FILE NAME: RT Vanderbilt (RTV)

DATE: 1977 Mat 10

DOC#: RTV233

DOCUMENT DESCRIPTION: OSHA Report of the Fiber Content of Talc Samples

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration
WASHINGTON, D.C. 20210

Office of the Assistant Secretary

20 MAY 1977

Enclosed is a copy of A Report of the Fiber Content Eighty Industrial Talc Samples Obtained from, and Using the Procedures of the Occupational Safety and Health Administrtion (OSHA).

The analysis discussed in the report was conducted by the National Bureau of Standards at the request of OSHA. The purpose of this study was to determine the fiber content of industrial talcs and thereby answer parties regulated by OSHA who challenged data of both OSHA and the National Institute for Occupational Safety and Health. The enclosed final report was received by OSHA on May 10, 1977. I hope you find that this report addresses your concerns and consider it, as does OSHA, a means to assure healthful working conditions for employees.

Sincerely,

Eula Bingham

Eula Bingham
Assistant Secretary
Occupational Safety and Health

Enclosure

RECEIVED
JUL 13 1977
SOUTHWEST
PURCH.

EXHIBIT
6

TALC SAMPLE NUMBER	COMPANY AND SAMPLE DESIGNATION
1	Vanderbilt Talc Company Nytal 300
2	Vanderbilt Talc Company Nytal 400
3	Vanderbilt Talc Company 5X
4	Vanderbilt Talc Company 325
5	Vanderbilt Talc Company X
6	Vanderbilt Talc Company FT
7	Vanderbilt Talc Company 3X
34	Hitchcock Corporation Murphy, N.C., Product Talc
35	Windsor Minerals, Gassets "37" July 29, 1975
36	Windsor Minerals, West Windsor Mineral Ray Grind Composite
37	Windsor Minerals, Ludlow "36" July 29-30, 1976
38	Windsor Minerals, "Gassetts" 36, July 28-30, 1975
39	Vermont Talc Company - Bagging Bulk Sample, 7/16/75, 2nd shift
40	Vermont Talc Company - Bagging Bulk Sample, vertah XXXD 9/17/76 1st shift

TALC SAMPLE NUMBER	COMPANY AND SAMPLE DESIGNATION
41	Southern Talc Co. (Cohutta Mill) Chatsworth, Ga. Product (Powder) Sample Mine, MESA I.D. #04-00493
42	Packer Station #3, Vanderbilt Talc, Mill #1 Gouverneur, N. Y. 1st shift 11/4/75 (FT)
43	Packer Station #2, Vanderbilt Talc, Mill #1 Gouverneur, N. Y. (Nytal 100), 1st shift 11/4/75
44	Ceramitalc HDT, Vanderbilt Talc Co. 1st shift 11/4/75
45	Bagging Station #3, Vanderbilt Talc Co., Mill #1, Gouverneur, N. Y. 11/4/75 (Nytal 200)
46	Hitchcock Corp. #5 Mine MESA ID# 3100222
47	Hitchcock Corp., #3 Mine MESA ID# 3100683
48	Wrau Mine 3 mill, Int. Minerals and chemicals MESA ID# 31-0008
49	Bagging Station, Vanderbilt Talc Co. 2nd shift, Mill #1 Gouverneur, N. Y. (Nytal 300) 11/3/75
50	Bagging Station, Vanderbilt Talc Co., 2nd shift, 11/3/75 (Nytal 200)
51	Southern Talc Co., Southern Mill Product Talc sample, Chatsworth Ga. Rock Cliff Mine, MESA ID# 0900492, 9/3/74
52	Southern Talc Co., Southern Mill, Chatsworth, Ga. ore from Rock Cliff MESA ID# 90-00492
53	Southern Talc Co., Southern Mill Ore from Jude Hole Mine MESA ID# 09-00492

TALC SAMPLE NUMBER	COMPANY AND SAMPLE DESIGNATION
54	Winterborg Mine & Mill, Ore from American Talc Co., Alpine, Ala. Willowreek Mine, MESA ID# 01-00433 9/4/75
55	Thompson-Weinman Co., Cartersville Plant, Cartersville, Ga., 9/5/74, Ore from Brady Mine, MESA ID# 09-00224
56	Southern Talc Co., Cohutta Mill Chatsworth, Ga. 9/3/74, Ore from Ernest Mine, MESA ID# 09-00493
57	American Talc Co., Alpine, Ga. Winterboro Mine & Mill, 9/5/75 MESA ID# 01-00433, Final Prod.
58	Pioneer Talc Co. Inc., Garren Pit. Prod. #5 Allamore, Hudspeth Co., Texas MESA ID# 41-00869
59	Pioneer talc Co., Inc., Apache Pit Product, #4, Texas MESA ID# 41-00869
60	Pioneer Talc Co. Inc., #4 Texola Pit Product, Texas MESA ID# 41-00869
61	Southern Clay Products, #2 Bottom Product, Allamore, Hudspeth Co., Texas #18
62	Milwhite Co. Inc., Van Horn, Cumberson Co., Texas MESA ID# 41-01527 Ground Calcined Product
63	Milwhite Co. Inc., #11, Van Horn, Culberson Co. Texas, Eagle Hat Pit Crude MESA ID# 41-01527
64	Pioneer Talc Co., Allamore, Hudspeth Co. Texas, #8 Garren Ceramic MESA ID# 41-00869

TALC SAMPLE NUMBER	COMPANY AND SAMPLE DESIGNATION
65	Milwhite Co. Inc., Van Horn, Texas #14 Tumble Down Pit Product, #14 MESA ID# 41-01527
66	Eastern Magnesia Talc Emtal 42, Co. Vermont 8/28/75
67	Pfizer (Barretts Mill) Montana minus 12 Micron
68	Pfizer (Barretts Mill) Montana minus 325 mesh
69	Pfizer (Barretts Mill) Montana minus 20 microns
70	Cyprus Industrial Minerals (Three Forks Mill) Montana minus 325 mesh
71	Cyprus Industrial Minerals (Three Forks Mill) Montana Mistron Vapor (minus 10 micron)
72	Cyprus Industrial Minerals (Three Forks Mill) Montana Floor Sweepings (Bagging Area)
73	Cyprus Industrial Minerals (Yellowstone Mine) Montana Drill Hole
74	Southern Talc (Southern Mill) Ga. 98% passing 200 mesh
75	Southern Talc (Southern Mill) Ga. 99% passing 325 mesh (#1767)
76	Southern Talc (Cohutta Mill) Ga. 95% passing 325 mesh
78	Milwhite Talc Co. Inc., (Tex.) Finished CM4 product (#2)
79	Westex Talc Co. (TDM) Dark - (Milwhite Inc.) (#1) Tex.

TALC SAMPLE NUMBER	COMPANY AND SAMPLE DESIGNATION
80	Milwhite Co., Inc. (Tex) Marshal mix - 92-200 mesh (#3)
81	Westex Talc Co. (Milwhite Inc.) (Tex.) White mine 93-200 mesh (#4)
82	Southern Clay Products - Tex. Garren Mine #2 (#5)
83	Texas Talc Co. - TPI (Tex.) Mine (Texas Pacific) (#6)
84	Texas Talc Co. Tex. David Mine (#7)
86	Cyprus Industrial Minerals Co. Loyce Fine Mine (Tex.) #9
87	Pioneer Talc Co. Inc. (Tex.) Texola Mine (#10)
88	Pioneer Talc Co. Inc. (Tex.) Dees Mine (#11)
89	Milwhite Co. Inc. Bryant Soapstone Mine Arkansas
91	Laws Mill Micro talc from White Eagle Mine Standard Industrial Minerals
92	Laws Mill Desert Talc Product Standard Industrial Minerals
93	Laws Mill Holiday Talc Product Standard Industrial Minerals
94	Keeler T-076 Tecopa Mine (100% Panamint) Cyprus Industrial Minerals, Montana
95	Keller HGO-55 Blend 4 Panamint, 3 Oasis, 3 White Eagle Cyprus Industrial Minerals, Montana
96	Keeler Sierra Cloud Blend 4 Paramint, 1 White Eagle Cyprus Industrial Minerals, Montana

TALC SAMPLE NUMBER	COMPANY AND SAMPLE DESIGNATION
97	Keeler, MSC Mistron Panamint + 0.5% stearite Cyprus Industrial Minerals
98	Keeler Sierralite Talc City (Frisco) Cyprus Industrial Minerals
99	Keeler Glacier 200 Talc City (Tailings) Cyprus Industrial Minerals
100	Keeler USP Oasis Mine (100%) Cyprus Industrial Minerals
101	Keeler White Eagle Screenings Cyprus Industrial Minerals
102	Keeler Suggar Mine Cyprus Industrial Minerals
103	Pfizer Inc. (Cal) Talcron CP 44-31 Eclipse, Bonnie, Mongolian
104	Pfizer Inc. (Cal) Cercron CP 96-38 Eclipse, Acme, Mongolian
105	Pfizer Inc. (Cal) Cercron CP 96-36 White Eagle, Mongolian, Apex
106	Cyprus Industrial Minerals (LA) Furnace Creek Tecopa (100% Panamint)
107	Cyprus Industrial Minerals (LA) Vanderbilt Co., crude Soft LB
108	American Talc (Alabama) 84 Color Dark 200 Mesh Willow Creek Mine
109	American Talc (Alabama) 92 Color 99% 200 Mesh Willow Creek Mine

BKK/mmc:3-21-77
Retyped/acb.'5-20-77

A REPORT ON THE FIBER CONTENT OF EIGHTY INDUSTRIAL TALC SAMPLES OBTAINED FROM, AND USING THE PROCEDURES OF, THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

Prepared for
Occupational Safety and Health Administration
Department of Labor
Washington, D. C. 20212

Prepared by the Staff of the
Analytical Chemistry Division, P. D. LaFleur, Chief
Institute for Materials Research
National Bureau of Standards
Washington, D. C. 20234

May 1977

U.S. DEPARTMENT OF COMMERCE, Juanita M. Kreps, *Secretary*
Dr. Betsy Ancker-Johnson, *Assistant Secretary for Science and Technology*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Acting Director*

I. INTRODUCTION

A. Purpose of Study

This report has been prepared in response to a request received by Dr. John D. Hoffman, Director of the Institute for Materials Research of the National Bureau of Standards (NBS), in a letter dated September 1, 1976, from Dr. Morton Corn, Assistant Secretary of Labor, Occupational Safety and Health Administration (OSHA). In that letter, Dr. Corn stated that analysis of talc samples for their asbestos content was being performed by OSHA and the National Institute of Occupational Safety and Health (NIOSH) but that the methodology was being challenged by some of those regulated by OSHA.

Dr. Corn indicated that his request to NBS was composed of two tasks:

(1) to resolve the variability in the definition of asbestos fibers in talc, and

(2) to determine the asbestos content of some 80 talc samples to be provided by OSHA.

Copies of the letter containing this request and the subsequent correspondence between Drs. Hoffman and Corn which provide further background information, are included in this report as Appendix I.

It was agreed by both parties that the first of these tasks, *i.e.*, resolving the variability of the definition of asbestos fibers, would be a complex, long-term program which would require input from a number of sources both in the private and public sectors. In view of this, it was agreed that the more limited task, that of determining the asbestos content of the OSHA talc samples, would be addressed by NBS first. As Dr. Corn pointed out in his letter of October 8, 1976, this was recognized not to be a research task but would involve an analysis performed according to the procedures given in 29 CFR 1910.1001.

29 CFR 1910.1001 [39 FR 23502, June 27, 1974, as amended in 41 FR 11505, March 19, 1976] deals exclusively with airborne asbestos and does not describe procedures for, nor make any reference to asbestos in talc. It does, however, include the following two paragraphs which are pertinent to the work discussed in this report:

> "(a) *Definitions.* For the purpose of this section, (1) 'Asbestos' includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
>
> (2) 'Asbestos fibers' means asbestos fibers longer than 5 micrometers.
>
> "(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 X (magnification) (4 millimeter objective) with phase contrast illumination."

These regulations do not, however, describe a measurement *procedure* but rather prescribe a *method* of measurement (*viz.*, phase contrast microscopy). A *procedure* contains a detailed listing of the sampling of the material, the specific experimental steps to be performed during an analysis, and, often, descriptions of the mathematical calculations to be performed and of the format for reporting results and their associated errors. A *method* of measurement is defined by a very general statement of the type of measurement to be made, from which a specific *procedure* is developed.

Since 29 CFR 1910.1001 stipulates only that the method of phase contrast microscopy is to be used for the determination of asbestos, NBS requested a detailed procedure from OSHA. In response, NBS was provided with a copy of the OSHA document "Asbestos Fiber in Air" - Method No. P&CAM 239, issued March 30, 1976. NBS was also informed that the determination of asbestos, including asbestos in talc, was performed at the OSHA Salt Lake City, Utah, laboratory (OSHA-SLC), using P&CAM 239. Method No. P&CAM 239, however, deals only with the determination of asbestos in air using phase contrast microscopy to examine membrane filters. Since the determination of asbestos in talc is not described in the document, NBS was told to contact Mr. Willard C. Dixon at OSHA-SLC to obtain an exact description of the procedure used on talc samples.

To become familiar with the asbestos in talc procedure, an NBS scientist then visited the OSHA-SLC laboratory and obtained verbal and written descriptions of the procedure used. He spent approximately one and one-half days at the laboratory observing the procedures and techniques used and discussing them with the OSHA employees. At the conclusion of the visit he wrote a detailed report of what he had observed. This report was submitted to Mr. Dixon for comment. A copy of the report is included as Appendix II to this document. The portions of the report that are enclosed in boxes are the comments added by OSHA-SLC personnel.

NBS scientists also discussed the analysis of talc with a number of other persons. Those contacted are listed in Appendix III to this report.

Prior to commencing the actual analysis of the 80 talc samples, we were assured by OSHA personnel that 29 CFR 1910.1001, P&CAM 239 and the annotated NBS trip report were the only documents appropriate for documenting the analytical procedure to be employed, and that the process followed by NBS in developing the detailed procedure was proper.

