12-0.15	93
<u>Mill*</u>				
Tremolite (N=160)	0.19	2.4	0.17-0.22	87
Anthophyllite (N=587)	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
Gouverneur Talc Company, Number One Mine and Mill

Operation and Fiber Type	Median Length μm	Geo. Std. Deviation	95% Conf. Interval for Median Length μm	% $\leq 5 \mu\text{m}$ in Length
<u>Mine*</u>				
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
<u>Mill*</u>				
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 μ m whereas 9-10% 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)

ASPECT RATIO (Length to Width)

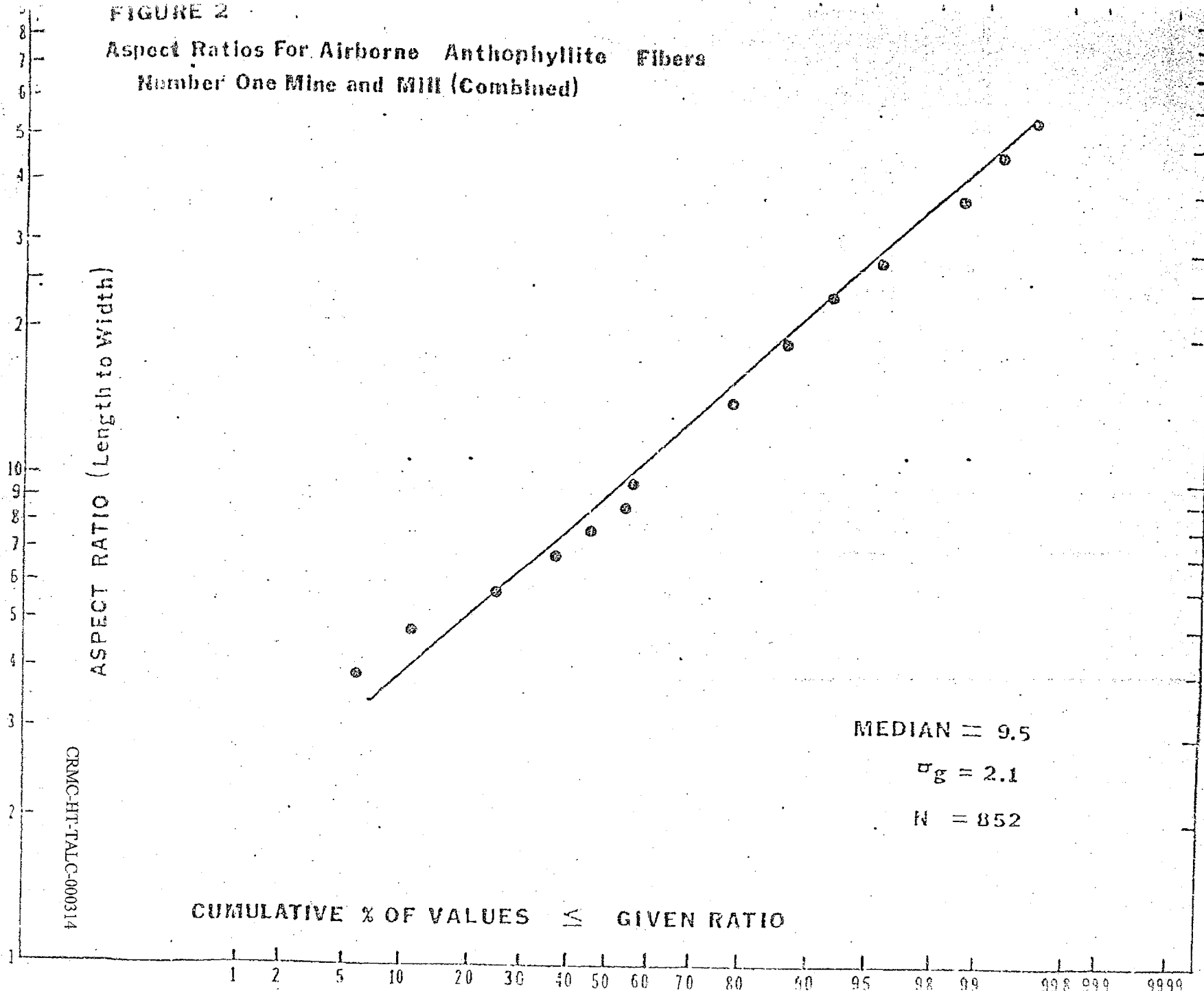
CRMCH-TALC-000314

CUMULATIVE % OF VALUES $\leq$ GIVEN RATIO

MEDIAN = 9.5

$\sigma_g = 2.1$

N = 852



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

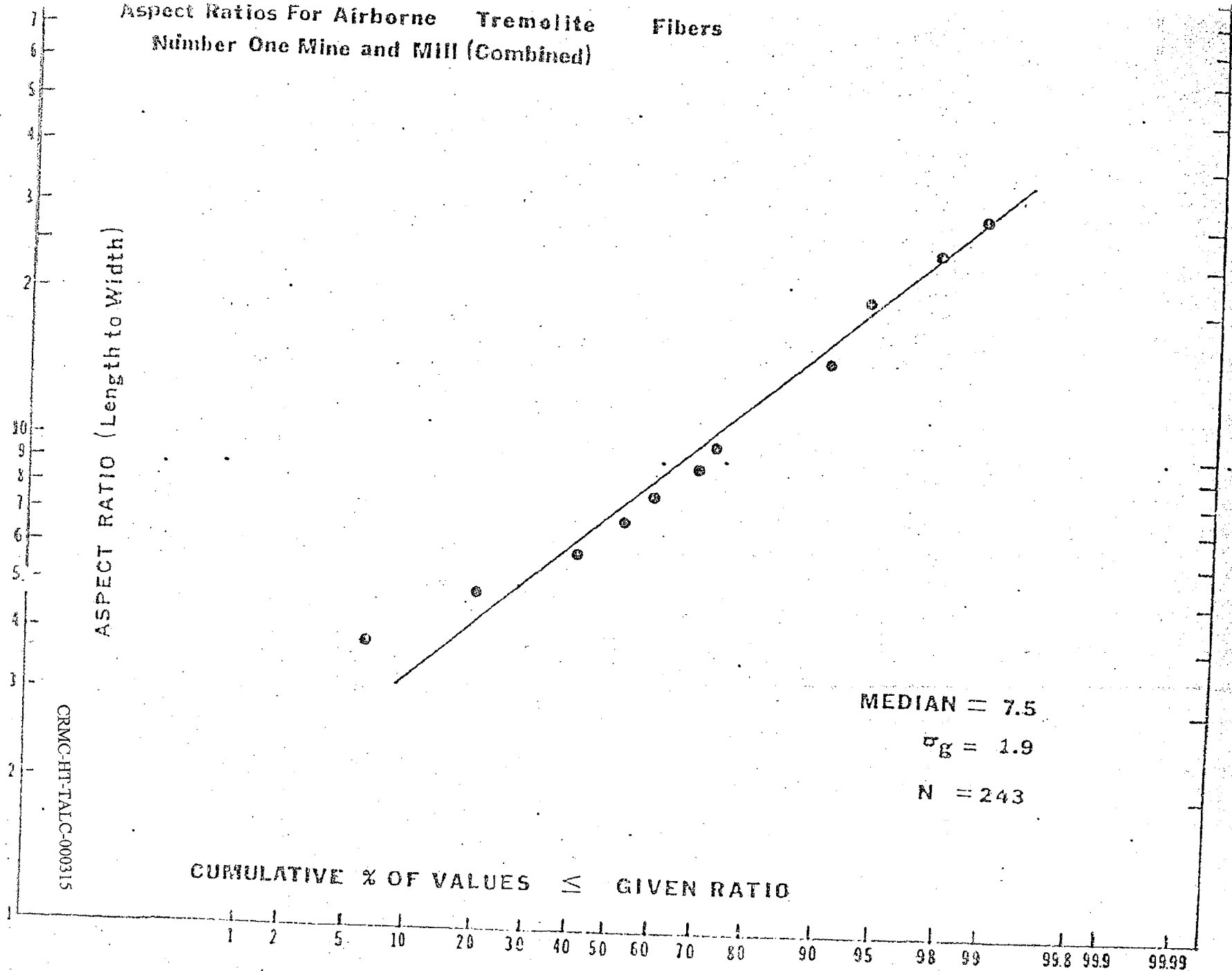


Figure. 4: Electron Photomicrograph of Airborne Particulates from number one Mill and Mine

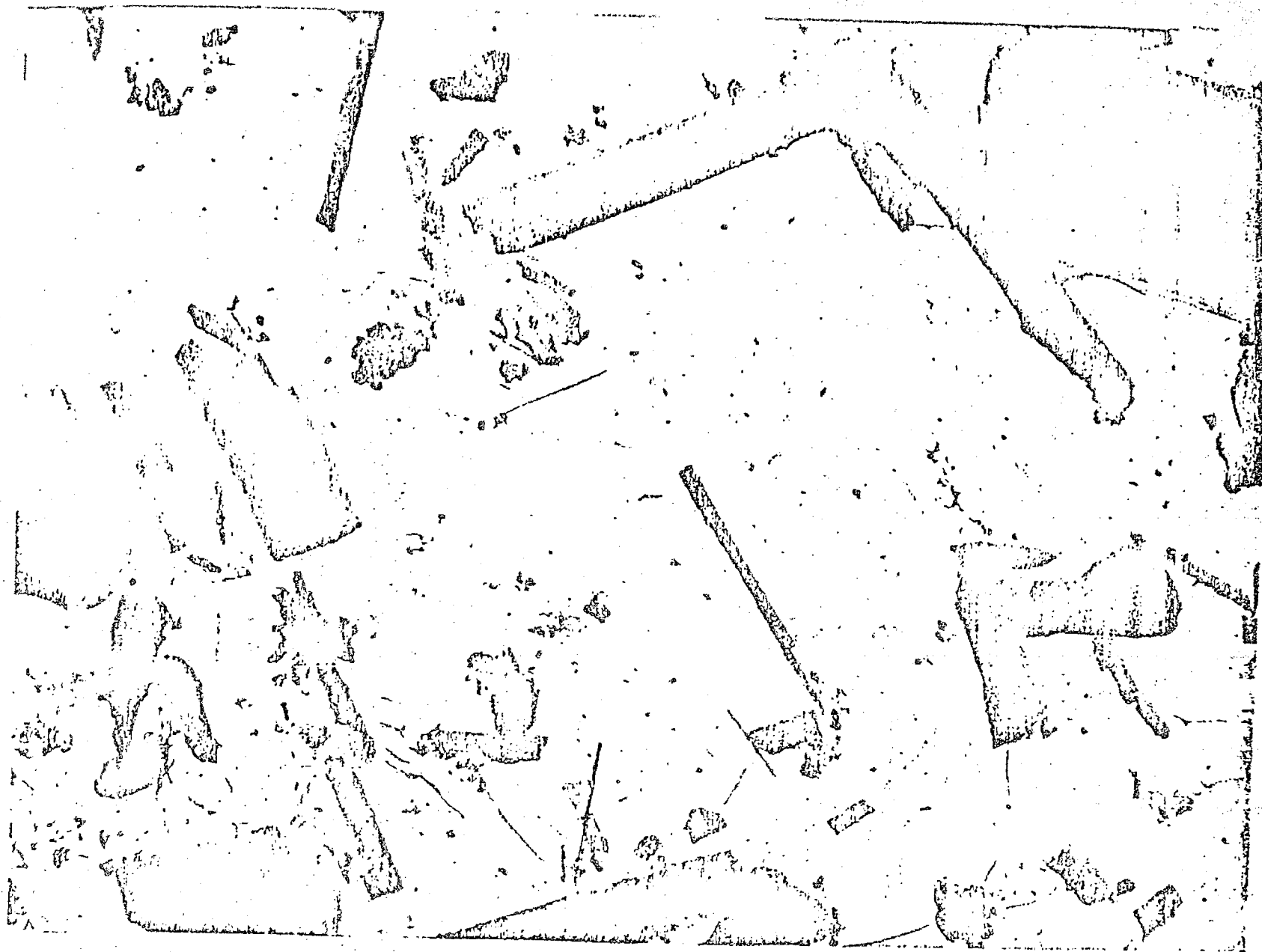
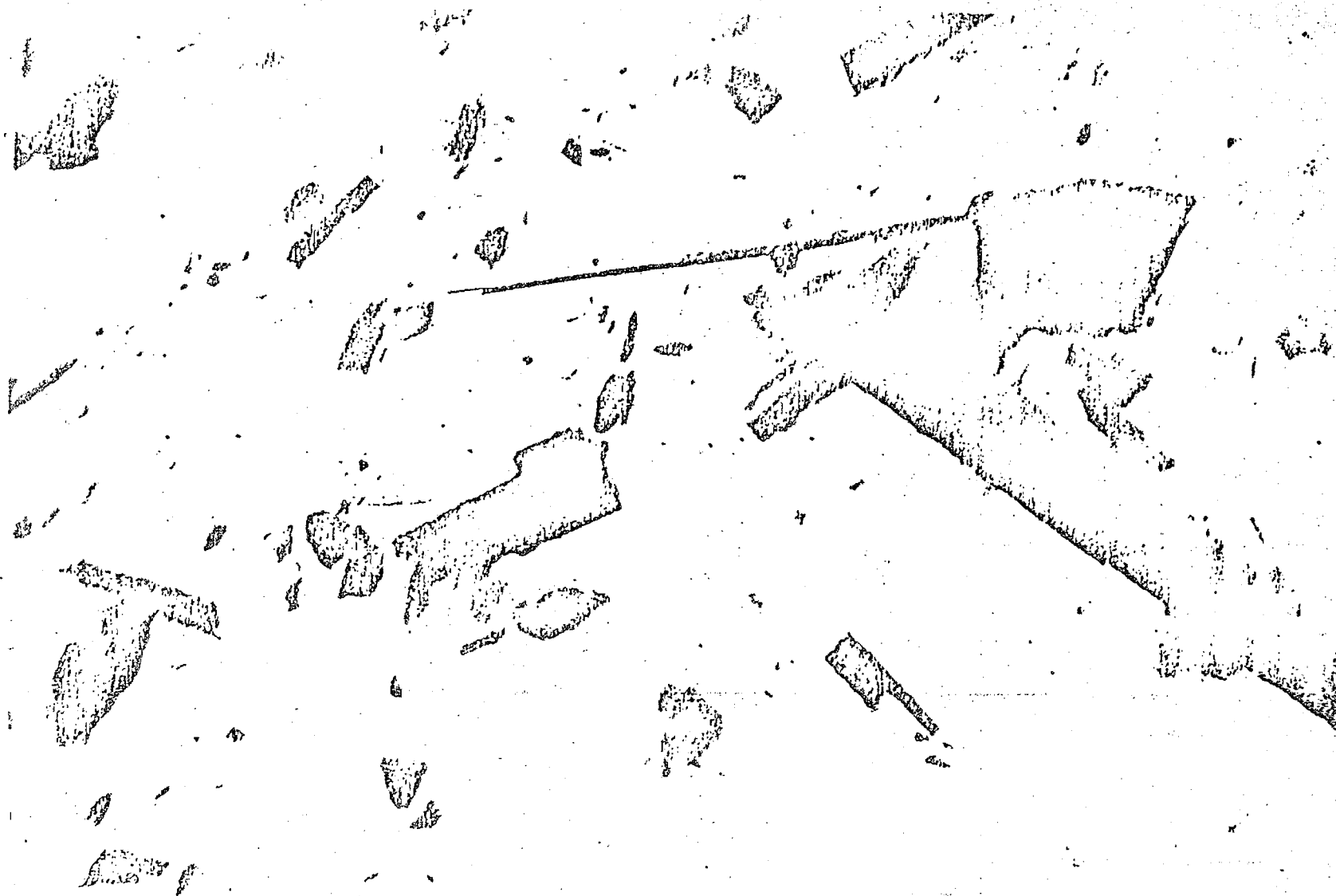


