36817

# NEW VERNON RESIDENTIAL ASBESTOS AIR INVESTIGATION

## MEYERSVILLE, NEW JERSEY


PREPARED BY:

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ENVIRONMENTAL RESPONSE TEAM
EMERGENCY RESPONSE DIVISION
OFFICE OF EMERGENCY & REMEDIAL RESPONSE


ABD 001 1771

## BACKGROUND

The air sampling conducted in this study was a result of consultation between EPA Region II, the Agency for Toxic Substance and Disease Registry, and the Environmental Response Team (ERT) based upon the results from the analysis of the vacuum bag and water samples collected from homes associated with the activities being conducted for the New Vernon Road/ Whitebridge Road asbestos sites in Meyersville, New Jersey.

## METHODOLOGY

Sampling methodology details may be found in the copy of the enclosed sampling plan.

The Teilman and Kehoe residences were sampled aggressively on October 16, 1990 and again on October 23 once the decontamination process had been completed. Each sampling round consisted of 5 sampling locations in the Teilman's residence and 4 in the Coho. Both rounds were taken at the same locations.

Two background homes, selected by EPA,in consultation with ATSDR, were sampled for an approximate twelve hour period versus a 14 hour period due to access time constraint coupled with occupancy of the homes at the time the sampling was conducted. Occupancy of the background homes prevented either of the homes from being aggressively sampled as it was agreed prior to the sampling event that those who chose to remain in their home during the sample period would not be subjected to increased dust and/or potential fiber entrainment thereby increased risk of exposure which may possibly have occurred by aggressively sampling. Attempts to produce a background home for aggressive sampling were unsuccessful.

All protocols outlined in the aforementioned Sampling Plan were strictly adhered to.

All samples were analyzed by Electron Microscopy Service Laboratory, Inc. following the EPA Level II Yamate et al. methodology and reporting additional criteria as outlined by the ERT per conference call ( 10-2-90) involving EPA Region II, ATSDR, and ERT specifically: fiber/cc volume count, length, diameter and fiber type. Additional details for analytical methodology may be found in the enclosed analytical report including procedure, count sheet and xerox of the photographs submitted as part of their final data package.

## RESULTS/DISCUSSION

Table 1.1, Section I, summarizes the results of the sampling effort. Additional information, for example breakdown of the size of the structure identified and all additional count sheets and accessory tables may be found in Appendix A. A cursory glance, in light of the expedience with which this issue is being dealt

with, tends to indicate that a majority of the asbestos structures which were identified were less than 5 microns. ATSDR had expressed interest in those fibers equal to or greater than 5 microns in length as those are the focus of health concerns. Additional counts to include all identifiable asbestos structures was suggested by ERT. Note in Table 1.1 that the concentration of structures greater than 5 microns is 0.0013 fibers/cc at its maximum in any of the samples. This value, in turn, is less than the total identifiable structure total of 0.0032 fibers/cc maximum concentration. All sets values reported for both criteria are below the discussed action limit of 0.01 fibers/cc. In comparison, the clearance round of samples in the Teilman and Coho residence demonstrated lower levels that the initial effort.

In Region II and ATSDR's evaluation of the data generated with respect to health risk analysis, it may be interesting to note some of the conclusions drawn in the EPA Environmental Asbestos Assessment Manual: Superfund Method for the Determination of Asbestos in Ambient Air, Part 2: Technical Background Document (Interim Version) (EPA/540/2-90/005b). Section 4.2, when discussing risk assessment objectives with reference to 95% Poisson confidence, states, " it is reasonable to assume that a minimum of 10 structures need to be counted at the concentration of interest to distinguish concentrations that differ by a factor of five." Note that no one filter produced more than 5 identifiable asbestos structures. While fibers were identified, their statistical significance may wished to be viewed with caution.

Background sample produced no identifiable asbestos fibers. This can be attributed to the fact the homes were passively sampled thereby not creating the worst conditions in the home if, in fact, fibers did exist in these homes, or the homes may not have contained any asbestos material.

One final consideration. All the vacuum and water samples collected and analyzed for asbestos produced >1% of asbestos material. This included the Teilman and Coho residence. Aggressively sampling the Teilman and Coho residences produced the worst case scenario for ambient air asbestos sampling as these homes were identified as those having the greatest potential for contamination and exposure from the asbestos containing fill material. The results produced from this sampling effort demonstrated extremely low levels, below the aforementioned 0.01 fiber/cc clean-up level instituted at Grammacy Park, NY. Consideration should be given to the usefulness of any additional air sampling in the other homes. Results thus far lend support to the assumption that similar below action limit and risk levels exist in the other homes. Again, this is only offered as a consideration to the time and effort required to sample the additional homes and the usefulness of the data which would be produced.

## I. BACKGROUND

The residences under consideration for the air monitoring effort in New Vernon, NJ are homes which may possibly have been contaminated from asbestos containing fill material brought to the New Vernon Road and Whitebridge Road locations.

## II. SAMPLING PLAN

The purpose of this sampling effort is to provide data for ATSDR and EPA to asses the risk associated with the living conditions at the aforementioned residences.

### A. Sampling Locations

Per residence, 2-3 sampling locations will be selected in the most heavily occupied rooms with a contingecy plan selecting up to five rooms should such efforts be required to accurately assess the area. Locations will be dependant upon resident information as well as professional judgment. Consideration will be given to occupancy, volume of travel through the area which may entrain any fibers into the air pathway, as well as access areas which may have potentially higher fiber contamination due to outdoor to indoor tracking of ACM (Asbestos Containing Material) debris by physical means.

Consideration will also be given with respect to the layout of the house, for example, ranch versus split level.

### B. Aggressive vs. Nonaggressive

Aggressive sampling will be conducted in homes which have agreed to vacate the premises for a time period adequate enough for sample results to be obtained indicating that reoccupancy will pose no threat from the fibers entrained into the air from the aggressive effort. The aggressive measure will simulate normal household activities which may possibly entrain any fibers present into the air pathway.

Nonaggressive sampling will occur in homes where occupants chose to remain during the sampling period. Their normal activities would provide the intrusive activity which may entrain any fibers present into the air pathway.

### C. Number and Duration of Samples

At each location, one medium volume Gilian AIRCON 520 pump will operate at a flow rate of approximately 12 liters per minute for approximately 14 hours to achieve a total sample volume of 10,000 liters recommended for risk level detection limits. Background will be obtained from at least one and up to three residence chosen by Region II EPA in consultation with ATSDR or area ambient asbestos information acquired from the State of New Jersey.

D. Sampling Methodology and Procedure

Each sampler will be equipped with a 25mm, 0.45 micron cellulose ester fiber filter with 50 mm extension cowl as specified in NIOSH method 7402: Asbestos Fibers. Pumps will draw a flow rate of approximately 12 liters per minute for a 14 hour period totaling 10,000 liters in volume.

Aggressive and nonaggressive procedures will be instituted as sampling requirements warrant.

Each sampler will be pre and post sampling calibrated with a representative sampler in line using a rotameter which in turn has been calibrated by a Gilian Gilibrator Soap Bubble Calibration System to 12 liters per minute. Both flows will be recorded and the average will serve as the sample flow rate.

Analysis will follow NIOSH method 7402 for Asbestos Fibers utilizing Transmission Electron Microscopy. The lab will be instructed to analyze to a detection limit of 0.01 fiber/cc as discussed by EPA and ATSDR or another limit if one has been selected. The lab will also be instructed to perform two counts. The first will analyze for the criteria outlined by ATSDR representatives per the October 2, 1990 conference call. Those criteria are fiber/cc volume, fiber length greater than or equal to 5 microns, fiber diameter and fiber type. A second count will be requested which will include ALL identifiable asbestos fibers.

Field datasheets will be used to collect all data relevant to the air sampling effort. Specifically:

- o The date and personnel visiting the site
- o Name and address of the residence
- o Location of the samplers
- o Pre and Post flow rates
- o Start and stop times
- o Aggressive or nonaggressive sampling
- o Additional information as pertains

Chain of custody forms will be executed at the time of filter removal and will accompany filters to the lab.

Appropriate field and lot blanks will be submitted for the sampling effort.

Analysis will be performed by an American Industrial Hygiene Accredited Laboratory with experience in Asbestos in air.

cc: Millington Asbestos

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Appendix will be furnished on request.

## INTRODUCTION

REAC Laboratory, in response to ERT work assignment 3347-21-01-3426, provided analytical services for air samples collected from the Millington Asbestos Dump Site, in Millington, NJ on August 16, 17, 18, and 22, 1990. These services involved the subcontracted analyses for asbestos and a final report summarizing the analytical results.

Upon receiving the samples in the laboratory the sample custodian followed standard procedures for inspection of the chain-of-custody and record keeping for sample tracking.

The analyses were performed by Electron Microscopy Service Laboratories, Inc., in Westmont, NJ.

Section I

## PROCEDURE FOR ASBESTOS

The procedure of G. Yamate, S. C. Agarwal and R. D. Gibbons given in "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy", draft report 1984, Washington, DC; Office of Research and Development, USEPA, Contract # 68-02-3266 was followed.

The samples were prepared by first coating them with a thin layer of carbon, then examining a 3mm x 3mm square by TEM at 20000 power. The samples were examined by morphological observation, selected area electron diffraction and energy dispersive X-ray analysis. USEPA level II protocol was followed in analysing the samples.



ABD 001 1779

Table 1.1 Results of the Asbestos Analysis
for Millington Asbestos Dump Site
Project # 3426

| Sample ID | Location | Volume (Liters) | Type of Asbestos Detected | # of Structures detected** Asb | NonAsb | Concentration of Asbestos Structures Detected AFP/cc | | AFP/cc >5* | Mass ng/m3 | Mass >5* ng/m3 |
|---|---|---|---|---|---|---|---|---|---|---|
| 04841 | Bedroom | 8746.20 | ND | 0 | 2 | 0.0004 | DL | 0.0000 | 0.0000 | 0.0000 |
| 04843 | Basement | 8765.00 | ND | 0 | 6 | 0.0004 | DL | 0.0000 | 0.0000 | 0.0000 |
| 04844 | Family Room | 7431.25 | ND | 0 | 828 | 0.0004 | DL | 0.0000 | 0.0000 | 0.0000 |
| 04845 | Lot Blank | ---- | ND | 0 | 0 | 0.0032 | DL | 0.0000 | 0.0003 M | 0.0000 |
| 04846 | Field Blank | ---- | ND | 0 | 0 | 0.0032 | DL | 0.0000 | 0.0003 M | 0.0000 |
| 04831 | Upstairs Family Room | 8773.75 | ND | 0 | 11 | 0.0004 | DL | 0.0000 | 0.0000 | 0.0000 |
| 04833 | Upstairs Family Room CBZ | 8771.25 | ND | 0 | 3 | 0.0004 | DL | 0.0000 | 0.0000 | 0.0000 |
| 04835 | Downstairs Family Room | 8850.00 | ND | 0 | 2 | 0.0004 | DL | 0.0000 | 0.0000 | 0.0000 |
| 04837 | Master Bedroom | 8776.25 | ND | 0 | 75 | 0.0004 | DL | 0.0000 | 0.0000 | 0.0000 |
| 04832 | Field Blank | ---- | ND | 0 | 0 | 0.0032 | DL | 0.0000 | 0.0003 M | 0.0000 |
| 04834 | Lot Blank | ---- | ND | 0 | 0 | 0.0032 | DL | 0.0000 | 0.0003 M | 0.0000 |
| 04861 | Resid #1/Kitchen 4' | 10184.10 | Chr Act | 5 | 36 | 0.0032 | | 0.0013 | 4.3678 | 4.2982 |
| 04869 | Resid #1/Kitchen 4' | 10199.00 | Chr Act | 5 | 38 | 0.0031 | | 0.0006 | 0.4436 | 0.0000 |
| 04867 | Resid #1/Kitchen | 10220.10 | Chr | 2 | 56 | 0.0009 | | 0.0004 | 0.0346 | 0.0000 |
| 04868 | Resid #1/Baby Rm | 10338.80 | Chr | 1 | 137 | 0.0004 | | 0.0004 | 0.1009 | 0.0000 |
| 04870 | Resid #1/Bedroom | 10416.30 | Chr | 2 | 52 | 0.0012 | | 0.0006 | 9.4349 | 9.4345 |
| 04862 | Resid #2/LR | 10011.60 | Chr | 2 | 36 | 0.0013 | | 0.0006 | 0.0540 | 0.0000 |
| 04851 | Resid #2/LR | 10510.50 | Chr | 5 | 58 | 0.0031 | | 0.0006 | 0.3474 | 0.0000 |
| 04852 | Resid #2/BR | 10368.80 | Chr Act | 3 | 35 | 0.0019 | | 0.0006 | 3.4865 | 3.2808 |
| 04853 | Resid #2/Den | 10313.80 | Chr Act | 2 | 36 | 0.0012 | | 0.0006 | 5.6912 | 5.4971 |
| 04866 | Field Blank #1 | ---- | ND | 0 | 1 | 0.0032 | DL | 0.0000 | 0.0003 M | 0.0000 |
| 04864 | Field Blank #2 | ---- | ND | 0 | 0 | 0.0032 | DL | 0.0000 | 0.0003 M | 0.0000 |
| 04865 | Lot Blank | ---- | ND | 0 | 0 | 0.0032 | DL | 0.0000 | 0.0003 M | 0.0000 |
| 04971 | #1, Baby Rm | 10136.3 | Chr | 1 | 7 | 0.0006 | | 0.0006 | 0.0658 | 0.0000 |
| 04972 | #1, Bedroom | 10125.0 | ND | 0 | 27 | 0.0003 | | 0.0000 | 0.0000 | 0.0000 |
| 04973 | #1, K./Liv. Rm | 9967.8 | Chr | 3 | 17 | 0.0019 | DL | 0.0006 | 0.2803 | 0.1883 |
| 04974 | #1, K./Liv. Rm | 9988.7 | Chr | 1 | 11 | 0.0005 | | 0.0005 | 0.0252 | 0.0000 |
| 04975 | #1, K./Liv. Rm | 10003.4 | Chr | 1 | 42 | 0.0006 | | 0.0006 | 0.0250 | 0.0000 |
| 04976 | #2, Bedroom | 10053.9 | ND | 0 | 161 | 0.0003 | DL | 0.0000 | 0.0000 | 0.0000 |
| 04977 | #2, Den | 10110.0 | Chr | 2 | 108 | 0.0013 | | 0.0006 | 0.5456 | 0.5184 |
| 04978 | #2, LR | 10126.3 | Chr | 1 | 69 | 0.0005 | | 0.0005 | 0.0498 | 0.0498 |
| 04979 | #2, LR | 10130 | Chr | 1 | 35 | 0.0006 | | 0.0006 | 0.5174 | 0.5174 |
| 04980 | Lot Blank | ---- | ND | 0 | 0 | 0.0032 | | 0.0000 | 0.0003 M | 0.0000 |
| 04981 | FB 1 | ---- | ND | 0 | 0 | 0.0032 | | 0.0000 | 0.0003 M | 0.0000 |
| 04982 | FB 2 | ---- | ND | 0 | 0 | 0.0032 | | 0.0000 | 0.0003 M | 0.0000 |

AFP denotes Asbestos Fibrous Particles
ND denotes Not Detected
Chr denotes Chrysotile
Act denotes Actinolite
* Asbestos structures greater than 5 micron in length
** Asb denotes Asbestos
** NonAsb denotes Non Asbestos
DL for blanks, number of AFP in millions of fibers/filter otherwise AFP/cc for ND results



ABD 001 1780

**Roy F. Weston, Inc.**
REAC, Edison, N.J.
EPA Contract 68-03-3482

# CHAIN OF CUSTODY RECORD/LAB WORK REQUEST

No: 3379 ABD 001 1781

SHEET NO. 1 OF 1

Project Name: Millington Asbestos / Garrison Residence
Project Number: 3347-21-01-3426
RFW Contact: Chris Schultze Phone: 201-632-9200 Due Date:

**SAMPLE IDENTFICATION** / **ANALYSES REQUESTED**

| Sample No. | Sampling Location | Matrix | Date Collected | Container/Preservative | Analysis | Vol. Coll. | | | |
|---|---|---|---|---|---|---|---|---|---|
| 04831 | Upstairs Family Room | .45(Air) | 10-17-90 | None .45 NCEF Cassette | TEM | 8773.75 l | | | |
| 04833 | Upstairs Family Room CBZ | .45(Air) | 10-17-90 | | TEM | 8771.25 l | | | |
| 04835 | Downstairs Family Room | .45(Air) | 10-17-90 | | TEM | 8850.0 l | | | |
| 04837 | Master Bedroom | .45(Air) | 10-17-90 | | TEM | 8776.25 l | | | |
| 04832 | Field Blank | .45(Air) | 10-17-90 | | TEM | 0 l | | | TNB |
| 04834 | Lot Blank | .45(Air) | 10-17-90 | | TEM | 0 l | | | |
| | | | | | | | | | TNB |

Matrix:
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

Special Instructions: * CBZ - Child Breathing Zone

| Items/Reason | Relinquished By | Received By | Date | Time | Items/Reason | Relinquished By | Received By | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| 6 for Analysis | Theresa A. N. Barbon | Kim Grace | 10/18/90 | 1354 | | | | | |

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ABD 001 1782

Appendix II

## QA/QC FOR ASBESTOS

The subcontrating laboratory supplied a photograph of a Chrysotile and an Actinolite particle, for sample 04861. Also supplied, was an Energy Dispersive Analysis (EDX), for both types of particle.

A photograph of a Chrysotile particle, an electron diffraction pattern, and an Energy Dispersive Analysis spectrum for sample 04971 was also supplied.



ABD 001 1783

Figure 1 Chrysotile Particle From Sample 04861 (Resid_#1, Kitchen 4')

ABD 001 1784

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Figure 2 Energy Dispersive Analysis for the Chrysotile Particle From Sample 04861 (Resid #1, Kitchen 4')

SPECTRUM LABEL

SPECTRUM FILE NAME

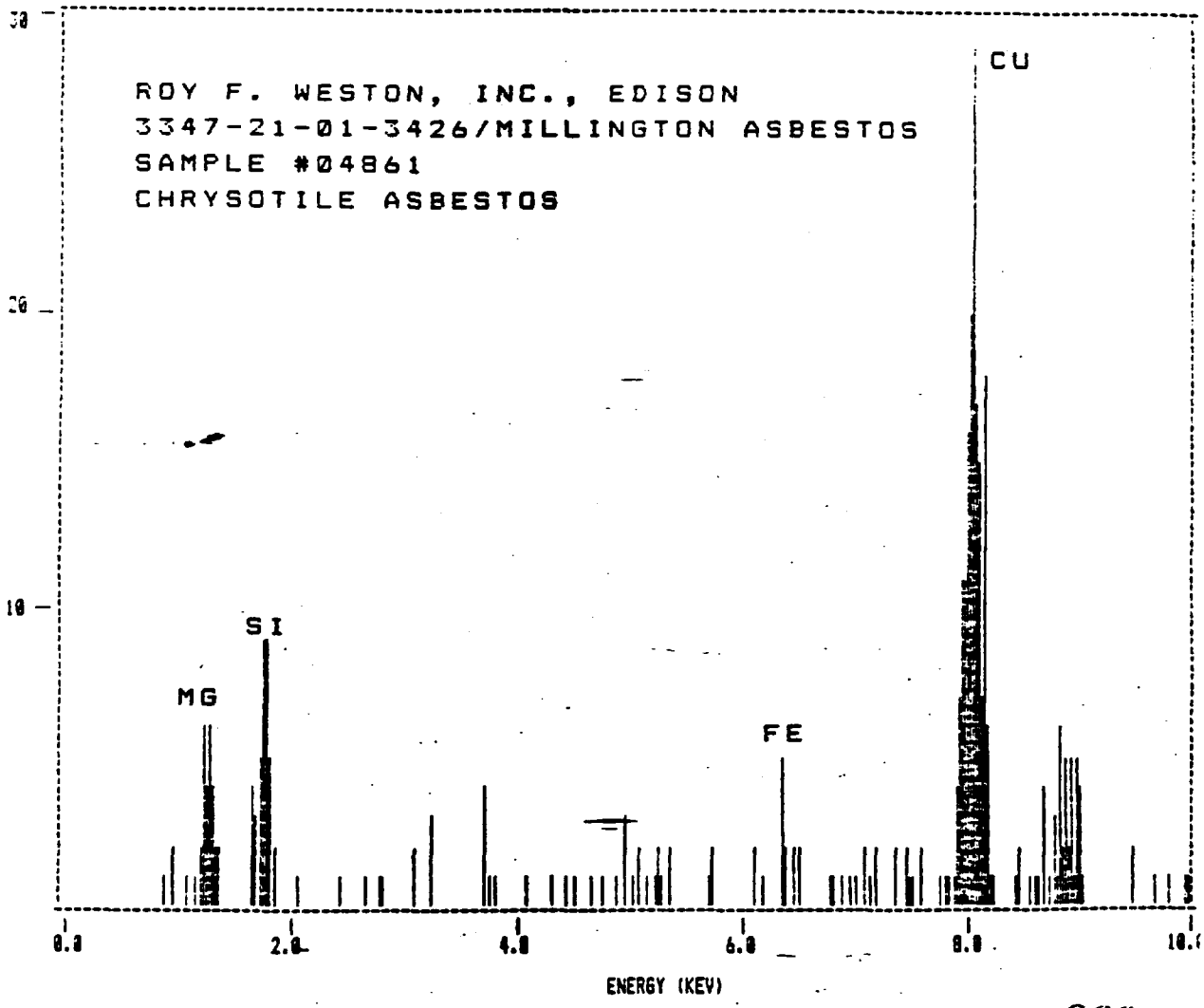


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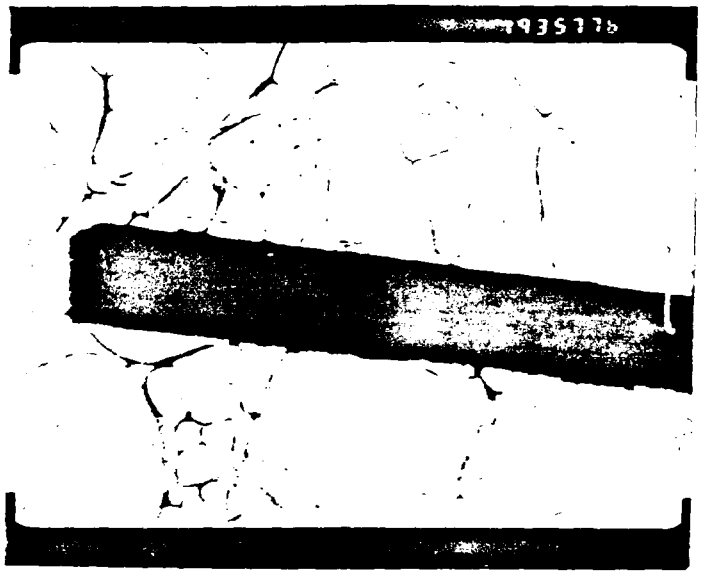
Figure 3 Actinolite Particle and Electron Diffraction Pattern For Sample 04861 (Resid #1, Kitchen 4')



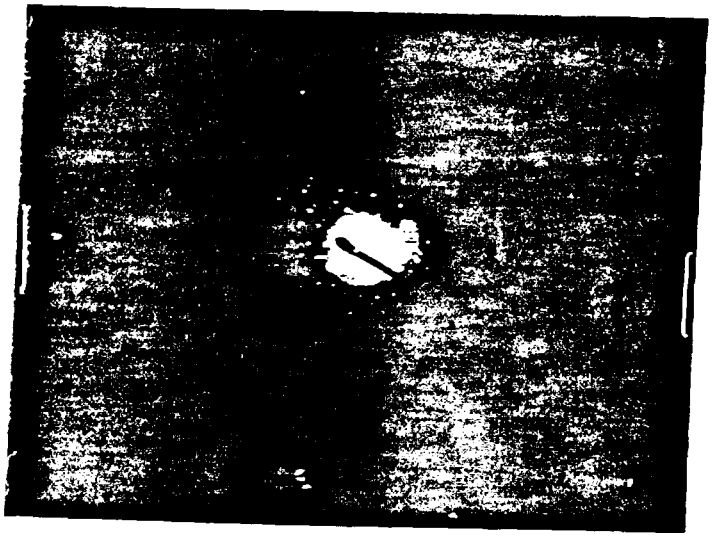


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Figure 4 Energy Dispersive Analysis for the Actinolite Particle From Sample 04861 (Resid #1, Kitchen 4')

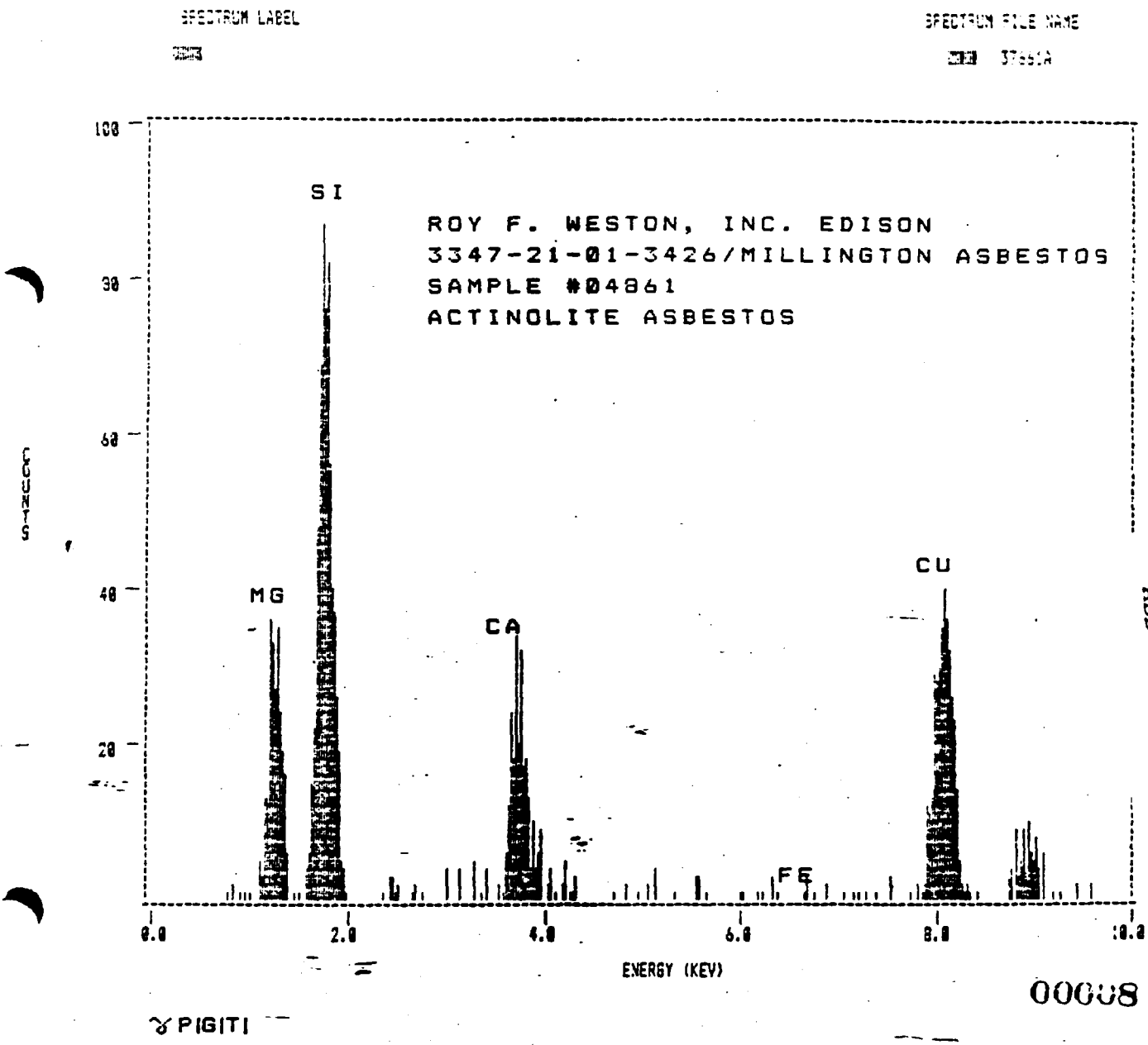


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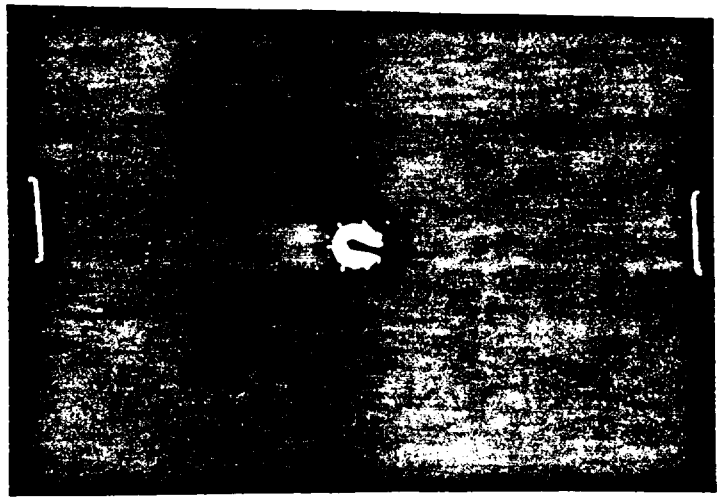
Figure 5 Chrysotile Particle and Electron Diffraction Pattern From Sample 04971 ( #1, Baby Room)



ABD 001 1788

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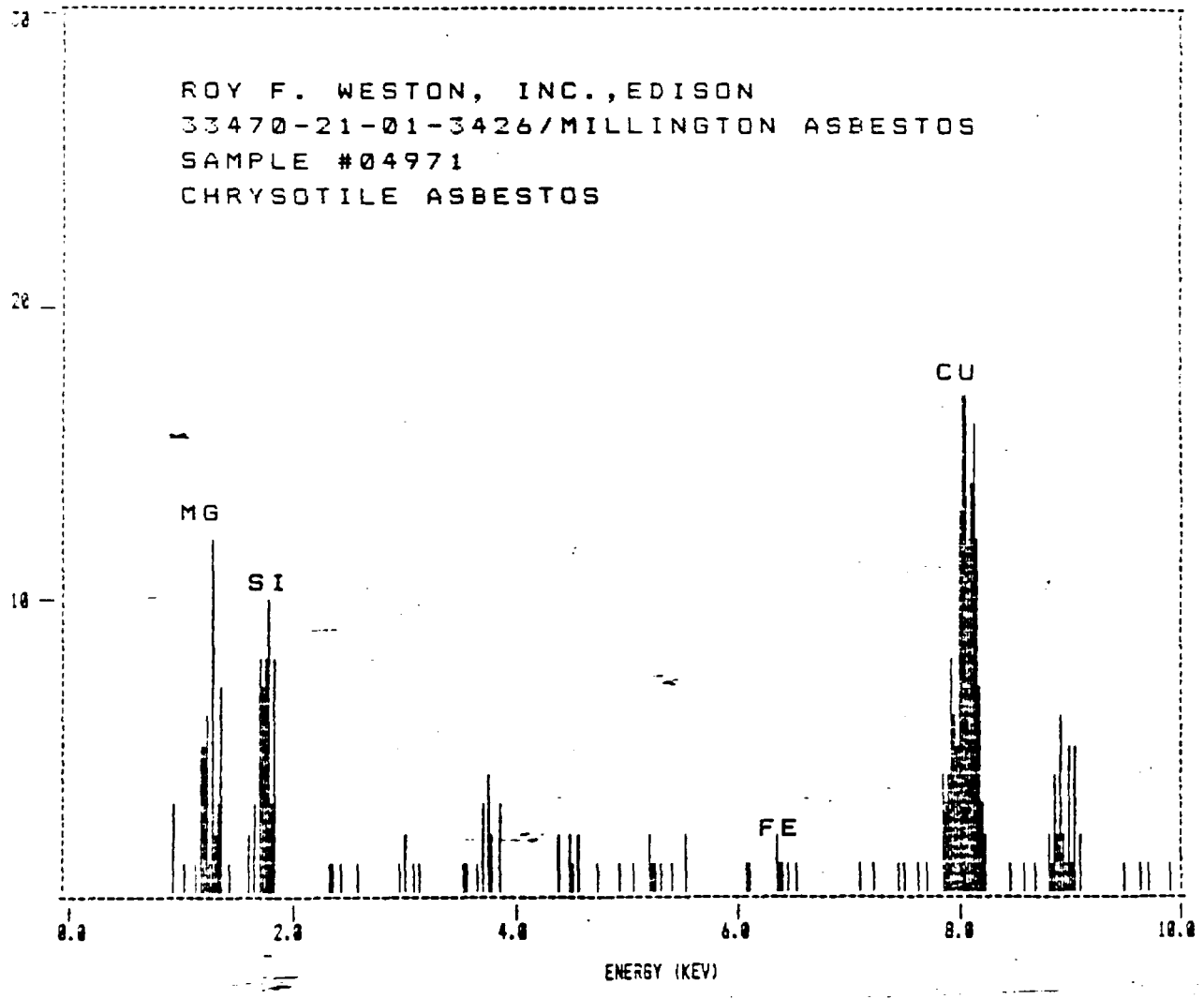
Figure 6 Energy Dispersive Analysis for the Chrysotile Particle From Sample 04971 ( #1, Baby Room)

SPECTRUM LABEL

SPECTRUM FILE NAME

33150

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Section III

**Roy F Weston, Inc.**
REAC, Edison, N.J.
EPA Contract 68-03-3482

# CHAIN OF CUSTODY REC RD/LAB WORK REQUEST

No: 3382

SHEET NO 1 OF

Project Name: Millington Asbestos
Project Number: 3347-21-01-3426
RFW Contact: Chris Schultze Phone 201-632-9200 Due Date (Final) 10/19/90

**SAMPLE IDENTFICATION** / **ANALYSES REQUESTED**

| Sample No. | Sampling Location | Matrix | Date Collected | Container/Preservative | Vol. Coll | TEM | | | |
|---|---|---|---|---|---|---|---|---|---|
| 04861 | Resid. #1 / Kitchen 4' | A | 10/16/90 | .45 um Filter | 10,184.1 l | ✓ | | | |
| 04869 | Resid #1 / Kitchen 1' | A | 10/16/90 | .45 um filter | 10,177.0 l | ✓ | | | |
| 04867 | Resid #1 / Kitchen | A | 10/16/90 | .45 um filter | 10,220.1 l | ✓ | | | |
| 04868 | Resid #1 / Baby Rm. | A | 10/16/90 | .45 um filter | 10,335.5 l | ✓ | | | |
| 04870 | Resid #1 / Bedroom | A | 10/16/90 | .45 um filter | 10,416.3 l | ✓ | | | |
| 04862 | Resid. #2 / LR | A | 10/16/90 | .45 um filter | 10,011.6 l | ✓ | | | |
| 04851 | Resid. #2 / LR | A | 10/16/90 | .45 um filter | 10,510.5 l | ✓ | | | |
| 04852 | Resid. #2 / BR | A | 10/16/90 | .45 um filter | 10,328.8 l | ✓ | | | |
| 04853 | Resid. #2 / den | A | 10/16/90 | .45 um filter | 10,313.8 l | ✓ | | | |
| 04866 | Field Blank 1 | A | 10/16/90 | .45 um filter | 0 l | ✓ | | | |
| 04864 | Field Blank 2 | A | 10/16/90 | .45 um filter | 0 l | ✓ | | | |
| 04865 | Lot Blank | A | 10/16/90 | .45 um filter | 0 l | ✓ | | | |

TNB

TNB

**Matrix:**
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

**Special Instructions:**

| Items/Reason | Relinquished By | Received By | Date | Time | Items/Reason | Relinquished By | Received By | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| 12 for Analysis | Theresa N. Bowlin | Schultze | 10/17/90 | 9 AM | | | | | |
| to lab | Schultze | M. Prego | 10/17/90 | 9 AM | | | | | |
| for Analysis | M. Prego | K.R. Wendell | 10/17/90 | 10:25 AM | | | | | |

ABD 001 1791

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Roy . . Weston, Inc.
REAC, Edison, N.J.
EPA Contract 68-03-3482

# CHAIN OF CUSTODY RECORD/LAB WORK REQUEST

No. 3401

SHEET NO. 1 OF 1

Project Name: Millington Asbestos
Project Number: 3347-21-01-3426
RFW Contact: Chris Schultze Phone: 201-632-9200 Due Date: 10/24/90

SAMPLE IDENTFICATION / ANALYSES REQUESTED

| Sample No. | Sampling Location | Matrix | Date Collected | Container/Preservative | Vol. Coll. | TEM | | | |
|---|---|---|---|---|---|---|---|---|---|
| 04971 | #1, Baby Rm | A | 10/22/90 | .45u filter | 10,136.3 l | ✓ | | | |
| 04972 | #1, Bedroom | A | 10/22/90 | .45u filter | 10,125.0 l | ✓ | | | |
| 04973 | #1, K./Liv. Rm. | A | 10/22/90 | .45u filter | 9967.8 l | ✓ | | | TNB |
| 04974 | #1, K./Liv. Rm. | A | 10/22/90 | .45u filter | 9988.7 l | ✓ | | | |
| 04975 | #1, K./Liv. Rm | A | 10/22/90 | .45u filter | 10,003.4 l | TNB ✓ | | | |
| 04976 | #2, Bedroom | A | 10/22/90 | .45u filter | 10,053.9 l | ✓ | 10,053.9 l TNB | | |
| 04977 | #2, den | A | 10/22/90 | .45u filter | 10,110.0 l | ✓ | | | |
| 04978 | #2, LR | A | 10/22/90 | .45u filter | 10,126.3 l | ✓ | | | |
| 04979 | #2, LR | A | 10/22/90 | .45u filter | 10,130 l | ✓ | | | |
| 04980 | lot Blank | A | 10/22/90 | .45u filter | 0 l | ✓ | | | |
| 04981 | FB 1 | A | 10/22/90 | .45u filter | 0 l | ✓ | | | TNB |
| 04982 | FB 2 | A | 10/22/90 | .45u filter | 0 l | ✓ | | | |

TNB

Matrix:
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

Special Instructions: A - Air

| Items/Reason | Relinquished By | Received By | Date | Time | Items/Reason | Relinquished By | Received By | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| 12/Analysis | [illegible] | K.R. Wendell | 10/23 | 9AM | | | | | |

ABD 001 1792

00012

**Roy F. Weston, Inc.**
REAC, Edison, N.J.
EPA Contract 68-03-3482

# CHAIN OF CUSTODY RECORD/LAB WORK REQUEST

No: 3380

Project Name: Millington Asbestos / Huhn Residence
Project Number: 3347-21-01-3426
RFW Contact: Chris Schultze Phone: 201-632-9200 Due Date: 24 Hr. Verbals finals in 3 days

SHEET NO. 1 OF 1

ABD 001 1793

00013

**SAMPLE IDENTFICATION** / **ANALYSES REQUESTED**

| Sample No. | Sampling Location | Matrix | Date Collected | Container/Preservative | Vol. coll. | TEM | | | |
|---|---|---|---|---|---|---|---|---|---|
| 04841 | Bedroom (Air) | 45 um | 10-18-90 | .45 um filter | 8746.2 l | ✓ | | | |
| ~~04842 SMB~~ | | | ~~10-18-90~~ | ~~.45 um filter~~ | | | | | |
| 04843 | Basement | Air | 10-18-90 | .45 um filter | 8765.0 l | ✓ | | | |
| 04844 | Family Room | Air | 10-18-90 | .45 um filter | 7431.25 l | ✓ | | | |
| 04845 | Lot Blank | Air | 10-18-90 | .45 um filter | 0 l | ✓ | | | |
| 04846 | Field Blank | Air | 10-18-90 | .45 um filter | 0 l | ✓ | | | |

TRB

INB

**Matrix:**
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

**Special Instructions:**

| Items/Reason | Relinquished By | Received By | Date | Time | Items/Reason | Relinquished By | Received By | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| Filters/Impinger | [signature] | Theresa Bourbon | 10/19/90 | 8:15am | Standards | Theresa Bourbon | Michael Morgan | 10/19/90 | 11:50am |
| Samples/Analysis | Michael Morgan | Kevin Jones | 10/19/90 | | | | | | |

Appendix A.