The detailed procedure followed at NBS is given in Section II of this report; however, a brief description of the procedure, and some comments, are given below:

> Phase contrast microscopy, with a mounting medium having an index of refraction of 1.546, is used. Both fibers (a fiber being defined as having a minimum length of 5 μm, a maximum diameter of 5 μm, and a minimum length to diameter ratio of 3:1) and other particles are counted.
>
> Early in the study we determined that the identification of "asbestos" with the procedure used was extremely difficult for the following reasons:
>
> (1) Since phase contrast microscopy is only a contrast mechanism, it does not indicate the *degree* of difference between the refractive index of the liquid and a particle or fiber. For example, if a specimen is mounted in a liquid which matches a refractive index of chrysotile, then the particles and fibers counted would include all fibers which do not have that particular refractive index, *e.g.*, talc, anthophyllite, wollastonite, fiber glass, etc. The same would be true for any other liquid used.
>
> (2) Most mineral species have three refractive indices, therefore, any mineral fiber not lying in the correct orientation for the selected liquid will not match and would be visible and would be counted.
>
> (3) The amphiboles are end members in solid solution. As a result there may be a large range of refractive indices from one end member to another. One example of such a series would be the tremolite-actinolite solid solution.

(4) In addition, the most common methods of talc formation are the hydrothermal alteration of ultrabasic rocks such as serpentine and tremolite and the thermal metamorphism of siliceous dolomites. Therefore, during the formation of talc in contact with other minerals, there may be extensive interconversions between talc and the minerals serpentine, tremolite and anthophyllite. These interconversions may give rise to single particles which have a combination of the talc, anthophyllite, and serpentine mineral phases.*

(5) There are many materials which may be present in talc which have overlapping refractive indices, *e.g.*,

Mineral	Refractive Index
Wollastonite	1.63
Tremolite	1.599 - 1.637
Quartz	1.55
Talc	1.539 - 1.589
Chrysotile	1.493 - 1.567

(6) Even if the refractive indices were known, positive identification of minerals could not be made since there may be interferences from other materials.

* Deer, W. A., Howie, R. A., and Zaussman, J., *Rock Forming Minerals*, Vol. 3, Longmans, Green and Co. Ltd, London, England (1967) pp. 126-128.

In his first letter to NBS, Dr. Corn requested a determination of the "number of fibers per unit weight or unit volume. Also, the asbestos content as percent of total weight...". This was to be based upon the definition of asbestos to be resolved by NBS. Since the definition of asbestos is to be investigated as part of the longer study, reporting results obtained in these analyses in terms of "asbestos" was not possible. The procedure used by OSHA-SLC did not use weight or volume of total sample, but instead used percent fibers as a function of total numbers of particles on a slide; that convention was followed at NBS. Thus, all data given in this report are on the basis of numbers or percent of fibers per total number of entities (particles plus fibers) counted (this is referred to as number percent).

B. Goal of the Study

In view of the current limitations both in the definition of asbestos and in the ability to distinguish minerals by the OSHA methods using the existing definition of asbestos, NBS established as the goal for this portion of the study to analyze the 80 talc samples supplied by OSHA to NBS and to report the number percent (and, if possible, the limits of error) of *fibers* using the phase contrast optical microscopy procedure discussed above and outlined in detail in Section II below.

II. Analysis Procedure

1. Equipment used by NBS
   a. A Leitz* Ortholux 1 microscope equipped with 10x and 40x phase contrast objectives and a phase contrast condenser.
   b. Cargille refractive index liquid (mounting medium) $n^{25\,°C} = 1.546$
   c. Porton Reticle
   d. 10x Periplan oculars
2. Specimen Mounting Procedure
   Two drops of the mounting medium were placed on a clean microscope slide.
   The end of a new (clean) metal wire (paper clip) was dipped into the mounting medium on the slide and then into the sample which was contained in a bottle.
   The material adhering to the wire was blended into the mounting medium on the slide.
   A cover slip was then placed over the preparation.

Note: No attempt was made to homogenize the contents of the sample bottle prior to drawing the specimen. A vigorous blending or mixing could itself lead to mechanical breakdown of particles into fragments with fibrous appearance or the separation of one fiber into many fibers. NBS did not attempt to homogenize

---

* In order to describe materials and experimental procedures adequately, it is occasionally necessary to identify the sources of commercial products by the manufacturer's name. In no instance does such identification imply endorsement by the National Bureau of Standards, nor does it imply that the particular product is necessarily the best available for that purpose.

the samples as the OSHA-SLC procedure does not include homogenization.

3. Sample Notation

Upon receipt of the samples, a scientist who was not involved in the analysis divided the samples and assigned internal NBS numbers. This prevented the analysts from knowing which of the 80 samples they were dealing with and permitted blind replicate analyses.

Note: In the original transfer of the samples from OSHA to NBS a list was inadvertently included which gave the sample identifications. As soon as this was discovered, the list was sealed in an envelope and placed in the NBS Security Office safe until it was returned to OSHA. The only person at NBS who saw the list did not participate in any any of the analytical work.

4. Microscopy Techniques

Phase contrast microscopy was the method used by NBS, since it is the only technique specified both in 29 CFR 1910.1001 and in OSHA Method No. P&CAM 239. The detailed procedure followed by NBS is described below. Any steps which differ from the OSHA-SLC procedure are noted.

(1) Before the analysis of a specimen was performed, the microscope illumination was adjusted for Kohler illumination, the annular diaphragm and phase-shifting elements were aligned and the Porton reticle was calibrated against a stage micrometer. The configuration of a Porton reticle is shown in figure 1. A detailed description of both the calibration and use of this reticle is given in P&CAM 239.

(2) The counting field was defined as the six rectangles on the left half of the Porton reticle.

(3) Fiber dimensions were determined by comparing the length and width to the diameters of the calibrated circles on the Porton reticle.

(4) The unknown samples were mounted as described above in a Cargille liquid with a refractive index of 1.546.

> *Note: OSHA mounted their samples in liquids with $n^{25\ °C}$ equal to 1.546 and 1.47. The 1.546 index was used to identify quartz and chrysotile which appear blue in bright-field observation with their Zeiss phase-contrast microscope, while the background is light brown and most other materials are brown or black. The 1.47 refractive index liquid is carried over from techniques for identifying airborne fibers collected on membrane filters as opposed to the 1.546 liquid used for talc analysis.*

(5) Counting fields were selected by advancing the mechanical stage in a pattern of traverses of the slide in one axis and steps along the other axis resulting in a rectangular zig-zag pattern. This procedure was followed until the necessary number of fields was counted.

(6) NBS used the definition of (asbestos) fibers, discussed above, *viz.*, a fiber is greater than or equal to 5 µm in length, has a length to width ratio of at least 3 to 1, and has a maximum diameter of 5 µm. Any particle meeting these criteria was counted as a fiber.

(7) The samples were continuously viewed over the range of focal planes covering the sample thickness during the counting.

(8) A preliminary scan of the slide was performed to attempt to find fibers in the specimen. If a fiber was found the following counting procedure was performed on newly prepared slides. Fibers were counted in as many fields as necessary to yield a total fiber count of 100 with the following exceptions:

(a) The analysts counted at least 20 fields even if they counted more than 100 fibers, and

(b) they stopped at 100 fields even if they did not count 100 fibers.

(9) For fibers and particles that crossed either one or two sides of the counting field, the following procedure was used to obtain a representative count:

The analysts counted all particles or any fibers of the correct dimensions which:

1. Were entirely within the counting area, or
2. Crossed the left or bottom sides, or
3. Crossed the upper or lower left corner, or
4. Crossed both the top and bottom sides.

Any other fibers and particles were not counted.

(10) When particle agglomerates covered a large portion of the field of view, the field was rejected and replaced by a new one.

(11) The measurements at NBS were performed @ 500x magnification. OSHA measurements were done @ 400x to 450x magnification, but NBS could not duplicate that magnification with the equipment available. Calculations performed indicate that the differences in magnification would not result in any significant changes in the number of fibers and particles identified.

(12) The numerical aperture, NA, of the NBS objective was 0.65. OSHA specifies a NA range of 0.65 to 0.75. With an objective having NA = 0.65, and at a total system magnification of 500x, the smallest diameter of a suspected fiber which could be seen was approximately 0.4 μm. Hence, any fiber 5 μm long but having a diameter less than 0.4 μm, could never be found unambiguously. The class of particles defined as fibers and visible by the procedure is depicted as the cross hatched portion shown in figure 2.

> *Note: The OSHA-SLC laboratory, in addition to phase-contrast microscopy, sometimes uses polarized light microscopy with a retardation plate to distinguish asbestos fibers from talc plates oriented on end and from other non-asbestos fibers such as glass or organic fibers which may have been present in the samples. Since these techniques are not part of the phase-contrast method they were not used at NBS.*

NBS used two analysts working independently and following the procedure given above in obtaining the results on the OSHA-supplied talc samples. While the analysts did not have, prior to this study, an extended period of experience with the specific methodology employed, they have had extensive experience in a wide range of particle characterization techniques, including general optical microscopy.

III. Preliminary Investigations of Samples

A. Macroscopic Description of Samples

A qualitative description of the 80 samples supplied to NBS by OSHA is given in table 1. The sample numbers are those assigned by OSHA. The number after the description refers to the number of the color chip in the Inter-Society Color Council-NBS Color Name Chart (Supplement to NBS Circular 553).

B. Scanning of Samples

Specimens of the 80 talc samples were mounted on slides by each analyst independently, using the "dip" method described in Section II.2 above. These specimens, each containing ~1000 particles, were then scanned rapidly, *i.e.*, only the presence or absence of fibers was noted and fiber counts were not made at this time. As a result of these scans, specimens taken from 31 samples were identified by both analysts as containing at least one fiber, specimens taken from an additional 21 samples were identified as containing at least one fiber by one analyst but no fiber was seen by the other analyst, and no fiber was seen by either analyst for specimens taken from the remaining 28 samples.

IV. Counting and Analysis of Samples

A. Samples Noted by Both Analysts as Containing Fibers

As noted above, 31 samples were identified by both analysts as containing fibers during scanning. Data for these samples are given in table 2. The observed counts for each specimen by each of the two analysts, listed as F/(P+F) (*i.e.*, fibers divided by non-fibrous particles + fibers) are shown. In addition the estimated percent of fibers (p), and the lower (L) and upper (U) limits of a 95 percent confidence interval for the "true" value of p for the slide on which the count was made are given.* It should be noted that the confidence interval refers only to the portion of fibers on the slide on which the count was made, and not necessarily to the true average of fibers in the entire sample. (Estimations of the latter would require that the slide constitute a random sample of a homogeneous material under examination.)

It is seen that for eight of these 31 materials, the confidence intervals for replicate slides failed to overlap, indicating a lack of statistical compatibility between these replicate determinations. To study in more detail the consistency (or lack thereof) of the results from replicate slides, a more exact statistical analysis was performed by considering the actual fiber and particle counts for each material as the elements of a contingency

---

* The calculation of confidence limits, and other statistical analyses in this report, are valid under the assumptions (i) that the fibers are randomly located among the particles on a slide, and (ii) that the stopping rule of Section II.4(8) above introduces negligible bias.

The confidence interval is based on the relation:

Prob [at most c occurrences of event E in N trials]

$$= \text{Prob} \left[F \geq \frac{n_2}{n_1} \frac{P}{1-P} \right]$$

where P is the probability of an event E, F is the F statistic with n_1 and n_2 degrees of freedom, and

$$n_1 = 2(c+1)$$

$$n_2 = 2(N-c)$$

This relation is cited in Fisher, R. A., and Yates, F., *Statistical Tables*, Hafner Publishing Company, N. Y. (1963) p. 3.

table* and calculating the corresponding chi-square value*. A significant value for chi-square, at the 5 percent level of significance, was taken to indicate statistical incompatibility between the replicate slides. The samples for which significance at the 5 percent level was thus determined are identified by an asterisk in table 2. Of the 31 materials, 17 showed incompatibility between replicate slides at the 5 percent level of significance.

The fact that over 50 percent of the results of these 31 samples were incompatible suggests problems either of inhomogeneity, or of difficulty in the determination of fiber morphology, or both. If the sample is inhomogeneous, the reason for the statistical incompatibility is obvious. The problem of determining fiber or particle morphology is very difficult as there is often a great deal of subjectivity in deciding whether or not a particle meets the criteria to be classed as a fiber. Photomicrographic examples of (1) a specimen containing unambiguous fibers, (2) a specimen in which no fiber can be discerned, and (3) a specimen which required a great deal of judgment are shown in figure 3, a, b, and c respectively. In figure 3 six different fields of view are shown for each specimen, three using an optical microscope and three using a scanning electron microscope (SEM). (The SEM fields do not correspond to the optical fields, but were chosen randomly.)

In the case of talc samples, one must also judge which of the apparent fibers are talc platelets seen on edge. It is possible to "roll over" some of these platelets by moving the cover plate slightly, but while doing so, one also may "roll" another platelet into a position where it would subsequently be viewed from the edge.

---

* Snedecor, G. W., and Cochran, W. G., *Statistical Methods*, 6th Ed., The Iowa State University Press, Ames, Iowa (1967). Eqn. 8.10.5, p. 217.

B. Samples Noted Initially by Both Analysts as not Containing Fibers

Because of our concern over the incompatibility of results in the 31 samples in which both analysts agreed there were fibers, we decided to reexamine a portion of the group of 28 samples originally classed by both analysts as not containing fibers. Ten samples were selected at random from the pool of 28 samples and were scanned a second time.

(Before discussing the results of additional scanning and counting in this group of samples, it is useful to calculate the probability of seeing no fibers in a count of N objects (particles or fibers). The probability is a function of the true fiber content of the material from which the slide is prepared. The calculation is based on the assumption that the specimen (*i.e.*, the portion of the material on the slide) is a random sample from the material being measured. According to the binominal distribution,* the probability (zero fibers in count of N) equals $(1-P)^N$ where $P=\frac{p}{100}$, and p is the number percent fiber content of the material. Table 3 lists values of this probability for various values of p, for N=200, 500, 1000, and 2000. It is evident that the probability of seeing no fibers in two slides of 1000 counts each (N=2000) is extremely small unless the true fiber content of the material is less than 0.25 percent. (Even for N=200, the probability of seeing no fibers is very small unless the fiber content of the material is less than 2.5 percent). One would therefore expect the materials in this group to have fiber contents not greater than 0.25 percent.

It is also interesting to note that for materials with very low fiber content, say 0.01 percent, there is only an 18 percent probability of finding at least one fiber in a count of 2000. In order to reach a probability of 95

* *Ibid.*, Chapter 8.

percent of finding at least one fiber in such a material, one would have to examine at least 30,000 particles. For a material with a 0.1 percent fiber content, the number of particles required to find at least one fiber with 95 percent probability is 3000.)

