PLAINTIFF'S
EXHIBIT
BIR-6

REPORT

of

ASBESTOS TESTING OF BIRD INC. ROOFING PRODUCTS

CONDUCTED FOR A PENDING COURT CASE

REPORT #430

Typed by:
TRW

W. B. R. ENGINEERING Inc.
Environmental & Management Consultants

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Distribution:
Mr. Stephen Siegris
Att'y.
(4 copies)

Report Issued: February 28, 1992

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Asbestos Resume
Test Report 22,437
Asbestos Testimony in Washington, D.C.

I

INTRODUCTION

Mr. Stephen Siegrist, Attorney for Moss, Powers & Kugler, Seven East Main Street, Moorestown, NJ 08057 (609) 235-4700, requested W.B.R. ENGINEERING INC.* to prepare a report on the series of asbestos tests conducted by ROSSNAGEL & ASSOCIATES in 1986 on Bird, Inc. Asphalt Base Sheet.

The purpose of those tests was to examine the products and determine the extent of ACM (Asbestos Containing Materials) normally on the surface and which would become airborne if the material were abraded (such as in cutting, sawing or demolishing of a built-up roof made with these products). It should be noted that the normal "built-up" 2, 3 or 4 ply asphalt roof would, by design and installation, normally encapsulate (saturate) all the asbestos fibers in both the asphalt base sheet (also called tar paper, asphalt paper, etc.) and the hot mopped-on sealers used to secure the asphalt base sheets to the roof and to each of the other base sheets. When the asbestos fibers are encapsulated there is no health hazard. Asbestos is only a problem when its fibers become airborne.

Figure I on Page 5 shows a typical 4 ply "built up" roof of the typical materials.

When this type of roof is demolished, damaged or "ripped off" in a storm, routinely repaired or is modified by drilling, saw cutting, etc., the surface sealing of the asbestos materials can be disturbed. To simulate a surface disturbance, the samples were abraded with a scalpel type razor knife. This was done by scraping the knife at right angles to the flat surface. In this way a small surface area of the material was removed so that the SEM and PLM microscope analyses could determine the extent of the exposed fibers (if any). It should be noted in this analysis that the term "fiber" and "asbestos fiber" are extremely important. "Fiber" means the result may include asbestos, fiberglass, rock wool, etc. fibers--while "asbestos fiber" means the result includes one or more of the 6 basic types of asbestos fibers.

This abrading/scraping procedure was determined by W.B.R. ENGINEERING INC. as the most accurate and fairest way to evaluate the exposure and/or breaking loose of asbestos fibers which might occur under such abrading actions. It should be noted that wind and normal air currents would rapidly disperse airborne asbestos fibers. Remember, over 90% of all airborne asbestos fibers come from vehicular brakes.

* W.B.R. ENGINEERING INC. is the present engineering consulting firm of W. B. Rossnagel, P.E. who, after 16 years as president; sold his former firm ROSSNAGEL & ASSOCIATES in 1986. Now, after five years, both firms are again operating from their three story building on Route 70 in Medford, New Jersey.

Levels of 3,000 to 9,000 asbestos fibers per cubic meter of air have been shown to be present in over 200 tests conducted by W. B. Rossnagel in homes, schools, parks, parking lots, shopping centers, etc. He presented that data at the USEPA Public Hearings on asbestos in Washington, D.C. on May 7, 1984. See M262B in the APPENDIX.

With a level of 3,000 to 9,000 asbestos fibers per cubic meter of air as an average non-industrial exposure; and considering a person breathes at least 3 to 9 cubic meters of air a day, then one can expect to breathe at least 9,000 to 27,000 asbestos fibers every day. That perspective is neccessary as the reader reviews the results in this report.

In SECTION II is the TEST PLAN. In SECTION III are the RESULTS & CONCLUSIONS. In SECTION IV are the DATA SHEETS.

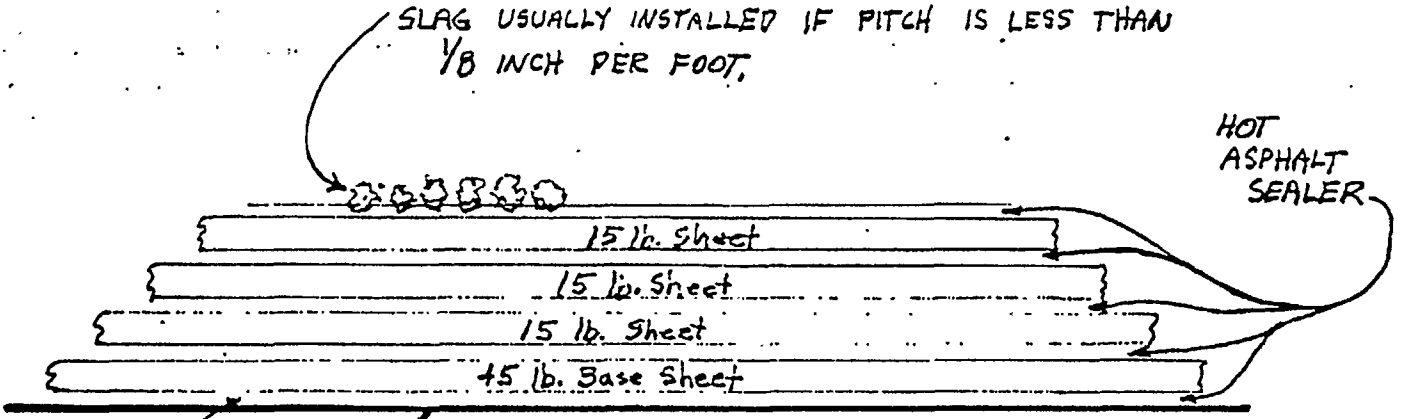
NOTE: 1. This report pertains only to the samples or source tested or the inspection of other work actually done. Information contained herein is not to be reproduced outside of the Buyer's organization, in whole or in part, without the prior written approval of the Buyer or W.B.R. ENGINEERING INC.

2. The liability of W.B.R. ENGINEERING INC., with respect to the services charged for herein, shall in no event exceed the amount of the invoice.

TYPICAL "BUILT-UP" ASPHALT ROOF

4 PLY ROOF

TYPICAL CONSTRUCTION



SUBSTRATE - OR SURFACE ROOFING MATERIALS ARE APPLIED ON. THIS CAN BE STEEL, CONCRETE, WOOD, ETC

Often Base Sheet is nailed or secured with metal clips instead of with hot asphalt sealer.

URR 11/21/86

II

TEST PLAN

The plan, developed by W.B.R. ENGINEERING INC., to test the Bird, Inc. 45 lb. Asphalt Base Sheet for asbestos fibers, is shown on the following page.

Scanning Electron Microscopy (SEM) was used in order to also include the short (under 5 micron) fibers and thin (less than 5 micron diameter) fibers which are not seen in the conventional lower cost PLM (Polarized Light Microscopy) analyses.

W.B.R. ENGINEERING INC. selected Structure-Probe Inc. of West Chester, Pennsylvania to conduct that important analysis. The PLM analysis was also done by them. The samples were delivered personally by W.B. Rossnagel to Mr. Gene Rodek of Structure-Probe on November 12, 1986.

When analyzing bulk materials (such as the Bird, Inc. 45 lb. Asphalt Base Sheet) for their type and quantity of asbestos, the basic USEPA Test Method is by Polarized Light Microscopy (PLM). Another USEPA Test Method is by Scanning Electron Microscopy (SEM). This is a much more expensive and accurate test which is conducted at much higher magnification. The SEM Method is done at 6,000 to 50,000 magnification. It will see the "thin and "short" asbestos fibers not seen in the basic PLM Method. Both of these methods were used in this study.

There is another basic asbestos test method. It is the NIOSH Test Method 239 or 7400--called Phase Contrast Microscopy (PCM). It was not utilized in these tests because it is an airborne test method. In the PCM test from 240 liters (in NIOSH Test Method 239) to 2,000 liters (in NIOSH Test Method 7400) of air are passed through a special Metracel filter which is then dissolved with a chemical. Then the asbestos fibers are counted at 400 magnification to determine the asbestos concentration in the air which passed through the filter. Since the plaintiff mentioned PCM testing, W.B.R. ENGINEERING initially contemplated to use it as another reference point in looking at the fibers on the surface of the 45 lb. Asphalt Base Sheet. However, W.B.R. ENGINEERING INC. decided not to conduct a PCM test on a bulk sample because it would not be the normal or approved test method. W.B. Rossnagel personally picked up the lab results and samples on November 20, 1986 and wrote up the analysis results on November 21-22, 1986.

In doing the abrasion with the scalpel knife, the surface was scraped 5 times. As the penetration of the scraping went deeper, the fibers which became exposed were proportional to the depth of the abrading. Therefore, the final SEM analysis was made at abrading locations near the surface because that was deemed a "worst case" test. This abrading activity on the test samples confirmed the thorough encapsulation of the asbestos fibers and other fibers and particulates in the asphalt coating.

W. B. R. ENGINEERING Inc.

Environmental & Management Consultants

R.C.R.A.
E.C.R.A.
E.I.S.
ASBESTOS

S.P.C.C.
O.S.H.A.
R.T.K.
INCINERATION

234 Rt. 70
Medford, New Jersey 08055
(609) 953-5355

AIR - WATER - ENERGY - INDUSTRIAL HYGIENE - NOISE - WASTE

- DESIGN OF AIR/ENERGY/NOISE POLLUTION CONTROL SYSTEMS
- SPECIFICATIONS/DRAWINGS/PERMITS
- INTERIM MANAGEMENT

Nov. 12, 1986

TO: Gene Rodek
Structure Probe Inc.
West Chester, Pa.

TEST PLAN FOR BIRD INC. ACM⊙ ROOF PRODUCT

MATERIAL	TYPE OF SEM△ TEST	TYPE OF PLM# TEST	REMARKS
45 lb. Asphalt Base Sheet*	1. SEM on 45 lb. sheet surface	3. PLM on 45 lb. sheet surface	
	2. SEM on 45 lb. sheet surface after abrasion	4. PLM on 45 lb. sheet surface after abrasion	

⊙ Asbestos Containing Materials
△ Scanning Electron Microscope
\# Polarized Light Microscope Test
* Manufactured by Bird, Inc.

This work to be done under W.B.R. ENGINEERING INC. Purchase Order #51 dated November 12, 1986.

NJ PE #12043 PA PE #11425E NY PE #047499 MA PE #27423

LAB PROCEDURE

W.B.R. ENGINEERING INC. instructed Structure-Probe to prepare the samples for SEM/EDS and PLM by the following procedure. The tests were designated as follows:

1) 45 lb. asphalt base sheet
2) 45 lb. asphalt base sheet (after abrasion)

In Test #2 the samples had their surfaces abraded 5 times by superficial scraping with a scalpel. The samples were then mounted onto a spectrographically pure carbon holder, followed by coating of the sample with evaporated spectrographically pure carbon using a SPI-Module Carbon Coater #12151.

The SEM examination was employed using a JEOL Scanning Electron Microscope. The entire sample was observed at various magnifications from 100X to 50,000X in order to determine a relative number of fibers per unit area on the surface. Several tentative fiber classes were chosen to represent the various observed sizes, shapes, surface features, etc. The S , along with its associated X-ray Detector and Multichannel Analy r, provided the information for the elemental analysis of the specimen. An EDS spectrum was recorded for each class. The micrograph accompanying each spectrum shows the area on a given fiber that represents the actual spot analyzed.

For the PLM portion of this study, sections from each sample were viewed using a Vicker's Instruments, Inc. M41 PhotoPlan Light Microscope. Due to the opaque nature of the sample material, the surfaces were viewed using Polarized Reflected Light. The surfaces were observed and photomicrographs were taken at various magnifications.

III

RESULTS & CONCLUSIONS

RESULTS

The results of the tests are shown in Table I below:

MATERIAL	TYPE OF SEM△ TEST	TYPE OF PLM # TEST	FIBER COUNT	COMMENT
45 lb. Asphalt Base Sheet*	1. SEM on 45 lb. sheet surface	—	10 fibers/ mm^2	Small number of non-asbestos fibers observed
	2. SEM on 45 lb. sheet surface after abrasion	—	7.5 fibers/ mm^2	Small number of asbestos fiber bundles c which most were exposed
	—	3. PLM on 45 lb. sheet surface	—	No fibrous materials observed
		4. PLM on 45 lb. sheet surface after abrasion	—	Confirms small number of asbestos fiber bundles exposed.

TABLE I

△ Scanning Electron Microscope
Polarized Light Microscope Test
* Manufactured by Bird Inc.

SEM Test (Sample) 1 on the 45 lb. sheet surface showed an average of 10 fibers/mm^2 (millimeter squared). The scanning was done at 100-1,000 magnification. The fiber counting was done at 500-50,000 magnification. The photomicrographs were made at the magnification shown on each picture.

The EDS* (Energy Dispersive X-ray Spectroscopy) analysis is described further along with the SEM and PLM analyses in SECTION V.

This means that an average of 10 fibers (not all of which were asbestos fibers)/mm^2 were seen in the scan. The EDS spectra and the physical nature of the fiber shown in Exhibit A, Pages 1 and 2, show the fiber not to be asbestos. It could be fiberglass, rock wool or any of over 60 similar crystalline materials.

Exhibit C, Pages 1 and 2, also show a non-asbestos fiber.

From these and other photomicrographs, the conclusion was made that the fibers on the surface of the 45 lb. Asphalt Base Sheet were not asbestos.

Exhibit D showed 1 fiber by PLM @ 300X and that same fiber at 50,000X by SEM.

SEM Test 2 on the 45 lb. sheet after abrading showed an average of 7.5 fibers/mm^2.

Exhibit E, Pages 1 and 2, shows a small bundle of asbestos fibers. The ESD spectra and the physical nature of the fibers confirm these are Chrysotile and asbestos fibers.

These asbestos fibers were not coated. Most of these fibers were exposed by the abrading action--but most were still partially secured to the asphalt base sheet.

Exhibit F via SEM showed 3 fibers.

* The "x" on the microphotograph indicates the exact location where the ESD X-ray beam was aimed.

PLM Test 3 showed there were no asbestos fibers in Exhibit G.

PLM Test 4 showed there were no asbestos fibers in Exhibit H.

PLM Test 5 showed no asbestos fibers present on the surface of the base sheet in Exhibit I.

PLM Test 6 showed some fibers (they are out of focus because they were partially exposed above the surface of the base sheet) in Exhibit J. However, because the regular PLM analysis could not be made (because light would not show through the base sheet) and a Reflective PLM test had to be done, that method was unable to confirm if these were asbestos fibers. However, it was confirmed in the more costly and more accurate SEM Analysis that the Test 6 fibers were asbestos.

The Table of X-ray Emission and Absorption Edge Energies at the end of this SECTION III provides additional information on the SEM analysis.

CONCLUSIONS

Test #1 showed 10 fibers/mm^2 but no asbestos fibers loose on the surface of the Bird 45 lb. Asphalt Base Sheet.

After abrasion, Test #2 showed 7.5 asbestos fibers/mm^2 partially or fully exposed on the disturbed surface. Most of the exposed fibers were still secured to the asphalt sealer.

When one considers 7.5 asbestos fibers/mm^2 it should be noted that the number converts to 4,688 asbestos fibers/square inch. It should also be understood that the 3,000 to 9,000 asbestos fibers per cubic meter* which a person breathes in normal air in homes, schools, parks, parking lots, shopping centers, etc. (See further information on APPENDIX Page 4) constitutes a much greater hazard in breathing than does an average of 4,688 asbestos fibers per square inch that were shown to be exposed, but mostly still secured, in the sealer in a "worst case" surface abrasion of the Bird 45 lb. Asphalt Base Sheet. Remember, a person breathes at least 3-9 cubic meters of air a day. A jogger can breathe up to 50 cubic meters of air a day. For additional perspective, a normal person will also breathe about 50,000 fiberglass fibers a day, about 500,000 viruses a day and over 1,000,000 bacteria a day.

An extrapolation of the 45 lb. felt test results can be made for the 15 lb. felt when a detailed comparison is made of their construction (See also the Product Specification Sheets in the APPENDIX) as shown in TABLE II on Page 13.1.

This comparison shows that the identical Code 29200 material (which contains the asbestos) is the base material in both the 45 lb. and 15 lb. felt. Each are then coated on both sides with the same saturating heavy Bunker C oil as shown in Item 4. It is believed that saturated heavy oil coating "secures in" (holds) in the asbestos fibers- and the additional coating in Item 7 (that only goes on the 45 lb. felt) does not necessarily encapture any more asbestos fibers. The Item 7 Code 14200 asphalt coating is primarily intended to provide more substance (thickness) for the 45 lb. felt as it is the base sheet (or 1st ply) laid on an often unsmooth surface.

