Attachment 1

479816

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The Materials Characterization Specialists

ANALYSIS OF DECEMBER 1999 INDOOR AIR SAMPLES FROM THE EXPORT AND SCREENING PLANTS, LIBBY MONTANA

In the Matter of
General Consulting

September 27, 2000
Project No. LSH002397

Prepared by

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Introduction

As part of its investigations in Libby, Montana, the EPA began a series of sampling events designed to quantify the level of asbestos exposure and the routes of exposure in Libby. In particular, air samples were collected in December 1999 at the former Export Plant and at the former Screening Plant and sent to RJ Lee Group for analysis. These samples were collected by representatives of the EPA in a manner reported to be side-by-side to the samples collected and analyzed by the EPA. No documentation was provided detailing the sample collection method or of sampling parameters (such as collection time and flowrates).

RJ Lee Group has analyzed these samples using three methods: phase contrast microscopy and two different transmission electron microscopy methods. This report details the results of these analyses.

Sample Information

Table 1 summarizes the sample information for each filter cassette. The sampled air volumes were taken from the cassette labels. The first five samples are from the export plant, the next four from the screening plant.

Analytical Protocols

Three analytical protocols were used by RJ Lee Group to evaluate these samples: phase contrast microscopy and two transmission electron microscopy methods.

Phase Contrast Microscopy (PCM)

Airborne fibers are observed using an optical phase contrast microscope and are counted according to NIOSH 7400 (NIOSH 7400, Asbestos and Other Fibers by PCM, NIOSH Manual of Analytical Methods. Current version listed as "Issue 2: 15 August 1994"). For PCM analysis, airborne particles are collected on a mixed cellulose ester filter. A quarter wedge of the filter is excised and made optically transparent by using acetone vapor. A drop of triacetin is placed on the cleared filter to adjust the refractive index of the cleared filter to allow for improved visual observation of the fibers. The prepared sample is placed in a phase contrast microscope and the fibers meeting specified criteria are counted. The protocol counts only fibers that are longer than 5 μm, at least three times longer than wide (aspect ratio), and which are visible in the microscope at a magnification of 400X. PCM cannot reliably distinguish between asbestos and non-asbestos fibers.

Transmission Electron Microscopy (TEM)

Two TEM methods were utilized in these analyses: NIOSH 7402 (NIOSH 7402, Asbestos by TEM, NIOSH Manual of Analytical Methods. Current version listed as "issue 2, 15 August 1994") and ISO 10312 (ISO 10312:1995(E), Ambient Air – Determination of asbestos fibres – Direct-transfer transmission electron microscopy method, International Organization for Standardization). In both TEM methods, a portion of the filter is made electron transparent using a direct transfer technique. Neither method permits the use of an indirect preparation procedure. TEM can accurately identify asbestos minerals by using selected area electron diffraction (SAED) and energy dispersive x-ray spectroscopy (EDXA). SAED provides information on the crystal structure of a particle while EDXA provides information on the elemental composition of the particle. Both EDXA and SAED are necessary to accurately classify amphibole asbestos.

NIOSH 7402 is the TEM analog to the PCM method (NIOSH 7400). Fibers, both asbestos and non-asbestos, are counted in the TEM. These fibers are at least 5 μm long, have an aspect ratio of at least 3:1 (length/width), and have a width between 0.25 μm and 3 μm. The asbestos concentration can be calculated directly from the TEM analysis resulting in a NIOSH 7402 asbestos concentration. However, the method is also designed to be used in conjunction with the PCM method. When samples are collected in a mixed fiber atmosphere, OSHA permits the use of the TEM data to adjust the PCM data to determine the actual asbestos content (letter, Daniel T. Crane to Jim Johnson, US Department of Labor, Occupational Safety & Health Administration, June 24, 1998). This adjustment is calculated by:

$$PCME\ Concentration,\ f/ml = PCM\ f/ml \times \frac{TEM\ Asbestos\ Count}{TEM\ Total\ Fiber\ Count}$$

where the PCME (PCM-Equivalent) Concentration is the adjusted PCM asbestos concentration.

ISO 10312 is an international standard TEM method. This method counts structures with an aspect ratio of 5:1. As used in these analyses, the asbestos fibers that were counted were at least 5 μm long and less than 0.5 μm in width. These are the dimensions recommended by Berman and Crump (Berman and Crump, 1999) as fibers which can be used to calculate a risk estimate. In addition to the aspect ratio, another difference between the ISO 10312 and NIOSH 7402 counting rules is the requirement to count substructures and to use this count in determining the asbestos concentrations. A substructure is the individual fiber or bundle which physically touch each other to create a larger countable structure (generally a cluster or a matrix particle).

Analytical Data

The data generated from the analyses of these samples are attached in Appendices A (PCM Data), B (NIOSH 7402) and C (ISO 10312). Table 2 summarizes the analytical data.

No amphibole asbestos fibers were observed in the samples from the export plant. Several amphibole asbestos fibers were observed on the samples from the screening plant during the TEM analyses. The highest amphibole concentration was observed in sample 28403 during the ISO analysis (0.0008 f/ml). Of the nine samples, no amphibole asbestos was observed in seven samples; amphibole asbestos was observed in two other samples.

Comparison With EPA Data

The data developed by RJ Lee Group can be compared with the data developed by the EPA (tables distributed 2/2/00 at a public meeting and updated on 2/23/00). The original analyses reported by the EPA contained data from a 10 grid opening analysis. The second set of EPA expanded on the original analyses by analyzing an additional 20 grid openings. These data are compared in Table 3 where the reported concentrations longer than 5 μm are shown for the actinolite and chrysotile minerals. Note that no sample collection sheets were available to accurately match the samples between the two groups. Instead, sequential sample numbers were paired together with an additional verification step following the issue of the July 20, 2000 database prepared by ISSI, Inc. and added to the Administrative Record by EPA.

As shown in Table 3, both laboratories are in agreement that four of the nine samples contain no asbestos and that two of the nine do contain amphibole asbestos (though we may differ on the actual amount of amphibole asbestos). There is disagreement on three of the samples as to the presence and concentration of amphibole asbestos.