Figure 5: Electron Photomicrograph of Airborne Particulates from Number one Mine and Mill



CRM-C-11-TALC-000317

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				
$\leq 5/1$	23%	24%	17%	15%
$\leq 10/1$	70%	70%	52%	52%
$\leq 20/1$	96%	96%	85%	88%
$\leq 50/1$	>99%	>99%	99%	>99%

* Data shown are for all fiber lengths.

COMPARISON OF SAMPLING AND ANALYTICAL METHODS

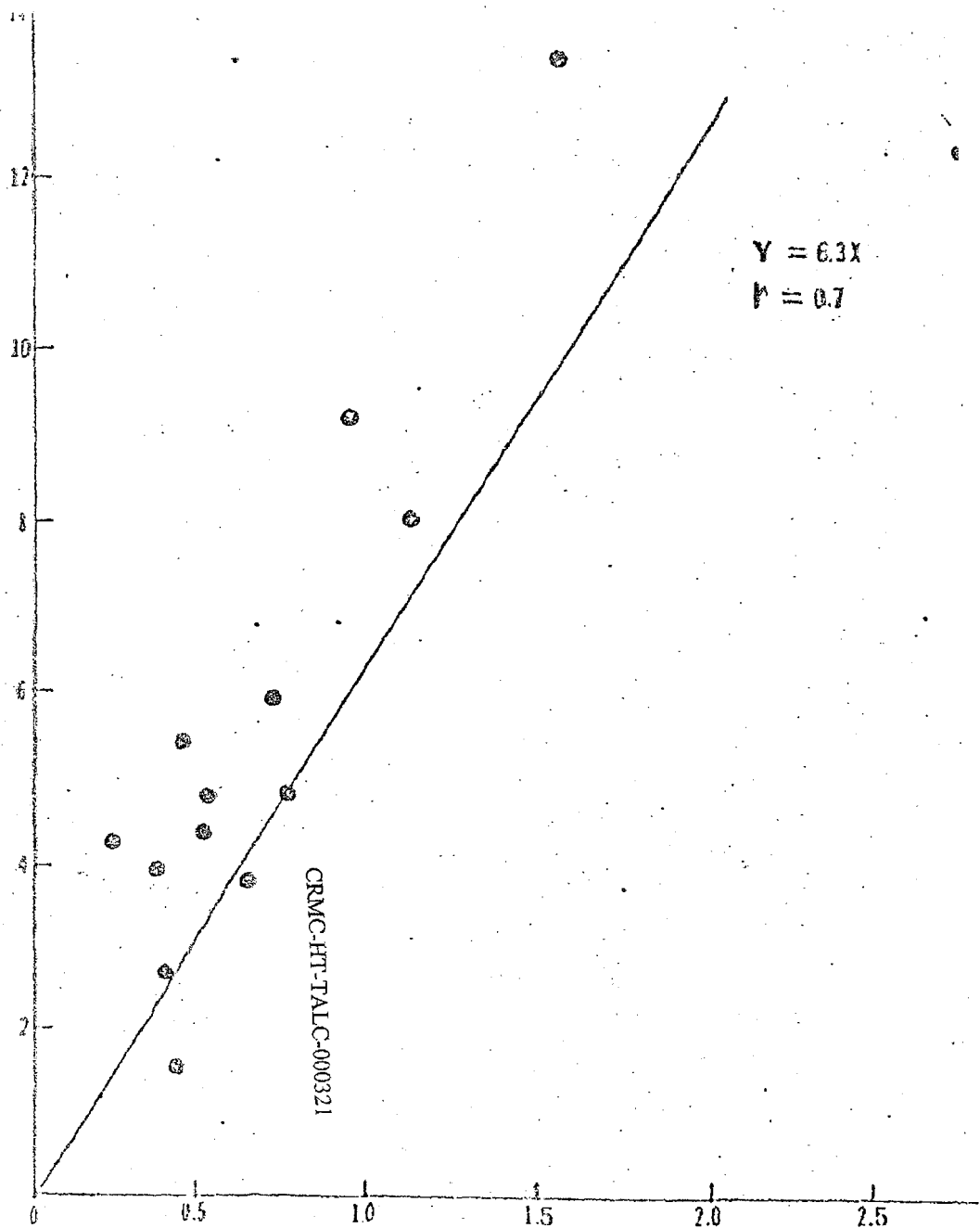
In order to compare results of the present study with historic dust measurements, several comparisons were made. Results of the stationary samples for correlation of sampling and analysis methods are shown in Table 14. Based on these limited data, the following average relationships were calculated:

Ratio	Average	Range
resp. dust, mg/m ³ /mppcf	0.22	0.12-0.2
fibers > 5 μ m/cc/resp. dust mg/m ³	6.7	3.1-11.9
fibers > 5 μ m/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 personal 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:

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



Respirable Dust Mg/M³

FIGURE 7

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

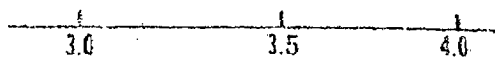


Table 14

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 $\mu\text{m}/\text{cc}$) 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 $\mu\text{m}/\text{cc}/\text{mppcf}$) 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 explanations 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 $\mu\text{m}/\text{cc}/\text{mppcf}$)	
	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.

A scatter plot showing the relationship between $\log_{10}(1 + 1000 \cdot I)$ on the y-axis and $\log_{10}(1 + 1000 \cdot I_0)$ on the x-axis. The x-axis ranges from 0 to 45 with major ticks every 10 units. The y-axis ranges from 0 to 7 with major ticks every 1 unit. There are 15 data points plotted as solid black circles. The points are scattered, with a general upward trend. The following table provides estimated coordinates for the 15 data points:

$\log_{10}(1 + 1000 \cdot I_0)$	$\log_{10}(1 + 1000 \cdot I)$
12	1.6
15	2.9
15	3.1
18	1.6
19	4.7
26	2.2
26	2.3
27	1.1
27	4.2
28	5.8
30	2.7
30	6.0
32	6.8
35	4.2
37	6.0
42	3.5
43	3.6
45	3.8

FIGURE 8

**Comparison of Fiber Concentrations
by Optical and Electron Microscopy**

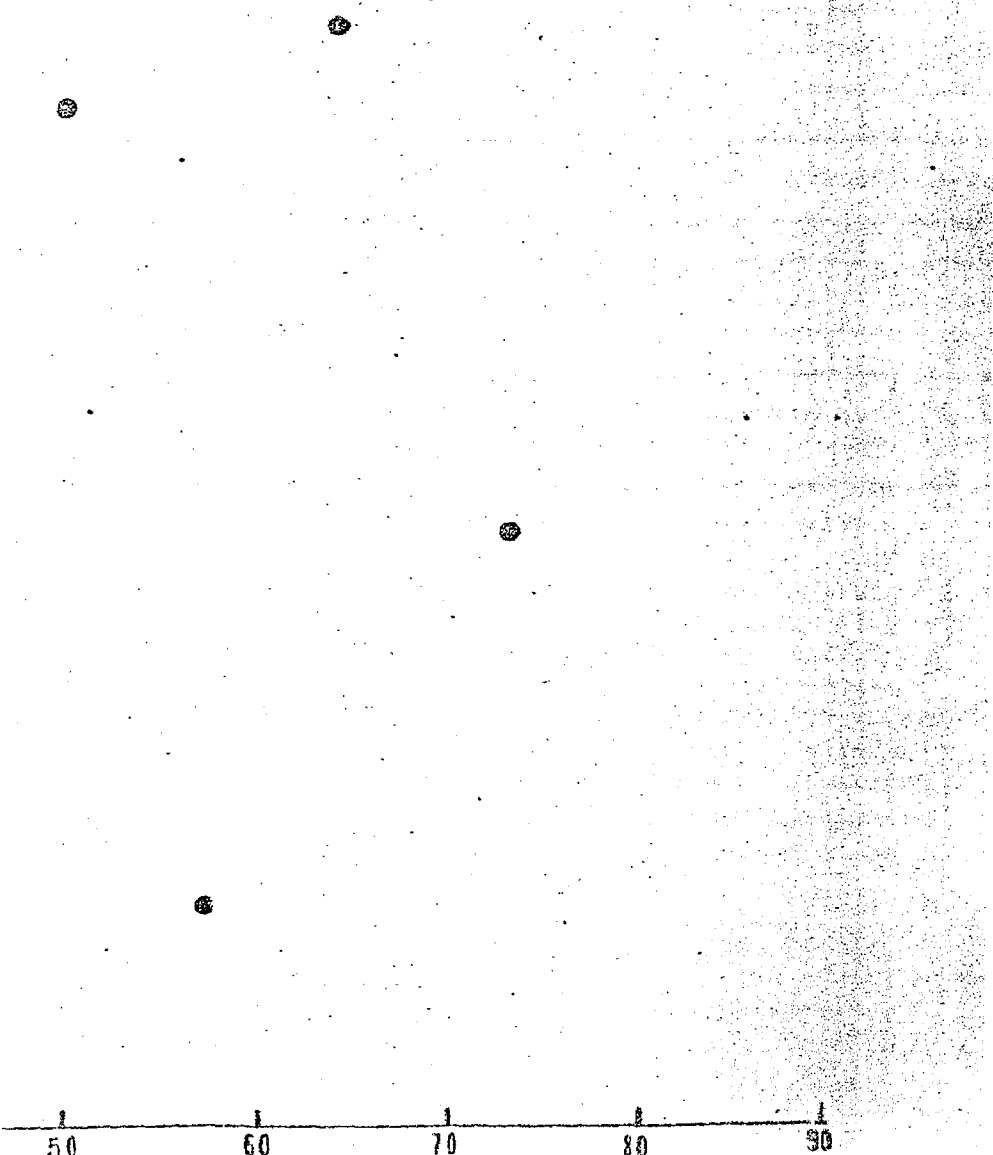


Table 16

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 μ m/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 $> 5 \mu\text{m/cc}$) 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 interpret for several reasons. First and most important is the relative paucity 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 explanation for this trend.