COMPARISON OF BIRD, INC.

ROOF FELT MATERIALS

Item	Parameter	45 lb.	15 lb.
1.	Organic with felt base	Yes	Yes
2.	Use on roof	As base sheet or base ply	As built-up sheet or built-up plys
3.	Contains talc on both sides	Yes	No, none
4.	Coated once through tank with Code 15375 saturating Bunker C oil on both sides	Yes	Yes
5.	Percent asbestos in Code 29200 10 lb. x 36" wide felt	85%	85%
6.	Weight per 100 sq. ft.	41.6 lbs.	13.8 lbs.
7.	Base sheet coated with Code 14200 coating asphalt	Yes	No
8.	Who supplied asbestos containing Code 29200 felt to Bird	Nicolett & GAF	Nicolett & GAF
9.	Where was Bird, Inc. treatment of felt done	Norwood plant	Perth Amboy plant

TABLE II

IV

DATA SHEETS

Section A
SEM/EDS Data in Exhibits A through F

Section B
PLM Data in Exhibits G through J

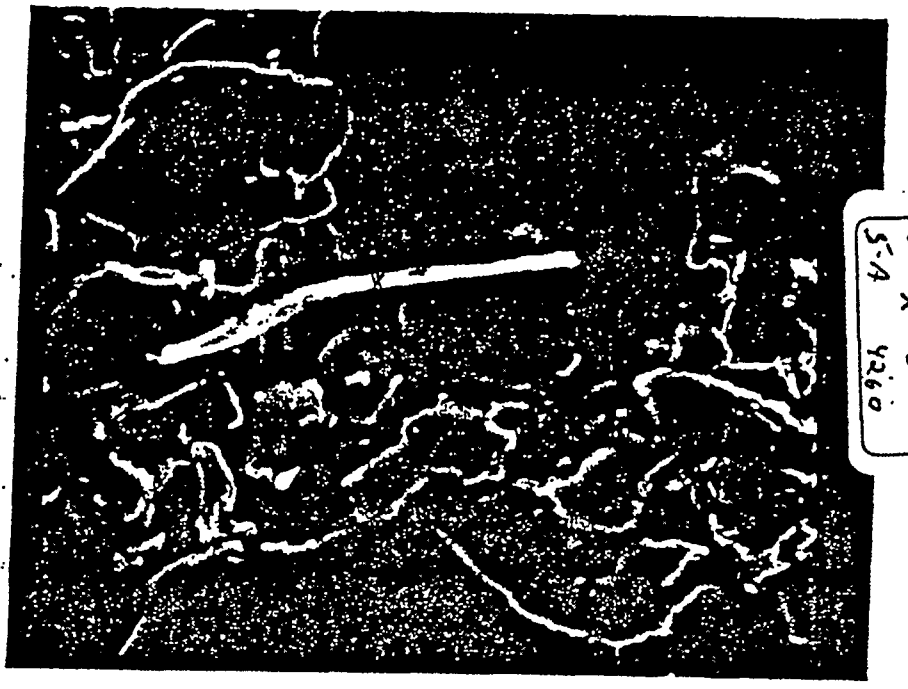


Exhibit A

Page 1 of 2

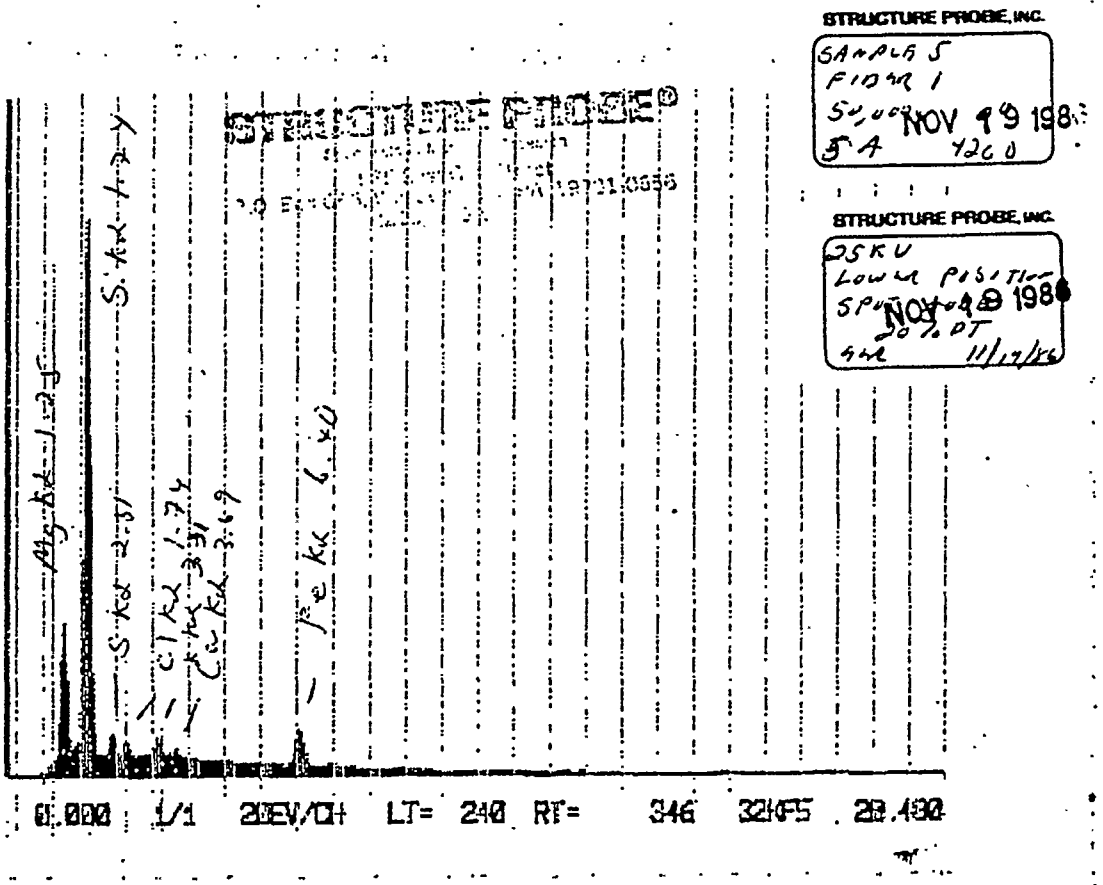


Exhibit A

Page 2 of 2

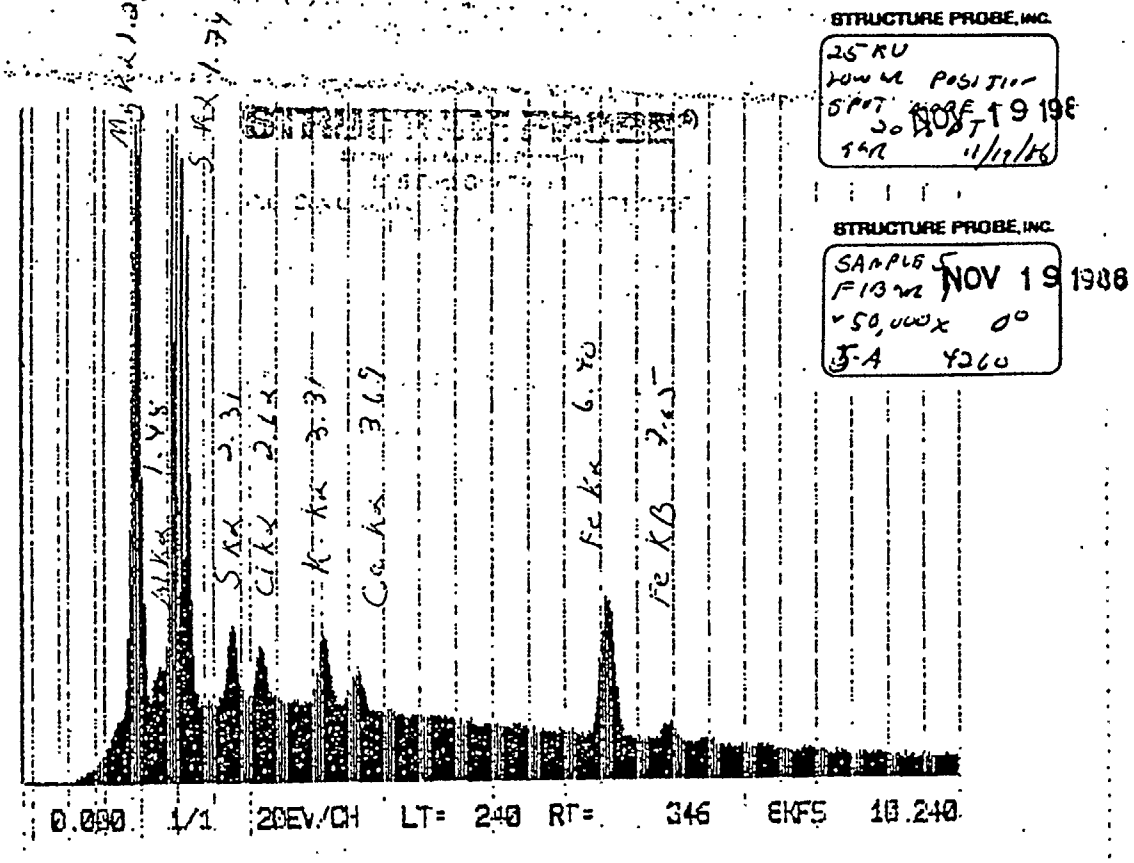
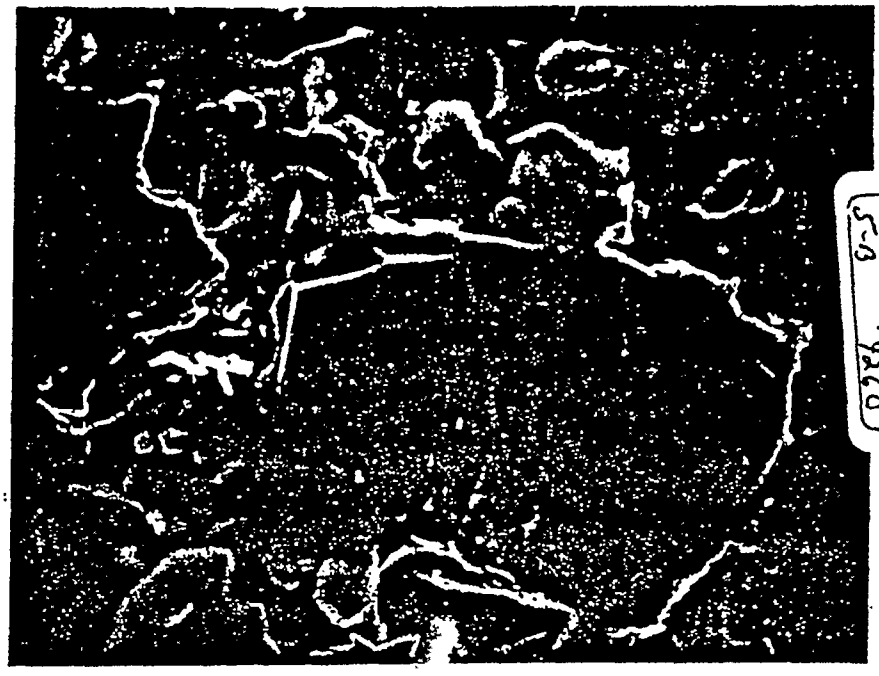
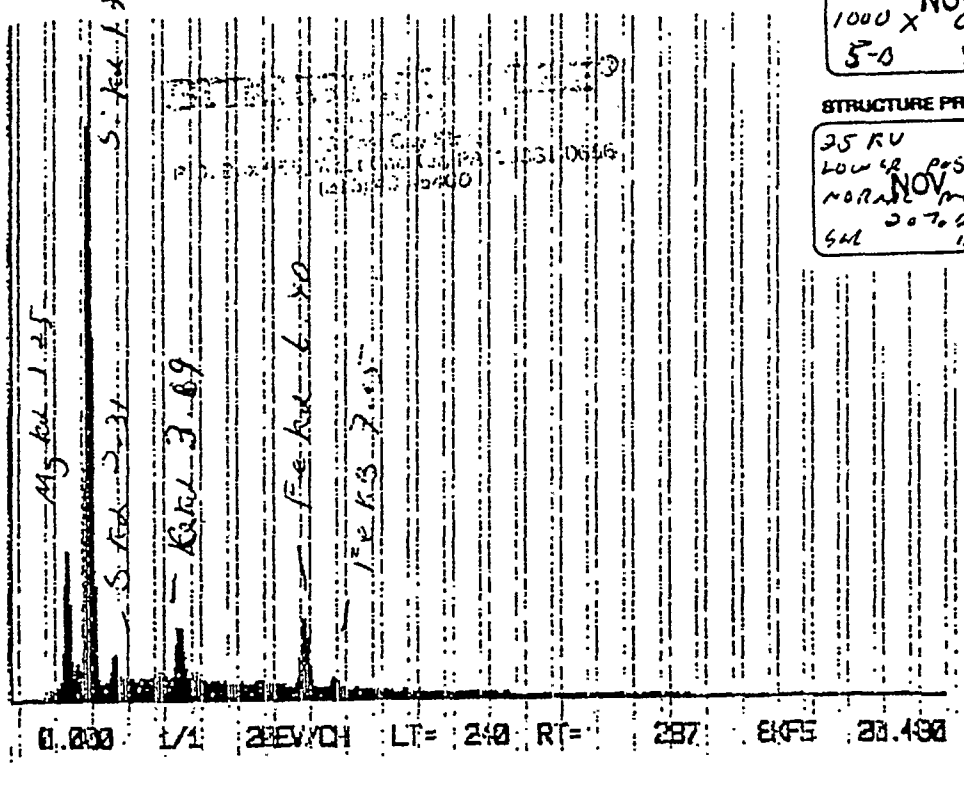