Table 1 Information on Samples Analyzed by RJ Lee Group

Location	Field ID	RJ Lee Group #	Volume, l
Export Plant			
Warehouse	28133	107240HT	4320
Planer	28135	107241HT	4320
Spencer	28137	107242HT	4140
Garage	28139	107243HT	4320
Woodshed	28141	107244HT	4320
Screening Plant			
Covered Workshop	28401	107245HT	4320
Living Room	28403	107246HT	3960
Office	28405	107247HT	3960
Mushroom Tunnel	28407	107248HT	4140

Table 2 Summary of PCM Fiber Data and TEM Amphibole Data

			Concentrations, f/mL			
Location	Field ID	RJ Lee Group	PCM[a]	NIOSH 7402[b]	PCME	ISO 10312[c]
Export						
Warehouse	28133	107240HT	0.0006	< 0.0002	< 0.0002	< 0.0002
Planer	28135	107241HT	0.0011	< 0.0002	< 0.0002	< 0.0002
Spencer	28137	107242HT	0.0004	< 0.0003	< 0.0003	< 0.0003
Garage	28139	107243HT	0.0009	< 0.0002	< 0.0002	< 0.0002
Woodshed	28141	107244HT	0.0003	< 0.0002	< 0.0002	< 0.0002
Screening						
Covered Workshop	28401	107245HT	0.0006	< 0.0002	< 0.0002	< 0.0002
Living Room	28403	107246HT	0.0148	0.0003	0.0003	0.0008
Office	28405	107247HT	0.0076	< 0.0003	< 0.0003	< 0.0003
Mushroom Tunnel	28407	107248HT	0.0030	0.0008	0.0004	0.0005

a Appendix A contains the analytical data for the PCM analyses.
b Appendix B contains the analytical data for the NIOSH 7402 analyses
c Appendix C contains the analytical data for the ISO 10312 analyses.

Table 3. Comparison of US EPA and RJ Lee Group Data

Field ID	Laboratory	Analysis	Analytical Sensitivity, f/cc	Concentration, f/ml	
				Actinolite	Chrysotile
28133	RJLG	ISO 10312	0.00025	0	0
	RJLG	7402	0.00025	0	0
28132	EPA	ISO 10312 - Original	0.00085	0	0
	EPA	ISO 10312 - Recount	0.00042	0	0
28135	RJLG	ISO 10312	0.00025	0	0
	RJLG	7402	0.00025	0	0
28134	EPA	ISO 10312 - Original	0.00085	0	0
	EPA	ISO 10312 - Recount	0.00042	0.00042	0
28137	RJLG	ISO 10312	0.00026	0	0
	RJLG	7402	0.00026	0	0
28136	EPA	ISO 10312 - Original	0.00089	0	0
	EPA	ISO 10312 - Recount	0.00044	0	0
28139	RJLG	ISO 10312	0.00025	0	0
	RJLG	7402	0.00025	0	0
28138	EPA	ISO 10312 - Original	0.00085	0	0
	EPA	ISO 10312 - Recount	0.00042	0	0
28141	RJLG	ISO 10312	0.00025	0	0
	RJLG	7402	0.00025	0	0
28140	EPA	ISO 10312 - Original	0.00085	0.00170	0
	EPA	ISO 10312 - Recount	0.00042	0	0
28401	RJLG	ISO 10312	0.00025	0	0
	RJLG	7402	0.00025	0	0
28400	EPA	ISO 10312 - Original	0.00093	0	0
	EPA	ISO 10312 - Recount	0.00046	0	0
28403	RJLG	ISO 10312	0.00027	0.00081	0.00027
	RJLG	7402	0.00027	0.00027	0
28402	EPA	ISO 10312 - Original	0.00093	0.00093	0
	EPA	ISO 10312 - Recount	0.00046	0.00138	0.00046
28405	RJLG	ISO 10312	0.00027	0	0
	RJLG	7402	0.00027	0	0.00014
28404	EPA	ISO 10312 - Original	0.00093	0.00093	0
	EPA	ISO 10312 - Recount	0.00046	0	0
28407	RJLG	ISO 10312	0.00026	0.00052	0
	RJLG	7402	0.00026	0.00078	0
28406	EPA	ISO 10312 - Original	0.00093	0.00186	0
	EPA	ISO 10312 - Recount	0.00046	0.00092	0

Appendix A

Phase Contrast Microscopy

TEST REPORT

PCM Air Analysis Results
Project LSC003405

Sample Number	Client Sample Number	Analyzed Area, mm^2	Volume, l	Fibers	Fields	Density, f/mm^2	Concentration, f/cc	95% Upper Confidence Level	Limit of Quantification	Analyst	Analysis Date
107240HT	28133	0.785	4320	5	100	<7.0064	<0.0006	0.0011	0.0006	BJW	3/28/00
107241HT	28135	0.785	4320	9.5	100	12.0958	0.0011	0.0018	0.0006	BJW	3/28/00
107242HT	28137	0.785	4140	3.5	100	<7.0064	<0.0007	0.0012	0.0007	BJW	3/28/00
107243HT	28139	0.785	4320	7.5	100	9.5493	0.0009	0.0014	0.0006	BJW	3/28/00
107244HT	28141	0.785	4320	2.5	100	<7.0064	<0.0006	0.0011	0.0006	BJW	3/28/00
107245HT	28401	0.785	4320	5.5	100	7.0064	0.0006	0.0011	0.0006	BJW	3/28/00
107246HT	28403	0.675	3960	102.5	86	151.7520	0.0148	0.0202	0.0008	BJW	3/28/00
107247HT	28405	0.785	3960	61.5	100	78.3040	0.0076	0.0106	0.0007	BJW	3/28/00
107248HT	28407	0.785	4140	25	100	31.8309	0.0030	0.0043	0.0007	BJW	3/28/00

Samples Received on: Tuesday, March 28, 2000
Analytical Results based on volumes provided by Radian
Prepared, counted, and calculated in accordance with NIOSH 7400, issue 2.
"<" indicates the results are below the method analytical sensitivity.