Table 17

Summary of Historic Impinger Dust Measurements at the
Gouverneur Tale 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
<u>Mine</u>										
Drilling	5		5		13	7	4	5	3	12
Dragline Loading			7			10	8	3	5	12
Tramming & Mucking					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
<u>Mill</u>										
Secondary Crushing	12	23	8	10	12	13	3	8	3	3
Wheeler Grinding	15	13	5	3	11	19		4	10	3
Hardinge Grind- ing	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				
<u>Other</u>										
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

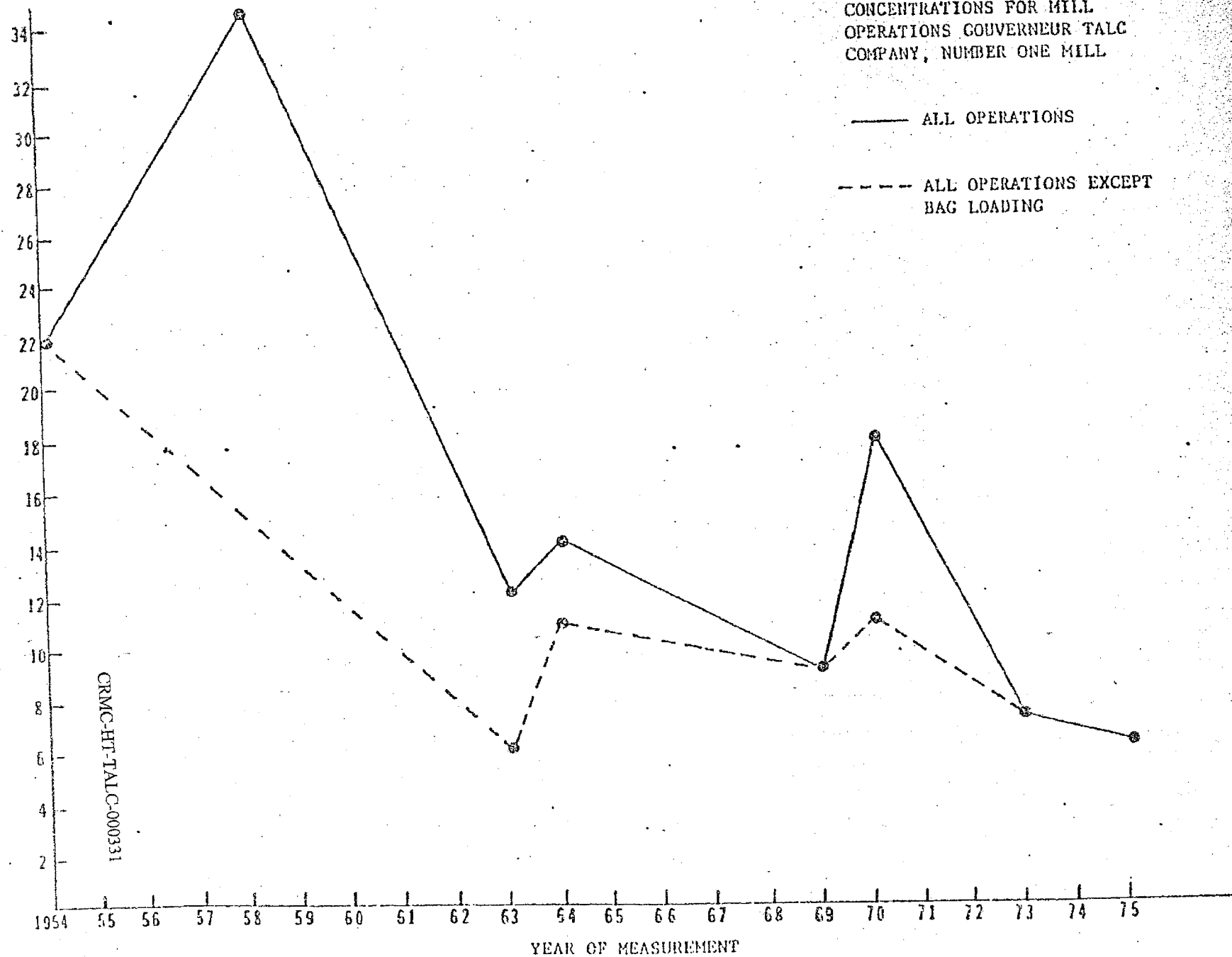
Summary of Historic Fiber Exposure Measurements at the
Gouverneur Talc Company, Number One Mine and Mill

Job or Operation	Mean Fiber Concentration (fiber > 5 $\mu\text{m}/\text{cc}$)						
	(1) 1970	(2) 1972	(2) 1973	(2) 1974	(2) 1975	NIOSH 1975	(2) 1976
<u>Mine</u>							
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
<u>Mill</u>							
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
Pelletizing	27		8	15		4	
Bulk Loading	8					2	
Loading Bags						3	
<u>Other</u>							
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



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 100 μpcf

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 York 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 asbestos 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, WEC, 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 fibrosis 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, including 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 talc and 14 of 30 workers in the group exposed to fibrous talc showing significantly 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 described 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 existence 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 malignancies 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 of 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 were 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)

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 19, 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	

MATERIAL	SECTION II INGREDIENTS	% 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 ₂ O = 1)	±2.7
APPEARANCE	Fibrous		
OTHER PROPERTIES			

MATERIAL	SECTION IV HEALTH HAZARD DATA	* TLV
Asbestiform talc and asbestiform anthophyllite	5 fibers/cc > 5µm. in length	
Talc - non-asbestiform		20 Maccf
Non-asbestiform tremolite and anthophyllite		20 Maccf
Serpentine		50 Maccf
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.

CRM-C-HT-TALC-000349

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 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 ₂ O = 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	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

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		% 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 ₂ O = 1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA		* 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.	
CRM-C-HT-TALC-000351	

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 20109.

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		% 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 ₂ O = 1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA		*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 STORAGE	
Avoid breathing dust. Use respirator if TLV's exceeded.	
CRM-C-HT-TALC-000352	

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	CERAMITALC 10AC, CERAMITALC HDT	Industrial Talc
MINERAL FAMILY	Hydrous silicates	
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates	

MATERIAL	SECTION II INGREDIENTS		% 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 ₂ O = 1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

MATERIAL	SECTION IV HEALTH HAZARD DATA		* 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 22139

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 ₂ O=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 STORAGE

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

CRMCM-HT-TALC-000354

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 20139.

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		* 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 ₂ O = 1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

SECTION IV HEALTH HAZARD DATA		* 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.	

DATE May 1, 1975

CRMC-HT-TALC-000355

APPENDIX II

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

GOVERNMENT TALC CO.

GOVERNMENT TALC CO.

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

AGENT STUDIED: TALC

COUNTYIST, LAWRENCE

SIC CODE: 1496

CRMC-HT-TALC-000357

PAGE 1 1

1. JOB DICTIONARY

CODE - JOB TITLE

0101 WIRE FOREMAN

0102 CRUSHER OPERATOR

0103 THAMER

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 ELMCO MAN (HUCKER)

CRM-FT-TALC-000358

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 MINE AND SHAFT DEVELOPMENT WORK

TO OPERATE HOIST LOWER OR RAISE CAGE AND SKIP AS SIGNED 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

C-CE JOB TITLE

0115 FACEMAN

0201 MILL FIREMAN

0202 MILLER

0203 GENERAL LABOURER

0204 CRUSHER OPERATOR

0205 FULLER-KINYON OPERATOR

0206 HANDLING OPERATOR

0207 PROCESS AIR OPERATOR

0208 WHEELER OPERATOR

0209 PACKER

0210 PACKHOUSE UTILITY MAN

0211 PACKER SERVICEMAN

CRM-C-H-TALC-000359

DUTIES
(FINCO 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 SUR-
FACE

SUPERVISES MILL GRIND-
ING, 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-W 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 SEC-
TIONS

OPERATES THE MILL AIR
COMPRESSOR, ALCOURN 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-AUTO-
MATIC PACKER AND LOADS BAGGED, FINISHED PRODUCT IN
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

C-1. JOB DICTIONARY

CODE JOB TITLE

0212 WAREHOUSE FOREMAN

0213 FORK LIFT OPERATION/TON MOTOR OPER.

0214 CAR LINER

0215 TRUCK DRIVER

0216 STOCK CLERK

0217 STENCIL AND CHECKWEIGH MAN

0218 SUPERVISION OF INVENTORY CONTROL

0219 CALIFORNIA PROCESS OPERATOR

0220 RULK CAR LOADER

0301 REPAIRMAN(MINE)

0302 REPAIRMAN'S HELPER

0303 BLACKSMITH

0304 MAINTENANCE MECHANIC

0305 HOSTILE EQUIPMENT MECHANIC

CRM-H-TALC-000360

DUTIES

SUPERVISES TALE BAGGING

OPERATES THE TOW MOTOR
AND MAINTAINS WAREHOUSE INVENTORY RECORDS

PREPARES EMPTY RAILROAD
CARS AND TRUCKS FOR LOADING AND PREPARES COMPLETED
CARS FOR SHIPMENT

OPERATES SERVICE VEHICLE
TO TRANSPORT VARIOUS MATERIALS IN OR OUTSIDE PLANT
AREA, LOADS AND UNLOADS VEHICLE

RESPONSIBLE FOR RECEIVING,
STORING AND CONSIGNMENT OF EQUIPMENT, SUPPLIES AND
SPARE PARTS, ETC., AND ASSISTS IN MAINTAINING ADEQUATE
STOCK LEVELS OF SUPPLIES AND SPARE PARTS

LABELS TALE BAGS-SHIPMEN

PROPERTY CONTROL

LOADS TALE INTO RAIL BU-
LK CARS USING PNEUMATIC FILLING SYSTEM

TO MAINTAIN AND REPAIR
MINE EQUIPMENT SUCH AS TUGGER-RODISTS, AND INSTALL,
CONSTRUCT AND REPAIR VARIOUS WOOD AND CONCRETE STRUCTURES

TO ASSIST THE REPAIRMAN
AND MAINTENANCE MECHANIC IN THE CONSTRUCTION, INSTALLATION,
MAINTENANCE AND REPAIR OF MINE MACHINERY AND EQUIPMENT

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

PERFORM THE LAYOUT,
ASSEMBLY, INSTALLATION, REPAIR AND MAINTENANCE OF MINE
SURFACE AND UNDERGROUND MACHINERY, EQUIPMENT AND WOOD
WORK CONSTRUCTION

INSPECT, TEST, ADJUST,
DISMANTLE AND REPLACE UNIT ASSEMBLIES OR PARTS, AND
MAKE COMPLETE REPAIRS TO GASOLINE, ELECTRIC AND DIESEL
POWERED EQUIPMENT

DUTIES

E 1, JOB DESCRIPTION

CONE

0401 MILLWRIGHT

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

0402 INSTRUMENT REPAIRMAN

TO INSTALL, REPAIR, CALIBRATE, TEST AND ADJUST ANY TYPE OF INTEGRATING, INDICATING, OR GRAPHIC ELECTRICAL OR MECHANICAL INSTRUMENT

0403 MACHINIST

TO LAY OUT WORK, SET UP AND OPERATE MACHINE TOOLS, AND PERFORM ANY DISMANTLING, FITTING OR ASSEMBLY WORK REQUIRED FOR PLANT MAINTENANCE OR CONSTRUCTION

0404 PLANTMAN(MILL)

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

0405 MILLWRIGHT MILLER

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

0406 SHEET METAL WORKER

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

0407 QUALITY CONTROL TECH.

TAKES TALC SAMPLES FOR LAB ANALYSIS

ASSIST IN QC ANALYSIS

0408 LAB TECHNICIAN

0409 ASSISTANT LAB TECHNICIAN

RESPONSIBLE FOR THE PROPER LUBRICATION OF ALL MACHINERY AND EQUIPMENT

0410 MILLER

GENERAL WELDING IN MILL

0411 MILLER

TO INSPECT, REPAIR, AND WIRE ALL ELECTRICAL APPARATUS, DEVICES, AND CIRCUITS OF ANY VOLTAGE IN THE PLANT OR ASSIGNED AREA INCLUDING POWER TRANSMISSION LINES, TRANSFORMERS, AND RELATED EQUIPMENT

0501 ELECTRICIAN AND ELECTRIC APPRENTICE

TO SHEEP AND CLEAN FLOOR OF HINE, HILL, OFFICES, LABORATORIES, CHANGE AND DINING ROOMS AND LABORATORY

0502 JANITOR

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

0503 WELDER

E 3. JOB DICTIONARY -

GRADE	JOB TITLE	DUTIES
0504	MOBILE UTILITY OPERATOR	TO OPERATE MOBILE EQUIP- MENT IN VARIOUS CAPACITIES SUCH AS CLEANING UP WASTE, DIRT AND DEBRIS, SNOW REMOVAL, ETC.
0505	WATCHMAN	MINE AND MILL SECURITY
0506	MINE AND MILL ENGINEER	
0601	ASSISTANT WESTVENT MANAGER	OFFICE DUTIES
0602	MINE SUPERINTENDANT	OFFICE DUTIES
0603	MILL SUPERINTENDANT	OFFICE DUTIES
0604	GENERAL MANAGER	OFFICE DUTIES
0605	PERSONNEL AND SAFETY DIRECTOR	OFFICE DUTIES
0606	OFFICE MANAGER	OFFICE DUTIES
0607	ENGINEER	
0608	PROCESSING 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	

2. SAMPLING PROCEDURES

SAMPLING METHOD ANALYTICAL TECH.