PROJECT _____ Continued From Page _____

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9033833 | HEALTH & HYGIENE 04 | 0 | | 0 | 1710 | 10 | 0.0035 | 4 |
| 033834 | 05 | 0 | | 0 | 1710 | 10 | 0.0035 | 4 |
| | 9-27-90 | | | | | | | |
| 9035473 | NATIONAL LAB. 03 | 0 | | 1 | 1235.5 | 10 | 0.0049 | 4 |
| 9035474 | 04 | 0 | | 0 | 1225 | 10 | 0.0049 | 4 |
| 9035475 | 05 | 0 | | 0 | 1237.5 | 10 | 0.0049 | 4 |
| 9035474 SR | 04 | 0 | | 0 | 1225 | 10 | 0.0049 | 4 |
| 9035354 | CONTEST JRA-092090-03 | 0 | | 4 | 2549 | 10 | 0.0024 | 2 |
| 9035355 | JRA-092190-03 | 53 | C | 0 | 3120 | 2 | 0.5113 | 2 |
| 9035356 | -09 | 2 | C+A | 4 | 1917 | 10 | 0.0063 | 2 |
| 9035357 | -09 | 0 | | 0 | 1984 | 10 | 0.0030 | 2 |
| 9035358 | -10 | 21 | C+A | 2 | 1736 | 10 | 0.0728 | 2 |
| 9035359 | -12 | 0 | | 1 | 1525 | 10 | 0.0039 | 2 |
| 9035822 | BRANDYWINE PECO-1 | 1 | A | 2 | 1127 | 10 | 0.0057 | 2 |
| 9035823 | -2 | 0 | | 0 | 1127 | 20 | 0.0028 | 2 |
| 9035824 | -3 | 0 | | 0 | 1672 | 20 | 0.0019 | 2 |
| | 9-28-90 | | | | | | | |
| 9035765 | HEALTH & HYGIENE R01 | 0 | | 8 | 1393 | 20 | 0.0023 | 2 |
| 9035842 | CRITERION A5291-6 | 0 | | 1 | 1370.6 | 10 | 0.0044 | 2 |
| 9035843 | -7 | 0 | | 3 | 1370.6 | 10 | 0.0044 | 2 |
| 9035844 | -8 | 0 | | 0 | 1409.76 | 10 | 0.0043 | 2 |
| 9035581 | AET P-73 | 0 | | 0 | 1540 | 10 | 0.0039 | 2 |
| | 10-4-90 | | | | | | | |
| 9036261 | TRC 232-7965 | 0 | | 8 | 3474 | 20 | 0.0009 | 2 |
| 9036262 | 237-7965 | 0 | | 6 | 3252 | 20 | 0.0010 | 2 |
| | 10-17-90 | | | | | | | |
| 9036941 | CONTEST AET- | 0 | | | BULK | 25 lb | — | 4 |
| 9037671 | WESTON 08864 | 0 | | 0 | BLANK | 20 | 0.0032 | 4 |
| 9037672 | 5 | 0 | | 0 | BLANK | 20 | 0.0032 | 4 |
| 9037670 | 6 | 0 | | 1 | BLANK | 20 | 0.0032 | 4 |

Continued on Page

Read and Understood By

Signed _____ Date 10/17/90 Signed _____ Date _____

A 00071

ABD 001 1795

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

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WESTMONT, N.J.
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1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

RECEIVED
OCT 19 1990
S&A

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

Project : 3247-21-01-3426/Millington Asbestos

## TEM SUMMARY REPORT

| SAMPLE ID | VOLUME (liters) | TYPE OF ASBESTOS | # STRUCTURES ASB | # STRUCTURES NONASB | CONCENTRATION OF ASBESTOS STRUCTURES AFP/cc | AFP/cc >5 | MASS | MASS >5 |
|---|---|---|---|---|---|---|---|---|
| 04861 | 10184.10 | Chrysotile,Actinolite | 5 | 36 | 0.0032 | 0.0013 | 4.3678 | 4.2982 |
| 04869 | 10199.00 | Chrysotile,Actinolite | 5 | 38 | 0.0031 | 0.0006 | 0.4436 | 0.0000 |
| 04867 | 10220.10 | Chrysotile | 2 | 56 | 0.0009 | 0.0004 | 0.3346 | 0.0000 |
| 04868 | 10338.30 | Chrysotile | 1 | 137 | 0.0004 | 0.0004 | 0.1009 | 0.0000 |
| 04870 | 10416.30 | Chrysotile | 2 | 52 | 0.0012 | 0.0006 | 9.4249 | 9.4345 |
| 04862 | 10011.60 | Chrysotile | 2 | 36 | 0.0013 | 0.0006 | 0.0540 | 0.0000 |
| 04851 | 10510.50 | Chrysotile | 5 | 58 | 0.0031 | 0.0006 | 0.3474 | 0.0000 |
| 04852 | 10368.90 | Chrysotile,Actinolite | 3 | 35 | 0.0019 | 0.0006 | 3.4865 | 3.2908 |
| 04853 | 10313.80 | Chrysotile,Actinolite | 2 | 36 | 0.0012 | 0.0006 | 5.6912 | 5.4971 |
| 04866 | Blank | none detected | 0 | 1 | 0.0032 | 0.0000 | 0.0003 | 0.0000 |
| 04864 | Blank | none detected | 0 | 0 | 0.0032 | 0.0000 | 0.0003 | 0.0000 |
| 04865 | Blank | none detected | 0 | 0 | 0.0032 | 0.0000 | 0.0003 | 0.0000 |

For none detected samples number under AFP/cc and MASS are detection limits.
AFP - Asbestos Fibrous Particulates.
AFP/cc - Concentration of Asbestos in AFP/cc; for blank sample AFP/cc represents number of AFP in million Fibers/Filter.
AFP/cc >5 - Concentration due to AFP greater than or equal to 5 microns in length.
MASS - Mass of AFP in ng/m³; for blank sample MASS reopresents the mass of AFP in ng/Filter.
MASS >5 - Mass due to AFP equal to or greater than 5 microns in length.

A 00001

ABD 001 1796

G. K. Mahoney

Peter Frasca, PH.D.
President

Laboratoy
Supervisor

Approved
Signatory

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

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609-858-4800

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PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-2426/Millington Asbestos
SAMPLE IDENTIFICATION : 04861
LOCATION : Resid. #1/Kitchen 4'
VOLUME : 10184.100 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 5 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 36 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile,Actinolite |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0032 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(40.0 %) (in AFP/cc or million/m³) | 0.0013 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 4.3678 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (98.4 %) (in nanograms/m³ ) | 4.2982 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Fibers Containing: (K,Ca).

ABD 001 1797

R.K. Mahoney
Approved Signatory

Peter Frasca, PH.D.
President

Laboratory Supervisor

A 00002

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04861

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 4 | 1 | 0 | 36 | 5 | 41 |
| # of Particulates on Whole Filter (in millions): | 0.0257 | 0.0064 | 0.0000 | 0.2310 | 0.0321 | 0.2631 |
| Concentration of Particulates (in million/m³): | 0.0025 | 0.0006 | 0.0000 | 0.0227 | 0.0032 | 0.0258 |
| % of Count due to Particulates ≥ 5 µm in length: | 25.000% | 100.000% | 0.000% | —— | 40.000% | —— |
| % Count due to Fibers: | 0.000% | 100.000% | 0.000% | —— | 20.000% | —— |
| % Count due to Matrices: | 100.000% | 0.000% | 0.000% | —— | 80.000% | —— |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.1925 | 0.1753 | —— | —— | 4.3678 | —— |
| % of Mass due to Particulates ≥ 5 µm in length: | 63.830% | 100.000% | —— | —— | 98.406% | —— |
| % Mass due to Fibers: | 0.000% | 100.000% | —— | —— | 95.593% | —— |
| % Mass due to Matrices: | 100.000% | 0.000% | —— | —— | 4.407% | —— |
| % Mass due to Bundles: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Clusters: | 0.000% | 0.000% | —— | —— | 0.000% | —— |

ABD 001 1798

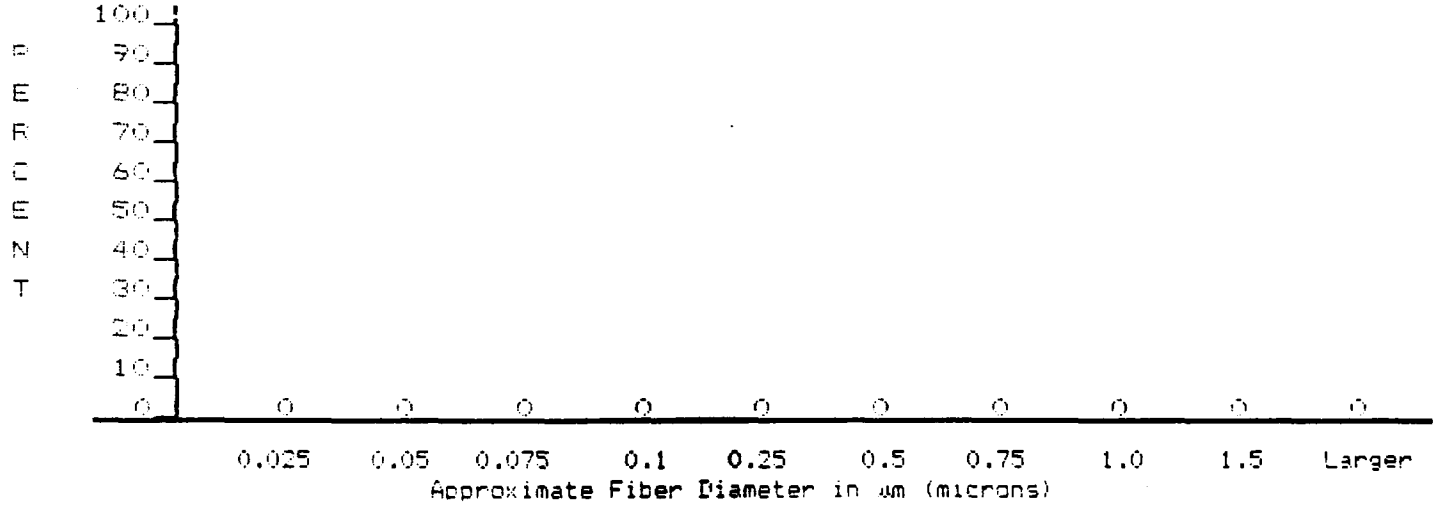
A 00003

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

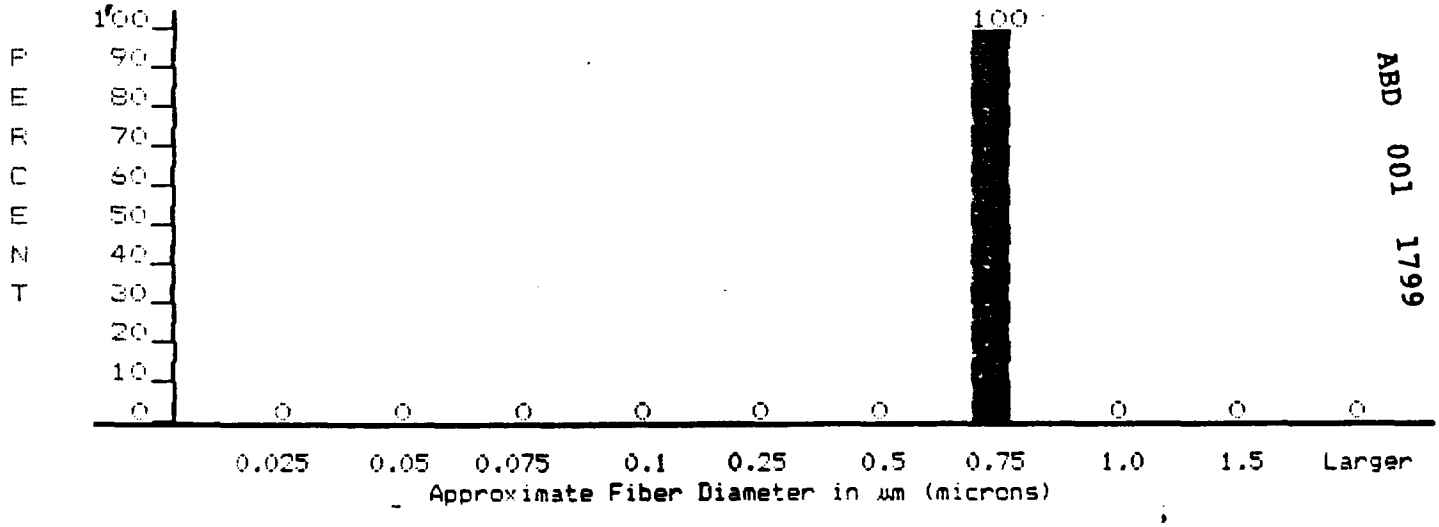
Sample : 04861

# AMPHIBOLES

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




*Sum of both histograms represents 100% of Amphibole fibers.

ABD 001 1799

A 00004

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet.

Sample: 04861

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 4 | | nonasbestos | | | | |
| 1 | 5 | matrix | chrysotile | 2.000 | 0.1000 | 0.1000 | 0.0520 |
| 2 | 6 - 8 | | nonasbestos | | | | |
| 2 | 9 | matrix | chrysotile | 1.250 | 0.1000 | 0.1000 | 0.0325 |
| 3 | 10 - 13 | | nonasbestos | | | | |
| 4 | 14 - 15 | | nonasbestos | | | | |
| 5 | 16 - 17 | | nonasbestos | | | | |
| 5 | 18 | matrix | chrysotile | 1.000 | 0.1000 | 0.1000 | 0.0260 |
| 5 | 19 | fiber | actinolite | 5.000 | 0.7500 | | 6.6268 |
| 6 | 20 - 21 | | nonasbestos | | | | |
| 7 | 22 - 24 | | nonasbestos | | | | |
| 8 | 25 - 30 | | nonasbestos | | | | |
| 9 | 31 - 37 | | nonasbestos | | | | |
| 9 | 38 | matrix | chrysotile | 7.500 | 0.1000 | 0.1000 | 0.1950 |
| 10 | 39 - 41 | | nonasbestos | | | | |

Mass of Chrysotile Particulates 0.3055
Mass of Amphibole Particulates 6.6268
Total Mass of Asbestos Particulates 6.9323

ABD 001 1800

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio $\geq$ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

A 00005

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample : 04861

Chrysotile

ABD 001 1801

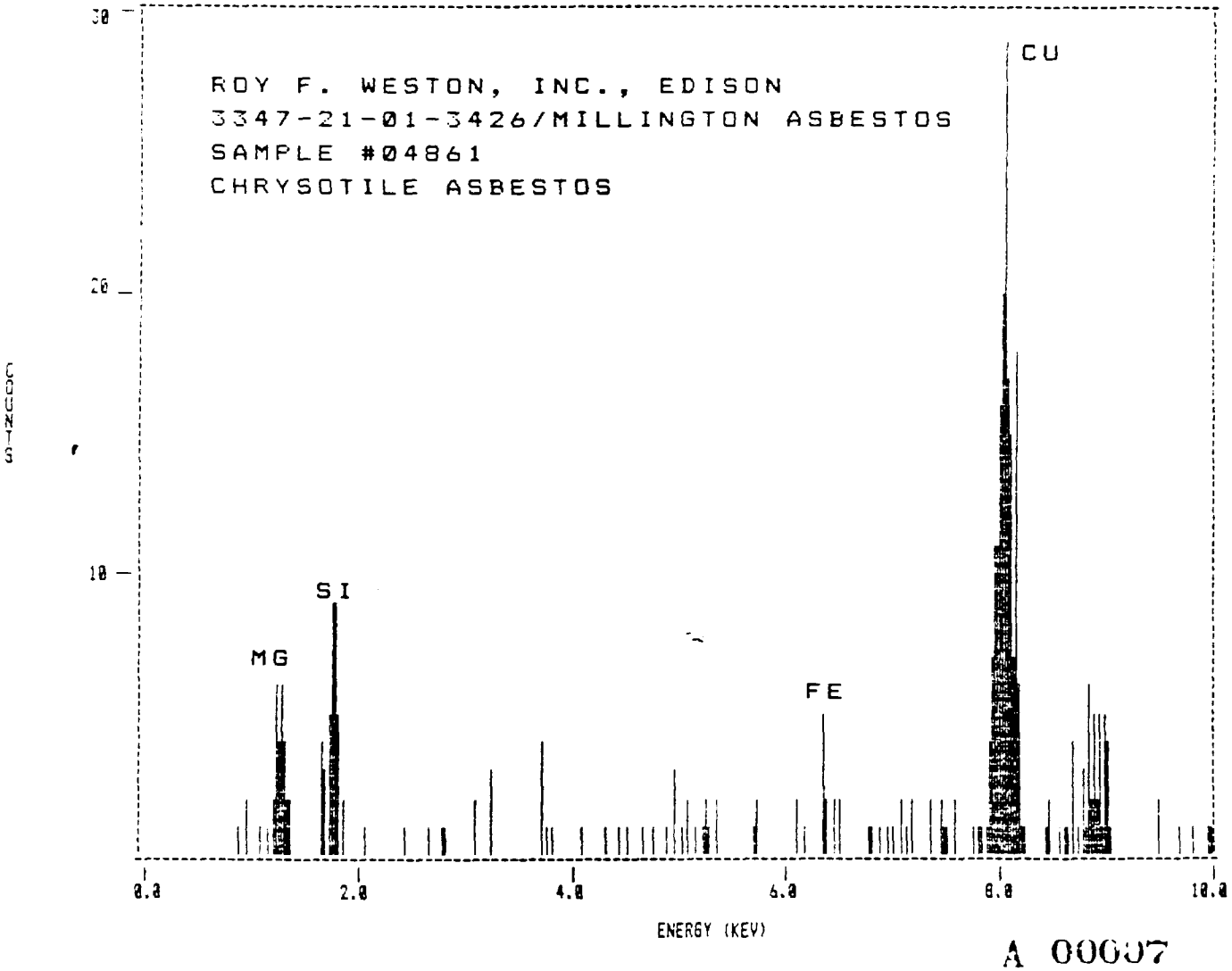
A 00006

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

SPECTRUM LABEL

SPECTRUM FILE NAME

37661




ABD 001 1802

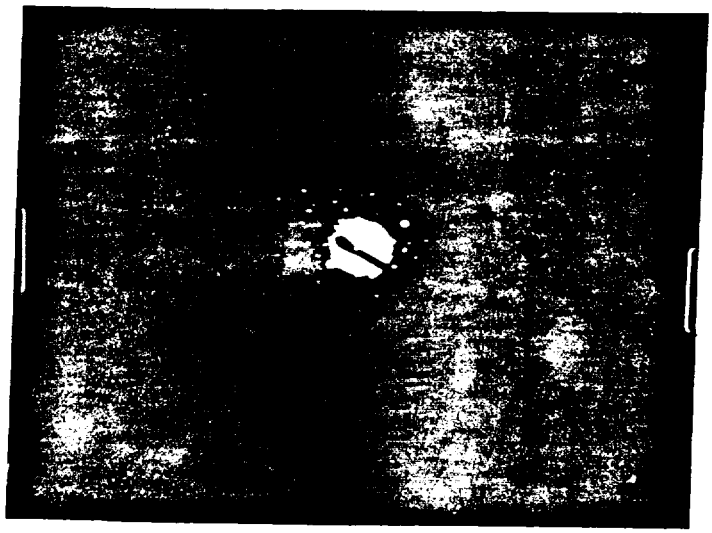
A 00037

PIGITI

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample : 04861

Actinolite



ABD 001 1803

A 00608

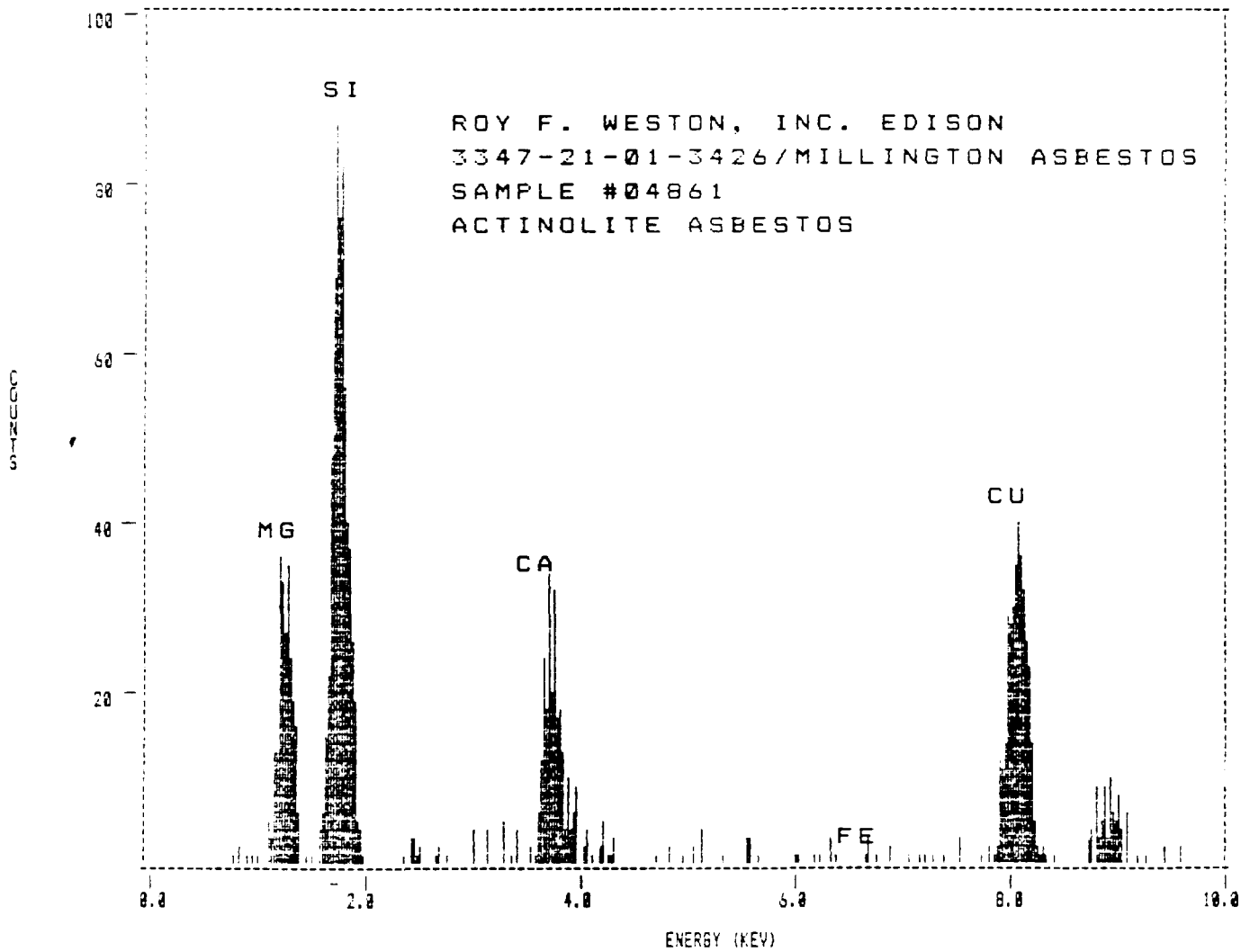
ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

SPECTRUM LABEL

[redacted]

SPECTRUM FILE NAME

[redacted] 37661A




ABD 001 1804

A 00609

PIGITI

E M S L

TEM AIR ANALYSIS WORKSHEET (TAMAIE) LEVEL II

LABORATORY # 9037661
CLIENT ID: Roy F Weston, Inc., Edison

Date: OCT 17 90
TAT: 24 Hr

SAMPLE ID: 04061
SAMPLE LOCATION:
Resid.#1/ Kitchen 4'

Project: 3047-21401-2426/Millington Asbestos

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 10194.10

GRID OPENINGS: 10

(B=Bundle C=Cluster M=Matrix)

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 4 | 2.0 | 0.1 | 0.1M | | | | | | | | | | | | |
| | 2 | 3 | 1.25 | 0.1 | 0.1M | | | | | | | | | | | | |
| | 3 | 4 | | | | | | | | | | | | | | | |
| | 4 | 3 | | | | | | | | | | | | | | | |
| | 5 | 2 | 1.0 | 0.1 | 0.1M | | | | | | | 5.0 | 0.75 | F | Actinolite | | |
| | 6 | 2 | | | | | | | | | | | | | | | |
| | 7 | 3 | | | | | | | | | | | | | | | |
| | 8 | 6 | | | | | | | | | | | | | | | |
| | 9 | 7 | 2.5 | 0.1 | 0.1M | | | | | | | | | | | | |
| | 10 | 3 | | | | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing K, CA.

Scope #: 2 Date: 10/17

Analyst: Al. Little

Q.C. Check: BF

Cc ster: Jodi

F a ☐ Spectrum ☑ SAED ☐ # 37661

Types Chrysotile 37662
Actinolite 37663
37664

**HAND CALCULATIONS**

(25mm) ---> 0.0642 (N) / G(Tm²) = 0.0032

Grid Box # 890999 Row A Col. 9

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

A 00010

ABD 001 1805

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1806

A 00011

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


| 109 HADDON AVENUE | 1056 STELTON ROAD | 1800 PEACHTREE STREET | 2 De ANGELO DRIVE |
|---|---|---|---|
| WESTMONT, N.J. | PISCATAWAY, N.J. | ATLANTA, GEORGIA | BEDFORD, MASS. |
| 08108 | 08858 | 30309 | 01730 |
| 609-858-4200 | 201-981-0550 | 404-355-4046 | 617-275-7080 |


Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04869
LOCATION : Resid. #1/Kitchen 4'
VOLUME : 10199.000 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 5 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 38 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile,Actinolite |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0031 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (0.0 %) (in AFP/cc or million/m³) | 0.0000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.4436 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (0.0 %) (in nanograms/m³ ) | 0.0000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Fibers Containing: (Ca).

R. K. Maloney

| Peter Frasca, PH.D. | Laboratory | Approved |
|---|---|---|
| President | Supervisor | Signatory |

A 00012

ABD 001 1807

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personnel. * Accredited for PLM

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04869

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 4 | 1 | 0 | 38 | 5 | 43 |
| # of Particulates on Whole Filter (in millions): | 0.0257 | 0.0064 | 0.0000 | 0.2438 | 0.0321 | 0.2759 |
| Concentration of Particulates (in million/m³): | 0.0025 | 0.0006 | 0.0000 | 0.0239 | 0.0031 | 0.0271 |
| % of Count due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Fibers: | 25.000% | 0.000% | 0.000% | ---- | 20.000% | ---- |
| % Count due to Matrices: | 75.000% | 100.000% | 0.000% | ---- | 80.000% | ---- |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.2667 | 0.1769 | ---- | ---- | 0.4436 | ---- |
| % of Mass due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Fibers: | 32.521% | 0.000% | ---- | ---- | 19.549% | ---- |
| % Mass due to Matrices: | 67.479% | 100.000% | ---- | ---- | 80.451% | ---- |
| % Mass due to Bundles: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Clusters: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |

ABD 001 1808

A 00013

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and place carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Alfred Baltz

EDUCATION

1944-49 Heidelberg University, Germany.
MA Physics, MA Physical Chemistry

EMPLOYMENT

EMSL: Since 1984

1965-84 Sperry Computer System (Blue Bell, PA)
Electron Microscopist, Principle Physicist,
Staff Scientist and Manager.

1960-65 Franklin Institute Research Laboratory (Phila. PA)
Sr. Physicist, Electron Microscopist.

1954-60 Atlantic Refinery Company, Sr. Physicist.

Member: Philadelphia Electron Microscopy Society (Chairman 1974-75);
International Society for Hybrid Microelectronics;
American Physical Society; Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100C Analytical TEM
EDX ANALYZER: Kevex Delta III System with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1809

A 00089

Continued From Page

PROJECT

| Comp # | CLIENT | # ASB | # NON ASB | VOL | GO | FIBERS/CC | EM |
|---|---|---|---|---|---|---|---|
| 10/17/90 | | | | | | | |
| 37030 | IHSC | 0 | 0 | 1573.75 | 20 | 0.0021 | 2 |
| 37031 | IHSC | 0 | 2 | 1526.25 | 20 | 0.0021 | 2 |
| 37032 | IHSC | 0 | 0 | 1507.75 | 20 | 0.0021 | 2 |
| 37661 | Weston | 5 | 36 | 10184.10 | 10 | 0.0032 | 2 |
| 37662 | " | 5 | 38 | 10199.00 | 10 | 0.0030 | 2 |
| 37663 | " | 2 | 56 | 10220.10 | 14 | 0.0009 | 2 |
| 37664 | " | 1 | 137 | 10358.80 | 16 | 0.00039 | 2 |
| 10/19/90 | | | | | | | |
| 37770 | Weston | 0 | 3 | 8771.25 | 20 | 0.00037 | 2 |
| 37771 | " | 0 | 2 | 8850.00 | 20 | 0.00036 | 2 |

Continued on Page

Read and Understood By

Signed Date Signed Date

Notebook No. _____

PROJECT _____

Continued From Page _____

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9037669 | WESTON 04853 | 2 | C.NT. | 52 | 10313.3 | 10 | 0.0012 | | 4 |
| 9037667 | 1 | 5 | C | 58 | 10510.5 | 10 | 0.0031 | | 4 |
| 9037668 | 2 | 3 | C+NCT | 35 | 10368.8 | 10 | 0.0019 | | 4 |
| 9037665 | 70 | 2 | C | 58 | 10416.3 | 10 | 0.0012 | | 4 |
| 9037660 | 62 | 2 | C | 36 | 10916.6 | 10 | 0.0013 | | 4 |

Millington Asbestos Dump Site
3347-21-01-3426

10/25/90

ABD 001 1811

Continued on Page

A 00072

Read and Understood By

Signed _____ Date _____ Signed _____ Date _____

# ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


109 PARSON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08854
201-981-0550

1500 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

1 DE ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7150


Friday, October 19, 1990

Roy F. Weston
REAC Project 884 Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Disp X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By Th Yamate et al. Method.

Project : 3347-01-01-3426/Millington Asbestos/Garrison Resider

RECEIVED
CONT
S&A

## TEM SUMMARY REPORT

| SAMPLE ID | VOLUME (liters) | TYPE OF ASBESTOS | # STRUCTURES ASB | # STRUCTURES NONASB | CONCENTRATION OF ASBESTOS STRUCTURES AFF/cc | AFF/cc >5 | MASS | MASS >5 |
|---|---|---|---|---|---|---|---|---|
| 14831 | 3772.75 | none detected | 0 | 11 | 0.0004 | 0.0000 | 0.0000 | 0.0000 |
| 14832 | 3771.25 | none detected | 0 | 3 | 0.0004 | 0.0000 | 0.0000 | 0.0000 |
| 14835 | 3850.00 | none detected | 0 | 2 | 0.0004 | 0.0000 | 0.0000 | 0.0000 |
| 14837 | 3776.25 | none detected | 0 | 75 | 0.0004 | 0.0000 | 0.0001 | 0.0000 |
| 14830 | Blank | none detected | 0 | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 14834 | Blank | none detected | 0 | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

For none detected samples number under AFF/cc and MASS are detection limits.
AFF - Asbestos Fibrous Particulates.
AFF/cc - Concentration of Asbestos in AFF/cc; for blank sample AFF/cc represents number of AFF in million Fibers/Filter.
AFF/cc >5 - Concentration due to AFF greater than or equal to 5 microns in length.
MASS - Mass of AFF in ng/m³;for blank sample MASS represents the mass of AFF in ng/Filter.
MASS >5 - Mass due to AFF equal to or greater than 5 microns in length.

