file (6) Asbestos Sampling task Force, ORC

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Organization Resources Counselors, Inc.

Memorandum

PLAINTIFF'S
EXHIBIT
AL-979

June 13, 1989

To: ORC Occupational Safety and Health Group
ORC Western Occupational Safety and Health Group
ORC Asbestos Task Force

From: Rebecca L. Daiss Becky

Subject: NIOSH Studies on Asbestos Exposure Associated with Use of General and Negative-Pressure Glove Bag Removal Methods

Attached is a copy a of slide presentation given at the National Asbestos Contractor's Symposium in March 1989, by Bruce Hollet of NIOSH's Engineering Control Technology Branch. Mr. Hollet's presentation was based on findings of an EPA sponsored NIOSH study on the effectiveness of two negative-pressure glove bag methods of controlling asbestos exposure during removal operations. The two types of glove bags examined, neither of which are widely used, were the Aero-pipe Capsule manufactured by Aerospace America, Inc., and a Custom Fabricated Glovebag designed to operate under negative pressure. Although Mr. Hollet presented the preliminary conclusions of the study at the symposium, the actual study is not yet publicly available. According to Mr. Hollet, NIOSH is waiting for the results of TEM analysis of a number of samples and the report has not yet completed internal review at NIOSH.

In the first half of the attached presentation describes an earlier EPA sponsored NIOSH effort to determine the effectiveness of glovebag methods in general. The second part outlines the preliminary findings of the negative-pressure study.

In the earlier study, conducted in 1985, NIOSH surveyed asbestos removal projects in four schools in Cincinnati, Ohio. NIOSH issued four reports on the findings of the Cincinnati school surveys in the summer of 1987. General conclusions drawn from observation and analysis of those removal jobs were that glove bags alone are insufficient to control daily TWAs below the OSHA PEL under what NIOSH considers to be normal conditions i.e., infrequent glove bag use, limited experience, and inadequate training in the use of glove bags. Accordingly, NIOSH concluded that use of glove bags by well trained personnel who use glove bags regularly would likely result in better containment. However, based on the assumption that the level of training and experience of workers observed in these studies is likely to be typical of workers involved in asbestos removal, NIOSH concluded that a second level of control, e.g. a negative-pressure enclosure, is needed to assure complete containment of asbestos fibers when glove bags are used. If you would like copies of the NIOSH survey reports, please call.

According to Mr. Hollet, the follow up study was conducted to investigate alternatives to the normal glove bag approach and determine if, as expected, negative-pressure glove bags provide better control of asbestos exposure. Preliminary PCM analysis results were favorable for the negative-pressure technology studied. However, NIOSH is awaiting TEM analysis of workers actual fiber exposure before making any definitive conclusions. For more information Mr. Hollet can be reached at (513) 841-4221.

OSHA has recently given increased attention to the use of glove bags due to controversy within the Agency's compliance division over when the use of glove bags is permitted under the Asbestos Standard. Apparently, OSHA was considering eliminating the small job exemption, which allows use of glove bags for small jobs, and allowing the use of glove bags for all removal jobs. However, due to concern over NIOSH's findings in the earlier studies and disclosures regarding the most recent study, OSHA is apparently not going to take actions until the agency has reviewed the latest study and assessed the findings (OSHA has also been unable to obtain a copy of the complete study). A more detailed explanation of the controversy over regulatory requirements governing the use of glove bags versus negative-pressure enclosures, excerpted from Darrell Mattheis' Health Standard Update, is attached.

OSHA would welcome any sampling data ORC members have on exposures during removals using glove bags. If you have information you are willing to provide, please send it to either my attention or Darrell's.

RLD:lgs

Attachments

<u>ASBESTOS</u> (exerpt from Health Standards Update)

Asbestos continues to be an important issue for OSHA compliance. Presently, the big question is the definition of paragraph (e)(6). The question involves the requirement for negative-pressure enclosures, the exception to the requirements of (e)(6) for small jobs, and the definition of a small job.

Paragraph (e) is regulated areas, and (e)(6) is requirements for asbestos removal, demolition, and renovation operations. (e)(6)(i) requires that:

> "Wherever feasible, the employer shall establish negative-pressure enclosures before commencing removal, demolition, and renovation operations."

(e)(6)(iv), Exception, establishes the exception for small jobs.

> "For small-scale, short duration operations, such as pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation, the employer is not required to comply with the requirements of paragraph (e)(6) of this section."

<u>Negative-Pressure Enclosures</u>: The question is, when is a negative-pressure enclosure required? OSHA solicitors have concluded, based on the standard, that a negative-pressure enclosure is required whenever the job is a removal, demolition or renovation, regardless of how small, and regardless of the level of airborne asbestos fibers generated. OSHA field people are not as convinced, however, believing that if an employer can demonstrate that the levels of airborne asbestos generated are below the PEL, OSHA would lose in court if a citation were contested.

In one case that is presently in court, the employer was removing asbestos insulation from 140 feet of pipe, treating it as a small job, using glove bags. OSHA came in, sampled for two hours, and found that the exposure for those two hours, was below the Action Level. OSHA cited the employer for not using a negative-pressure enclosure for a removal operation, regardless of what the level of exposure was.

The issue here is the application of certain requirements in the standard based upon the presence of asbestos, regardless of the level of any exposure that might take place. If this approach is upheld in court, OSHA would not need to monitor, but simply to ascertain that asbestos was present and whether it was a large or small job.

The OSHA field people are now being told that if the primary reason for the job is the removal of asbestos, it is to be treated as large-scale, and a negative-pressure enclosure is required. A job is small scale only if the asbestos removal is secondary to the performance of the job.

Definition of a Small Job: OSHA has been writing citations for the use of glove bags for what are essentially removal operations. OSHA designed the small job exception for operations where asbestos removal or release is incidental to the performance of the job. OSHA views any operation where the removal of asbestos is the main purpose, as a large scale job requiring a negative-pressure enclosure.

It generally makes no difference that the job could be done in a glove bag with exposure levels below the Action Level. Some employers have used multiple glove bags to sequentially remove asbestos containing insulation from pipes. OSHA considers this to be a violation of the standard. One standard that some in OSHA have used is that if a glove bag is longer than ten feet, it is no longer a small job.