GRAVIMETRIC POST-PRE WEIGHT

IMPINGER SAMPLE OPTICAL MICRO.

CRM-CR-TALC-000363

RESPIRABLE MASS SAMPLES ARE COLLECTED ON MSA POLY-VINYL CHLORIDE FILTERS(5.0UM PORE SIZE) WITH FLOW 1.7 LITERS PER MINUTE, NYLON CYCLONES (10UM) ARE USED FOR SIZE SEPARATION, FILTERS ARE WEIGHED TO THE NEAREST 0.1MG USING A CANN GRAH ELECTROBALANCE AND DUST CONCENTRATIONS REPORTED AS MG/H3.

HIDGET 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	ANALYTICAL TECHNIQUE	CHARACTERIC	POST-PRE	WEIGHT		
SHEET	SAMPLE	DATE	TIME	TIME	VOLUME	CONC.	
NO.	NO.		ON	OFF	ML		
19	1008	11/06/75	0655	1455	0.8159	0.846	
WEIGHTED AVE. = 0.846							
19	1009	11/06/75	0654	1456	0.8193	0.952	
WEIGHTED AVE. = 0.952							
19	1024	11/06/75	0703	1455	0.8023	0.125	
WEIGHTED AVE. = 0.125							
19	1009	11/06/75	0653	1459	0.8261	0.581	
WEIGHTED AVE. = 0.581							
19	1058	11/06/75	0659	1455	0.8091	1.569	
WEIGHTED AVE. = 1.569							
19	1003	11/06/75	0700	1455	0.8006	1.723	
WEIGHTED AVE. = 1.723							
19	1023	11/06/75	0700	1455	0.8074	0.582	
WEIGHTED AVE. = 0.582							
19	1000	11/06/75	0656	1405	0.7292	1.001	
WEIGHTED AVE. = 1.001							
19	1019	11/06/75	0658	1300	0.6833	1.419	
WEIGHTED AVE. = 1.419							
19	1007	11/06/75	0706	1415	0.7292	0.535	
WEIGHTED AVE. = 0.535							
19	1041	11/06/75	0659	1459	0.8159	0.233	
WEIGHTED AVE. = 0.233							
19	1049	11/04/75	0719	1420	0.7156	0.643	
WEIGHTED AVE. = 0.643							
19	1066	11/03/75	1513	2238	0.7560	0.516	
WEIGHTED AVE. = 0.516							
19	1019	11/04/75	0731	1430	0.7122	1.137	

CRM-C-H-T-TALC-000364

UNITS

HG/M3

HG/M3

MOVED TO 700 LEVEL AT 830

HG/M3

HG/M3

DRAWING TO 700 FOOT LEVEL LUNCH TAKEN 1136 TO 1240

HG/M3

SCRAPPING TO 700 FOOT LEVEL

HG/M3

HG/M3

UNDERGROUND LABORER

HG/M3

LUNCH TAKEN FROM 1130 TO 1240

HG/M3

HG/M3

HG/M3

HG/M3

HG/M3

HG/M3

GENERAL LABORER

3. INDIVIDUAL SAMPLE RESULTS

LE TALC
LE PERCENTAGE OF TALC IN THE SAMPLE

SAMPLE NO.	DATE	TYPE	TIME	VOLUME	WEIGHT	UNITS
			OFF	M3	CURIC.	
13	11/04/75	0719	1425	0.7241	1.132	MG/M3
14	11/04/75	0719	1425	0.7241	1.132	MG/M3
21	11/03/75	1438	2238	0.8159	0.600	MG/M3
22	11/03/75	0708	1425	0.7428	1.561	MG/M3
23	11/03/75	1440	2237	0.8006	0.649	MG/M3
11	11/04/75	0707	1430	0.7530	2.735	MG/M3
22	11/03/75	1444	2230	0.8023	0.449	MG/M3
18	11/04/75	0700	1417	0.6744	0.756	MG/M3
15	11/04/75	0743	1420	0.6740	0.415	MG/M3
16	11/04/75	0745	1421	0.6731	0.720	MG/M3
17	11/04/75	0711	1427	0.7411	0.391	MG/M3
18	11/04/75	0711	1426	0.7394	0.460	MG/M3
19	11/04/75	0714	1429	0.7394	0.433	MG/M3
27	11/03/75	1520	2248	0.7615	0.499	MG/M3
28	11/03/75	1526	2253	0.7598	0.947	MG/M3
29	11/03/75	1520	2250	0.7649	0.719	MG/M3
30	11/04/75	0730	1428	0.7105	0.436	MG/M3

CRM-C-H-TALC-000365

3. INDIVIDUAL SAMPLE RESULTS

12 TALL		12 METROANALYTICAL TECHNIQUE		GRAVIMETRIC		POST-PRE WEIGHT	
SHEET	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME M3	CONC.	
						WEIGHTED AVE. =	
1	24 1057	11/03/75	1525	2252	0.7598	0.395	
						WEIGHTED AVE. =	
2	11 1000	11/04/75	0810	1428	0.6025	0.218	
						WEIGHTED AVE. =	
2	25 1017	11/03/75	1521	2300	0.7802	0.282	
						WEIGHTED AVE. =	
3	10 1359	11/04/75	0737	1424	0.6918	0.231	
						WEIGHTED AVE. =	
3	10 1003	11/04/75	0915	1424	0.7292	0.439	
						WEIGHTED AVE. =	
3	26 1032	11/03/75	1524	2247	0.7530	0.372	
						WEIGHTED AVE. =	
14	10 1028	11/04/75	0737	1429	0.7003	0.314	
						WEIGHTED AVE. =	
20	14 1036	11/04/75	0755	1413	0.6425	0.249	
						WEIGHTED AVE. =	
01	11 1053	11/06/75	0654	1455	0.8176	1.137	
						WEIGHTED AVE. =	
02	12 1035	11/06/75	0655	1455	0.8159	0.858	
						WEIGHTED AVE. =	
04	15 1008	11/06/75	0701	1455	0.8057	0.422	
						WEIGHTED AVE. =	
01	14 1005	11/07/75	0715	1327	0.6323	0.158	
						WEIGHTED AVE. =	
01	10 1000	11/07/75	0723	1325	0.6153	4.647	
						WEIGHTED AVE. =	
02	10 1050	11/07/75	0729	1336	0.6238	0.593	
						WEIGHTED AVE. =	
02	14 1010	11/07/75	0746	1300	0.5337	0.581	
						WEIGHTED AVE. =	

UNITS

HG/H3

HG/H3

HG/H3

HG/H3

HG/H3

HG/H3

HG/H3

HG/H3

HG/H3

HG/H3

HG/H3

WORKING AT SHAFT STATION

HG/H3

HG/H3

HG/H3

HG/H3

CRM-CIT-TALC-000366

3. INDIVIDUAL SAMPLE RESULTS

SAMPLE		DATE	TIME	WEIGHT	VOLUME	CONC.	UNITS
CALCULATED AVERAGE							
14	10-4	11/01/15	0712	1324	0.0323	0.395	MG/H3
15	13-4	11/01/15	0725	1331	0.0221	2.957	MG/H3
16	10-2	11/01/15	0718	1325	0.0238	0.497	MG/H3
17	10-2	11/01/15	0707	1421	0.1479	0.722	MG/H3
18	14/3	11/01/15	0727	1321	0.0119	0.752	MG/H3

INDIVIDUAL SAMPLE RESULTS

HT TALC

PLE METHOD/ANALYTICAL TECHNIQUE: IMPINGER SAMPLE/OPTICAL MICRO

SHIFT	SAMPLE	DATE	TIME	TIME	VOLUME	CONC.
HAN. NO.	NO.		ON	OFF	LT	
3	10	0135	11/06/75		3.0000	12.708

WEIGHTED AVE. = 12.708

3	16	0020	11/06/75	0112	0124	1.6946	12.424
---	----	------	----------	------	------	--------	--------

3	16	0554	11/06/75	1244	1312	2.7485	5.951
---	----	------	----------	------	------	--------	-------

WEIGHTED AVE. = 8.596

4	1A	0005	11/06/75	0845	0715	3.0000	4.308
---	----	------	----------	------	------	--------	-------

WEIGHTED AVE. = 4.308

4	1E	0445	11/06/75	0800	0830	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

4	1C	0535	11/06/75	0938	0953	1.5017	11.678
---	----	------	----------	------	------	--------	--------

WEIGHTED AVE. = 11.678

14	14	0233	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

CRM:HT-TALC-000368

UNITS

MPPCF

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

MPPCF

SAMPLER WAS HOOKED ONTO TRAMMEN 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 800 FEET AND WORKING DOWN TO 900 FEET NO RESPIRATOR.

MPPCF

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

MPPCF

MPPCF

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

4. INDIVIDUAL SAMPLE RESULTS

TABLE

4. METHOD/OPTICAL TECHNIQUE 14P10000 SAMPLE/OPTICAL HIGH.

SAMPLE NO.	SAMPLE NO.	DATE	TIME (H)	TIME (M)	VOLUME (L)	CONC.
20	0415	11/03/75			3.0000	1.013
WEIGHTED AVE. = 1.013						
15	0201	11/04/75	1325	1355	3.0000	0.546
WEIGHTED AVE. = 0.546						
14	0644	11/06/75	1230	1300	3.0000	2.411
14	0904	11/06/75	0908	0930	3.0000	2.056
WEIGHTED AVE. = 2.784						
13	0783	11/04/75	0944	1014	3.0000	3.515
WEIGHTED AVE. = 3.515						
21	0274	11/03/75			3.0000	1.204
WEIGHTED AVE. = 1.204						
12	0241	11/04/75	1038	1108	3.0000	3.426
WEIGHTED AVE. = 3.426						
23	0131	11/03/75			3.0000	2.884
WEIGHTED AVE. = 2.884						
11	0705	11/04/75	0833	0903	3.0000	3.579
WEIGHTED AVE. = 3.579						
22	0613	11/03/75			3.0000	2.540
WEIGHTED AVE. = 2.540						

CRM-CIT-TALC-000369

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 10-
TAL 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

7-10-68
SAC, NEW YORK
FROM SAC, ALBANY (100-9045)
SUBJECT: [REDACTED]
[REDACTED]

[illegible]

THE
LINE

DATE: 10-17-68
BY: J. L. H.
P. 1000

16-110 Avl. 6.304

[illegible]

30884 1970-10-13

[illegible]

34 0103

3,471
1,000
2,431
MPPCF

151.2 = 187 031.013 = 2.131

00001 = 344 031.0134 34

16-10 Ave. = 1000

[illegible]

WORKING AT SHAFT STATION

2. 344 (6314717-2) 1.466

CRMC-HT-TALC-000370

FILLING SACKS WITH PRODUCT BY MACHINE. SEVERAL
HURST DURING SAMPLING

C5. STATISTICS

PLS TECHNICAL RECORDS GRAVIMETRIC / PUSHPME HEIGHT

JOB CODE	NO. OF SAMPLES	FAVOR MO/MO (1-100)	MEAN MG/MG	MEDIAN MG/MG	1.0% AVE. DEVIATION	STANDARD DEVIATION	JOB TITLE
0103	003	000.452-000.125	0.041	0.040	0.040	0.200	TRAMMER
0104	003	001.723-000.541	1.291	1.509	1.205	0.350	SCRAPPER MAN
0105	001	000.502-000.542	0.582	0.502	0.582	0.000	UNDERGROUND LABORER
0106	003	001.014-000.535	0.985	1.001	0.976	0.255	DRILLER
0115	001	000.233-000.233	0.233	0.233	0.233	0.000	CAGEMAN
0116	001	001.723-000.125	0.070	0.040	0.527	0.150	HILL FOREMAN
0201	002	000.043-000.510	0.580	0.500	0.578	0.003	GENERAL LABORER
0203	001	001.137-001.137	1.137	1.137	1.137	0.000	CRUSHER OPERATOR
0204	002	001.132-000.000	0.000	0.000	0.850	0.200	HARDING OPERATOR
0205	002	001.501-000.049	1.105	1.105	1.008	0.456	WHEELER OPERATOR
0206	002	002.733-000.449	1.592	1.592	1.556	1.143	PACKER
0207	009	000.447-000.391	0.594	0.499	0.594	0.066	PACKER SERVICE MAN
0211	002	000.430-000.395	0.410	0.410	0.415	0.020	PACKHOUSE FOREMAN
0212	002	000.202-000.210	0.250	0.250	0.253	0.032	FORK LIFT OPERATOR/TON MOTOR OPER.
0213	003	000.43-000.231	0.347	0.372	0.350	0.061	CAR LINER
0214	001	000.314-000.310	0.314	0.314	0.314	0.000	BULK CAR LOADER
0220	001	000.209-000.249	0.249	0.249	0.249	0.000	
0402	027	002.733-000.210	0.050	0.000	0.521	0.100	REPAIRMAN(MINE)
0301	001	001.137-001.137	1.137	1.137	1.137	0.000	REPAIRMAN'S HELPER
0302	001	000.050-000.050	0.050	0.050	0.050	0.000	MAINTENANCE MECHANIC
0304	001	000.422-000.422	0.422	0.422	0.422	0.000	
0401	003	001.137-000.422	0.800	0.850	0.360	0.208	HILLKNIGHT
0402	002	004.047-000.150	2.403	2.403	2.372	2.244	INSTRUMENT REPAIRMAN
0403	002	000.543-000.541	0.547	0.587	0.587	0.006	MACHINIST
0404	001	000.543-000.545	0.545	0.595	0.595	0.000	HILLKNIGHT HELPER
0405	001	002.957-002.957	2.957	2.957	2.957	0.000	SHEET METAL WORKER
0406	001	000.497-000.497	0.497	0.497	0.497	0.000	OILER
0410	001	000.722-000.722	0.722	0.722	0.722	0.000	WELDER
0411	001	000.752-000.752	0.752	0.752	0.752	0.000	
0401	009	004.047-000.150	1.250	0.593	1.514	0.505	

PLANT TOTAL

0.020

0.582

0.112

LE 6. STATISTICS

ENTR DUC
SULE CULUM/ALVALITICE TECHNICAL IMPINGER SAMPLE/OPTICAL MICHU.

