HYGEIA INC.

March 9, 1989

Richard B. Kirby, Esquire
Richard B. Kirby, P.C.
20 Ashburton Place
Boston, MA 02108

Subject: A. W. Chesterton Company; Testing of Packing and Gasket Materials
HYGEIA INC. Project No. 5617
Ref: CMS5617/RICHARD

Dear Mr. Kirby:

As you had requested last week, I have prepared this preliminary report of our field sampling and analysis for airborne asbestos fiber during the removal of a valve at the A. W. Chesterton Company facility in Woburn, Massachusetts. I have outlined below the methods of air sampling and the results of filter analyses by both phase contrast and analytical transmission electron microscopy. Bulk analyses of the gasket and packing products are also reported.

The methods of air sampling will be illustrated with 35 mm slides at the conference scheduled for next week. Both area and personal samples were collected using high volume pumps having volumetric flow rates in the range of 9.50 to 9.75 liters per minute.

The tests were conducted on a damaged valve fitted to a Cyclotherm steam generator. The item tested was a Walworth gate (main stop) valve fitted to a 6-inch pipe flange. The valve packing Chesterton Style 1722 (size 3/8 inches) and the gasket is also an A. W. Chesterton product. The boiler was taken out of service in July, 1985 and the packing and gasket material had dried and hardened in place. As a consequence, the packing and gasket material had to be removed using a cold chisel and hammer.

Bulk analyses were performed on one sample each of the packing and gasket materials with the following result.

Packing Material, HB27878, (P-11).
Asbestos (Chrysotile) 50%; Opaque Phases 45%; Vermiculite, 5%; Gypsum/Anhydrite Trace.

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Gasket Material, HB2786B, (G-10).
Asbestos (Chrysotile) 45%; Cellulose Fiber 35%; Opaque Phases 20%.

The bulk samples were analyzed by polarized light microscopy (EPA Interim Method: Appendix A to Subpart F-40 CFR Part 763) at magnifications ranging from 10x to 400x. The estimated phase abundances are provided in weight percent and are accurate to within 10 to 15 percent of the amount reported. This method is sensitive to the detection of asbestos to less than one percent by weight.

Four filters were analyzed using phase contrast microscopy according to the NIOSH 7400 method. This is the procedure followed by OSHA for workplace compliance with the Permissible Exposure Limit standards. The results are as follows. A background sample taken before any activity took place gave a fiber count of less than 0.01 fiber per cubic centimeter (f/cc). During gasket removal the fiber count was 0.01 f/cc. During packing removal the fiber count was less than 0.01 f/cc. Finally, a personal sample collected during the whole operation gave a fiber count of 0.01 f/cc. Note that 0.01 f/cc is the limit of detection by this method. Accordingly, a value reported to be less than 0.01 f/cc means that no fibers were detected. This operation included pulling the gate valve away from the flange, and the removal of both packing and gasket materials using a cold chisel. During this "aggressive" removal, some dust was released into the air. The total elapsed time for this operation was about 20 minutes.

Four air samples were collected for analysis by analytical transmission electron microscopy (ATEM), with the following result. A background sample drawn over a period of 50 minutes gave an asbestos structure count of less than 0.005 structures per cc. That is, no asbestos fiber was found at the limit of detection.

During packing removal, an asbestos count of 0.03 structures per cc was found. During gasket removal, the asbestos count was 0.005 structures per cc. These samples represent airborne fiber concentrations in the area adjacent to the operation. A personal sample collected in the breathing zone of the operator gave a result of 0.015 structures per cc for the duration of the operation.

By way of explanation, we provide the following comments. The term "structures per cubic centimeter" includes individual fibers, fiber bundles, clusters and matrices. Referring to the photographs, we see that the majority of asbestos-containing artifacts found were matrices. Very few single unattached asbestos fibers were found on any of the filters. We were unable to obtain selected area electron diffraction (SAED) patterns on the fibers because they were coated with resin, a finding that may have medical consequences. Fiber identification was made on the basis of morphology and chemistry.

The short duration of the dismantling operation made it necessary to collect the personal samples at a higher volumetric flow rate than is normally used. Also, a far greater number of TEM grids had to be examined in order to attain the detection limit of 0.005 structures per cc. The computer printout attached provides individual measurements of the asbestos fiber matrices. The photographs, we believe, are a good representation of the structures observed (keeping in mind that there were very few of them).