In some instances however, OSHA has allowed the small job designation to be used for what was in fact asbestos removal. In one case, where a large building was being renovated, there were one hundred rooms with an essentially identical pipe elbow with asbestos in the insulation. OSHA allowed the contractor to use glove bags on each of the elbows, class it as a small job, and not use negative-pressure enclosures.

Bruce's presentation at NAC meeting

cc Bill Burch
Bob Jordan
Betsy
Dave Kling

From KEG 4/14/89

USPHS/CDC/NIOSH/DPSE

ENGINEERING CONTROL TECHNOLOGY BRANCH

CONTROL TECHNOLOGY ASSESSMENT OF ASBESTOS PIPE LAGGING REMOVAL USING TWO NEGATIVE-AIR GLOVE BAG REMOVAL METHODS

BY: BRUCE HOLLETT
AND PHILLIP FROEHLICH

NAC SYMPOSIUM MARCH 31, 1989

Background: Many workers are exposed to asbestos:

Construction workers - Demolition, Renovation, Sprinkler Fitters, Sheet Metal, Roofing, etc.

Operations and Maintenance - Plumbing, HVAC, Electrical, House Keeping, etc.

Building Occupants - Office Workers, clients, students, customers, public, etc.

We proposed a pilot study in 1983 to assess need for research in the asbestos removal industry.

INTRODUCTION

- PILOT STUDY , 1984
- PROTOCOL PEER REVIEW
  SPRING 1985
- FOUR SCHOOL STUDY
  SUMMER 1985

WORKER PROTECTION & ENVIRONMENTAL PROTECTION

CONTROL AT THE SOURCE - THE BEST APPROACH

CONTAIN THE ASBESTOS BEFORE IT IS RELEASED
INTO THE ENVIRONMENT.

JOINT PROJECT WITH EPA -SUMMER OF 1985

EPA PROVIDED FUNDING FOR ANALYSIS
NIOSH ADDED EVALUATION OF CLEARANCE AND
EVALUATION OF EFFICACY

SOURCE CONTROLS

- FOR WORK AND ENVIRONMENT
- FIRST PRIORITY GLOVE BAGS WIDELY USED/OFTEN ALONE

Glove Bags were chosen as the first priority because they were widely used by the construction trades as well as by the O&M workers.

They are often used as the only control measure.

They seem to represent an economical source control te 'nology.

GLOVE BAG PHASE

OBJECTIVES

- EVALUATE WORKERS' EXPOSURE DURING GLOVE BAG REMOVAL
- EVALUATE CLEARANCE SAMPLING METHODS
- EVALUATE THE EFFICACY OF THE GLOVE BAG REMOVAL METHODS

EVALUATE WORKERS

- By Personal Breathing Zone Full Term Seq.
- Half day activity -> Morning and Afternoon
- One Short Term sample on each worker: AM & PM

EVALUATE CLEARANCE SAMPLING METHODS

- By comparing PCM & TEM analysis both methods. I will describe aggressive and nonaggressive
- Replicate samples were taken on polycarbonate & cellulose ester media for the two analysis

EVALUATE THE EFFICACY OF THE GLOVE BAG REMOVAL M

- By determining if the post levels are lower by collecting samples before and after

SAMPLING STRATEGY

- OUTDOOR AMBIENT
- PRE-REMOVAL - 2 METHODS
- PERSONAL BREATHING ZONE
  TWA AND SHORT TERM
- AREA DURING REMOVAL
- POST REMOVAL - 2 METHODS

OUTDOORS AMBIENT

•Paired 25mm Cellulose Ester - foil wrapped

•Gast pumps at 3.5 lpm for the full shift

PRE & POST REMOVAL -(First the room is sealed off)

• Two eight hour sequential sampling periods

>1st Non-Aggressive - Taken in a dry quiet room per EPA Blue Book guidance.

> Aggressive - Taken in a dry room with blowers

- Blow down room with leaf blower - 3 passes keep air moving with oscillating fans

• Triplicate Replicate sampling - 25 & 37mm

AREA DURING REMOVAL

• Duplicate Replicate sampling - 25 & 37mm

PBZ's 25mm cellulose esters in foil wrapped cowls

PRE AND POST REMOVAL

SAMPLING EQUIPMENT

FILTERS IN OPEN FACED CASSETTES AND MOUNTED ON A 9 POSITION SAMPLING RING:

- 3 - 37mm cellulose ester 0.8 u
- 3 - 37mm polycarbonate 0.4u. with a 5.0 u cellulose ester backup
- 3 - 25mm cellulose ester 0.8u

SAMPLING PUMPS:

- 6 cassettes on a manifold, each with 3.5 lpm orifices with high powered GE and Gast vacuum pumps.
- 3 cassettes on dupont P4000 pumps

THREE MEHODS SIDE BY SIDE IN TRIPLICATE.

OTHER MONITORING

AMBIENT, SHORT TERM, FAM's

Ambient outside samples on paired 25mm cellulose ester filters with 2" foil wrapped cowls.

A 15 minute short term breathing zone sample on each worker, morning and afternoon.

FAM MEASURED RELATIVE LEVELS ONLY

REMOVAL ACTIVITY

MONITORING

Morning and afternoon sequential breathing zone and replicate area samples collected at 2.5 to 3.5 lpm.

Filters mounted in open faced cassettes.

Areas mounted on 4 position ring

* 2 - 37 mm Polycarbonate 0.4u
* 2 - 25 mm cellulose ester 0.8u

in aluminum foil wrapped 2"cowls

DUPONT P4000 SAMPLING PUMPS

GLOVE BAG REMOVAL PROCESS

- PREPARATION
  *MIST LAGGING WITH AGENT
  *COVER PIPE LAGGING WITH POLY
  *INSTALL BAGS OVER COVERING
- REMOVAL WORK INSIDE GLOVE BAG
  *REMOVE POLY AND WET LAGGING
  *REMOVE LAGGING & BRUSH CLEAN
- MOVE OR REPLACE GLOVE BAG
  *WASH WELL AND TIE OFF BAG
- CLEANUP AND DISPOSE OF WASTE

Preparation: First mist lightly to suppress dust.
Cover lagging in poly envelope then glovebags.
*** SEE PHOTOS ***
Removal: Done inside sealed bags using long gloves
-Cut poly envelope & lagging at joints. USE CARE
-WET lagging and wash bag down OFTEN AND HEAVILY.
-Wash and Brush the pipe. Bottle or horse brushes
*** SEE PHOTOS ***
Moving/Removing Bag:VERY CRITICAL OPEN BAG TASK
-Wet the asbestos and wash bag thoroughly.
-Use HEPA vacuum when collapsing bag - tie it off
*** SEE PHOTOS ***
Cleanup: Ongoing task use HEPA and wet mopping
-Double bag/label and dispose in approved fill.