Exhibit B Page 1 of 2



STRUCTURE PROBE, INC.
SAMPLE 5
AREA 1 (Cu-Ka)
300 X
5-0 4260
NOV 19 1986



STRUCTURE PROBE, INC.
SAMPLE 5
AREA 1 (Cu-Ka)
1000 X
5-0 4260
NOV 19 1986

STRUCTURE PROBE, INC.
25 KV
LOW ER POSITIVE
NORMAL MODE
20.0 DT
SM 11/19/86
NOV 19 1986

Exhibit B

Page 2 of 2

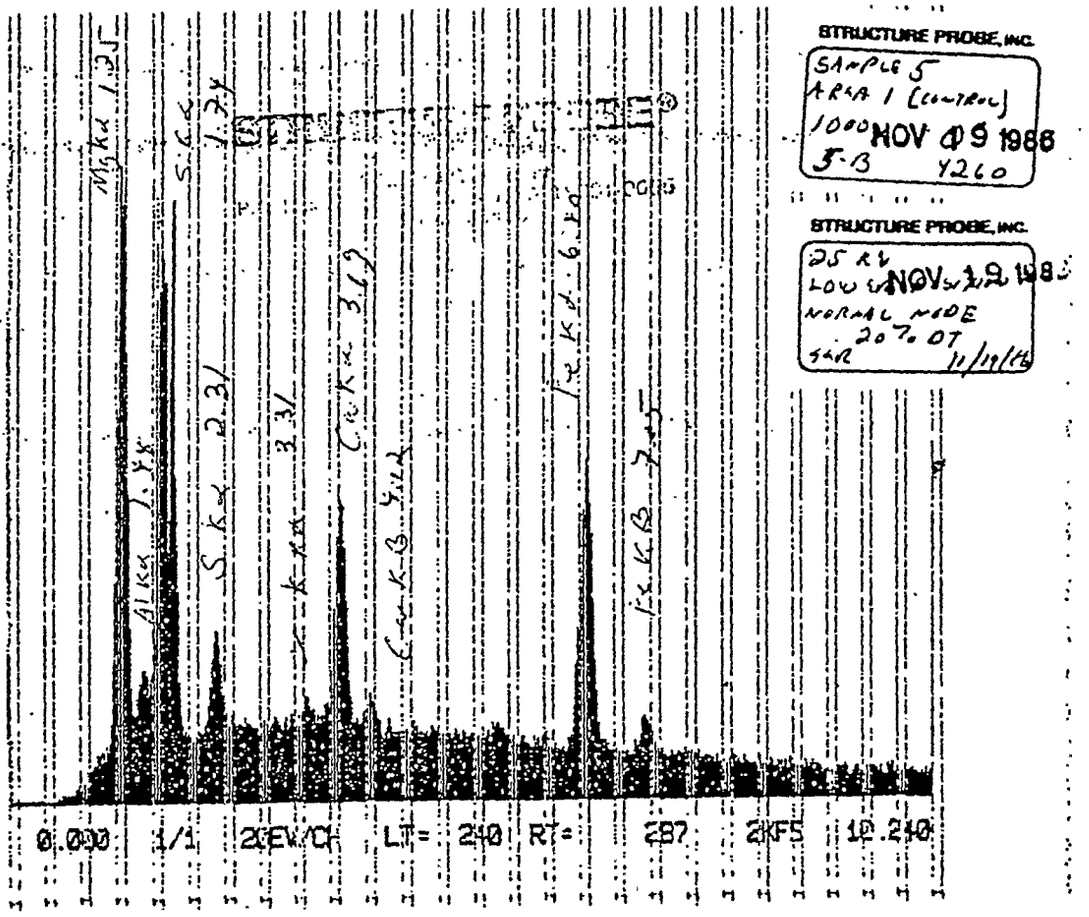


Exhibit C

Page 1 of 2

STRUCTURE PROBE, INC.
SAMPLE 5
FIBER 2
300 X 0°
5-C Y260
NOV 19 1986

STRUCTURE PROBE, INC.
25 KV
LOW MAG PHOTO
SPOT MODE
20 TO 0T
4 4R 11/19/86
NOV 19 1986

STRUCTURE PROBE, INC.
SAMPLE 5
FIBER 2
~50,000 X 0°
5-C Y260
NOV 19 1986

Exhibit C

Page 2 of 2

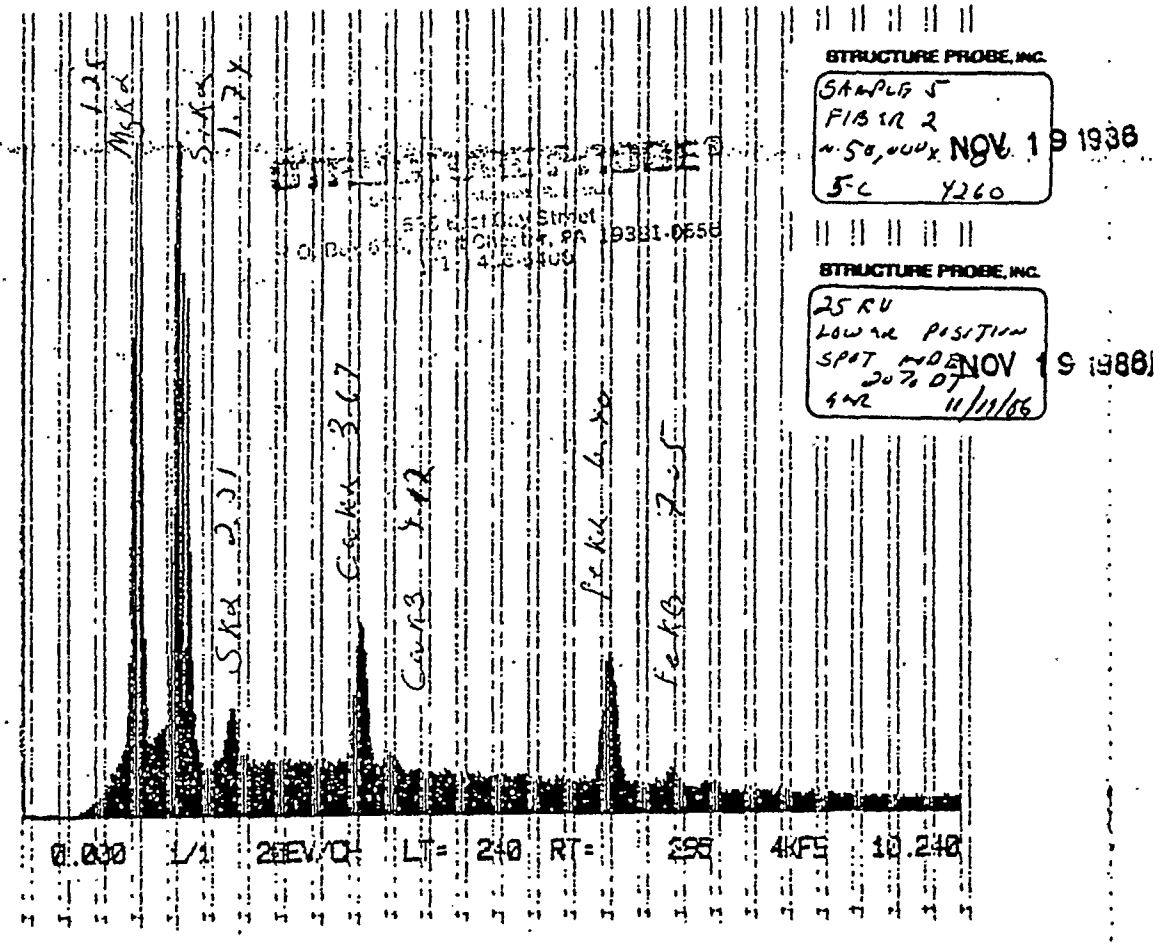


Exhibit D

Page 1 of 2

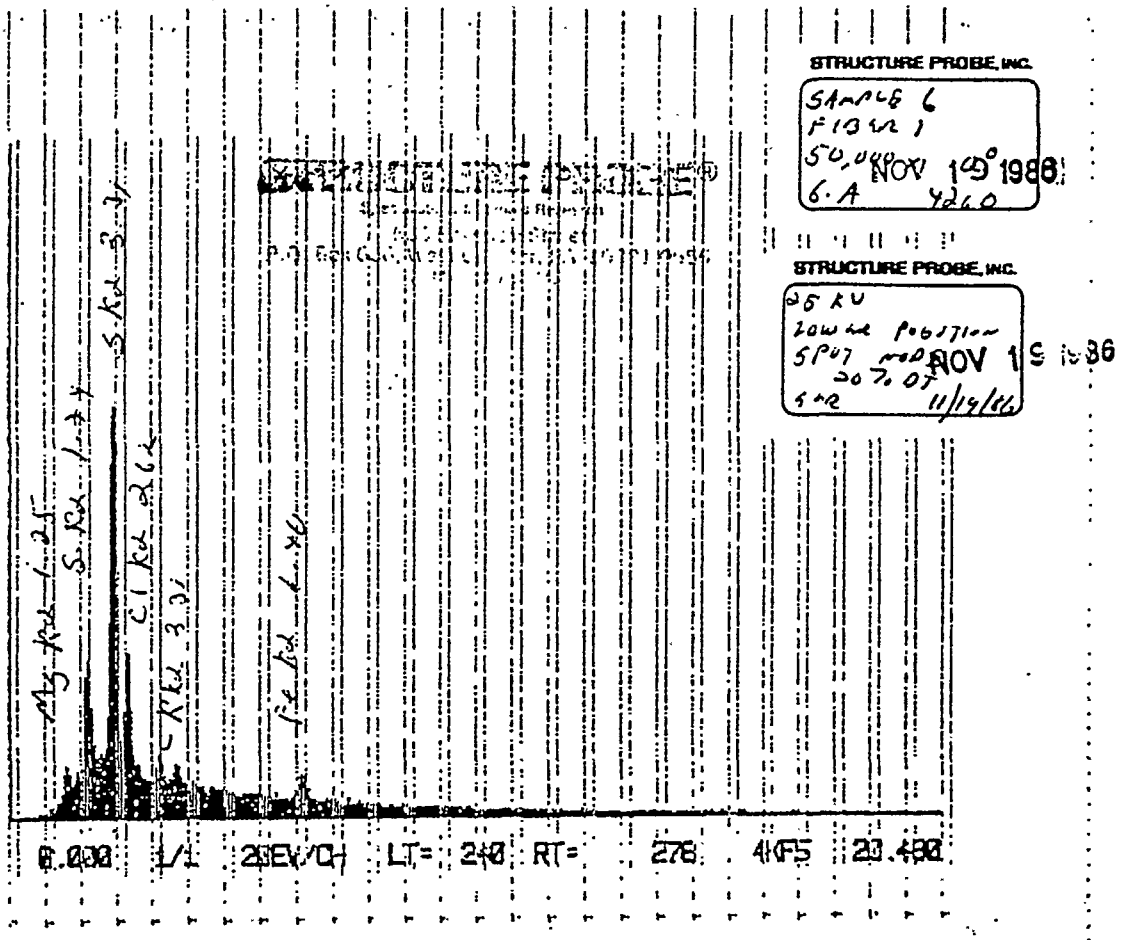


Exhibit D
Page 2 of 2

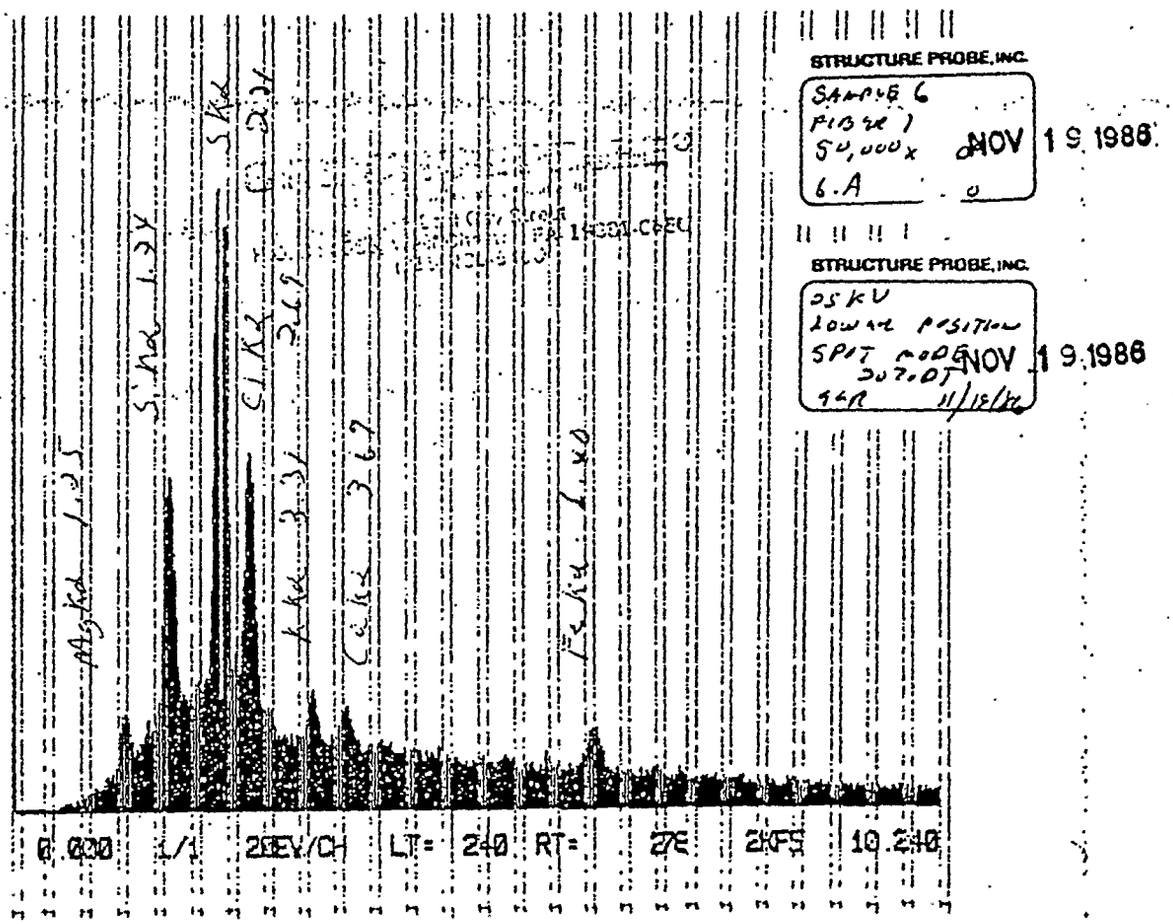
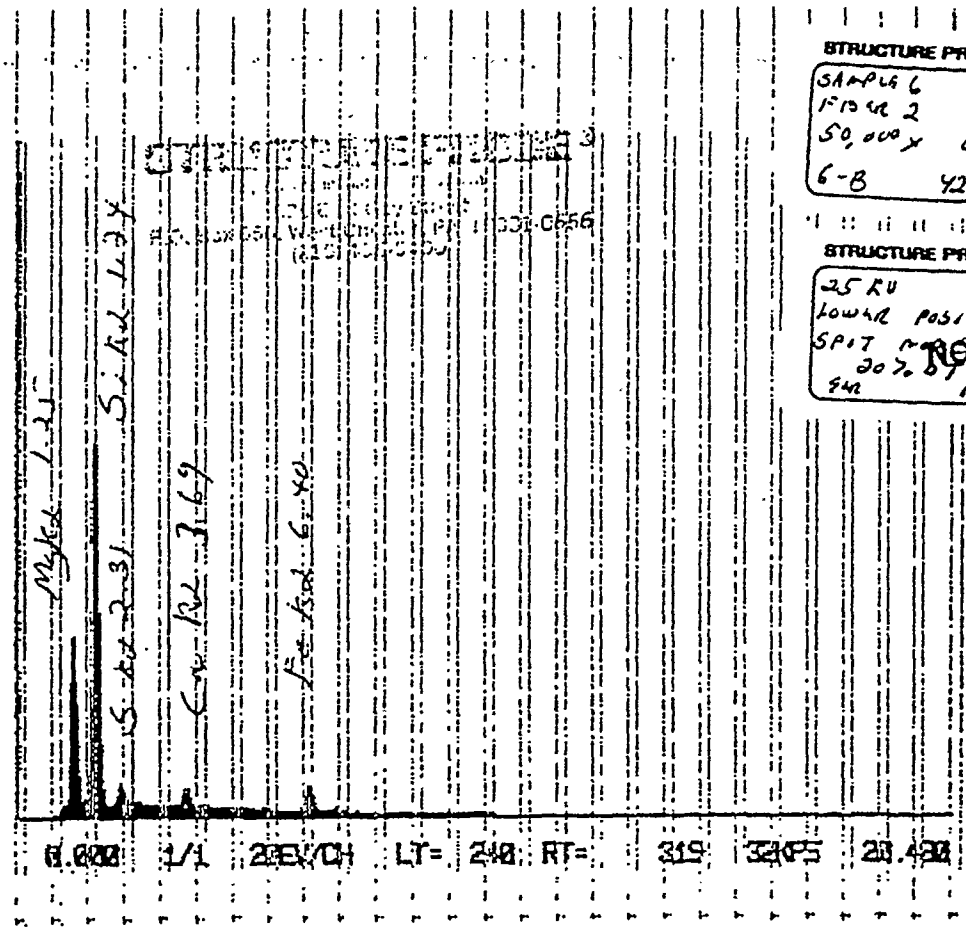