These filter samples were analyzed following the U. S. EPA AHERA protocol which includes only those asbestos fibers having an aspect ratio of 5 or greater and, in addition, a minimum length of 0.5 micrometers.

At this point, I would suggest that the reviewers of this work examine the individual asbestos fiber dimension data given in the computer printout.

Yours sincerely,

HYGEIA INC.

Charles M. Spooner, Ph.D.
Certified Industrial Hygienist
Principal Consultant

CMS/lcr

Enc.

HYGEIA INC.

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Asbestos Analysis by
Transmission Electron Microscopy

Client Name: Richard Kirby
Client Sample I.D.: 01
Sample Location: Boiler Room Background

HYGEIA Project #5617
HYGEIA Batch 88 Nov 01
HYGEIA ID HT88-3279

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DATA SUMMARY

Sample Volume (liters): 480.0
Sample Collected by: C. Spooner
Filter Type: Millipore
TEM Analyst: W. Cranton
Number of Structures: 1
Grid Openings: 22

Date of Collection: 11/23/88
Filter Diameter: 25 mm.
Date of Analysis: 03/03/89
Grid Opening Area (mm^2): 0.007189
Total Grid Area Analyzed (mm^2): 0.158158

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SUMMARY OF ANALYSIS

Total Structure Count (s/cc)	0.005
Total Structure Count (s/mm^2)	6.323
Asbestos Structure Count (s/cc)*	ND
Asbestos Structure Count (s/mm^2)*	ND
Asbestos Structure Mass (ng/m^3)*	ND
Asbestos Structure Concentration (s/cc)* for all structures greater than 5 microns in length with an aspect ratio of 3:1 or greater.	ND
Analytical Sensitivity (s/cc)	0.005

*Includes Ambiguous Structures
Ref: TEM/Form1

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Asbestos Analysis by
Transmission Electron Microscopy

Client Name: Richard Kirby
Client Sample I.D.: 01
Sample Location: Boiler Room Background

HYGEIA Project #5617
HYGEIA Batch 88 Nov 01
HYGEIA ID HT88-3279

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STRUCTURE LISTING

	----- Microns -----					Mass	Aspect		EDAX				
No	Length	Width	Thkness	Ident	Form	(Picogm)	Ratio	SAED	MG	SI	CA	FE	NA
--	------	-----	-------	-----	------	-------	-----	----	--	--	--	--	--

Grid #1: No Structures Encountered

Grid #2: No Structures Encountered

Grid #3: No Structures Encountered

Grid #4: No Structures Encountered

Grid #5:

1	1.653	0.127	0.000	Cellu. Fiber		2.10E-2	13						

Grid #6 through Grid #22: No Structures Encountered

HYGEIA INC.

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Asbestos Analysis by Transmission Electron Microscopy

Client Name: Richard Kirby
Client Sample I.D.: 03
Sample Location: Gasket Removal

HYGEIA Project #5617
HYGEIA Batch 88 Nov 01
HYGEIA ID HT88-3280

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DATA SUMMARY

Sample Volume (liters): 80.8
Sample Collected by: C. Spooner
Filter Type: Millipore
TEM Analyst: M. O'Halloran
Number of Structures: 17
Grid Openings: 135

Date of Collection: 11/23/88
Filter Diameter: 25 mm.
Date of Analysis: 03/01/89
Grid Opening Area (mm^2): 0.007189
Total Grid Analyzed (mm^2): 0.970515

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SUMMARY OF ANALYSIS

Total Structure Count (s/cc)	0.063
Total Structure Count (s/mm^2)	17.517
Asbestos Structure Count (s/cc)*	0.005
Asbestos Structure Count (s/mm^2)*	1.03[illegible]
Asbestos Structure Mass (ng/m^3)*	0.41[illegible]
Asbestos Structure Concentration (s/cc)*. for all structures greater than 5 microns in length with an aspect ratio of 5.1 or greater.	ND
Analytical Sensitivity (s/cc)	0.005

*Includes Ambiguous Structures
Ref: TEM/Form1

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Asbestos Analysis by
Transmission Electron Microscopy