VIDEO CONVENTIONAL
GLOVE BAG METHOD STUDIED

NIOSH CONTROL TECHNOLOGY ASSESSMENT

A brief video presentation of the types of work activities and equipment associated with the asbestos removal methods studied.

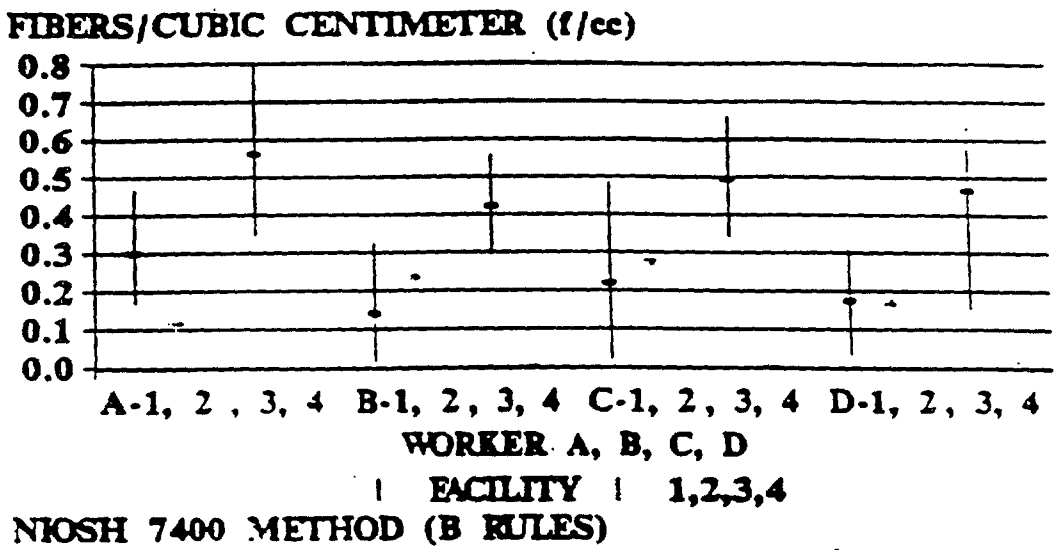
Also a illustration of the monitoring and site preparations for this control technology study.

FINDINGS
WORKING CONCENTRATIONS

PBZ AND AREA MONITORING

TWA EXPOSURE RANGES FOR

FOUR WORKERS AT FOUR SITES 14 DAYS



Here you see a summary of the four workers' TWA exposures at all four sites.

Each vertical entry shows the range, Max and Min, and Mean for the specified worker and school.

Note that nearly all of the Daily TWA's were above .1 f/cc and many were above .2 f/cc

The percentages are shown in the next slide.

WORKER BREATHING ZONE
FINDINGS

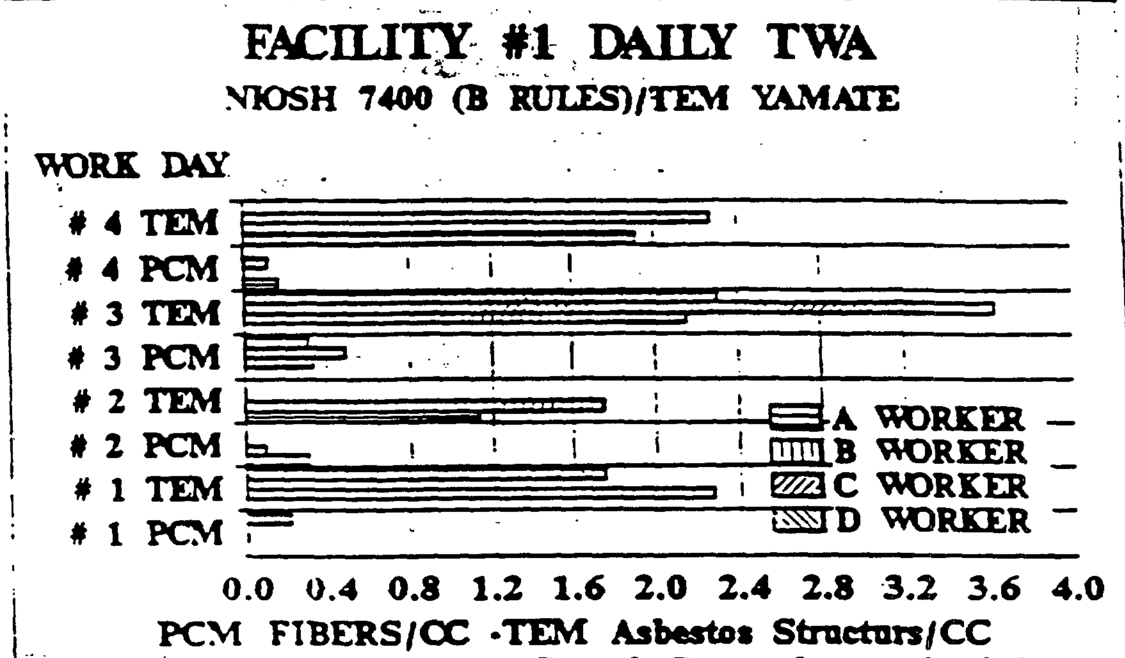
- DAILY TWA LEVELS:
  - *37 / 51 (73%) ARE ABOVE 0.1 f/cc
  - *30 / 51 (58%) ARE ABOVE 0.2 f/cc
- PREPARATION VS REMOVAL LEVELS:
  - *PREPARATION AVG 0.02 f/cc
  - *REMOVAL WORK AVG 0.35 f/cc
- SHORT TERM LEVELS: HIGH> 9.3 f/c
  - *16 / 69 (23%) ARE ABOVE 1.0 f/cc

NIOSH 7400 METHOD (B RULES)

Daily TWA'S reflect a significant exposure potential above recommended control limits.