Exhibit E

Page 1 of 2

STRUCTURE PROBE, INC.
SAMPLE 6
FIGURE 2
300 X 00
6-B 4260
NOV 19 1988



STRUCTURE PROBE, INC.
SAMPLE 6
FIGURE 2
50,000 X 00
6-B 4260

STRUCTURE PROBE, INC.
25 KV
LOWER POSITION
SPOT
20° 07
NOV 19 1988
11/19/88

Exhibit E Page 2 of 2

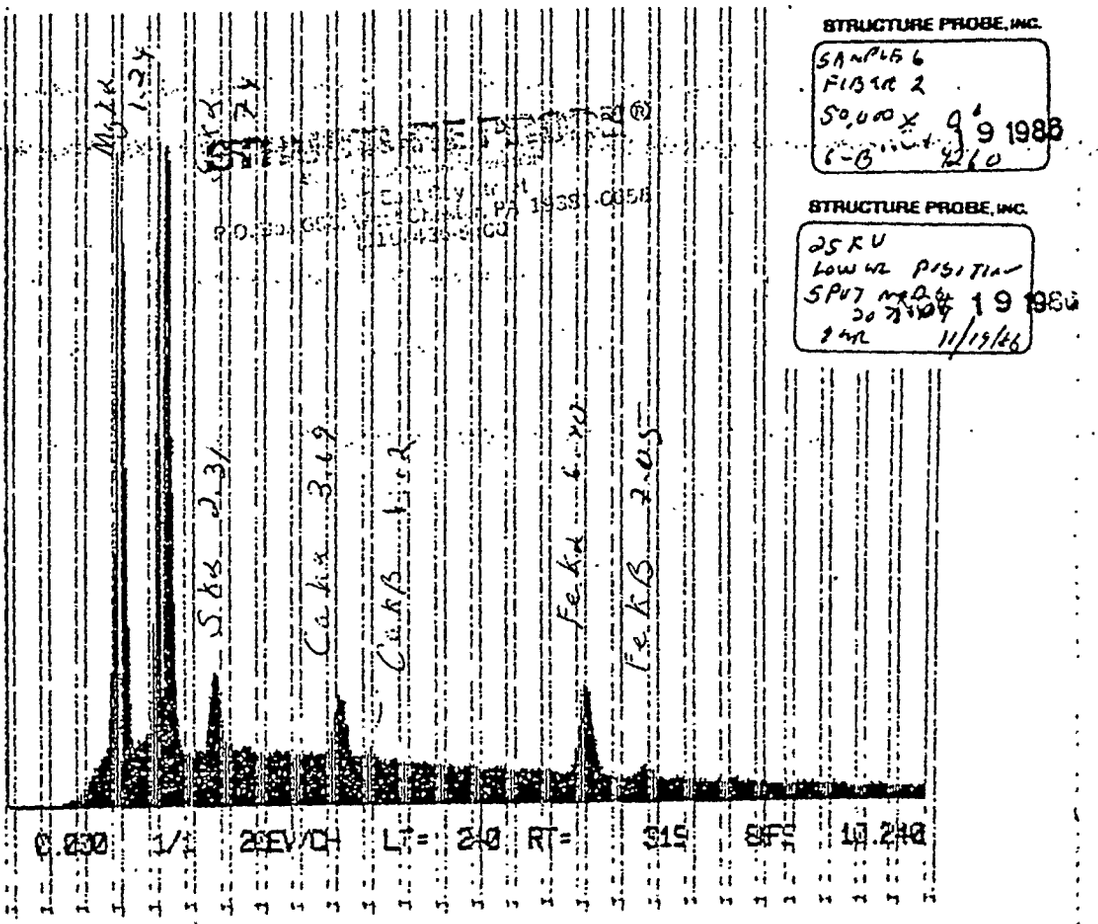


Exhibit F Page 1 of 2

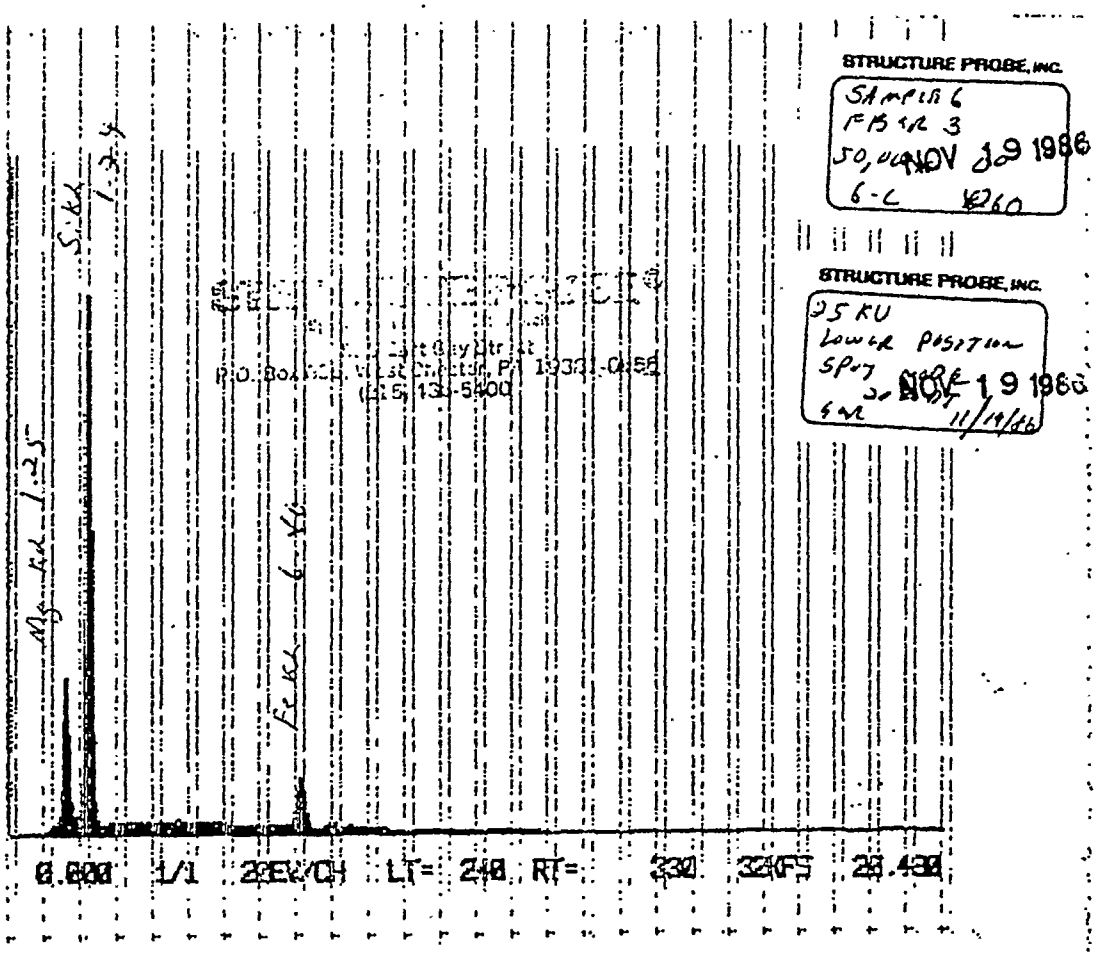
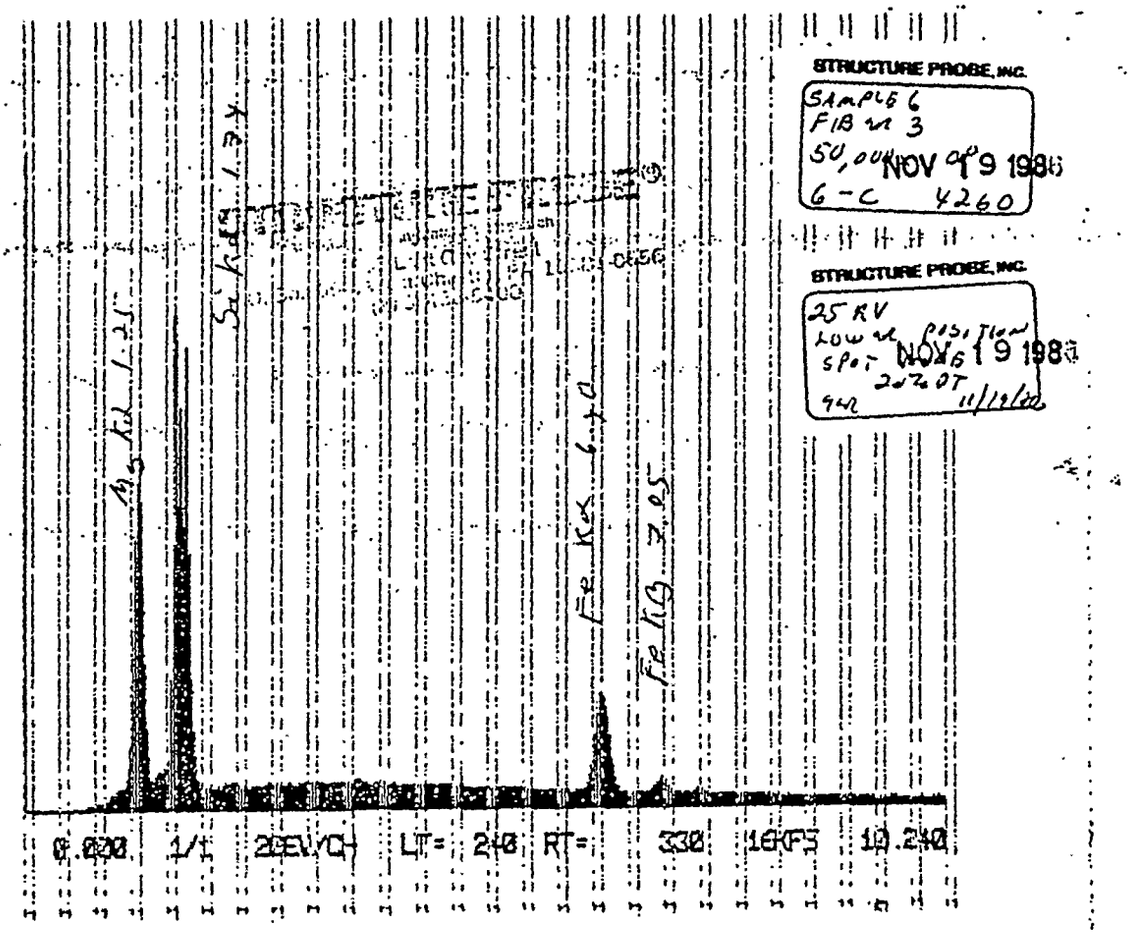


Exhibit F

Page 2 of 2



STRUCTURE PROBE, INC.
SAMPLE 6
FIB # 3
50,000X
6-C 4260
NOV 19 1986

STRUCTURE PROBE, INC.
25 KV
LOW α POSITION
SPOT
NOV 19 1986
2020T 11/19/86
942

Exhibit G


STRUCTURE PROBE, INC.
SAMPLE 3
REFLECTIVE LIGHT
SEMI-CROSSED POLARS
3-A
100X
CU30

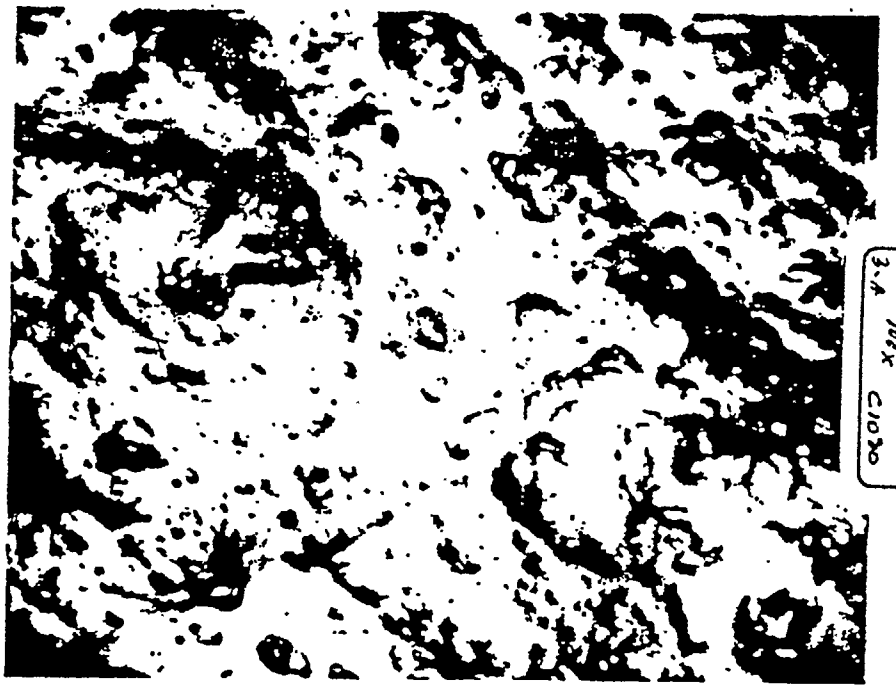
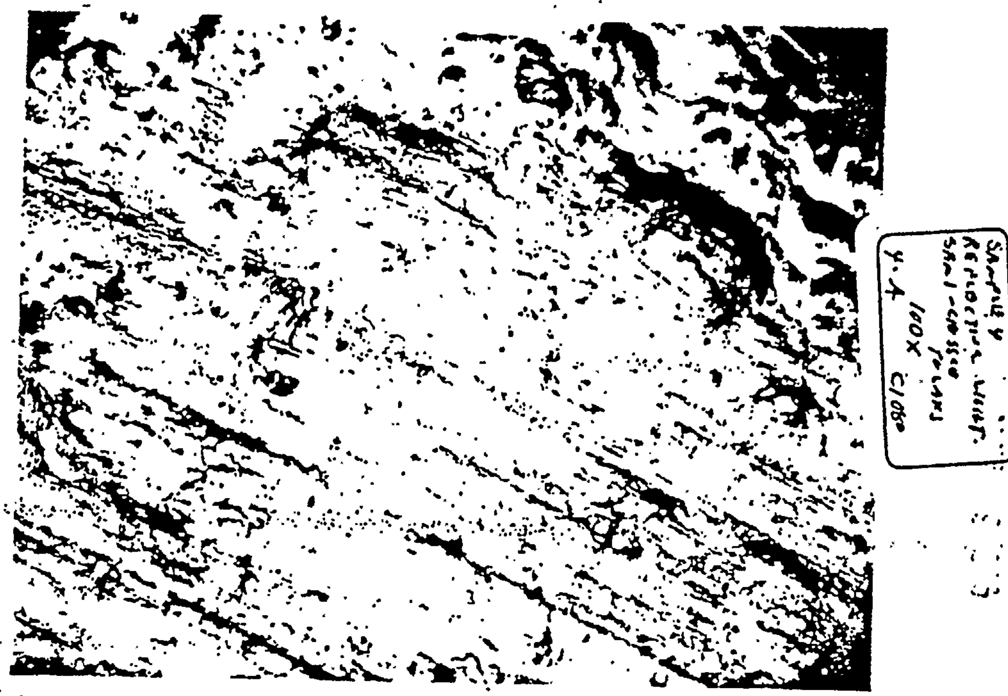

STRUCTURE PROBE, INC.
SAMPLE 3
REFLECTIVE LIGHT
SEMI-CROSSED
3-A
100X
POLARS
CU30

Exhibit H



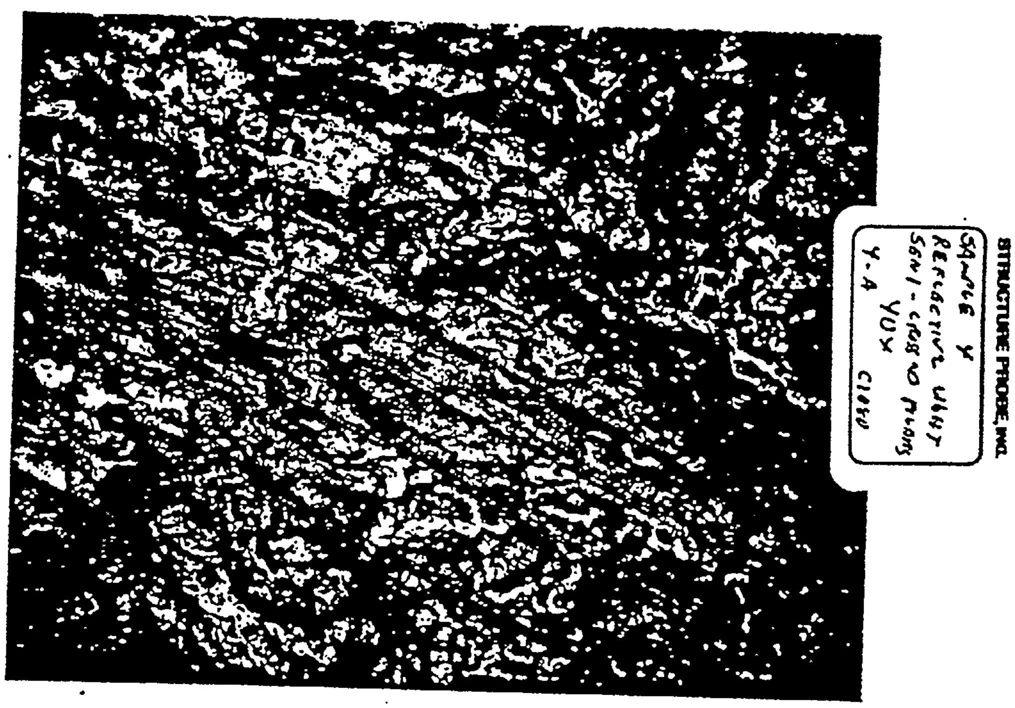


Exhibit I


STRUCTURE PROBE, INC.
SAMPLE 5
100X
5-A

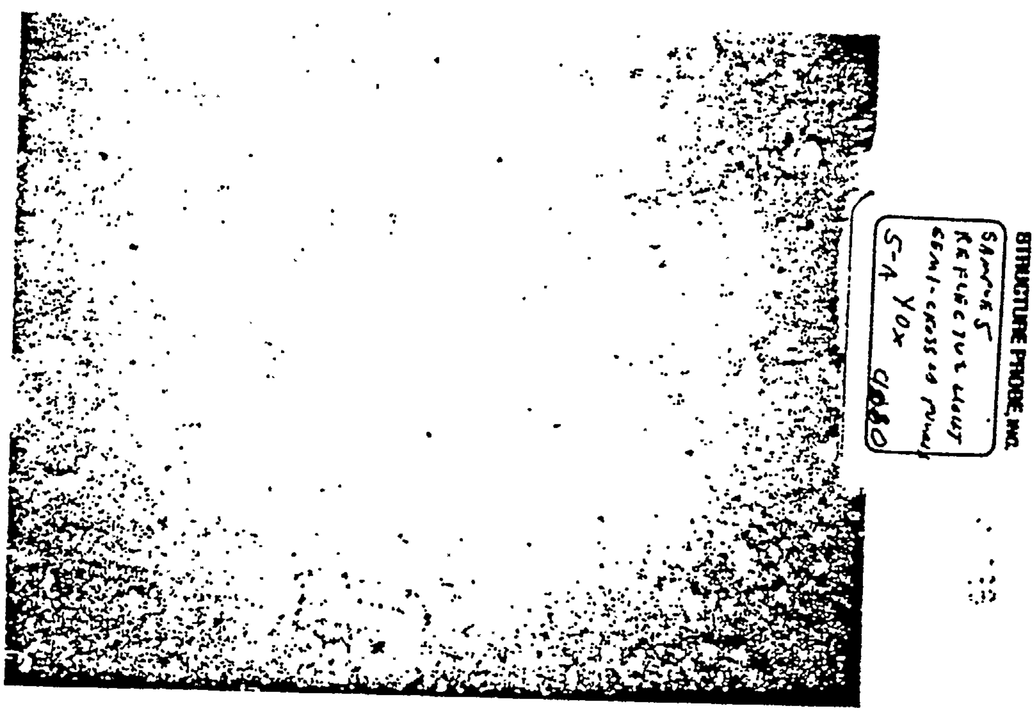

STRUCTURE PROBE, INC.
SAMPLE 5

Exhibit J

STRUCTURE PROBE, INC.