Authorized Signature Barbara J. Woodside
Barbara J. Woodside, Microscopist
Wednesday, March 29, 2000

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Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	1.0	0.0	0.0	0.0	0.0	Date:	03/20/[illegible]
2	0.0	0.0	0.0	0.0	0.0	Analyst:	BJW
3	0.0	0.0	0.0	0.0	0.0	Initials:	BJW
4	0.0	0.0	0.0	0.0	0.0	Job:	1[illegible]C003405
5	1.0	0.0	0.0	0.0	0.0	Client/Dept/Area:	RJLG
6	0.0	0.0	0.0	0.0	0.0	Sample Number:	7240
7	0.0	0.0	0.0	0.0	0.0	Client Sample No.:	28133
8	0.0	0.0	0.0	0.0	0.0	Sample Cost:	0.00
9	0.0	0.0	0.0	0.0	0.0	Volume (liters):	4320.0
10	0.5	0.0	0.0	0.0	0.0	Blank per 100 flds:	0.00
11	0.0	0.0	1.0	0.0	0.0	Total fibers:	5.0
12	0.0	0.0	0.0	0.0	0.0	Number of fields:	100
13	0.0	0.0	0.0	0.0	0.0		
14	0.0	0.0	0.0	1.0	0.0	Field area:	0.007854
15	0.0	0.0	0.0	0.0	0.0	Filter area:	385
16	0.0	0.0	0.0	0.0	0.0	Fibers/sq. mm:	<7.00*
17	0.0	0.0	0.0	0.0	0.0	Fibers/filter:	<2695.0*
18	0.0	0.0	0.0	0.5	0.0	Fibers/cc:	<0.0006*
19	0.0	0.0	0.0	0.0	0.0	Confidence Interval:	0.0001-0.0011
20	0.0	0.0	0.0	0.0	0.0	Remarks: None	

* Below Analytical Sensitivity of 7.00 fibers/sq. mm
Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

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Location: SSN: - - Sample Time: (min)

Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	0.0	0.0	0.0	0.0	0.0	Date:	03/26/00
2	0.0	0.0	0.0	0.0	0.0	Analyst:	BJW
3	0.0	0.0	0.0	0.0	0.0	Initials:	BJW
4	0.0	0.0	0.0	0.0	0.0	Job:	LS0003405
5	0.0	0.0	0.0	0.0	1.0	Client/Dept/Area:	RJLG
6	0.0	0.0	0.0	0.0	0.0	Sample Number:	7[illegible]1
7	0.0	0.0	0.0	0.0	0.0	Client Sample No.:	28135
8	0.0	0.0	0.0	0.5	0.0	Sample Cost:	0.[illegible]0
9	0.0	0.5	0.0	0.0	0.0	Volume (liters):	4320.0
10	0.0	0.0	0.5	0.0	1.0	Blank per 100 flds:	0.00
11	0.0	0.0	0.0	0.0	0.0	Total fibers:	9.5
12	0.0	0.0	0.0	0.0	0.0	Number of fields:	1[illegible]0
13	0.0	0.0	0.0	0.0	0.0		
14	0.0	0.0	0.0	0.0	0.0	Field area:	0.00[illegible]
15	0.0	0.0	1.0	0.0	0.0	Filter area:	385
16	0.0	0.0	0.0	0.0	1.0	Fibers/sq. mm:	12.10
17	0.0	0.0	0.0	0.0	0.0	Fibers/filter:	4656.9
18	1.0	0.0	0.0	0.0	0.5	Fibers/cc:	0.00[illegible]
19	0.0	1.0	0.0	0.0	0.0	Confidence Interval:	0.0004-0.0018
20	0.0	1.0	0.5	0.0	0.0	Remarks: None	

Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

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Location: SSN: - - Sample Time: (min)

Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	0.0	0.0	0.0	0.0	0.0	Date:	03/26/00
2	0.0	0.5	0.0	0.0	0.0	Analyst:	BJW
3	0.0	0.0	0.0	0.0	0.0	Initials:	BJW
4	0.0	0.0	0.0	1.0	0.0	Job:	LSC003405
5	0.0	0.0	0.0	0.0	0.0	Client/Dept/Area:	RJLG
6	0.0	0.0	0.0	0.0	0.0	Sample Number:	7 2
7	0.0	0.0	0.0	0.0	0.0	Client Sample No.:	28137
8	0.0	0.5	0.0	0.0	0.0	Sample Cost:	0.00
9	0.0	0.0	0.0	0.0	0.0	Volume (liters):	4140.0
10	0.0	0.0	0.0	0.5	0.0	Blank per 100 flds:	0.00
11	0.0	0.0	0.0	0.0	0.0	Total fibers:	3.5
12	0.0	0.0	0.0	0.0	0.0	Number of fields:	100
13	0.0	0.0	0.0	0.0	0.0		
14	0.0	0.0	0.0	0.0	0.0	Field area:	0.007[illegible]4
15	0.0	0.0	0.0	0.0	0.0	Filter area:	385
16	0.0	0.0	0.0	0.0	0.0	Fibers/sq. mm:	<7.00*
17	0.0	0.0	1.0	0.0	0.0	Fibers/filter:	<2695.0*
18	0.0	0.0	0.0	0.0	0.0	Fibers/cc:	<0.00[illegible]7*
19	0.0	0.0	0.0	0.0	0.0	Confidence Interval:	0.0001-0.0012
20	0.0	0.0	0.0	0.0	0.0	Remarks: None	

* Below Analytical Sensitivity of 7.00 fibers/sq. mm
Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

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Location: SSN: - - Sample Time: (min)

Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	0.0	0.0	0.0	0.0	0.0	Date:	03/2[illegible]
2	0.0	0.0	0.0	0.0	0.0	Analyst:	BJW
3	0.0	0.0	0.0	0.0	0.0	Initials:	[illegible]
4	0.0	0.0	0.0	0.0	0.0	Job:	LSC003405
5	0.0	0.0	0.0	0.0	0.0	Client/Dept/Area:	RJLG
6	0.0	0.0	0.0	0.0	0.0	Sample Number:	7243
7	0.0	0.0	0.0	0.0	1.0	Client Sample No.:	28139
8	0.0	0.0	0.0	0.0	0.0	Sample Cost:	0.00
9	0.0	0.0	0.0	0.0	1.0	Volume (liters):	4320.0
10	0.0	0.0	0.0	0.0	0.0	Blank per 100 flds:	0.00
11	0.0	0.0	0.0	0.0	0.0	Total fibers:	7.5
12	0.0	0.0	1.0	1.0	0.0	Number of fields:	100
13	0.0	0.0	0.0	0.0	0.0		
14	0.0	0.0	0.0	0.0	0.0	Field area:	0.007854
15	0.0	0.0	0.0	0.0	0.0	Filter area:	385
16	0.0	0.0	1.0	0.0	0.0	Fibers/sq. mm:	9.55
17	0.0	0.0	0.0	0.0	0.0	Fibers/filter:	3676.5
18	0.0	0.0	0.0	0.0	0.0	Fibers/cc:	0.0009
19	0.0	0.5	1.0	0.0	0.0	Confidence Interval:	0.0003-0.0[illegible]
20	0.0	0.0	0.0	1.0	0.0	Remarks: None	

Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

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Location: SSN: - - Sample Time: (min)

Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	0.0	0.0	0.0	0.0	0.0	Date:	03/26 0
2	0.0	0.0	0.0	0.0	0.0	Analyst:	BJW
3	0.0	0.0	0.0	0.0	0.0	Initials:	BJW
4	0.0	0.0	0.0	0.0	0.0	Job:	LSC003405
5	0.0	0.0	0.0	0.0	0.0	Client/Dept/Area:	RJLG
6	0.0	0.0	0.0	0.0	0.0	Sample Number:	7244
7	0.0	0.0	0.0	0.0	0.0	Client Sample No.:	28141
8	0.0	0.0	0.0	0.0	0.0	Sample Cost:	0.00
9	0.0	1.0	0.0	0.0	0.0	Volume (liters):	4320.0
10	0.0	0.0	0.0	0.0	0.0	Blank per 100 flds:	0.00
11	0.0	0.0	0.0	0.0	0.0	Total fibers:	2.5
12	0.0	0.0	0.0	0.0	0.0	Number of fields:	100
13	0.0	0.0	0.0	0.0	0.0		
14	0.0	0.0	0.0	0.0	0.0	Field area:	0.007854
15	0.0	0.0	0.0	0.0	0.0	Filter area:	385
16	1.0	0.0	0.0	0.0	0.0	Fibers/sq. mm:	<7.00*
17	0.0	0.0	0.0	0.0	0.0	Fibers/filter:	<2695.0*
18	0.0	0.0	0.0	0.0	0.0	Fibers/cc:	<0.0006*
19	0.5	0.0	0.0	0.0	0.0	Confidence Interval:	0.0001-0.0011
20	0.0	0.0	0.0	0.0	0.0	Remarks: None	

* Below Analytical Sensitivity of 7.00 fibers/sq. mm
Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

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Location: SSN: - - Sample Time: (min)

Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	0.0	0.0	0.0	0.0	0.0	Date:	03/26/00
2	0.0	0.0	1.0	0.0	0.0	Analyst:	BJW
3	0.0	0.0	0.0	0.0	0.0	Initials:	BJW
4	0.0	0.0	0.0	0.0	0.0	Job:	LS0003405
5	0.0	0.0	0.0	0.0	0.0	Client/Dept/Area:	RJLG
6	0.0	0.0	1.0	0.0	0.0	Sample Number:	7245
7	0.0	0.0	0.0	0.0	0.0	Client Sample No.:	28401
8	0.0	0.0	0.0	0.0	0.0	Sample Cost:	0.00
9	0.0	0.0	0.0	0.0	0.0	Volume (liters):	4320.0
10	0.0	0.0	0.0	0.0	0.0	Blank per 100 flds:	0.00
11	0.5	0.0	0.0	0.0	0.0	Total fibers:	5.5
12	0.0	0.0	0.0	0.5	0.0	Number of fields:	100
13	0.0	0.0	0.0	0.0	0.0		
14	0.0	0.0	0.0	0.0	0.0	Field area:	0.007[illegible]1
15	0.0	0.0	0.0	0.0	0.0	Filter area:	385
16	0.0	0.0	1.0	0.0	0.0	Fibers/sq. mm:	7.00
17	0.0	0.0	0.0	0.0	0.0	Fibers/filter:	2696.1
18	0.0	0.5	0.0	0.0	0.0	Fibers/cc:	0.00[illegible]6
19	0.0	0.0	0.0	0.0	0.0	Confidence Interval:	0.0001-0.0011
20	0.0	0.0	0.0	1.0	0.0	Remarks: None	

Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

RJ Lee Group, Inc.
Headquarters
350 Hochberg Road
Monroeville, PA 15146
Phone (412) 325-1776
Telefax (412) 733-1799

Location: SSN: - - Sample Time: (min)

Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	1.0	1.0	2.5	2.0	0.5	Date:	03/26/00
2	1.0	1.0	0.0	1.0	1.0	Analyst:	BJW
3	0.0	3.0	1.5	1.0	1.0	Initials:	BJW
4	1.5	1.0	0.5	1.0	3.0	Job:	LSC003405
5	2.0	1.5	0.0	1.5	0.0	Client/Dept/Area:	RJLG
6	2.5	0.0	1.5	0.5	3.0	Sample Number:	7[illegible]6
7	1.0	0.0	1.0	0.0		Client Sample No.:	28403
8	1.0	1.0	1.0	0.5		Sample Cost:	0.[illegible]0
9	2.0	2.0	0.0	1.5		Volume (liters):	3960.0
10	2.5	2.5	1.0	1.0		Blank per 100 flds:	0.00
11	2.5	2.0	0.5	2.0		Total fibers:	102.5
12	1.0	1.0	2.5	2.0		Number of fields:	86
13	1.0	1.0	0.5	0.0			
14	0.0	0.5	0.5	0.0		Field area:	0.007854
15	1.5	2.0	1.5	0.5		Filter area:	385
16	3.0	1.0	0.5	1.5		Fibers/sq. mm:	151.75
17	2.0	1.0	1.0	1.0		Fibers/filter:	58424.5
18	1.5	1.0	1.0	1.0		Fibers/cc:	0.0148
19	1.5	1.0	2.0	0.0		Confidence Interval:	0.0093-0.0[illegible]2
20	2.0	1.5	1.5	0.0		Remarks: None	

Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

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Location: SSN: - - Sample Time: (min)

Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	2.0	0.0	0.0	1.0	0.0	Date:	03/26 0
2	0.0	1.5	0.0	0.5	0.0	Analyst:	BJW
3	0.0	0.0	0.0	1.0	0.0	Initials:	BJW
4	1.0	0.0	0.0	0.5	0.0	Job:	LS003405
5	0.0	0.5	1.0	1.0	0.0	Client/Dept/Area:	RJLG
6	0.0	1.0	0.0	0.0	1.0	Sample Number:	7247
7	0.5	1.0	0.5	0.0	0.0	Client Sample No.:	28405
8	0.5	1.5	1.0	0.0	0.5	Sample Cost:	0.00
9	0.5	2.0	2.0	0.0	0.0	Volume (liters):	3960.0
10	1.0	1.0	0.0	0.5	0.0	Blank per 100 flds:	0.00
11	0.0	0.0	0.0	0.0	1.0	Total fibers:	61.5
12	4.0	0.0	0.5	3.0	0.0	Number of fields:	100
13	1.0	3.0	0.0	0.5	2.0		
14	1.0	0.0	1.5	0.0	1.0	Field area:	0.007854
15	0.0	1.5	1.0	0.5	1.0	Filter area:	385
16	0.0	0.5	0.0	0.0	0.0	Fibers/sq. mm:	78.30
17	0.5	0.0	1.0	0.0	1.0	Fibers/filter:	30147.1
18	1.5	0.0	2.0	0.0	1.0	Fibers/cc:	0.0076
19	0.5	0.5	0.0	0.0	0.0	Confidence Interval:	0.0046-0.0[illegible]6
20	1.0	3.0	1.0	0.0	1.0	Remarks: None	

Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

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Location: SSN: - - Sample Time: (min)

Fiber Counting By Phase Contrast Microscopy (PCM)

	A	B	C	D	E		
1	0.0	0.0	1.0	1.0	0.0	Date:	03/26/[illegible]
2	0.0	0.0	0.0	0.0	0.0	Analyst:	BJW
3	0.0	0.0	1.0	0.0	0.0	Initials:	BJW
4	0.0	1.5	1.0	0.0	0.0	Job:	LSC003405
5	0.0	0.5	0.0	0.0	0.5	Client/Dept/Area:	RJLG
6	1.0	0.0	0.5	0.0	1.0	Sample Number:	7248
7	0.0	0.0	1.0	0.0	0.0	Client Sample No.:	28407
8	0.0	0.5	0.0	0.0	0.0	Sample Cost:	0.00
9	0.0	0.5	1.0	0.0	0.0	Volume (liters):	4140.0
10	0.5	0.5	0.0	0.0	0.0	Blank per 100 flds:	0.00
11	0.0	1.0	0.0	1.0	0.0	Total fibers:	2[illegible].0
12	0.0	0.0	0.0	0.0	0.0	Number of fields:	100
13	0.0	0.0	0.0	0.0	0.0		
14	0.0	1.0	0.0	1.0	0.0	Field area:	0.007854
15	0.0	0.5	0.0	0.0	0.0	Filter area:	385
16	0.5	0.0	0.0	0.0	0.0	Fibers/sq. mm:	31.83
17	1.0	1.0	0.0	0.0	0.0	Fibers/filter:	12254.9
18	0.0	0.0	2.0	0.0	0.0	Fibers/cc:	0.0030
19	1.0	0.0	0.0	1.0	0.0	Confidence Interval:	0.0016-0.0[illegible]3
20	0.0	0.0	0.0	0.0	1.0	Remarks: None	

Prepared, counted, and calculated in accordance with the NIOSH 7400 method.

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Headquarters
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Telefax (412) 733-1799

Location: SSN: - - Sample Time: (min)

Appendix B

Transmission Electron Microscopy

NIOSH 7402

Test Report

Asbestos Concentrations and Fiber Ratios
NIOSH 7402 Analysis
Project LSC003405

RJ Lee Group Sample Number	Client Sample Number	Filter Area (sq mm)	Volume ‡ (Liters)	Area Analyzed (sq mm)	Asbestos Fibers (fs) Chr	Asbestos Fibers (fs) Amp	Analytical Sensitivity (f/cc)	Asbestos Concentration (f/cc)	Total Fibers (Fs)	Fiber Ratio (fs/Fs)	Analysis Date
0107240HT	28133	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	2.0	0	3/28/0
0107241HT	28135	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	0.0	0.00	3/28/0
0107242HT	28137	385	4140.00	0.3604	0.0	0.0	0.0003	<0.0003*	2.0	0	3/29/0
0107243HT	28139	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	1.0	0	3/29/0
0107244HT	28141	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	4.0	0	3/29/0
0107245HT	28401	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	7.5	0	3/29/0
0107246HT	28403	385	3960.00	0.3604	0.0	1.0	0.0003	0.0003	42.5	0.02	3/29/0
0107247HT	28405	385	3960.00	0.3604	0.5	0.0	0.0003	0.0001	29.5	0.02	3/29/0
0107248HT	28407	385	4140.00	0.3604	0.0	3.0	0.0003	0.0008	23.0	0.13	3/29/0

‡ Volumes provided by W R Grace for Project Libby, MT - Parker Property were used to calculate analytical results and sensitivities.
†Analytical sensitivity is the calculated concentration based on one structure in the area analyzed.
Chr - Chrysotile, Amp - Amphibole
* Results Less Than Analytical Sensitivity.