Activity related exposure levels show that the removal exposures are an order of magnitude higher than the preparation work exposures.

Short Term levels were peaked by the unplanned episode with a 9.0 f/cc. Also the 1.0 f/cc level was exceeded 23% of the time overall.



Note: Day #1 afternoon B and C samples overloaded

Note: Day one workers B and C samples were overloaded with particulate. Unable to count.

The TEM analysis was done on the same Cellulose Ester 25mm filter that the PCM Personal Beathing Zone analysis was. Due to limited support these are the only worker PBZ samples done by TEM.

WORKER GLOVE BAG EXPOSURE OBSERVATION & CONCLUSION

- WORKERS WITH LIMITED TRAINING AND EXPERIENCE HAVE EXPOSURES ABOVE NIOSH RECOMMENDATIONS AND OSHA CRITERIA LEVELS.
- GLOVE BAGS ALONE DO NOT SUFFICE IN CONTROLLING EXPOSURES *UNDER THESE CONDITIONS*.

It is prudent to use respiratory protection during any glove bag operation due to potential leaks.

OSHA permits the use of high efficiency, air purifying respirators for asbestos; However, NIOSH recommends that type C positive pressure, supplied air respirators be used if levels exceed the REL.

As a minimum it is appropriate to seal off the air ducts and doorways to avoid contamination from an accidental release during glove bag work.

More extensive work should likely include the use of decontamination facilities and negative air.

Glove Bag Evaluation Status

Negative Air Technology

Two types of negative air glove enclosures have been studied. The AERO-PIPE CAPSULE manufactured by Aerospace America, Inc. and a Custom Fabricated Glovebag designed to operate under negative pressure conditions.

Preliminary PCM results would indicate that both methods produced adequate control to meet the OSHA PEL and the NIOSH REL. However, TEM analysis of the post removal aggressive sampling have shown many thin fibers. We are awaiting TEM analysis of some of the working area samples to quantify the workers actual fiber exposure levels.