JOB	NO.	US	MAJOR	MPPEP	MEAN	MEDIAN	1.0% AVE. DEVIATION	STANDARD THRUH	JOB TITLE
001	001	001	001	001	12.424	12.424	7.217	2.176	TRAMMER
002	002	002	002	002	10.121	10.121	3.822	2.207	SCRAPPER MAN
003	003	003	003	003	11.830	11.830	9.350	4.181	DRILLER
004	004	004	004	004	11.078	11.078	0.000	0.000	ETCHED MAN(MUCKER)
005	005	005	005	005	15.774	15.774	0.000	0.000	CAGEMAN
006	006	006	006	006	1.972	1.972	0.000	0.000	
007	007	007	007	007	11.000	11.000	7.217	2.176	MILL FOREMAN
008	008	008	008	008	2.877	2.877	1.504	1.063	GENERAL LABOURER
009	009	009	009	009	0.540	0.540	0.000	0.000	CRUSHER OPERATOR
010	010	010	010	010	2.784	2.784	0.980	0.490	HARDINGE OPERATOR
011	011	011	011	011	3.405	3.405	0.737	0.521	WHEELER OPERATOR
012	012	012	012	012	3.000	3.000	0.735	0.519	PACKER
013	013	013	013	013	3.343	3.343	1.564	0.638	PACKER SERVICEMAN
014	014	014	014	014	2.131	2.131	0.000	0.000	FORK LIFT OPERATOR/TOM MOTOR OPER.
015	015	015	015	015	1.030	1.030	0.000	0.000	
016	016	016	016	016	2.770	2.770	1.287	0.288	
017	017	017	017	017	3.033	3.033	0.000	0.000	REPAIRMAN'S HELPER
018	018	018	018	018	1.409	1.409	0.000	0.000	MAINTENANCE MECHANIC
019	019	019	019	019	2.551	2.551	1.530	1.082	
020	020	020	020	020	5.015	5.015	0.000	1.000	
021	021	021	021	021	3.579	3.579	0.000	1.000	
022	022	022	022	022	2.551	2.551	1.530	1.082	
023	023	023	023	023	5.015	5.015	0.000	1.000	
024	024	024	024	024	3.579	3.579	0.000	1.000	
025	025	025	025	025	2.551	2.551	1.530	1.082	
026	026	026	026	026	5.015	5.015	0.000	1.000	
027	027	027	027	027	3.579	3.579	0.000	1.000	
028	028	028	028	028	2.551	2.551	1.530	1.082	
029	029	029	029	029	5.015	5.015	0.000	1.000	
030	030	030	030	030	3.579	3.579	0.000	1.000	
031	031	031	031	031	2.551	2.551	1.530	1.082	
032	032	032	032	032	5.015	5.015	0.000	1.000	
033	033	033	033	033	3.579	3.579	0.000	1.000	
034	034	034	034	034	2.551	2.551	1.530	1.082	
035	035	035	035	035	5.015	5.015	0.000	1.000	
036	036	036	036	036	3.579	3.579	0.000	1.000	
037	037	037	037	037	2.551	2.551	1.530	1.082	
038	038	038	038	038	5.015	5.015	0.000	1.000	
039	039	039	039	039	3.579	3.579	0.000	1.000	
040	040	040	040	040	2.551	2.551	1.530	1.082	
041	041	041	041	041	5.015	5.015	0.000	1.000	
042	042	042	042	042	3.579	3.579	0.000	1.000	
043	043	043	043	043	2.551	2.551	1.530	1.082	
044	044	044	044	044	5.015	5.015	0.000	1.000	
045	045	045	045	045	3.579	3.579	0.000	1.000	
046	046	046	046	046	2.551	2.551	1.530	1.082	
047	047	047	047	047	5.015	5.015	0.000	1.000	
048	048	048	048	048	3.579	3.579	0.000	1.000	
049	049	049	049	049	2.551	2.551	1.530	1.082	
050	050	050	050	050	5.015	5.015	0.000	1.000	
051	051	051	051	051	3.579	3.579	0.000	1.000	
052	052	052	052	052	2.551	2.551	1.530	1.082	
053	053	053	053	053	5.015	5.015	0.000	1.000	
054	054	054	054	054	3.579	3.579	0.000	1.000	
055	055	055	055	055	2.551	2.551	1.530	1.082	
056	056	056	056	056	5.015	5.015	0.000	1.000	
057	057	057	057	057	3.579	3.579	0.000	1.000	
058	058	058	058	058	2.551	2.551	1.530	1.082	
059	059	059	059	059	5.015	5.015	0.000	1.000	
060	060	060	060	060	3.579	3.579	0.000	1.000	
061	061	061	061	061	2.551	2.551	1.530	1.082	
062	062	062	062	062	5.015	5.015	0.000	1.000	
063	063	063	063	063	3.579	3.579	0.000	1.000	
064	064	064	064	064	2.551	2.551	1.530	1.082	
065	065	065	065	065	5.015	5.015	0.000	1.000	
066	066	066	066	066	3.579	3.579	0.000	1.000	
067	067	067	067	067	2.551	2.551	1.530	1.082	
068	068	068	068	068	5.015	5.015	0.000	1.000	
069	069	069	069	069	3.579	3.579	0.000	1.000	
070	070	070	070	070	2.551	2.551	1.530	1.082	
071	071	071	071	071	5.015	5.015	0.000	1.000	
072	072	072	072	072	3.579	3.579	0.000	1.000	
073	073	073	073	073	2.551	2.551	1.530	1.082	
074	074	074	074	074	5.015	5.015	0.000	1.000	
075	075	075	075	075	3.579	3.579	0.000	1.000	
076	076	076	076	076	2.551	2.551	1.530	1.082	
077	077	077	077	077	5.015	5.015	0.000	1.000	
078	078	078	078	078	3.579	3.579	0.000	1.000	
079	079	079	079	079	2.551	2.551	1.530	1.082	
080	080	080	080	080	5.015	5.015	0.000	1.000	
081	081	081	081	081	3.579	3.579	0.000	1.000	
082	082	082	082	082	2.551	2.551	1.530	1.082	
083	083	083	083	083	5.015	5.015	0.000	1.000	
084	084	084	084	084	3.579	3.579	0.000	1.000	
085	085	085	085	085	2.551	2.551	1.530	1.082	
086	086	086	086	086	5.015	5.015	0.000	1.000	
087	087	087	087	087	3.579	3.579	0.000	1.000	
088	088	088	088	088	2.551	2.551	1.530	1.082	
089	089	089	089	089	5.015	5.015	0.000	1.000	
090	090	090	090	090	3.579	3.579	0.000	1.000	
091	091	091	091	091	2.551	2.551	1.530	1.082	
092	092	092	092	092	5.015	5.015	0.000	1.000	
093	093	093	093	093	3.579	3.579	0.000	1.000	
094	094	094	094	094	2.551	2.551	1.530	1.082	
095	095	095	095	095	5.015	5.015	0.000	1.000	
096	096	096	096	096	3.579	3.579	0.000	1.000	
097	097	097	097	097	2.551	2.551	1.530	1.082	
098	098	098	098	098	5.015	5.015	0.000	1.000	
099	099	099	099	099	3.579	3.579	0.000	1.000	
100	100	100	100	100	2.551	2.551	1.530	1.082	

PLANT TOTAL
033 024,530-000,500 5,015 3,579

END OF REPORT

11/07/75

GOVERNMENT TALC CO.

GOVERNMENT TALC CO.

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

AGENT STUDIOS SILICA
COUNTY, LAWRENCE

SIC CODE 11490

7. SAMPLING PROCEDURES

SAMPLING METHOD ANALYTICAL TECH.

GRAVIMETRIC XRAYDIFFRACTION

RESPIRABLE MASS SAMPLES ARE COLLECTED ON MSA POLY-
VINYL CHLORIDE FILTERS(5.0UM PORE SIZE) AT A FLOW
RATE OF 1.7 LITER PER MINUTE. NYLON CYCLOCATIONS
ARE USED FOR SIZE SEPARATION. X-RAY SILICA DETERMINA-
TIONS ARE MADE USING QUANTITATIVE X-RAY DIFFRACTION
AND SILICA CONCENTRATIONS REPORTED AS MG/M3.

D. INDIVIDUAL SAMPLE RESULTS

SILICA		ANALYTICAL TECHNIQUES GRAVIMETRIC		X-RAY DIFFRACTION			
SHEET	SAMPLE	DATE	TIME	TIME	VOLUME	CONC.	UNITS
NO.	NO.		ON	OFF	M3		
15	1419	11/04/75	0731	1430	0.7122	0.014	MG/H3
WEIGHTED AVE. = 0.014							
13	1442	11/04/75	0719	1425	0.7241	0.028	MG/H3
WEIGHTED AVE. = 0.028							
21	1430	11/03/75	1438	2238	0.8159	0.012	MG/H3
WEIGHTED AVE. = 0.012							
12	1461	11/04/75	0708	1425	0.8159	0.000	MG/H3
WEIGHTED AVE. = 0.000							
23	1454	11/03/75	1446	2237	0.8008	0.012	MG/H3
WEIGHTED AVE. = 0.012							
11	1456	11/04/75	0707	1430	0.8006	0.000	MG/H3
WEIGHTED AVE. = 0.000							
22	1429	11/03/75	1444	2236	0.8023	0.012	MG/H3
WEIGHTED AVE. = 0.012							
18	1445	11/04/75	0740	1417	0.6748	0.017	MG/H3
WEIGHTED AVE. = 0.015							
16	1431	11/04/75	0743	1420	0.6748	0.000	MG/H3
WEIGHTED AVE. = 0.000							
16	1439	11/04/75	0745	1421	0.6748	0.000	MG/H3
WEIGHTED AVE. = 0.000							
17	1464	11/04/75	0711	1427	0.7411	0.000	MG/H3
WEIGHTED AVE. = 0.000							
15	1459	11/04/75	0711	1426	0.7411	0.000	MG/H3
WEIGHTED AVE. = 0.000							
19	1449	11/04/75	0714	1429	0.7394	0.014	MG/H3
WEIGHTED AVE. = 0.014							
27	1472	11/03/75	1520	2248	0.7015	0.013	MG/H3
WEIGHTED AVE. = 0.013							
24	1445	11/03/75	1526	2253	0.7598	0.013	MG/H3
WEIGHTED AVE. = 0.013							
20	1430	11/03/75	1520	2250	0.7049	0.013	MG/H3
WEIGHTED AVE. = 0.013							