Authorized Signature
Kimberly A. Allison, Manager-TEM Analysis
Date Friday, March 31, 2000

Samples received on: Tuesday, March 28, 2000

RJ Lee Group, Inc.
Headquarters

350 Hochberg Road
Monroeville, PA 15146

Phone (724) 325-1776
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RJ Lee Group, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107240HT	**Grid Openings**	40
Client Sample #	28133	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	2
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	4320.0 Liters
Analyst	TWS	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	1	9.50	1.00	Nonasbestos						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	1	11.00	1.00	Nonasbestos						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee Group, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107241HT	**Grid Openings**	40
Client Sample #	28135	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	0
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	4320.0 Liters
Analyst	TWS	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107242HT	**Grid Openings**	40
Client Sample #	28137	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	2
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	4140.0 Liters
Analyst	TWS	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	1	9.00	1.00	Nonasbestos						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	1	6.00	0.70	Nonasbestos						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107243HT	**Grid Openings**	40
Client Sample #	28139	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	1
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	4320.0 Liters
Analyst	TWS	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	1	6.25	1.90	Nonasbestos		X				
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107244HT	**Grid Openings**	40
Client Sample #	28141	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	4
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	4320.0 Liters
Analyst	TWS	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	1	7.50	1.20	Nonasbestos						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	1	15.00	1.75	Nonasbestos						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	1	12.50	1.20	Nonasbestos						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	1	8.50	1.00	Nonasbestos						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee Group, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107245HT	**Grid Openings**	40
Client Sample #	28401	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	7.5
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	4320.0 Liters
Analyst	DHG	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	1	8.70	1.20	Nonasbestos						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	1	7.00	1.25	Nonasbestos						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	1	5.50	0.75	Nonasbestos						
18	1	7.20	1.20	Nonasbestos						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	1	6.50	0.30	Nonasbestos						
29	1	14.50	1.25	Nonasbestos						
30	0			NSD						
31	0.5	22.50	0.80	Nonasbestos						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	1	8.30	1.00	Nonasbestos						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107246HT	**Grid Openings**	40
Client Sample #	28403	**Total Asbestos**	1
Microscope	1200 EX	**Total Non-Asbestos**	41.5
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	3960.0 Liters
Analyst	DHG/RBG	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0.5	8.50	0.40	Nonasbestos						
2	1	9.50		Nonasbestos						
2	0.5	17.00	1.00	Nonasbestos						
3	1	20.00	2.00	Nonasbestos						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	1	8.50	1.30	Nonasbestos						
7	1	8.00	1.60	Nonasbestos						
7	1	26.20	1.25	Nonasbestos						
8	1	7.00	0.70	Nonasbestos		42		38482		
8	0.5	35.00	1.00	Nonasbestos						
9	0			NSD						
10	1	13.00	0.30	Nonasbestos						
10	1	15.00	1.00	Nonasbestos						
10	1	32.00	1.25	Nonasbestos						
11	0.5	23.50	1.00	Nonasbestos						
12	0.5	13.50	0.70	Nonasbestos						
13	0			NSD						
14	1	14.50	1.25	Nonasbestos						
15	0.5	22.50	1.50	Nonasbestos						
16	1	7.00	1.20	Nonasbestos						
17	0.5	11.00	0.90	Nonasbestos						
18	1	15.00	0.80	Nonasbestos						
19	1	12.00	1.10	Nonasbestos						
20	1	27.50	1.30	Nonasbestos						
21	0.5	10.50	1.50	Nonasbestos						
22	1	10.50	1.20	Nonasbestos		X		X		
23	1	13.00	1.60	Nonasbestos						
23	1	10.50	0.60	Amphibole		43		38486		
23	1	16.00	0.50	Nonasbestos						
23	1	22.50	1.00	Nonasbestos						
23	1	23.00	0.50	Nonasbestos	M	X		X		
24	1	10.00	1.00	Nonasbestos						
24	1	8.50	0.50	Nonasbestos						
25	0			NSD						
26	1	30.00	0.50	Nonasbestos						
27	0			NSD						
28	1	30.00	3.50	Nonasbestos						
29	0.5	13.00	0.50	Nonasbestos						
30	1	16.00	0.60	Nonasbestos						
31	0			NSD						
32	0			NSD						
33	0			NSD						

NSD - No Structures Detected

RJ Lee Group, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107246HT	**Grid Openings**	40
Client Sample #	28403	**Total Asbestos**	1
Microscope	1200 EX	**Total Non-Asbestos**	41.5
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	3960.0 Liters
Analyst	DHG/RBG	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
34	1	37.50	0.80	Nonasbestos						
35	1	6.50	0.50	Nonasbestos						
35	1	35.50	0.30	Nonasbestos						
35	1	12.50	0.80	Nonasbestos						
36	1	27.00	1.20	Nonasbestos						
36	1	18.50	1.00	Nonasbestos						
36	1	23.50	0.70	Nonasbestos						
37	1	18.50	1.60	Nonasbestos		44		38488		
38	1	17.50	1.00	Nonasbestos						
38	1	9.00	0.35	Nonasbestos		45		38489		
39	1	16.00	1.50	Nonasbestos						
39	1	17.50	3.50	Nonasbestos						
40	1	8.00	2.00	Nonasbestos		X				