A 00073

ABD 001 1812

Peter Fraasca, Ph.D.
President

Laboratory Supervisor

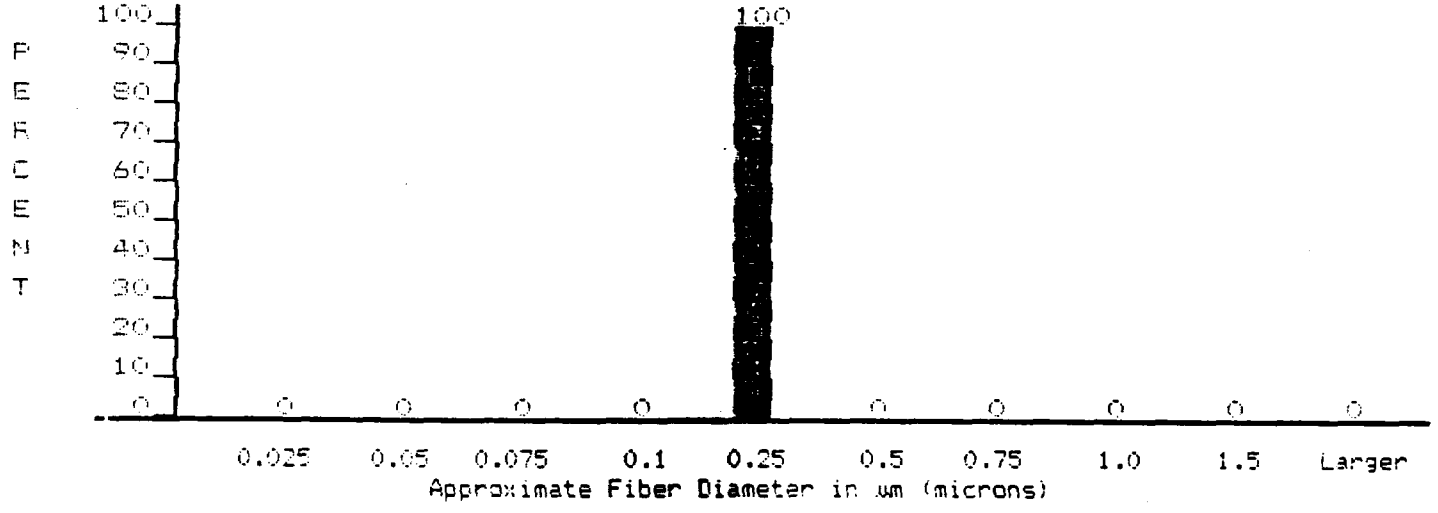
Approved Signatory

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

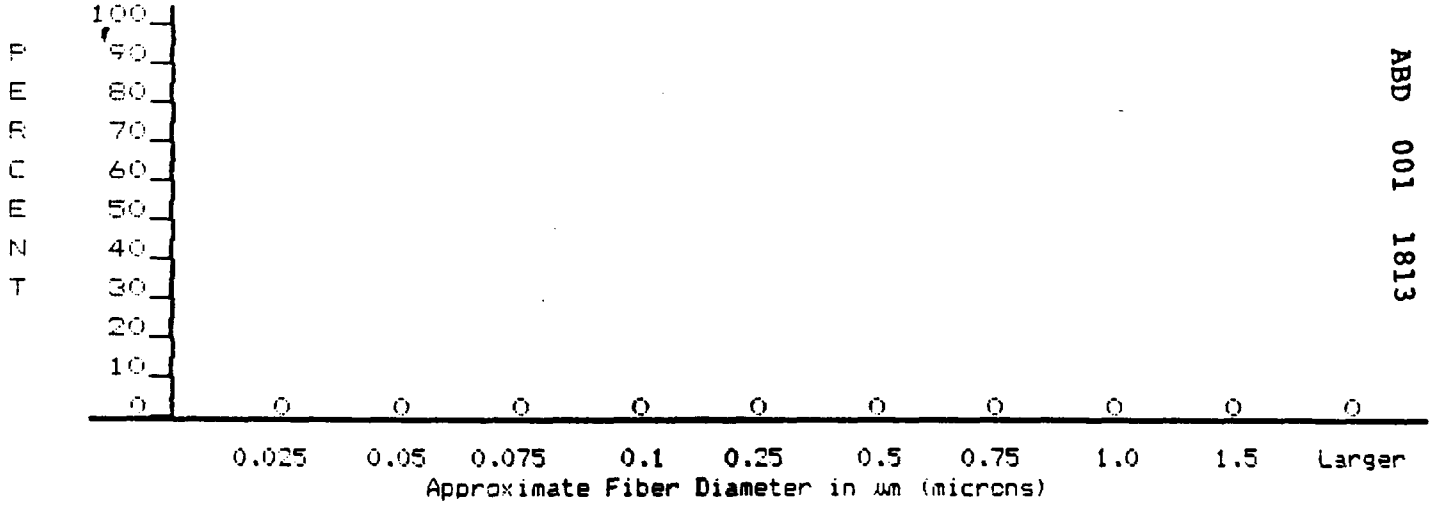
Sample : 04569

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




*Sum of both histograms represents 100% of Chrysotile fibers.

ABD 001 1813

A 00014

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04E69

Dimensions in um (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 6 | | nonasbestos | | | | |
| 2 | 7 - 9 | | nonasbestos | | | | |
| 2 | 10 | matrix | chrysotile | 1.500 | 0.0500 | 0.5000 | 0.0975 |
| 3 | 11 - 14 | | nonasbestos | | | | |
| 3 | 15 | fiber | chrysotile | 3.000 | 0.1500 | | 0.1378 |
| 3 | 16 | matrix | chrysotile | 1.000 | 0.1000 | 0.1000 | 0.0260 |
| 4 | 17 - 18 | | nonasbestos | | | | |
| 4 | 19 | matrix | actinolite | 1.500 | 0.2500 | 0.2500 | 0.2812 |
| 5 | 20 - 24 | | nonasbestos | | | | |
| 6 | 25 - 28 | | nonasbestos | | | | |
| 7 | 29 - 32 | | nonasbestos | | | | |
| 8 | 33 - 34 | | nonasbestos | | | | |
| 9 | 35 - 36 | | nonasbestos | | | | |
| 10 | 37 - 42 | | nonasbestos | | | | |
| 10 | 43 | matrix | chrysotile | 1.000 | 0.2500 | 0.2500 | 0.1625 |

ABD 001 1814

Mass of Chrysotile Particulates 0.4238
Mass of Amphibole Particulates 0.2812
Total Mass of Asbestos Particulates 0.7051

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio $\geq$ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

A 00615

E M S L

TEM AIR ANALYSIS WORKSHEET (TAMAIE) LEVEL II

LABORATORY #: 9037662
CLIENT ID: Roy F. Weston, Inc., Edison

PROJECT: 0347-21-01-2426/Millington Asbestos

SAMPLE ID: 94069
SAMPLE LOCATION:
Resid.#1/Kitchen 4'

Date: OCT 17 90
TAT: 24 Hr

FILTER SIZE: 25
FILTER TYPE: ACE PC

VOLUME(LITERS): 10199.00

GRID OPENINGS: 10

(B=Bundle C=Cluster M=Matrix)

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 6 | | | | | | | | | | | | | | | |
| | 2 | 3 | 1.5 | 0.05 | 0.5M | | | | | | | | | | | | |
| | 3 | 4 | 3.0 | 0.15 | F | 1.0 | 0.1 | 0.1M | | | | | | | | | |
| | 4 | 2 | | | | | | | | | | 1.5 | 0.25 | 0.25M. | Actinolite | | |
| | 5 | 5 | | | | | | | | | | | | | | | |
| | 6 | 4 | | | | | | | | | | | | | | | |
| | 7 | 4 | | | | | | | | | | | | | | | |
| | 8 | 2 | | | | | | | | | | | | | | | |
| | 9 | 2 | | | | | | | | | | | | | | | |
| | 10 | 6 | 1.0 | 0.25 | 0.25M. | | | | | | | | | | | | |

5

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☑ (5) Fibers Containing CA.

Scope #: 2 Date: 10/17

Analyst: M. Little

Q.C. Check: BF

Computer: Dodi

Figure ☐ Spectrum ☐ SAED ☐ #

Types

**HAND CALCULATIONS**

(25mm) ---> 0.0642 (Z) / G(Tm²) = 0.0024

Grid Box # 890999 Row B Col. 10.

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 1815

A 00016

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1816

A 00017

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08854
201-981-0550

1500 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04867
LOCATION : Resid. #1/Kitchen
VOLUME : 10220.100 Liters
Grid Openings Analyzed : 14
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 2 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 56 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0009 |
| Concentration Detection Limit: | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(0.0 %) (in AFP/cc or million/m³) | 0.0000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.0346 |
| Mass Detection Limit : | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (0.0 %) (in nanograms/m³ ) | 0.0000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Fibers Containing: (Mg,Fe)(Al,Si).

R. K. Maloney

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 00018

ABD 001 1817

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by analyzer personnel, not accepted for TEM.

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04867

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 2 | 0 | 0 | 56 | 2 | 58 |
| # of Particulates on Whole Filter (in millions): | 0.0092 | 0.0000 | 0.0000 | 0.2567 | 0.0092 | 0.2658 |
| Concentration of Particulates (in million/m³): | 0.0009 | 0.0000 | 0.0000 | 0.0251 | 0.0009 | 0.0260 |
| % of Count due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Fibers: | 50.000% | 0.000% | 0.000% | ---- | 50.000% | ---- |
| % Count due to Matrices: | 50.000% | 0.000% | 0.000% | ---- | 50.000% | ---- |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.0346 | 0.0000 | ---- | ---- | 0.0346 | ---- |
| % of Mass due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Fibers: | 66.256% | 0.000% | ---- | ---- | 66.256% | ---- |
| % Mass due to Matrices: | 33.744% | 0.000% | ---- | ---- | 33.744% | ---- |
| % Mass due to Bundles: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Clusters: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |

ABD 001 1818

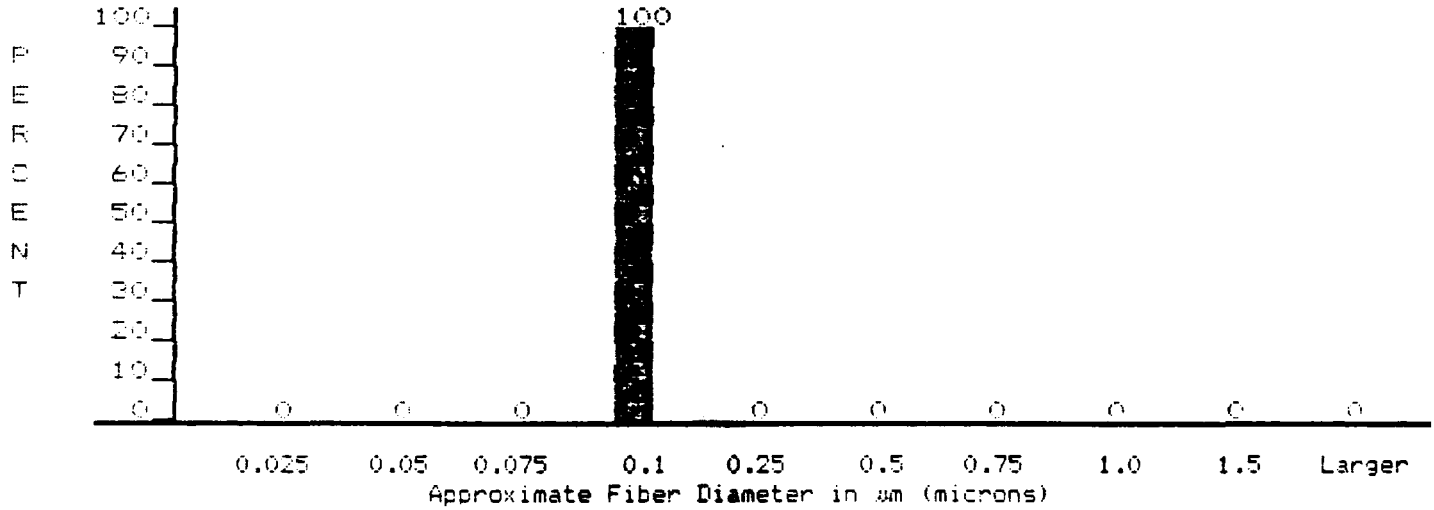
A 00019

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

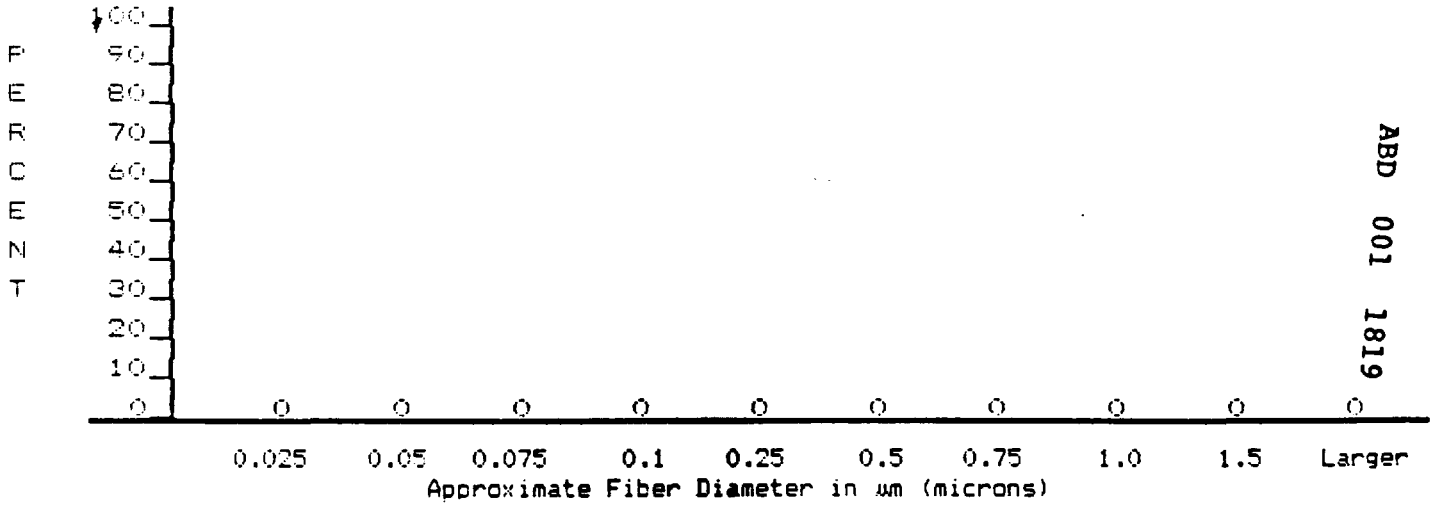
Sample : 04867

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1819

*Sum of both histograms represents 100% of Chrysotile fibers.

A 00020

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04867

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 4 | | nonasbestos | | | | |
| 2 | 5 - 8 | | nonasbestos | | | | |
| 3 | 9 - 13 | | nonasbestos | | | | |
| 4 | 14 - 16 | | nonasbestos | | | | |
| 5 | 17 - 18 | | nonasbestos | | | | |
| 6 | 19 - 22 | | nonasbestos | | | | |
| 7 | 23 - 24 | | nonasbestos | | | | |
| 8 | 25 - 28 | | nonasbestos | | | | |
| 9 | 29 - 33 | | nonasbestos | | | | |
| 10 | 34 - 36 | | nonasbestos | | | | |
| 11 | 37 - 41 | | nonasbestos | | | | |
| 12 | 42 - 48 | | nonasbestos | | | | |
| 13 | 49 - 51 | | nonasbestos | | | | |
| 14 | 52 - 56 | | nonasbestos | | | | |
| 14 | 57 | matrix | chrysotile | 1.000 | 0.1000 | 0.1000 | 0.0260 |
| 14 | 58 | fiber | chrysotile | 2.500 | 0.1000 | | 0.0511 |

Mass of Chrysotile Particulates 0.0771
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.0771

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.

Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.

Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.

Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

ABD 001 1820

A 00021

E M S L

# TEM AIR ANALYSIS WORKSHEET (TAMAHE) LEVEL II

Date: OCT 17 00
TAT: ~24 Hr

LABORATORY #: 9007663
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04867
SAMPLE LOCATION:
Resid. #II/ Kitchen

PROJECT: 3047-21-01-0425/ Millington Asbestos

VOLUME(LITERS): 10220.10 X

FILTER SIZE
FILTER TYPE: MCE PC

GRID OPENINGS: 14

(B=Bundle C=Cluster M=Matrix)

IF ASHED:
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 4 | | | | | | | | | | | | | | | |
| | 2 | 4 | | | | | | | | | | | | | | | |
| | 3 | 5 | | | | | | | | | | | | | | | |
| | 4 | 3 | | | | | | | | | | | | | | | |
| | 5 | 2 | | | | | | | | | | | | | | | |
| | 6 | 4 | | | | | | | | | | | | | | | |
| | 7 | 2 | | | | | | | | | | | | | | | |
| | 8 | 4 | | | | | | | | | | | | | | | |
| | 9 | 5 | | | | | | | | | | | | | | | |
| | 10 | 3 | | | | | | | | | | | | | | | |
| | 11 | 5 | | | | | | | | | | | | | | | |
| | 12 | 2 | | | | | | | | | | | | | | | |
| | 13 | 3 | | | | | | | | | | | | | | | |
| | 14 | 5 | 1.0 | 0.1 | 0.1 | 2.5 | 0.1 | F | | | | | | | | | |

2

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☑ (5) Fibers Containing MG, FE, AL, SI

Scope #: 2 Date: 10/17

Analyst: A. Little

Q Check: B Faulk

Computer: Jodi

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (N) / 143.0814 G(Tm³) = 0.0009

Grid Box # 890999 Row C Col. 8 & 10

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 182

A 00022

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

A 00023

A00 001 1822

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1500 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04868
LOCATION : Resid. #1/Baby Room
VOLUME : 10338.800 Liters
Grid Openings Analyzed : 16
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 1 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 137 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0004 |
| Concentration Detection Limit: | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(0.0 %) (in AFP/cc or million/m³) | 0.0000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.1009 |
| Mass Detection Limit : | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (0.0 %) (in nanograms/m³ ) | 0.0000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Fibers Containing: (Al,Si).

ABD 001 1823

R. K. Maloney

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

00024

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04868

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 1 | 0 | 0 | 137 | 1 | 138 |
| # of Particulates on Whole Filter (in millions): | 0.0040 | 0.0000 | 0.0000 | 0.5494 | 0.0040 | 0.5534 |
| Concentration of Particulates (in million/m³): | 0.0004 | 0.0000 | 0.0000 | 0.0531 | 0.0004 | 0.0535 |
| % of Count due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Fibers: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Matrices: | 100.000% | 0.000% | 0.000% | ---- | 100.000% | ---- |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.1009 | 0.0000 | ---- | ---- | 0.1009 | ---- |
| % of Mass due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Fibers: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Matrices: | 100.000% | 0.000% | ---- | ---- | 100.000% | ---- |
| % Mass due to Bundles: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Clusters: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |

ABU 001 18224

A 00025

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04868

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 9 | | nonasbestos | | | | |
| 2 | 10 - 16 | | nonasbestos | | | | |
| 3 | 17 - 26 | | nonasbestos | | | | |
| 4 | 27 - 36 | | nonasbestos | | | | |
| 5 | 37 - 45 | | nonasbestos | | | | |
| 6 | 46 - 51 | | nonasbestos | | | | |
| 7 | 52 - 59 | | nonasbestos | | | | |
| 8 | 60 - 69 | | nonasbestos | | | | |
| 9 | 70 - 76 | | nonasbestos | | | | |
| 10 | 77 - 88 | | nonasbestos | | | | |
| 11 | 89 - 96 | | nonasbestos | | | | |
| 12 | 97 - 106 | | nonasbestos | | | | |
| 13 | 107 - 114 | | nonasbestos | | | | |
| 14 | 115 - 120 | | nonasbestos | | | | |
| 15 | 121 - 128 | | nonasbestos | | | | |
| 16 | 129 - 137 | | nonasbestos | | | | |
| 16 | 138 | matrix | chrysotile | 2.500 | 0.2000 | 0.2000 | 0.2600 |

Mass of Chrysotile Particulates 0.2600
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.2600

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.

Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.

Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.

Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

ABD 001 1825

A 00026

E M S L

# TEM AIR ANALYSIS WORKSHEET (TAMAIE) LEVEL II

LABORATORY #: 9057664
CLIENT ID: Roy F. Weston, Inc., Edison

PROJECT: 3247-21-01-0406/Millington Asbestos

Date: OCT 17 90
TAT: 24 Hr

SAMPLE ID: 04068
SAMPLE LOCATION:
Resid.#1/Baby Room

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 10333.00

GRID OPENINGS: 16.

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 9 | | | | | | | | | | | | | | | |
| | 2 | 7 | | | | | | | | | | | | | | | |
| | 3 | 10 | | | | | | | | | | | | | | | |
| | 4 | 10 | | | | | | | | | | | | | | | |
| | 5 | 9 | | | | | | | | | | | | | | | |
| | 6 | 6 | | | | | | | | | | | | | | | |
| | 7 | 8 | | | | | | | | | | | | | | | |
| | 8 | 10 | | | | | | | | | | | | | | | |
| | 9 | 7 | | | | | | | | | | | | | | | |
| | 10 | 12 | | | | | | | | | | | | | | | |
| | 11 | 8 | | | | | | | | | | | | | | | |
| | 12 | 10 | | | | | | | | | | | | | | | |
| | 13 | 8 | | | | | | | | | | | | | | | |
| | 14 | 6 | | | | | | | | | | | | | | | |
| | 15 | 8 | | | | | | | | | | | | | | | |
| | 16 | 9 | 2.5 | 0.2 | 0.2 | | | | | | | | | | | | |

1

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☑ (5) Fibers Containing AL Si

Scope #: 2 Date: 10/17

Analyst: DL Little

Q. Check: BF

C uter: Dodi

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (W)
165.4208 (Area) = 0.00039

Grid Box # 890999 Row D Col. 8 & 10

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 1826

A 00027

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1827

A 00028

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4300

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
RIAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04870
LOCATION : Resid. #1/Bedroom
VOLUME : 10416.300 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 2 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 52 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0012 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(50.0 %) (in AFP/cc or million/m³) | 0.0006 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 9.4349 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (100.0 %) (in nanograms/m³ ) | 9.4345 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum.

ABD 001 1828

R. K. Maloney

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 00029

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04870

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 2 | 0 | 0 | 52 | 2 | 54 |
| # of Particulates on Whole Filter (in millions): | 0.0129 | 0.0000 | 0.0000 | 0.3337 | 0.0129 | 0.3465 |
| Concentration of Particulates (in million/m³): | 0.0012 | 0.0000 | 0.0000 | 0.0320 | 0.0012 | 0.0333 |
| % of Count due to Particulates ≥ 5 um in length: | 50.000% | 0.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Fibers: | 50.000% | 0.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Matrices: | 50.000% | 0.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 9.4349 | 0.0000 | —— | —— | 9.4349 | —— |
| % of Mass due to Particulates ≥ 5 um in length: | 99.997% | 0.000% | —— | —— | 99.997% | —— |
| % Mass due to Fibers: | 99.997% | 0.000% | —— | —— | 99.997% | —— |
| % Mass due to Matrices: | 0.003% | 0.000% | —— | —— | 0.003% | —— |
| % Mass due to Bundles: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Clusters: | 0.000% | 0.000% | —— | —— | 0.000% | —— |

ABD 001 1829

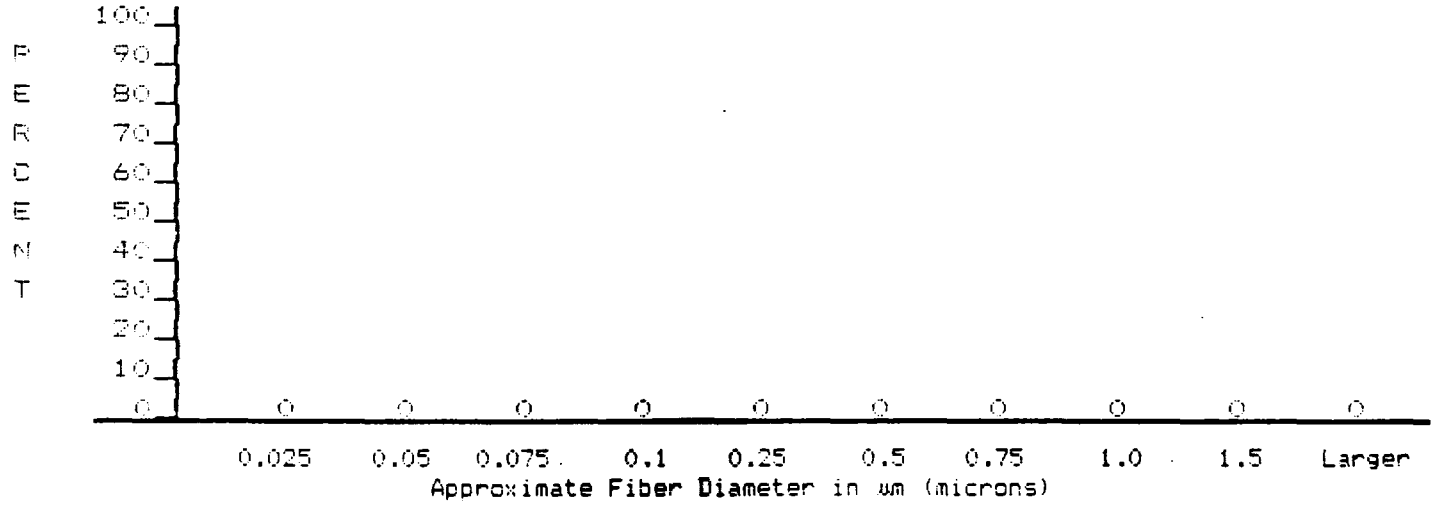
A 00030

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

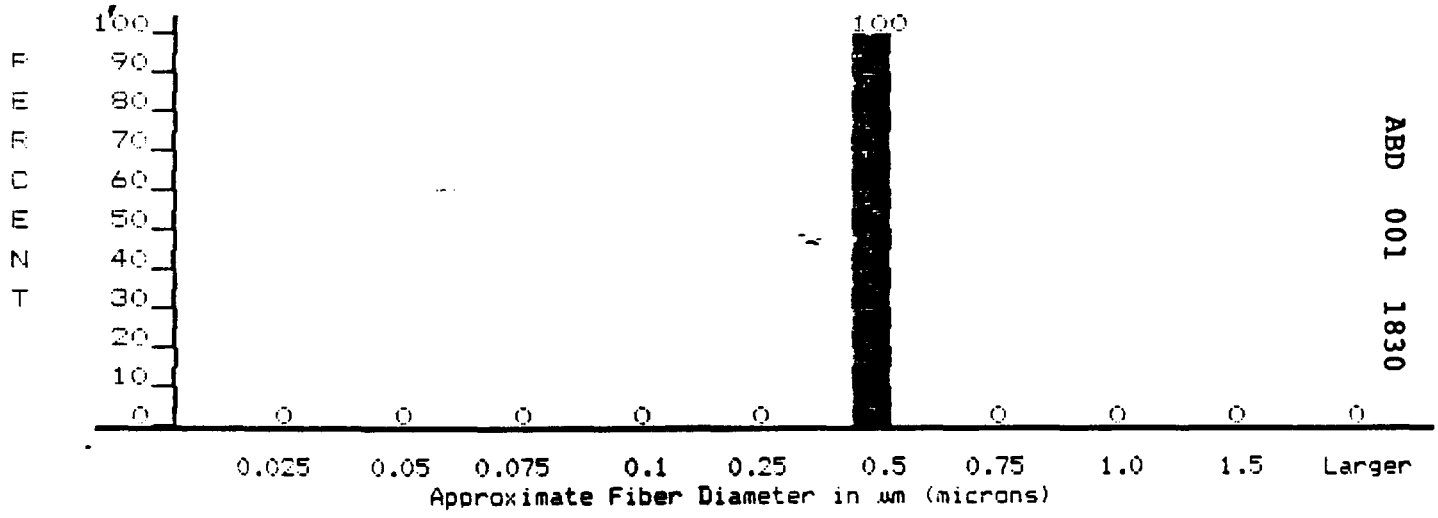
Sample : 04870

# CHRYSOTILE

Fiber(s) Less than 5 um in length*




Fiber(s) Greater than or Equal To 5 um in length*




ABD 001 1830

*Sum of both histograms represents 100% of Chrysotile fibers.

A 00031

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04370

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 7 | | nonasbestos | | | | |
| 2 | 8 - 13 | | nonasbestos | | | | |
| 2 | 14 | matrix | chrysotile | 0.500 | 0.0200 | 0.0200 | 0.0005 |
| 3 | 15 - 20 | | nonasbestos | | | | |
| 4 | 21 - 23 | | nonasbestos | | | | |
| 5 | 24 - 30 | | nonasbestos | | | | |
| 6 | 31 - 36 | | nonasbestos | | | | |
| 7 | 37 - 41 | | nonasbestos | | | | |
| 8 | 42 - 47 | | nonasbestos | | | | |
| 8 | 48 | fiber | chrysotile | 30.000 | 0.5000 | | 15.3153 |
| 9 | 49 - 53 | | nonasbestos | | | | |
| 10 | 54 | | nonasbestos | | | | |

| | |
|---|---|
| Mass of Chrysotile Particulates | 15.3158 |
| Mass of Amphibole Particulates | 0.0000 |
| Total Mass of Asbestos Particulates | 15.3158 |

ABD 001 1831

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio $\geq$ 3:1 and parallel sides. Thickness is equivalent to diameter.

Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.

Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.

Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

E M S L

TEM AIR ANALYSIS WORKSHEET (TAMATE) LEVEL II

LABORATORY #: 9037665
CLIENT ID: Roy F. Weston, Inc., Edison

PROJECT: 0047-21 01-0420/Millington Asbestos

Date: OCT 17 90
TAT: 24 Hr

SAMPLE ID: 04870
SAMPLE LOCATION:
Resid.#1/ Bedroom

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 10410.30

GRID OPENINGS: 10

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 7 | | | | | | | | | | | | | | | |
| | 2 | 6 | 0.5 | 0.02 | 0.02M | | | | | | | | | | | | |
| | 3 | 6 | | | | | | | | | | | | | | | |
| | 4 | 3 | | | | | | | | | | | | | | | |
| | 5 | 7 | | | | | | | | | | | | | | | |
| | 6 | 6 | | | | | | | | | | | | | | | |
| | 7 | 5 | | | | | | | | | | | | | | | |
| | 8 | 6 | 30.0 | 0.5 | F | | | | | | | | | | | | |
| | 9 | 5 | | | | | | | | | | | | | | | |
| | 10 | 7 | | | | | | | | | | | | | | | |

2

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☒ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 4 Date: 10/17/90

Analyst: [illegible]

Q.C. Check: BF

C[illegible]uter: Dodi

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (W) / G(Tot.) = 0.0012

Grid Box # 890999 Row E Col. 9

Filter Accepted for Analysis: Yes ☒ No ☐

If No, Reason for Rejection:

ABD 001 1832

A 00033

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Alfred Baltz

EDUCATION

1944-49 Heidelberg University, Germany.
MA Physics, MA Physical Chemistry

EMPLOYMENT

EMSL: Since 1984

1965-84 Sperry Computer System (Blue Bell, PA)
Electron Microscopist, Principle Physicist,
Staff Scientist and Manager.

1960-65 Franklin Institute Research Laboratory (Phila. PA)
Sr. Physicist, Electron Microscopist.

1954-60 Atlantic Refinery Company, Sr. Physicist.

Member: Philadelphia Electron Microscopy Society (Chairman 1974-75);
International Society for Hybrid Microelectronics;
American Physical Society; Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100C Analytical TEM
EDX ANALYZER: Kevex Delta III System with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
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1500 PEACHTREE STREET
ATLANTA, GEORGIA
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404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3247-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04862
LOCATION : Resid. #2/LR
VOLUME : 10011.600 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 2 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 36 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0013 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(0.0 %) (in AFP/cc or million/m³) | 0.0000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.0540 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (0.0 %) (in nanograms/m³ ) | 0.0000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Cellulose.

R.K. Maloney

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 00035

ABD 001 1834

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04862

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 2 | 0 | 0 | 36 | 2 | 38 |
| # of Particulates on Whole Filter (in millions): | 0.0128 | 0.0000 | 0.0000 | 0.2310 | 0.0128 | 0.2438 |
| Concentration of Particulates (in million/m³): | 0.0013 | 0.0000 | 0.0000 | 0.0231 | 0.0013 | 0.0244 |
| % of Count due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Fibers: | 50.000% | 0.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Matrices: | 50.000% | 0.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.0540 | 0.0000 | —— | —— | 0.0540 | —— |
| % of Mass due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Fibers: | 96.915% | 0.000% | —— | —— | 96.915% | —— |
| % Mass due to Matrices: | 3.085% | 0.000% | —— | —— | 3.085% | —— |
| % Mass due to Bundles: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Clusters: | 0.000% | 0.000% | —— | —— | 0.000% | —— |

ABD 001 1836

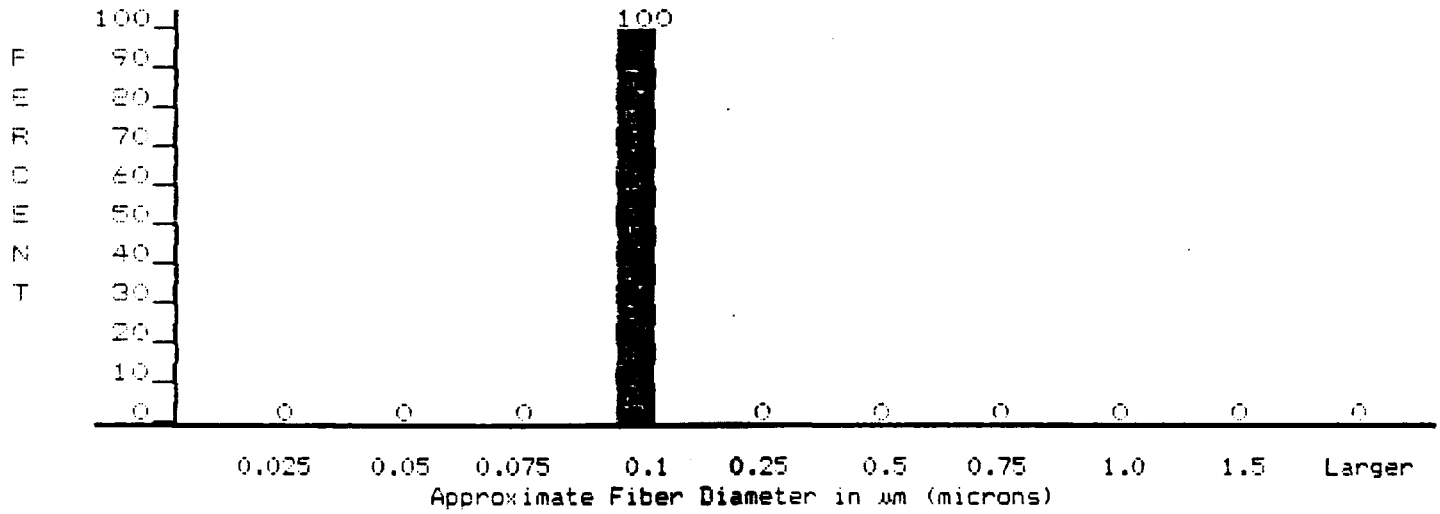
A 00036

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

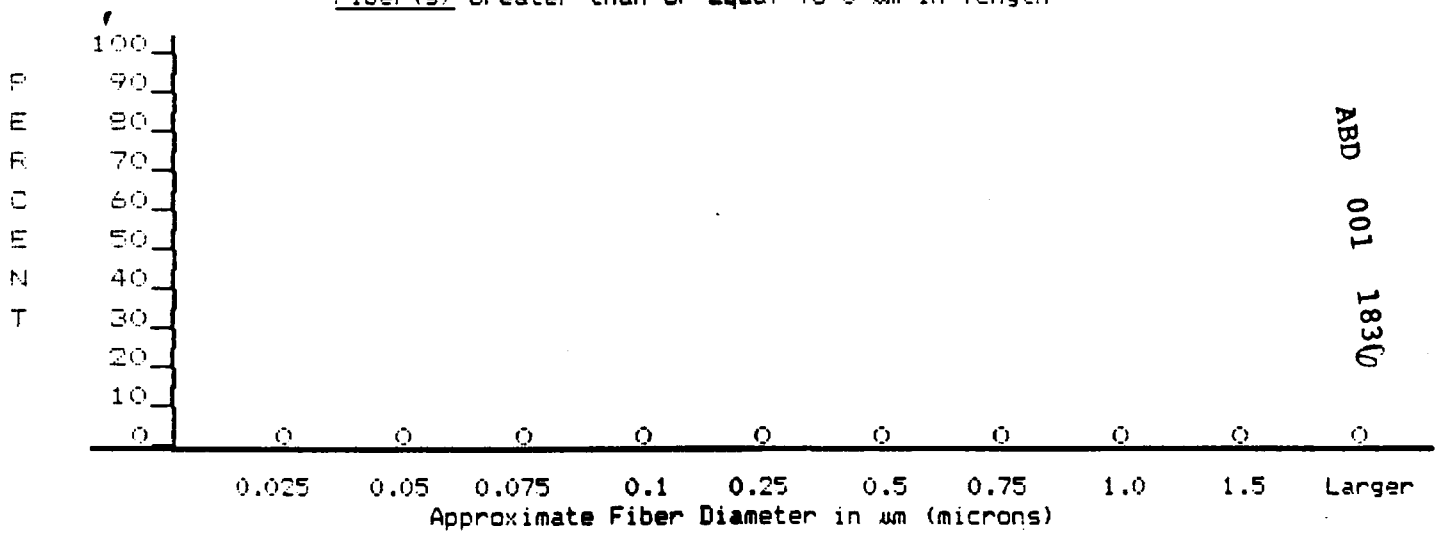
Sample : 04862

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1836

*Sum of both histograms represents 100% of Chrysotile fibers.