GENERAL LAHOREN

X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES

X RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES

X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES

X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES

E.B. INDIVIDUAL SAMPLE RESULTS

SITE: STURGEA		GRAVIMETRIC		X-RAY DIFFRACTION		UNITS	
SHIFT	SAMPLE	DATE	TIME	TIME	VOLUME	CONC.	
NO.	NO.		OR	OFF	M3		
1	1A	11/04/75	0730	1428	0.7105	0.000	MG/H3
WEIGHTED AVE. = 0.000							
11	2A	11/03/75	1525	2252	0.7598	0.013	MG/H3
WEIGHTED AVE. = 0.013							
12	11	11/04/75	0810	1428	0.6425	0.016	MG/H3
WEIGHTED AVE. = 0.016							
12	25	11/03/75	1521	2300	0.7002	0.013	MG/H3
WEIGHTED AVE. = 0.013							
13	10	11/04/75	0737	1424	0.7002	0.000	MG/H3
X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES							
13	10	11/04/75	0715	1424	0.7002	0.000	MG/H3
13	20	11/03/75	1524	2247	0.7530	0.000	MG/H3
WEIGHTED AVE. = 0.000							
14	1C	11/04/75	0737	1424	0.7003	0.000	MG/H3
WEIGHTED AVE. = 0.000							
20	14	11/04/75	0755	1413	0.6425	0.016	MG/H3
WEIGHTED AVE. = 0.016							
301	11	11/06/75	0654	1455	0.6425	0.000	MG/H3
X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES							
302	11	11/06/75	0655	1455	0.8159	0.000	MG/H3
WEIGHTED AVE. = 0.000							
304	15	11/06/75	0701	1455	0.8057	0.000	MG/H3
WORKING AT SHAFT STATION							
WEIGHTED AVE. = 0.000							
401	18	11/07/75	0715	1327	0.6323	0.016	MG/H3
WEIGHTED AVE. = 0.016							
401	10	11/07/75	0723	1325	0.6153	0.065	MG/H3
WEIGHTED AVE. = 0.065							
402	1C	11/07/75	0729	1330	0.6153	0.000	MG/H3
X-RAY ANALYSIS IMPOSSIBLE DUE TO INTERFERENCES							
402	10	11/07/75	0746	1300	0.5337	0.000	MG/H3
WEIGHTED AVE. = 0.000							

C. D. INDIVIDUAL SAMPLE RESULTS

SHEET		SAMPLE	DATE	TIME	TIME	VOLUME	CONC.	UNITS
NO.		NO.		ON	OFF	ML		
3	1A	1804	11/07/75	0712	1324	0.8523	0.000	HG/H3
		WEIGHTED AVE. =	0.000					
5	1B	1314	11/07/75	0725	1331	0.6221	0.016	HG/H3
		WEIGHTED AVE. =	0.016					
6	1C	1444	11/07/75	0718	1325	0.6238	0.000	HG/H3
		WEIGHTED AVE. =	0.000					
6	1D	1462	11/04/75	0707	1427	0.7479	0.013	HG/H3
		WEIGHTED AVE. =	0.013					
1	1E	1473	11/07/75	0727	1327	0.6119	0.016	HG/H3
		WEIGHTED AVE. =	0.016					

SAMPLE 1A5 DELETED FROM THE STATISTICAL RESULTS (TABLE 4) AND THE TIME WEIGHTED AVERAGES

CRMC-HT-TALC-000379

GOUVERNEMENT TALC CO.

GOUVERNEMENT H.C.Y.

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

AGENT STUDIED: ASBESTOS
COUNTRY: LAMENCE

SIC CODE: 1496

10. SAMPLING PROCEDURES

5109

SAMPLING METHOD ANALYTICAL TECH.

FIBER COUNT

OPTICAL MICRO.

5109

FIBER COUNT

ELECTRON MICRO.

CRMCH-TALC-000381

AIRBORNE 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

SITE 25-053105		ANALYTICAL TECHNIQUE: FIBER COUNT		OPTICAL MICRO.			
SHIFT	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS
2	11	G198	11/05/75	0936	1025	83,3000	14,673 FB/CC
							700 FOOT CRUSHERMAN
2	11	G220	11/05/75	1025	1149	83,3000	0,000 FB/CC
							1100 FT CRUSHER, TOO HIGH TO COUNT.
2	11	G221	11/05/75	0652	0805	124,1000	7,714 FB/CC
							3 CHARGES SET OFF, DRILLED AND WORKED CRUSHER-DUSTY.
2	11	G224	11/05/75	0805	0936	154,7000	8,874 FB/CC
							WORKING CRUSHER & DRILLING, 80-90% AT CRUSHER.
2	11	G241	11/05/75	1259	1415	129,2000	9,740 FB/CC
							20 MIN IN BREAK ROOM.
WEIGHTED AVE. =		9.792					
03	1A	G155	11/05/75	1250	1403	124,1000	2,571 FB/CC
03	1A	G218	11/05/75	1112	1144	54,4000	9,625 FB/CC
03	1A	G224	11/05/75	0846	1112	248,2000	2,863 FB/CC
03	1A	G236	11/05/75	0700	0846	180,2000	5,079 FB/CC
WEIGHTED AVE. =		4.007					
03	1D	G189	11/05/75	1300	1455	127,5000	3,387 FB/CC
03	1D	G190	11/05/75	1104	1340	197,2000	3,511 FB/CC
							TRAINING 23 SLOPE TOOK LUNCH BREAK 1130-1215
03	1D	G195	11/05/75	1041	1144	107,1000	8,096 FB/CC
03	1D	G196	11/05/75	0859	1041	173,4000	8,299 FB/CC
03	1D	G232	11/05/75	0703	0859	197,2000	6,504 FB/CC
							TRAINING #23 STOPE.
WEIGHTED AVE. =		5.874					
103	1E	G199	11/05/75	0900	1045	178,5000	5,836 FB/CC
103	1E	G211	11/05/75	1045	1151	112,2000	10,787 FB/CC
							TRAINING 23 STOPE.
103	1E	G217	11/05/75	1151	1455	312,8000	2,300 FB/CC
							TRAINING STOPE 23, TOOK 45 MIN LUNCH BREAK.

II. INDIVIDUAL SAMPLE RESULTS

SAMPLE METHOD		ANALYTICAL TECHNIQUE		FIBER COUNT		OPTICAL MICRO,			
SHEET	SAMPLE	DATE	TIME	TIME	VOLUME	CUNC.	UNITS		
NO.	NO.		ON	OFF	LITERS				
13	18	G238	11/05/75	0704	0900	197.2000	2.814	FB/CC	TRAMMER #23 STOPE.
WEIGHTED AVE. = 4.000									
13	12	G214	11/05/75	0836	1021	178.5000	8.703	FB/CC	DAGGING ORE, SHALL CAVERN 700FT.
13	12	G219	11/05/75	1021	1141	138.0000	10.626	FB/CC	
13	12	G222	11/05/75	0853	0836	175.1000	3.748	FB/CC	
WEIGHTED AVE. = 7.005									
13	17	G156	11/05/75	1240	1455	229.5000	2.672	FB/CC	
13	17	G207	11/05/75	1019	1100	69.7000	14.599	FB/CC	
103	17	G226	11/05/75	0859	0902	209.1000	4.319	FB/CC	DAGGING ROCK DOWN FROM 500FT LEVEL, LARGE CAVERN.
103	17	G228	11/05/75	0902	1019	130.9000	3.174	FB/CC	
WEIGHTED AVE. = 4.014									
103	19	G149	11/05/75	1325	1415	85.0000	4.209	FB/CC	SPENT 20 MIN IN BREAK ROOM.
133	19	G193	11/05/75	0832	1022	187.0000	9.724	FB/CC	
103	19	G213	11/05/75	1102	1145	73.1000	11.037	FB/CC	
103	19	G237	11/05/75	0700	0832	156.4000	4.697	FB/CC	DAGGING ORE, SHALL CAVERN 700FT LEVEL.
133	19	G212	11/05/75	1022	1102	68.0000	11.157	FB/CC	
WEIGHTED AVE. = 7.800									
0105	18	G148	11/05/75	1340	1457	130.9000	4.844	FB/CC	
0105	18	G200	11/05/75	0917	1040	141.1000	6.828	FB/CC	
0106	18	G209	11/05/75	1040	1240	204.0000	4.722	FB/CC	TOOK 45 MIN LUNCH BREAK.
0106	18	G229	11/05/75	0658	0917	236.3000	2.574	FB/CC	DRILLER, #23 STOPE
WEIGHTED AVE. = 4.412									
0106	18	G200	11/05/75	0940	1415	467.5000	0.876	FB/CC	TOOK LUNCH BREAK FOR 45 MIN, SPENT AFTERNOON IN LUNCH

II. INDIVIDUAL SAMPLE RESULTS

SHEET		SAMPLE	DATE	TIME AM	TIME PM	VOLUME LITERS	CONC.
4254513							
LEACHING ANALYTICAL TECHNIQUE							OPTICAL HIGH.
SHEET		SAMPLE	DATE	TIME AM	TIME PM	VOLUME LITERS	CONC.
14	G210	11/05/75	0659	0940	461,5000	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	10.152	
15	G223	11/05/75	1200	1415	161,5000	5.965	
15	G233	11/05/75	1104	1240	163,2000	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	G01	11/04/75	0719	0839	136,0000	3.630	
14	G76	11/04/75	0839	1040	215,9000	2.371	
14	G79	11/04/75	1046	1205	134,3000	7.532	
14	G143	11/04/75	1300	1420	136,0000	4.693	
WEIGHTED AVE. =		4.266					
24	G04	11/03/75	1513	1755	275,4000	5.816	
24	G42	11/03/75	1755	1954	210,8000	5.284	
24	G43	11/03/75	1953	2129	153,0000	3.306	
24	G52	11/03/75	2129	2238	117,3000	3.703	
WEIGHTED AVE. =		4.832					
14	G150	11/04/75	1047	1155	117,3000	0.000	
15	G08	11/04/75	0731	0840	117,3000	13.243	
15	G09	11/04/75	0840	0945	110,5000	5.473	

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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 RESPIRATOR
ALL OF THE TIME

FB/CC

E II. INDIVIDUAL SAMPLE RESULTS

SHEET SAMPLE				DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS	
NO	MAN	NO.	NO.							
23	15	G98		11/04/75	0945	1047	105,4000	5.941	FR/CC	TOO HIGH TO COUNT
23	15	G136		11/04/75	1155	1335	170,0000	1.507	FR/CC	WORKED OUTSIDE MOVING RUSTY PIPE FOR 45 MIN.
23	15	G146		11/04/75	1335	1430	93,5000	2.927	FR/CC	OUTSIDE WORKING
WEIGHTED AVE. =				5.554						
204	14	G190		11/07/75	0746	0905	134,3000	1.686	FR/CC	
WEIGHTED AVE. =				1.686						
204	14	G115		11/04/75	1040	1150	119,0000	4.776	FR/CC	
WEIGHTED AVE. =				4.776						
204	13	G56		11/04/75	0719	0826	113,9000	7.612	FR/CC	1 RUN TO SLEEP AND BRUSH UP FOR 10 MIN. USUALLY STAYS INSIDE WEARS RESPIRATOR MOST OF THE TIME
204	13	G77		11/04/75	0826	0945	134,3000	3.848	FR/CC	
204	13	G103		11/04/75	0945	1040	93,5000	8.372	FR/CC	
204	13	G138		11/04/75	1150	1255	110,5000	8.664	FR/CC	
204	13	G139		11/04/75	1255	1345	85,0000	11.617	FR/CC	
204	13	G145		11/04/75	1350	1425	59,5000	11.030	FR/CC	
WEIGHTED AVE. =				7.990						
204	14	G63		11/04/75	0711	0827	129,2000	9.367	FR/CC	15 MIN BREAK,
WEIGHTED AVE. =				9.367						
204	21	G01		11/03/75	1438	1655	232,9000	1.865	FR/CC	MADE 6 CHECKS ON MACHINERY. AFTER 1900 WILL BE MAKING SAMPLE RUNS IN ADDITION TO CHECKING MACHINERY.
204	21	G24		11/03/75	1655	1752	96,9000	2.368	FR/CC	4 RUNS TO CHECK MACHINERY, 6 MIN.
204	21	G26		11/03/75	1752	1852	102,0000	4.632	FR/CC	1 RUN TO DISENGAGE BY HAMMERING, HEAVY EXPOSURE, 2 RUNS TO CHECK MACHINERY, 8 MIN.
204	21	G38		11/03/75	1852	1958	112,2000	2.168	FR/CC	5 RUNS, 10 MIN.

E 11. INDIVIDUAL SAMPLE RESULTS

SEE ASBESTOS
PLE METHOD 15/22-TECHNIQUE FIBER COUNT OPTICAL MICRO.