Client Name: Richard Kirby
Client Sample I.D.: 03
Sample Location: Gasket Removal

HYGEIA Project #5617
HYGEIA Batch 88 Nov 01
HYGEIA ID HT88-3280

STRUCTURE LISTING

No	Microns Length	Width	Thkness	Ident	Form	Mass (Picogm)	Aspect Ratio	SAED	EDAX MG SI CA FE NA
Grid #1			No Structures Encountered						
Grid #2:			No Structures Encountered						
Grid #3:									
1	2.263	0.151	0.000	Cellu	Fiber	4.04E-2	15	None	Non Asbestos
Grid #4 through Grid #14:			No Structures Encountered						
Grid #15:									
1	2.369	0.118	0.000	Cellu	Fiber	2.61E-2	20	None	Non Asbestos
Grid #16:			No Structures Encountered						
Grid #17:									
1	0.868	0.059	0.000	NonAst	Fiber	4.92E-3	15	None	Non Asbestos
Grid #18 through Grid #22:			No Structures Encountered						
Grid #23:									
1	2.663	0.059	0.000	Cellu	Fiber	7.34E-3	45	None	Non Asbestos
Grid #24:			No Structures Encountered						
Grid #25:									
1	3.258	0.237	0.000	NonAst	Fiber	2.89E-1	14		Non Asbestos
Grid #26 through Grid #28:			No Structures Encountered						

No	Microns Length	Microns Width	Microns Thkness	Ident	Form	Mass (Picogm)	Aspect Ratio	SAED	EDAX MG SI CA FE NA
Grid #29:									
6	1.481	0.059	0.000	Unknown	Fiber	8.20E-3	25	None	Non Asbestos
Grid #30:									
7	1.895	0.059	0.000	NonAsb	Fiber	1.05E-2	32	None	Non Asbestos
8	2.665	0.237	0.000	Cellu	Fiber	1.17E-1	11		
Grid #31:									
9	5.330	0.592	0.000	Cellu	Fiber	1.47E00	9		
Grid #32:			No Structures Encountered						
Grid #33:									
10	5.390	0.118	0.000	Cellu	Fiber	5.94E-2	46		
Grid #34 through Grid #38:			No Structures Encountered						
Grid #39:									
11	3.850	0.178	0.000	NonAsb	Fiber	1.92E-1	22		Non Asbestos
Grid #40:			No Structures Encountered						
Grid #41:									
12	1.777	0.118	0.000	NonAsb	Fiber	3.94E-2	15		Non Asbestos
Grid #42 through Grid #67:			No Structures Encountered						
Grid #68:									
13	1.836	0.118	0.000	NonAsb	Fiber	4.07E-2	15		Non Asbestos
Grid #69 through Grid #74:			No Structures Encountered						
Grid #75:									
14	3.317	0.118	0.000	NonAsb	Fiber	7.35E-2	28		Non Asbestos
Grid #76 through Grid #100:			No Structures Encountered						
Grid #101:									
	3.672	0.592	0.000	NonAsb	w/Fibr	2.03E00	6		

No	Microns Length	Width	Thkness	Ident	Form	Mass (Picogm)	Aspect Ratio	SAED	EDAX MG	SI	CA	FE	NA
Grid #102:													
16	4.738	0.118	0.059	Chryso	Bundle	8.44E-2	40	Faint	5	10	0	1	:
Grid #103:				No Structures Encountered									
Grid #104:				No Structures Encountered									
Grid #105:													
17	3.554	0.592	0.000	NonAsb	Fiber	1.97E00	6		Non Asbestos				
Grid #106 through Grid #135:				No Structures Encountered									

Ref: TEM/Form2

HYGEIA INC.