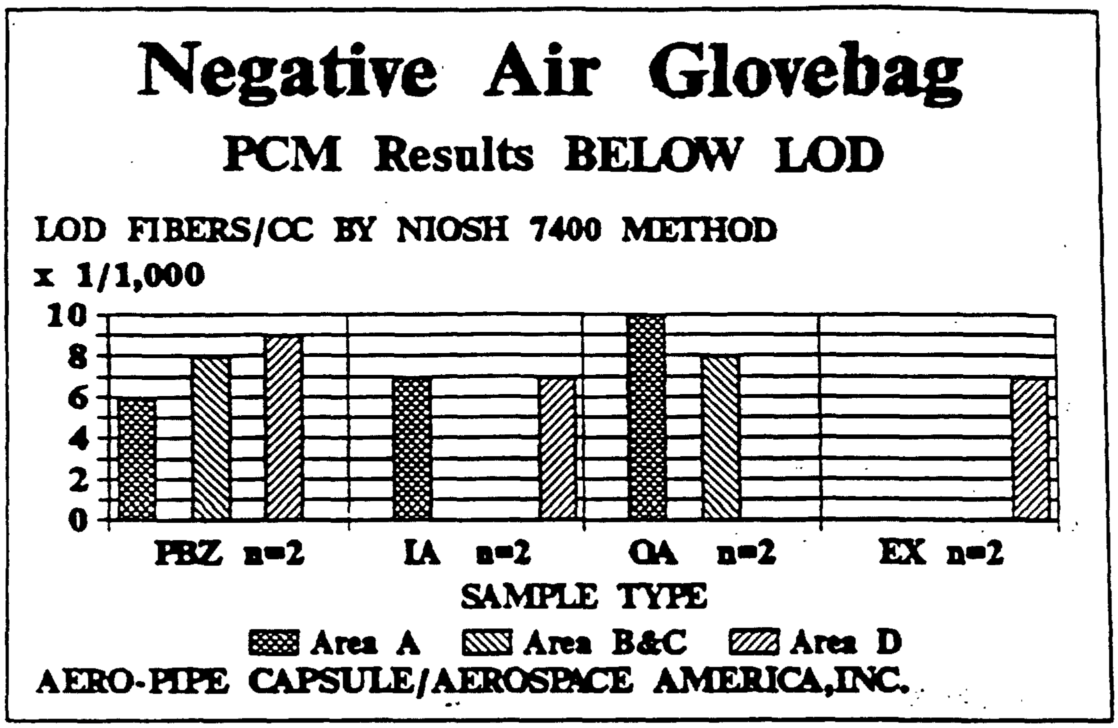
VIDEO OF NEGATIVE-AIR

GLOVE BAG METHOD STUDIED

NIOSH CONTROL TECHNOLOGY ASSESSMENT

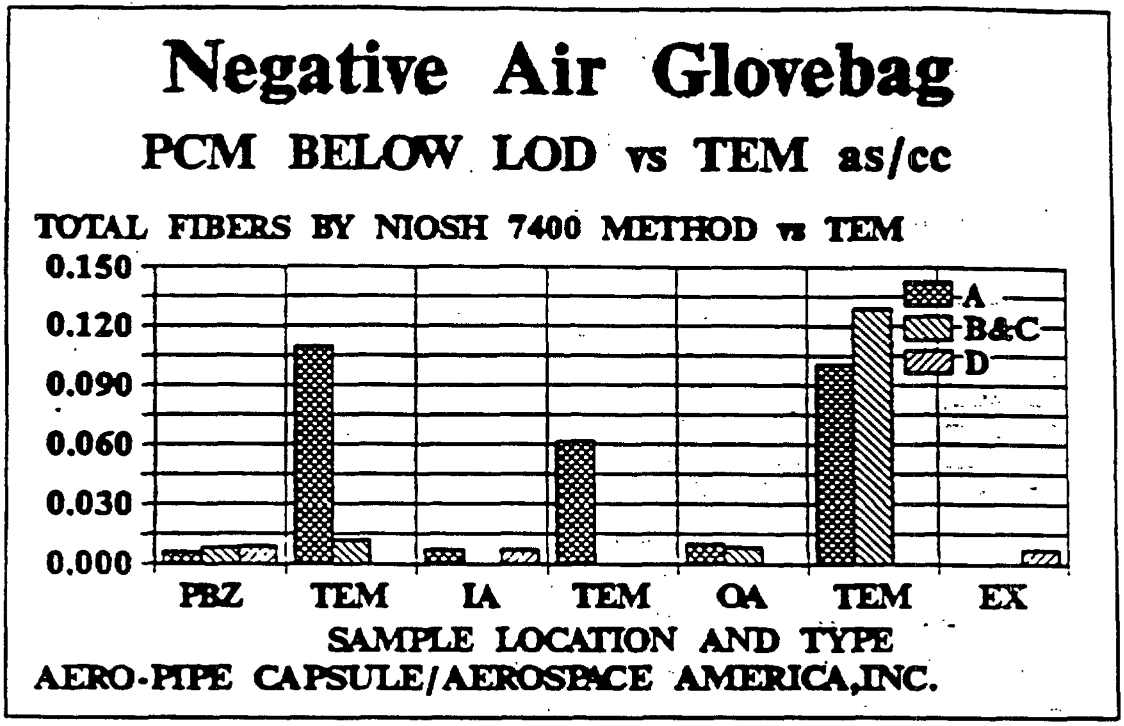
A brief video presentation of the types of work activities and equipment associated with the asbestos removal methods studied.

Also a illustration of the monitoring and site preparations for this control technology study.



These results are all below the LOD and therefore differences reflect the sample volume. The lower less than concentrations representing longer times for sample collection. Two short term samples of 20 minute duration were taken in area D. The also were below the LOD around < 0.05 f/cc.

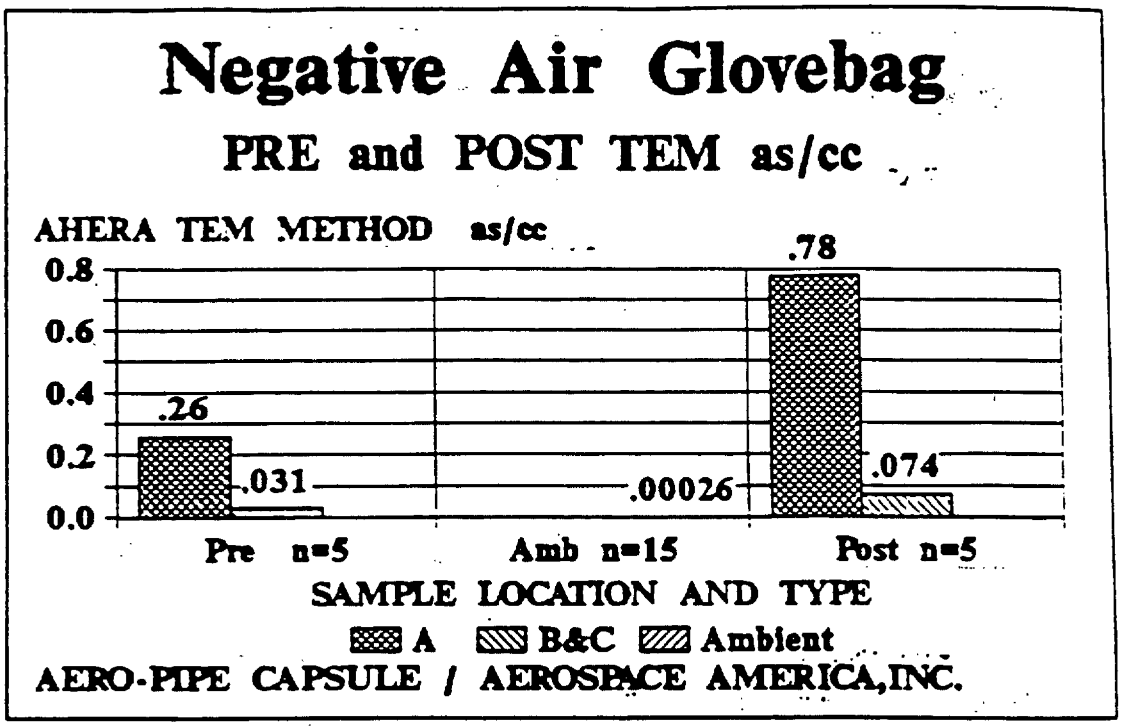
We have received preliminary results of our TEM on these personal breathing zone samples. They indicate higher concentrations of asbestos that must be confirmed by a more complete analysis which is pending. The pre and post TEM analysis shows many fine fibers outside the PCM range.



PCM results are presented to the left of TEM for: Personal Breathing Zone (PBZ), Interior Area (IA), Outer Area (OA) and the HEPA Exhaust (EX).

The PCM data represent two samples each. The TEM data is from an unetched half of one of the two 0.8 u MCE filter samples used for the PCM. Our laboratory had poor etching results.

The other half from the remainder of the PCM have been submitted to the same laboratory which did the pre and post analysis to eliminate this TEM interlaboratory variability factor.



Five pre and post abatement samples were taken for six and a quarter hours using aggressive sampling in a poly enclosure at eight to ten liters per minute for a minimum sample volume of 3000 liters.

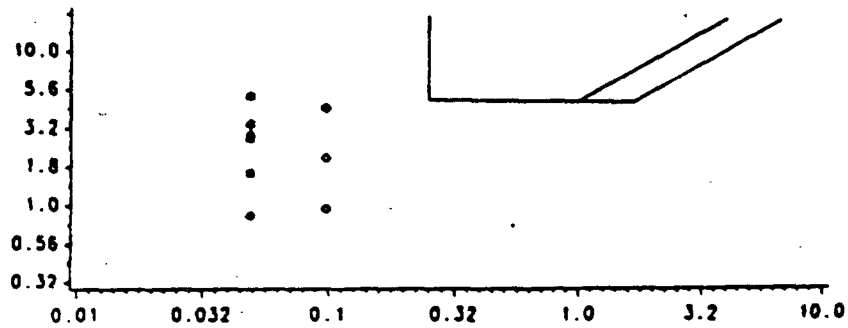
Both the post sample sets are significantly higher than pre using a t-test on ln(concentration) with p-values 0.0014 for area A and 0.0013 for area B/C

The 15 outdoor ambients were at or below 0.0012 as/cc. As shown above all of the mean values for both area A (0.26 - 0.78) and for area B/C (0.013-0.074) well above this ambient level.