SHIFT	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS	
21	G45	11/03/75	1958	2059	103,7000	1,935	FB/CC	5 RUNS, 6 MIN.
21	G51	11/03/75	2059	2154	93,5000	5,913	FB/CC	1 RUN TO CLEAN UP PER SHIFT, 2 SAMPLE RUNS PER SHIFT.
21	G54	11/03/75	2154	2236	71,4000	2,607	FB/CC	MADE 3 RUNS, 10 MIN.
WEIGHTED AVE. = 2.054								
11	G114	11/04/75	1055	1200	110,5000	6,593	FB/CC	
WEIGHTED AVE. = 6.593								
12	G58	11/04/75	0708	0841	158,1000	11,197	FB/CC	1 SAMPLE RUN PER HR TAKES CARE OF SPILLS TOO USUALLY STAYS OUTSIDE-WEARS RESPIRATOR-SOME OF THE TIME
12	G74	11/04/75	0841	0946	110,5000	13,622	FB/CC	BLEW HIMSELF OFF WITH AIR GUN
12	G101	11/04/75	0946	1055	117,3000	8,932	FB/CC	
12	G126	11/04/75	1200	1255	93,5000	8,822	FB/CC	BLEW HIMSELF OFF WITH AIR GUN.
12	G142	11/04/75	1255	1345	85,0000	16,930	FB/CC	
12	G152	11/04/75	1345	1425	68,0000	26,829	FB/CC	
WEIGHTED AVE. = 13.391								
23	G93	11/03/75	1646	1648	207,4000	1,725	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.
23	G22	11/03/75	1648	1748	102,0000	5,527	FB/CC	3 SAMPLE RUNS, 5 MIN.
23	G27	11/03/75	1748	1850	105,4000	3,570	FB/CC	2 SAMPLES RUN, 3 MIN
23	G40	11/03/75	1850	2005	127,5000	2,891	FB/CC	2 SAMPLE RUNS, 1 CLEAN UP, TOOK 15 MIN.
23	G48	11/03/75	2005	2105	102,0000	6,233	FB/CC	1 RUN TO SKEEP UP PER SHIFT, 2 SAMPLE RUNS, 15 MIN.
23	G50	11/03/75	2105	2155	85,0000	5,962	FB/CC	2 SAMPLE RUNS, 10 MIN

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21. INDIVIDUAL SAMPLE RESULTS

21.1 ASBESTOS
 ANALYTICAL TECHNIQUE: FIBER COUNT OPTICAL MICRO.

SHIFT	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS
21	23	G55	11/03/75	2155	2237	71,4000	3,469 FB/CC
WEIGHTED AVE. = 3,017							
21A	11	G121	11/04/75	1040	1145	110,5000	5,394 FB/CC
WEIGHTED AVE. = 5,394							
21B	11	G57	11/04/75	0707	0820	124,1000	14,070 FB/CC
1 CLEANUP OF SPILL 1 SHEEP UP 1 SAMPLE RUN OUTSIDE MUST ALL OF THE TIME WEAR RESPIRATOR MOST OF THE TIME							
21B	11	G15	11/04/75	0820	0930	119,0000	7,084 FB/CC
1 RUN TO CLEAN UP SPILL DURING SAMPLE PERIOD							
21B	11	G100	11/04/75	0930	1040	119,0000	5,060 FB/CC
21B	11	G125	11/04/75	1145	1220	59,5000	29,144 FB/CC
USED AIR GUN ON EQUIPMENT, HEAVY EXPOSURE							
21B	11	G144	11/04/75	1220	1330	119,0000	6,831 FB/CC
21B	11	G148	11/04/75	1330	1408	64,6000	23,115 FB/CC
21B	11	G159	11/04/75	1408	1430	37,4000	15,639 FB/CC
WEIGHTED AVE. = 12,104							
21B	22	G02	11/03/75	1444	1649	212,5000	5,979 FB/CC
MADE 2 SAMPLE RUNS 1 RUN PER HOUR							
21A	22	G23	11/03/75	1649	1749	102,0000	8,441 FB/CC
3 SAMPLE RUNS, 8 MIN.							
21A	22	G25	11/03/75	1749	1848	100,3000	2,610 FB/CC
1 SAMPLE RUN, 3 MIN.							
21B	22	G29	11/03/75	2008	2108	102,0000	3,472 FB/CC
1 RUN TO CLEAN UP, BLOWS THE MILLS WITH AIR GUN, ONE 11 ME PER SHIFT, 2 SAMPLE RUNS, 15 MIN.							
21B	22	G39	11/03/75	1848	2008	136,0000	5,844 FB/CC
2 SAMPLE RUNS, 5 MIN.							
21A	22	G53	11/03/75	2155	2236	69,7000	6,170 FB/CC
2 SAMPLE RUNS, 5 MIN.							
WEIGHTED AVE. = 5,498							
21A	1E	G71	11/04/75	0740	0922	173,4000	4,722 FB/CC

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 WEARING RESPIRATOR.

54658.25

DATE	SHEET	SAMPLE	DATE	TIME	TIME	VOLUME	CONC.
				IN	OFF	LITERS	

15 26161730 436 = 7.972

UNITS

FB/CC

FB/CC

CHANGED FROM NYTAL 100 TO CERAHATA HP7 AT 11115, TOOK
30 MIN LUNCH BREAK.

FB/CC

WEARING RESPIRATOR

FB/CC

FB/CC

CHANGED FROM NYTAL 100 TO CERAMATALC 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 1115, 45 MIN LUNCH AT 1145.

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

FB/CC

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II. INDIVIDUAL SAMPLE RESULTS

11-15-75

DETERMINATION OF FIBER COUNT / OPTICAL MICRO

SAMPLE NO.	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS
1	14	649	11/04/75	1027	1136	117,3000	9,291 FB/CC
2	14	645	11/04/75	0929	1027	98,6000	9,038 FB/CC
3	15	646	11/04/75	0927	1027	204,0000	1,181 FB/CC
4	12	6130	11/04/75	1240	1340	102,0000	7,792 FB/CC
5	15	6133	11/04/75	1136	1240	108,8000	6,088 FB/CC
6	14	6157	11/04/75	1340	1426	78,2000	9,394 FB/CC
WEIGHTED AVE. = 6,220							
7	19	660	11/04/75	0714	0811	96,9000	6,649 FB/CC
8	19	681	11/04/75	0914	1014	102,0000	3,011 FB/CC
9	19	690	11/04/75	1014	1114	102,0000	6,434 FB/CC
10	19	692	11/04/75	0812	0914	105,4000	3,808 FB/CC
11	19	6123	11/04/75	1114	1237	141,1000	5,334 FB/CC
12	19	6129	11/04/75	1237	1337	102,0000	5,903 FB/CC
13	19	6153	11/04/75	1337	1429	88,4000	12,941 FB/CC
WEIGHTED AVE. = 6,110							
14	20	666	11/03/75	1520	1647	1983,9000	0,202 FB/CC
WEIGHTED AVE. = 0,202							
15	27	619	11/03/75	1647	1906	236,3000	4,306 FB/CC
16	27	635	11/03/75	1906	2016	119,0000	6,780 FB/CC
17	27	644	11/03/75	2141	2248	113,9000	3,420 FB/CC
18	27	647	11/03/75	2016	2141	144,5000	3,237 FB/CC
WEIGHTED AVE. = 4,370							
19	24	608	11/03/75	1526	1648	139,4000	2,400 FB/CC
20	24	612	11/03/75	1648	1856	217,6000	7,499 FB/CC

15 MIN BREAK, 45 MIN LUNCH

TOOK COFFEE-BREAK,

TOOK 15 MIN COFFEE BREAK,

BAG BURST AT 1600 HRS,

E 1. INDIVIDUAL SAMPLE RESULTS

FALL 1975

FALL 1975 ANALYTICAL TECHNIQUE: FIBER COUNT OPTICAL MICRO.

DE	SHIFT	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS
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04	2A	G33	11/03/75	2130	2229	100.3000	15.908	FB/CC
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BAG BURST AT 2225

04	2A	G36	11/03/75	2005	2130	144.5000	10.063	FB/CC
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TOOK 15 MIN COFFEE BREAK, CLEANED HIMSELF WITH COMPRESSED AIR. BAG BURST 2125.

04	2A	G37	11/03/75	2229	2253	40.8000	20.956	FB/CC
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WEIGHTED AVE. = 9.130

04	2A	G37	11/03/75	1520	1647	147.9000	3.016	FB/CC
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04	2A	G13	11/03/75	1645	1904	236.3000	6.013	FB/CC
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TOOK DINNER BREAK 30 MIN

04	2A	G15	11/03/75	1904	2012	115.6000	6.354	FB/CC
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04	2A	G2A	11/03/75	2144	2250	112.2000	6.037	FB/CC
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04	2A	G46	11/03/75	2012	2144	156.4000	3.080	FB/CC
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TOOK 15 MIN. COFFEE BREAK.

WEIGHTED AVE. = 4.894

211	1A	G46	11/04/75	0730	0832	105.4000	5.713	FB/CC
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15 MIN. BREAK.

211	1A	G25	11/04/75	0433	1033	612.0000	1.604	FB/CC
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211	1A	G46	11/04/75	1033	1138	110.5000	6.430	FB/CC
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211	1A	G74	11/04/75	0832	0932	102.0000	7.438	FB/CC
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211	1A	G134	11/04/75	1140	1230	85.0000	8.288	FB/CC
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211	1A	G135	11/04/75	1232	1332	102.0000	7.585	FB/CC
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211	1A	G15A	11/04/75	1332	1428	95.2000	5.515	FB/CC
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WEIGHTED AVE. = 4.171

211	2A	G10	11/03/75	1525	1654	151.3000	4.218	FB/CC
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211	2A	G14	11/03/75	1858	2031	158.1000	2.176	FB/CC
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211	2A	G20	11/03/75	1654	1858	210.8000	3.142	FB/CC
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TOOK DINNER BREAK, 30 MIN.

211	2A	G32	11/03/75	2031	2252	239.7000	1.812	FB/CC
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TOOK 15 MIN COFFEE BREAK.

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E 11. INDIVIDUAL SAMPLE RESULTS

NOTE: ASBESTOS

PER MINUTE ANALYTICAL TECHNIQUE: FIBER COUNT OPTICAL MICRO

	SHEET NO.	SAMPLE NO.	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS
WEIGHTED AVE. = 2.736								
2	11	G78	11/04/75	0810	1007	198,9000	1,911	FB/CC
12	11	G113	11/04/75	1007	1428	443,7000	1,588	FB/CC
WEIGHTED AVE. = 1.688								
12	25	G05	11/03/75	1521	1810	297,5000	1,079	FB/CC
12	25	G16	11/03/75	1816	2030	227,8000	1,859	FB/CC
12	25	G01	11/03/75	2030	2300	255,0000	1,015	FB/CC
WEIGHTED AVE. = 1.246								
13	11	G05	11/04/75	0815	0830	127,5000	5,478	FB/CC
13	11	G04	11/04/75	0930	1030	102,0000	4,722	FB/CC
13	11	G08	11/04/75	0830	0930	102,0000	5,420	FB/CC
13	11	G01	11/04/75	1030	1137	113,9000	6,284	FB/CC
13	11	G128	11/04/75	1235	1335	102,0000	7,261	FB/CC
13	11	G132	11/04/75	1137	1235	98,6000	4,614	FB/CC
13	11	G147	11/04/75	1335	1420	83,3000	6,592	FB/CC
WEIGHTED AVE. = 5,750								
13	10	G02	11/04/75	0737	0911	159,8000	3,135	FB/CC
13	10	G03	11/04/75	0911	1101	187,0000	1,146	FB/CC
13	10	G118	11/04/75	1101	1237	163,2000	1,653	FB/CC
13	10	G119	11/04/75	1237	1421	176,8000	2,598	FB/CC
WEIGHTED AVE. = 2,103								
13	26	G09	11/03/75	1521	1700	168,3000	2,581	FB/CC
13	26	G10	11/03/75	1700	1953	294,1000	3,340	FB/CC

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TOOK 30 MIN LUNCH BREAK.

WENT TO #3 HILL DURING SAMPLE FOR 10 MIN.

TOOK 15 MIN BREAK.

15 MIN BREAK.

CRMCHT-TALC-000391

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

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

E (1). INDIVIDUAL SAMPLE RESULTS.

NOTE: 45405145
 SAMPLE METHOD: ANALYTICAL TECHNIQUE: FINE COUNT / OPTICAL MICRO.

SHIFT	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS	
DE	MAN	NO.						
								TOOK DINNER BREAK.
13	26	G10	11/03/75	1953	2150	196,9000	3,814	FR/CC
								TOOK 15 MIN COFFEE BREAK.
13	26	G11	11/03/75	2150	2247	96,9000	8,264	FR/CC
14	10	G70	11/04/75	0714	0918	176,8000	1,336	FR/CC
14	10	G102	11/04/75	0918	1044	146,2000	5,354	FR/CC
								HAND SWEEPING DUST FROM BROKEN BAGS DURING SURVEY.
214	10	G108	11/04/75	1044	1337	294,1000	2,938	FR/CC
								TOOK 30 MIN LUNCH BREAK.
214	10	G151	11/04/75	1337	1429	88,4000	5,558	FR/CC
220	14	G79	11/04/75	0855	0926	154,7000	1,573	FR/CC
220	14	G82	11/04/75	0926	1245	338,3000	2,367	FR/CC
220	14	G106	11/04/75	1245	1413	149,6000	1,750	FR/CC
303	14	G164	11/05/75	1241	1455	227,8000	4,414	FR/CC
303	14	G203	11/05/75	1148	1241	158,1000	3,736	FR/CC
								WORKING AT SHAFT STATION, TOOK LUNCH BREAK FOR 30 MIN.
303	14	G227	11/05/75	0741	1108	419,9000	1,195	FR/CC
								MAINTENANCE AT SHAFT STATION.
334	14	G234	11/05/75	0655	0904	219,3000	0,763	FR/CC
								REPAIRING BLUSHER, 4FW RAMP.
3304	10	G245	11/05/75	1110	1457	385,9000	1,447	FR/CC
								TOOK 30 MIN LUNCH BREAK.
3304	10	G251	11/05/75	0742	1112	425,0000	1,269	FR/CC
								MAINTENANCE AT SHAFT STATION.
3304	14	G141	11/05/75	1410	1455	76,5000	3,878	FR/CC

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E 11. INDIVIDUAL SAMPLE RESULTS

DATE: 11/05/75

ANALYTICAL TECHNIQUE: FIBER COUNT OPTICAL MICRO.