A 00037

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04862

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 2 | | nonasbestos | | | | |
| 1 | 3 | matrix | chrysotile | 2.500 | 0.0200 | 0.0200 | 0.0026 |
| 2 | 4 - 8 | | nonasbestos | | | | |
| 3 | 9 - 14 | | nonasbestos | | | | |
| 4 | 15 - 18 | | nonasbestos | | | | |
| 5 | 19 - 21 | | nonasbestos | | | | |
| 5 | 22 | fiber | chrysotile | 4.000 | 0.1000 | | 0.0817 |
| 6 | 23 - 25 | | nonasbestos | | | | |
| 7 | 26 - 29 | | nonasbestos | | | | |
| 8 | 30 - 32 | | nonasbestos | | | | |
| 9 | 33 - 36 | | nonasbestos | | | | |
| 10 | 37 - 38 | | nonasbestos | | | | |

Mass of Chrysotile Particulates 0.0843
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.0843

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio $\geq$ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

A60 001 1837

A 00038

# 12m AIR ANALYSIS WORKSHEET (TAMATE) LEVEL II

LABORATORY # 9037666
CLIENT ID: Roy F. Weston, Inc., Edison

PROJECT: 3047-21-01-0426/ Millington Asbestos

FILTER SIZE: 25
FILTER TYPE: MCE PC

SAMPLE ID: 04062
SAMPLE LOCATION:
Resid. #2/ LR

Date: OCT 17 90
TAT: 24 Hr

VOLUME(LITERS): 10011.60

GRID OPENINGS: 10

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 2.5 | 0.02 | 0.62 | | | | | | | | | | | | |
| | 2 | 5 | | | | | | | | | | | | | | | |
| | 3 | 6 | | | | | | | | | | | | | | | |
| | 4 | 4 | | | | | | | | | | | | | | | |
| | 5 | 3 | 4.0 | 0.1 | F | | | | | | | | | | | | |
| | 6 | 3 | | | | | | | | | | | | | | | |
| | 7 | 4 | | | | | | | | | | | | | | | |
| | 8 | 3 | | | | | | | | | | | | | | | |
| | 9 | 4 | | | | | | | | | | | | | | | |
| | 10 | 2 | | | | | | | | | | | | | | | |

2

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☐ (2) Glass
- ☒ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 4 Date: 10/17/90

Analyst:

QC. Check: B Faulent

Mounter: Dodi

Image ☐ Spectrum ☐ SAED ☐ #

Other:

## HAND CALCULATIONS

(25mm) ---> 0.0642 (X) / G(Vm) = 0.0013

Grid Box # 890999 Row F Col. 10

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 1838

A 00039

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Alfred Baltz

EDUCATION

1944-49 Heidelberg University, Germany.
MA Physics, MA Physical Chemistry

EMPLOYMENT

EMSL: Since 1984

1965-84 Sperry Computer System (Blue Bell, PA)
Electron Microscopist, Principle Physicist,
Staff Scientist and Manager.

1960-65 Franklin Institute Research Laboratory (Phila. PA)
Sr. Physicist, Electron Microscopist.

1954-60 Atlantic Refinery Company, Sr. Physicist.

Member: Philadelphia Electron Microscopy Society (Chairman 1974-75);
International Society for Hybrid Microelectronics;
American Physical Society; Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100C Analytical TEM

EDX ANALYZER: Kevex Delta III System with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABN 001 1839

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4900

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1900 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3247-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04851
LOCATION : Resid. #2/LR
VOLUME : 10510.500 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 5 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 58 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0031 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(0.0 %) (in AFP/cc or million/m³) | 0.0000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.3474 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (0.0 %) (in nanograms/m³ ) | 0.0000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, Cellulose, and Fibers Containing: (Talc).

R. K. Maloney

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

ABD 001 1840

A 00041

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04851

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 5 | 0 | 0 | 58 | 5 | 63 |
| # of Particulates on Whole Filter (in millions): | 0.0321 | 0.0000 | 0.0000 | 0.3722 | 0.0321 | 0.4043 |
| Concentration of Particulates (in million/m³): | 0.0031 | 0.0000 | 0.0000 | 0.0354 | 0.0031 | 0.0385 |
| % of Count due to Particulates ≥ 5 um in length: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Fibers: | 40.000% | 0.000% | 0.000% | ---- | 40.000% | ---- |
| % Count due to Matrices: | 60.000% | 0.000% | 0.000% | ---- | 60.000% | ---- |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | ---- | 0.000% | ---- |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.3474 | 0.0000 | ---- | ---- | 0.3474 | ---- |
| % of Mass due to Particulates ≥ 5 um in length: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Fibers: | 64.591% | 0.000% | ---- | ---- | 64.591% | ---- |
| % Mass due to Matrices: | 35.409% | 0.000% | ---- | ---- | 35.409% | ---- |
| % Mass due to Bundles: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |
| % Mass due to Clusters: | 0.000% | 0.000% | ---- | ---- | 0.000% | ---- |

ABD 001 1841

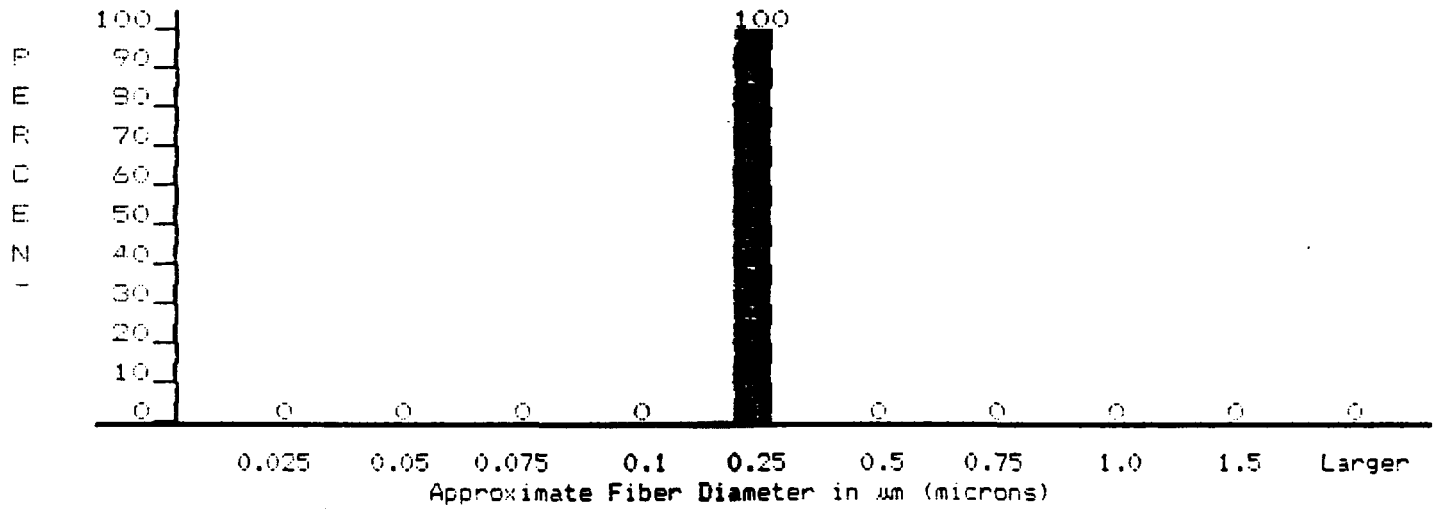
A 00042

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

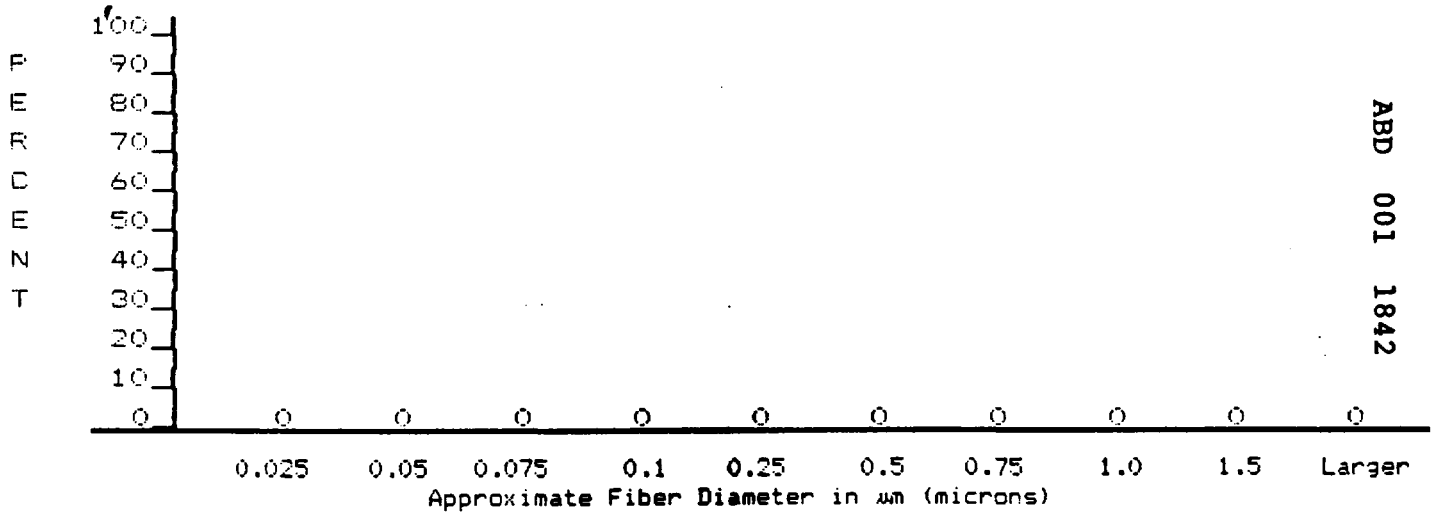
Sample : 04851

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1842

*Sum of both histograms represents 100% of Chrysotile fibers.

A 00043

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04851

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 6 | | nonasbestos | | | | |
| 1 | 7 | fiber | chrysotile | 1.500 | 0.2000 | | 0.1225 |
| 2 | 8 - 12 | | nonasbestos | | | | |
| 3 | 13 - 21 | | nonasbestos | | | | |
| 4 | 22 - 26 | | nonasbestos | | | | |
| 4 | 27 | fiber | chrysotile | 3.000 | 0.2000 | | 0.2450 |
| 5 | 28 - 34 | | nonasbestos | | | | |
| 5 | 35 | matrix | chrysotile | 1.500 | 0.1500 | 0.1500 | 0.0878 |
| 6 | 36 - 39 | | nonasbestos | | | | |
| 7 | 40 - 46 | | nonasbestos | | | | |
| 8 | 47 - 50 | | nonasbestos | | | | |
| 8 | 51 | matrix | chrysotile | 1.000 | 0.1000 | 0.1000 | 0.0260 |
| 9 | 52 - 54 | | nonasbestos | | | | |
| 10 | 55 - 62 | | nonasbestos | | | | |
| 10 | 63 | matrix | chrysotile | 1.500 | 0.1500 | 0.1500 | 0.0878 |

ABD 001 1843

Mass of Chrysotile Particulates 0.5691
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.5691

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.
STRUCTURE TYPES
Fiber - a fiber is a particle with an aspect ratio $\geq$ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

LABORATORY #: 9037667
CLIENT ID: Roy F. Weston, Inc., Edison

PROJECT: 0347-01-01-0406/Millington Asbestos

SAMPLE ID: 04351
SAMPLE LOCATION:
Resid. #2/ LR

Date: OCT 17 90
TAT: 24 Hr

FILTER SIZE 25
FILTER TYPE MCE PC

VOLUME(LITERS): 10510.50

GRID OPENINGS: 10

(B=Bundle C=Cluster M=Matrix)

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 6 | 1.5 | 0.2 | F | | | | | | | | | | | | |
| | 2 | 5 | | | | | | | | | | | | | | | |
| | 3 | 9 | | | | | | | | | | | | | | | |
| | 4 | 5 | 3.0 | 0.2 | F | | | | | | | | | | | | |
| | 5 | 7 | 1.5 | 0.15 | 0.15M | | | | | | | | | | | | |
| | 6 | 4 | | | | | | | | | | | | | | | |
| | 7 | 7 | | | | | | | | | | | | | | | |
| | 8 | 4 | 1.0 | 0.1 | 0.1M | | | | | | | | | | | | |
| | 9 | 3 | | | | | | | | | | | | | | | |
| | 10 | 8 | 1.5 | 0.15 | 0.15M | | | | | | | | | | | | |

5

Nonasbestos Fibers Present
- [x] (1) Gypsum
- [ ] (2) Glass
- [x] (3) Cellulose
- [ ] (4) Organic Fibers
- [x] (5) Fibers Containing TALC

Scope #: 4 Date: 10/17/90

Analyst: [illegible]

Q.C. Check: BF

Computer: Dodi

P. a ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (W) / G(Tm²) = 0.0031

Grid Box # 89 999 Row G Col. 9

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 1844

A 00045

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Alfred Baltz

EDUCATION

1944-49 Heidelberg University, Germany.
MA Physics, MA Physical Chemistry

EMPLOYMENT

EMSL: Since 1984

1965-84 Sperry Computer System (Blue Bell, PA)
Electron Microscopist, Principle Physicist,
Staff Scientist and Manager.

1960-65 Franklin Institute Research Laboratory (Phila. PA)
Sr. Physicist, Electron Microscopist.

1954-60 Atlantic Refinery Company, Sr. Physicist.

Member: Philadelphia Electron Microscopy Society (Chairman 1974-75);
International Society for Hybrid Microelectronics;
American Physical Society; Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100C Analytical TEM
EDX ANALYZER: Kevex Delta III System with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1845

A 00046

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

109 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4200

1056 STELTON ROAD
PISCATAWAY, N.J.
08854
201-981-0550

1900 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04852
LOCATION : Resid. #2/BR
VOLUME : 10368.800 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 3 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 35 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | Chrysotile,Actinolite |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0019 |
| Concentration Detection Limit: | | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (in AFP/cc or million/m³) | (33.3 %) | 0.0006 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 3.4865 |
| Mass Detection Limit : | | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/m³ ) | (94.1 %) | 3.2808 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum.

ABD 001 1846

Peter Frasca, PH.D.
President

Laboratory
Supervisor

R.P. Mahoney
Approved
Signatory

A 00047

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04852

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 2 | 1 | 0 | 35 | 3 | 38 |
| # of Particulates on Whole Filter (in millions): | 0.0128 | 0.0064 | 0.0000 | 0.2246 | 0.0192 | 0.2438 |
| Concentration of Particulates (in million/m³): | 0.0012 | 0.0006 | 0.0000 | 0.0217 | 0.0019 | 0.0235 |
| % of Count due to Particulates ≥ 5 µm in length: | 0.000% | 100.000% | 0.000% | —— | 33.333% | —— |
| % Count due to Fibers: | 50.000% | 100.000% | 0.000% | —— | 66.667% | —— |
| % Count due to Matrices: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Clusters: | 50.000% | 0.000% | 0.000% | —— | 33.333% | —— |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.2057 | 3.2808 | —— | —— | 3.4865 | —— |
| % of Mass due to Particulates ≥ 5 µm in length: | 0.000% | 100.000% | —— | —— | 94.100% | —— |
| % Mass due to Fibers: | 6.143% | 100.000% | —— | —— | 94.462% | —— |
| % Mass due to Matrices: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Bundles: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Clusters: | 93.857% | 0.000% | —— | —— | 5.538% | —— |

ABD 001 1847

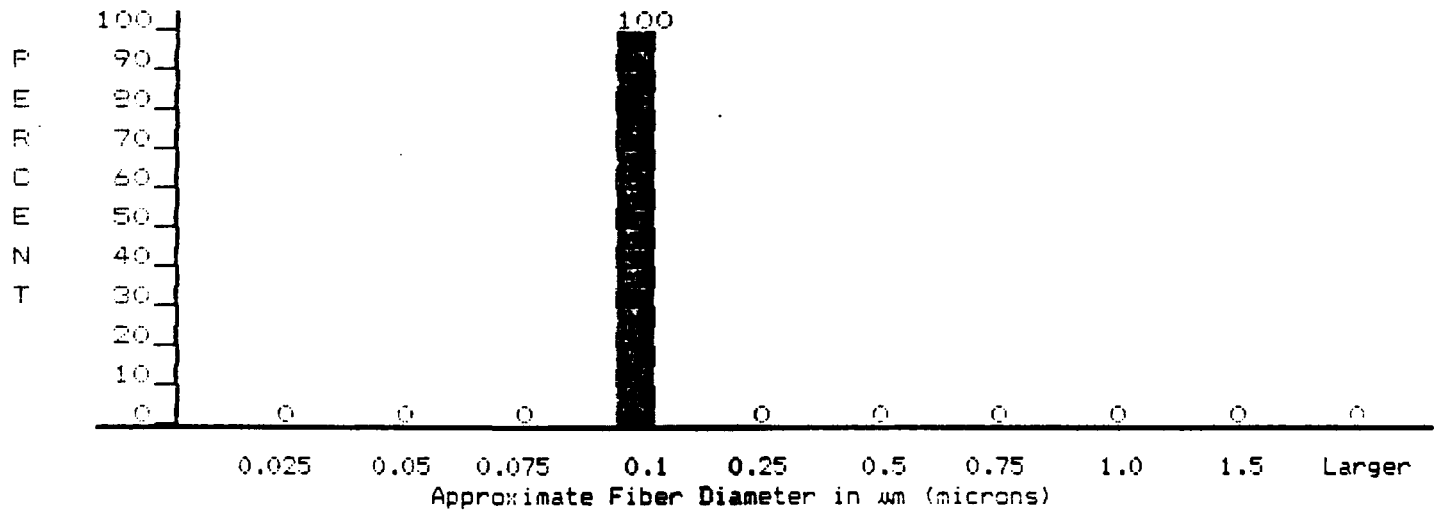
A 00048

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

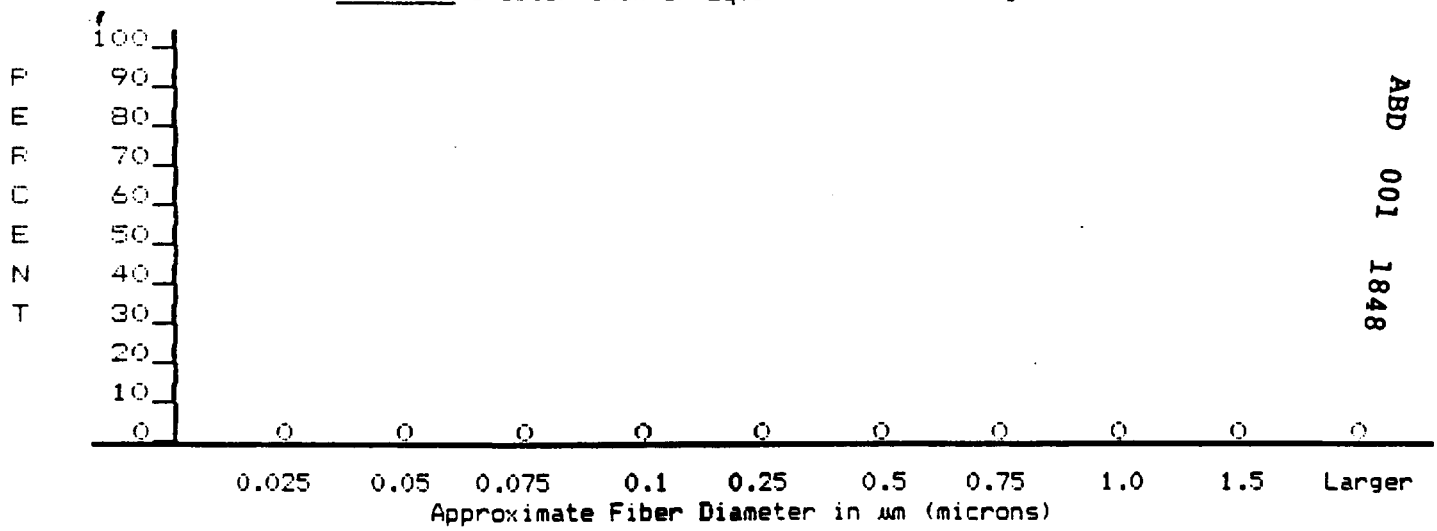
Sample : 04852

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1848

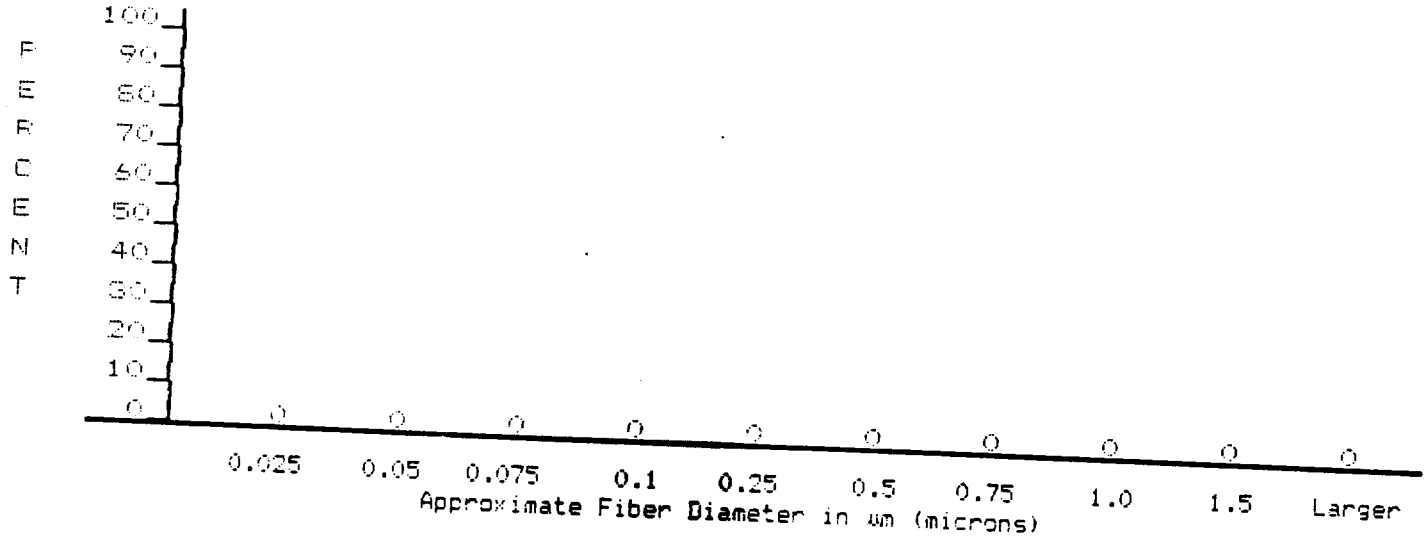
*Sum of both histograms, represents 100% of Chrysotile fibers.

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

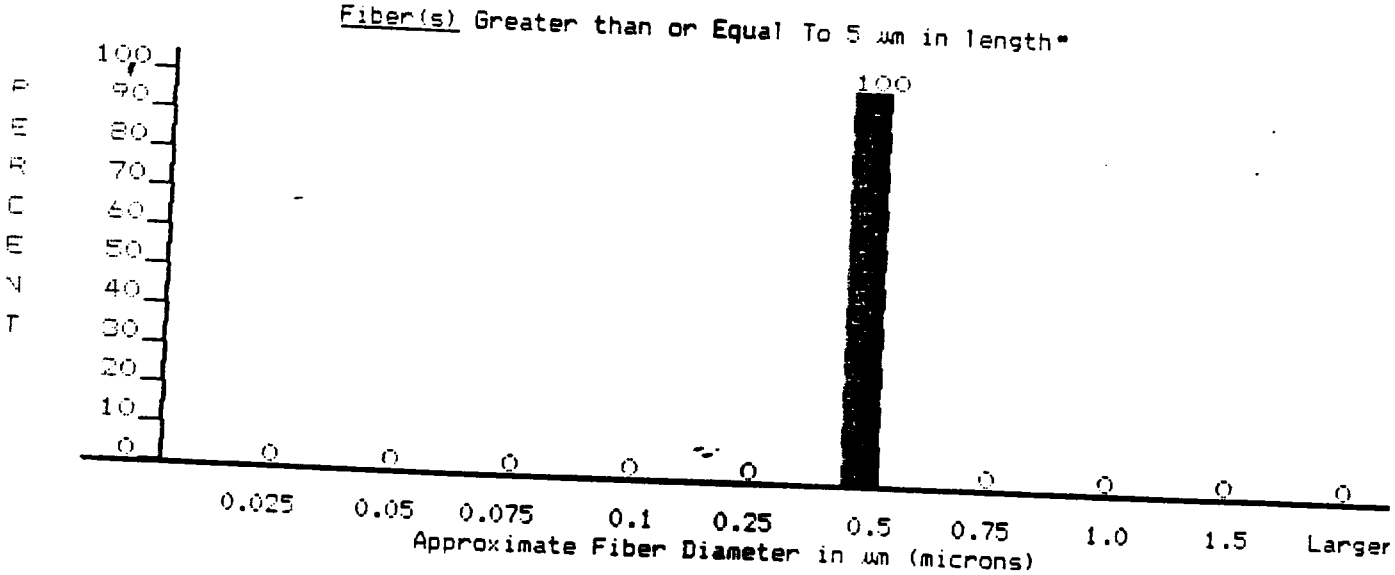
Sample : 04952

# AMPHIBOLES

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




*Sum of both histograms represents 100% of Amphibole fibers.

ABD 001 1849

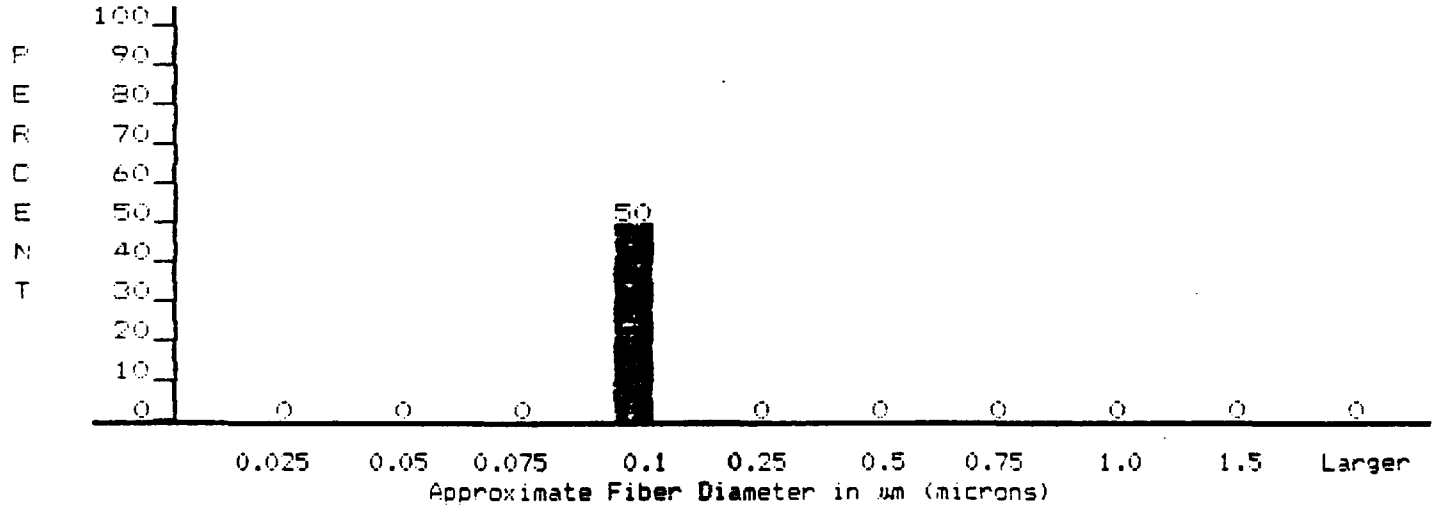
A 00050

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

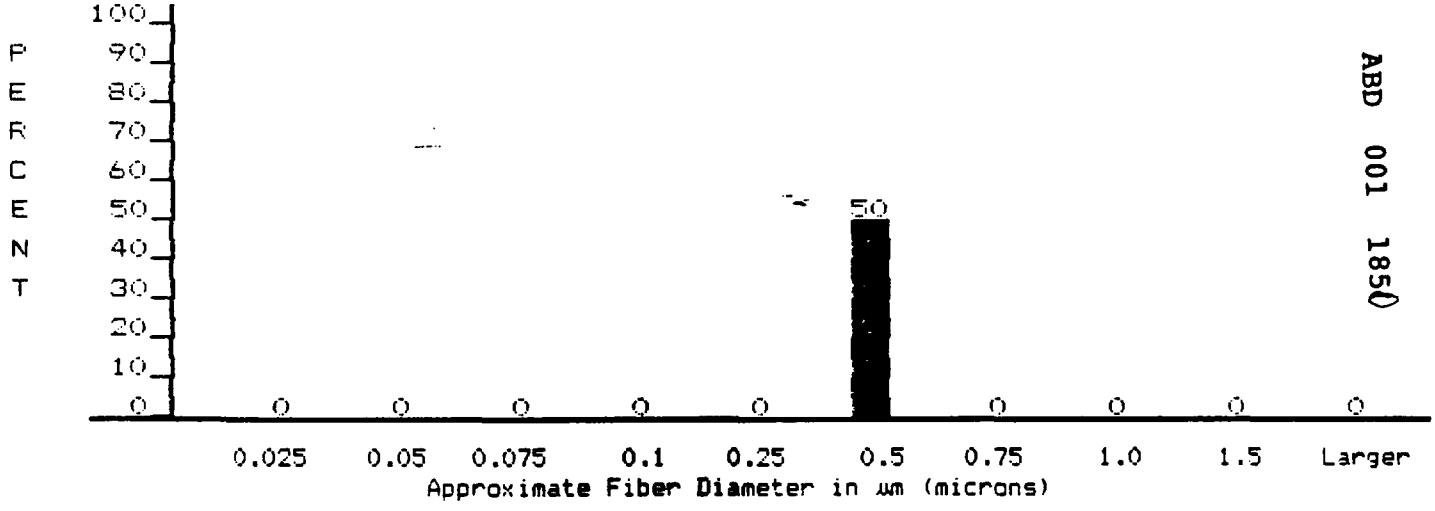
Sample : 04852

# TOTAL ASBESTOS

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1850

*Sum of both histograms represents 100% of total asbestos fibers.

A 00051

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04852

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 2 | | nonasbestos | | | | |
| 2 | 3 - 8 | | nonasbestos | | | | |
| 2 | 9 | cluster | chrysotile | 3.000 | 0.0500 | 0.8000 | 0.3120 |
| 3 | 10 - 11 | | nonasbestos | | | | |
| 3 | 12 | fiber | chrysotile | 1.000 | 0.1000 | | 0.0204 |
| 4 | 13 - 14 | | nonasbestos | | | | |
| 5 | 15 - 18 | | nonasbestos | | | | |
| 5 | 19 | fiber | actinolite | 9.000 | 0.5000 | | 5.3014 |
| 6 | 20 - 22 | | nonasbestos | | | | |
| 7 | 23 - 30 | | nonasbestos | | | | |
| 8 | 31 - 34 | | nonasbestos | | | | |
| 9 | 35 - 36 | | nonasbestos | | | | |
| 10 | 37 - 38 | | nonasbestos | | | | |

Mass of Chrysotile Particulates 0.3324
Mass of Amphibole Particulates 5.3014
Total Mass of Asbestos Particulates 5.6339

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

ABD 001 1851

A 00052

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

LABORATORY #: 9037bnR
CLIENT ID: Roy F. Weston, Inc., Edison

PROJECT: 1047-01-01-0428/Millington Asbestos

Date: OCT 17 90
TAT: 24 Hr

SAMPLE ID: 04052
SAMPLE LOCATION:
Resid.#2/BR

VOLUME(LITERS): 10368.00

GRID OPENINGS: 10

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

FILTER SIZE: 25
FILTER TYPE: MCE / PC

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | | | | | | | | | | | | | | | |
| | 2 | 6 | 3.0 | 0.05 | 0.8C | | | | | | | | | | | | |
| | 3 | 2 | 1.0 | 0.1 | F | | | | | | | | | | | | |
| | 4 | 2 | | | | | | | | | | | | | | | |
| | 5 | 4 | | | | | | | | | | 9.0 | 0.5 | F | ACTINOLITE | | |
| | 6 | 3 | | | | | | | | | | | | | | | |
| | 7 | 8 | | | | | | | | | | | | | | | |
| | 8 | 4 | | | | | | | | | | | | | | | |
| | 9 | 2 | | | | | | | | | | | | | | | |
| | 10 | 2 | | | | | | | | | | | | | | | |

3

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 4 Date: 10/17/90

Analyst: [illegible]

Check: [illegible]

Computer: Dodi

Picture ☐ Spectrum ☐ SAED ☐ # -

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (N) / G(Tm²) = 0.0019

Grid Box # 090999 Row H Col. 10

Filter Accepted for Analysis: Yes ☒ No ☐

If No, Reason for Rejection:

001 1852

A 000153

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Alfred Baltz

EDUCATION

1944-49 Heidelberg University, Germany.
MA Physics, MA Physical Chemistry

EMPLOYMENT

EMSL: Since 1984

1965-84 Sperry Computer System (Blue Bell, PA)
Electron Microscopist, Principle Physicist,
Staff Scientist and Manager.

1960-65 Franklin Institute Research Laboratory (Phila. PA)
Sr. Physicist, Electron Microscopist.

1954-60 Atlantic Refinery Company, Sr. Physicist.

Member: Philadelphia Electron Microscopy Society (Chairman 1974-75);
International Society for Hybrid Microelectronics;
American Physical Society; Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100C Analytical TEM
EDX ANALYZER: Kevex Delta III System with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1853

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

105 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4300

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04853
LOCATION : Resid. #2/Den
VOLUME : 10313.800 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 2 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 36 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | Chrysotile,Actinolite |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0012 |
| Concentration Detection Limit: | | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (in AFP/cc or million/m³) | (50.0 %) | 0.0006 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 5.6912 |
| Mass Detection Limit : | | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/m³ ) | (96.6 %) | 5.4971 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Fibers Containing: (Talc).

