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RJ Lee Group, Inc.

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Asbestos Analysis Report

FAX 412/733-1799

Project No. AOH110601

February 5, 1992

On October 7, 1991, 24 air samples were received from Mr. John Kelse of the R. T. Vanderbilt Company, Inc. It was requested that these air samples be analyzed for asbestos content through the application of mineralogically correct criteria specific to asbestos and to compare this analysis with the nonspecific NIOSH 7400 method for fiber counting.

In following the NIOSH 7400 method, a portion of the filter (1/4 circumference wedge) was removed and mounted on a glass slide using acetone vapor and triacetin. The preparation was then covered with a No. 1-1/2 glass coverslip and allowed to sit until the filter wedge became transparent. The method requires that 100 fields be counted, or at least a minimum of 20 fields, depending upon fiber concentration. All fibers or fiberlike particles measuring 5 micrometers (μm) in length and having a length-to-width aspect ratio equal to or greater than 3:1 were counted. This count considers particles typically referred to as "federal fibers" and does not distinguish asbestos fibers from elongated nonasbestos particles. These results are presented in Table I.

During the fiber count, the particles counted were "defined" based on the guidelines set forth in the testimony presented before OSHA by Dr. R. J. Lee, March 9, 1990. Dr. Lee proposed that PCM be used as a screening technique to overcome the intrinsic limitations of the current PCM method (i.e., nonspecificity). The advantage of the proposed method is that it retains and builds on historical federal fiber data (fibers $>5 \mu\text{m}$ length, $\geq 3:1$ aspect ratio) which has been developed under the P&CAM 239 and NIOSH 7400 methods. Basically, the proposed method categorizes federal fibers by width. If the $\leq 1 \mu\text{m}$ diameter plus bundles $>1 \mu\text{m}$ in width federal fiber count is statistically below the permissible limit, the analysis is terminated; otherwise additional analysis can be performed by scanning electron microscopy (SEM) or transmission electron microscopy (TEM) to determine the portion of the count that is asbestos. A copy of this approach with supporting data is enclosed.

Table II gives the fiber diameter breakdown for each sample. The column identities are shown on page 2 of Table II. Columns B and E were identified as possibly asbestos based on the morphological characteristics of asbestos. The fibers in column C were considered "fibrous" (long and thin), but not asbestiform, and those in column D were clearly cleavage fragments. Table III presents a comparison of the PCM counts as determined by the NIOSH 7400 method and the proposed method. The NIOSH 7400 method column is the calculation of all the fibers counted during the PCM analysis. The proposed method column is the calculation using only those fibers $\leq 1 \mu\text{m}$ in diameter and fiber bundles $>1 \mu\text{m}$ in diameter (columns B, C, and E of Table II).

In following this protocol, SEM analysis should have been the next method of analysis, due to the concentration of fibers in columns B, C and E of Table II. SEM, though, has not been a good analytical tool in differentiating between fibrous talc, anthophyllite, and talc-anthophyllite intergrowth because of the confusion that stems from similarity of their elemental chemistries (i.e., similar silicon to magnesium ratio). Therefore, in an attempt to identify the various species on the filters, we undertook the polarizing light microscopy (PLM) analysis using the following approach.

Each slide which had been prepared for PCM was scanned by PLM at approximately 200X magnification, during which time 100 fibers were counted and characterization attempted. However, severe limitations were placed on the analysis by using a medium much lower than one would use in identifying the particles by normal PLM. The PCM preparation has a refractive index of 1.46; and to the best of his ability, our analyst categorized the fibers he counted as talc, anthophyllite, tremolite, and miscellaneous. The miscellaneous particles included all 5 μ m, 3:1 particles that did not fit into any of the previous categories, and the majority of these were cellulose, glass, and quartz.

Unfortunately, we did not feel confident with the results of this analysis, and those results are not included in this report. However, the analysis did give us information on the morphology of the fibers.

It was felt that by starting "fresh" with a sample that could be analyzed by PLM using the proper refractive index liquid, an accurate identification of the mineral species present could be made. The final step performed in this analysis was correlating the data accumulated from the fiber count by PCM and that obtained by the PLM morphological interpretation. Based on the PLM observation, we identified the fibers in columns B and E of Table II as talc fibers and talc fiber bundles. The "federal fibers" in column C were elongated (between 0.5 and 1.0 μ m in width) but not asbestiform and were identified as anthophyllite. The fibers in column D were cleavage fragments and included a portion of the anthophyllitic and all of the tremolite.