As a result of the second scan on newly prepared slides, four samples were still identified as fiber-free, but fibers were observed in the remaining six samples. The results are given in table 4.

Four samples showed fiber contents larger than 0.25 percent by both analysts. Furthermore, for two of these samples, the two new slides gave incompatible results (as shown by the chi-square test). These are indicated by an asterisk in table 4.

The results obtained from this reexamination of the materials in the group of initial negative scans thus support the interpretations given by the analysis of the samples in the first group: inhomogeneity and/or subjectivity in deciding fiber morphology.

C. Samples Noted as Containing Fibers by Only one Analyst During the Initial Scan

The remaining pool of 21 samples, which were noted as containing fibers by only one of the analysts during the initial scan, was then examined. In all of these cases the percent of fibers was estimated to be low and the arguments given above about the probability of finding fibers as a function of total number of particles are equally valid. In this case, eight samples were selected for fiber counts. Of the eight samples selected, seven provided incompatible replicates, given further support to the interpretation made on the basis of the other two groups of samples. These data are given in table 5. Again, incompatible results are indicated with an asterix.

V. Conclusions

In this report the results of the determination of the fiber content of 80 OSHA-supplied samples of talc are presented, along with a statistical interpretation of these results. Of the 45 samples on which fiber counts were made, the results for replicate analyses on 26 of the samples were statistically incompatible. This incompatibility was not confined to any particular concentration range of fibers. As a result, NBS deemed it inadvisable to report uncertainty limits for the fiber content determinations obtained on the samples measured. Fiber counts could be made using the present procedure on the 35 samples which were not counted, but it is doubtful that any useful additional information would be obtained.

The variability of these results raises several questions regarding the OSHA procedure, particularly sampling technique, sample homogeneity, and determining fiber morphology. It is the opinion at NBS that, even under favorable circumstances (*e.g.*, homogeneous samples, easily identified fibers, etc.), the existing OSHA procedure is useful only for determining "fiber" content and not "asbestos" content. Although careful manipulation of the mounting medium might make it possible to identify some of the fibers as "asbestos", the problem of the definition of "asbestos" still remains. NBS believes that the resolution of the measurement problem, including the definition and identification of asbestos, will be accomplished only by significant changes in the procedure and probably the method as well.

In order to complete the tasks requested by Dr. Corn in his letter of September 1, 1976, it will be necessary to arrive at an acceptable definition of asbestos and to develop the necessary measurement techniques and standards. Once that has been achieved, a more meaningful analysis of the 80 OSHA-supplied talc samples can be accomplished.

Table 1

Description of bulk material

Sample	Description
1	fine white powder (263)
2	fine white powder (263)
3	fine white powder (263)
4	fine white powder (263)
5	fine white powder (263)
6	fine white powder (263)
7	fine white powder (263)
34	fine white powder (263)
35	coarse grains (sand-like) (92) inhomogeneous
36	fine off-white powder (93)
37	beige fine-grained non-homogeneous some dark material, some light (93)
38	beige fine-grained non-homogeneous some dark material, some light material (93)
39	off-white powder (92)
40	fine very light grey powder (92)
41	fine light grey powder (264)
42	fine white powder (263)
43	fine white powder (263)
44	fine white powder (263)

Table 1 (continued)

Sample	Description
45	fine white powder (263)
46	fine white powder (263)
47	fine white powder (263)
48	light brown powder (264)
49	off-white powder clumps together in small aggregates (263)
50	off-white powder clumps together in small aggregates (263)
51	light grey powder (154)
52	grey granular material, non-homogeneous (155)
53	light grey powder (fine) (154)
54	fine white powder (263)
55	fine off-white powder (92)
56	grey granular material, non-homogeneous (154)
57	fine white powder, some aggregation (263)
58	fine off-white powder (263)
59	off-white powder clumps together in small aggregates (92)
60	off-white powder clumps together in small aggregates (263)
61	dark grey granular, some small fragments (265)
62	fine off-white powder (263)
63	fine off-white powder (9)

Table 1 (continued)

Sample	Description
64	fine brown-grey powder (264)
65	fine grey powder (265)
66	fine off-white powder (264)
67	off-white powder, some aggregation (263)
68	fine white powder (263)
69	off-white powder, some aggregation (263)
70	fine off-white powder (92)
71	off-white powder, some aggregation (263)
72	off-white powder, some aggregation (92)
73	small light grey pebbles and powder, inhomogeneous (264)
74	fine light grey powder (264)
75	fine off-white powder (264)
76	fine grey powder (154)
78	light grey to brown powder (264)
79	dark grey rock, some large fragments but mostly small grains (265)
80	fine grey powder (264)
81	off-white powder (fine)(9)
82	dark grey rock, mostly large fragments with some granular material (265)

Table 1 (continued)

Sample	Description
83	dark grey rock, mostly large fragments with some granular and powdered material (265)
84	dark grey rock almost all large fragments, very little granular or powdered material (266)
86	dark grey granular material with some large fragments (265)
87	white and pink rocks, very little granular or powdered material (
88	coarse granular light brown several large fragments with some powder (93)
89	grey-brown granular, inhomogeneous (93)
91	fine off-white powder (263)
92	white rock with powder (263)
93	grey and brown rocks (93)
94	fine white powder (263)
95	off-white powder, some aggregation (263)
96	fine white powder (263)
97	fine white powder (263)
98	fine off-white powder (92)
99	fine beige powder (153)
100	fine white powder (263)
101	white to light grey rocks with a fairly large amount of powder (92)

Table 1 (continued)

Sample	Description
102	large grey rocks with white powder @ the bottom (153)
103	fine white powder (263)
104	off-white powder (263)
105	fine white powder (263)
106	fine white powder (263)
107	large grey and light brown rocks, some powder in the bottom, very inhomogeneous (92)
108	fine white powder (263)
109	white powder, extensive aggregation (263)

Table 2

Results of the 31 Samples Identified as Containing Fibers by Both Analysts on the Initial Scan

	Analyst 1				Analyst 2			
			95% Confidence Intervals				95% Confidenc Intervals	
Sample No.	Count [F/(P+F)]	p (%)	L (%)	U (%)	Count [F/(P+F)]	p (%)	L (%)	U (%)
1	102/760	13.4	11.1	16.0	125/833	15.0	12.7	17.6
2*	135/809	16.7	14.2	19.4	142/1138	12.5	10.6	14.5
3	100/480	20.8	17.3	24.7	103/445	23.1	19.3	27.3
4	105/660	15.9	13.2	18.9	109/670	16.3	13.6	19.3
5	100/711	14.1	11.6	16.8	109/720	15.1	12.6	18.0
6	158/1606	9.8	8.4	11.4	83/714	11.6	9.4	14.2
7*	102/852	12.0	9.9	14.3	102/586	17.4	14.4	20.7
34*	101/696	14.5	12.0	17.3	105/1028	10.2	8.4	12.2
38*	45/652	6.9	5.1	9.1	17/451	3.8	2.2	6.0
41*	100/991	10.1	8.3	12.1	70/501	14.0	11.1	17.3
42	105/593	17.7	14.7	21.0	106/492	21.5	18.0	25.4
43	103/835	11.6	9.6	13.9	102/829	12.3	10.2	14.7
45	106/682	15.5	12.9	18.5	86/627	13.7	11.1	16.6
46	104/1163	8.9	7.3	10.7	103/1155	8.9	7.3	10.7
47	104/543	19.2	15.9	22.7	136/817	16.6	14.2	19.4
49*	142/1263	11.2	9.6	13.1	102/393	26.0	21.7	30.6
50*	124/659	18.8	15.9	22.0	127/600	21.2	18.0	24.6
	100/848	11.8	9.7	14.2	76/866	8.8	7.0	10.9

* Incompatible replicates.

Table 2 (continued)

Sample No.	Analyst 1 Count [F/(P+F)]	Analyst 1 p (%)	Analyst 1 95% Confidence Intervals L (%)	Analyst 1 95% Confidence Intervals U (%)	Analyst 2 Count [F/(P+F)]	Analyst 2 p (%)	Analyst 2 95% Confidence Intervals L (%)	Analyst 2 95% Confidence Intervals U (%)
✓52*	100/919	10.9	8.9	13.1	54/767	7.0	5.3	9.1
✓56	72/900	8.0	6.3	10.0	54/581	9.3	7.1	11.9
✓58*	48/1863	2.6	1.9	3.4	29/503	5.8	3.9	8.2
✓60*	100/1285	7.8	6.4	9.4	60/1190	5.0	3.9	6.4
68	67/1901	3.5	2.7	4.4	79/1685	4.7	3.7	5.8
	87/2237	3.9	3.1	4.8				
75*	111/1474	7.5	6.2	9.0	109/686	15.9	13.2	18.8
	105/1245	8.4	7.0	10.1				
76*	100/759	13.2	10.8	15.8	100/522	19.2	15.9	22.8
87	48/471	10.2	7.6	13.3	55/527	10.4	8.0	13.4
92	101/329	30.7	25.8	36.0	111/314	35.4	30.1	40.9
94*	35/3276	1.1	0.7	1.5	105/906	11.6	9.6	13.8
					72/1674	4.3	3.4	5.4
95*	43/1947	2.2	1.6	3.0	37/2820	1.3	0.9	1.8
96*	55/1571	3.5	2.6	4.5	36/625	5.8	4.1	7.9
104*	69/959	7.2	5.6	9.0	101/773	13.1	10.8	15.6
109*	111/2674	4.2	3.4	5.0	104/1890	5.5	4.5	6.6

* Incompatible replicates.

NOTE: Confidence limits were calculated using an approximate formula and a few may be in error by one or two units in the last place.

Table 3

Probability of Finding No Fibers in Counts of Size N

True Fiber Content, in Percent	Size of Count N=200	N=500	N=1000	N=2000
0.01	0.98	0.95	0.90	0.82
0.05	0.90	0.78	0.61	0.37
0.10	0.82	0.61	0.37	0.14
0.15	0.74	0.47	0.22	0.05
0.20	0.67	0.37	0.14	0.02
0.25	0.60	0.29	0.08	0.01
0.30	0.55	0.22	0.05	<0.01
0.40	0.45	0.13	0.02	
0.50	0.37	0.08	0.01	
0.60	0.30	0.05	<0.01	
0.80	0.20	0.02		
1.00	0.13	0.01		
1.50	0.05	<0.01		
2.00	0.02			
2.50	<0.01			

Table 4

Results of the 28 Samples Identified by Both Analysts as Not Containing Fibers on the Initial Scan

Sample No.	Analyst 1 Count [F/(P+F)]	Analyst 1 p (%)	Analyst 1 95% Confidence Intervals L (%)	Analyst 1 95% Confidence Intervals U (%)	Analyst 2 Count [F/(P+F)]	Analyst 2 p (%)	Analyst 2 95% Confidence Intervals L (%)	Analyst 2 95% Confidence Intervals U (%)
36	not counted							
37	not counted							
+54*	22/828	2.7	1.7	4.0	5/899	0.6	0.2	1.3
55	not counted							
61	not counted							
+62	4/1395	0.3	0.1	0.7	0/1410	0.0	0.0	0.2
+63	no fibers observed on second scan							
+65	no fibers observed on second scan							
+66	18/1545	1.2	0.7	1.8	10/1598	0.6	0.3	1.1
70	not counted							
71	not counted							
72	not counted							
73	not counted							
78	not counted							
80	not counted							
81	not counted							

* Incompatible replicates.

+ Samples selected for second scan.

Table 4 (continued)

Sample No.	Analyst 1 Count [F/(P+F)]	p (%)	95% Confidence Intervals L (%)	U (%)	Analyst 2 Count [F/(P+F)]	p (%)	95% Confid Interval L (%)	(
+82	no fibers observed on second scan							
84	not counted							
86	not counted							
+88	no fibers observed on second scan							
89	not counted							
91	not counted							
93	not counted							
+98	18/746	2.4	1.4	3.8	9/522	1.7	0.8	3.
+101	2/200	1.0	0.1	3.6	6/230	2.6	1.0	5.
102	not counted							
107	not counted							
+108*	56/833	6.7	5.1	8.6	18/1165	1.5	0.9	2.

* Incompatible replicates.

† Samples selected for second scan.

Table 5

Results on the 21 Samples Identified as Containing Fibers
by Only One Analyst on the Initial Scan

Sample No.	Analyst 1 Count [F/(P+F)]	Analyst 1 p (%)	Analyst 1 95% Confidence Intervals L (%)	Analyst 1 95% Confidence Intervals U (%)	Analyst 2 Count [F/(P+F)]	Analyst 2 p (%)	Analyst 2 95% Confidence Intervals L (%)	Analyst 2 95% Confidence Intervals U (%)
35	not counted							
39	29/813	3.6	2.4	5.1	9/550	1.6	0.7	3.1
40	not counted							
44*	100/905	11.0	9.1	13.3	81/418	19.4	15.7	23.5
48	not counted							
51*	45/833	5.4	4.0	7.2	39/1354	2.9	2.0	3.9
53*	50/1091	4.6	3.4	6.0	42/1771	2.4	1.7	3.2
57	not counted							
59	not counted							
64	not counted							
67	not counted							
69	not counted							
74	not counted							
79	not counted							
83*	18/430	4.2	2.5	6.5	3/630	0.5	0.1	1.4
97*	36/1861	1.9	1.4	2.7	18/1693	1.1	0.6	1.7
99*	30/1212	2.5	1.7	3.5	1/739	0.1	0.0	0.8

* Incompatible replicates.

Table 5 (continued)

	Analyst 1				Analyst 2		
			95% Confidence Intervals				95% Confi Interva
Sample No.	Count [F/(P+F)]	p (%)	L (%)	U (%)	Count [F/(P+F)]	p (%)	L (%)
100	not counted						
103	not counted						
105*	86/1498	5.7	4.6	7.0	27/777	3.5	2.3
106	not counted						

* Incompatible replicates.