Peter Frasca, PH.D.
President

Laboratory
Supervisor

R. K. Maloney
Approved
Signatory

00055

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

ARN 001 1854

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04853

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 1 | 1 | 0 | 36 | 2 | 38 |
| # of Particulates on Whole Filter (in millions): | 0.0064 | 0.0064 | 0.0000 | 0.2310 | 0.0128 | 0.2438 |
| Concentration of Particulates (in million/m³): | 0.0006 | 0.0006 | 0.0000 | 0.0224 | 0.0012 | 0.0236 |
| % of Count due to Particulates ≥ 5 µm in length: | 0.000% | 100.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Fibers: | 0.000% | 100.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Matrices: | 100.000% | 0.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.1941 | 5.4971 | —— | —— | 5.6912 | —— |
| % of Mass due to Particulates ≥ 5 µm in length: | 0.000% | 100.000% | —— | —— | 96.589% | —— |
| % Mass due to Fibers: | 0.000% | 100.000% | —— | —— | 96.589% | —— |
| % Mass due to Matrices: | 100.000% | 0.000% | —— | —— | 3.411% | —— |
| % Mass due to Bundles: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Clusters: | 0.000% | 0.000% | —— | —— | 0.000% | —— |

ABD 001 1855

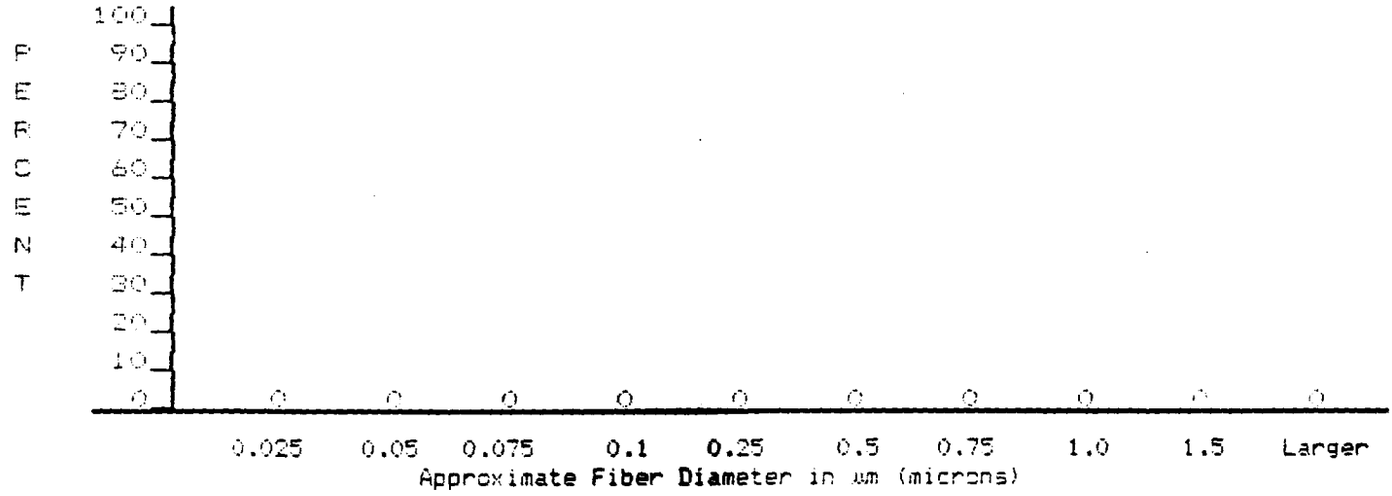
A 00056

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

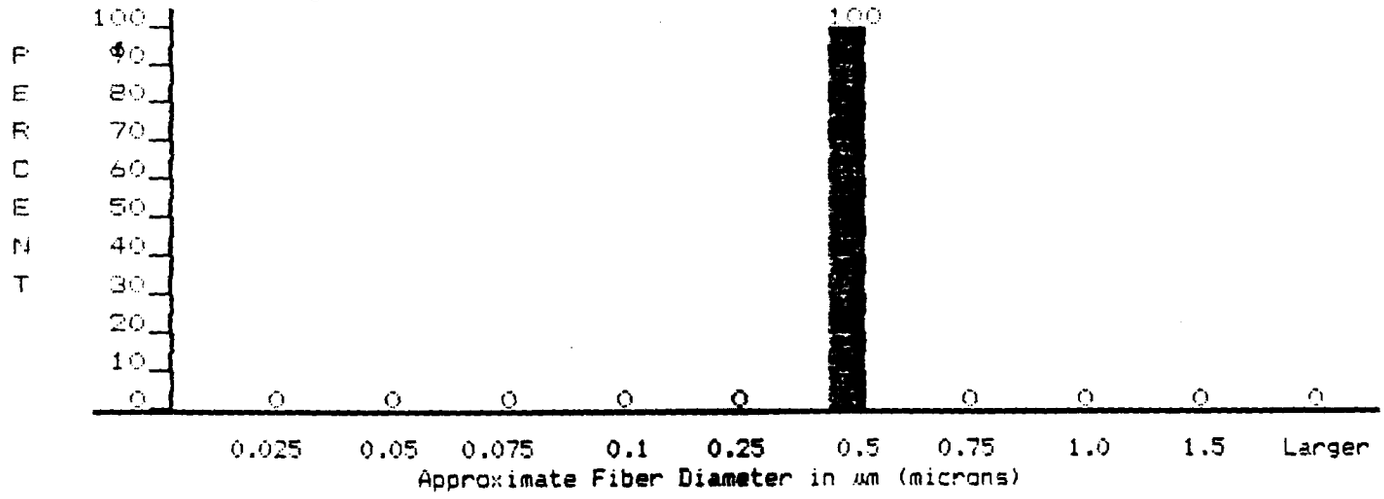
Sample : 04353

# AMPHIBOLES

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




*Sum of both histograms represents 100% of Amphibole fibers.

ABD 001 1856

A 00057

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04853

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | STRUCTURE TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 3 | | nonasbestos | | | | |
| 2 | 4 | | nonasbestos | | | | |
| 3 | 5 - 8 | | nonasbestos | | | | |
| 3 | 9 | matrix | chrysotile | 3.000 | 0.2000 | 0.2000 | 0.3120 |
| 4 | 10 - 12 | | nonasbestos | | | | |
| 5 | 13 - 15 | | nonasbestos | | | | |
| 6 | 16 - 21 | | nonasbestos | | | | |
| 7 | 22 - 23 | | nonasbestos | | | | |
| 8 | 24 - 29 | | nonasbestos | | | | |
| 9 | 30 - 33 | | nonasbestos | | | | |
| 10 | 34 - 37 | | nonasbestos | | | | |
| 10 | 38 | fiber | actinolite | 15.000 | 0.5000 | | 8.8357 |

Mass of Chrysotile Particulates 0.3120
Mass of Amphibole Particulates 8.8357
Total Mass of Asbestos Particulates 9.1477

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio $\geq$ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

ABD 001 1857

A 00058

E M S L

# TEM AIR ANALYSIS WORKSHEET (TAMATE) LEVEL II

LABORATORY # 9037669
CLIENT ID: Roy F. Weston, Inc., Edison

PROJECT: 3047-21-01-0425/ Killington Asbestos

Date: OCT 17 90
TAT: 24 Hr

SAMPLE ID: 04953
SAMPLE LOCATION:
Resid. #2/ Den

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 10313.80

GRID OPENINGS: 10

(B=Bundle C=Cluster M=Matrix)

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | | | | | | | | | | | | | | | | |
| 2 | 7 | | | | | | | | | | | | | | | | |
| 3 | 4 | | 3.0 | 0.2 | 0.2M | | | | | | | | | | | | |
| 4 | 3 | | | | | | | | | | | | | | | | |
| 5 | 3 | | | | | | | | | | | | | | | | |
| 6 | 10 | | | | | | | | | | | | | | | | |
| 7 | 2 | | | | | | | | | | | | | | | | |
| 8 | 6 | | | | | | | | | | | | | | | | |
| | 7 | | | | | | | | | | | | | | | | |
| 10 | 4 | | | | | | | | | | | 15.0 | 0.5 | F | ACTINOLITE | | |

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☒ (5) Fibers Containing TALC

Scope #: 4 Date: 10/17/90

Analyst:

Q.C. Check:

Computer: Lori

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (K) / G(mm²) = 0.0012

Grid Box # 890999 Row I Col. 9

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 1858

A 00059

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Alfred Baltz

EDUCATION

1944-49 Heidelberg University, Germany.
MA Physics, MA Physical Chemistry

EMPLOYMENT

EMSL: Since 1984

1965-84 Sperry Computer System (Blue Bell, PA)
Electron Microscopist, Principle Physicist,
Staff Scientist and Manager.

1960-65 Franklin Institute Research Laboratory (Phila. PA)
Sr. Physicist, Electron Microscopist.

1954-60 Atlantic Refinery Company, Sr. Physicist.

Member: Philadelphia Electron Microscopy Society (Chairman 1974-75);
International Society for Hybrid Microelectronics;
American Physical Society; Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council.

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100C Analytical TEM
EDX ANALYZER: Kevex Delta III System with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1859

A 00060

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


| 108 HADDON AVENUE | 1056 STELTON ROAD | 1800 PEACHTREE STREET | 2 De ANGELO DRIVE |
|---|---|---|---|
| WESTMONT, N.J. | PISCATAWAY, N.J. | ATLANTA, GEORGIA | BEDFORD, MASS. |
| 08108 | 08858 | 30309 | 01730 |
| 609-858-4200 | 201-921-0550 | 404-355-4046 | 617-275-7080 |


Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Faritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3247-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04866
LOCATION : Field Blank 1
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 1 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | 0.0000 |
| Concentration Detection Limit: | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (0.0 %) (on whole filter (in millions) ) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | 0.0000 |
| Mass Detection Limit : | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : ( 0.0 %) (in nanograms/filter) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Fibers Containing: (Al,Si).

R. K. Maloney

| Peter Frasca, PH.D. | Laboratory | Approved |
|---|---|---|
| President | Supervisor | Signatory |

* laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent volume collected by nonlaboratory personal. * Accredited for PLM

ABD 001 1860

A 00061

E M S L

# TEM AIH ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 17 90
TAT: 24 Hr

LABORATORY #: 9037n70
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04956
SAMPLE LOCATION:
Field Blank 1

PROJECT: 3047-01-01-0426/Millington Asbestos

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 0.00

GRID OPENINGS: 20

IF ASHED*
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | | | | | | | | | | | | | | | | |
| 2 | 0 | | | | | | | | | | | | | | | | |
| 3 | 0 | | | | | | | | | | | | | | | | |
| 4 | 0 | | | | | | | | | | | | | | | | |
| 5 | 0 | | | | | | | | | | | | | | | | |
| 6 | 0 | | | | | | | | | | | | | | | | |
| 7 | 0 | | | | | | | | | | | | | | | | |
| 8 | 1 | | | | | | | | | | | | | | | | |
| 9 | 0 | | | | | | | | | | | | | | | | |
| 10 | 0 | | | | | | | | | | | | | | | | |
| 11 | 0 | | | | | | | | | | | | | | | | |
| 12 | 0 | | | | | | | | | | | | | | | | |
| 13 | 0 | | | | | | | | | | | | | | | | |
| 14 | 0 | | | | | | | | | | | | | | | | |
| 15 | 0 | | | | | | | | | | | | | | | | |
| 16 | 0 | | | | | | | | | | | | | | | | |
| 17 | 0 | | | | | | | | | | | | | | | | |
| 18 | 0 | | | | | | | | | | | | | | | | |
| 19 | 0 | | | | | | | | | | | | | | | | |
| 20 | 0 | | | | | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☒ (5) Fibers Containing

Scope #: 4 Date: 10/17/90

Analyst:

Q.C. Check: BF

Computer: Dodi

Photo ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (N) / G(Fm²) = 0.0032

Grid Box # 80949 Row J Col. 8, 10

Filter Accepted for Analysis: Yes ☒ No ☐

If No, Reason for Rejection:

ABD 001 1861

A 00052

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and place carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Alfred Baltz

EDUCATION

1944-49 Heidelberg University, Germany.
MA Physics, MA Physical Chemistry

EMPLOYMENT

EMSL: Since 1984

1965-84 Sperry Computer System (Blue Bell, PA)
Electron Microscopist, Principle Physicist,
Staff Scientist and Manager.

1960-65 Franklin Institute Research Laboratory (Phila. PA)
Sr. Physicist, Electron Microscopist.

1954-60 Atlantic Refinery Company, Sr. Physicist.

Member: Philadelphia Electron Microscopy Society (Chairman 1974-75);
International Society for Hybrid Microelectronics;
American Physical Society; Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100C Analytical TEM
EDX ANALYZER: Kevex Delta III System with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1862

A 00063

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

| 109 HADDON AVENUE | 1056 STELTON ROAD | 1800 PEACHTREE STREET | 2 De ANGELO DRIVE |
|---|---|---|---|
| WESTMONT, N.J. | PISCATAWAY, N.J. | ATLANTA, GEORGIA | BEDFORD, MASS. |
| 08108 | 08858 | 30309 | 01730 |
| 609-858-4300 | 201-981-0550 | 404-355-4045 | 617-275-7080 |


Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2290 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04864
LOCATION : Field Blank 2
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 0 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | | 0.0000 |
| Concentration Detection Limit: | | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (on whole filter (in millions) ) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | | 0.0000 |
| Mass Detection Limit : | | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/filter) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

ABD 001 1863

R.K. Mahoney

Peter Frasca, PH.D. President | Laboratory Supervisor | Approved Signatory

A 00064

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent on volume collected by personnel, a procedure not TEM

EHSL

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 17 90
TAT: 24 Hr

LABORATORY #: 9037671
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04864
SAMPLE LOCATION:
Field Blank 2

PROJECT: 0047-21-01-0426/ Millington Asbestos

VOLUME(LITERS): 0.00

FILTER SIZE: 25
FILTER TYPE: MCE PC

GRID OPENINGS: 20
(B=Bundle C=Cluster M=Matrix)

IF ASHED*
37mm Q= 1.13
25mm Q= 2.49
K= % RESUSPENDED/100
% RESUSPENDED=

| G# | NON ASB | CHRYSOTILE LENGTH | THICK | TYPE WIDTH | LENGTH | THICK | TYPE WIDTH | AMPHIBOLE LENGTH | THICK | TYPE WIDTH | LENGTH | THICK | TYPE WIDTH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | | | | | | | | | | | | |
| 2 | 0 | | | | | | | | | | | | |
| 3 | 0 | | | | | | | | | | | | |
| 4 | 0 | | | | | | | | | | | | |
| 5 | 0 | | | | | | | | | | | | |
| 6 | 0 | | | | | | | | | | | | |
| 7 | 0 | | | | | | | | | | | | |
| 8 | 0 | | | | | | | | | | | | |
| 9 | 0 | | | | | | | | | | | | |
| 10 | 0 | | | | | | | | | | | | |
| | 0 | | | | | | | | | | | | |
| | 0 | | | | | | | | | | | | |
| 13 | 0 | | | | | | | | | | | | |
| 14 | 0 | | | | | | | | | | | | |
| 15 | 0 | | | | | | | | | | | | |
| 16 | 0 | | | | | | | | | | | | |
| 17 | 0 | | | | | | | | | | | | |
| 18 | 0 | | | | | | | | | | | | |
| 19 | 0 | | | | | | | | | | | | |
| 20 | 0 | | | | | | | | | | | | |

NONASBESTOS FIBERS PRESENT
- ☐ GYPSUM (1)
- ☐ GLASS (2)
- ☐ CELLULOSE (3)
- ☐ ORGANIC FIBERS (4)
- ☐ FIBERS CONTAINING (5)

SCOPE* 4

ANALYST:

Q.C. CHECK:

COMPUTER: Dodi

TURE ☐ SPECTRUM ☐ SAED ☐ *

..PES

HAND CALCULATIONS

(25mm) ---> $\frac{0.0642\ (N)}{G(F_{IN}^2)}$ = 0.0032

GRID BOX # 490999 & ROW K

FILTER ACCEPTED FOR ANALYSIS: YES ☒ NO ☐

IF NO, WHY?

FORM #1 RE: 4

ABD 001 1864

A 00055

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Alfred Baltz

EDUCATION

1944-49 Heidelberg University, Germany.
MA Physics, MA Physical Chemistry

EMPLOYMENT

EMSL: Since 1984

1965-84 Sperry Computer System (Blue Bell, PA)
Electron Microscopist, Principle Physicist,
Staff Scientist and Manager.

1960-65 Franklin Institute Research Laboratory (Phila. PA)
Sr. Physicist, Electron Microscopist.

1954-60 Atlantic Refinery Company, Sr. Physicist.

Member: Philadelphia Electron Microscopy Society (Chairman 1974-75);
International Society for Hybrid Microelectronics;
American Physical Society; Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100C Analytical TEM

EDX ANALYZER: Kevex Delta III System with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1865

A 00066

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08854
201-981-0550

1900 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Thursday, October 18, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04865
LOCATION : Lot Blank
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 0 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | | 0.0000 |
| Concentration Detection Limit: | | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (on whole filter (in millions) ) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | | 0.0000 |
| Mass Detection Limit : | | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/filter) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

ABD 001 186

R. K. Maloney

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 00007

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent on volume collected by nonlaboratory personnel, a responsibility for this

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 17 90
TAT: 24 Hr

LABORATORY #: 9037672
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04865
SAMPLE LOCATION:
Lot Blank

JECT. 3347-21-01-3426/ Millington Asbestos

VOLUME(LITERS): 0.00

GRID OPENINGS: 20

FILTER SIZE: 25
FILTER TYPE: MCE PC

(B=Bundle C=Cluster M=Matrix)

IF ASHED*
37mm Q= 1.13
25mm Q= 2.49
K= % RESUSPENDED/100
% RESUSPENDED=

| G# | NON ASB | CHRYSOTILE LENGTH | CHRYSOTILE THICK | CHRYSOTILE TYPE WIDTH | CHRYSOTILE LENGTH | CHRYSOTILE THICK | CHRYSOTILE TYPE WIDTH | AMPHIBOLE LENGTH | AMPHIBOLE THICK | AMPHIBOLE TYPE WIDTH | AMPHIBOLE LENGTH | AMPHIBOLE THICK | AMPHIBOLE TYPE WIDTH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | | | | | | | | | | | | |
| 2 | 0 | | | | | | | | | | | | |
| 3 | 0 | | | | | | | | | | | | |
| 4 | 0 | | | | | | | | | | | | |
| 5 | 0 | | | | | | | | | | | | |
| 6 | 0 | | | | | | | | | | | | |
| 7 | 0 | | | | | | | | | | | | |
| 8 | 0 | | | | | | | | | | | | |
| 9 | 0 | | | | | | | | | | | | |
| 10 | 0 | | | | | | | | | | | | |
| | 0 | | | | | | | | | | | | |
| 11 | 0 | | | | | | | | | | | | |
| 12 | 0 | | | | | | | | | | | | |
| 14 | 0 | | | | | | | | | | | | |
| 15 | 0 | | | | | | | | | | | | |
| 16 | 0 | | | | | | | | | | | | |
| 17 | 0 | | | | | | | | | | | | |
| 18 | 0 | | | | | | | | | | | | |
| 19 | 0 | | | | | | | | | | | | |
| 20 | 0 | | | | | | | | | | | | |

NONASBESTOS FIBERS PRESENT
- ☐ GYPSUM (1)
- ☐ GLASS (2)
- ☐ CELLULOSE (3)
- ☐ ORGANIC FIBERS (4)
- ☐ FIBERS CONTAINING (5)

SCOPE* 4

ANALYST:

Q.C. CHECK:

COMPUTER: Dodi

TURE ☐ SPECTRUM ☐ SAED ☐ *

ES

**HAND CALCULATIONS**

(25mm) ---> $\frac{0.0642\ (N)}{G(Fm^2)}$ = 0.0032

GRID BOX * 890999 ROW 6

FILTER ACCEPTED FOR ANALYSIS: YES ☑ NO ☐

IF NO, WHY?

FORM #1 RE: 4

ABD 001 1867

A 00068

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1005 STELTON ROAD
PISCATAWAY, N.J.
08854
201-561-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7181

Friday, October 19, 1990

Mr. F. Weston
REAC Project 33A/Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-01-01-3426/Millington Asbestos Garrison Residence
SAMPLE IDENTIFICATION : 04231
LOCATION : Upstairs Family Room
VOLUME : 2773.750 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 11 |
| 3. Number of Amoiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0000 |
| Concentration Detection Limit: | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (0.0 %) (in AFP/cc or million/m³) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.0000 |
| Mass Detection Limit : | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (0.0 %) (in nanograms/m³) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, Glass, and Fibers Containing: (Al,Si).

A 00074

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

ABD 001 1868

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 18 90
TAT: 24 Hr

LABORATORY #: 9037769
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04831
SAMPLE LOCATION:
Upstairs Family Room

Debbie

OJECT: 3347-21-01-3426/Millington Asbestos/Garrison Residence

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 3773.75

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 1 | | | | | | | | | | | | | | | |
| | 3 | 1 | | | | | | | | | | | | | | | |
| | 4 | 0 | | | | | | | | | | | | | | | |
| | 5 | 1 | | | | | | | | | | | | | | | |
| | 6 | 1 | | | | | | | | | | | | | | | |
| | 7 | 0 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 0 | | | | | | | | | | | | | | | |
| | 10 | 2 | | | | | | | | | | | | | | | |
| | 11 | 0 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 1 | | | | | | | | | | | | | | | |
| | 14 | 1 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 0 | | | | | | | | | | | | | | | |
| | 17 | 1 | | | | | | | | | | | | | | | |
| | 18 | 0 | | | | | | | | | | | | | | | |
| | 19 | 2 | | | | | | | | | | | | | | | |
| | 20 | 0 | | | | | | | | | | | | | | | |

ND

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☒ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☒ (5) Fibers Containing A/S

Scope #: 2 Date: 10/18/90

Analyst: RKm

Q.C. Check:

C puter:

F a ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (N) / G(Fm³) = 0.0004

Grid Box # R90998 Row M Col. 10,P

Filter Accepted for Analysis: Yes ☒ No ☐

If No, Reason for Rejection:

A 00075

ABD 001 1869

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

## METHODOLOGY: Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm x 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

## ANALYST: Ronald Mahoney

EDUCATION

1981 Florida Institute of Technology; M.S. Bio-Environmental Oceanography

1974 Pennsylvania State University; B.S. Biology

EMPLOYMENT

EMSL: Since 1990

1979-1990 The Academy of Natural Sciences; Philadelphia PA, Division of Systematics.

1980-1990 Diatom Herbarium; Phycologist/Collection Manager.

1979-1980 Algae Section; Phytoplankton Ecologist/Taxonomist

Member: Electron Microscopy Society of America, Philadelphia Electron Microscopy Society.

## LABORATORY DIRECTOR: Peter Frasca, Ph.D.

EDUCATION

Rensselaer Polytechnical Institute, Troy, New York

1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)

Research Associate Professor

Director of Orthopaedic Research

Director of Ultrastructure and X-Ray Microanalysis Laboratory

Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council.

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

## ELECTRON MICROSCOPE and EDX ANALYZER

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.



A B D 001 1870

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


| | | | |
|---|---|---|---|
| [illegible] HADDON AVENUE | 105a STELTON ROAD | 1500 PEACHTREE STREET | 2 De ANGELO DRIVE |
| [illegible]MONT, N.J. | PISCATAWAY, N.J. | ATLANTA, GEORGIA | BEDFORD, MASS. |
| 08105 | 08854 | 30309 | 01730 |
| 609-[illegible]-4010 | 201-981-0550 | 404-355-4746 | 617-275-7020 |


Friday, October 19, 1990

Rob F. Weston
REAC Project/38A Raritan Depot
2891 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679
Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 0847-01-01-3426/Millington Asbestos/Garrison Residence
SAMPLE IDENTIFICATION : 04233
LOCATION : Upstairs Family Room-CBZ
VOLUME : 9771.250 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 3 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0000 |
| Concentration Detection Limit: | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (0.0 %) (in AFP/cc or million/m³) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.0000 |
| Mass Detection Limit : | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : ( 0.0 %) (in nanograms/m³ ) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Fibers Containing: (Al,Si).

ABD 001 1871

A 00077

| | | |
|---|---|---|
| Peter Frasca, Ph.D. President | Laboratory Supervisor | Approved Signatory |

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

E M S L

# TEM AIR ANALYSIS WORKSHEET (TAMATE) LEVEL II

Date: OCT 18 90
TAT: 24 Hr

LABORATORY #: 9037770
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04833
SAMPLE LOCATION:
Upstairs Family Room-CBZ

SUBJECT: 3347-21-01-3426/Millington Asbestos/Garrison Residence

VOLUME(LITERS): 8771.25

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

FILTER SIZE: 25
FILTER TYPE: MCE PC

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | | | |
| | 3 | 0 | | | | | | | | | | | | | | | |
| | 4 | 0 | | | | | | | | | | | | | | | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 0 | | | | | | | | | | | | | | | |
| | 7 | 1 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 1 | | | | | | | | | | | | | | | |
| | 10 | 1 | | | | | | | | | | | | | | | |
| | 11 | 0 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 0 | | | | | | | | | | | | | | | |
| | 14 | 0 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 0 | | | | | | | | | | | | | | | |
| | 17 | 0 | | | | | | | | | | | | | | | |
| | 18 | 0 | | | | | | | | | | | | | | | |
| | 19 | 0 | | | | | | | | | | | | | | | |
| | 20 | 0 | | | | | | | | | | | | | | | |

ND

Nonasbestos Fibers Present
- ☑ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

ALSI

Scope #: 2 Date: 10/19

Analyst: D. Little

Q.C. Check:

C puter:

P. ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (N) / 175.425 G(Tm³) = 0.00037

Grid Box # 890998 Row N Col. 7 & 9

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 1872

A 00078

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm x 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1981

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselaer Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor.
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1873

A 00079

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


108 MADISON AVENUE, WESTMONT, N.J. 08108, 609-858-4800

1055 STELTON ROAD, PISCATAWAY, N.J. 08859, 201-981-0550

1800 PEACHTREE STREET, ATLANTA, GEORGIA 30309, 404-355-4046

2 DE ANGELO DRIVE, BEDFORD, MASS. 01730, 617-275-7080


Friday, October 19, 1990

Rev F. Weston
FIAC Project/334 Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos/Garrison Residence
SAMPLE IDENTIFICATION : 04335
LOCATION : Downstairs Family Room
VOLUME : 3550.000 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 2 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0000 |
| Concentration Detection Limit: | | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 um (microns) in length : (in AFP/cc or million/m³) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 0.0000 |
| Mass Detection Limit : | | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5um (microns) in length : (in nanograms/m³ ) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Fibers Containing: (Al,Si).

| Peter Frasca, PH.D. President | Laboratory Supervisor | Approved Signatory |
|---|---|---|

A 00080

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume colleted by nonlaboratory personal. * Accredited for PLM

ABD 001 1874

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 18 90
TAT: 24 Hr

LABORATORY #: 9037771
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04835
SAMPLE LOCATION:
Downstairs Family Room

PROJECT: 3347-21-01-3426/Millington Asbestos/Garrison Residence

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

VOLUME(LITERS): 8850.00

FILTER SIZE: 25
FILTER TYPE: MCE PC

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 1 | | | | | | | | | | | | | | | |
| | 3 | 0 | | | | | | | | | | | | | | | |
| | 4 | 0 | | | | | | | | | | | | | | | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 0 | | | | | | | | | | | | | | | |
| | 7 | 0 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 0 | | | | | | | | | | | | | | | |
| | 10 | 0 | | | | | | | | | | | | | | | |
| | 11 | 0 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 0 | | | | | | | | | | | | | | | |
| | 14 | 1 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 0 | | | | | | | | | | | | | | | |
| | 17 | 0 | | | | | | | | | | | | | | | |
| | 18 | 0 | | | | | | | | | | | | | | | |
| | 19 | 0 | | | | | | | | | | | | | | | |
| | 20 | 0 | | | | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☑ (5) Fibers Containing ALSI

Scope #: 2 Date: 10/19

Analyst: M. Tittle

Q.C. Check:

Co[illegible]ter:

P[illegible] ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> $\frac{0.0642\ (N)}{177\ G(Fm^2)}$ = 0.00036

Grid Box # 890998 Row 0 Col. 8 & 10

Filter Accepted for Analysis: Yes ☐ No ☐

If No, Reason for Rejection:

ABD 001 1875

A 00031

# ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000x by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSL Certified Electron Microscopy Technologist

1973-1977 Bryn Mawr College, Philadelphia

EMPLOYMENT

EMSL: Since 1980

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

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Rensselaer Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

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EMSL: Founder 1981

1973-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council.

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1876

A 00082

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


| | | | |
|---|---|---|---|
| 109 MADISON AVENUE | 1036 STELTON ROAD | 1500 PEACHTREE STREET | 2 De ANGELO DRIVE |
| WESTMONT, N.J. | PISCATAWAY, N.J. | ATLANTA, GEORGIA | BEDFORD, MASS. |
| 08108 | 08858 | 30309 | 01730 |
| 609-858-4800 | 201-561-0550 | 404-355-4046 | 617-275-7080 |


Friday, October 19, 1990

Mr. F. Weston
FEAC Project/GSA Raritan Depot
CERC Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos/Garrison Residence
SAMPLE IDENTIFICATION : 04837
LOCATION : Master Bedroom
VOLUME : 8776.250 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 75 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0000 |
| Concentration Detection Limit: | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (0.0 %) (in AFP/cc or million/m³) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.0000 |
| Mass Detection Limit : | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : ( 0.0 %) (in nanograms/m³ ) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Organic Fibers.

| | | |
|---|---|---|
| Peter Frasca, PH.D. President | Laboratory Supervisor | Approved Signatory |

A 00083

ABD 001 1877

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

Date: OCT 18 90
TAT: 24 Hr

LABORATORY #: 9037772
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04837
SAMPLE LOCATION:
Master Bedroom

PROJECT: 3347-21-01-3426/Millington Asbestos/Garrison Residence

VOLUME(LITERS): 8776.25

GRID OPENINGS: 30

FILTER SIZE: 25
FILTER TYPE: MCE PC

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 10 | | | | | | | | | | | | | | | |
| | 2 | 10 | | | | | | | | | | | | | | | |
| | 3 | 10 | | | | | | | | | | | | | | | |
| | 4 | 1 | | | | | | | | | | | | | | | |
| | 5 | 10 | | | | | | | | | | | | | | | |
| | 6 | 10 | | | | | | | | | | | | | | | |
| | 7 | 10 | | | | | | | | | | | | | | | |
| | 8 | 10 | | | | | | | | | | | | | | | |
| | 9 | 10 | | | | | | | | | | | | | | | |
| | 10 | 10 | | | | | | | | | | | | | | | |
| | 11 | 5 | | | | | | | | | | | | | | | |
| | 12 | 6 | | | | | | | | | | | | | | | |
| | 13 | 5 | | | | | | | | | | | | | | | |
| | 14 | 10 | | | | | | | | | | | | | | | |
| | 15 | 8 | | | | | | | | | | | | | | | |
| | 16 | 12 | | | | | | | | | | | | | | | |
| | 17 | 5 | | | | | | | | | | | | | | | |
| | 18 | 8 | | | | | | | | | | | | | | | |
| | 19 | 10 | | | | | | | | | | | | | | | |
| | 20 | 5 | | | | | | | | | | | | | | | |

ND

Nonasbestos Fibers Present
- ☑ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☑ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/19
Analyst: [illegible]
Q.C. Check: [illegible]
Co[illegible]ter: [illegible]
F[illegible] ☐ Spectrum ☐ SAED ☐ #
Types

**HAND CALCULATIONS**

(25mm) ---> 0.0642 (N) / 175,525 G(Fm³) = 0.00037

Grid Box # 890998 Row P Col. 7 & 9.

Filter Accepted for Analysis: Yes ☑ No ☐
If No, Reason for Rejection:

ABD 001 1878

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

## METHODOLOGY: Yamate et al. 1984 (11), EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

## ANALYST: Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1980

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

## LABORATORY DIRECTOR: Peter Frasca, Ph.D.

EDUCATION

Rensselaer Polytechnical Institute, Troy, New York

1974 PhD (Physical), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council.

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

## ELECTRON MICROSCOPE and EDX ANALYZER

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1879

00085

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


| | | | |
|---|---|---|---|
| 108 HAZEDON AVENUE | 1055 STELTON ROAD | 1800 PEACHTREE STREET | 3 De ANGELO DRIVE |
| WESTMONT, N.J. | PISCATAWAY, N.J. | ATLANTA, GEORGIA | BEDFORD, MASS. |
| 08108 | 08854 | 30309 | 01730 |
| 609-858-4800 | 201-981-0550 | 404-355-4046 | 617-275-7050 |


Friday, October 19, 1990

Roy F. Weston
REAC Project 554 Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3079

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-01-01-3426/Millington Asbestos/Garrison Residence
SAMPLE IDENTIFICATION : 04832
LOCATION : Field Blank
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 0 |
| 3. Number of Amoiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | 0.0000 |
| Concentration Detection Limit: | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (0.0 %) (on whole filter (in millions) ) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | 0.0000 |
| Mass Detection Limit : | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : ( 0.0 %) (in nanograms/filter) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

ABD 001 1880

Peter Frasca, PH.D.
President

Laboratory Supervisor

Approved Signatory

A 00036

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PCM

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 18 90
TAT: 24 Hr

LABORATORY #: 9037773
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04832
SAMPLE LOCATION:
Field Blank

SUBJECT: 3347-21-01-3426/Millington Asbestos/Garrison Residence

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 0.00

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | | | |
| | 3 | 0 | | | | | | | | | | | | | | | |
| | 4 | 0 | | | | | | | | | | | | | | | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 0 | | | | | | | | | | | | | | | |
| | 7 | 0 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 0 | | | | | | | | | | | | | | | |
| | 10 | 0 | | | | | | | | | | | | | | | |
| | 11 | 0 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 0 | | | | | | | | | | | | | | | |
| | 14 | 0 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 0 | | | | | | | | | | | | | | | |
| | 17 | 0 | | | | | | | | | | | | | | | |
| | 18 | 0 | | | | | | | | | | | | | | | |
| | 19 | 0 | | | | | | | | | | | | | | | |
| | 20 | 0 | | | | | | | | | | | | | | | |

ND

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/19

Analyst: M. Tuttle

Q.C. Check: [illegible]

Co. uter: [illegible]

P. ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (N) / G(Tm²) = 0.0032

Grid Box # 890998 Row [illegible] Col. 8 & 10

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 1881

A 00687

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 III, EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm x 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive x-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1980

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselaer Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1882

A 00088

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


108 HADDON AVENUE, WESTMONT, N.J. 08108, 609-858-4311

1095 STELTON ROAD, PISCATAWAY, N.J. 08854, 201-981-1550

1500 PEACHTREE STREET, ATLANTA, GEORGIA 30309, 404-355-4046

2 De ANGELO DRIVE, BEDFORD, MASS. 01730, 617-275-7020


Friday, October 19, 1990

Roy F. Weston
REAC Project/SSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive x-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 0847-01-01-0426/Millington Asbestos/Garrison Residence
SAMPLE IDENTIFICATION : 04824
LOCATION : Lab Blank
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 0 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | 0.0000 |
| Concentration Detection Limit: | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 um (microns) in length : (0.0 %) (on whole filter (in millions) ) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | 0.0000 |
| Mass Detection Limit : | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5um (microns) in length : ( 0.0 %) (in nanograms/filter) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

Peter Fraseca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

ABD 001 1883

A 00089

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

LABORATORY #: 9037774
CLIENT ID: Roy F. Weston, Inc., Edison

Date: OCT 18 90
TAT: 24 Hr

SAMPLE ID: 04834
SAMPLE LOCATION:
Lot Blank

JECT: 3047-21-01-3426/Millington Asbestos/Garrison Residence

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 0.00

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | | | |
| | 3 | 0 | | | | | | | | | | | | | | | |
| | 4 | 0 | | | | | | | | | | | | | | | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 0 | | | | | | | | | | | | | | | |
| | 7 | 0 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 0 | | | | | | | | | | | | | | | |
| | 10 | 0 | | | | | | | | | | | | | | | |
| | 11 | 0 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 0 | | | | | | | | | | | | | | | |
| | 14 | 0 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 0 | | | | | | | | | | | | | | | |
| | 17 | 0 | | | | | | | | | | | | | | | |
| | 18 | 0 | | | | | | | | | | | | | | | |
| | 19 | 0 | | | | | | | | | | | | | | | |
| | 20 | 0 | | | | | | | | | | | | | | | |

ND

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/19
Analyst: D. Little
Q.C. Check:
Cc ıter:
P ☐ Spectrum ☐ SAED ☐ #
Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (N) / G(Vm³) = 0.0032

Grid Box # 890998 Row R Col. 759.

Filter Accepted for Analysis: Yes ☐ No ☐

If No, Reason for Rejection:

ABD 001 1884

A 00090

EMSL ELECTRON·MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselaer Polytechnical Institute, Troy, New York
1974 PhD(Physical), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1885

A 00091

ABD 001 1886

**Roy F. Weston, Inc.**
REAC, Edison, N.J.
EPA Contract 68-03-3482

# CHAIN OF CUSTODY RECORD/LAB WORK REQUEST

No: 3379

SHEET NO. 1 OF 1

Project Name: Millington Asbestos / Garrison Residence
Project Number: 3347-21-01-3426
RFW Contact: Chris Schultze Phone: 201-632-9200 Due Date:

A 00032

**SAMPLE IDENTFICATION** / **ANALYSES REQUESTED**

| Sample No. | Sampling Location | Matrix | Date Collected | Container/Preservative | Analysis | Vol. Coll. | | | |
|---|---|---|---|---|---|---|---|---|---|
| 04831 | Upstairs Family Room | .45(AIR) | 10-17-90 | None .45 MCEF Cassette | TEM | 8773.75 l | | | |
| 04833 | Upstairs Family Room CBZ | .45(AIR) | 10-17-90 | | TEM | 8771.25 l | | | |
| 04835 | Downstairs Family Room | .45(AIR) | 10-17-90 | | TEM | 8850.0 l | | | |
| 04837 | Master Bedroom | .45(AIR) | 10-17-90 | | TEM | 8776.25 l | | | |
| 04832 | Field Blank | .45(AIR) | 10-17-90 | | TEM | 0 l | | | INB |
| 04834 | Lot Blank | .45(AIR) | 10-17-90 | | TEM | 0 l | | | INB |

Matrix:
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

Special Instructions: * CBZ - Child Breathing Zone

| Items/Reason | Relinquished By | Received By | Date | Time | Items/Reason | Relinquished By | Received By | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| 6 for Analysis | Theresa A. M. Barber | [illegible] | 10/18/90 | 1350 | | | | | |

The deliverable requirements for Metals analyses are as follows:

1. Copies of the analysts' notebook which shows not only results, but also standard curve used.
2. A list of instrument and method detection limits for each compound analyzed.
3. A copy of the sample digestion method.
4. Tabulated sample results.
5. Tabulated MS/MSD results.
6. All instrument printouts and notebook pages for standard curve.