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Asbestos Analysis by
Transmission Electron Microscopy

Client Name: Richard Kirby
Client Sample I.D.: 05
Sample Location: Packing Removal

HYGEIA Project #5617
HYGEIA Batch 88 Nov 01
HYGEIA ID HT88-3281

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DATA SUMMARY

Sample Volume (liters): 108.1
Sample Collected by: C. Spooner
Filter Type: Millipore
TEM Analyst: W. Cranton
Number of Structures: 19
Grid Openings: 99

Date of Collection: 11/23/88
Filter Diameter: 25 mm.
Date of Analysis: 03/02/89
Grid Opening Area (mm^2): 0.007189
Total Grid Area Analyzed (mm^2): 0.711711

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SUMMARY OF ANALYSIS

Total Structure Count (s/cc)	0.095
Total Structure Count (s/mm^2)	26.696
Asbestos Structure Count (s/cc)*	0.050
Asbestos Structure Count (s/mm^2)*	14.051
Asbestos Structure Mass (ng/m^3)*	25.042
Asbestos Structure Concentration (s/cc)*. for all structures greater than 5 microns in length with an aspect ratio of 5:1 or greater.	0.005
Analytical Sensitivity (s/cc)	0.005

*Includes Ambiguous Structures
Ref: TEM/Form1

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Asbestos Analysis by
Transmission Electron Microscopy

Client Name: Richard Kirby
Client Sample I.D.: 05
Sample Location: Packing Removal

HYGEIA Project #5617
HYGEIA Batch 88 Nov 01
HYGEIA ID HT88-3261

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STRUCTURE LISTING

No	Microns Length	Width	Thkness	Ident	Form	Mass (Picogm)	Aspect Ratio	SAED	EDAX MG	SI	CA	FE	NA
Grid #1 through Grid #6:	No Structures Encountered												
Grid #7:													
1	6.358	0.636	0.064	Ambigu	Clump	5.17E-1	10	None	8	10	0	12	0
Grid #8 through Grid #16:	No Structures Encountered												
Grid #17:													
3	1.006	0.084	0.000	NonAsb	Fiber	1.12E-2	12	None	Non Asbestos				
Grid #18:	No Structures Encountered												
Grid #19:													
4	9.921	5.669	0.142	Unknwn	Matrix	1.60E01	2	None	Non Asbestos				
Grid #20 through Grid #23:	No Structures Encountered												
Grid #24:													
5	3.185	0.913	0.084	Ambigu	Matrix	4.50E-1	4	None					
Grid #25:	No Structures Encountered												
Grid #26:													
6	1.844	0.084	0.000	NonAsb	Fiber	2.04E-2	22	None	Non Asbestos				
Grid #27 through Grid #38:	No Structures Encountered												
Grid #39:													
	3.436	0.168	0.000	Cellu.	Fiber	7.58E-2	21	None	Non Asbestos				

No	Length	Width	Thkness	Ident	Form	Mass (Picogm)	Aspect Ratio	SAED	EDAX MG	SI	CA	FE	NA
Grid #40:													
8	2.643	0.110	0.000	Chryso	Fiber	6.40E-2	24	None	6	10	0	2	3
Grid #41 through Grid #44:			No Structures Encountered										
Grid #45:													
9	4.405	3.304	0.055	Ambigu	Matrix	1.61E00	1	None					
Grid #46:			No Structures Encountered										
Grid #47:													
10	9.637	0.441	0.000	Cellu	Fiber	1.47E00	22	None	Non Asbestos				
Grid #48:													
11	0.716	0.110	0.000	NonAsb	Fiber	1.37E-2	7	None	Non Asbestos				
12	1.542	0.385	0.000	Ambigu	Fiber	3.62E-1	4	Ambig	2	10	3	3	3
Grid #49 through Grid #51:			No Structures Encountered										
Grid #52:													
13	3.194	0.826	0.055	Chryso	Bundle	3.69E-1	4	None	6	10	0	0	3
Grid #53:													
14	1.211	0.055	0.000	Chryso	Fiber	7.33E-3	22	Faint	6	10	0	0	3
15	1.046	0.110	0.055	Chryso	Bundle	1.61E-2	10	Faint	8	10	1	2	3
16	1.156	0.055	0.000	Unknwn	Fiber	5.54E-3	21	None					
Grid #54 through Grid #66:			No Structures Encountered										
Grid #67:													
17	2.037	0.068	0.000	Chryso	Matrix	1.87E-2	30	None	7	10	0	0	0
Grid #68 through Grid #71:			No Structures Encountered										
Grid #72:													
18	6.790	1.358	0.068	Chryso	Matrix	1.59E00	5	Faint	6	10	0	1	0
Grid #73 through Grid #82:			No Structures Encountered										