	SHEET NO.	SAMPLE NO.	DATE	TIME IN	TIME OFF	VOLUME LITERS	CONC.
4	18	G187	11/05/75	1324	1410	78,2000	1.063
4	18	G200	11/05/75	1021	1137	129,2000	2.716
4	18	G210	11/05/75	1137	1324	181,9000	2.780

WEIGHTED AVE. = 2.657

4	13	G178	11/05/75	1325	1455	153,0000	2.361
4	13	G197	11/05/75	0904	0959	93,5000	2.323
4	13	G201	11/05/75	0959	1147	183,8000	2.454
4	13	G212	11/05/75	1147	1325	166,6000	0.239

4	13	G239	11/05/75	0654	0904	221,0000	1.112
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WEIGHTED AVE. = 1.608

01	18	G104	11/07/75	1132	1324	190,4000	2.580
01	18	G146	11/07/75	0715	0952	266,9000	0.916

WEIGHTED AVE. = 1.009

01	10	G171	11/07/75	1133	1324	266,9000	0.000
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01	10	G238	11/07/75	0955	1133	266,9900	0.000
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01	18	G150	11/07/75	0723	0955	258,4000	2.346
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WEIGHTED AVE. = 2.346

02	16	G101	11/07/75	0900	0937	62,9000	3.025
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02	16	G102	11/07/75	0729	0900	154,7000	2.912
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02	16	G100	11/07/75	0937	1150	192,1000	2.299
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02	16	G170	11/07/75	1131	1325	195,8000	1.218
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WEIGHTED AVE. = 2.165

02	18	G143	11/07/75	1145	1300	127,5000	3.148
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02	18	G184	11/07/75	0905	1145	272,0000	4.029
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UNIT 13

FB/CC

FB/CC

FB/CC

MAINT. AT 4FW RAMP. TOOK LUNCH BREAK, 45 MIN.

FB/CC

FB/CC

FB/CC

FB/CC

MAINTENANCE AT SLUSHER 4FW RAMP - TOOK LUNCH BREAK - AT 1130-1215

FB/CC

MAINTENANCE REPAIRING SLUSHER 4FW 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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FB/CC

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TABLE II. INDIVIDUAL SAMPLE RESULTS

DATE: 11/07/75

ANALYTICAL TECHNIQUE: FIBER COUNT OPTICAL MICRO.

IN	SHEET	SAMPLE	DATE	TIME	TIME	VOLUME	CONC.
NO	NO.	NO.		ON	OFF	LITERS	
WEIGHTED AVE. = 3.748							
403	1A	G165	11/07/75	1133	1324	188.7000	0.542
403	1A	G174	11/07/75	0951	1133	173.4000	0.285
403	1A	G150	11/07/75	0712	0951	270.3000	3.586
WEIGHTED AVE. = 1.773							
405	1E	G173	11/07/75	1134	1324	270.3000	0.800
405	1E	G177	11/07/75	0725	0954	253.3000	0.677
405	1E	G142	11/07/75	0954	1134	170.0000	0.855
WEIGHTED AVE. = 3.961							
406	1C	G172	11/07/75	0950	1134	176.8000	2.197
406	1C	G191	11/07/75	0718	0950	250.4000	1.235
406	1C	G192	11/07/75	1135	1324	185.3000	1.913
WEIGHTED AVE. = 1.712							
410	1B	G64	11/04/75	0707	0958	290.7000	4.453
410	1B	G197	11/04/75	0958	1142	176.8000	4.019
410	1B	G137	11/04/75	1142	1342	204.0000	4.339
410	1B	G147	11/04/75	1342	1427	76.5000	1.656
WEIGHTED AVE. = 4.033							
411	1F	G154	11/07/75	0727	0957	255.0000	1.574
411	1F	G176	11/07/75	0957	1152	195.5000	3.141
411	1F	G185	11/07/75	1152	1324	156.4000	0.751
WEIGHTED AVE. = 1.867							

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DN119

FB/CC

FB/CC

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FB/CC

--- TOO HIGH TO COUNT. ---

FB/CC

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FB/CC

- HIGH CONC. ESTIMATED CONC. ONLY -

FB/CC

FB/CC

WORKER TURNED OFF PUMP DURING 30 MIN FOR LUNCH,

CRMC-HT-TALC-000394

E12. INDIVIDUAL SAMPLE RESULTS

DATE: 11/05/75

SAMPLE METHOD: GRAVIMETRIC TECHNIQUE: FINE COUNT / ELECTRON MICRO,

SE	SHIFT	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.
03	10	G194	11/05/75	1144	1340	197.2000	20.152
WEIGHTED AVE. = 20.152							
03	17	G156	11/05/75	1240	1455	229.5000	22.563
WEIGHTED AVE. = 22.563							
03	18	G149	11/05/75	1325	1415	85.0000	13.223
03	19	G237	11/05/75	0700	0832	156.4000	8.855
WEIGHTED AVE. = 10.343							
06	18	G240	11/05/75	0659	0940	273.7000	9.460
WEIGHTED AVE. = 9.460							
15	15	G223	11/05/75	1240	1415	161.5000	17.523
WEIGHTED AVE. = 17.523							
201	24	G404	11/03/75	1513	1755	275.4000	18.365
201	24	G42	11/03/75	1755	1959	210.8000	33.705
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
WEIGHTED AVE. = 23.612							
204	13	G17	11/04/75	0836	0945	134.3000	8.967
WEIGHTED AVE. = 8.967							
204	21	G15	11/03/75	1852	1958	112.2000	15.563
WEIGHTED AVE. = 15.563							
206	12	G141	11/04/75	0946	1055	117.3000	102.662
WEIGHTED AVE. = 102.662							
206	23	G22	11/03/75	1648	1748	102.0000	33.647
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.

CRMC-HT-TALC-000395

2. INDIVIDUAL SAMPLE RESULTS

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

SHEET NO.	SAMPLE	DATE	TIME ON	TIME OFF	VOLUME LITERS	CONC.	UNITS
11	G144	11/04/75	1220	1330	119,0000	18,215	FB/CC
EIGHTED AVE. = 18,215							
22	G002	11/03/75	1404	1649	212,5000	25,501	FB/CC
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
EIGHTED AVE. = 41,752							
19	G45	11/04/75	0433	1033	612,0000	7,280	FB/CC
EIGHTED AVE. = 7,280							
24	G10	11/03/75	1525	1654	151,3000	26,863	FB/CC
EIGHTED AVE. = 26,863							
11	G113	11/04/75	1007	1428	443,7000	13,570	FB/CC
EIGHTED AVE. = 13,570							
25	G05	11/03/75	1521	1816	297,5000	16,191	FB/CC
EIGHTED AVE. = 16,191							
24	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	G143	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							

MADE 2 SAMPLE RUNS 1 RUN PER HOUR

TOOK 15 MIN COFFEE BREAK.

TOOK 30 MIN LUNCH BREAK.

WENT TO #3 HILL DURING SAMPLE FOR 10 MIN.

SPL WAS DELETED FROM THE STATISTICAL RESULTS (TABLE 4) AND THE TIME WEIGHTED AVERAGES

13. STATISTICS

TE ASBESTOS
LE MET-HOD/ANALYTICAL TECHNIQUES FIBER COUNT OPTICAL MICRO.

JOB	UNIT	RANGE FIB/CC (1-100)	MEAN FIB/CC	MEDIAN FIB/CC	T.W. AVE.	STANDARD DEVIATION	STANDARD ERROR	JOB TITLE
0102	004	014,673-007,114	10,250	9,307	9.792	3,063	1,531	CRUSHER OPERATOR
0103	025	014,597-002,309	6,413	5,079	5,575	3,544	0,709	THAMMER
0105	005	006,620-000,476	3,929	4,644	3,011	2,275	1,017	DRILLER
0115	005	018,152-005,465	10,254	8,377	9,518	4,778	2,137	CAGEMAN
AREA	01	039 018,152-000,876	6,982	6,504		3,949	0,632	
0201	004	010,035-002,371	5,819	4,673	5,305	4,128	1,376	HILL FOREMAN
0203	005	013,243-001,507	5,818	5,473	5,554	4,533	2,027	GENERAL LABORER
0204	010	011,617-001,006	5,529	4,704	5,074	3,460	0,865	CRUSHER OPERATOR
0206	010	020,829-001,725	8,736	6,413	7,901	6,743	1,802	HANDING OPERATOR
0208	010	029,144-002,219	9,918	6,501	8,393	7,838	2,095	WHEELER OPERATOR
0209	004	020,456-000,202	6,892	6,063	5,673	4,174	0,602	PACKER
0211	011	000,246-001,004	4,402	5,515	3,618	2,447	0,738	PACKER SERVICE MAN
0212	005	001,911-001,015	1,490	1,588	1,467	0,424	0,189	PACKHOUSE FOREMAN
0213	015	008,204-001,146	4,460	4,014	3,962	2,096	0,541	FORK LIFT OPERATOR/TOW MOTOR-OPER.
0214	004	005,557-001,330	3,197	4,140	3,365	2,026	1,013	CAR LINER
0220	003	002,507-001,573	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	003,878-000,239	1,868	1,885	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	HILLWRIGHT
0402	005	004,029-001,218	2,772	2,969	2,807	0,943	0,385	INSTRUMENT REPAIRMAN
0403	003	003,586-000,245	1,471	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	HILLWRIGHT HELPER
0406	003	002,197-001,235	1,782	1,913	1,712	0,494	0,285	SHEET METAL WORKER
0410	004	007,453-001,056	3,617	4,179	4,033	1,320	0,666	OILER
0411	003	003,141-000,751	1,022	1,574	1,867	1,214	0,701	WELDER
AREA	04	024 008,855-000,245	2,571	2,323		1,836	0,375	
PLANT TOTAL	252	029,144-000,202	5,751	4,722		4,536	0,304	

19. STATISTICS

PLANT ASBESTOS
 ANALYTICAL TECHNIQUE: FIBER COUNT / ELECTRON MICRO

JOB	NO. OF SAMPLES	NAME FN/CC (-1-LEAD)	MEAN FN/CC	MEDIAN FN/CC	T.M. AVE. DEVIATION	STANDARD DEVIATION	STANDARD ERROR	JOB TITLE
0103	004	022,503-008,455	16,198	16,688	17,454	6,296	3,148	TRAMMER
0106	001	009,460-009,460	9,460	9,460	9,460	0,000	0,000	DRILLER
0115	001	017,523-017,523	17,523	17,523	17,523	0,000	0,000	CAGEHAN
0201	006	022,503-008,455	15,290	15,373		5,678	2,318	
0201	002	033,705-018,365	20,035	26,035	25,016	10,847	7,670	HILL FOREMAN
0203	002	030,501-007,416	22,789	22,789	23,612	19,477	13,772	GENERAL LABORER
0204	002	015,503-008,467	12,205	12,205	11,969	4,664	3,294	CRUISER OPERATOR
0206	002	102,002-033,047	60,155	68,155	70,502	48,801	34,507	HARDING OPERATOR
0208	002	025,501-010,215	21,858	21,858	22,886	5,152	3,643	WHEELER OPERATOR
0209	002	041,752-031,077	30,815	36,815	35,972	6,983	4,937	PACKER
0211	002	020,003-017,280	10,972	16,972	11,122	13,706	9,691	PACKER SERVICEHAN
0212	002	010,191-013,570	14,881	14,881	14,622	1,853	1,310	PACKHOUSE FOREMAN
0213	001	030,040-030,040	30,040	30,040	30,040	0,000	0,000	FORK LIFT OPERATOR/TOW MOTOR OPER.
0302	017	102,002-007,280	27,975	25,501		22,124	5,366	
0304	001	010,743-010,743	10,743	16,743	16,743	0,000	0,000	MAINTENANCE MECHANIC
0303	001	010,743-010,743	10,743	16,743		0,000	0,000	
0403	001	024,049-024,949	24,949	24,949	24,949	0,000	0,000	MACHINIST
0411	001	007,850-004,856	9,856	9,856	9,856	0,000	0,000	WELDER
0404	002	024,949-009,856	17,403	17,403		10,672	7,546	
PLANT TOTAL	026	102,002-007,280	23,804	18,290		18,941	3,715	

END OF REPORT