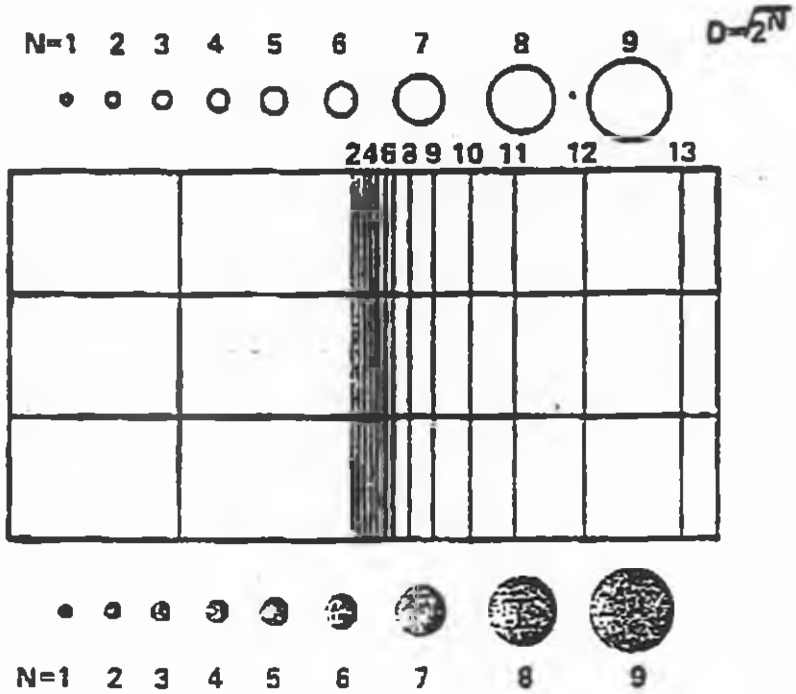


Figure 1. Porton Reticle

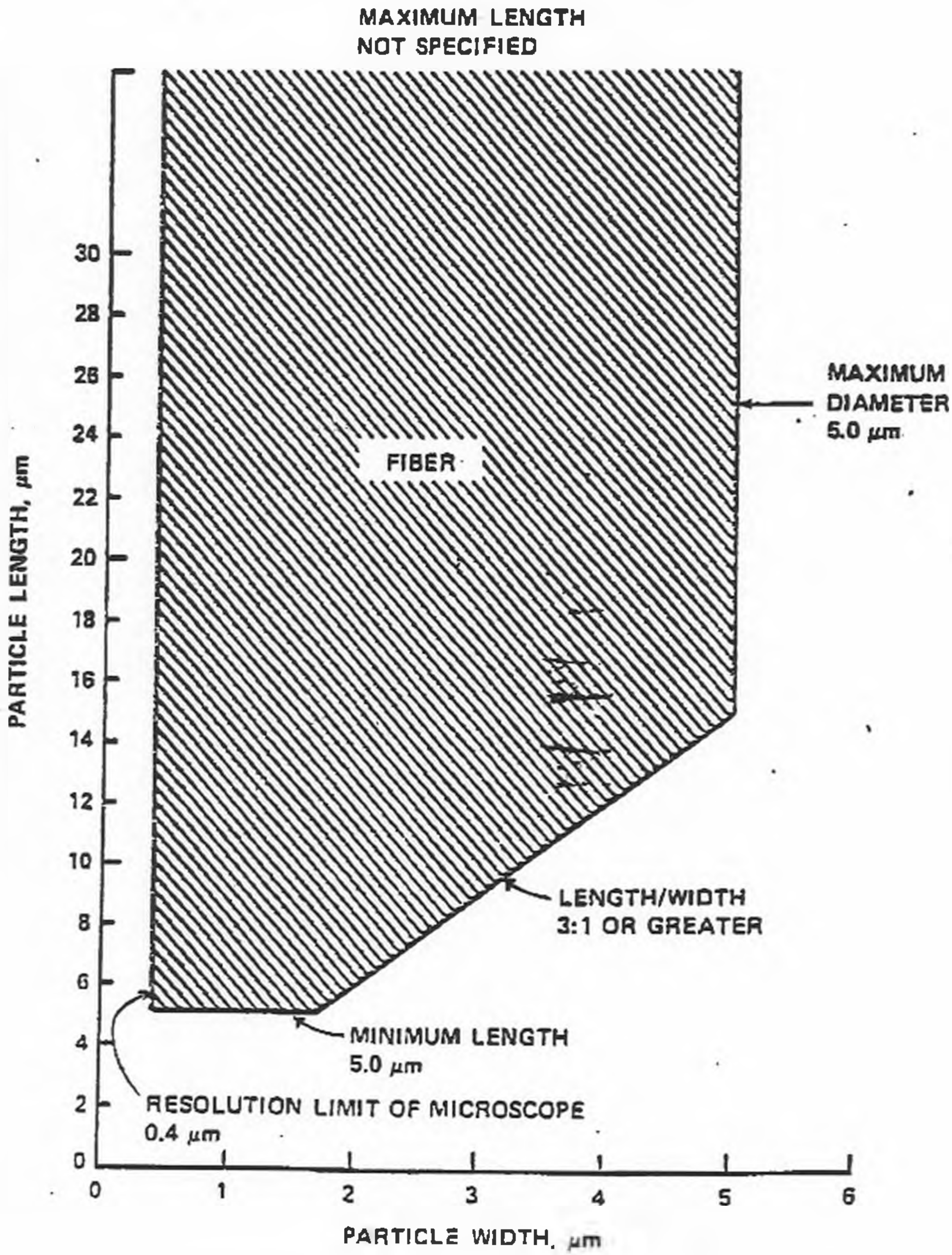


Figure 2. Fiber dimensions that would be observed as per OSHA definitions and resolution limit of microscope.