PLOT OF STRUCTURES

BY LENGTH AND DIAMETER

STRUCTURE LENGTH, MICROMETERS



AMBIENT

STRUCTURE DIAMETER, MICROMETERS

AHERA TEM METHOD/ AERO-PIPE

This slide shows the size distribution of asbestos structures from all fifteen outdoors ambient samples. The region outlined in the upper right quarter defines the ranges visible to PCM analysis for a 3:1 and 5:1 aspect ratio.

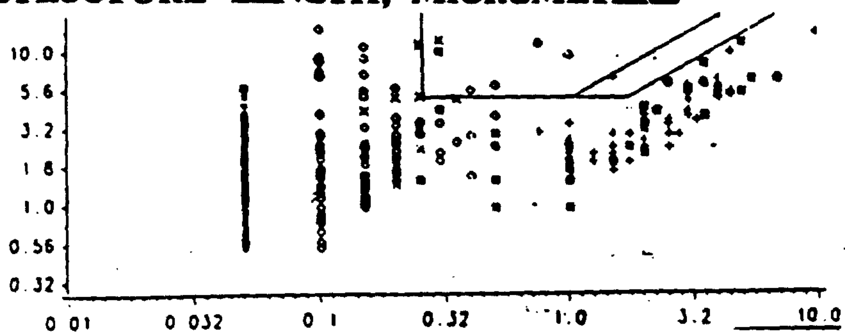
Clearly there would not be a large number of PCM fibers on any one filter. The mean concentration for these samples was 0.0012 as/cc.

—— PCM METHOD 7400	• • • 1 CHRYSOTILE F	● ● ● 1 CHRYSOTILE B
◆ ◆ 1 CHRYSOTILE M	■ ■ ■ 1 CHRYSOTILE C	✖ ✖ ✖ 1 AMPHIBOLE F
▲ ▲ 1 AMPHIBOLE B	O O O 1 AMPHIBOLE M	◘ ◘ ◘ 1 AMPHIBOLE C
B B 1 AMBIGUOUS F	● ● ● 1 AMBIGUOUS B	Z Z Z 1 AMBIGUOUS M
C C 1 AMBIGUOUS C	N N N 1 NON ASBESTOS F	V V V 1 NON ASBESTOS B
W W 1 NON ASBESTOS M	Y Y Y 1 NON ASBESTOS C	

PLOT OF STRUCTURES

BY LENGTH AND DIAMETER

STRUCTURE LENGTH, MICROMETERS



PRE AREA A

STRUCTURE DIAMETER, MICROMETERS

AHERA TEM METHOD/ AERO-PIPE

This slide shows the size distribution of asbestos structures from all five pre-removal aggressive samples. The region outlined in the upper right quarter defines the ranges visible to PCM analysis for a 3:1 and 5:1 aspect ratio.

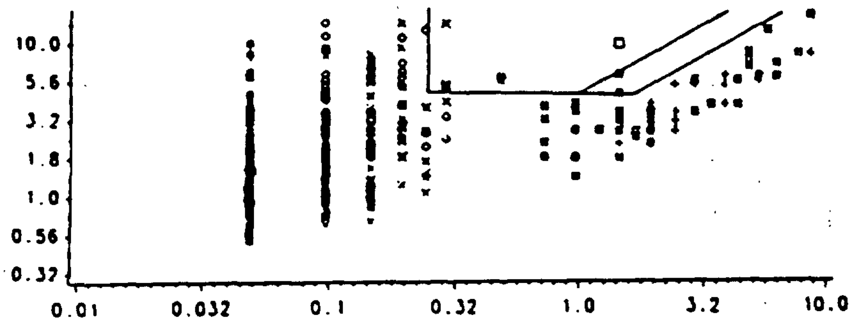
Clearly there would not be a large number of PCM fibers on any one filter. The mean concentration for these samples was 0.26 as/cc.

PCM METHOD 7400
1 CHRYSOTILE M
1 AMPHIBOLE B
1 AMBIGUOUS F
1 AMBIGUOUS C
W W 1 NON ASBESTOS M
1 CHRYSOTILE F
1 CHRYSOTILE C
O O O 1 AMPHIBOLE M
1 AMBIGUOUS B
N N N 1 NON ASBESTOS F
Y Y Y 1 NON ASBESTOS C
1 CHRYSOTILE B
X X X 1 AMPHIBOLE F
1 AMPHIBOLE C
Z Z Z 1 AMBIGUOUS M
V V V 1 NON ASBESTOS B

PLOT OF STRUCTURES

BY LENGTH AND DIAMETER

STRUCTURE LENGTH, MICROMETERS



POST AREA A

STRUCTURE DIAMETER, MICROMETERS

AHERA TEM METHOD/ AERO-PIPE

This slide shows the size distribution of asbestos structures from all five post-removal aggressive samples. The region outlined in the upper right quarter defines the ranges visible to PCM analysis for a 3:1 and 5:1 aspect ratio.