RJ Lee Group, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107247HT	**Grid Openings**	40
Client Sample #	28405	**Total Asbestos**	0.5
Microscope	1200 EX	**Total Non-Asbestos**	29
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	3960.0 Liters
Analyst	RBG	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	1	8.50	0.80	Nonasbestos						
2	1	7.50	1.00	Nonasbestos						
3	1	17.50	4.00	Nonasbestos						
3	0.5	20.00	0.50	Nonasbestos						
4	0			NSD						
5	0.5	15.00	0.75	Nonasbestos						
5	1	11.00	1.50	Nonasbestos						
5	1	12.50	2.50	Nonasbestos						
6	0			NSD						
7	1	10.00	0.50	Nonasbestos						
8	0			NSD						
9	1	5.50	1.00	Nonasbestos		X				
10	0.5	8.50	0.40	Nonasbestos						
10	1	9.00	1.00	Nonasbestos						
11	1	22.50	0.80	Nonasbestos		46		38491		
12	1	12.50	0.35	Nonasbestos						
13	0			NSD						
14	1	10.00	1.00	Nonasbestos						
15	0			NSD						
16	0.5	20.00	0.50	Nonasbestos						
17	0			NSD						
18	1	13.00	0.65	Nonasbestos	M	X		X		
19	0.5	35.00	2.50	Nonasbestos						
20	0			NSD						
21	0			NSD						
22	1	7.50	1.25	Nonasbestos						
22	1	22.50	2.00	Nonasbestos						
23	0			NSD						
24	0.5	9.80	0.40	Nonasbestos		X		X		--
24	1	8.50	0.40	Nonasbestos		X		X		
24	1	17.50	2.00	Nonasbestos						
25	1	11.00	0.80	Nonasbestos						
26	1	25.00	0.75	Nonasbestos						
26	0.5	8.00	0.65	Nonasbestos						
27	1	11.50	1.00	Nonasbestos						
27	1	17.50	2.00	Nonasbestos		X				
28	0			NSD						
29	1	9.00	2.00	Nonasbestos		X				
30	0			NSD						
31	0			NSD						
32	1	7.00	0.70	Nonasbestos						
33	0.5	22.50	0.30	Chrysotile				38492		
33	0.5	17.50	0.50	Nonasbestos						

NSD - No Structures Detected

RJ Lee *Group* , Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107247HT	**Grid Openings**	40
Client Sample #	28405	**Total Asbestos**	0.5
Microscope	1200 EX	**Total Non-Asbestos**	29
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	3960.0 Liters
Analyst	RBG	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
34	0			NSD						
35	0.5	10.00	1.20	Nonasbestos						
35	1	7.50	1.30	Nonasbestos						
36	1	17.50	0.60	Nonasbestos						
37	0			NSD						
38	0.5	10.00	1.50	Nonasbestos						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee Group, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107248HT	**Grid Openings**	40
Client Sample #	28407	**Total Asbestos**	3
Microscope	1200 EX	**Total Non-Asbestos**	20
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	4140.0 Liters
Analyst	TWS	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0.5	29.00	3.50	Nonasbestos						
4	0			NSD						
5	1	53.00	5.00	Nonasbestos						
6	0			NSD						
7	1	7.00	0.50	Amphibole		47		38493		
7	0.5	9.50	0.80	Nonasbestos						
7	1	6.25	1.50	Nonasbestos						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	1	19.00	1.80	Nonasbestos		X				
12	0			NSD						
13	0			NSD						
14	1	6.00	0.40	Nonasbestos						
14	1	8.00	0.50	Nonasbestos						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	1	14.00	2.50	Nonasbestos						
19	0			NSD						
20	1	8.50	0.80	Nonasbestos						
21	1	10.00	2.00	Nonasbestos						
22	1	5.10	1.20	Nonasbestos						
23	1	7.50	2.00	Nonasbestos						
24	0			NSD						
25	0			NSD						
26	1	9.50	0.50	Amphibole		X		X		
27	1	20.00	2.50	Nonasbestos						
28	1	5.25	0.60	Nonasbestos						
28	1	6.25	0.30	Amphibole		X		X		
29	1	8.00	1.00	Nonasbestos						
29	1	6.50	0.40	Nonasbestos						
30	0			NSD						
31	1	9.50	1.00	Nonasbestos						
32	0			NSD						
33	0.5	7.00	0.60	Nonasbestos						
34	1	10.50	1.00	Nonasbestos						
35	0			NSD						
36	1	6.00	0.50	Nonasbestos						
37	0			NSD						
38	0.5	41.00	2.00	Nonasbestos						
39	1	12.00	0.50	Nonasbestos						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405	**RJL QA Number**	HQ17809
RJL Sample #	0107248HT	**Grid Openings**	40
Client Sample #	28407	**Total Asbestos**	3
Microscope	1200 EX	**Total Non-Asbestos**	20
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	1000 X	**Volume**	4140.0 Liters
Analyst	TWS	**Grid Opening Area**	0.009 mm^2
EDS Disk	1753	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
40	0			NSD						

NSD - No Structures Detected

Appendix C

Transmission Electron Microscopy

ISO 10312

Test Report

Asbestos Concentrations and Fiber Ratios
Berman and Crump Risk Fiber Analysis
Project LSC003405-1

RJ Lee Group Sample Number	Client Sample Number	Filter Area (sq mm)	Volume ‡ (Liters)	Area Analyzed (sq mm)	Asbestos Fibers (fs) Chr	Asbestos Fibers (fs) Amp	Analytical Sensitivity (f/cc)	Asbestos Concentration (f/cc)	Total Fibers (Fs)	Fiber Ratio (fs/Fs)	Analysis Date
0107240HT-1	28133	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	0.0	0.00	5/17/0
0107241HT-1	28135	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	0.0	0.00	5/17/0
0107242HT-1	28137	385	4140.00	0.3604	0.0	0.0	0.0003	<0.0003*	0.0	0.00	5/17/0
0107243HT-1	28139	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	0.0	0.00	5/17/0
0107244HT-1	28141	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	0.0	0.00	5/17/0
0107245HT-1	28401	385	4320.00	0.3604	0.0	0.0	0.0002	<0.0002*	0.0	0.00	5/17/0
0107246HT-1	28403	385	3960.00	0.3604	1.0	3.0	0.0003	0.0011	7.0	0.57	5/16/0
0107247HT-1	28405	385	3960.00	0.3604	0.0	0.0	0.0003	<0.0003*	1.0	0	5/16/0
0107248HT-1	28407	385	4140.00	0.3604	0.0	2.0	0.0003	0.0005	3.0	0.67	5/16/0

‡ Volumes provided by W R Grace for Project Libby, MT - Parker Property were used to calculate analytical results and sensitivities.
†Analytical sensitivity is the calculated concentration based on one structure in the area analyzed.
Chr - Chrysotile, Amp - Amphibole
* Results Less Than Analytical Sensitivity.