SAMPLE 6
REFLECTIVE LIGHT
SEMI-CROSSED POLARS
400X
6-A C1050

STRUCTURE PROBE, INC.

SAMPLE 6
REFLECTIVE LIGHT
SEMI-CROSSED POLARS
100X
6-A C1050

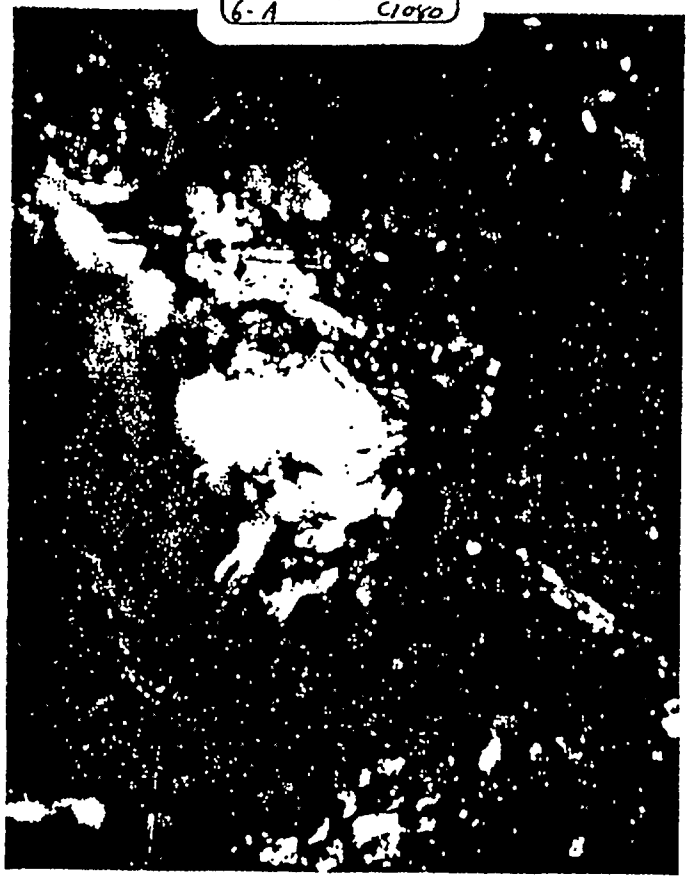


Table of X-ray Emission and Absorption Edge Energies (keV)

atomic number	K_α	K_β	$K_{(abs)}$	L_α	$L_{\beta 1}$	$L_{\beta 2}$	$L_{\gamma 1}$	$L_{III(abs)}$	$L_{II(abs)}$	$M_{V(abs)}$	M_α
1 H			0.014								
2 He			0.025								
3 Li			0.055					0.003	0.003		
4 Be			0.112					0.002	0.002		
5 B			0.186					0.003	0.003		
6 C	0.277		0.282					0.007	0.002		
7 N	0.392		0.400					0.008	0.008		
8 O	0.525		0.531					0.009	0.009		
9 F	0.677		0.692								
10 Ne	0.848		0.874					0.019	0.019		
11 Na	1.041	1.067	1.070					0.031	0.031		
12 Mg	1.253	1.296	1.303					0.050	0.050		
13 Al	1.486	1.553	1.559					0.073	0.073		
14 Si	1.739	1.829	1.842					0.102	0.103		
15 P	2.013	2.136	2.142					0.128	0.129		
16 S	2.307	2.464	2.470					0.163	0.164		
17 Cl	2.621	2.815	2.820					0.197	0.199		
18 Ar	2.957	3.190	3.200					0.224	0.246		
19 K	3.312	3.589	3.609					0.295	0.298		
20 Ca	3.690	4.012	4.038	0.341	0.345		0.350	0.346	0.350		
21 Sc	4.088	4.460	4.496	0.395	0.400		0.401	0.403	0.411		
22 Ti	4.508	4.931	4.964	0.452	0.458		0.460	0.454	0.460		
23 V	4.949	5.426	5.464	0.511	0.519		0.520	0.513	0.519		
24 Cr	5.411	5.924	5.987	0.573	0.583		0.583	0.574	0.581		
25 Mn	5.894	6.489	6.537	0.637	0.649		0.652	0.641	0.650		
26 Fe	6.398	7.057	7.111	0.705	0.718		0.721	0.709	0.720		
27 Co	6.924	7.648	7.709	0.776	0.791		0.794	0.779	0.794		
28 Ni	7.471	8.263	8.331	0.851	0.869			0.854	0.871		
29 Cu	8.040	8.904	8.981	0.930	0.950			0.933	0.953		
30 Zn	8.630	9.570	9.661	1.012	1.034			1.022	1.045		
31 Ga	9.241	10.267	10.395	1.098	1.125			1.144	1.171		
32 Ge	9.874	10.9	11.100	1.188	1.218			1.214	1.245		
33 As	10.530	11.7	11.867	1.282	1.317			1.324	1.359		
34 Se	11.207	12.4	12.656	1.379	1.419			1.434	1.475		
35 Br	11.907	13	13.470	1.480	1.526			1.552	1.599		
36 Kr	12.631	14.94	14.320	1.586	1.636		1.703	1.674	1.729		
37 Rb	13.373	14.956	15.201	1.694	1.752		2.050	1.806	1.866		
38 Sr	14.140	15.829	16.106	1.806	1.871		2.196	1.941	2.008		
39 Y	14.931	16.731	17.037	1.922	1.995		2.346	2.080	2.155		
40 Zr	15.744	17.660	17.995	2.042	2.124	2.219	2.302	2.221	2.305		
41 Nb	16.581	18.614	18.989	2.166	2.257	2.367	2.461	2.374	2.467		
42 Mo	17.441	19.600	20.002	2.293	2.394	2.518	2.623	2.524	2.629		
43 Tc	18.325	20.608	21.054	2.424	2.536			2.677	2.795		
44 Ru	19.233	21.646	22.117	2.558	2.683	2.835	2.964	2.838	2.966		
45 Rh	20.165	22.712	23.218	2.696	2.834	3.001	3.143	3.002	3.144		
46 Pd	21.121	23.806	24.349	2.838	2.990	3.171	3.328	3.172	3.329		
47 Ag	22.101	24.928	25.512	2.984	3.150	3.347	3.519	3.350	3.527		
48 Cd	23.106	26.081	26.711	3.133	3.316	3.528	3.716	3.538	3.727		
49 In	24.136	27.260	27.937	3.286	3.487	3.713	3.920	3.729	3.937		

50 Sn	25.191	28.467	29.200	3.443	3.662	3.904	4.130	3.928	4.156		
51 Sb	26.271	29.706	30.491	3.604	3.843	4.100	4.347	4.132	4.381		
52 Te	27.377	30.974	31.813	3.768	4.029	4.301	4.570	4.347	4.612		
53 I	28.508	32.277	33.170	3.937	4.220	4.507	4.800	4.559	4.855		
54 Xe	29.666	33.599	34.561	4.109				4.785	5.103		
55 Cs	30.851	34.961	35.983	4.286	4.619	4.935	5.279	5.011	5.359		
56 Ba	32.062	36.354	37.443	4.466	4.827	5.156	5.530	5.247	5.624		
57 La	33.299	37.771	38.932	4.650	5.041	5.383	5.788	5.490	5.897		0.833
58 Ce	34.566	39.223	40.447	4.839	5.261	5.612	6.051	5.729	6.169		0.883
59 Pr	35.860	40.711	41.995	5.033	5.488	5.849	6.321	5.969	6.445		0.929
60 Nd	37.182	42.231	43.577	5.229	5.721	6.088	6.602	6.215	6.728		0.978
61 Pm	38.532	43.783	45.190	5.432	5.960	6.338	6.891	6.467	7.027		
62 Sm	39.911	45.366	46.835	5.635	6.204	6.586	7.177	6.720	7.340		1.081
63 Eu	41.320	46.987	48.498	5.845	6.455	6.842	7.479	6.981	7.633		1.131
64 Gd	42.757	48.642	50.278	6.056	6.712	7.102	7.784	7.243	7.930		1.185
65 Tb	44.226	50.325	51.983	6.272	6.977	7.365	8.100	7.515	8.252		1.240
66 Dy	45.724	52.058	53.840	6.494	7.246	7.634	8.417	7.796	8.588		1.293
67 Ho	47.253	53.813	55.600	6.719	7.524	7.910	8.746	8.067	8.917		1.347
68 Er	48.813	55.606	57.457	6.947	7.809	8.188	9.087	8.357	9.263		1.406
69 Tm	50.406	57.437	59.376	7.179	8.100	8.467	9.424	8.650	9.616		1.462
70 Yb	52.030	59.322	61.313	7.414	8.400	8.757	9.778	8.944	9.979		1.521
71 Lu	53.687	61.235	63.306	7.654	8.708	9.047	10.142	9.242	10.346		1.581
72 Hf	55.382	63.183	65.347	7.898	9.021	9.346	10.514	9.558	10.736		1.644
73 Ta	57.098	65.125	67.406	8.145	9.342	9.650	10.893	9.874	11.179		1.709
74 W	58.856	67.140	69.519	8.396	9.671	9.960	11.284	10.202	11.540	1.809	1.774
75 Re	60.648	69.199	71.678	8.651	10.008	10.274	11.683	10.537	11.960		1.842
76 Os	62.477	71.298	73.866	8.910	10.354	10.597	12.093	10.866	12.380		1.914
77 Ir	64.339	73.438	76.108	9.174	10.706	10.919	12.510	11.210	12.819	2.041	1.978
78 Pt	66.241	75.618	78.386	9.441	11.069	11.249	12.940	11.557	13.266	2.122	2.048
79 Au	68.177	77.840	80.723	9.712	11.440	11.585	13.379	11.919	13.734	2.206	2.120
80 Hg	70.154	80.103	83.113	9.987	11.821	11.937	13.828	12.286	14.213	2.295	2.195
81 Tl	72.167	82.497	85.529	10.267	12.211	12.270	14.289	12.658	14.696	2.389	2.268
82 Pb	74.221	84.859	88.014	10.550	12.612	12.621	14.767	13.039	15.205	2.484	2.343
83 Bi	76.315	87.328	90.471	10.837	13.021	12.978	15.249	13.419	15.715	2.579	2.418
84 Po	78.452	89.781	93.112	11.129	13.445	13.338	15.741	13.817	16.244		
85 At	80.624	92.287	95.740	11.425	13.874		16.249	14.215	16.784		
86 Rn	82.843	94.850	98.418	11.725	14.313		16.768	14.618	17.337		
87 Fr	85.110	97.460	101.147	12.029	14.768	14.448	17.300	15.028	17.904		
88 Ra	87.418	100.113	103.900	12.338	15.233	14.839	17.845	15.444	18.482		
89 Ac	89.773	102.829	106.759	12.650	15.710		18.405	15.865	19.078		
90 Th	92.174	105.591	109.630	12.967	16.199	15.621	18.979	16.299	19.696	3.332	2.991
91 Pa	94.627	108.409	112.581	13.288	16.699	16.022	19.565	16.731	20.311		3.077
92 U	97.131	111.281	115.610	13.612	17.217	16.425	20.164	17.164	20.939	3.552	3.165
93 Np	99.407	113.725	118.619	13.942	17.747	16.837	20.781	17.614	21.596		
94 Pu	101.857	116.943	121.800	14.276	18.291	17.257	21.414	18.066	22.267		
95 Am	104.431	120.350	124.876	14.615	18.849	17.673	22.061	18.575	22.944		
96 Cm	107.139	123.733	128.088	14.953	19.399	18.096	22.703	18.990	23.640		
97 Bk	109.991	126.490	131.351	15.304	19.961	18.529	23.389	19.461	24.357		
98 Cf	112.999	127.794	134.683	15.852	20.557	18.983	24.070	19.938	25.080		

Scanning electron microscopy (SEM) uses a highly focused electron beam (less than 10nm diameter) which can be scanned in a raster on the sample surface. The intensity of secondary electrons produced at each point is used to form a picture of the sample. Magnification factors from 10X to 100,000X can be obtained. The depth of field is inherently quite large which allows the micrographs to be in focus at all points across a rough surface. In addition, the SEM does not suffer from the light microscope problem of light reflecting off at odd angles and being lost from view. Micrographs are marked with full identification. The sample number/description and area designation are noted on the top one or two lines. Next is the magnification and finally the micrograph sequence code. The first number in the code refers to the sample being examined while the letter refers to a particular area on that sample. The final 4 digits are used for our work records. When a tilt angle (often 45°) is imposed upon the sample, the resulting micrographs should be viewed with the Polaroid print tab at the top and all dimension measurements made parallel to the short side of the micrograph. Some foreshortening is expected in the "longer" viewing direction if a tilt is imposed.

Energy dispersive x-ray spectroscopy (EDS) is an effective method for analyzing for the main components as well as low-level (nominally 0.1%) contaminants in relatively thick (several micron) layers. The x-ray spectra display an intensity versus energy plot of x-rays given off by the sample bombarded by the electron beam of the SEM. The vertical scale is x-ray intensity at each energy position. The spectrum is usually recorded at a scale calibration of 32,000 counts full scale. Small peaks are then recorded on the same chart at one or two higher sensitivities. The horizontal scale runs from 0 to 20 kev and the x-ray peaks which appear on the spectrum have energies in the same range. Each element emits x-rays of characteristic energies so it is a simple matter to relate an x-ray peak to its corresponding element using the attached table of Major X-Ray Emission Energies. Only those elements sodium and heavier on the Periodic Table are included in this study. Except when a 'windowless' detector is employed, the EDS technique does not detect x-rays originating from the light elements.

The area analyzed is noted on the spectrum. A magnification on the spectrum label (usually that of a higher magnification photograph attached to the spectrum) indicates that the electron beam was scanned in a raster on the sample while the spectrum was collected. "Spot" indicates that the beam scan was disabled to allow analysis of the particular spot noted on the micrograph.

Polarized light microscopy/dispersion staining (PLM/DS) is a method for determining the unique optical crystallographic properties of various crystal phases in a sample. PLM/DS is an invaluable tool in the identification of crystalline materials such as asbestos. It is basically a particle identification technique based on the difference between refractive index dispersion of a particle and of the liquid medium in which the particle is immersed. Two different procedures are based on the use of stops in the objective back focal plane; both procedures give colored particle boundaries. An annular stop shows a color consisting of wavelengths near that at which particle and medium match in refractive index; a central stop shows colors complementary to those shown by the annual stop, that is, light of wavelengths refracted by the particle in that medium.

These effects make it possible to systematically identify transparent substances by their dispersion colors in known refractive index media. The procedure has been applied to refractive index determination, identification of quartz in lung tissue, determination of toxic dusts, particle counting, identification of glass fragments, identification of asbestos, mineral characterization, identification of settled dust and fiber identification.

APPENDIX

Product Specification Sheets
W. B. Rossnagel's Asbestos Resume
Test Report 22,437
W. B. Rossnagel's Asbestos Testimony
in Washington, D.C.

DISCONTINUED

PRODUCT SPECIFICATIONS

DIVISION PERTH AMBOY, N. J. MACHINE # 2

ISSUED DATE 5/9/73

REV:

PRODUCT CODE 22-01-432 PRODUCT NAME NO. 15 PERFORATED ASPHALT SATURATED ASBESTOS FELT

SUPERSEDES: 3/2/70

DESCRIPTION: Made on FJPM-2. Four square roll, 36" wide and 144 ft. long. Laying lines 2", 8-1/2", 11-1/4", 17", 19", 24-3/4", 27-1/2", and 34" from edge. Aluminum lines put on by our Asb. Felt Vendor.