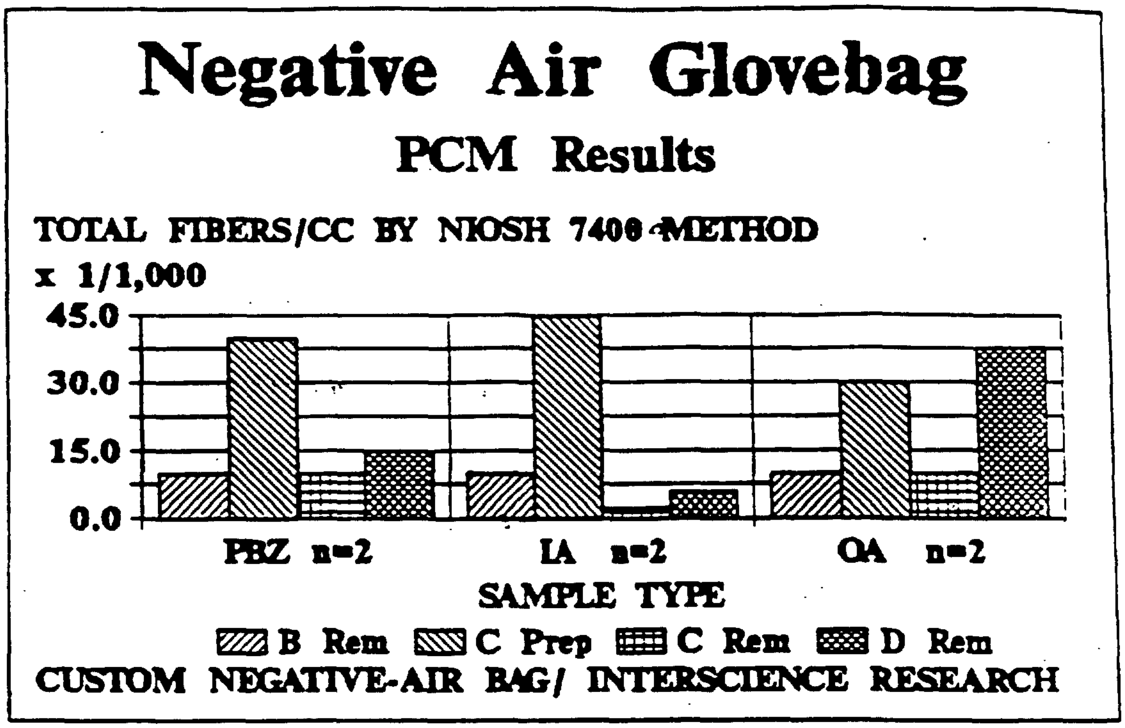
Clearly there would not be a large number of PCM fibers on any one filter. The mean concentration for these samples was 0.78 as/cc.

—— PCM METHOD 7400	• • • 1 CHRYSOTILE F	● ● ● 1 CHRYSOTILE B
◆ ◆ 1 CHRYSOTILE M	■ ■ ■ 1 CHRYSOTILE C	X X X 1 AMPHIBOLE F
▲ ▲ 1 AMPHIBOLE B	O O O 1 AMPHIBOLE M	□ □ □ 1 AMPHIBOLE C
B B 1 AMBIGUOUS F	● ● ● 1 AMBIGUOUS B	Z Z Z 1 AMBIGUOUS M
C C 1 AMBIGUOUS C	N N N 1 NON ASBESTOS F	V V V 1 NON ASBESTOS B
W W 1 NON ASBESTOS M	Y Y Y 1 NON ASBESTOS C	

EFFICACY CONCLUSIONS
NEGATIVE AIR METHODS

- THIS UNIT MET THE OSHA PEL AND NIOSH REL FOR CONTROL OF WORKERS EXPOSURE TO ASBESTOS.
- FURTHER STUDY IS NEEDED TO DETERMINE THE SOURCE OF THE FINE ASBESTOS FIBERS SEEN IN TEM ANALYSIS.

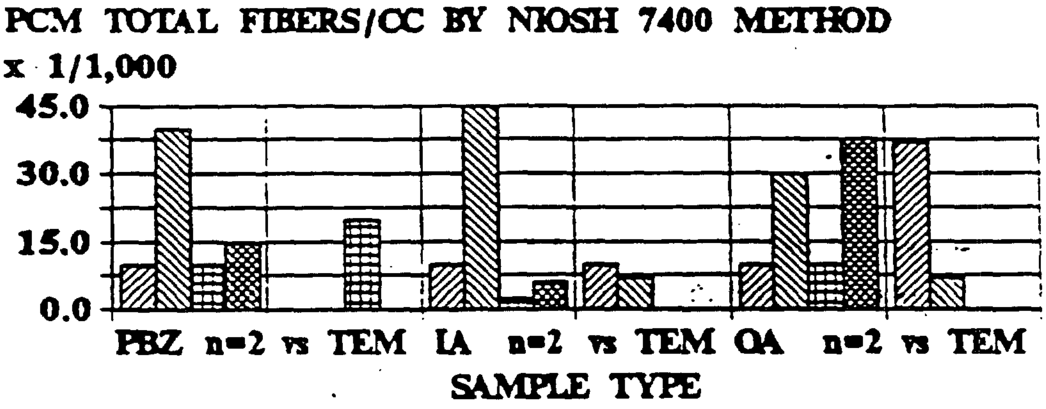
AERO-PIPE CAPSULE/AEROSPACE AMERICA,INC.



These results are all below the OSHA PEL and NIOSH REL. TEM analysis have shown there are asbestos structures present here although not as numerous as in the other study. It is noted that these PCM results would have indicated higher levels in this survey. Each abatement environment well present a different relationship between the PCM results and the actual fiber distribution as shown by TEM.