The deliverables requirements for all other analyses are as follows:

1. Copies of all analysts' notebook data.
2. Tabulated sample results.
3. Tabulated MS/MSD duplicate results.
4. Copies of standard curve used.
5. Copies of all raw data.

The following is the Roy F. Weston Penalty Clause:
Whenever a data package is late a 3% reduction in total charges will occur on the first day, an additional 2% reduction in the total charges will occur on the second day and additional 1% reductions in the total charges will occur on the third and each additional day a complete data package is late.

The turn around time begins with the data your laboratory takes custody of the samples. If the receipt of the amples is after 10:30 am, the turn around time will begin on the following day, unless otherwise specified.

Notebook No. _____

PROJECT _____ Continued From Page _____

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 15 October 1990 | | | | | | | |
| | Environmental Testing | | | | | | | |
| 9037386 | 1015-NHS-04 (IWA) Field Blank | 0 | 0 | A | 1203.15 | 10 | 0.0050 | |
| 9037387 | 1015-NHS-05 | 0 | 0 | A | 1203.15 | 10 | 0.0050 | |
| 9037384 | 1015-NHS-02 | | | A | 1203.15 | 10 | | |
| | 16 October 1990 | | | | | | | |
| | AET | | | | | | | |
| 9037392 | P-105 (OWA) | 1 | 1 | A | 17200 | 7 | 0.0500 | |
| | Spectech | | | | | | | |
| 9037398 | 35-01 (IWA) | 0 | 0 | A | 1500.00 | 10 | 0.0040 | |
| 9037399 | 35-02 | 0 | 1 | A | 1500.00 | 10 | 0.0040 | |
| 9037400 | 35-03 | 0 | 0 | A | 1500.00 | 10 | 0.0040 | |
| 9037401 | 35-04 | 0 | 0 | A | 1500.00 | 10 | 0.0040 | |
| | 18 October 1990 | | | | | | | |
| | Weston | | | | | | | |
| 9037769 | 04831 | 0 | 11 | A | 8773.75 | 20 | 0.0025 | |

ABD 001 1888

Continued on Page

Read and Understood By

Signed _____ Date _____ Signed _____ Date _____

PROJECT

| Comp # | Client | # Fib | # Non Asb | Vol | Co | Fibers/cc | cm |
|---|---|---|---|---|---|---|---|
| 10/17/90 | | | | | | | |
| 37030 | IHSC | 0 | 0 | 1573.75 | 20 | 0.0021 | 2 |
| 37031 | IHSC | 0 | 2 | 1526.25 | 20 | 0.0021 | 2 |
| 37032 | IHSC | 0 | 0 | 1507.75 | 20 | 0.0021 | 2 |
| 37661 | Weston | 5 | 36 | 10184.10 | 10 | 0.0032 | 2 |
| 37662 | " | 5 | 38 | 10199.00 | 10 | 0.0030 | 2 |
| 37663 | " | 2 | 56 | 10220.10 | 14 | 0.0009 | 2 |
| 37664 | " | 1 | 137 | 10338.80 | 16 | 0.00039 | 2 |
| 10/19/90 | | | | | | | |
| 37770 | Weston | 0 | 3 | 8771.25 | 20 | 0.00037 | 2 |
| 37771 | " | 0 | 2 | 8850.00 | 20 | 0.00036 | 2 |
| 37773 | " | 0 | 0 | 0.00 | 20 | 0.0032 | 2 |
| 37774 | " | 0 | 0 | 0.00 | 20 | 0.0032 | 2 |
| 37772 | Weston | 0 | 7 | 8776.25 | 20 | 0.00037 | 2 |
| 37791 | Agnant Ass | 2 | 2 | 1200 | 10 | 0.010 | 2 |
| 37792 | " | 4 | 0 | 1200 | 10 | 0.020 | 2 |
| 793 | " | 4 | 1 | 1200 | 10 | 0.020 | 2 |
| 37794 | " | 21 | 2 | 1200 | 5 | 0.21 | 2 |

Continued From Page

Continued on Page

Read and Understood By

Signed _____ Date _____ Signed _____ Date _____



ABD 001 1889

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Saturday, October 20, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

Project : 3347-21-01-3426/Millington Asbestos/Huhn Residence

## TEM SUMMARY REPORT

| SAMPLE ID | VOLUME (liters) | TYPE OF ASBESTOS | # STRUCTURES ASB | # STRUCTURES NONASB | CONCENTRATION OF ASBESTOS STRUCTURES AFP/cc | AFP/cc >5 | MASS | MASS >5 |
|---|---|---|---|---|---|---|---|---|
| 04841 | 8746.20 | none detected | 0 | 2 | 0.0004 | 0.0000 | 0.0000 | 0.0000 |
| 04843 | 8765.00 | none detected | 0 | 6 | 0.0004 | 0.0000 | 0.0000 | 0.0000 |
| 04844 | 7431.25 | none detected | 0 | 828 | 0.0004 | 0.0000 | 0.0000 | 0.0000 |
| 04845 | Blank | none detected | 0 | 0 | 0.0032 | 0.0000 | 0.0003 | 0.0000 |
| 04846 | Blank | none detected | 0 | 0 | 0.0032 | 0.0000 | 0.0003 | 0.0000 |

RECEIVED
OCT 22 1990
S&A

For none detected samples number under AFP/cc and MASS are detection limits.
AFP - Asbestos Fibrous Particulates.
AFP/cc - Concentration of Asbestos in AFP/cc; for blank sample AFP/cc represents number of AFP in million Fibers/Filter.
AFP/cc >5 - Concentration due to AFP greater than or equal to 5 microns in length.
MASS - Mass of AFP in ng/m³;for blank sample MASS represents the mass of AFP in ng/Filter.
MASS >5 - Mass due to AFP equal to or greater than 5 microns in length.

A 00096

ABD 001 1890

Peter Frasca, PH.D.
President

Laboratoy
Supervisor

Approved
Signatory

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Saturday, October 20, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos/Huhn Residence
SAMPLE IDENTIFICATION : 04841
LOCATION : Bedroom
VOLUME : 8746.200 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 2 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0000 |
| Concentration Detection Limit: | | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (in AFP/cc or million/m³) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 0.0000 |
| Mass Detection Limit : | | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/m³ ) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Fibers Containing: (Si,S,Ca).

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 000

ABD 001 1891

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personnel. * Accredited for PLM

EMSL

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

DATE: 10/19/90

LABORATORY # 9037851

SAMPLE # 04841

TAT 6 1 (2 4) 3 3 4 5 1 0

CLIENT: Weston

LOCATION: Bedroom

PREPARED BY: Lorren

JECT: Millington

VOLUME (liters) 6746.2

FILTER SIZE: (25) 37

GRID OPENINGS: 20

FILTER TYPE: (MCE) PC

(B=Bundle C=Cluster M=Matrix)

IF ASHED#
37mm Q= 1.13
25mm Q= 2.49
K= % RESUSPENDED/100
% RESUSPENDED=

| G# | NON ASB | CHRYSOTILE LENGTH | CHRYSOTILE THICK | CHRYSOTILE TYPE WIDTH | CHRYSOTILE LENGTH | CHRYSOTILE THICK | CHRYSOTILE TYPE WIDTH | AMPHIBOLE LENGTH | AMPHIBOLE THICK | AMPHIBOLE TYPE WIDTH | AMPHIBOLE LENGTH | AMPHIBOLE THICK | AMPHIBOLE TYPE WIDTH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | | | | | | | | | | | | |
| 2 | 0 | | | | | | | | | | | | |
| 3 | 0 | | | | | | | | | | | | |
| 4 | 0 | | | | | | | | | | | | |
| 5 | 1 | | | | | | | | | | | | |
| 6 | 0 | | | | | | | | | | | | |
| 7 | 0 | | | | | | | | | | | | |
| 8 | 0 | | | | | | | | | | | | |
| 9 | 0 | | | | | | | | | | | | |
| 10 | 0 | | | | | | | | | | | | |
| 11 | 0 | | | | | | | | | | | | |
| [illegible] | 0 | | | | | | | | | | | | |
| [illegible] | 0 | | | | | | | | | | | | |
| 14 | 0 | | | | | | | | | | | | |
| 15 | 1 | | | | | | | | | | | | |
| 16 | 0 | | | | | | | | | | | | |
| 17 | 0 | | | | | | | | | | | | |
| 18 | 0 | | | | | | | | | | | | |
| 19 | 0 | | | | | | | | | | | | |
| 20 | 0 | | | | | | | | | | | | |

NONASBESTOS FIBERS PRESENT
- ☐ GYPSUM (1)
- ☐ GLASS (2)
- ☐ CELLULOSE (3)
- ☐ ORGANIC FIBERS (4)
- ☒ FIBERS CONTAINING (5) Si Sl Ca

SCOPE# 3

ANALYST: JGS

Q.C. CHECK: [illegible]

CO..PUTER: [illegible]

JRE ☐ SPECTRUM ☐ SAED ☐ #

TYPES

HAND CALCULATIONS

(37mm) ⟶ .1425 (N) / G (Vm³) =

(25mm) ⟶ .0642 (N) / G (Vm³) = 0.0004

GRID BOX # 8 9 100 ROW E

FILTER ACCEPTED FOR ANALYSIS: YES ☒ NO ☐

IF NO, WHY?

FORM #1 RE: 4

A 00098

ABD 001 1892

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and place carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

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1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
North Carolina Society for Electron Microscopy and Microbeam Analysis;

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council.

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 1200 EX Analytical STEM
EDX ANALYZER: Kevex Delta III System with Quantum thin window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

A 00099

ABD 001 1893

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
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2 De ANGELO DRIVE
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01730
617-275-7080

Saturday, October 20, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos/Huhn Residence
SAMPLE IDENTIFICATION : 04843
LOCATION : Basement
VOLUME : 8765.000 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 6 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0000 |
| Concentration Detection Limit: | | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (in AFP/cc or million/m³) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 0.0000 |
| Mass Detection Limit : | | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/m³ ) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum.

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 0010

ABD 001 1894

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

EMSL

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

DATE: 10/19/96

LABORATORY # 9037852

SAMPLE # 04643

TAT
6 1 (2) 4 8 3 4 5 1 0

CLIENT: Weston

LOCATION: Basement

PREPARED BY: Loreen

SUBJECT: Millington

VOLUME (liters) ~~9445.2~~ 876.50

FILTER SIZE: (25) 37

GRID OPENINGS: 20

FILTER TYPE: (MCE) PC

(B=Bundle C=Cluster M=Matrix)

IF ASHED#
37mm Q= 1.13
25mm Q= 2.49
K= % RESUSPENDED/100
% RESUSPENDED=

| G# | NON ASB | CHRYSOTILE LENGTH | THICK | TYPE WIDTH | LENGTH | THICK | TYPE WIDTH | AMPHIBOLE LENGTH | THICK | TYPE WIDTH | LENGTH | THICK | TYPE WIDTH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | | | | | | | | | | | | |
| 2 | 0 | | | | | | | | | | | | |
| 3 | 1 | | | | | | | | | | | | |
| 4 | 1 | | | | | | | | | | | | |
| 5 | 1 | | | | | | | | | | | | |
| 6 | 0 | | | | | | | | | | | | |
| 7 | 1 | | | | | | | | | | | | |
| 8 | 0 | | | | | | | | | | | | |
| 9 | 0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 11 | 0 | | | | | | | | | | | | |
| | 0 | | | | | | | | | | | | |
| | 0 | | | | | | | | | | | | |
| 14 | 0 | | | | | | | | | | | | |
| 15 | 0 | | | | | | | | | | | | |
| 16 | 0 | | | | | | | | | | | | |
| 17 | 0 | | | | | | | | | | | | |
| 18 | 1 | | | | | | | | | | | | |
| 19 | 0 | | | | | | | | | | | | |
| 20 | 0 | | | | | | | | | | | | |

NONASBESTOS FIBERS PRESENT
- [x] GYPSUM (1)
- [ ] GLASS (2)
- [ ] CELLULOSE (3)
- [ ] ORGANIC FIBERS (4)
- [ ] FIBERS CONTAINING (5)

SCOPE# 3

ANALYST: TOS

Q.C. CHECK: [illegible]

COMPUTER: [illegible]

URE ☐ SPECTRUM ☐ SAED ☐ #

TYPES

HAND CALCULATIONS

(37mm) ⟶ 1425(N) / G(Vm³) =

(25mm) ⟶ .0642 (N) / G(Vm³) = 0.00037

GRID BOX # 591000 ROW G

FILTER ACCEPTED FOR ANALYSIS: YES ☐ NO ☐

IF NO, WHY?

FORM #1 RE: 4

ABD 001 1895

A 00101

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

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**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 1200 EX Analytical STEM
EDX ANALYZER: Kevex Delta III System with Quantum thin window detector
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ABD 001 1896

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

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Saturday, October 20, 1990

Roy F. Weston
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2890 Woodbridge Avenue/Bldg. 209 Annex
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Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos/Huhn Residence
SAMPLE IDENTIFICATION : 04844
LOCATION : Family Room
VOLUME : 7431.250 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 828 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0000 |
| Concentration Detection Limit: | | 0.0004 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (in AFP/cc or million/m³) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 0.0000 |
| Mass Detection Limit : | | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/m³ ) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Fibers Containing: (Si,S,Ca).

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

ABD 001 1897

A 00103

EMSL

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

DATE: 10/19/90

LABORATORY # 903753

CLIENT: Weston

PROJECT: Millington

FILTER SIZE: 25 37

FILTER TYPE: MCE PC

SAMPLE # 04844

LOCATION: Family Room

VOLUME(liters) 7431,25

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

TAT 61 08345 10

PREPARED BY: Lovern

IF ASHED*
37mm Q= 1.13
25mm Q= 2.49
K= % RESUSPENDED/100
% RESUSPENDED=

| G# | NON ASB | CHRYSOTILE LENGTH | THICK | TYPE WIDTH | LENGTH | THICK | TYPE WIDTH | AMPHIBOLE LENGTH | THICK | TYPE WIDTH | LENGTH | THICK | TYPE WIDTH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30 | | | | | | | | | | | | |
| 2 | 50 | | | | | | | | | | | | |
| 3 | 44 | | | | | | | | | | | | |
| 4 | 75 | | | | | | | | | | | | |
| 5 | 60 | | | | | | | | | | | | |
| 6 | 44 | | | | | | | | | | | | |
| 7 | 73 | | | | | | | | | | | | |
| 8 | 36 | | | | | | | | | | | | |
| 9 | 44 | | | | | | | | | | | | |
| 10 | 35 | | | | | | | | | | | | |
| 11 | 24 | | | | | | | | | | | | |
| 12 | 15 | | | | | | | | | | | | |
| 13 | 6 | | | | | | | | | | | | |
| 14 | 41 | | | | | | | | | | | | |
| 15 | 67 | | | | | | | | | | | | |
| 16 | 35 | | | | | | | | | | | | |
| 17 | 21 | | | | | | | | | | | | |
| 18 | 35 | | | | | | | | | | | | |
| 19 | 20 | | | | | | | | | | | | |
| 20 | 25 | | | | | | | | | | | | |

NONASBESTOS FIBERS PRESENT ☐ GYPSUM(1) ☐ GLASS(2) ☐ CELLULOSE(3) ☐ ORGANIC FIBERS(4) ☒ FIBERS CONTAINING(5) S, S Ca

SCOPE# 3

ANALYST: DS

Q.C. CHECK: BT

COMPUTER: JW

URE ☐ SPECTRUM ☐ SAED ☐ #

TYPES

HAND CALCULATIONS

(37mm) ⟶ 1425(N) / G(Vm³) =

(25mm) ⟶ .0642(N) / G(Vm³) = 0.0004

GRID BOX # 891000 ROW H

FILTER ACCEPTED FOR ANALYSIS: YES ☒ NO ☐

IF NO, WHY?

FORM #1 RE: 4

ABD 001 1898

A 00104

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

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**ANALYST:** Timothy G. Schneider

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Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

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EDX ANALYZER: Kevex Delta III System with Quantum thin window detector
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Saturday, October 20, 1990

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Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos/Huhn Residence
SAMPLE IDENTIFICATION : 04845
LOCATION : Lot Blank
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 0 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | 0.0000 |
| Concentration Detection Limit: | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (0.0 %) (on whole filter (in millions) ) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | 0.0000 |
| Mass Detection Limit : | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : ( 0.0 %) (in nanograms/filter) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

ABD 001 1900

A 0010

EMSL

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

DATE: 10/17/90

LABORATORY # 9037854 SAMPLE # 04845

TAT 6 (24) 3 4 5 1 0

CLIENT: Weston LOCATION: Lot Blank

PREPARED BY: Yoveen

JECT: Millington

VOLUME (liters) 0.00

FILTER SIZE: (25) 37

GRID OPENINGS: 20

FILTER TYPE: (MCE) PC

(B=Bundle C=Cluster M=Matrix)

IF ASHED*
37mm Q= 1.13
25mm Q= 2.49
K= % RESUSPENDED/100
% RESUSPENDED=

| G# | NON ASB | CHRYSOTILE LENGTH | THICK | TYPE WIDTH | LENGTH | THICK | TYPE WIDTH | AMPHIBOLE LENGTH | THICK | TYPE WIDTH | LENGTH | THICK | TYPE WIDTH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | | | | | | | | | | | | |
| 2 | 0 | | | | | | | | | | | | |
| 3 | 0 | | | | | | | | | | | | |
| 4 | 0 | | | | | | | | | | | | |
| 5 | 0 | | | | | | | | | | | | |
| 6 | 0 | | | | | | | | | | | | |
| 7 | 0 | | | | | | | | | | | | |
| 8 | 0 | | | | | | | | | | | | |
| 9 | 0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 11 | 0 | | | | | | | | | | | | |
| 12 | 0 | | | | | | | | | | | | |
| | 0 | | | | | | | | | | | | |
| 14 | 0 | | | | | | | | | | | | |
| 15 | 0 | | | | | | | | | | | | |
| 16 | 0 | | | | | | | | | | | | |
| 17 | 0 | | | | | | | | | | | | |
| 18 | 0 | | | | | | | | | | | | |
| 19 | 0 | | | | | | | | | | | | |
| 20 | 0 | | | | | | | | | | | | |

NONASBESTOS FIBERS PRESENT
- ☐ GYPSUM (1)
- ☐ GLASS (2)
- ☐ CELLULOSE (3)
- ☐ ORGANIC FIBERS (4)
- ☐ FIBERS CONTAINING (5)

SCOPE# 2

ANALYST: BS

Q.C. CHECK: RF

C PUTER: Henry

PICTURE ☐ SPECTRUM ☐ SAED ☐ #

ES

HAND CALCULATIONS

(37mm) ⟶ 1425 (N) / G (Vm³) =

(25mm) ⟶ .0642 (N) / G (Vm³) =

GRID BOX # Sample ROW 1

FILTER ACCEPTED FOR ANALYSIS: YES ☒ NO ☐

IF NO, WHY?

FORM #1 RE: 4

ABD 001 1901

A 001

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

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ABD 001 1902

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Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 3347-21-01-3426/Millington Asbestos/Huhn Residence
SAMPLE IDENTIFICATION : 04846
LOCATION : Field Blank
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 0 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | | 0.0000 |
| Concentration Detection Limit: | | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (on whole filter (in millions) ) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | | 0.0000 |
| Mass Detection Limit : | | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/filter) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 001

ABD 001 1903

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

LABORATORY #: 9037855
CLIENT ID: Roy F. Weston, Inc., Edison

Date: OCT 1990
TAT: 24 Hr

SAMPLE ID: 04846
SAMPLE LOCATION:
Feild Blank

ECT: 3347-21-01-3426/Millington Asbestos/Huhn Residence

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 0.00

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100
% Resuspended =

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0 | | | | | | | | | | | | | | | |
| 2 | | 0 | | | | | | | | | | | | | | | |
| 3 | | 0 | | | | | | | | | | | | | | | |
| 4 | | 0 | | | | | | | | | | | | | | | |
| 5 | | 0 | | | | | | | | | | | | | | | |
| 6 | | 0 | | | | | | | | | | | | | | | |
| 7 | | 0 | | | | | | | | | | | | | | | |
| 8 | | 0 | | | | | | | | | | | | | | | |
| 9 | | 0 | | | | | | | | | | | | | | | |
| 10 | | 0 | | | | | | | | | | | | | | | |
| 11 | | 0 | | | | | | | | | | | | | | | |
| 12 | | 0 | | | | | | | | | | | | | | | |
| 13 | | 0 | | | | | | | | | | | | | | | |
| 14 | | 0 | | | | | | | | | | | | | | | |
| 15 | | 0 | | | | | | | | | | | | | | | |
| 16 | | 0 | | | | | | | | | | | | | | | |
| 17 | | 0 | | | | | | | | | | | | | | | |
| 18 | | 0 | | | | | | | | | | | | | | | |
| 19 | | 0 | | | | | | | | | | | | | | | |
| 20 | | 0 | | | | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/20/90

Analyst: DGS

Q.C. Check: KRF

Co. puter:

F 3 ☐ Spectrum ☐ SAED ☐ #

Types

**HAND CALCULATIONS**

(25mm) ⟶ 0.0642 (N) / G(Vm³) = _____

Grid Box # 691000 Row J Col. 8/10

Filter Accepted for Analysis: Yes ☐ No ☐

If No, Reason for Rejection:

ABD 001 1904

A 00110

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
North Carolina Society for Electron Microscopy and Microbeam Analysis;

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 1200 EX Analytical STEM
EDX ANALYZER: Kevex Delta III System with Quantum thin window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

A 00111

ABD 001 1905

PROJECT 9037337

Continued From Page _____

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ~~9037337~~ | AET | P108 | 2 | NSD | Alpha | 1200 | 10 0.0050 |
| 9037338 | AET | P109 | 2 | Acling | Alpha | 1200 | 100.0100 |
| 9037339 | AET | P110 | 2 | NSD | Alpha | 1200 | 100.0050 |
| 9037340 | AET | P111 | 2 | NSD | Alpha | 1200 | 100.0080 |
| 9037334 | AET | SK | 2 | NSD | Alpha | 1200 | 100.0080 |
| | | 10/29/90 | | | | | |
| 9037346 | ETT | 01 | 3 | NSD | Alpha | 2550 | 100.0034 |
| 9037347 | ETT | 02 | 3 | Acling | Alpha | 1924 | 100.0031 |
| 9037344 | ETT | 03 | 3 | NSD | Alpha | 2850 | 100.0032 |
| 9037351 | Weston | 04941 | 3 | NSD | II | 6745 | 20 0.00032 |
| 9037352 | Weston | 04943 | 3 | NSD | II | 6765 | 200.0004 |
| 9037353 | Weston | 04944 | 2 | NSD | II | 7419 | 200.0004 |
| 9037354 | Weston | 04945 | 2 | NSD | II | Blok | 20 — |
| | | 10/21/90 | | | | | |
| | IIIBART | | 2 | NSD | Alpha | 1250 | 100.0048 |
| | 2 IIB | ART | 2 | NSD | Alpha | 1215 | 100.0049 |
| | 3 IIB | ART | 2 | NSD | Alpha | 1215 | 100.0049 |
| | 4 IIB | ART | 2 | NSD | Alpha | 1235 | 100.0048 |
| | 5 IIB | ART | 2 | NSD | Alpha | 1215 | 100.0049 |

Continued on Page

Read and Understood By

Signed _____ Date _____ Signed _____ Date _____

Roy F. Weston, Inc.
REAC, Edison, N.J.
EPA Contract 68-03-3482

# CHAIN OF CUSTODY RECORD/LAB WORK REQUEST

No: 3380

SHEET NO. 1 OF 1

Project Name: Millington Asbestos / Huhn Residence
Project Number: 3347-21-01-3426
RFW Contact: Chris Schultze Phone: 201-632-9200 Due Date: 24 Hr. Verbals finals in 3 days

ABD 001 1907

00113

SAMPLE IDENTFICATION / ANALYSES REQUESTED

| Sample No. | Sampling Location | Matrix | Date Collected | Container/Preservative | Vol. Coll. | TEM | | | |
|---|---|---|---|---|---|---|---|---|---|
| 04841 | Bedroom (Air) | 45 mm | 10-18-90 | .45 um filter | 8746.2 l | ✓ | | | |
| ~~04842 SMB~~ | | | ~~10-18-90~~ | ~~.45 um filter~~ | | | | | |
| 04843 | Basement | Air | 10-18-90 | .45 um filter | 8765.0 l | ✓ | | | |
| 04844 | Family Room | Air | 10-18-90 | .45 um filter | 7431.25 l | ✓ | | | |
| 04845 | Lot Blank | Air | 10-18-90 | .45 um filter | 0 l | ✓ | | | |
| 04846 | Field Blank | Air | 10-18-90 | .45 um filter | 0 l | ✓ | | | |

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions:

| Items/Reason | Relinquished By | Received By | Date | Time | Items/Reason | Relinquished By | Received By | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| Filters/analysis | [illegible] | Theresa Bourbon | 10/19/90 | 8:15am | 5/analysis | Theresa Bourbon | Michael Morgan | 10/19/90 | 11:50am |
| 5 samples/analysis | Michael Morgan | [illegible] | 10/19/90 | | | | | | |

NVLAP

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


108 HADDON AVENUE, WESTMONT, N.J. 08108, 609-858-4800
1056 STELTON ROAD, PISCATAWAY, N.J. 08858, 201-981-0550
1800 PEACHTREE STREET, ATLANTA, GEORGIA 30309, 404-355-4046
2 De ANGELO DRIVE, BEDFORD, MASS. 01730, 617-275-7080


Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.


RECEIVED
OCT 24 1990
WES


Project : 33470-21-01-3426/Millington Asbestos

## TEM SUMMARY REPORT

| SAMPLE ID | VOLUME (liters) | TYPE OF ASBESTOS | # STRUCTURES ASB | # STRUCTURES NONASB | CONCENTRATION OF ASBESTOS STRUCTURES AFP/cc | AFP/cc >5 | MASS | MASS >5 |
|---|---|---|---|---|---|---|---|---|
| 04971 | 10136.30 | Chrysotile | 1 | 7 | 0.0006 | 0.0006 | 0.0658 | 0.0000 |
| 04972 | 10125.00 | none detected | 0 | 27 | 0.0003 | 0.0000 | 0.0000 | 0.0000 |
| 04973 | 9967.80 | Chrysotile | 3 | 17 | 0.0019 | 0.0006 | 0.2803 | 0.1883 |
| 04974 | 9988.70 | Chrysotile | 1 | 11 | 0.0005 | 0.0005 | 0.0252 | 0.0000 |
| 04975 | 10003.40 | Chrysotile | 1 | 42 | 0.0006 | 0.0006 | 0.0250 | 0.0000 |
| 04976 | 10053.90 | none detected | 0 | 161 | 0.0003 | 0.0000 | 0.0000 | 0.0000 |
| 04977 | 10110.00 | Chrysotile | 2 | 108 | 0.0013 | 0.0006 | 0.5456 | 0.5184 |
| 04978 | 10126.30 | Chrysotile | 1 | 69 | 0.0005 | 0.0005 | 0.0498 | 0.0498 |
| 04979 | 10130.00 | Chrysotile | 1 | 35 | 0.0006 | 0.0006 | 0.5174 | 0.5174 |
| 04380 | Blank | none detected | 0 | 0 | 0.0032 | 0.0000 | 0.0003 | 0.0000 |
| 04981 | Blank | none detected | 0 | 0 | 0.0032 | 0.0000 | 0.0003 | 0.0000 |
| 04982 | Blank | none detected | 0 | 0 | 0.0032 | 0.0000 | 0.0003 | 0.0000 |

For none detected samples number under AFP/cc and MASS are detection limits.
AFP - Asbestos Fibrous Particulates.
AFP/cc - Concentration of Asbestos in AFP/cc; for blank sample AFP/cc represents number of AFP in million Fibers/Filter.
AFP/cc >5 - Concentration due to AFP greater than or equal to 5 microns in length.
MASS - Mass of AFP in ng/m³;for blank sample MASS represents the mass of AFP in ng/Filter.
MASS >5 - Mass due to AFP equal to or greater than 5 microns in length.

A 00114

ABD 001 1908

Bruce Faulant

Peter Frasca, PH.D.
President

Laboratoy Supervisor

Approved Signatory

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
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1800 PEACHTREE STREET
ATLANTA, GEORGIA
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404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04971
LOCATION : #1 Baby Room
VOLUME : 10136.300 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 1 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 7 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0006 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(0.0 %) (in AFP/cc or million/m³) | 0.0000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.0658 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (0.0 %) (in nanograms/m³ ) | 0.0000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Fibers Containing: (Mg,Al,Si).

A 00115

ABD 001 1909

| Peter Frasca, PH.D. | Laboratory | Approved |
|---|---|---|
| President | Supervisor | Signatory |

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04971

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 1 | 0 | 0 | 7 | 1 | 8 |
| # of Particulates on Whole Filter (in millions): | 0.0064 | 0.0000 | 0.0000 | 0.0449 | 0.0064 | 0.0513 |
| Concentration of Particulates (in million/m³): | 0.0006 | 0.0000 | 0.0000 | 0.0044 | 0.0006 | 0.0051 |
| % of Count due to Particulates ≥ 5 mm in length: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Fibers: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Matrices: | 100.000% | 0.000% | 0.000% | —— | 100.000% | —— |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.0658 | 0.0000 | —— | —— | 0.0658 | —— |
| % of Mass due to Particulates ≥ 5 mm in length: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Fibers: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Matrices: | 100.000% | 0.000% | —— | —— | 100.000% | —— |
| % Mass due to Bundles: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Clusters: | 0.000% | 0.000% | —— | —— | 0.000% | —— |

A 00116

ABD 001 1910

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04971

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 3 | 1 | | nonasbestos | | | | |
| 4 | 2 | | nonasbestos | | | | |
| 6 | 3 - 4 | | nonasbestos | | | | |
| 7 | 5 | matrix | chrysotile | 4.000 | 0.1000 | 0.1000 | 0.1040 |
| 10 | 6 - 8 | | nonasbestos | | | | |

Mass of Chrysotile Particulates 0.1040
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.1040

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

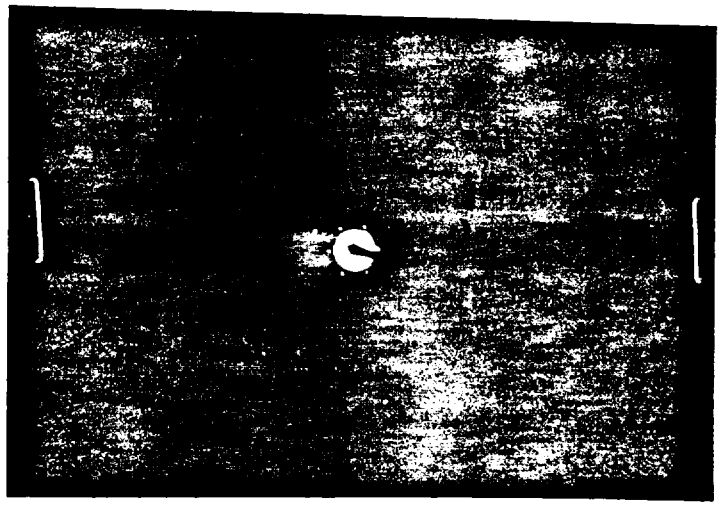
ABD 001 1911

A 00117

ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample : 04971

Chrysotile



ABD 001 1912

A 001

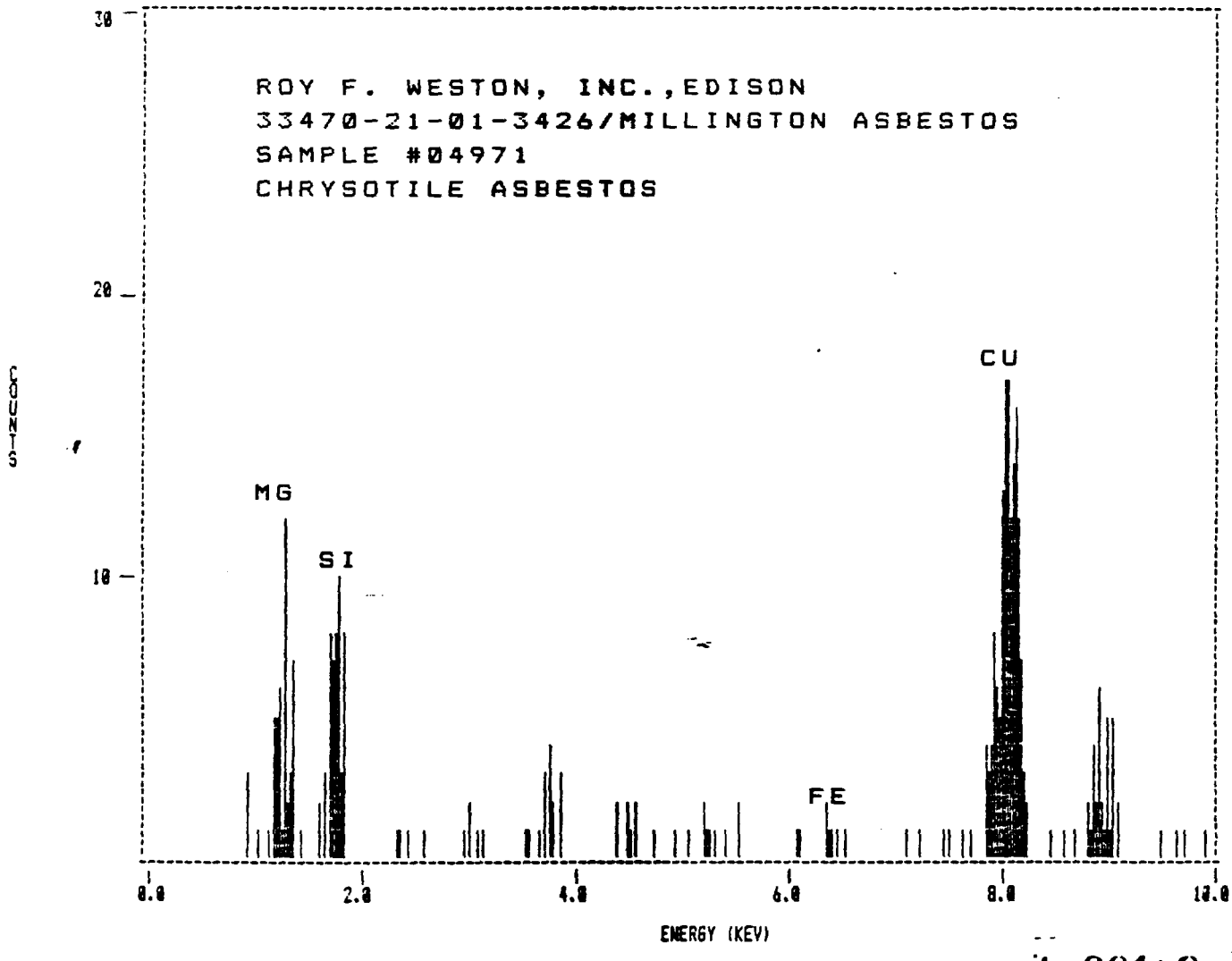
EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

SPECTRUM LABEL

[redacted]

SPECTRUM FILE NAME

[redacted] 38150




ABD 001 1913

A 00119

γ PIGIT)

E M S L (650)

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 23 00
TAT: 24 Hr

LABORATORY #: 90138148
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04971
SAMPLE LOCATION:
#1 Baby Crib

PROJECT: 10470-21-01-3435 Millington Asbestos

Nancy

FILTER SIZE (25)
FILTER TYPE MEC

VOLUME(LITERS): 10135.00

GRID OPENINGS: 10

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | | | | | | | | | | | | | | | | |
| | 20 | | | | | | | | | | | | | | | | |
| | 41 | | | | | | | | | | | | | | | | |
| | 50 | | | | | | | | | | | | | | | | |
| | 62 | | | | | | | | | | | | | | | | |
| | 70 | | 4.0 | 0.1 | 3.0 | | | | | | | | | | | | |
| | 80 | | | | | | | | | | | | | | | | |
| | 90 | | | | | | | | | | | | | | | | |
| | 103 | | | | | | | | | | | | | | | | |

(1 CHRY NON ASB.)