Sample 92

Light Microscope **Scanning Electron Microscope**

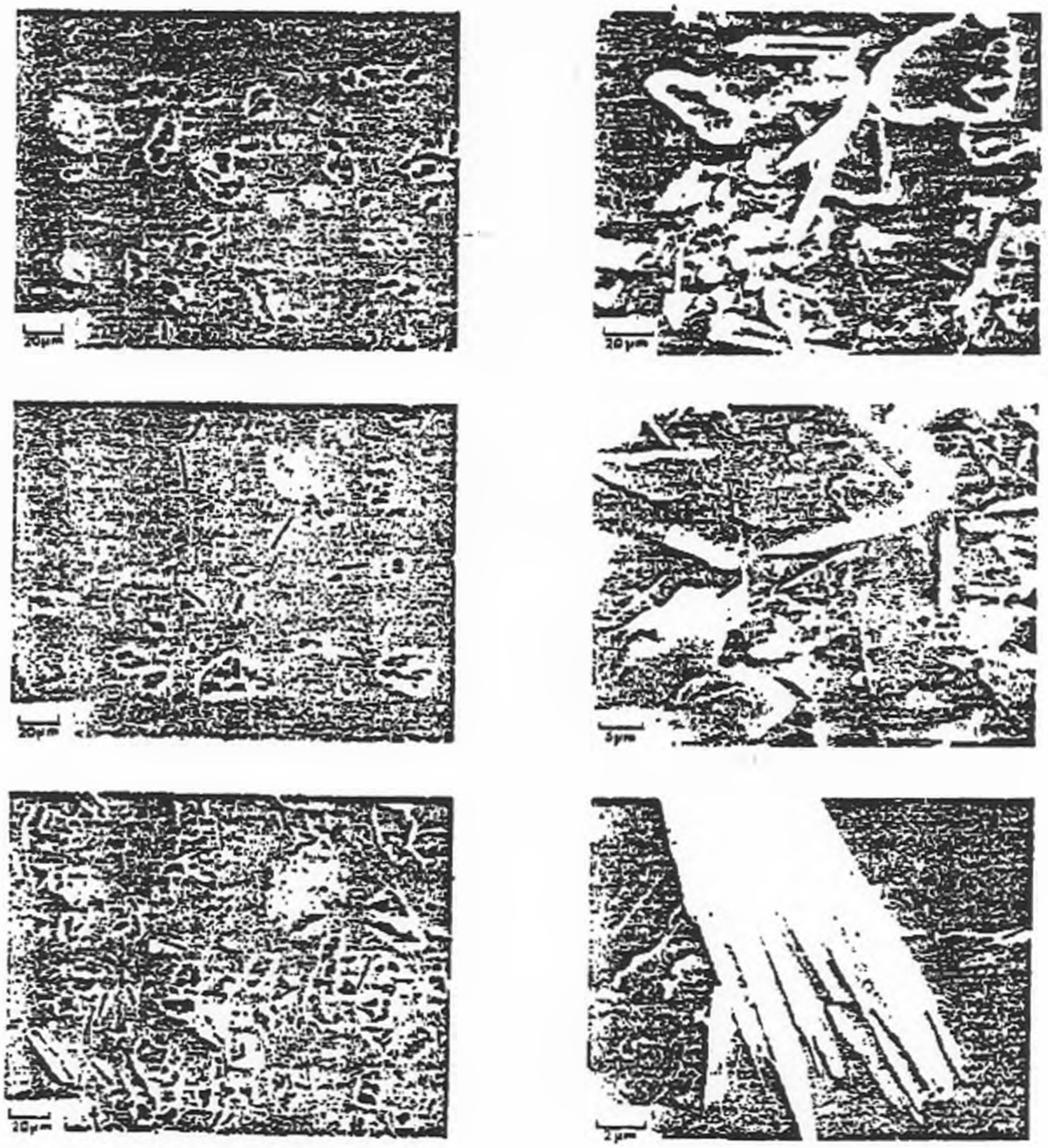


Figure 3a

Sample 81

Light Microscope | Scanning Electron Microsco

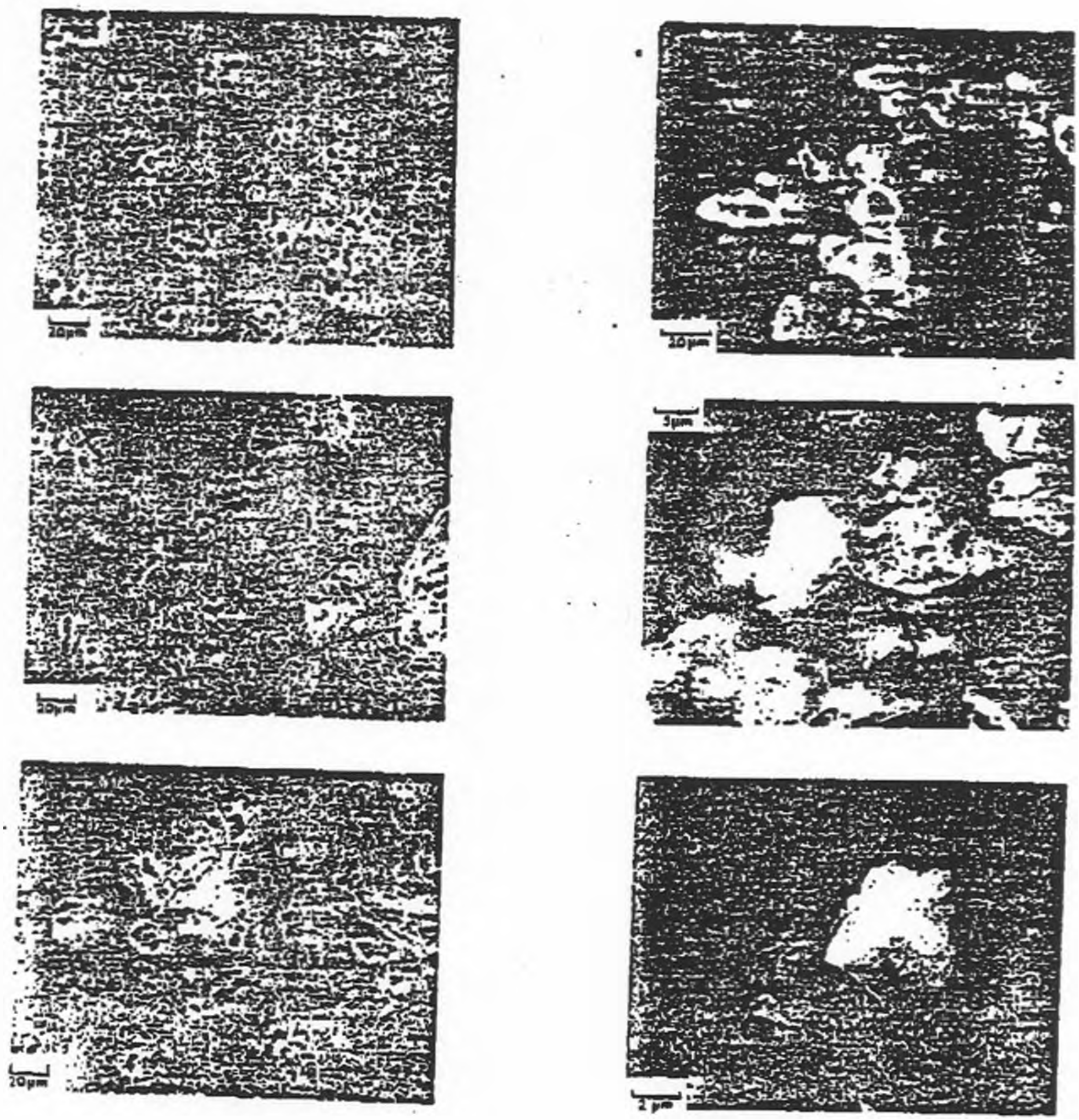


Figure 3b

Sample 108

Light Microscope

Scanning Electron Microscop

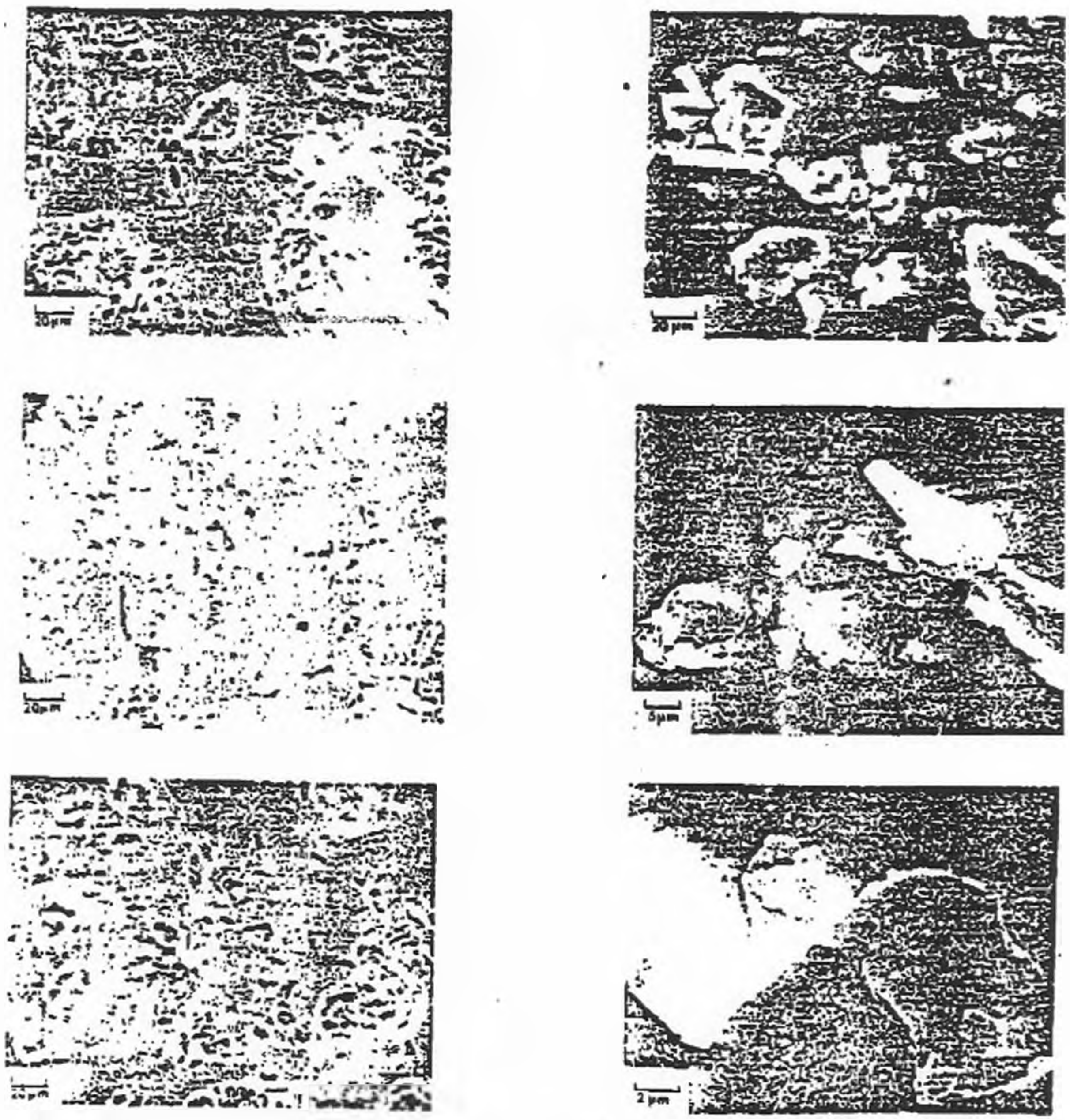


Figure 3c

COPY

WATERS & KRAUS, LLP

C. ANDREW WATERS (CA, DC, NC, TX)
PETER A. KRAUS (TX, VA)
CHARLES S. SIEGEL
JEFFREY B. SIMON (NY, TX)
TROYCE G. WOLF

Ron C. Eddins
George G. Tankard, III (DC, MA, MD, PA, TX)
Dana Cannelli Fox
Michelle B. Norton
Nelda Talamantes
Paul C. Cook (CA)
Charles E. Valles (TN, TX)
Greg W. Lisemby
Sam Swartzman (CA, IL)
Kyla Gail Cole

3219 McKinney Avenue
Dallas, Texas 75204
Telephone 214-357-6244
Telecopier 214-357-7252

DAVID C. GREENSTONE (NY, TX)
MICHAEL L. ARMITAGE (CA, LA)
B. SCOTT KRUKA
LESLIE C. MacLEAN

Jay E. Stuemke
Jennifer L. Bartlett (CA)
Loren Jacobson (NY)
H. W. Trey Jones
Bryan C. Mashore (CA, LA)

OF COUNSEL:

James C. Barber
(Board Certified in Personal Injury Trial Law by the TX Board of Legal Specialization & certified in Civil Trial Law by the Nat'l Board of Trial Advocacy)

California Office:
300 N. Continental Blvd., Ste. 500
El Segundo, California 90245
Telephone: 310-414-8146
Telecopier: 310-414-8156

Maryland Office:
10015 Old Columbia Rd., Ste. B-215
Columbia, Maryland 21046
Telephone: 410-312-5599
Telecopier: 410-312-5595

PLEASE RESPOND TO THE DALLAS OFFICE

June 30, 2005

VIA CMRRN 7004 1160 0000 3323 1368

Laura Kugler
Bailey Crowe & Kugler
901 Main Street
Dallas, TX 75202

VIA CMRRN 7004 1160 0000 3323 1375

Maria Karos
Bell, Nunnally & Martin
3232 McKinney Avenue Suite 1400
Dallas, TX 75204

RE: All Waters & Kraus asbestos cases vs. Georgia Pacific

Dear Laura and Kiki:

Enclosed please find several documents (there are others) that indicate Georgia Pacific, and its predecessor Bestwall, added asbestos-containing talc to its joint compound products.

As you know, Georgia Pacific's Interrogatory responses consistently fail to disclose this crucial fact: GP products, incuding but not limited to joint compounds, contained amphibole asbestos, such as tremolite and/or anthophyllite talc. The various Georgia-Pacific motions to exclude causation testimony and evidence on the basis that "pure" chrysotile does not cause mesothelioma — filed in the Texas MDL Court and in various Courts throughout the country, for years — are misleading.

We are hereby requesting available dates to depose Mr. Lenhart and Mr. Burch with respect to these issues.

Please also immediately amend all applicable Georgia Pacific Interrogatory responses in individual cases and in all In Re Proceedings to reflect this information. In addition, please immediately supplement applicable document requests by forwarding all documents evidencing the purchase of and/or presence of talc that may have contained asbestiform mineral(s) in Georgia Pacific products. Although the following is not perhaps an exhaustive list, I would think that responsive documents would include at least the following:

EXHIBIT
7

All contracts to which GP/Bestwall was party evidencing purchase of fibrous talc;

All formulations of GP/Bestwall joint compounds evidencing talc, including but not limited to documents which indicate the percentage, by weight or otherwise, of fibrous talc in the joint compound products;

All communications between GP/Bestwall and sellers of fibrous talc;

All GP/Bestwall internal communications discussing the purchase and/or use of fibrous talc in its joint compound products;

Any testing (eg. IH testing, air monitoring, etc.) evidencing the presence of amphibole asbestos in GP/Bestwall products;

All photos of any bags and/or buckets of GP/Bestwall joint compound products used during a period in which they may have contained fibrous talc;

All lists of joint compound ingredients GP/Bestwall used internally and/or made available to its joint compound customers during the time period that GP/Bestwall joint compound products contained fibrous talc.

Please let me have your agreement by Friday, July 8, 2005, to comply with the foregoing requests so that we need not file motions seeking to compel the depositions, documents and interrogatory responses, and other relief which we believe to be justified.

Sincerely,

Jeffrey B. Simon

cc: Peter Kraus

WATERS & KRAUS, LLP

C. ANDREW WATERS (CA, DC, NC, TX)
PETER A. KRAUS (TX, VA)
CHARLES S. SIEGEL
JEFFREY B. SIMON (NY, TX)
TROYCE G. WOLF

Ron C. Eddins
George G. Tankard, III (DC, MA, MD, PA, TX)
Dana Casselli Fox
Michelle B. Norton
Nelda Talamantes
Paul C. Cook (CA)
Charles E. Valles (TN, TX)
Greg W. Lisemby
Sam Swartzon (CA, IL)
Kyla Gail Cole

3219 McKinney Avenue
Dallas, Texas 75204
Telephone 214-357-6244
Telecopier 214-357-7252

California Office:
300 N. Continental Blvd., Ste. 500
El Segundo, California 90245
Telephone: 310-414-8146
Telecopier: 310-414-8156

Maryland Office:
10015 Old Columbia Rd., Ste. B-215
Columbia, Maryland 21046
Telephone: 410-312-5599
Telecopier: 410-312-5595

DAVID C. GREENSTONE (NY, TX)
MICHAEL L. ARMITAGE (CA, LA)
B. SCOTT KRUKA
LESLIE C. MacLEAN

Jay E. Stuemke
Jennifer L. Bartlett (CA)
Loren Jacobson (NY)
H. W. Trey Jones
Bryan C. Mashore (CA, LA)

OF COUNSEL

James C. Barber
(Board Certified in Personal Injury Trial Law by the TX Board of Legal Specialization & certified in Civil Trial Law by the Nat'l Board of Trial Advocacy)

PLEASE RESPOND TO THE DALLAS OFFICE

July 20, 2005

VIA FACSIMILE 214-231-0556
Laura Kugler
Bailey Crowe & Kugler
901 Main Street
Dallas, TX 75202

VIA FACSIMILE 469-227-8004
Maria Karos
Sedgwick Detert Moran & Arnold
1717 Main Street Suite 5400
Dallas, TX 75201

RE: All Waters & Kraus Asbestos Cases vs. Georgia Pacific

Dear Laura and Kiki:

I have not yet seen a response from you regarding my letter of June 30, 2005, imploring your client, Georgia Pacific, to amend its interrogatory responses and requests for production of documents in our cases to accurately reflect the presence of asbestiform talc in several Georgia Pacific joint compounds. Therefore, I will move to compel accurate and complete discovery responses as well as seek appropriate sanctions against your client for my having to compel such disclosure.

Please produce all non-privileged documents relating to Georgia Pacific's adding of talc to its joint compounds. If you claim any privilege to any such documents, please produce an appropriate privilege log so that I may seek appropriate relief.

I have not yet received dates for depositions of Mr. Burch and Mr. Lehnert regarding these matters. If you don't provide me dates for deposition by Friday, July 22, 2005, at 5:00PM, I will move to compel. However, I need all talc-related documents produced at least 1 week in advance of those depositions, so I again request prompt production of those documents.

Sincerely,

Jeffrey B. Simon

EXHIBIT
8

Ad Hoc Broadcast Report

Line 1: WATERS / KRAUS ID: 2143577252 20 Jul'05 14:38 Page 1
Line 2: WATERS / KRAUS ID: 2143577252

Job	Phone Number	Start time	Pages	Mode	Status
785	2142310556	7/20 14:38	2/ 2	BC	Completed
785	4692278004	7/20 14:34	2/ 2	BC	Completed

Explanation of items in the Mode column:

EC=Error correction
96=9600 BPS
48=4800 BPS
SA=Subaddress
PW=Password
MP=Multi-poll
BC=Broadcast

WATERS & KRAUS, LLP
3219 McKinney Avenue
Dallas, Texas 75204
Telephone: 214-357-6244
Telecopier: 214-357-7252

300 N. Continental Blvd., Suite 500
El Segundo, California 90245
Telephone: 310-414-8146
Telecopier: 310-414-8156

10015 Old Columbia Road, Suite B-215
Columbia, Maryland 21046
Telephone: 410-312-5599
Telecopier: 410-312-5595

DATE: July 20, 2005

TO: Laura Kugler and Kilo Karos

FAX #: See attached letter

FROM: Lynn Martin, Paralegal to Jeffrey Simon

RE: Georgia Pacific

NUMBER OF PAGES: 2

COMMENTS:

IF ANY PART OF THIS TRANSMISSION WAS INCOMPLETE OR IF YOU HAVE ANY QUESTIONS, PLEASE CALL (214) 357-6244
THANK YOU.

American Journal of Industrial Medicine 26:809–819 (199

Asbestos-Related Disease Associated With Exposur to Asbestiform Tremolite

Sharon H. Srebro, MD, and Victor L. Roggli, MD

Tremolite is nearly ubiquitous and represents the most common amphibole fiber in th lungs of urbanites. Tremolite asbestos is not mined or used commercially but is frequent contaminant of chrysotile asbestos, vermiculite, and talc. Therefore, indivic uals exposed to these materials or to end-products containing these materials may b exposed to tremolite. We have had the opportunity to do asbestos body counts ar mineral fiber analysis on pulmonary tissue from five mesothelioma cases and tw asbestosis cases with pulmonary tremolite burdens greater than background level: There were no uncoated amosite or crocidolite fibers detected in any of these case: Three patients were occupationally exposed to chrysotile asbestos; two patients ha environmental exposures (one to vermiculite and one to chrysotile and talc) and one wa a household contact of a shipyard worker. The tremolite burdens for the asbestosis case were one to two orders of magnitude greater than those for the mesothelioma cases. Ou study confirms the relationship between tremolite exposure and the development c asbestos-associated diseases. Furthermore, the finding of relatively modest elevations c tremolite content in some of our mesothelioma cases suggests that, at least for som susceptible individuals, moderate exposures to tremolite-contaminated dust can produc malignant pleural mesothelioma.

Key words: asbestosis, chrysotile, mesothelioma, tremolite, vermiculite

INTRODUCTION

Tremolite is a hydrated magnesium silicate ($Ca_2Mg_5Si_8O_{22}(OH)_2$) that belong to the amphibole group of minerals. Collectively, actinolite, anthophyllite, and trem olite are often referred to as noncommercial amphiboles. Although the noncommer cial amphiboles are, geologically, the most common amphiboles, they are of littl industrial importance and not mined commercially [Pooley, 1987]. Thus, tremolit and other noncommercial amphibole exposure levels are not routinely monitored and, until recently, were not usually considered in the epidemiology or etiology o asbestos-related disease [Weill et al., 1990]. However, recent attention has focuse on the health effects of exposure to tremolite asbestos.

Although tremolite is not mined commercially, it is a common contaminant o

Department of Pathology, Durham Veterans' Administration and Duke University Medical Centers Durham, NC.
Address reprint requests to Victor L. Roggli, MD, Department of Pathology, Box 3712, Duke Universit Medical Center, Durham, NC 27710.
Accepted for publication March 4, 1994

other mineral deposits, such as chrysotile asbestos (which accounts for 90–95% of commercial asbestos in the United States), vermiculite, and talc [McDonald et al., 1989]. Workers may be exposed to tremolite asbestos from mining or manufacturing processes involving these minerals. Additionally, some end-products contain these minerals (such as cosmetic talc or spackling compound, which contains chrysotile) and may present a potential source of tremolite exposure. At Canadian chrysotile mines, tremolite is present in only trace amounts in the deposits [Gibbs and Lachance, 1972]. Nevertheless, several studies suggested that most cases of malignant mesothelioma observed in these miners were probably attributable to tremolite, rather than to chrysotile asbestos. This conclusion is based on the observation that the majority of uncoated fibers detected in the lungs of the miners with mesothelioma was tremolite, and pulmonary tremolite contents for the chrysotile miners exceeded control levels [Churg, 1988; McDonald et al., 1982, 1989]. One study concluded, because chrysotile represents 90–95% of all asbestos used, as many as 20% of all malignant mesotheliomas in North America may be due to tremolite [McDonald et al., 1989]. Several studies regarding vermiculite miners demonstrated a dose-related increase in asbestos-associated diseases and suggested, according to the American Thoracic Society, that tremolite exposure "represents health consequences similar to other forms of asbestos exposure, including lung cancer and mesothelioma" [Amandus and Wheeler, 1987; McDonald et al., 1986; Weill et al., 1990]. Also, in Turkey and the Metsovo region of Greece, where naturally occurring asbestiform tremolite is used for whitewashing and for stucco, studies have demonstrated an increased mesothelioma risk for residents with no history of occupational exposure and no identifiable history of exposure to other fiber types [Baris et al., 1988; Langer et al., 1987].