No	Microns Length	Width	Thkness	Ident	Form	Mass (Picogm)	Aspect Ratio	SAED	EDAX MG	SI	CA	FE	NA
Grid #83:													
19	2.444	0.136	0.000	Unknwn	Fiber	7.12E-2	18	None	Non Asbestos				
Grid #84:			No Structures Encountered										
Grid #85:													
20	5.432	2.716	0.068	Unknwn	Fiber	2.01E00	2	None	9	10	0	1	1
Grid #86 through Grid #99:			No Structures Encountered										

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Asbestos Analysis by
Transmission Electron Microscopy

Client Name: Richard Kirby
Client Sample I.D.: 07
Sample Location: Breathing Zone during hole operations

HYGEIA Project #5617
HYGEIA Batch 88 Nov 01
HYGEIA ID HT88-3282

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DATA SUMMARY

Sample Volume (liters): 190.2
Sample Collected by: C. Spooner
Filter Type: Millipore
TEM Analyst: W. Cranton
Number of Structures: 11
Grid Openings: 56

Date of Collection: 11/23/88
Filter Diameter: 25 mm.
Date of Analysis: 03/01/89
Grid Opening Area (mm^2): 0.007189
Total Grid Area Analyzed (mm^2): 0.402584

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SUMMARY OF ANALYSIS

Total Structure Count (s/cc)	0.055
Total Structure Count (s/mm^2)	27.334
Asbestos Structure Count (s/cc)*	0.035
Asbestos Structure Count (s/mm^2)*	17.388
Asbestos Structure Mass (ng/m^3)*	174.427
Asbestos Structure Concentration (s/cc)*.	0.025

or all structures greater than 5 microns in length with an spect ratio of 5.1 or greater.

Analytical Sensitivity (s/cc) 0.005

cludes Ambiguous Structures
: TEM/Forml

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Asbestos Analysis by Transmission Electron Microscopy

Client Name: Richard Kirby
Client Sample I.D.: 07
Sample Location: Breathing Zone during hole operations

HYGEIA Project #5617
HYGEIA Batch 88 Nov 01
HYGEIA ID HT88-3282

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STRUCTURE LISTING

No	Microns Length	Width	Thkness	Ident	Form	Mass (Picogm)	Aspect Ratio	SAED	EDAX MG	SI	CA	FE	NA
Grid #1:	No Structures Encountered												
Grid #2:	No Structures Encountered												
Grid #3:													
1	1.584	0.151	0.000	Cellu	Fiber	2.83E-2	11	None					
Grid #4:	No Structures Encountered												
Grid #5:	No Structures Encountered												
Grid #6:	No Structures Encountered												
Grid #7:													
2	3.017	0.377	0.075	Chryso	Bundle	2.16E-1	8	Faint	7	10	1	1	C
Grid #8:													
3	9.805	2.263	0.075	Chryso	Clump	4.25E00	4	Faint	8	10	1	3	C
Grid #9:													
4	8.296	0.151	0.000	Cellu	Fiber	1.48E-1	55	None					
Grid #10													
55	5.279	0.226	0.000	Cellu	Fiber	2.12E-1	23	None					
Grid #11	No Structures Encountered												
Grid #12:	No Structures Encountered												
Grid #13:													
6	5.759	5.759	0.096	Chryso	Matrix	8.09E00	1	None	5	10	0	2	
Grid #14 through Grid #19:	No Structures Encountered												

No	Microns Length	Width	Thkness	Ident	Form	Mass (Picogm)	Aspect Ratio	SAED	EDAX MG	SI	CA	FE	NA
Grid #20													
7	10.558	1.440	0.000	NonAsb	Fiber	3.45E01	7	None	Non Asbestos				
Grid #21 through Grid #39:			No Structures Encountered										
Grid #40:													
8	9.642	6.026	0.121	Chryso	Matrix	1.78E01	2	None	6	10	0	2	0
Grid #41 through Grid #43:			No Structures Encountered										
Grid #44:													
9	48.758	0.480	0.048	Chryso	Bundle	2.85E00	102	Faint	8	10	0	1	0
10	9.118	0.960	0.048	Chryso	Bundle	1.07E00	10	None	8	10	0	1	0
11	4.799	0.768	0.048	Ambigu	Matrix	3.55E-1	6	None					
Grid #45 through Grid #56:			No Structures Encountered										