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☑ (5) Fibers Containing MGAL, SI

Scope #: 2 Date: 10/23

Analyst: L. Little

C. Check:

Computer: Pat

Picture ☐ Spectrum ☑ SAED ☑ #38148

Types Chrysotile 38149, 38150

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (N) / G(Fm²) = 0.00063

Grid Box # 891004 Row A Col. 9

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

A 00120

ABD 001 1914

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council.

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1915

A 001-1

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
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1056 STELTON ROAD
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08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04972
LOCATION : #1 Bedroom
VOLUME : 10125.000 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 27 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0000 |
| Concentration Detection Limit: | | 0.0003 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (in AFP/cc or million/m³) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 0.0000 |
| Mass Detection Limit : | | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/m³ ) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Fibers Containing: (Al,Si,K,Fe)

Bruce Faulent

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 001

ABD 001 1916

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 23 99
TAT: 24 Hr

LABORATORY # 9938149
CLIENT: Roy F. Weston, Inc., Edison

SAMPLE ID: 04972
SAMPLE LOCATION: #1 Bedroom

PROJECT: 09470-021-001-0426/Killington Asbestos

Nancy

IF ASHED*
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

VOLUME(LITERS): 10125.00

FILTER SIZE 25
FILTER TYPE MCE PC

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1 | | | | | | | | | | | | | | | |
| | 2 | 1 | | | | | | | | | | | | | | | |
| | 3 | 1 | | | | | | | | | | | | | | | |
| | 4 | 5 | | | | | | | | | | | | | | 1 | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 2 | | | | | | | | | | | | | | | |
| | 7 | 1 | | | | | | | | | | | | | | | |
| | 8 | 1 | | | | | | | | | | | | | | | |
| | 9 | 0 | | | | | | | | | | | | | | | |
| | 10 | 2 | | | | | | | | | | | | | | | |
| | 11 | 2 | | | | | | | | | | | | | | | |
| | 12 | 3 | | | | | | | | | | | | | | | |
| | 13 | 2 | | | | | | | | | | | | | | | |
| | 14 | 1 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 2 | | | | | | | | | | | | | | | |
| | 17 | 1 | | | | | | | | | | | | | | | |
| | 18 | 1 | | | | | | | | | | | | | | | |
| | 19 | 1 | | | | | | | | | | | | | | | |
| | 20 | 1 | | | | | | | | | | | | | | | |

ND

27 NON ASB

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☑ (5) Fibers Containing AL, SI, K, FE

Scope #: 2 Date: 10/23

Analyst: Al. Little

Q. Check: [illegible]

Computer: Pat

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) → 0.0642 (B) / 202.5 G(Tm²) = 0.00032

Grid Box # 891004 Row B Col. 8 & 10

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

A 00123

ABD 001 1917

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council.

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1918

A 00124

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04973
LOCATION : #1,K/Liv. Room
VOLUME : 9967.800 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 3 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 17 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0019 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(33.3 %) (in AFP/cc or million/m³) | 0.0006 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.2803 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (67.2 %) (in nanograms/m³ ) | 0.1883 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Fibers Containing: (Mg,Al,Si,Fe)

Peter Frasca, PH.D.
President

Laboratory Supervisor

Approved Signatory

A 00125

ABD 001 1919

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04973

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 3 | 0 | 0 | 17 | 3 | 20 |
| # of Particulates on Whole Filter (in millions): | 0.0192 | 0.0000 | 0.0000 | 0.1091 | 0.0192 | 0.1283 |
| Concentration of Particulates (in million/m³): | 0.0019 | 0.0000 | 0.0000 | 0.0109 | 0.0019 | 0.0129 |
| % of Count due to Particulates ≥ 5 µm in length: | 33.333% | 0.000% | 0.000% | — | 33.333% | — |
| % Count due to Fibers: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Matrices: | 100.000% | 0.000% | 0.000% | — | 100.000% | — |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.2803 | 0.0000 | — | — | 0.2803 | — |
| % of Mass due to Particulates ≥ 5 µm in length: | 67.164% | 0.000% | — | — | 67.164% | — |
| % Mass due to Fibers: | 0.000% | 0.000% | — | — | 0.000% | — |
| % Mass due to Matrices: | 100.000% | 0.000% | — | — | 100.000% | — |
| % Mass due to Bundles: | 0.000% | 0.000% | — | — | 0.000% | — |
| % Mass due to Clusters: | 0.000% | 0.000% | — | — | 0.000% | — |

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

# Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04973

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 2 | | nonasbestos | | | | |
| 2 | 3 - 4 | | nonasbestos | | | | |
| 3 | 5 - 6 | | nonasbestos | | | | |
| 4 | 7 | | nonasbestos | | | | |
| 5 | 8 - 10 | | nonasbestos | | | | |
| 6 | 11 | matrix | chrysotile | 2.000 | 0.1500 | 0.1500 | 0.1170 |
| 7 | 12 | | nonasbestos | | | | |
| 7 | 13 | matrix | chrysotile | 5.000 | 0.1500 | 0.1500 | 0.2925 |
| 8 | 14 | matrix | chrysotile | 1.000 | 0.1000 | 0.1000 | 0.0260 |
| 9 | 15 - 16 | | nonasbestos | | | | |
| 10 | 17 - 20 | | nonasbestos | | | | |

Mass of Chrysotile Particulates 0.4355
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.4355

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 23 90
TAT: 24 Hr

LABORATORY #: 9058150
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04973
SAMPLE LOCATION: #1 K/Lin. Rm.

PROJECT: 30470-21-01-3426/Millington Asbestos

Nancy

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

FILTER SIZE (25)
FILTER TYPE (MCE) PC

VOLUME(LITERS): 9997.00

GRID OPENINGS: 10

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | | | | | | | | | | | | | | | |
| | 2 | 2 | | | | | | | | | | | | | | | |
| | 3 | 2 | | | | | | | | | | | | | | | |
| | 4 | 1 | | | | | | | | | | | | | | 1 | |
| | 5 | 3 | | | | | | | | | | | | | | | |
| | 6 | 0 | 2.0 | 0.15 | 0.15 | | | | | | | | | | | | |
| | 7 | 1 | 5.0 | 0.15 | 0.15 | | | | | | | | | | | | |
| | 8 | 0 | 1.0 | 0.1 | 0.1 | | | | | | | | | | | | |
| | 9 | 2 | | | | | | | | | | | | | | | |
| | 10 | 4 | | | | | | | | | | | | | | | |

5 CHRY

7 NON ASB

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☑ (5) Fibers Containing MG, AL, SI, FE

Scope #: 2 Date: 10/23

Analyst: Al Little

C. Check: [illegible]

Computer: [illegible]

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (B) / G(Tm²) = 0.0019

Grid Box # 891004 Row C Col. 1

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

ABD 001 1922

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council.

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1923

A 00129

NVLAP*

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04974
LOCATION : #1,K/Liv. Room
VOLUME : 9988.700 Liters
Grid Openings Analyzed : 13
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 1 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 11 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0005 |
| Concentration Detection Limit: | 0.0005 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(0.0 %) (in AFP/cc or million/m³) | 0.0000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.0252 |
| Mass Detection Limit : | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (0.0 %) (in nanograms/m³ ) | 0.0000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum.

Bruce Faulent

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 001.

ABD 001 1924

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04974

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 1 | 0 | 0 | 11 | 1 | 12 |
| # of Particulates on Whole Filter (in millions): | 0.0049 | 0.0000 | 0.0000 | 0.0543 | 0.0049 | 0.0592 |
| Concentration of Particulates (in million/m³): | 0.0005 | 0.0000 | 0.0000 | 0.0054 | 0.0005 | 0.0059 |
| % of Count due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Fibers: | 100.000% | 0.000% | 0.000% | — | 100.000% | — |
| % Count due to Matrices: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.0252 | 0.0000 | — | — | 0.0252 | — |
| % of Mass due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | — | — | 0.000% | — |
| % Mass due to Fibers: | 100.000% | 0.000% | — | — | 100.000% | — |
| % Mass due to Matrices: | 0.000% | 0.000% | — | — | 0.000% | — |
| % Mass due to Bundles: | 0.000% | 0.000% | — | — | 0.000% | — |
| % Mass due to Clusters: | 0.000% | 0.000% | — | — | 0.000% | — |

ABD 001 1925

A 00131

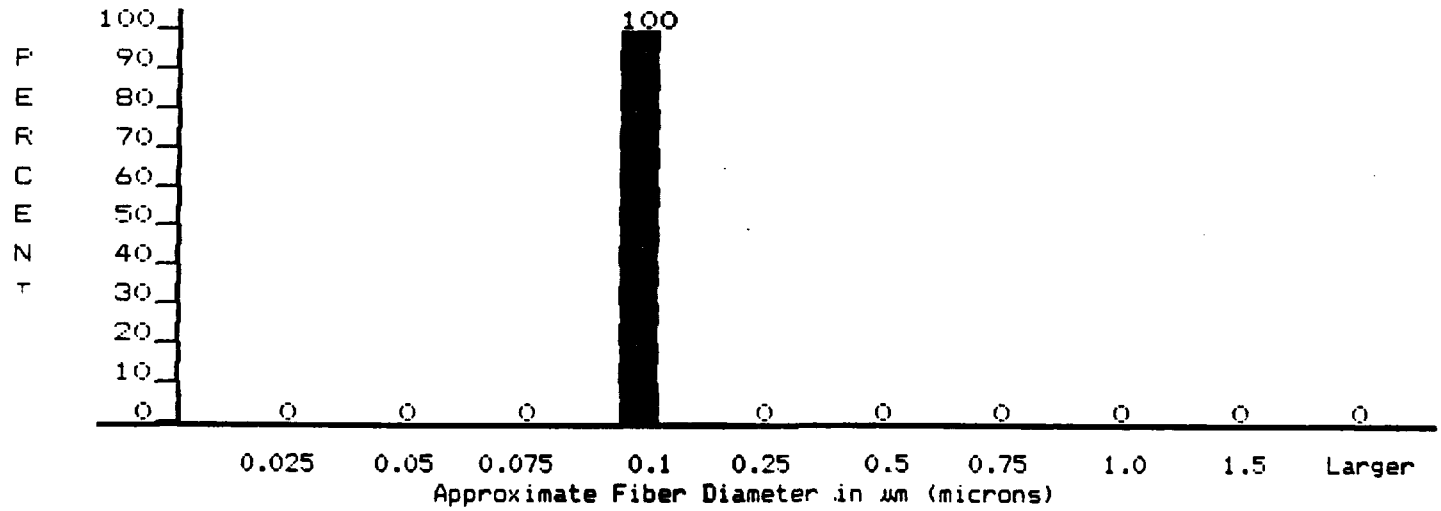
NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

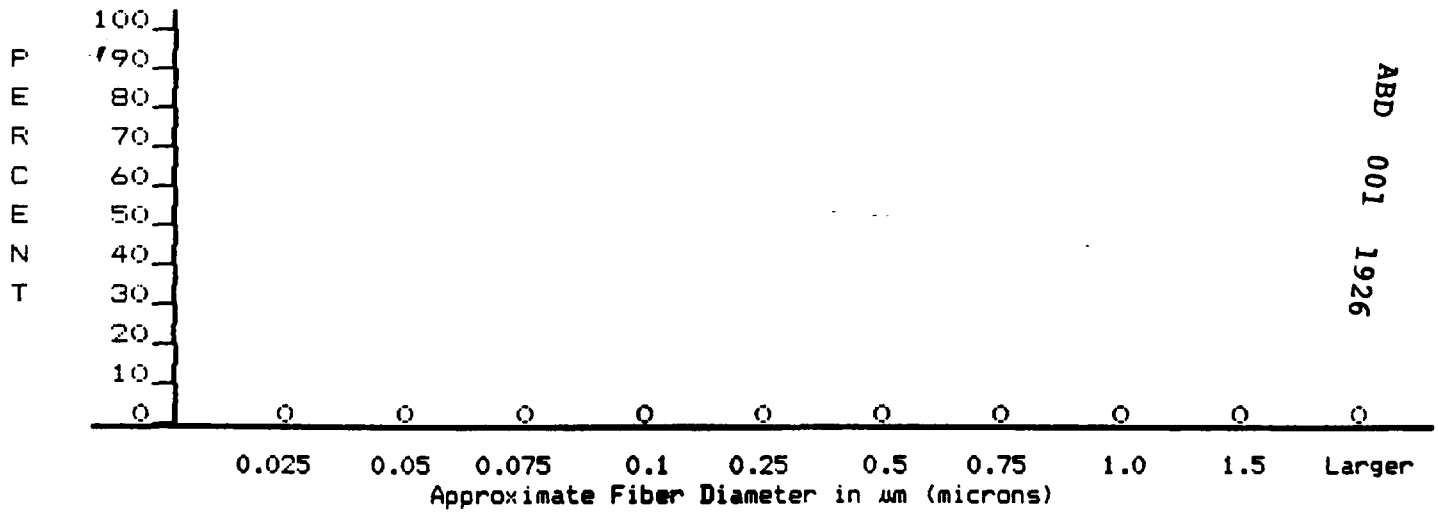
Sample : 04974

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1926

*Sum of both histograms represents 100% of Chrysotile fibers.

A 00132

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04974

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 3 | 1 | | nonasbestos | | | | |
| 4 | 2 | | nonasbestos | | | | |
| 7 | 3 - 5 | | nonasbestos | | | | |
| 8 | 6 | | nonasbestos | | | | |
| 9 | 7 | | nonasbestos | | | | |
| 10 | 8 - 9 | | nonasbestos | | | | |
| 11 | 10 | | nonasbestos | | | | |
| 13 | 11 | | nonasbestos | | | | |
| 13 | 12 | fiber | chrysotile | 2.500 | 0.1000 | | 0.0511 |

Mass of Chrysotile Particulates 0.0511
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.0511

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

A 00133

ABD 001 1927

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 20 00
TAT: 24 hr

LABORATORY #: 9058151
CLIENT ID: Roy F Weston, Inc., Edison

SAMPLE ID: 04974
SAMPLE LOCATION: #1 K Area Rm.

PROJECT: 20470-01-01-0426/Millington Asbestos

Nancy

VOLUME (LITERS): 9900.70

FILTER SIZE: (25)
FILTER TYPE: (MCE) PC

GRID OPENINGS: 13

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K = Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | | | |
| | 3 | 1 | | | | | | | | | | | | | | | |
| | 4 | 1 | | | | | | | | | | | | | | | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 0 | | | | | | | | | | | | | | | |
| | 7 | 3 | | | | | | | | | | | | | | | |
| | 8 | 1 | | | | | | | | | | | | | | | |
| | 9 | 1 | | | | | | | | | | | | | | | |
| | 10 | 2 | | | | | | | | | | | | | | | |
| | 11 | 1 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 1 | 2.5 | 0.1 | F | | | | | | | | | | | | |
| | 14 | 0 | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | | | |
| | 16 | | | | | | | | | | | | | | | | |
| | 17 | | | | | | | | | | | | | | | | |
| | 18 | | | | | | | | | | | | | | | | |
| | 19 | | | | | | | | | | | | | | | | |
| | 20 | | | | | | | | | | | | | | | | |

1 CHK
11 NON ASB

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/23

Analyst: R. Little

Q.C. Check:

Computer: Pat

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (N) / G(Vm³) = .00049 / 0.00064

Grid Box # 891004 Row D Col. 8 10

Filter Accepted for Analysis: Yes ☑ No ☐ A 00134

If No, Reason for Rejection:

ABD 001 1928

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Deborah Little

EDUCATION

1984 University of Illinois, Center for Electron Microscopy
EMSA Certified Electron Microscopy Technologist

1975-1977 Pierce Junior College, Philadelphia

EMPLOYMENT

EMSL: Since 1990

1977-Present Children's Hospital of Philadelphia,
Research Technologist in Electron Microscopy Lab

Member: Electron Microscopy Society of America.

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York

1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM

EDX ANALYZER: PGT System 4 with Beryllium window detector

Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1929

A 00135

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04975
LOCATION : #1,K/Liv. Room
VOLUME : 10003.400 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 1 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 42 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0006 |
| Concentration Detection Limit: | | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (in AFP/cc or million/m³) | (0.0 %) | 0.0000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 0.0250 |
| Mass Detection Limit : | | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/m³ ) | (0.0 %) | 0.0000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Fibers Containing: (Ca)(Al,Si,K).

Bruce Faulent

| | | |
|---|---|---|
| Peter Frasca, PH.D. President | Laboratory Supervisor | Approved Signatory |

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

ABD 001 1930

A 00136

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04975

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 1 | 0 | 0 | 42 | 1 | 43 |
| # of Particulates on Whole Filter (in millions): | 0.0064 | 0.0000 | 0.0000 | 0.2695 | 0.0064 | 0.2759 |
| Concentration of Particulates (in million/m³): | 0.0006 | 0.0000 | 0.0000 | 0.0269 | 0.0006 | 0.0276 |
| % of Count due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Fibers: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Matrices: | 100.000% | 0.000% | 0.000% | — | 100.000% | — |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.0250 | 0.0000 | — | — | 0.0250 | — |
| % of Mass due to Particulates ≥ 5 µm in length: | 0.000% | 0.000% | — | — | 0.000% | — |
| % Mass due to Fibers: | 0.000% | 0.000% | — | — | 0.000% | — |
| % Mass due to Matrices: | 100.000% | 0.000% | — | — | 100.000% | — |
| % Mass due to Bundles: | 0.000% | 0.000% | — | — | 0.000% | — |
| % Mass due to Clusters: | 0.000% | 0.000% | — | — | 0.000% | — |

ABD 001 1931

A 00137

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

NVLAP

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04975

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | STRUCTURE TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 6 | | nonasbestos | | | | |
| 2 | 7 - 11 | | nonasbestos | | | | |
| 3 | 12 - 13 | | nonasbestos | | | | |
| 4 | 14 - 22 | | nonasbestos | | | | |
| 5 | 23 - 26 | | nonasbestos | | | | |
| 6 | 27 - 37 | | nonasbestos | | | | |
| 9 | 38 - 40 | | nonasbestos | | | | |
| 9 | 41 | matrix | chrysotile | 1.500 | 0.1000 | 0.1000 | 0.0390 |
| 10 | 42 - 43 | | nonasbestos | | | | |

Mass of Chrysotile Particulates 0.0390
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.0390

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

ABD 001 1932

A 00138

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 23 90
TAT: 24 Hr

LABORATORY #: 9038152
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04975
SAMPLE LOCATION:
#1 K Liv Rm.

PROJECT: 00470-21-01-2420 (Milltown Asbestos)

Nancy

FILTER SIZE: 25
FILTER TYPE: MCE PC

1 chrys

VOLUME(LITERS): 10003.40

GRID OPENINGS: 10

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K = Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Wid |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 6 | | | | | | | | | | | | | | | |
| | 2 | 5 | | | | | | | | | | | | | | | |
| | 3 | 2 | | | | | | | | | | | | | | | |
| | 4 | 9 | | | | | | | | | | | | | | | |
| | 5 | 4 | | | | | | | | | | | | | | | |
| | 6 | 11 | | | | | | | | | | | | | | | |
| | 7 | 0 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 3 | 1.5 | 0.1 | M.1 | | | | | | | | | | | | |
| | 10 | 2 | | | | | | | | | | | | | | | |

ABD 001 1933

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☒ (5) Fibers Containing Ca/Al Silk

Scope #: 2 Date: 10/23/90

Analyst: TVS

Q.C. Check: [signature]

Computer: [signature]

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (N) / G(Tm³) = 0.00064

Grid Box # 891004 Row E Col. 5

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

A 00139

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
North Carolina Society for Electron Microscopy and Microbeam Analysis;

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1934

A 00140

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04976
LOCATION : #2 Bedroom
VOLUME : 10053.900 Liters
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 161 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | | 0.0000 |
| Concentration Detection Limit: | | 0.0003 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (in AFP/cc or million/m³) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | | 0.0000 |
| Mass Detection Limit : | | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/m³ ) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum.

ABD 001 1935

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 001-1

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personnel. • Accredited for PLM

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 22 90
TAT: 24 Hr

LABORATORY # 9038153
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04976
SAMPLE LOCATION:
#2, Bedroom

PROJECT: 30470-01-01-0426 Millington Asbestos

Nancy

FILTER SIZE (25)
FILTER TYPE (MCE) PC

NSD

VOLUME(LITERS) 10053.90

GRID OPENINGS 20

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 01 | | | | | | | | | | | | | | | |
| | 2 | 4 | | | | | | | | | | | | | | | |
| | 3 | 7 | | | | | | | | | | | | | | | |
| | 4 | 5 | | | | | | | | | | | | | | 1 | |
| | 5 | 15 | | | | | | | | | | | | | | | |
| | 6 | 7 | | | | | | | | | | | | | | | |
| | 7 | 5 | | | | | | | | | | | | | | | |
| | 8 | 6 | | | | | | | | | | | | | | | |
| | 9 | 7 | | | | | | | | | | | | | | | |
| | 10 | 5 | | | | | | | | | | | | | | | |
| | 11 | 4 | | | | | | | | | | | | | | | |
| | 12 | 3 | | | | | | | | | | | | | | | |
| | 13 | 5 | | | | | | | | | | | | | | | |
| | 14 | 6 | | | | | | | | | | | | | | | |
| | 15 | 21 | | | | | | | | | | | | | | | |
| | 16 | 15 | | | | | | | | | | | | | | | |
| | 17 | 15 | | | | | | | | | | | | | | | |
| | 18 | 6 | | | | | | | | | | | | | | | |
| | 19 | 7 | | | | | | | | | | | | | | | |
| | 20 | 5 | | | | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/23/90

Analyst: TWS

Q.C. Check: B Fanelli

Computer: [illegible]

Picture ☐ Spectrum ☐ SAED ☐ #

Notes

## HAND CALCULATIONS

$$\frac{(25mm) \longrightarrow 0.0642\ (N)}{G(Tm^2)} = 0.00032$$

Grid Box # 991004 Row F Col. 8/10

Filter Accepted for Analysis: Yes ☒ No ☐

If No, Reason for Rejection:

ABD 001 1936

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

--

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and place carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
North Carolina Society for Electron Microscopy and Microbeam Analysis;

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1937

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
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1056 STELTON ROAD
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Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04977
LOCATION : #2 Den
VOLUME : 10110.000 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 2 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 108 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0013 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(50.0 %) (in AFP/cc or million/m³) | 0.0006 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.5456 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (95.0 %) (in nanograms/m³ ) | 0.5184 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum.

| Peter Frasca, PH.D. | Laboratory | Approved |
|---|---|---|
| President | Supervisor | Signatory |

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

ABD 001 1938

A 00144

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04977

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 2 | 0 | 0 | 108 | 2 | 110 |
| # of Particulates on Whole Filter (in millions): | 0.0128 | 0.0000 | 0.0000 | 0.6930 | 0.0128 | 0.7058 |
| Concentration of Particulates (in million/m³): | 0.0013 | 0.0000 | 0.0000 | 0.0685 | 0.0013 | 0.0698 |
| % of Count due to Particulates ≥ 5 µm in length: | 50.000% | 0.000% | 0.000% | —— | 50.000% | —— |
| % Count due to Fibers: | 100.000% | 0.000% | 0.000% | —— | 100.000% | —— |
| % Count due to Matrices: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.5456 | 0.0000 | —— | —— | 0.5456 | —— |
| % of Mass due to Particulates ≥ 5 µm in length: | 95.012% | 0.000% | —— | —— | 95.012% | – |
| % Mass due to Fibers: | 100.000% | 0.000% | —— | —— | 100.000% | – |
| % Mass due to Matrices: | 0.000% | 0.000% | —— | —— | 0.000% | – |
| % Mass due to Bundles: | 0.000% | 0.000% | —— | —— | 0.000% | – |
| % Mass due to Clusters: | 0.000% | 0.000% | —— | —— | 0.000% | – |

ABD 001 1939

A 00145

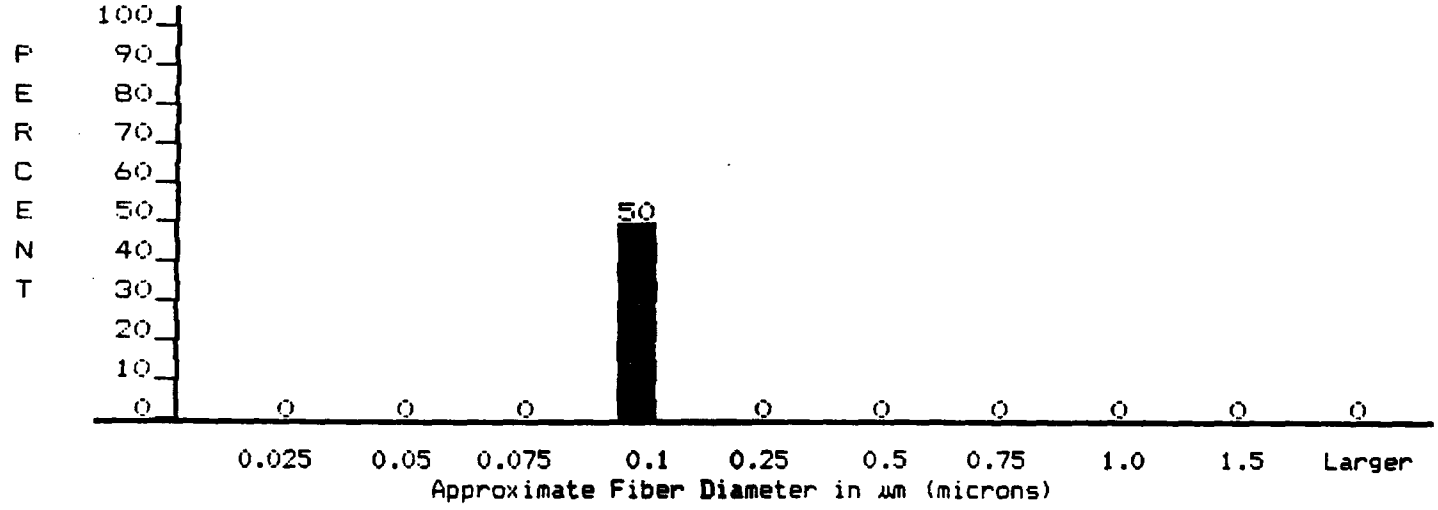
NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

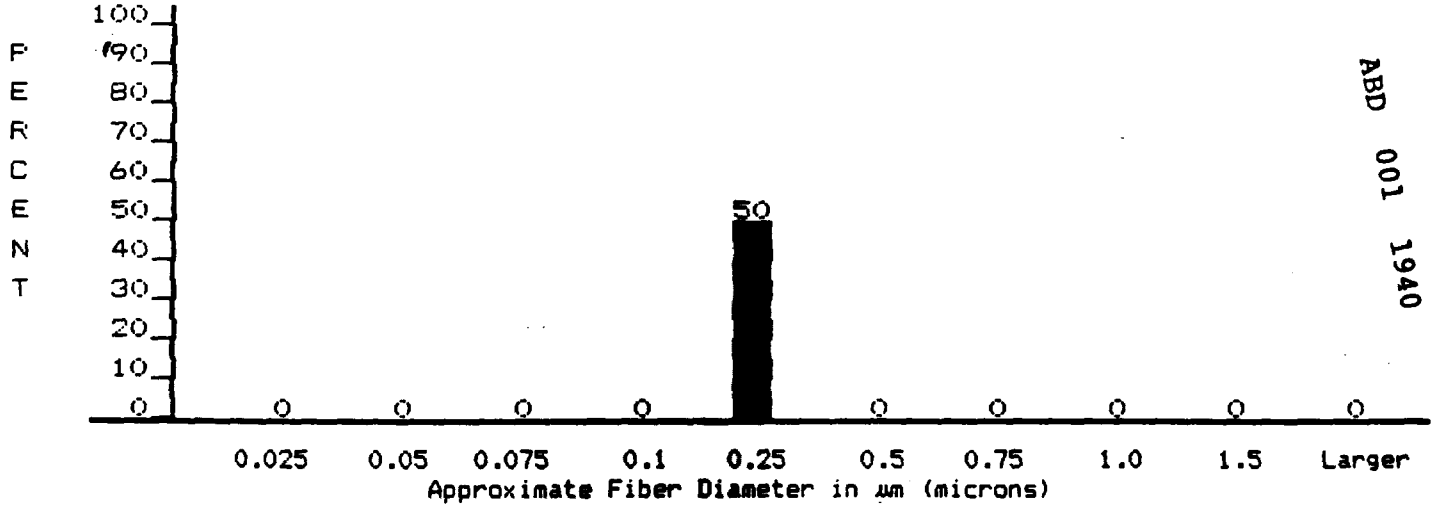
Sample : 04977

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1940

*Sum of both histograms represents 100% of Chrysotile fibers.

A 00146

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04977

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 15 | | nonasbestos | | | | |
| 2 | 16 - 28 | | nonasbestos | | | | |
| 3 | 29 - 39 | | nonasbestos | | | | |
| 4 | 40 - 45 | | nonasbestos | | | | |
| 4 | 46 | fiber | chrysotile | 2.100 | 0.1000 | | 0.0429 |
| 5 | 47 - 53 | | nonasbestos | | | | |
| 6 | 54 - 63 | | nonasbestos | | | | |
| 7 | 64 - 75 | | nonasbestos | | | | |
| 8 | 76 - 90 | | nonasbestos | | | | |
| 9 | 91 - 98 | | nonasbestos | | | | |
| 10 | 99 - 109 | | nonasbestos | | | | |
| 10 | 110 | fiber | chrysotile | 10.000 | 0.2000 | | 0.8168 |

ABD 001 1941

Mass of Chrysotile Particulates 0.8597
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.8597

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 20 90
TAT: 24 Hr

LABORATORY #: 9038154
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04977
SAMPLE LOCATION: #2, Den

PROJECT: 03470-21-01-0426/Millington Asbestos

Nancy

FILTER SIZE (25)
FILTER TYPE (MCE) PC

2c hrs

VOLUME (LITERS): 10110.00

GRID OPENINGS: 10

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 15 | | | | | | | | | | | | | | | |
| | 2 | 13 | | | | | | | | | | | | | | | |
| | 3 | 11 | | | | | | | | | | | | | | | |
| | 4 | 6 | 2.1 | 0.1 | F | | | | | | | | | | | | |
| | 5 | 7 | | | | | | | | | | | | | | | |
| | 6 | 10 | | | | | | | | | | | | | | | |
| | 7 | 12 | | | | | | | | | | | | | | | |
| | 8 | 15 | | | | | | | | | | | | | | | |
| | 9 | 8 | | | | | | | | | | | | | | | |
| | 10 | 11 | 10.0 | 0.2 | F | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/23/90

Analyst: B-S

Q.C. Check: B Tanka

Computer: Pat

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (Z) / G(Tm²) = 0.0013

Grid Box # 891004 Row G Col. 9

Filter Accepted for Analysis: Yes ☐ No ☐

If No, Reason for Rejection:

ABD 001 1942

A 00148

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
North Carolina Society for Electron Microscopy and Microbeam Analysis;

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1943

A 00149

NVLAP

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


| 108 HADDON AVENUE | 1056 STELTON ROAD | 1800 PEACHTREE STREET | 2 De ANGELO DRIVE |
|---|---|---|---|
| WESTMONT, N.J. | PISCATAWAY, N.J. | ATLANTA, GEORGIA | BEDFORD, MASS. |
| 08108 | 08858 | 30309 | 01730 |
| 609-858-4800 | 201-981-0550 | 404-355-4046 | 617-275-7080 |


Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04978
LOCATION : #2, LR
VOLUME : 10126.300 Liters
Grid Openings Analyzed : 13
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 1 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 69 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0005 |
| Concentration Detection Limit: | 0.0005 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(100.0 %) (in AFP/cc or million/m³) | 0.0005 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.0498 |
| Mass Detection Limit : | 0.0000 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (100.0 %) (in nanograms/m³ ) | 0.0498 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Cellulose.

| Peter Frasca, PH.D. | Laboratory | Approved |
|---|---|---|
| President | Supervisor | Signatory |

A 00150

ABD 001 1944

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Sample: 04978

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 1 | 0 | 0 | 69 | 1 | 70 |
| # of Particulates on Whole Filter (in millions): | 0.0049 | 0.0000 | 0.0000 | 0.3406 | 0.0049 | 0.3455 |
| Concentration of Particulates (in million/m³): | 0.0005 | 0.0000 | 0.0000 | 0.0336 | 0.0005 | 0.0341 |
| % of Count due to Particulates ≥ 5 µm in length: | 100.000% | 0.000% | 0.000% | —— | 100.000% | —— |
| % Count due to Fibers: | 100.000% | 0.000% | 0.000% | —— | 100.000% | —— |
| % Count due to Matrices: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | —— | 0.000% | —— |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.0498 | 0.0000 | —— | —— | 0.0498 | —— |
| % of Mass due to Particulates ≥ 5 µm in length: | 100.000% | 0.000% | —— | —— | 100.000% | —— |
| % Mass due to Fibers: | 100.000% | 0.000% | —— | —— | 100.000% | —— |
| % Mass due to Matrices: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Bundles: | 0.000% | 0.000% | —— | —— | 0.000% | —— |
| % Mass due to Clusters: | 0.000% | 0.000% | —— | —— | 0.000% | —— |

ABD 001 1945

A 00151

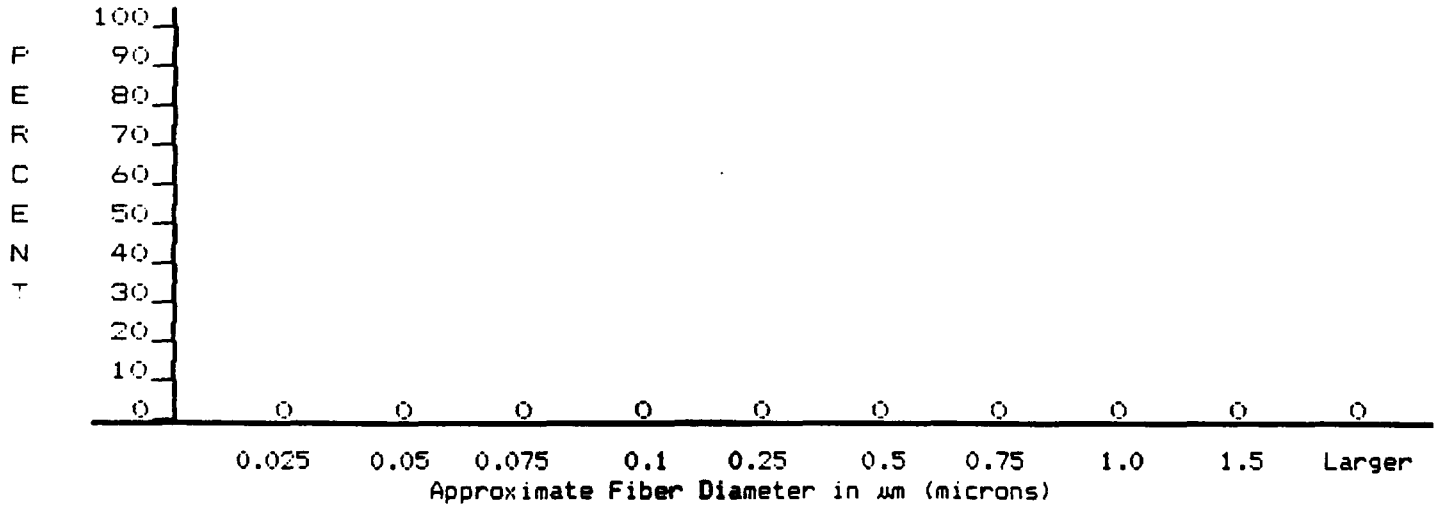
NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

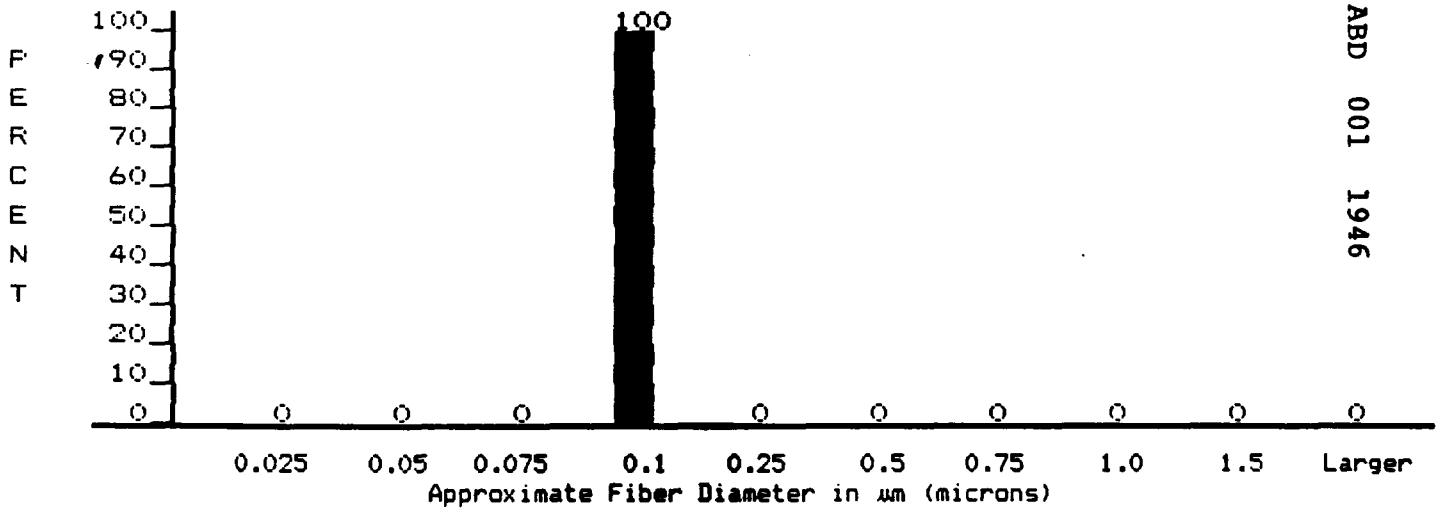
Sample : 04978

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1946

*Sum of both histograms represents 100% of Chrysotile fibers.