Collectively, these studies suggest that tremolite asbestos exposure represents a potential health risk not only to miners and manufacturers of tremolite-contaminated mineral products but also to those exposed to tremolite-contaminated end-products. This report presents seven cases of asbestos-related disease, for which scanning electron microscopic (SEM) pulmonary mineral fiber analyses support an etiologic role for tremolite.

MATERIALS AND METHODS

Case Selection

The seven cases selected for this study were obtained from one of the author's (V.L.R.) consultation files. The criteria for selection included 1) a diagnosis of asbestos-related disease, 2) no uncoated amosite or crocidolite fibers detected by SEM, and 3) pulmonary uncoated tremolite fiber content greater than control levels. The upper limit of the control level was 2,540 uncoated fibers (5 μm or greater in length) per gram of wet lung. This value was based on SEM mineral fiber analyses for 19 control cases, as defined in earlier reports (i.e., macroscopically normal lungs at autopsy, no evidence of asbestos-related disease, and no documented history of asbestos exposure) [Roggli et al., 1986, 1992a,b].

Five of the cases represented in this study were malignant pleural mesotheliomas. The remaining two cases had diagnoses of asbestosis; one of these also had adenocarcinoma of the lung. The diagnosis of malignant mesothelioma was confirmed by one of the authors (V.L.R.) using our previously published criteria. These criteria include gross distribution of the tumor, histologic appearance, and, when

TABLE I. Demographic, Pathologic, and Occupational Information for Seven Patients With Asbestos-Related Diseases*

Case[a]	Age/sex	Diagnosis	Occupation	Exposure duration	Smoking history
1	74/M	Asbestosis	Manufactured asbestos blankets/gaskets	7 yr	Smoker (PY unknown)
2	44/M	Asbestosis/Lung adenocarcinoma	Lived near vermiculite plant during childhood	20 yr	Ex-smoker, (1-2 PY) (quit 20 years)
3	56/M	BPL	Painter/spackler	38 yr	Smoker (70 PY)
4	62/M	EPL	Engineer at power plant; insulator	N/A	Smoker (6 PY)
5	44/F	EPL	Assembler at dry cleaner	N/A	N/A
6	57/F	EPL	Housewife of shipyard worker	1–2 yr	Smoker (40 PY)
7	58/F	DPL	Teacher's aide in building with tremolite in tiles	18 yr	Nonsmoker

*BPL = biphasic pleural mesothelioma; DPL = desmoplastic pleural mesothelioma, EPL = epithelial pleural mesothelioma; PY = pack-years; N/A = not available.

[a]Data for the 19 control cases are summarized in the text of this report and are detailed in earlier as yet unpublished observations.

indicated, the findings of histochemical, immunohistochemical, and/or ultrastructural studies [Roggli et al., 1992b]. In all cases, the diagnosis of mesothelioma was made independently of asbestos exposure history or tissue mineral fiber content. The diagnosis of asbestosis was confirmed by one of the authors (V.L.R.) using the histologic criteria set forth by the Pneumoconiosis Committee of the College of American Pathologists and the National Institute for Occupational Safety and Health, which defines the minimum criteria permitting the diagnosis of asbestosis as "demonstration of discrete foci of fibrosis in the wall of respiratory bronchioles associated with accumulations of asbestos bodies" [Craighead et al., 1982].

Tissue Digestion Technique and AB (by LM) Analysis

Formalin-fixed lung parenchyma was prepared for analysis by digestion in a 5.25% sodium hypochlorite solution (commercial bleach), as detailed in previous reports [Roggli, 1992b; Roggli et al., 1986]. Asbestos body (AB) counts for two mesothelioma cases (cases 6 and 7; see Table I) were quantified using the technique of Smith and Naylor for approximately 5 g samples of lung tissue [Roggli, 1992b; Smith and Naylor, 1972]. For three cases (cases 1,2, and 5; see Table I), limited lung tissue (<1.0 g) was available. For these cases, our laboratory developed a hypochlorite digestion procedure [modified from Williams et al., 1982] which is suitable for smaller sample sizes (0.1–0.4 g wet weight). Our laboratory has shown that, for small sample sizes, AB counts obtained by this technique are, on average, within 10% of values determined by the Smith and Naylor procedure [Roggli et al., 1986].

Digested lung tissue was collected on 0.4 μm pore size polycarbonate filters. One filter was mounted on a glass slide, and the entire filter was examined by light microscopy (LM, at a magnification of ×200) for AB. Ferroprotein-coated fibers with broad yellow or black cores were considered to be nonasbestos ferruginous bodies (pseudoasbestos bodies) and were not counted in these analyses [Roggli,

Ann. occup. Hyg., Vol. 46, Supplement 1, pp. 132–135, 2002

Published by Oxford University Press
DOI: 10.1093/annhyg/mef651

Mesothelioma among Workers in Asbestiform Fiber-bearing Talc Mines in New York State

MINDY J. HULL[1], JERROLD L. ABRAHAM[1]* and BRUCE W. CASE[2]

[1]*State University of New York, Upstate Medical University, Pathology, Syracuse, NY 13210, USA;*
[2]*School of Environment, McGill University, Montreal, Canada*

Asbestos-related disease among talc miners and millers in a group of mines in two counties of northern New York State has been noted and disputed since the 1930s. One of the two counties was identified as among the 10 in the USA with the highest mesothelioma mortality up to 1981 for both men and women. Eight talc miners had been identified in previous studies as having mesothelioma. In the current study we: (i) report five new cases of mesothelioma among talc workers; (ii) present the results of and demonstrate the similarity between lung fiber burden analyses for selected cases and controls; and (iii) update mesothelioma mortality in this district using demographic and cause of death cancer information from 1950 to 1997. Our results indicate that New York talc exposure is associated with mesothelioma, and deserves further public health attention.

Keywords: mesothelioma; talc; pathology; epidemiology; mortality; scanning electron microscopy; asbestos

BACKGROUND

In 1878 talc mining introduced an economic boon to the rural agricultural counties of St Lawrence and Jefferson in northern New York State. The hub of this industry was Gouverneur, home of several talc mines, at least one of which is still operational. We believe that occupational exposure to dust from the talc mines and mills caused the mesothelioma excess in these counties. We support this by examining the similarity between the lung fiber burden of talc miners with and without mesothelioma, and determining the presence or absence of retained fibers indicative of commercial amphibole asbestos exposure. There are at least eight histologically confirmed cases of mesothelioma among New York State talc miners and millers reported as of 1986, and increased pleural mesothelioma mortality in Jefferson County. Here we report five new mesothelioma cases and epidemiological data to determine if this trend continues.

In the 1930s Merewether (1930) and others begin to describe asbestos exposure and its role in fibrotic lung disease. Pathology related to talc exposure also was being investigated, with a reported range of lung findings from nodular, silicosis-like to diffuse, asbestos-like patterns (Porro *et al.*, 1942). By 1943, Siegal and co-workers were studying New York State talc miners and millers (Siegal *et al.*, 1943). They described the mined talc 'of a fibrous variety…with it is found tremolite…a similar appearing mineral occurring in a fibrous or asbestiform state which… changes over to talc'. Midget impinger concentrations of particles ranged from 6 to 5000 million particles per cubic foot (mpcf) in mining and from 20 to 215 mpcf in milling. They found evidence of marked pulmonary fibrosis on chest roentgenograms in 32, all of whom had a >10 yr exposure history, out of a total of 221 talc workers. This established a clear relationship between lung fibrosis and duration of talc exposure. Fourteen of these workers also had pleural plaques, providing the first documentation of 'talc plaques'. In 1967 Kleinfeld *et al.* documented 9/220 talc workers with lung cancer; this represented a >4-fold excess. In addition, the first pleural 'fibrosarcoma' and peritoneal mesothelioma in talc miners were described in this cohort. Vianna *et al.* (1981) conducted an incidence study of all histologically confirmed mesos in New York State between 1973 and 1978. They found that Jefferson County had a mesothelioma rate twice that of the rest of the state. A total of six cases of mesothelioma (four male, two female) occurred in talc miners. Enterline and Henderson (1987) also concluded a mesothelioma excess in Jefferson County after looking at national mesothelioma incidence by county from 1968 to 1981. They observed four cases in

*Author to whom correspondence should be addressed.
Department of Pathology, SUNY Upstate Medical University, 750 East Adams Street, Syracuse, NY 13210, USA.

Table 1. Diagnosis and immunohistochemical results (where applicable) of three mesothelioma cases

	Description of pleural mesothelioma	Immunohistochemistry
Case 1	Biphasic, diffuse	Pan-cytokeratin (+++), calretinin (+++)
Case 2	Sarcomatous	Cytokeratin (+++), calretinin (–)
Case 3	Epithelial, with rare biphasic areas	CEA (–), alcian blue (+ cellular), mucicarmine (+ rare focal)
Case 4	Diagnosis of mesothelioma made by New York State Worker's Compensation Board. No tissue available	
Case 5	Diagnosis of mesothelioma made by death certificate. No tissue available	

(+++) strongly positive; (+) weakly positive; (–) negative.

Table 2. Pertinent data from New York talc miners diagnosed with malignant mesothelioma

Case	Birth	Death	Smoking history[a]	Relevant occupation(s) in the talc industry[b]	First year on job	Job duration (yr)
1	1931	1989	10	Mucker, driller, Hardinge operator	1952	22
2	1937	1990	0	Packed talc into trucks	1955	4
3	1912	1984	0	Mechanical engineer—helped construct two talc mines	Unknown	2
4	1923	1981	Unknown	Unspecified employment at a single talc company	1953	22
5	1925	1994	Unknown	Roustabout, foreman, packhouse worker	1949	25

[a]In pack-yr (no. of packs per day × no. of yr smoking).
[b]Includes all known dusty jobs (talc or otherwise).

females (0.6 expected), and seven cases in males (1.4 expected). This gave Jefferson County the second and sixth highest mortality rates from mesothelioma for females and males, respectively, in the USA.

METHODS AND RESULTS

Subjects

The SUNY Upstate Medical University serves the catchment area of Jefferson and St Lawrence counties. From 1984 to 1987, 36 biopsy and/or autopsy samples were recovered from talc workers with lung disease. Hospitalization, employment and (when applicable) death information were collected. From the 36 miners, five mesothelioma cases were documented. For three of these, the diagnosis of mesothelioma was histologically and immunohistochemically confirmed using hematoxylin & eosin, alcian blue, mucicarmine, calretinin, carcinoembryonic antigen (CEA) and cytokeratin staining (see Table 1). Case 1 is described in detail as a representative clinical course of mesothelioma. Table 2 contains demographic data for the five mesothelioma cases.

Observed and expected pleural mesothelioma mortality in mining counties

Calculations of mortality were performed at the University of Pittsburgh using the same protocol as that described by Enterline and Henderson (1987). Observed and expected values were updated to include the most recent years available (overall, from 1968 to 1997). Figure 1a,b presents the mesothelioma mortality for males and females, respectively.

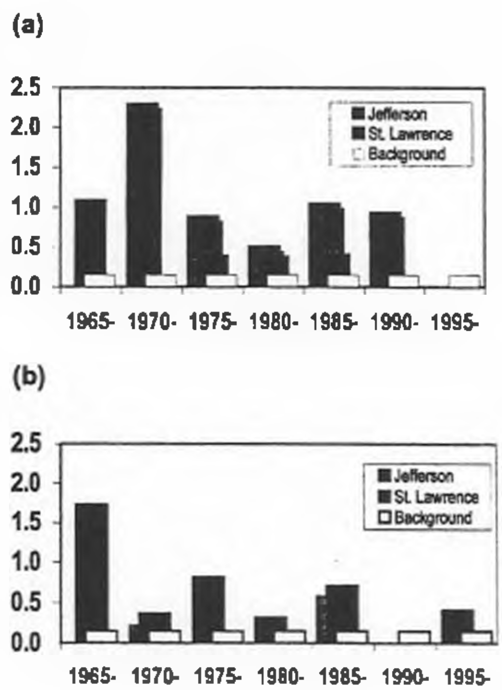


Fig. 1. Yearly mesothelioma mortality rate per 100000 (a) males and (b) females.

Lung-retained particulate and fiber analysis

Lung parenchyma from two mesothelioma cases and eight non-mesothelioma cases was available for analysis. The non-fibrous inorganic particulate lung burden was measured using morphometric *in situ* analysis of tissue sections (Abraham and Burnett, 1983). For fiber analysis, lung tissue was digested with sodium hypochlorite and the residue collected on polycarbonate filters for analysis of asbestos bodies by light microscopy or fibers by scanning electron microscopy/energy dispersive X-ray spectroscopy (Abraham *et al.*, 1991). The analytical results are displayed in Table 3. For fibers >1 µm, length, width and chemistry were recorded. Log normalized lengths and widths of the fibers found in the mesothelioma cases and the non-mesothelioma cases were compared using Student's *t*-test (Analyze-It Software, Ltd). Significance was defined as $P < 0.05$. Finding no difference between dimensions of each fiber type would support similar dust exposure between miners with and without mesothelioma.