Authorized Signature Kimberly A. Allison
Kimberly A. Allison, Manager-TEM Analysis
Date Wednesday, September 13, 2000

Samples received on: Tuesday, May 16, 2000

RJ Lee Group, Inc.
Headquarters

350 Hochberg Road
Monroeville, PA 15146

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Fax (724) 733-1799

RJ Lee *Group*, Inc
Count Sheet

Client Name	**W R Grace**		
Project Number	**LSC003405-1**	**RJL QA Number**	HQ17809
RJL Sample #	**0107240HT-1**	**Grid Openings**	40
Client Sample #	28133	**Total Asbestos**	0
Microscope	2000 FX	**Total Non-Asbestos**	0
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	4320.0 Liters
Analyst	JPM	**Grid Opening Area**	0.009 mm^2
EDS Disk	1754	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405-1	**RJL QA Number**	HQ17809
RJL Sample #	0107241HT-1	**Grid Openings**	40
Client Sample #	28135	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	0
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	4320.0 Liters
Analyst	BF	**Grid Opening Area**	0.009 mm^2
EDS Disk	Gresham	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405-1	**RJL QA Number**	HQ17809
RJL Sample #	0107242HT-1	**Grid Openings**	40
Client Sample #	28137	**Total Asbestos**	0
Microscope	2000 FX	**Total Non-Asbestos**	0
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	4140.0 Liters
Analyst	JPM	**Grid Opening Area**	0.009 mm^2
EDS Disk	1754	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	**LSC003405-1**	**RJL QA Number**	HQ17809
RJL Sample #	**0107243HT-1**	**Grid Openings**	40
Client Sample #	28139	**Total Asbestos**	0
Microscope	2000 FX	**Total Non-Asbestos**	0
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	4320.0 Liters
Analyst	KA	**Grid Opening Area**	0.009 mm^2
EDS Disk	1754	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	**LSC003405-1**	**RJL QA Number**	HQ17809
RJL Sample #	**0107244HT-1**	**Grid Openings**	40
Client Sample #	28141	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	0
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	4320.0 Liters
Analyst	BF	**Grid Opening Area**	0.009 mm^2
EDS Disk	Gresham	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405-1	**RJL QA Number**	HQ17809
RJL Sample #	0107245HT-1	**Grid Openings**	40
Client Sample #	28401	**Total Asbestos**	0
Microscope	1200 EX	**Total Non-Asbestos**	0
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	4320.0 Liters
Analyst	BF	**Grid Opening Area**	0.009 mm^2
EDS Disk	Gresham	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405-1	**RJL QA Number**	HQ17809
RJL Sample #	0107246HT-1	**Grid Openings**	40
Client Sample #	28403	**Total Asbestos**	4
Microscope	2000 FX	**Total Non-Asbestos**	3
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	3960.0 Liters
Analyst	KA	**Grid Opening Area**	0.009 mm^2
EDS Disk	1754	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	1	12.00	0.30	Amphibole		120		29030		
5	1	10.00	0.25	Amphibole		X		X		
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	1	7.50	0.50	Nonasbestos		X		X		
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	1	9.00	0.30	Nonasbestos		X		X		
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	1	7.00	0.30	Amphibole		X		X		
24	1	5.90	0.10	Chrysotile		X		29032		
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	1	7.50	0.50	Nonasbestos		X		X		
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group*, Inc
Count Sheet

Client Name	W R Grace		
Project Number	**LSC003405-1**	**RJL QA Number**	HQ17809
RJL Sample #	**0107247HT-1**	**Grid Openings**	40
Client Sample #	28405	**Total Asbestos**	0
Microscope	2000 FX	**Total Non-Asbestos**	1
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	3960.0 Liters
Analyst	KA	**Grid Opening Area**	0.009 mm^2
EDS Disk	1754	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	0			NSD						
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	0			NSD						
16	0			NSD						
17	0			NSD						
18	0			NSD						
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	1	10.10	0.50	Nonasbestos		X		X		
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected

RJ Lee *Group* , Inc
Count Sheet

Client Name	W R Grace		
Project Number	LSC003405-1	**RJL QA Number**	HQ17809
RJL Sample #	0107248HT-1	**Grid Openings**	40
Client Sample #	28407	**Total Asbestos**	2
Microscope	2000 FX	**Total Non-Asbestos**	1
Accelerating Volt	120 Kv	**Filter**	CE 385 mm^2
Magnification	10000 X	**Volume**	4140.0 Liters
Analyst	KA	**Grid Opening Area**	0.009 mm^2
EDS Disk	1754	**Dilution Factor**	1

Field	Fiber	Length µm	Width µm	Structure Type	Morph	EDS	Photo	SAED	Amphibole Type	Comment
1	0			NSD						
2	0			NSD						
3	0			NSD						
4	0			NSD						
5	0			NSD						
6	0			NSD						
7	0			NSD						
8	0			NSD						
9	0			NSD						
10	1	15.00	0.40	Amphibole		121		29033		
11	0			NSD						
12	0			NSD						
13	0			NSD						
14	0			NSD						
15	1	10.00	0.50	Nonasbestos		X		X		
16	0			NSD						
17	0			NSD						
18	1	6.50	0.50	Amphibole		X		X		
19	0			NSD						
20	0			NSD						
21	0			NSD						
22	0			NSD						
23	0			NSD						
24	0			NSD						
25	0			NSD						
26	0			NSD						
27	0			NSD						
28	0			NSD						
29	0			NSD						
30	0			NSD						
31	0			NSD						
32	0			NSD						
33	0			NSD						
34	0			NSD						
35	0			NSD						
36	0			NSD						
37	0			NSD						
38	0			NSD						
39	0			NSD						
40	0			NSD						

NSD - No Structures Detected