Results

Based upon this analysis, none of the "federal fibers" observed should be considered asbestos. Although the particle size distribution and mineral mix varies somewhat from that observed in previously examined R. T. Vanderbilt tremolitic talc, the cleavage fragment and talc fiber observations are consistent with prior observations relative to the absence of chrysotile and amphibole asbestos. Differences from prior analysis may, in part, be attributable to a mixed dust environment (i.e., not a pure talc sample) and to some methodological differences in sample handling dictated by sample loading.

Table I
Total Fiber Concentrations
PCM Air Analysis
Project AOH110601

Sample Number	Client Sample Number	Analyzed Area (sq. mm)	Volume (Liters)	Fibers	Fields	Concentration (fibers/sq. mm)	Concentration† (fibers/cc)	90% Confidence Limit‡		Limit of Quantification‡
0402365BHPC	1491-F	0.6123	24.48	100	78	163.3186	2.5685	1.6237	3.5133	0.1102
0402366BHPC	1478-F	0.5495	21.42	100.5	70	182.8935	3.2873	2.0787	4.4959	0.1259
0402367BHPC	1485-F	0.6123	32.13	100.5	78	164.1352	1.9668	1.2437	2.6898	0.0840
0402368BHPC	1479-F	0.5495	15.3	100	70	181.9836	4.5793	2.8949	6.2638	0.1763
0402369BHPC	1383-F	0.4239	38.25	100.5	54	237.0842	2.3863	1.5090	3.2637	0.0705
0402370BHPC	1393-F	0.4318	39.78	103	55	238.5640	2.3089	1.4621	3.1557	0.0678
0402371BHPC	1475-F	0.785	Blank	1	100	1.2739*	§	§	§	§
0402372BHPC	1487-F	0.4632	19.89	102.5	59	221.3106	4.2838	2.7119	5.8557	0.1356
0402373BHPC	1481-F	0.4632	29.51	102	59	220.2310	2.8732	1.8184	3.9280	0.0914
0402374BHPC	1490-F	0.785	26.82	21	100	26.7516	0.3840	0.1970	0.5710	0.1006
0402375BHPC	1462-F	0.2905	14.9	100.5	37	346.0148	8.9407	5.6536	12.2277	0.1810
0402376BHPC	1456-F	0.4318	35.76	100	55	231.6155	2.4936	1.5764	3.4109	0.0754
0402377BHPC	1457-F	0.314	14.9	101	40	321.6561	8.3112	5.2571	11.3654	0.1810
0402378BHPC	1398-F	0.785	0	0	100	<7.0064*	§	§	§	§
0402379BHPC	1452-F	0.4475	165.39	102	57	227.9584	0.5306	0.3358	0.7255	0.0163
0402380BHPC	1348-F	0.4239	27.55	100	54	235.9047	3.2967	2.0840	4.5093	0.0979
0402381BHPC	1381-F	0.4946	27.55	100.5	63	203.2150	2.8398	1.7958	3.8839	0.0979
0402382BHPC	1378-F	0.5495	17.4	101.5	70	184.7134	4.0870	2.5859	5.5882	0.1550

† Analytical results based upon the volumes provided by R.T. Vanderbilt Company.

§ Sample is a Blank, or no volume was supplied. Calculation could not be done.

* Results Below Analytical Sensitivity

Prepared, Counted, and Calculated in accordance with NIOSH 7400

Authorized Signature
Date

Tuesday, February 4, 1992

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Table I
Total Fiber Concentrations
PCM Air Analysis
Project AOH110601

Sample Number	Client Sample Number	Analyzed Area (sq. mm)	Volume (Liters)	Fibers	Fields	Concentration (fibers/sq. mm)	Concentration† (fibers/cc)	90% Confidence Limit‡		Limit of Quantification‡
0402383BHPC	1377-F	0.5888	14.5	101.5	75	172.3992	4.5775	2.8962	6.2588	0.1860
0402384BHPC	1375-F	0.4632	18.85	101	59	218.0719	4.4540	2.8173	6.0907	0.1431
0402385BHPC	1344-F	0.785	Blank	0	100	<7.0064*	§	§	§	§
0402386BHPC	1386-F	0.5338	24.65	102.5	68	192.0195	2.9991	1.8986	4.0996	0.1094
0402387BHPC	1384-F	0.6673	13.05	102	85	152.8662	4.5098	2.8542	6.1655	0.2067
0402388BHPC	1387-F	0.4161	23.2	101	53	242.7593	4.0285	2.5482	5.5089	0.1163
0402389BHPC	1389-F	0.369	23.2	100	47	271.0394	4.4979	2.8434	6.1523	0.1163
0402390BHPC	1394-F	0.4004	20.3	101.5	51	253.5282	4.8083	3.0423	6.5743	0.1329
0402391BHPC	1396-F	0.2277	8.7	103	29	452.4489	20.0222	12.6788	27.3655	0.3101
0402392BHPC	1372-F	0.785	Blank	0	100	<7.0064*	§	§	§	§

† Analytical results based upon the volumes provided by R.T. Vanderbilt Company.