Case 1 illustrates a representative medical history. This was a 43-yr-old, 5'8", 190 lb, white, hypertensive male, with a 10 pack-yr smoking history who presented in 1974 with 'hardness of breathing' for 4–5 yr. He reported nocturnal wheezing, persistent anterior chest pressure, chronic cough (1 oz daily sputum), occasional hemoptysis, and difficulty walking ~200 m. He had a 22 yr talc dust exposure history, working at times as a mucker, driller and Hardinge™ operator at two New York talc mines. He had optional access to a respirator that proved too cumbersome to work with. Both his father (now deceased) and brother had been diagnosed with talc pneumoconiosis. His physical examination showed a symmetrical chest wall with an increased anteroposterior dimension and diminished inspiratory expansion. Auscultation revealed harsh inspiratory and expiratory bilateral diffuse rhonchi and fine scattered expiratory wheezing. A chest X-ray showed bilateral prominence of mediastinal/cardiac shadows and increased reticular pulmonary markings, particularly over the lower lung zones. He had markedly restricted ventilatory function on spirometry, with FVC = 3.3 l (75% predicted), FEV_1 = 2.5 l (74% predicted) and $\dot{V}_{max}$ = 60 l/min (39% predicted). Like his brother and father, he was diagnosed with talc pneumoconiosis. His disease progressed, and in <2 yr he was placed on permanent total disability. He died at age 58, 15 yr after presentation. The post-mortem revealed a biphasic diffuse pleural mesothelioma encasing the left lung, which had not been suspected during life. It is noteworthy that 'congestive heart failure' was the only listed cause of death—there was no mention of mesothelioma on the death certificate.

DISCUSSION AND CONCLUSIONS

We have found a continued trend of increased mesothelioma mortality at 5–10 times the background rate in Jefferson County from 1982 to 1997, with five new male cases (two expected) and three new female cases (0.5 expected). We also show that increasing talc exposure duration is associated with an increase in lung burden of both fibrous and non-fibrous talc. Asbestos bodies were also seen in elevated concentration in most men with >10 yr exposure who had not been diagnosed with mesothelioma. The concentrations of each fiber type from mesothelioma and non-mesothelioma cases were similar, except for a high tremolite concentration in case 2. There was no significant difference found between non-mesothelioma and mesothelioma miners with regard to length and width of the tremolite and talc fibers (Tables 4 and 5), supporting our hypothesis that they were exposed to dust with similar

Table 3. Lung-retained particulate analyses of mesothelioma and non-mesothelioma cases

	Mesotheliomas		Non-mesotheliomas							
	1	2	A	B	C	D	E	F	G	H
Age at death	58	52	49	58	60	63	66	71	71	76
Years of talc mining	22	4	21	21	18	30	23	25	2	10
Diagnosis[a]	ATM	ATM	ATSC	ATS	ATP	ATSP	ATPC	ATP	Nl	Pn
Asbestos bodies[b]	350	93	200	10	980	890	417	4850	1	10
Asbestos fibers[c]										
Anthophyllite	5	n/d	12	85	64	4	14	n/d	0.04	0.4
Tremolite/actinolite	2	1110	1	105	7	17	31	43	0.07	0.9
Chrysotile	5	21	7	188	10	21	9	19	0.18	2.6
Talc (fibrous)[c]	46	96	24	716	4 7	157	195	233	0.1	3.1
Talc (non-fibrous)[d]	37	146	511	60	n/a	139	n/a	51	1	1
Silica[d]	7	n/d	15	10	n/a	68	n/a	n/d	1	1

n/a, not available; n/d, not detected.
[a] Nl, normal; Pn, pneumonia; A, asbestosis; T, talcosis; S, silicosis; P, pleural plaques; M, mesothelioma; C, lung cancer.
[b] Thousands of bodies/gram dry lung.
[c] Millions of fibers/gram dry lung.
[d] Millions of non-fibrous particles/ml lung.

Table 4. Dimensional analysis for lung fibers in two New York State talc miners with immunohistochemically diagnosed malignant mesothelioma

Fiber type	n[a]	Width (μm)			Length (μm)			AR[b]
		X[c]	Min	Max	X	Min	Max	
Actinolite	1	0.20	–	–	4.6	–	–	23
Anthophyllite	6	0.15	0.06	0.30	10.6	3.9	30.2	90
Chrysotile	5	0.05	0.03	0.06	4.1	1.9	6.1	93
Tremolite	38	0.22	0.10	0.40	4.5	1.7	10.6	26
Talc	54	0.20	0.05	1.00	5.3	1.4	53.0	43

[a]Number of fibers measured.
[b]Mean aspect ratio = length × width^{-1}.
[c]Geometric mean.

Table 5. Dimensional analysis for lung fibers in eight New York State talc miners with pulmonary disease other than mesothelioma

Fiber type	n[a]	Width (μm)			Length (μm)			AR[b]
		X	Min	Max	X	Min	Max	
Actinolite	7	0.18	0.12	0.25	3.4	2.5	5.4	20
Anthophyllite	85	0.24	0.05	1.60	7.7	1.6	146.0	56
Chrysotile	33	0.08	0.04	0.40	7.4	2.1	36.1	133
Tremolite	51	0.34	0.04	1.00	5.3	1.5	17.0	24
Talc	284	0.33	0.06	2.80	6.4	1.3	219.0	30

[a]Number of fibers measured.
[b]Mean aspect ratio = length × width^{-1}.
[c]Geometric mean.

fiber dimensions. Finally, in all of the 10 cases analyzed, only a single commercial amphibole fiber was found.

New York talc miners are exposed to a mixture of platy talc, silica and fibrous minerals, resulting in a disease process much more complex than pure talcosis. The asbestiform fibers in the New York talc miners' lungs are a mixture of talc, tremolite and related mineral series. Our results indicate that mesos continue to occur at high rates in counties where New York talc mining occurs. Furthermore, New York talc miners without evidence of commercial amphibole asbestos exposure develop mesos. Talc miners with mesos have lung fiber burdens similar to those without, indicating comparable exposures. Increased public health attention to the risks of exposure to New York talc is indicated.

Acknowledgements—M.J.H. was a Post Sophomore Fellow in Pathology during part of this work. Supported by Department of Pathology, SUNY Upstate Medical University.

REFERENCES

Abraham JL, Burnett BR. (1983) Quantitative analysis of inorganic particulate burden *in situ* in tissue sections. Scanning Electron Microsc (Part 2); 681–96.

Abraham JL, Burnett BR, Hunt A. (1991) Development and use of a pneumoconiosis database of pulmonary inorganic particulate burden in over 400 lungs. Scanning Microsc; 5: 95–104.

Enterline P, Henderson B. (1987) Geographic patterns for pleural mesothelioma deaths in the United States, 1968–81. J Natl Cancer Inst; 79: 31–7.

Kleinfeld M, Messite J, Kooyman O, Zaki MH. (1967) Mortality among talc miners and millers in New York State. Arch Environ Health; 14: 666–7.

Merewether ERA. (1930) Occurrence of pulmonary fibrosis and other pulmonary affections in asbestos workers. J Ind Hyg; 12: 198.

Porro FW, Patton JR, Hobbs AA. (1942) Pneumoconiosis in the talc industry. Am J Roentgen; 42: 507–24.

Siegal W, Smith AR, Greenburg L. (1943) The dust hazard in tremolite talc mining, including roentgenological findings in talc workers. Am J Roentgen; 49: 11–29.

Vianna NJ, Maslowsky J, Robert S, Spellman G, Patton B. (1981) Malignant mesothelioma: epidemiologic patterns in New York State. NY State J Med; 81: 735–8.

Expense Calculation Worksheet
In Re Asbestos Litigation
Exhibit Number 11

Attorney & Legal Fees

Jeffrey Simon - 16 Hours @ $300/hr	$4,800.00
Benjamin Braly - 16 Hours @ $125/hr	$2,000.00
Total	$6,800.00

Travel Expenses

Airfare	Waters & Kraus will supplement this worksheet once travel costs are known
Hotel / Lodging	
Meals	
Misc. Expenses	
Total	

Total Expense	**$6,800.00**

AFFIDAVIT OF JEFFREY SIMON

STATE OF Texas §
§
COUNTY OF Dallas §

BEFORE ME, the undersigned authority, on this day personally JEFFREY SIMON, known to me or through his drivers' license and who, upon his oath, deposes and states as follows:

"My name is JEFFREY SIMON. I am over the age of 18 years and fully competent to make this affidavit. The facts stated in this affidavit are within my personal knowledge and are true and correct.

In my role as a partner of Waters & Kraus LLP, I spent at least sixteen hours preparing for hearings conducted in the Houston MDL, cause number 2004-03964, case styled *In Re Asbestos Litigation*. The Law Firm of Waters & Kraus LLP bills my time at $300 per hour."

Further affiant sayeth not.

SHELI ABBOTT NOTARY PUBLIC STATE OF TEXAS EXPIRES 08-20-2006

JEFFREY SIMON

SUBSCRIBED AND SWORN TO BEFORE ME by JEFFREY SIMON on this 5th day of Aug, 2005.

Sheli Abbott
Notary Public

[SEAL]

EXHIBIT 12

AFFIDAVIT OF BENJAMIN BRALY

STATE OF Texas §
§
COUNTY OF Dallas §

BEFORE ME, the undersigned authority, on this day personally BENJAMIN BRALY, known to me or through his drivers' license and who, upon his oath, deposes and states as follows:

"My name is BENJAMIN BRALY. I am over the age of 18 years and fully competent to make this affidavit. The facts stated in this affidavit are within my personal knowledge and are true and correct.

In my role as a Law Clerk of Waters & Kraus LLP, I spent at least sixteen hours preparing for hearings conducted in the Houston MDL, cause number 2004-03964, case styled *In Re Asbestos Litigation*. The Law Firm of Waters & Kraus LLP bills my time at $125 per hour."

Further affiant sayeth not.

BENJAMIN BRALY

SUBSCRIBED AND SWORN TO BEFORE ME by BENJAMIN BRALY on this 4th day of Aug., 2005.

Notary Public

[SEAL] RACHEL L BRADBERRY
Notary Public
State of Texas
My Commission Expires
January 26, 2006

EXHIBIT
13

'It didn't matter what they called it ... it's killing us'

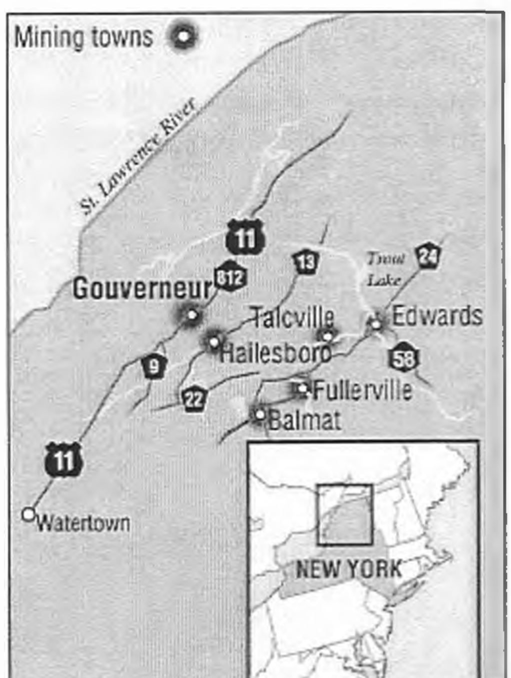
Generations of miners were fiber's victims

Thursday, June 22, 2000

By ANDREW SCHNEIDER
SEATTLE POST-INTELLIGENCER SENIOR NATIONAL CORRESPONDENT

GOUVERNEUR, N.Y. -- The tombstones of Talcville and Balmat and Hailesboro tell the story.

Beneath them lie generations of talc miners, and the numbers carved in the marble and granite stones show that generations here run short. Many of the men who took their living from this soft white rock died young -- in their late 40s and 50s.



Mining has always been a perilous profession, but few of these men died from caved-in shafts or runaway ore cars or any of the multitude of accidents that torment humans extracting minerals from the earth.

Far more of them died the excruciating death of suffocation — from lungs made uselessly rigid by scarring from deeply embedded mineral fibers, lungs with cancerous tumors, lungs filled with muddy-yellow fluid the consistency of honey. Lungs that could no longer absorb life-giving air.

EXHIBIT
14

The fibers that did this are the same fibers the government found this month in crayons. That's because most of the nation's top crayon makers put talc from The R.T. Vanderbilt Co. mines here in their products.

The Post-Intelligencer reported last month that tests commissioned by the newspaper had found asbestos in three major brands of crayons. Two weeks ago, after the Consumer Product Safety Commission conducted its own tests, the agency urged crayon makers to eliminate talc from their products. The three major manufacturers agreed to do so within a year.

Vanderbilt insists that the fibers in its talc are not asbestos. The Occupational Safety and Health Administration agrees, despite the fact that doctors say the fibers have the same chemical composition and shape as asbestos.

Spending even a short time in St. Lawrence County makes it clear that whatever the fibers are called, they are dangerous to miners.

Many of the houses tell the same story as the gravestones:

Kitchen tables bear baskets full of pills -- unless the grandkids are visiting, and the pills are shoved out of reach.

Cylinders of oxygen and coils of tubing can often be found beside the bed, or next to the best armchair in the living room.

These men have the same disease that has been killing the miners and millers of talc for years. Doctors say the cause is asbestos.

Vanderbilt says it's anything but.

"There have been many claims of finding asbestos in our mines, but when we've been able to analyze those claims, we've not been able to confirm it," said John Kelse, manager of Vanderbilt's Corporate Risk Management Department.

"There is no asbestiform -- anthophyllite or tremolite. There are transitional fibers which can be described as asbestiform, and we wouldn't argue with that. Are those things considered asbestos? No. And more importantly, do they pose the same type of risk as asbestos? The data that we have says they do not."

Kelse, who sounded weary from decades of explaining Vanderbilt's position, said yesterday he has "stacks of boxes filled with studies and reports showing the talc contains no asbestos." Despite repeated requests, this material was not made available to the Post-Intelligencer.

The Syracuse law firm of Setright & Longstreet spent years gathering depositions and other evidence on behalf of 139 talc-country miners or the heirs of miners who died from asbestos-related diseases.

Asbestos bei
tests show

Fear of losin
prompted in
to fight regu

Safety grour
ignore asbes

Nationwide
asbestos to

If you think
asbestos in
alone

Mine wants
trust

Class-action
Grace Co., i

Asbestos-lac
being sold ir

Asbestos fou
common gar

One victim's
couldn't get
scared me t

Horseman ir
life

Asbestos bill
questions

Back to intro

Other cover
issues

A jury will never get to weigh the evidence or hear the miners' stories. Last year, the New York Supreme Court ruled that the mining companies cannot be sued because state law requires claims to be handled through workers' compensation.

The P-I found hundreds of such claims, in which talc workers were found to have work-related respiratory disabilities.

A foot-high stack of the documents -- autopsy reports, medical records, pathology studies and death certificates -- show that miners, millers and mine supervisors have died or are dying from disease caused by fibers -- mostly asbestos -- in their lungs.