A 00152

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04978

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 10 | | nonasbestos | | | | |
| 2 | 11 - 19 | | nonasbestos | | | | |
| 3 | 20 - 30 | | nonasbestos | | | | |
| 4 | 31 - 39 | | nonasbestos | | | | |
| 5 | 40 - 47 | | nonasbestos | | | | |
| 6 | 48 - 50 | | nonasbestos | | | | |
| 7 | 51 - 52 | | nonasbestos | | | | |
| 8 | 53 - 55 | | nonasbestos | | | | |
| 9 | 56 - 57 | | nonasbestos | | | | |
| 10 | 58 - 59 | | nonasbestos | | | | |
| 11 | 60 - 62 | | nonasbestos | | | | |
| 12 | 63 | | nonasbestos | | | | |
| 13 | 64 - 69 | | nonasbestos | | | | |
| 13 | 70 | fiber | chrysotile | 5.000 | 0.1000 | | 0.1021 |

ABD 001 1947

Mass of Chrysotile Particulates 0.1021
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.1021

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.

STRUCTURE TYPES

Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

A 00153

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Dr

Date: OCT 22 90
TAT: 24 Hr

LABORATORY #: 9038155
CLIENT ID: Rep E Weston, Inc., Edison

SAMPLE ID: 04978
SAMPLE LOCATION:
#2 LR

PROJECT: 00479-21-01-3426/Millington Asbestos

Harry

FILTER SIZE 25
FILTER AREA 490 MM²

Ichiro

VOLUME (LITERS): 10126.30

GRID OPENINGS: 13

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K = Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 10 | | | | | | | | | | | | | | | |
| | 2 | 9 | | | | | | | | | | | | | | | |
| | 3 | 11 | | | | | | | | | | | | | | | |
| | 4 | 9 | | | | | | | | | | | | | | | |
| | 5 | 8 | | | | | | | | | | | | | | | |
| | 6 | 3 | | | | | | | | | | | | | | | |
| | 7 | 2 | | | | | | | | | | | | | | | |
| | 8 | 3 | | | | | | | | | | | | | | | |
| | 9 | 2 | | | | | | | | | | | | | | | |
| | 10 | 2 | | | | | | | | | | | | | | | |
| | 11 | 3 | | | | | | | | | | | | | | | |
| | 12 | 1 | | | | | | | | | | | | | | | |
| | 13 | 6 | 5.0 | 0.1 | F | | | | | | | | | | | | |

ABD 001 1948

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/23/90

Analyst: RS

Q.C. Check: B Taylor

Computer: Pat

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (F) / G(Fm²) = 0.00048

Grid Box # 991004 Row H Col. 8/10

Filter Accepted for Analysis: Yes ☑ No ☐

If No, Reason for Rejection:

A 00154

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
North Carolina Society for Electron Microscopy and Microbeam Analysis;

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1949

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04979
LOCATION : #2, LR
VOLUME : 10130.000 Liters
Grid Openings Analyzed : 10
Sample Condition: Acceptable.

## CONDENSED DATA

| | |
|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | 1 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | 35 |
| 3. Number of Ambiguous Fibrous Particulates : | 0 |
| 4. Type(s) of Asbestos : | Chrysotile |
| 5. Concentration of Asbestos Fibrous Particulates : (in AFP/cc or million/m³) | 0.0006 |
| Concentration Detection Limit: | 0.0006 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length :(100.0 %) (in AFP/cc or million/m³) | 0.0006 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/m³) | 0.5174 |
| Mass Detection Limit : | 0.0001 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (100.0 %) (in nanograms/m³ ) | 0.5174 |

Comments: Filter Type: MCE, Filter Size: 25mm.
Nonasbestos fibers present were: Gypsum, and Fibers Containing: (Al,Si).

ABD 001 1950

| Peter Frasca, PH.D. | Laboratory | Approved |
|---|---|---|
| President | Supervisor | Signatory |

A 00156

The laboratory is only responsible for fibers counted in fibers/mm² and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PCM

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

NVLAP

Sample: 04979

## FIBER TYPE and FIBER SIZE DISTRIBUTION

| | CHRYSOTILE | AMPHIBOLE | AMBIGUOUS | NONASBESTOS | TOTAL ASBESTOS | TOTAL PARTICULATES |
|---|---|---|---|---|---|---|
| **COUNT** | | | | | | |
| Particulates Analyzed: | 1 | 0 | 0 | 35 | 1 | 36 |
| # of Particulates on Whole Filter (in millions): | 0.0064 | 0.0000 | 0.0000 | 0.2246 | 0.0064 | 0.2310 |
| Concentration of Particulates (in million/m³): | 0.0006 | 0.0000 | 0.0000 | 0.0222 | 0.0006 | 0.0228 |
| % of Count due to Particulates ≥ 5 µm in length: | 100.000% | 0.000% | 0.000% | — | 100.000% | — |
| % Count due to Fibers: | 100.000% | 0.000% | 0.000% | — | 100.000% | — |
| % Count due to Matrices: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Bundles: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| % Count due to Clusters: | 0.000% | 0.000% | 0.000% | — | 0.000% | — |
| **MASS** | | | | | | |
| Concentration (in ng/m³): | 0.5174 | 0.0000 | — | — | 0.5174 | |
| % of Mass due to Particulates ≥ 5 µm in length: | 100.000% | 0.000% | — | — | 100.000% | |
| % Mass due to Fibers: | 100.000% | 0.000% | — | — | 100.000% | |
| % Mass due to Matrices: | 0.000% | 0.000% | — | — | 0.000% | |
| % Mass due to Bundles: | 0.000% | 0.000% | — | — | 0.000% | |
| % Mass due to Clusters: | 0.000% | 0.000% | — | — | 0.000% | — |

ABD 001 1951

A 00157

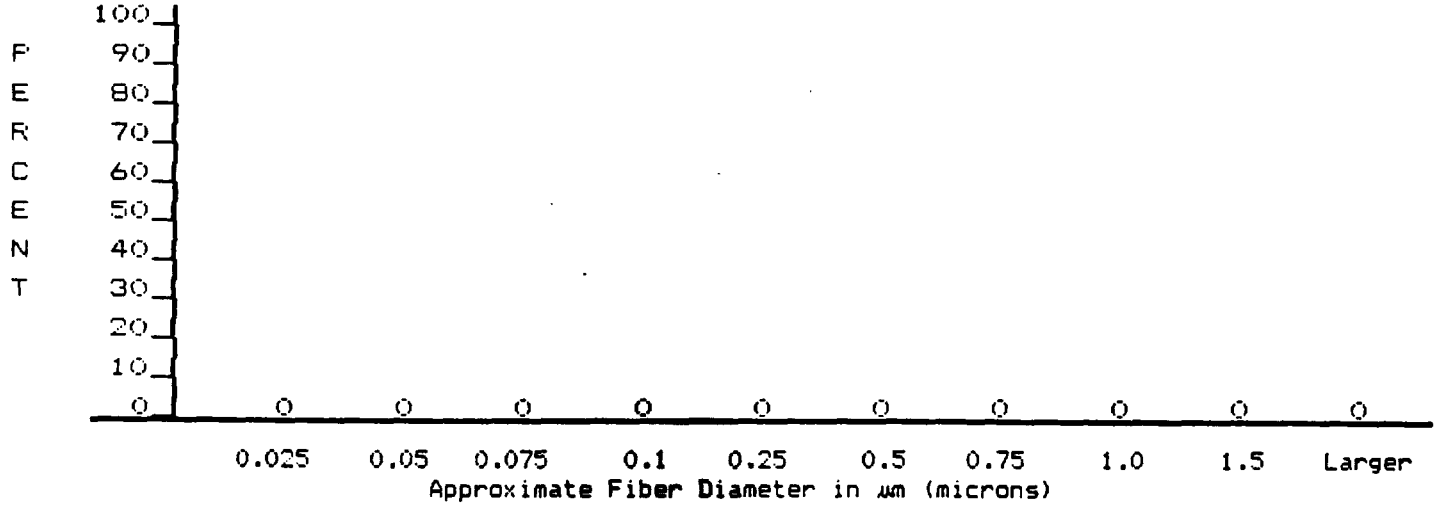
NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

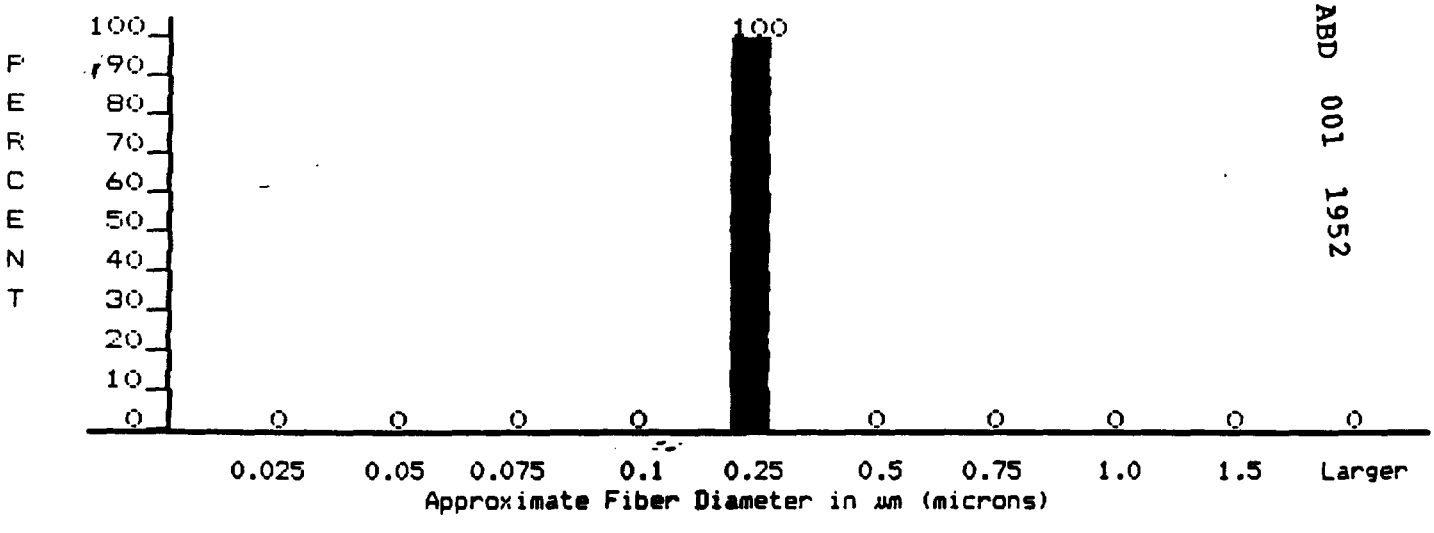
Sample : 04979

# CHRYSOTILE

Fiber(s) Less than 5 µm in length*




Fiber(s) Greater than or Equal To 5 µm in length*




ABD 001 1952

*Sum of both histograms represents 100% of Chrysotile fibers.

A 00158

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

NVLAP

Transmission Electron Microscopy (TEM) Raw Data Sheet

Sample: 04979

Dimensions in µm (microns). Mass in Picograms.

| GRID OPENING | STRUCTURE # | TYPE | ASBESTOS TYPE | LENGTH | THICKNESS | WIDTH | MASS |
|---|---|---|---|---|---|---|---|
| 1 | 1 - 4 | | nonasbestos | | | | |
| 2 | 5 - 11 | | nonasbestos | | | | |
| 2 | 12 | fiber | chrysotile | 10.000 | 0.2000 | | 0.8168 |
| 3 | 13 - 17 | | nonasbestos | | | | |
| 4 | 18 - 19 | | nonasbestos | | | | |
| 5 | 20 - 23 | | nonasbestos | | | | |
| 6 | 24 - 26 | | nonasbestos | | | | |
| 7 | 27 - 28 | | nonasbestos | | | | |
| 8 | 29 - 31 | | nonasbestos | | | | |
| 9 | 32 - 33 | | nonasbestos | | | | |
| 10 | 34 - 36 | | nonasbestos | | | | |

ABD 001 1953

Mass of Chrysotile Particulates 0.8168
Mass of Amphibole Particulates 0.0000
Total Mass of Asbestos Particulates 0.8168

Amosite, Anthophyllite, Tremolite, Actinolite and Crocidolite are classified as Amphiboles.
STRUCTURE TYPES
Fiber - a fiber is a particle with an aspect ratio ≥ 3:1 and parallel sides. Thickness is equivalent to diameter.
Bundle - a bundle is a particulate composed of fibers in a parallel arrangement with a fiber spacing < 1 diameter.
Cluster - a cluster is a particulate with intermixed fibers in a random arrangement.
Matrix - a matrix is a fiber or fibers with one free end and the other end hidden by a particulate.

A 00159

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Spc

Date: OCT 23 00
TAT: 24 Hr

LABORATORY # 9038156
CLIENT: Roy F. Weston, Inc., Edison

SAMPLE ID: 04979
SAMPLE LOCATION:
#2 LR

PROJECT: 20479-21-01-3426 Ellington Asbestos

FILTER SIZE: 25
FILTER TYPE: MCE

1C hrs

VOLUME (LITERS): ~~1001.00~~ 1030

GRID OPENINGS: 10

Hazy

IF ASHED*
37 mm Q = 1.13
25 mm Q = 2.49
K = Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Wid |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 4 | | | | | | | | | | | | | | | |
| | 2 | 7 | 10.0 | 0.2 | F | | | | | | | | | | | | |
| | 3 | 5 | | | | | | | | | | | | | | | |
| | 4 | 2 | | | | | | | | | | | | | | | |
| | 5 | 4 | | | | | | | | | | | | | | | |
| | 6 | 3 | | | | | | | | | | | | | | | |
| | 7 | 2 | | | | | | | | | | | | | | | |
| | 8 | 3 | | | | | | | | | | | | | | | |
| | 9 | 2 | | | | | | | | | | | | | | | |
| | 10 | 3 | | | | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☒ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☒ (5) Fibers Containing A-L, S!

Scope #: 2 Date: 10/23/00

Analyst: TGS

Q.C. Check: [illegible]

Computer: [illegible]

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (N) / G(Tm²) = 0.00063

Grid Box # 491004 Row J Col. 6

Filter Accepted for Analysis: Yes ☐ No ☐

If No, Reason for Rejection:

ABD 001 1954

A 00120

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
North Carolina Society for Electron Microscopy and Microbeam Analysis;

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT-System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1955

A 00161

NVLAP

# EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.


108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080


Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04380
LOCATION : Lot Blank
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 0 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | | 0.0000 |
| Concentration Detection Limit: | | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (on whole filter (in millions) ) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | | 0.0000 |
| Mass Detection Limit : | | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/filter) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

ABD 001 1956

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 00162

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 23 90
TAT: 24 Hr

LABORATORY #: 9034157
CLIENT ID: Roy F. Weston, Inc., Edison

SAMPLE ID: 04980
SAMPLE LOCATION:
Lot Blank

PROJECT: 30470-01-01-2426 Millington Asbestos

Nancy

NSD

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 0.00
GRID OPENINGS: 20

IF ASHED*
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Chrysotile Length | Chrysotile Thick | Chrysotile Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Width | Amphibole Length | Amphibole Thick | Amphibole Type Widt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | | | |
| | 3 | 0 | | | | | | | | | | | | | | | |
| | 4 | 0 | | | | | | | | | | | | | | 1 | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 0 | | | | | | | | | | | | | | | |
| | 7 | 0 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 0 | | | | | | | | | | | | | | | |
| | 10 | 0 | | | | | | | | | | | | | | | |
| | 11 | 0 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 0 | | | | | | | | | | | | | | | |
| | 14 | 0 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 0 | | | | | | | | | | | | | | | |
| | 17 | 0 | | | | | | | | | | | | | | | |
| | A | 0 | | | | | | | | | | | | | | | |
| | 19 | 0 | | | | | | | | | | | | | | | |
| | 20 | 0 | | | | | | | | | | | | | | | |

ABD 001 1957

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/22/90

Analyst: TCS

Q.C. Check: AP

Computer: Yes

cture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) → 0.0642 (N) / G(Tm²) = .0032

Grid Box # 891004 Row K Col. 4/10

Filter Accepted for Analysis: Yes ☒ No ☐

If No, Reason for Rejection:

00163

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
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1974 PhD(Physics), 1969 MS, 1967 BS

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EMSL: Founder 1981

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Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1958

A 00154

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04981
LOCATION : Field Blank 1
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 0 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | | 0.0000 |
| Concentration Detection Limit: | | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (on whole filter (in millions) ) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | | 0.0000 |
| Mass Detection Limit : | | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/filter) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

ABD 001 1959

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

A 00165

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

LABORATORY #: 9038158
CLIENT ID: Roy F Weston, Inc., Edison

Date: OCT 23 90
TAT: 24 Hr

SAMPLE ID: 04991
SAMPLE LOCATION:
Field Blank 1

PROJECT: 20470-01-01-0425 Millington Asbestos

Nancy

FILTER SIZE (25) 37
FILTER TYPE (MCE) PC

VOLUME (LITERS) 0.00

GRID OPENINGS: 20

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49
K= Q / % Resuspended/100

% Resuspended =

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Thick | Type Width | Length | Thick | Type Width | Length | Thick | Type Width | Amphibole Length | Thick | Type Width | Length | Thick | Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | | | |
| | 3 | 0 | | | | | | | | | | | | | | | |
| | 4 | 0 | | | | | | | | | | | | | | | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 0 | | | | | | | | | | | | | | | |
| | 7 | 0 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 0 | | | | | | | | | | | | | | | |
| | 10 | 0 | | | | | | | | | | | | | | | |
| | 11 | 0 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 0 | | | | | | | | | | | | | | | |
| | 14 | 0 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 0 | | | | | | | | | | | | | | | |
| | 17 | 0 | | | | | | | | | | | | | | | |
| | 18 | 0 | | | | | | | | | | | | | | | |
| | 19 | 0 | | | | | | | | | | | | | | | |
| | 20 | 0 | | | | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/23/90

Analyst: TGS

Q.C. Check: [illegible]

Computer: [illegible]

Picture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ⟶ 0.0642 (K) / 6 (Vm³) = .0032

Grid Box # 891004 Row L Col. 719

Filter Accepted for Analysis: Yes ☒ No ☐

If No, Reason for Rejection:

A 00156

ABD 001 1960

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

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MA Biology

1975-78 State University of New York at Plattsburgh
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EMPLOYMENT

EMSL: Since 1986

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Research Associate, Electron Microscopist

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Dept. of Anatomy
Electron Microscopist

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EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
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Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society; Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1961

A 00107

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

108 HADDON AVENUE
WESTMONT, N.J.
08108
609-858-4800

1056 STELTON ROAD
PISCATAWAY, N.J.
08858
201-981-0550

1800 PEACHTREE STREET
ATLANTA, GEORGIA
30309
404-355-4046

2 De ANGELO DRIVE
BEDFORD, MASS.
01730
617-275-7080

Wednesday, October 24, 1990

Roy F. Weston
REAC Project/GSA Raritan Depot
2890 Woodbridge Avenue/Bldg. 209 Annex
Edison, NJ 08837-3679

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selective Area Electron Diffraction (SAED) and Energy Dispersive X-Ray Microanalysis (EDX) --- EPA LEVEL II Performed By The Yamate et al. Method.

PROJECT : 33470-21-01-3426/Millington Asbestos
SAMPLE IDENTIFICATION : 04982
LOCATION : Field Blank 2
VOLUME : BLANK
Grid Openings Analyzed : 20
Sample Condition: Acceptable.

## CONDENSED DATA

| | | |
|---|---|---|
| 1. Number of Asbestos Fibrous Particulates (AFP) Analyzed : | | 0 |
| 2. Number of Nonasbestos Fibrous Particulates Analyzed : | | 0 |
| 3. Number of Ambiguous Fibrous Particulates : | | 0 |
| 4. Type(s) of Asbestos : | | none detected |
| 5. Concentration of Asbestos Fibrous Particulates : (on whole filter (in millions)) | | 0.0000 |
| Concentration Detection Limit: | | 0.0032 |
| 6. Concentration due to Asbestos Fibrous Particulates equal to or greater than 5 µm (microns) in length : (on whole filter (in millions) ) | (0.0 %) | 0.000 |
| 7. Mass of Asbestos Fibrous Particulates : (in nanograms/filter) | | 0.0000 |
| Mass Detection Limit : | | 0.0003 |
| 8. Mass due to Asbestos Fibrous Particulates equal to or greater than 5µm (microns) in length : (in nanograms/filter) | ( 0.0 %) | 0.000 |

Comments: Filter Type: MCE, Filter Size: 25mm.

Peter Frasca, PH.D.
President

Laboratory
Supervisor

Approved
Signatory

The laboratory is only responsible for fibers counted in fibers/mm$^2$ and not in fibers/cc, which is dependent on volume collected by nonlaboratory personal. * Accredited for PLM

ABD 001 1962

A 0(

E M S L

# TEM AIR ANALYSIS WORKSHEET (YAMATE) LEVEL II

Date: OCT 23 90
TAT: 24 Hr

LABORATORY # 9038159
CLIENT ID: Roy F Weston, Inc., Edison

SAMPLE ID: 04992
SAMPLE LOCATION
Field Blank 2

PROJECT: 03470-21-01-0406/Millington Asbestos

Harvey

IF ASHED *
37 mm Q = 1.13
25 mm Q = 2.49

K= Q / % Resuspended/100

% Resuspended =

FILTER SIZE: 25
FILTER TYPE: MCE PC

VOLUME(LITERS): 0.00

GRID OPENINGS: 20

(B=Bundle C=Cluster M=Matrix)

| GO # | G# | NON ASB | Chrysotile Length | Thick | Type Width | Length | Thick | Type Width | Length | Thick | Type Width | Amphibole Length | Thick | Type Width | Length | Thick | Type Width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | | | |
| | 3 | 0 | | | | | | | | | | | | | | | |
| | 4 | 0 | | | | | | | | | | | | | | | |
| | 5 | 0 | | | | | | | | | | | | | | | |
| | 6 | 0 | | | | | | | | | | | | | | | |
| | 7 | 0 | | | | | | | | | | | | | | | |
| | 8 | 0 | | | | | | | | | | | | | | | |
| | 9 | 0 | | | | | | | | | | | | | | | |
| | 10 | 0 | | | | | | | | | | | | | | | |
| | 11 | 0 | | | | | | | | | | | | | | | |
| | 12 | 0 | | | | | | | | | | | | | | | |
| | 13 | 0 | | | | | | | | | | | | | | | |
| | 14 | 0 | | | | | | | | | | | | | | | |
| | 15 | 0 | | | | | | | | | | | | | | | |
| | 16 | 0 | | | | | | | | | | | | | | | |
| | 17 | 0 | | | | | | | | | | | | | | | |
| | 18 | 0 | | | | | | | | | | | | | | | |
| | 19 | 0 | | | | | | | | | | | | | | | |
| | 20 | 0 | | | | | | | | | | | | | | | |

Nonasbestos Fibers Present
- ☐ (1) Gypsum
- ☐ (2) Glass
- ☐ (3) Cellulose
- ☐ (4) Organic Fibers
- ☐ (5) Fibers Containing

Scope #: 2 Date: 10/23/90

Analyst: TCS

Q.C. Check:

Computer:

icture ☐ Spectrum ☐ SAED ☐ #

Types

## HAND CALCULATIONS

(25mm) ---> 0.0642 (N) / G(Fm²) = .0032

Grid Box # 891004 Row M Col. 8/10

Filter Accepted for Analysis: Yes ☒ No ☐

If No, Reason for Rejection:

ABD 001 1963

A 00109

NVLAP

EMSL ELECTRON-MICROSCOPY SERVICE LABORATORIES INC.

**METHODOLOGY:** Yamate et al. 1984 [1], EPA level II

Air samples are first coated with a thin layer of carbon in a vacuum evaporator. Small squares (approximately 3mm X 3mm) are subsequently cut out from the coated filter and placed carbon side down onto TEM copper grids and placed in a Jaffe Wick chamber either with chloroform (for polycarbonate filters) or acetone (for MCE filters).

In the TEM analysis fibers are scrutinized at about 20,000X by morphological observation, selected area electron diffraction (SAED), and energy dispersive X-ray microanalysis (EDX). In a level I analysis (not recommended by EMSL) EDX analysis is omitted and chances for error and ambiguity increase.

1. Yamate G., Agarwal S.C., and Gibbons R.D. 1984. Methodology for the Measurement of Airborne Asbestos by Electron Microscopy. Draft Report. Washington, D.C.: Office of Research and Development, US Environmental Protection Agency, Contract No. 68-02-3266

**ANALYST:** Timothy G. Schneider

EDUCATION

1980-81 State University of New York at New Paltz
MA Biology

1975-78 State University of New York at Plattsburgh
BA Biology

EMPLOYMENT

EMSL: Since 1986

1986-Present Thomas Jefferson University (Phila. PA)
Dept. of Surgery
Research Associate, Electron Microscopist

1982-86 Duke University Medical Center (Durham N.C.)
Dept. of Anatomy
Electron Microscopist

Member: Electron Microscopy Society of America;
North Carolina Society for Electron Microscopy and Microbeam Analysis;

**LABORATORY DIRECTOR:** Peter Frasca, Ph.D.

EDUCATION

Rensselear Polytechnical Institute, Troy, New York
1974 PhD(Physics), 1969 MS, 1967 BS

EMPLOYMENT

EMSL: Founder 1981

1975-85 Thomas Jefferson University (Phila. PA)
Research Associate Professor
Director of Orthopaedic Research
Director of Ultrastructure and X-Ray Microanalysis Laboratory
Member of Professorial and Graduate Faculty

Member: American Industrial Hygiene Society; American Chemical Society; Phila. Electron Microscopy Society;
Scanning Electron Microscopy Society, National Asbestos Council .

Dr. Frasca has demonstrated extensive experience in electron microscopy of asbestos acquired through 7 years of analysis of asbestos found in air, water, bulk and soil samples. He implemented an SEM method which made SEM analysis of asbestos filters commercially feasible. This led to a publication in the EPAs Proceedings of the Workshop on Monitoring and Evaluation of Airborne Asbestos Levels Following an Abatement Program pp 225-232, April 1985.

**ELECTRON MICROSCOPE and EDX ANALYZER**

MICROSCOPE: JEOL 100 CX-II Analytical STEM
EDX ANALYZER: PGT System 4 with Beryllium window detector
Instruments are routinely calibrated on the first work day of each month and following instrument repair.

ABD 001 1964

A 00170

ABD 001 1965

**Roy F. Weston, Inc.**
REAC, Edison, N.J.
EPA Contract 68-03-3482

(433)

# CHAIN OF CUSTODY RECORD/LAB WORK REQUEST

No: 3401

SHEET NO. 1 OF 1

Project Name: Millington Asbestos
Project Number: 3342-21-01-3426
RFW Contact: Chris Schultze Phone: 201-632-9200 Due Date: 10/24/90

(18387)

**SAMPLE IDENTFICATION** / **ANALYSES REQUESTED**

| | Sample No. | Sampling Location | Matrix | Date Collected | Container/Preservative | Vol. Coll. | TEM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 38148 | 04971 | #1, baby Rm | A | 10/22/90 | .45u filter | 10,136.3 l | ✓ | | | |
| 49 | 04972 | #1, Bedroom | A | 10/22/90 | .45u filter | 10,125.0 l | ✓ | | | |
| 50 | 04973 | #1, K./Liv. Rm. | A | 10/22/90 | .45u filter | 9967.8 l | ✓ | | | TNB |
| 51 | 04974 | #1, K./Liv. Rm. | A | 10/22/90 | .45u filter | 9988.7 l | ✓ | | | |
| 52 | 04975 | #1, K./Liv. Rm | A | 10/22/90 | .45u filter | 10,003.4 l | TNB ✓ | | | |
| 53 | 04976 | #2, Bedroom | A | 10/22/90 | .45u filter | 10,053.9 l | ✓ | 10,053.9 l TNB | | |
| 54 | 04977 | #2, den | A | 10/22/90 | .45u filter | 10,110.0 l | ✓ | | | |
| 55 | 04978 | #2, LR | A | 10/22/90 | .45u filter | 10,126.3 l | ✓ | | | |
| 56 | 04979 | #2, LR | A | 10/22/90 | .45u filter | 10,130 l | ✓ | | | |
| 57 | 04980 | Lot Blank | A | 10/22/90 | .45u filter | 0 l | ✓ | | | |
| 58 | 04981 | FB 1 | A | 10/22/90 | .45u filter | 0 l | ✓ | | | TNB |
| 38159 | 04982 | FB 2 | A | 10/22/90 | .45u filter | 0 l | ✓ | | | |
| | (12) | | | | | | | | | |
| | | | | | | | | | | TNB |

**Matrix:**
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

**Special Instructions:** A - Air

| Items/Reason | Relinquished By | Received By | Date | Time | Items/Reason | Relinquished By | Received By | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| 12/ Analysis | [illegible] | [illegible] | [illegible] | 7:AM | | | | | |

A 001 1

Continued From Page

| WECT Sample # | CLIENT | # ASB | # NON ASB | VOL | GO | FIBERS/CC | cm |
|---|---|---|---|---|---|---|---|
| 11/7/90 | | | | | | | |
| 130 | IHSC | 0 | 0 | 1573.75 | 20 | 0.0021 | 2 |
| 37031 | IHSC | 0 | 2 | 1526.25 | 20 | 0.0021 | 2 |
| 37032 | IHSC | 0 | 0 | 1507.75 | 20 | 0.0021 | 2 |
| 37661 | Weston | 5 | 36 | 10184.10 | 10 | 0.0032 | 2 |
| 37662 | " | 5 | 38 | 10199.00 | 10 | 0.0030 | 2 |
| 37663 | " | 2 | 56 | 10220.10 | 14 | 0.0009 | 2 |
| 37664 | " | 1 | 137 | 10338.80 | 16 | 0.00039 | 2 |
| 10/19/90 | | | | | | | |
| 37770 | Weston | 0 | 3 | 8771.25 | 20 | 0.00037 | 2 |
| 37771 | " | 0 | 2 | 8850.00 | 20 | 0.00036 | 2 |
| 37773 | " | 0 | 0 | 0.00 | 20 | 0.0032 | 2 |
| 37774 | " | 0 | 0 | 0.00 | 20 | 0.0032 | 2 |
| 37772 | Weston | 0 | 75 | 8776.25 | 20 | 0.00037 | 2 |
| 37791 | Hand of Ass. | 2 | 2 | 1200 | 10 | 0.010 | 2 |
| 37792 | " | 4 | 0 | 1200 | 10 | 0.020 | 2 |
| 37793 | " | 4 | 1 | 1200 | 10 | 0.020 | 2 |
| 37794 | " | 21 | 2 | 1200 | 5 | 0.21 | 2 |
| 11/23/90 | | | | | | | |
| 138160 | CON-TEST | 1 | 5 | 1203.50 | 14 | 0.0038 | 2 |
| 38148 | Weston | 1 | 1 | 10136.30 | 10 | 0.00063 | 2 |
| 38149 | " | 0 | 29 | 10125.00 | 20 | 0.00032 | 2 |
| 38150 | " | 3 | 17 | 9967.80 | 10 | 0.0019 | 2 |
| 38157 | " | 1 | 11 | 9988.70 | 13 | 0.00064 | 2 |
| 38149SR | " | 0 | 6 | 10125.00 | 10 | 0.00063 | 2 |
| 37972 | TVA BULK ND. | | | | | | 2 |
| 10/24/90 | | | | | | | |
| 38016 | ENV TESTING | 0 | 0 | 1230.48 | 10 | 0.0049 | 2 |
| 38017 | " | 0 | 0 | 1232.10 | 10 | 0.0049 | 2 |
| 38018 | " | 0 | 0 | 1230.48 | 10 | 0.0049 | 2 |
| 38019 | " | 1 | 0 | 1230.48 | 10 | 0.0049 | 2 |
| 38020 | " | 0 | 0 | 1230.48 | 10 | 0.0049 | 2 |

Continued on Page

Read and Understood By

Signed Date Signed Date



ABD 001 1966

PROJECT ~~9037337~~ 9037337

Continued From Page _____

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ~~9037337~~ | AET | P108 | 2 | NSD | Alpha | 1200 | 10 0.0050 |
| 9037334 | AET | P109 | 2 | 2 chg | Alpha | 1200 | 100.0100 |
| 9037334 | AET | P110 | 2 | NSD | Alpha | 1200 | 100.0050 |
| 9037342 | AET | P111 | 2 | NSD | Alpha | 1200 | 100.0080 |
| 9037334 | AET | SR | 2 | NSD | Alpha | 1200 | 100.0080 |
| | | 10/24/90 | | | | | |
| 9037346 | ETT | 01 | 3 | NSD | Alpha | 2550 | 100.0034 |
| 9037347 | ETT | 02 | 3 | 1 chg | Alpha | 1924 | 100.0031 |
| 9037341 | ETT | 03 | 3 | NSD | Alpha | 2850 | 100.0031 |
| 9037351 | Weston | 04941 | 3 | NSD | II | 6745 | 20 0.00032 |
| 9037352 | Weston | 04943 | 3 | NSD | II | 5765 | 200 0.0004 |
| 9037353 | Weston | 04944 | 3 | NSD | II | 7419 | 200.004 |
| 9037354 | Weston | 04945 | 2 | NSD | II | Blank | 20 — |
| | | 10/21/90 | | | | | |
| | IIIBART | | 2 | NSD | Alpha | 1250 | 100.0049 |
| | 2 IIIB | ART | 2 | NSD | Alpha | 1215 | 100.0049 |
| | 3 IIIB | ART | 2 | NSD | Alpha | 1215 | 100.0049 |
| | 4 IIIB | ART | 2 | NSD | Alpha | 1235 | 100.0048 |
| | 5 IIIB | ART | 2 | NSD | Alpha | 1215 | 100.0049 |
| | | 10/23/90 | | | | | |
| 9034152 | Weston | 04975 | 2 | 1 chg | II | 10003 | 100.0006 |
| 9034153 | Weston | 04976 | 2 | NSD | II | 10,053 | 200.0032 |
| 9034154 | Weston | 04977 | 2 | 2 Chg | II | 10110 | 100.0013 |
| 9034155 | Weston | 04978 | 2 | 1 chg | II | 10,120 | 100.0008 |
| 9034156 | Weston | 04979 | 2 | 1 chg | II | 10013 | 100.0064 |
| 9034157 | Weston | 04980 | 2 | NSD | II | Blank | 20 — |
| 9034158 | Weston | 04981 | 2 | NSD | II | Blank | 20 — |
| 9034159 | Weston | 04982 | 2 | NSD | II | Blank | — |
| 9034156 | Weston | SQRT | 2 | NSD | II | 10,012 | 0.0032 |

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Read and Understood By

Signed _____ Date _____ Signed _____ Date _____

ABD 001 1967

A 00173