CODE	RAW MATERIAL DESCRIPTION	WT./432 SQ. FT. ROLL NET WEIGHT	GROSS WEIGHT	NET PER 100 Sq. Feet
	Materials Per 432 sq. ft.			
29200	Felt - 10# x 36" Asb.	41.0#	43.5#	9.40#
15375	Saturation - #3533 Roll (45.8%)	18.8	19.6	4.35
	Weight per sq. ft.	59.8#	63.1#	13.84#
	Finishing Materials	0.2		
	Shipping Weight - Std.	60.0#		
	" " - Min.	57.0#		

FINISHING MATERIALS/ROLL: Resin Emulsion Adhesive - .005#/roll. Each roll Dated Coded.
U/L Type 15 B.U. Label applied to wrapper. (R-1177-P)
U/L Min. Saturation - 40%
" " Dry Unsat. Wt. - 8.5# 100 Sq. Ft.
Up to 3% of rolls may have 2 pieces.
No piece under 12 ft. long. All spliced rolls must have Ident. Sticker.
No. rolls per pallet 30 Wt. 1800#
Plain wrapper/blue printing 21"W x 35½"L

RCD Operating Speed 125 Rolls/Hour Production Size 6 Rolls

Colo

1-1-83

PRODUCT SPECIFICATIONS

DIVISION NORWOOD

ROOFING MACHINE # 9

ISSUED DATE 4/9/73
REV: 1-1-75

PRODUCT CODE 22-50-162

PRODUCT NAME #45 ASBESTOS BASE SHEET (1½ SQUARE)

SUPERSEDES: 11/6/70

DESCRIPTION: Coating ribbed both sides, evenly distributed front and back. Surfaced on face with #36 Talc. Talc (Fine Grading) Slurry on back. 36" wide, 54' long. Laying lines 2", 17", 19", and 34" in from each edge.

CODE	RAW MATERIALS DESCRIPTION	MATERIALS PER ROLL NET WEIGHT	GROSS WEIGHT	NET PER 100 Sq. Ft.
	Materials Per 162 sq. ft.			
29200	Felt Asbestos 10x36	15.5#	16.4#	9.6#
15375	Saturation 50%	7.6	7.8	4.7
14200	Coating Asphalt	20.2	20.8	12.5
56200	Filler 50%	20.2	20.8	12.5
59050	Surfacing #36 Talc	3.4	3.7	2.1
	Backing - Talc (Fine Grading) Slurry	0.3	0.4	0.2
	Weight per 162 sq. ft.	67.2#	69.9#	41.6#
	Finishing Materials	0.2		
	Shipping Weight	67.4#		

FINISHING MATERIALS: Printed wrapper -
Resin Emulsion Adhesive- .007#
Underwriters' Label - Type 15 B.U.
Orange Laying Line - 1#/1,400 Rolls

RCP Operating Speed 150 ~~300~~ rolls/hr. Production Crew Size _____ Unit Rolls

COLORS: _____

DISCONTINUED 1-1-83

PRODUCT SPECIFICATIONS

DIVISION NORWOOD

ROOFING MACHINE #9

ISSUED DATE 4/9/73

REV:

PRODUCT CODE 22-50-216

PRODUCT NAME #45 ASBESTOS BASE SHEET (2 Square)

SUPERSEDES: 11/7/70

DESCRIPTION: Coating ribbed both sides, evenly distributed front and back. Surfaced on face with #36 Talc. Talc (Fine Grading) Slurry on back. 36" wide, 72' long. Laying lines 2", 17", 19", and 34" on from each edge.

CODE	RAW MATERIALS DESCRIPTION	MATERIALS PER ROLL NET WEIGHT	GROSS WEIGHT	NET PER 100 Sq. Ft.
	Materials Per 216 sq. ft.			
29200	Felt Asbestos 10 x 36	20.6#	21.8#	9.6#
15375	Saturation 50%	10.2	10.5	4.7
14200	Coating Asphalt	27.0	27.8	12.5
56200	Filler 50%	27.0	27.8	12.5
59050	Surfacing #36 Talc	4.5	5.0	2.1
	Backing - Talc (Fine Grading) Slurry	0.4	0.5	0.2
	Weight per 216 sq. ft.	89.7#	93.4#	41.6#
	Finishing Materials	0.2		
	Shipping Weight	89.9#		

FINISHING MATERIALS:

Printed Wrapper
Resin Emulsion Adhesive - .007#
Underwriters' Label - Type 15 BU
Orange Laying Line - 1#/1,000 Rolls

RCD Operating Speed 225 rolls/hr. Production Crew Size 15-1/2 Unit Rolls

COLORS:

PROFESSIONAL RESUME ON ASBESTOS (CURRICULUM VITAE)

Two years U.S.N. - 14 Months Radar School, 1946 - 1948
Graduate, Stevens Institute of Technology, 1952
During college formed Rossnagel Television in Fair Lawn, NJ
Operated TV service company while employed at Bendix,
McAvoy Target Co. and Kearfott.

At Kearfott was Assistant Manager of Experimental Assembly Shop where contamination problems were a major problem in final testing of Polaris Gyros. First worked with airborne asbestos in 1956 as it was a contaminant in the crucial balancing of the gyros. Spent long hours studying (under microscopes) the various types of asbestos dust and fiberglass contaminants.

In 1960 founded National Target Ranges Inc. in Lincoln Park, N.J. and designed 11,000 sq. ft. indoor shooting range with asbestos insulation and sound deadening materials. Like other engineers and architects, little was known then of the health problems with asbestos. During early 1960's (was Reliability Test Manager at Walter Kidde Co.) worked on air contamination problems in gyros and early electronic "Clean Rooms." Part of committee that wrote Rev. A to FEDERAL STANDARD 209 entitled, "CLEAN ROOMS." By 1968, had over 30 published articles, three on air contamination and clean room problems.

In 1966, after 1 1/2 years as Quality Control and Test Manager at VECTOR DIV. UNITED AIRCRAFT in Trevose, Pa. (early leader in computer chip manufacture), joined the RE-ENTRY & ENVIRONMENTAL SYSTEMS DIV. OF GENERAL ELECTRIC in Philadelphia, Pa. For 3 1/2 years was in charge of 325 persons handling all the Component Quality Control and Test for Minute Man Missiles and space satellites. This work involved miniaturized electronics and integrated circuits; all made in a clean room environment. Special experience on testing and contamination problems included 20 trips to California in three years.

In early 1970 Minute Man program development was completed, left GENERAL ELECTRIC and formed ROSSNAGEL & ASSOCIATES in Cherry Hill, N.J. Within a few months this new firm was conducting many types of airborne tests; including asbestos; as well as clean room tests in hospitals, computer rooms, factories, schools, etc. By 1976 ROSSNAGEL & ASSOCIATES was larger than all other air testing firms in New Jersey.

In 1977 ROSSNAGEL & ASSOCIATES was picked by N.J. Department of Health to conduct the airborne and bulk asbestos tests at the Rumtown School in Howell Township, N.J. Those tests brought the school asbestos problem to the forefront with national media coverage. Within a month after that, wrote the first article on asbestos, entitled, "ASBESTOS CEILINGS--ARE THEY SAFE OR NOT?" See attached list of papers and articles on asbestos. By this time ROSSNAGEL & ASSOCIATES had divisions in Atlanta, Ga. and Charlotte, N.C.

Has been a leader since then in all aspects of asbestos removal/encapsulation/enclosure/repair work by performing the following:

1. Wrote the first asbestos removal specification in the country in 1977 for Howell Twp.
2. Performed test work from California to Egypt--also asbestos testing/consulting in schools, hospitals, ships, tunnels, manufacturing plants, homes, shopping centers, city streets, etc.
3. Switched ROSSNAGEL & ASSOCIATES' annual seminar in 1982 from general air pollution problems to concentrate on three subjects: ASBESTOS-FORMALDEHYDE-FIBERGLASS. This seminar had Dr. Selikoff as its keynote speaker in 1983 and 1985. This was the first regularly scheduled annual asbestos seminar in the country.
4. Provided key testimony at several N.J. asbestos Public Hearings and at USEPA Asbestos Public Hearings on May 7, 1984 in Washington, D.C.
5. Was selected to do asbestos inspection and testing for 15 major N.J. State buildings in Trenton. Became NJDEP Certified Asbestos Safety Technician #185.
6. By end of 1987, had 15 published articles or papers on asbestos problems.
7. Prepared and conducted asbestos test programs for:
   a. Cleaning a former asbestos gasket manufacturing plant for resale.
   b. Simulating test of asbestos gasket removal exposure during assembly and dissembly of U.S.N. pipe flanges.
8. Had provided court testimony in several asbestos workman's compensation and other cases.

By 1979 ROSSNAGEL & ASSOCIATES had moved into its own new three story 8,500 sq. ft. office and lab in Medford, N.J.

ROSSNAGEL & ASSOCIATES had conducted asbestos tests in over 500 schools in seven states. As a leader in that aspect of asbestos work, conducted the first asbestos seminar just for auto/truck/railroad brake overhaul/repair persons in conjunction with the NILFISK COMPANY.

In the Summer of 1985 spent two 4 day periods giving deposition testimony in San Francisco asbestos court case. In January 1986 ROSSNAGEL & ASSOCIATES was selected to write the asbestos removal specification for the Martin Luther King School in Philadelphia. This difficult project (because the school had been closed for five years due to asbestos contamination) included removal of over 715,000 sq. ft. of asbestos for $5 million. In May 1986 ROSSNAGEL & ASSOCIATES held its 14th Annual Air Pollution/Contamination Control Seminar in King of Prussia, Pa. This seminar was the leading annual asbestos meeting in the metropolitan area. Mr. Richard Young, Editor of POLLUTION ENGINEERING Magazine, was the keynote speaker.

On June 2, 1986, Bill Rossnagel sold ROSSNAGEL & ASSOCIATES to NORTHEASTERN ANALYTICAL CORPORATION.

W. B. Rossnagel has brought a unique level of expertise, as a licensed professional engineer in four states and as a Senior Member of the American Society for Quality Control, to provide a realistic appraisal of the airborne asbestos risk in our country today.

Bill Rossnagel is Certified for Asbestos Work as follows:

NJDEP Asbestos Safety Monitor #003 • AHERA Certified Asbestos Inspector BI-2-16
NJDEP Asbestos Safety Technician #185 • AHERA Certified Asbestos Manager #MP-170

A LIST OF ASBESTOS
RELATED ARTICLES OR PAPERS WRITTEN BY W. B. ROSSNAGEL, P.E.

	Title	Date	Designation
1.	"ASBESTOS CEILINGS - ARE THEY SAFE OR NOT"	1977, Revised 6/26/80	M128
2.	"REQUIREMENTS FOR ASBESTOS TESTING & REMOVAL"	1977	M138
3.	"O.S.H.A. FIBER & DUST TESTS"	1978, Revised 11/83	M139
4.	"MAKING DECISIONS TODAY ON ASBESTOS, FORMALDEHYDE & FIBERGLASS CONTAMINATION"	1982	M191
5.	"SUPPLEMENTAL INDOOR & OUTDOOR AIRBORNE ASBESTOS CONTAMINATION LEVEL DATA"	1982, Revised	M222
6.	"NOTIFICATION REQUIREMENTS RE FRIABLE ASBESTOS IN SCHOOL BUILDINGS"	1983	M224
7.	"A MUCH NEEDED DISCUSSION OF ASBESTOS AIR MONITORING SPECIFICATIONS"	1983	M251
8.	"THE CRISIS OF MISUNDERSTANDING ON AIRBORNE ASBESTOS LEVELS"	1984	M256
9.	"ASBESTOS TESTIMONY AT PUBLIC HEARINGS ON N.J. ASSEMBLY RESOLUTION 75"	11/14/84	
10.	"TESTIMONY OF W. B. ROSSNAGEL, P.E. AT EPA PUBLIC HEARINGS ON ASBESTOS IN WASHINGTON, D.C. ON MAY 7, 1984"	7/84	M258
11.	"THE REAL STORY ON ASBESTOS," presented to N.J. Public Advocate's Office on October 15, 1984	10/84	M264
12.	"THE REAL STORY ON THE ASBESTOS PROBLEM"	11/15/84	M269
13.	"CONSIDERATIONS IF YOU HAVE A SPRAYED-ON ASBESTOS CEILING PROBLEM"		Form 215
14.	"ASBESTOS--LET'S LOOK AT BOTH SIDES OF THIS CONTROVERSIAL ISSUE"	5/85	M316
15.	"COMPARATIVE LEVELS OF AIRBORNE ASBESTOS FIBERS"	8/85	
16.	"PROCEDURE FOR LIMITED REPAIRS & MAINTENANCE WORK AND MINOR REMOVAL OF MATERIAL IN BUILDINGS WHERE "SPRAYED-ON ASBESTOS IS KNOWN OR SUSPECTED TO BE PRESENT"	10/29/85	Procedure 263
17.	REVIEWING THE FIRST SCHOOL ASBESTOS PROJECT	4/91	M451

* Not available

ROSSNAGEL & ASSOCIATES

Customer Ed Moss

POLARIZED LIGHT MICROSCOPY RESULTS

Form #RA-214-4 F

Sample No.	1
Sample Identification (if other than Sample No.)	
Sample Taken From:	ASPHALT ROOFING MATERIAL
Analytical Method - PLM + Dispersion Staining	√
Gross Sample Appearance (note color)	BLACK ASPHALT WITH FIBERS
Sample Treatment (enter number) 1. Homogenized 2. Untreated	1, 2
Amount of Material Examined (mg)	15
Asbestos Present (enter number and percent) 1. Amosite 2. Chrysotile 3. Crocidolite 4. Other, specify (if possible)	2) 5-8% (SURFACE)
Percent Total Asbestos Present in Sample	5-8%
Other Fibrous Material Present (enter number and percent) 1. Fiberglass 2. Mineral Wool 3. Cellulose 4. Glass Wool 5. Other, specify (if possible)	3) 20-30% (INNER) MANMADE 5-7%
Nonfibrous Materials Present (description and percent) 1. Gypsum 2. Silicate 3. Sand 4. Cement 5. Mica 6. Other	(ASPHALT) CALCITE, QUARTZ

Prepared By: [signature] Date: 11/1/85 Approved: [signature] Date: 11/4

TESTIMONY

OF

W. B. ROSSNAGEL, P.E.

PRESIDENT

ROSSNAGEL & ASSOCIATES

234 ROUTE 70

MEDFORD, NJ 08055

(609) 654-1441

at the

USEPA PUBLIC HEARINGS ON ASBESTOS

on

May 7, 1984

in the

NORTH AUDITORIUM OF THE HEALTH & SERVICES NORTH BUILDING

330 Independence Avenue, SW

Washington, DC

ROSSNAGEL & ASSOCIATES

Engineering & Testing Consultants
Air - Water - Noise
234 Rt. 70 • Medford, N.J. 08055
(609) 654-1441

M262 B

BACKGROUND

My name is Bill Rossnagel. I am President of ROSSNAGEL & ASSOCIATES in Medford, New Jersey. We are one of the largest asbestos testing/consulting firms in the 9 state area from Massachusetts to Virginia. We did all the testing at the famous Howell Township, N.J. Ramtown School in 1977. That is the incident that triggered off the concern over asbestos in schools. We have tested asbestos in over 500 schools; in ships, tunnels, colleges, hospitals, state capitol buildings, etc. A further list of our experience is in the Appendix.

My own work with asbestos goes back 25 years when it was a problem in testing Polaris Gyros. Like thousands of other professional engineers (and architects), back in the 1960's I designed buildings which used asbestos containing materials. It was the right thing to do under the building codes of that time. In 1970 I founded my firm and we began doing bulk and airborne asbestos tests. In 1984 we were involved with the EPA in testing on the major Ambler, PA asbestos tailings waste pile project.

TESTIMONY

There are 5 basic points p ints in my testimony today. My first point is:

1) The USEPA, OSHA and the medical people have published the Airborne Asbestos Allowable Limits in a way which is misleading to the public. You probably are aware the limit, for 40 hours a week exposure (called the TLV■ or PEL▲), is now 2 fibers/cc or 2 fibers/milliliter (both designations mean the same) in the workplace.

SUMMARY OF ASBESTOS REQUIREMENTS - in fibers/ml or fibers/cc

Primary Requirements	Code from 6/72 to 7/76	Code from 7/76 to Now.	Proposed Code
1. Allowable Maximum Limit	10 fibers*	10 fibers*	5 or .5 fibers*
2. Allowable TWA (Time Weighted Average) for 8 hours exposure per day	5 fibers*	2 fibers*	.5 or .1 fibers*
* fiber defined as larger than 5 microns in length and having an aspect (length-to-diameter) ratio of at least 3:1.			