The depositions, medical records and company documents show repeated examples of company doctors telling workers for years that they were healthy, when X-rays locked away in company files showed lungs filled with asbestos or tumors. If the miners had known this medical information, they could have halted the deadly exposures, doctors say.

"We probably didn't believe that the X-rays showed asbestosis," Kelse said when asked why the company withheld the information. "You can't do mineral analysis on an X-ray."

Other statements showed Vanderbilt's continuing assurances to its workers that there was no asbestos in the talc. But interspersed are company letters and reports touting the value and variety of the asbestos-containing products it sold.

Surviving is not easy

While the court depositions graphically document the medical plight of the miners, the true magnitude of the pain inflicted on these families is far more apparent sitting across a kitchen table.

If Norman Rockwell was still searching for images that capture the spirit of the nation, Herb and Margaret Conklin would be great models.

An American flag hangs from a pole in a driveway covered with white tailings from the mine. Behind the pristine, carefully kept house are two large, dilapidated barns.

A doctor in 1990 told Herbert Conklin, 77, right, that

Conklin is one who did not die young. But his later years have been filled with suffering.

"I worked in the mines for 30 years to the day," says Conklin, who is 77. He ran a rock crusher, drove ore cars, fixed heavy machinery.

he had talcosis, an incurable condition. Conklin and his wife, Margaret, 72, had noticed the problem in 1987. Conklin worked at the Gouverneur Talc Co., a subsidiary of R.T. Vanderbilt Co. in Balmat, N.Y., for 30 years. A bowl of medicine is a constant reminder of his illness.
Renee C. Byer/P-I

"I did about everything that could be done at the mines and all of it in dust so heavy you sometimes couldn't see 10 feet," he recalls.

"They claimed the dust was safe, non-asbestiform. Vanderbilt called it non-fibrous, nothing that would harm us. They posted signs on the bulletin board saying the government doctors, the guys from NIOSH, were wrong, that it wasn't dangerous," he says.

He recalls a late afternoon in one of the buildings away from the dustiest areas of the mine and mill.

"The sun had dropped low enough to shine though one of the dirty windows," he says, "and the sunbeam cutting across the room was thick with fine particles of dust.

"It scared me because I knew there was asbestos in that dust. The company knew it and they tried to hush it up every time the government mine inspectors came up."

He and other miners interviewed were critical of mine inspectors for being too cozy with Vanderbilt.

"They always called two or three days before they came out to tell the company they were on the way and for the next two or three days we shoveled, swept and wet down all the dust we could find," Conklin said, fingering a brown pill bottle.

It was 1978 when he realized just how much he had been harmed.

"I was climbing up a ladder to work on the roof of the barn and all of a sudden, I couldn't breathe. I just held on knowing that the asbestos had gotten me," he says, patting the hand of his wife of 53 years.

The Conklins' lives and future changed. The 35 cows that he and Margaret had milked twice a day, and were to provide enough to live on when he retired, were soon sold.

He lowers his head, raises his thick glasses and rubs his eyes. Margaret clutches his arm a little tighter.

Conklin says he's not going to let anger burn him out, but the anger is always there.

"It was wrong. If Vanderbilt didn't care enough about its workers, why didn't the government step in? Everything got tied up over what the company called the fibers. It didn't matter what they called it, it was dangerous.

"It is killing us."

Fingers tell the tale

About a mile away, on the main street of Edwards, down from the one store and tiny cafe, two other Vanderbilt veterans sit in an immaculate living room and compare notes on life in the mine.

Charlie Minckler, 65, of Edwards, N.Y., worked at the Gouverneur Talc Co., a subsidiary of R.T. Vanderbilt Co. in Balmat, N.Y., until 1989, when he underwent a quadruple heart bypass. Minckler, who worked in the mine pit, knew he had a lung disease by the curving of his fingernails.
Renee C. Byer/P-I

Charlie Minckler spent almost half of his 65 years working for Vanderbilt. Bill Fuller, who is 68, did more than 26 years at the same company and at St. Joe's, a zinc mine across the road.

As a yellow canary looked on from its cage, they tried to recall the young men they started at the mines with decades earlier.

After a litany of "He's dead," "He's gone," and "Nope, he passed also," the men became quiet.

"I guess I'm lucky," Minckler says in a soft but raspy voice. "Of the 52 guys I began with at the mine, all but three are dead and most of them died young, in their 40s and 50s.

"Cancer took a bunch of them. The rest just couldn't breathe."

They talk about other acquaintances who must use tanks of oxygen to make it through the day.

"Once they get on that oxygen, they won't be around much longer," Minckler says, shaking his head sadly.

As the two old friends used their precious breath to tell stories, they compared notes on the private anguish of being unable to suck in a chest full of air.

"I used to be able to mow my lawn in 20 minutes," Minckler said. "Now, if I'm lucky and it's not too hot, it can take four hours."

Fuller doesn't even try to do anything strenuous.

"I can't walk to the window without stopping," he says, "and that's no way for a man to live."

Like Conklin, they target their anger at both Vanderbilt and the government.

"We know why Vanderbilt lied about the danger. It would be bad for business and no one

Bill Fuller, 68, who worked in the talc pit of the Gouverneur Talc Co., inhales from a portable medical device that forces oxygen to his lungs, helping him to breathe. He uses the appliance every six hours. Fuller has an incurable lung disease, and says he "can't walk to the window without stopping." *Renee C. Byer/P-I*

would work for them," says Fuller. "But what about the government? Why don't they care? This asbestos, or whatever Vanderbilt wants to call it, is not a secret. The graveyards are filled with proof that those fibers are dangerous."

What sparks their fury more than anything, they say, is that company doctors hid the illness from them.

"It wasn't as if they didn't know," Minckler said. "Hell, just look at our fingers. They're clubbed. Everybody's are like that. It's a sign the lungs aren't working."

Clubbing, a bulbous distortion of the fingertips and nails, is caused by a prolonged state of inadequate oxygenation. Asbestos specialists say it's rare today and usually only found when there has been poor medical treatment or no treatment.

"They knew we were sick. We took company physicals every year," Minckler says. "They knew whose lungs were shot, but they wouldn't tell us and they wouldn't send us to a specialist."

Local doctors miss signs

Most of the asbestos disease cases were not reported to workers by company doctors or diagnosed by other physicians in the county.

When deteriorating health and increasing difficulty breathing forced the miners and millers to seek other opinions, usually at their own expense at medical centers far outside St. Lawrence County, physicians often quickly diagnosed asbestosis, lung cancer and other significant respiratory impairment.

One local doctor did find the disease, and suffered for his efforts.

Dr. George Wineburgh, a radiologist, stood up for the sick miners. He showed that scores of patients diagnosed as suffering from emphysema actually had asbestosis.

Even though the state health department confirmed his findings, by the end of his first year on the job, Wineburgh found himself fired as the radiologist at a community hospital in the heart of talc country. (See accompanying story.)

'Asbestos by any standard'

Dr. Jerrold Abraham is director of environmental and occupational pathology at Upstate Medical University in Syracuse and has fought the battle over asbestos in talc for years.

Dr Jerrold Abraham, a pathologist at Upstate Medical University in Syracuse, N.Y., has fought the battle over asbestos in talc for years.
Renee C. Byer/P-I

His cluttered office in the crowded, red-brick pathology department is probably one of the world's largest storehouses of knowledge on the health effects of the fine white powder.

The two rooms house an eclectic accumulation of voluminous file folders, overfilled cabinets, floor-to-ceiling shelves brimming with medical charts, death certificates, studies on talc going back to the 1920s, and hundreds of slides with the slivers of organs of miners.

"It doesn't bother me that Vanderbilt can get away with not calling the fibers what they are -- asbestos," Abraham says. "What should bother everyone is that Vanderbilt and the government say they're not harmful."

Vanderbilt's Kelse, who acknowledges that Abraham is "a good pathologist," says, "Vanderbilt has never said that overexposure to our talc or anyone else's talc is safe. It isn't. Talcosis is different from asbestosis. But there's not much difference in the X-rays."

Abraham peers over the top of his glasses at a dozen microphotographs spread atop a long table.

"These are fibers from the mill at Vanderbilt mine," he says, holding a photo up.

"This is from the lung of a Vanderbilt miner," he says, reaching for another. "They're identical. Anyone can see that. My findings in reviewing the autopsy lung tissues of these miners show disease attributed to asbestos by any competent medical standard. You get OSHA and the mine inspectors to say why they don't believe it's asbestos."

Vanderbilt fights hard

"Our position," Kelse said yesterday, "has always been just call the stuff what it is. Whatever the health effect that's demonstrated as a result of overexposure to these fibers, you regulate it and control it to avoid those health problems."

But regulation is precisely what Vanderbilt has been fighting for decades.

In a 1983 letter to the Department of Labor, lawyers for Vanderbilt challenged OSHA's acceptance of NIOSH's determination that asbestos in their mine was tremolite and was harming the health of the miners.

OSHA's decision "portends disastrous economic consequences," the letter said.

"If such talcs are going to be considered as asbestos both the paint and ceramic tile industries will eliminate the use of talc" and Vanderbilt will be forced out of business, the letter predicted.

A note to Vanderbilt employees May 27, 1988, said: "We are certain that the aspect of labeling our product as asbestos as required by the OSHA regulations would lead to a rapid loss of our business. The public panic over asbestos is such that our operation could not survive the stigma attached to such a label."

About the same time, then-company president Hugh Vanderbilt came to the mine to rally the miners. A portion of his speech is vividly etched in the minds of the miners who heard it.

Bill Fuller was there.

"I've never seen a nicer dressed, more well-spoken man in my life," he recalls.

The mine captain gathered all of the day-shift miners and millers in the carpenter shop.

Vanderbilt, attired in a dark suit and tie, stood before the talc-smeared miners and told them not to worry about the debate over defining the fibers in the talc as asbestos because everything was under control.

The miners' depositions differed on how much money Vanderbilt said he had spent -- hundreds of thousands or millions -- but all agreed that Vanderbilt then told his workers, it would be OK, that if all else failed, he had a senator in his back pocket, and he made a show of patting his wallet. He said none of them had to worry about their jobs.

Documents touted asbestos

Neither Abraham's works, Wineburgh's X-rays nor the repeated studies by NIOSH investigators has diminished Vanderbilt's insistence that there is no asbestos in its talc.

But going back years, Vanderbilt's own documents tell a different story.

In a Jan. 2, 1975, letter from Vanderbilt to the Georgia Pacific Corp. in Portland, the sales office wrote that "in assuming the business of the International Talc Company, we will continue to market five fibrous asbestiform talcs," and then went on the list them.

The letter concluded by saying Vanderbilt would "label bags containing these products with an asbestos caution label as follows: CAUTION -- PRODUCT CONTAINS ASBESTOS FIBERS. AVOID CREATING DUST. BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM."

"At that time there was no one here at Vanderbilt that had good mineralogical expertise or a full understanding of what OSHA's regulations were all about," Kelse says. "The people here didn't understand that there are two varieties of tremolite and they assumed that meant that the company would have to label some of its talc products as asbestos-containing.

"Then they hired a mineralogist who said, 'What are you doing?' So the company stopped" the labeling.

International Talc, which mined from the same area that Vanderbilt mines, sold at least seven different products called Asbestine. Court documents show they contained as much as 50 percent asbestos.

Court documents show that prior to the advent of OSHA in 1972 and the agency's concerns about asbestos as a risk to workers, Vanderbilt capitalized on the fact that its talc products contained asbestos.

Talc's long history

Talc has been mined and milled in St. Lawrence County since 1878, when Henry Palmer opened America's first talc mine, on a farm near Talcville. By the end of World War II, the county was honeycombed with deep shafts and pits, some mom-and-pop operations, others producing thousands of tons of minerals. The miners dug not only talc, but zinc, lead and other minerals. The one common fiber throughout the mines was asbestos.

Yet Vanderbilt continues to say it isn't so.

In 1942, the Saranac Laboratory documented that anthophyllite, tremolite and four other fibers were plentiful in the mines.

A book published by Vanderbilt in 1966 to celebrate its 50th anniversary described the importance of the talc and asbestos mixtures that it sold.

The deposition of Frederick Kuehl, a mining engineer who worked for International Talc for 27 years and ended up a general manager, talked of the mine that Vanderbilt bought having various types of asbestos that were mined depending on what the customer needed.

The tremolite portion went mostly into wall tiles and paints, he said. If you wanted a fibrous ore you mined the veins that contained more anthophyllite, Kuehl said.

In 1993, Arthur Rohl, a mineralogist with Mount Sinai School of Medicine and consultant to OSHA, testified that all the talc mines of St. Lawrence County contain asbestiform material. His studies of the Gouverneur Talc Mines found that the ore contained 60 percent tremolite, anthophyllite and a small amount of chrysotile.

Effects continue today

The effect that Vanderbilt, the asbestos industry, the American Mining Congress and the National Stone Association had in the '70s and '80s on OSHA's definition of asbestos continues to have ramifications today, well beyond the sickened talc miners.

The Consumer Product Safety Commission announced last week that it had found trace amounts of anthophyllite asbestos in crayons. But the two labs who did the government's analysis also found much larger quantities of what OSHA's laboratory in Salt Lake City called "transitional fibers." Scores of labs across the country, testing crayons for local and state agencies, found the same fibers and called them asbestos, as defined by the Environmental Protection Agency.

Unless or until OSHA decides to revisit the asbestos debate, the agency must follow the decisions the industry pressured it to make in 1980s. Since OSHA's laboratory does the analysis for the Mine Safety and Health Administration, this may be skewing the results of sampling done by mine inspectors.

With rare exceptions, OSHA's analysis of MSHA's testing reported no asbestos detected in samples from talc mines in New York, taconite mines in Northern Michigan and Minnesota and vermiculite mines in Virginia and South Carolina.

Davitt McAteer, MSHA's director, said in a January interview that he and his technical staff are mystified at the apparent contradictions between no asbestos being found and reports from unions, physicians and miners themselves of significant asbestos-related diseases among the work forces at these mines.

Meanwhile, conditions have improved somewhat at Vanderbilt. Better ventilation has been installed, and some workers have newer protective gear, although the dust is still a major concern.

As the miners in New York's talc country continue to do what their fathers and grandfathers did for more than a century, they still must wonder if their stories will end differently.

P-I senior national correspondent Andrew Schneider can be reached at 206-448-8218 or andrewschneider@seattle-pi.com

P-I reporter Carol Smith contributed to this report.