§ Sample is a Blank, or no volume was supplied. Calculation could not be done.

* Results Below Analytical Sensitivity

Prepared, Counted, and Calculated in accordance with NIOSH 7400

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Page: 2 of 2

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Table II
Project No. AOH110601
Fiber Diameter Breakdown - Based on PCM Analysis

<u>Sample No.</u>	<u>Number of Fibers*</u>				
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>
1348-F	100.0	16.0	9.0	60.0	15.0
1375-F	101.0	8.5	8.0	78.5	6.0
1377-F	101.5	6.5	16.0	73.0	6.0
1378-F	101.5	9.5	19.5	69.0	3.5
1381-F	100.5	9.5	14.0	69.5	7.5
1383-F	100.5	17.5	17.5	59.5	6.0
1384-F	102.0	16.0	5.0	75.0	6.0
1386-F	102.5	8.0	4.5	84.0	6.0
1387-F	101.0	15.0	10.0	71.0	5.0
1389-F	100.0	11.0	8.5	76.5	4.0
1393-F	103.0	19.5	9.5	69.0	5.0
1394-F	101.5	7.5	9.5	78.0	6.5
1396-F	103.0	18.5	7.0	68.5	9.0
1452-F	102.0	17.5	19.0	58.0	7.5
1456-F	100.0	7.5	16.5	65.0	11.0
1457-F	101.0	16.0	12.0	67.0	6.0
1462-F	100.5	18.0	8.5	67.0	7.0
1478-F	100.5	8.5	19.5	67.5	5.0
1479-F	100.0	9.5	22.5	59.0	9.0
1481-F	102.0	14.0	5.5	73.0	9.5
1485-F	100.5	12.0	20.0	59.0	9.5

Table II (Cont'd)

Project No. AOH110601
Fiber Diameter Breakdown - Based on PCM Analysis

Sample No.	Number of Fibers*				
	A	B	C	D	E
1487-F	102.5	20.0	10.5	62.5	9.5
1490-F	21.0	6.0	1.5	10.5	3.0
1491-F	100.0	15.0	12.5	59.5	13.0

*Column Identities

A-Particles $>5\mu\text{m}$ long; $\geq 3:1$ aspect ratio; all diameters

B-Particles $>5\mu\text{m}$ long; $\geq 3:1$ aspect ratio; $\leq 0.5\mu\text{m}$ diameter

C-Particles $>5\mu\text{m}$ long; $\geq 3:1$ aspect ratio; $>0.5/\leq 1.0\mu\text{m}$ diameter

D-Particles $>5\mu\text{m}$ long; $\geq 3:1$ aspect ratio; $>1.0\mu\text{m}$ diameter

E-Particles $>5\mu\text{m}$ long; $3:1$ aspect ratio; $>1.0\mu\text{m}$ diameter-bundles

Table III

Project No. AOH110601
Fiber Count Comparison Between NIOSH 7400 and Proposed Method
Based on PCM Analysis

<u>Sample No.</u>	<u>NIOSH 7400 Fibers per cc</u>	<u>Proposed Method Fibers per cc</u>
1348-F	3.2967	1.3187
1375-F	4.4540	0.9922
1377-F	4.5775	1.2853
1378-F	4.0870	1.3087
1381-F	2.8398	0.8760
1383-F	2.3863	0.9735
1384-F	4.5098	1.1938
1386-F	2.9991	0.5413
1387-F	4.0285	1.1966
1389-F	4.4979	1.0570
1393-F	2.3089	0.7621
1394-F	4.8083	1.1132
1396-F	20.0222	6.7064
1452-F	0.5306	0.2289
1456-F	2.4936	0.8728
1457-F	8.3112	2.7978
1462-F	8.8407	2.9802
1478-F	3.2873	1.0794
1479-F	4.5793	1.8775
1481-F	2.8732	0.8169
1485-F	1.9668	0.8121

Table III (Cont'd)

Project No. AOH110601
Fiber Count Comparison Between NIOSH 7400 and Proposed Method
Based on PCM Analysis

<u>Sample No.</u>	<u>NIOSH 7400</u> <u>Fibers per cc</u>	<u>Proposed Method</u> <u>Fibers per cc</u>
1487-F	4.2838	1.6717
1490-F	0.3840	0.1920
1491-F	2.5685	1.0402