That designation makes the public think the level is near zero. They should have better explained what is shown on the following pages.

TLV - Threshold Allowable Limit - maximum concentration of a contaminant that an adult male can be safely exposed to for 40 hours a week, 50 weeks a year.

PEL - Permissible Exposure Limit - maximum concentration of a contaminant that an adult male can be safely exposed to for 40 hours a week, 50 weeks a year.

Rev. 5

SLIDE 2

2 fibers/cc = 2,000,000 fibers/cubic meter

- - - - - - - - - -

SLIDE 3

and a person breathes 3-9 cubic meters/day (or more)

- - - - - - - - - -

Let's take the example of a relatively low outdoor/indoor airborne concentration of asbestos fibers. Let's assume a recognized very low concentration of .003 fibers/milliliter, which is the same as 3,000 fibers/cubic meter. If a person breathes at a:

Low Breathing Capacity & Rate

3 cubic meters/day x 3,000 = 9,000 asbestos fibers/day

High Breathing Capacity & Rate

9 cubic meters/day x 3,000 =27,000 asbestos fibers/day

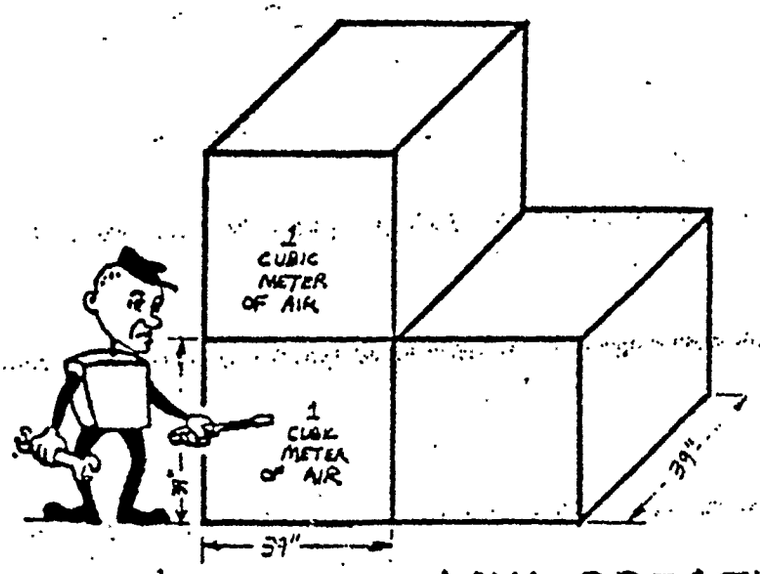
This is illustrated in Slide 4 which is also shown on the following page.

That is the way test data and the allowable limits should be presented. They should talk about numbers of 9,000 to 27,000 asbestos fibers a day that you and I, in this meeting today and travelling to and from it, will breathe. If the majority of the public knew that fact, they might take a second look before removing asbestos from some buildings with very, very little damage and a non-friable cementitious type asbestos ceiling that is above the reach of the students.

One more quick comment. ROSSNAGEL & ASSOCIATES has often been accused of being "against removal". That simply is not true. Our firm recommended over $6 million in asbestos removal work in schools in 1983 alone.

I also want to state that I have talked with persons suffering with mesothelioma, and who later died from it--only then can one really appreciate this American tragedy.

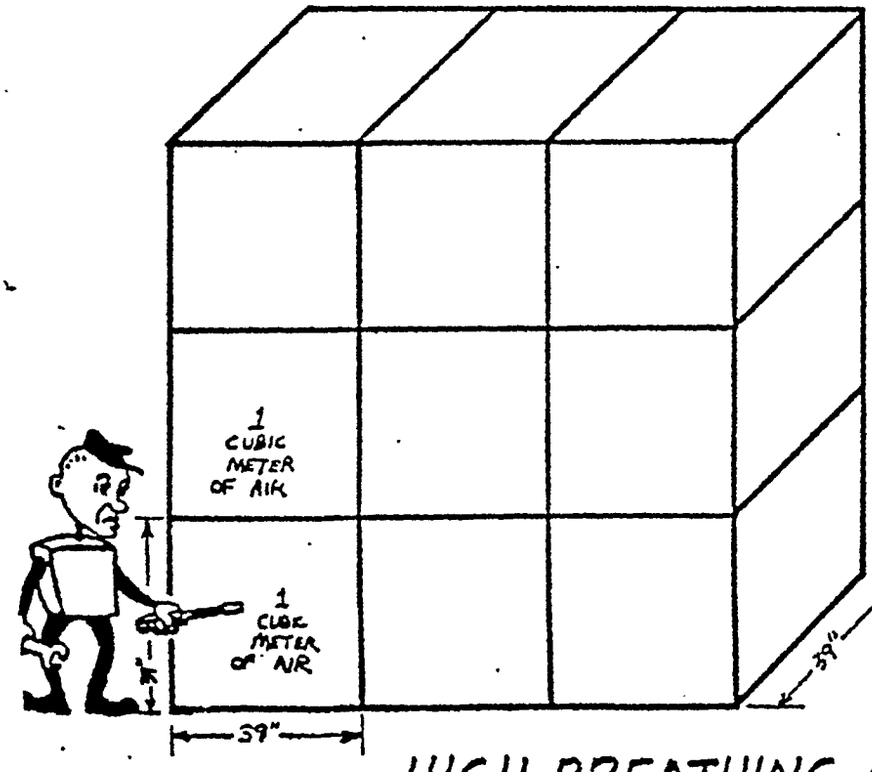
PERSPECTIVE ON THE AIR WE BREATHE



LOW BREATHING CAPACITY & RATE

2 liters/minute × 60 minutes × 24 hours = 3 cubic meters/day

If the airborne asbestos level is a very low .003 fibers/milliliter, then under this condition a person will breathe .003 × 1,000,000 × 3 = 9,000 asbestos fibers/day.



6 liters/minute × 60 minutes × 24 hours = 9 cubic meters/day

If the airborne asbestos level is a very low .003 fibers/milliliter, then under this condition a person will breathe .003 × 1,000,000 × 9 = 27,000 asbestos fibers/day

HIGH BREATHING CAPACITY & RATE

ed by ROSSNAGEL & Assoc.
ledford, N.J. 3/12/84

FIGURE I

Rev. B

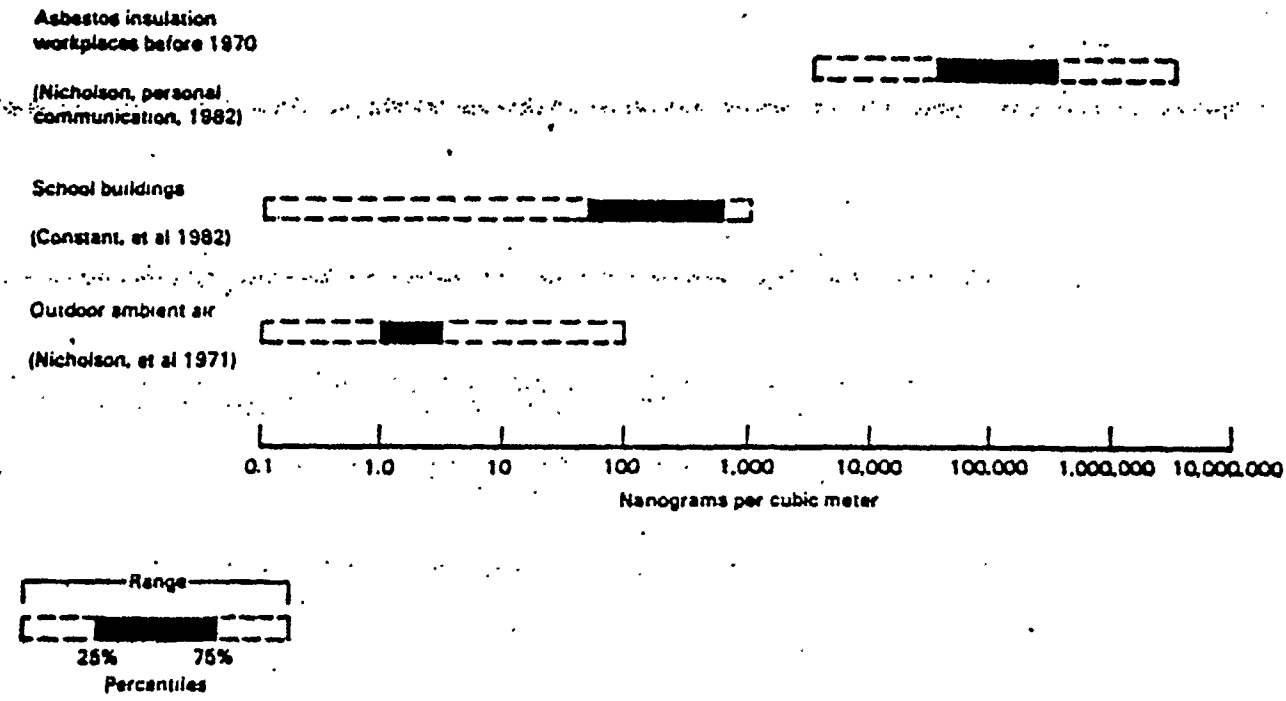
SLIDE 5

Here is my second point:

2) The EPA issued 2 asbestos guideline manuals in 1979, referred to in the industry as the Part I & II "orange" books, and another guideline "blue" book in 1981. The only presentation in all 3 of their books on the ambient asbestos levels was this EPA graph shown on Page 5.1 (Also Slide 6)

While the footnote on this EPA slide explains the data shown was by 2 significantly different test methods, the EPA ignored PCM (Phase Contrast Microscopy) data it had which would have helped provide a comparison based on similar test methods. The EPA disregarded the PCM data used by over 5 governmental agencies or profession societies (see Page 10) for over 25 years.

Figure 1. Comparison of measured airborne asbestos concentrations in three settings.*



*Levels in asbestos workplaces were derived from measurements using phase contrast microscopy (PCM) while levels in school buildings and outdoors were measured using electron microscopy (EM). PCM and EM measurements are not directly comparable. PCM measures all fibers whereas EM can distinguish between asbestos and nonasbestos fibers. In addition, EM has a better capability than PCM for detecting small fibers. In order to translate the workplace PCM measurements (expressed as fiber counts) into values of asbestos mass (nanograms) that are approximately comparable to EM measurements, 30 fibers were assumed to equal one nanogram. This value is an average obtained from many comparisons of PCM and EM measurements taken at the same location (industrial settings) and time. Values for individual samples range from about 10 fibers per nanogram of asbestos to well over 100 fibers per nanogram, depending on the average size of fibers and the relative number of asbestos and nonasbestos fibers in the air (Versar 1980 and William Nicholson, personal communication, 1982).

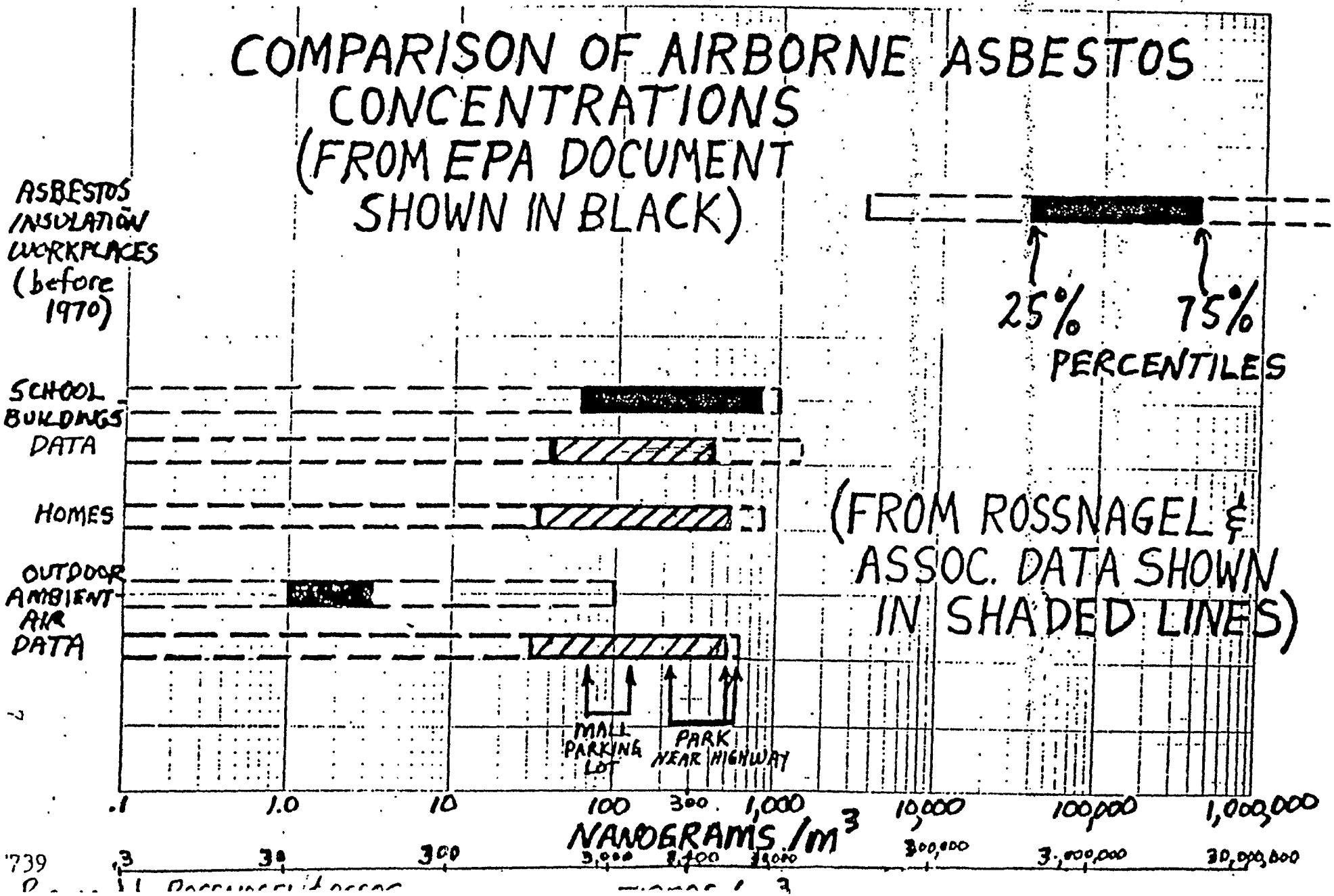
SLIDE 6

1-5

And the EPA did not make it easy for the industry and public to understand this graph. You will note the "X axis" is in the units "nanograms/cubic meter". Less than .01% of all the airborne asbestos made to date have the units used by the EPA. The EPA should have added the widely used "fibers/cc" as shown in this graph we overlaid on the EPA graph (using the EPA conversion factor of 30:1): The EPA used nanograms/cubic meter which requires an expensive Transmission Electron Microscopy (T.E.M.) Analysis. The cost of T.E.M. is 7 times that of PCM.

SLIDE 7

SLIDE 7


COMPARISON OF AIRBORNE ASBESTOS CONCENTRATIONS (FROM EPA DOCUMENT SHOWN IN BLACK)
ASBESTOS INSULATION WORKPLACES (before 1970)
25%
75%
PERCENTILES
SCHOOL BUILDINGS DATA
HOMES
OUTDOOR AMBIENT AIR DATA
(FROM ROSSNAGEL & ASSOC. DATA SHOWN IN SHADED LINES)
MALL PARKING LOT
PARK NEAR HIGHWAY
.1
1.0
10
100
300
1,000
10,000
100,000
1,000,000
NANOGRAMS/m3
3
30
300
3,000
30,000
300,000
3,000,000
30,000,000

739

You will note also that our data shows a much higher level of ambient asbestos, almost equal to the level in the schools. We have been unable to find out where the EPA ambient data was taken--but it must have been a very pristine location. All our over two hundred airborne asbestos tests in homes, stores, outdoors, parks, parking lots, playgounds, etc. show the ambient level in urban areas to be as shown on Page 7. This is over a hundred times higher than the EPA ambient level shown on Page 9.

The EPA has done little to explain to the American public that the average American will breathe perhaps 9,000 to 27,000 (or more) asbestos fibers TODAY. If you have a son who shoots baskets near a busy street--or a friend who jogs along a road, they may breathe up to 50,000 asbestos fibers in a day. This may be the first time many of you have heard this--because the agencies have rarely compared the test results to the amount of air (3-9 cubic meters) that a person can be expected to breathe every day.

Please do not conclude from Pages 5.1 and 7 that the asbestos levels in all schools is equal to the ambient level. The graph shows the 25% and 75% percentiles. Of course many hundreds of schools had to have asbestos removed because they are extreme cases beyond th percentile limits.

My third point is:

3) The EPA should have told all this to the American public--and particularly to the school board members anquishing over the costly decisions on whether to remove, enclose, encapsulate or do nothing about the asbestos in some school ceilings and pipes. They should also have been told that after the asbestos has been removed the airborne level of asbestos in the school will not be zero--but will be equal to the ambient level in that neighborhood as shown on Page 9.

SLIDE 8

For example, in a city school surrounded by 2-4 story "brownstone" or similar houses, the street becomes a "canyon" holding high levels of airborne asbestos from the vehicular brakes. If it has not rained for several days, that level could be proportionally high as shown by Ambient Level 3 on Page 9.

SLIDE 8

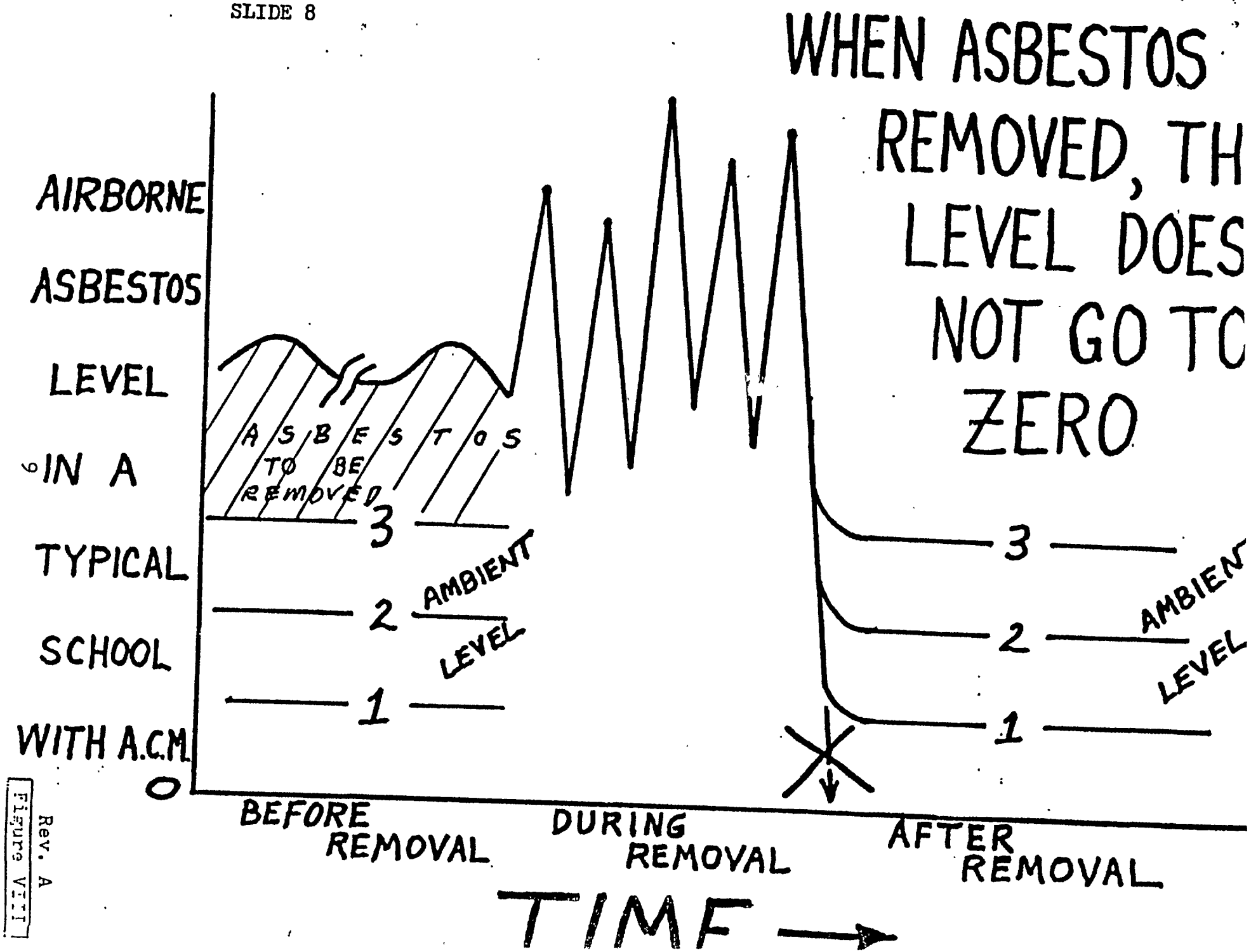


Figure VIII
Rev. A

4) If the EPA had better explained the airborne asbestos levels, then they could have better explained the conflicts arising when they state that even 1 asbestos fiber can cause mesothelioma....yet the EPA algorithm allows a risk level of 12 out of 162.

SLIDE 9

The EPA has also opposed airborne asbestos tests--even those tests (designated as NIOSH Test Method 239) which have been accepted in courts for years and has been used by the following 5 agencies <u>each for over 25 years</u>:

SLIDE 10

a) Occupational Safety & Health Administration
b) National Institute of Occupational Safety & Health
c) American Industrial Hygiene Association
d) American Conf. of Gov't. Industrial Hygienist
e) U.S. Bureau of Mines

Since asbestos is primarily only a problem when it is airborne, what is more accurate to test it than an airborne test very similar to the way in which a person breathes, as shown in these slides:

SLIDE 11

SLIDE 12

The EPA has consistantly opposed airborne asbestos tests.

The major concern is not whether a school ceiling has 5% or 50% asbestos as indicated in the bulk test. I would rather have my childrer in a school with 50% asbestos which is bound in tight (non-friable) than in a school with friable 5% asbestos ceilings. The question is how much of that asbestos is friable and becomes airborne because of:

- vandalism
- building vibration
- temperature changes
- air movement
- sloppy maintenance
- roof and pipe leaks
- drying out of A.C.M.
- other causes

To determine that one needs an air test, after the bulk test has confirmed the material to contain asbestos.

My fifth and final point is:

5) The EPA established the June 27, 1983 school inspection deadline--but they did not require a copy of the school's asbestos "Notification Sheets" to be forwarded to either the EPA or the applicable state agency. The present EPA audit of schools shows that many schools did not comply with those June 27, 1983 requirements. Other agencies also have outlined in detail the shortcomings of the EPA's Asbestos Control Program.

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4022 Stonehaven Rd.
South Euclid, Ohio
(216) 382-1719

AIR - WATER - ENERGY - INDUSTRIAL HYGIENE - NOISE -- WASTE

- STACK & EXHAUST TESTING
- DESIGN OF AIR/WATER/NOISE POLLUTION CONTROL SYSTEMS
- BACTERIA / MOLD / FUNGUS / SPORES
- SPECIFICATIONS / DRAWINGS
- WATER / WASTEWATER / SLUDGE
- CHEMICAL ANALYSES. R.C.R.A.
- GAS CHROMATOGRAPHY. I.R. & A.A.
- ENVIRONMENTAL IMPACT STUDIES

PLM ASBESTOS TEST REPORT # 22,437

Nov. 8, 1985

Lab Report # 19,229

To: Moss, Powers & Lezenby
7 East Main St.
Moorestown, NJ 08057

Attention: Mr. Ed Moss, Atty.

The results of the analysis of the bulk sample(s) submitted on Oct. 29, 1985 to ROSSNAGEL & ASSOCIATES for analysis by Polarized Light Microscopy (PLM) and Dispersion Staining are shown on the following page.

If you wish a further analysis, ROSSNAGEL & ASSOCIATES can conduct any of the tests or analyses shown on Page 3 of this report.

Other Comments:
Some asbestos fibers were found below the surface of the material. Cellulose was the primary fiber type inside the layers. This material is not friable. The asphaltic surface coating had to be removed by scraping to expose the asbestos fibers.

Analysis by: S. Harris / WBR
Skip Harris
Industrial Hygienist
ROSSNAGEL & ASSOCIATES

Approved by: W. B. Rossnagel
W. B. Rossnagel, P.E.
President
ROSSNAGEL & ASSOCIATES

SH/jar
cc: WBR

Notes: 1) This report pertains only to the sample or source tested. Information contained herein is not to be reproduced outside of the Buyer's company, in whole or in part, without the prior written approval of ROSSNAGEL & ASSOCIATES, or the Buyer.

2) The liability of ROSSNAGEL & ASSOCIATES and its divisions, with respect to the services charged for herein, shall in no event exceed the amount of the invoice.

ROSSNAGEL & ASSOCI

Customer Ed Moss

POLARIZED LIGHT MICROSCOPY RESULTS

Sample No.	1
Sample Identification (if other than Sample No.)	
Sample Taken From:	ASPHALT ROOFING MATERIAL
Analytical Method - PLM + Dispersion Staining	√
Gross Sample Appearance (note color)	BLACK ASPHALT WITH FIBERS
Sample Treatment (enter number) 1. Homogenized 2. Untreated	1, 2
Amount of Material Examined (mg)	15
Asbestos Present (enter number and percent) 1. Amosite 2. Chrysotile 3. Crocidolite 4. Other, specify (if possible)	2) 5-8% (SURFACE)
Percent Total Asbestos Present in Sample	5-8%
Other Fibrous Material Present (enter number and percent) 1. Fiberglass 2. Mineral Wool 3. Cellulose 4. Glass Wool 5. Other, specify (if possible)	3) 20-30% (INNER) MAN-MADE 5-7%
Nonfibrous Materials Present (description and percent) 1. Gypsum 2. Silicate 3. Sand 4. Cement 5. Mica 6. Other	(ASPHALT) CALCITE, QUARTZ

Prepared By: [signature] Date: 11/1/85 Approved: [signature] Date: 11

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N. B. ROSSNAGEL

PROFESSIONAL RESUME ON ASBESTOS

After 2 years in the USN in which he received 14 months of radar school training, N. B. Rossnagel entered Stevens Institute of Technology. During college, he formed a TV repa- business (ROSSNAGEL TV) in Fair Lawn, N.J. Upon graduation 1952, the business had a store, 2 trucks and 5 employees. Bill operated the service business while he was employed at Bendix, McAvoy Target Co. and at Kearfott. In 1956, he sold it when he was promoted at Kearfott and he got married.

At Kearfott, Bill was Assistant Manager of the Experimental Assembly Shop where contamination problems were a major problem in the final testing of Polaris Gyros. It was here that he first worked with asbestos as it was a contaminant in the crucial balancing of the gyros. Bill spent long hours under microscopes studying the various types of asbestos dust and fiberglass contaminants.

In 1960, Bill designed an 11,000 sq.ft. indoor shooting range with asbestos insulation and sound deadening materials. Like other engineers and architects, little was known then of the health problems with asbestos. During the early 1960's (he was by then Reliability Test Manager at Walter Kidde Co.) his work on air contamination problems in gyro and early electronic "clean rooms" was well enough known that he was part of the committee that wrote Rev. A to FEDERAL STANDARD 209 entitled, "CLEAN ROOMS." By 1968, Bill had over 30 published articles--and 3 of them were on air contamination and clean room problems.

In 1966, after 1-1/2 years as Quality Control and Test Manager at VECTOR DIVISION OF UNITED AIRCRAFT in Trevose, Pa. (an early leader in computer ship manufacture), Bill joined the RE-ENTRY & ENVIRONMENTAL SYSTEMS DIVISION OF GENERAL ELECTRIC in Philadelphia, Pa. Here he was for 3-1/2 years in charge of 325 persons handling all the component Q.C. & Test for Minute Man Missiles and space satallites. Since this work involved much

his special experience on testing and contamination problems made him a long-distance traveler. He made over 20 trouble-shooting trips to California during this time.

In early 1970, the Minute Man program development was completed, Bill left G.E. and formed ROSSNAGEL & ASSOCIATES. Within a few months, his new firm was conducting all kinds of airborne tests, including asbestos; clean room tests in hospitals.

By 1976, ROSSNAGEL & ASSOCIATES was larger than all the other air testing firms combined.

In 1977, ROSSNAGEL & ASSOCIATES was picked by the N.J. Dept. of Health to conduct the airborne and bulk asbestos tests at the Ramtown School in Howell Township, N.J. Those tests brought the school asbestos problem to the forefront with national TV coverage. Within a month after that, W. B. Rossnagel wrote his first article on asbestos, entitled, "ASBESTOS CEILINGS--ARE THEY SAFE OR NOT?" It is the first article listed on the attached Form #752.

ROSSNAGEL & ASSOCIATES has been a leader since then in all aspects of asbestos removal/encapsulation/enclosure/repair work, by performing the following:

1) Wri[illegible]g the 1st asbestos removal specification in the [illegible]ountry in 1977.

2) Performing test work from California to Egypt--and asbestos testing/consulting in schools, hospitals, ships, tunnels, manufacturing plants

3) Switching their annual seminar in 1982 from general air pollution problems to concentrate on 3 subjects: ASBESTOS-FORMALDEHYDE-FIBERGLASS. This seminar had Dr. Selikoff as its keynote speaker in 1983. It is the only regularly scheduled annual asbestos seminar in the country.

4) Providing key testimony at several N.J. asbestos Public Hearings and at the USEPA Asbestos Public Hearings on May 7, 1984 in Washington

5) Being selected to do the asbestos inspection and testing for major N.J. State buildings in Trenton.

6) By the end of 1984, W. B. Rossnagel had 10 published articles or papers on asbestos problems

7) Prepared and conducted test programs for:

a) cleaning a former asbestos gasket manufacturing plant for resale

b) simulating a test of asbestos gasket removal exposure during assembly and disassembly of USN pipe flanges

8) Has provided court testimony in several asbestos workman's compensation cases.

W. B. Rossnagel has brought a unique level of expertise, as a licensed professional engineer in 4 states and as a Senior Member of the American Society for Quality Control, to provide a realistic appraisal of the airborne asbestos risk in our country today.

ROSSNAGEL & ASSOCIATES has conducted asbestos tests in over 500 schools in 7 states. They conducted the original major test program for SEARS in their auto brake shops. As a leader in that aspect of asbestos work, ROSSNAGEL & ASSOCIATES conducted the first asbestos seminar just for auto/truck/railroad brake overhaul/repair persons in conjunction with the NILFISK CO. on October 23, 1984. Over 45 persons attended.

Our lab is certified under the following programs:

- NJDEP and EPA Water Testing, Lab #03117 NJ.
- NIOSH Asbestos Fiber Counting, PAT Lab #08003-001.
- EPA Interlab Quality Assurance Survey #C-08006.
- EPA Polarized Light Microscopy--through our associate Jim McVeigh (Lab #776).
- Polarized Light Microscopy by our own industrial hygienist Skip Harris who is a graduate of the McCrone Microscopy Institute in Chicago, Illinois.

LIST OF ARTICLES ON ASBESTOS BY W. B. ROSSNAGEL, P.E.

		YEAR
M128 -	"ASBESTOS CEILINGS--ARE THEY SAFE OR NOT?"	1977
M138 -	"REQUIREMENTS FOR ASBESTOS TESTING & REMOVAL"	1977
M139 -	"OSHA FIBER & MINERAL DUST TESTS"	1978
M191 -	"MAKING DECISIONS TODAY ON ASBESTOS, FORMALDEHYDE & FIBERGLASS CONTAMINATION"	1982
M222 -	"SUPPLEMENTAL INDOOR & OUTDOOR AIRBORNE ASBESTOS CONTAMINATION LEVEL DATA"	1982
M224 -	"NOTIFICATION REQUIREMENTS RE FRIABLE ASBESTOS IN SCHOOL BUILDINGS"	1983
M251 -	"A MUCH NEEDED DISCUSSION OF ASBESTOS AIR MONITORING SPECIFICATIONS"	1983
M256 -	"THE CRISIS O' MISUNDERSTANDING ON AIRBORNE ASBESTOS LEVELS," PRESENTED TO SERVICE EMPLOYEES INT'L. UNION IN WASHINGTON D.C. ON MARCH 16, 1984	1984
M258 -	TESTIMONY OF W. B. ROSSNAGEL, P.E. AT EPA PUBLIC HEARINGS ON ASBESTOS IN WASHINGTON, D.C. ON May 7, 1984	1984
M264 -	"THE REAL STORY ON ASBESTOS," PRESENTED TO NEW JERSEY PUBLIC ADVOCATE'S OFFICE IN TRENTON, NJ on October 15, 1984	1984

W. B. ROSSNAGEL IS ALSO THE EDITOR OF THREE 35 MM SLIDE AUDIO/VISUAL TAPES (EACH 30 MINUTES DURATION) ON ASBESTOS AS LISTED BELOW:

ASBESTOS PART I -"ASBESTOS: A CHRONOLOGICAL HISTORY OF THIS HEALTH PROBLEM"

ASBESTOS PART II -"ASBESTOS: IMPORTANT DECISIONS TO BE MADE"

ASBESTOS PART III -"A CLARIFICATION OF TESTING METHODS"

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