Negative Air Glovebag

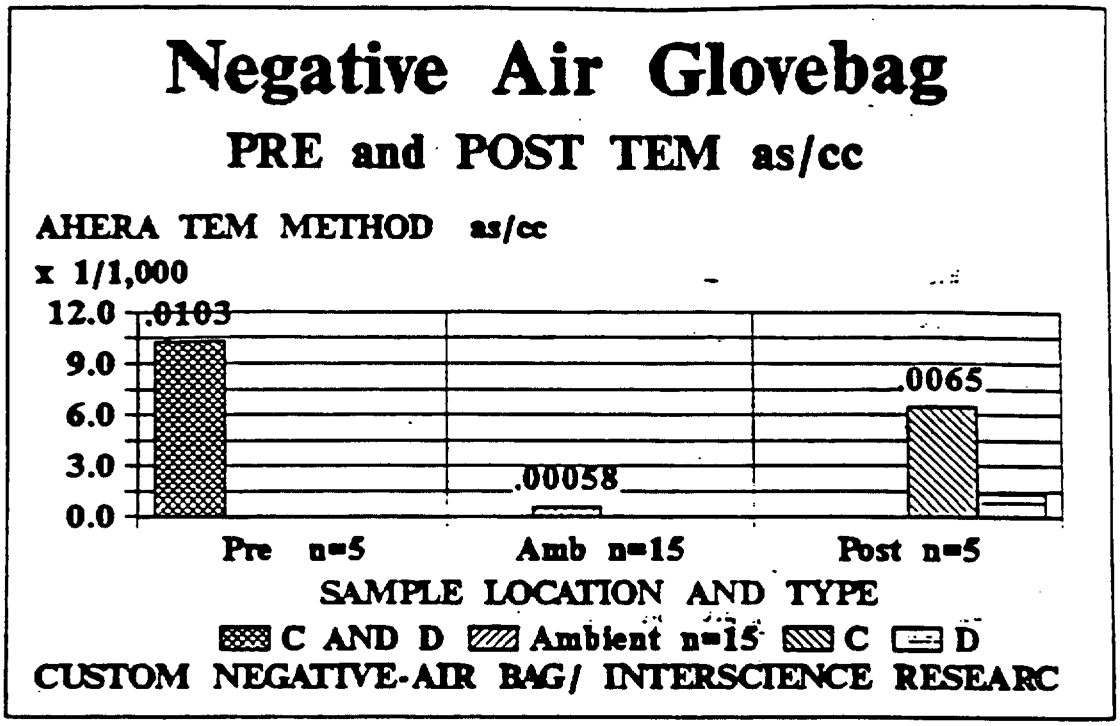
PCM Results vs TEM as/cc



CUSTOM NEGATIVE-AIR BAG/ INTERSCIENCE RESEARCH

PCM results are presented to the left of TEM for: Personal Breathing Zone (PBZ), Interior Area (IA), Outer Area (OA). Area B samples were taken during removal activity. Area C Prep samples were taken during Preparation activity and C Rem were taken during removal activity in area C.

The PCM data represents two samples each. The TEM data is from an unetched half of one of the two 0.8um MCE filter samples used for the PCM. Since this TEM method may undercount embedded fibers, the other half have been submitted to the same lab that performed etched pre and post TEM analysis.



Five pre and post abatement samples were taken for six and a quarter hours using aggressive sampling in a poly enclosure at eight to ten liters per minute for a minimum sample volume of 3000 liters.

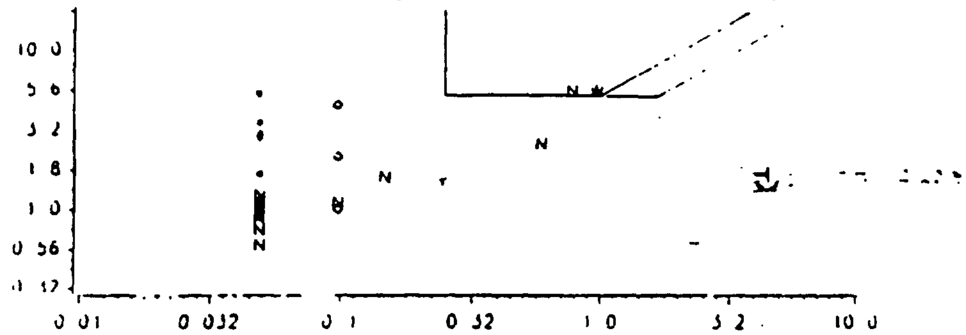
Area D post samples are significantly lower than the pre. Using a t-test on ln(concentration) yield p-values of 0.16 for area C and 0.0001 for area D.

The 15 outdoor ambients were at or below 0.0011 as/cc. As shown above all of the mean values for both area C (0.010 - 0.0065) and area D (0.010 - 0.014) were slightly above ambient level.

PLOT OF STRUCTURES

BY LENGTH AND DIAMETER

STRUCTURE LENGTH, MICROMETERS



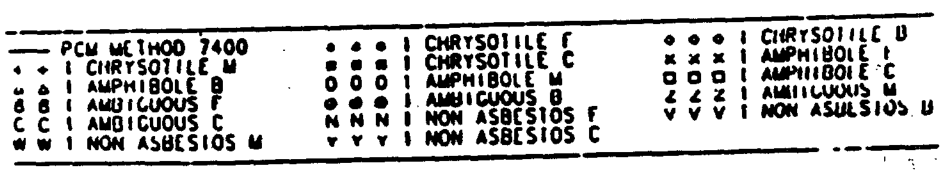
AMBIENT

STRUCTURE DIAMETER, MICROMETERS

AHERA TEM METHOD/ CUSTOM GLOVEBAG

This slide shows the size distribution of asbestos structures from all fifteen outdoors ambient samples. The region outlined in the upper right quarter defines the ranges visible to PCM analysis for a 3:1 and 5:1 aspect ratio.

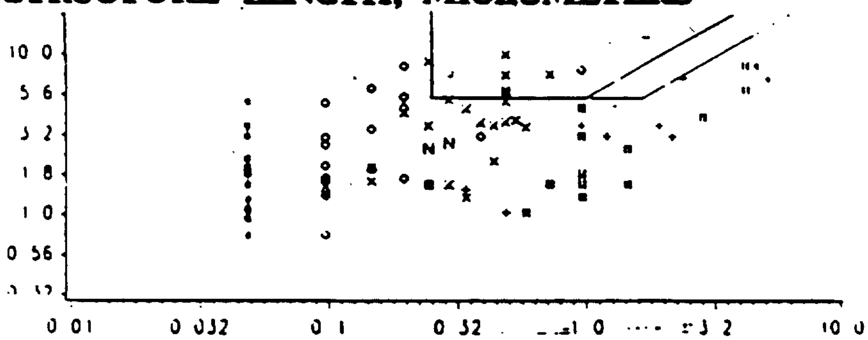
Clearly there would not be a large number of PCM fibers on any one filter. The mean concentration for these samples was 0.0002 as/cc.



PLOT OF STRUCTURES

BY LENGTH AND DIAMETER

STRUCTURE LENGTH, MICROMETERS



PRE AREA C/D

STRUCTURE DIAMETER, MICROMETERS

AHERA TEM METHOD/ CUSTOM GLOVEBAG

This slide shows the size distribution of asbestos structures from all five pre-removal aggressive samples. The region outlined in the upper right quarter defines the ranges visible to PCM analysis for a 3:1 and 5:1 aspect ratio.

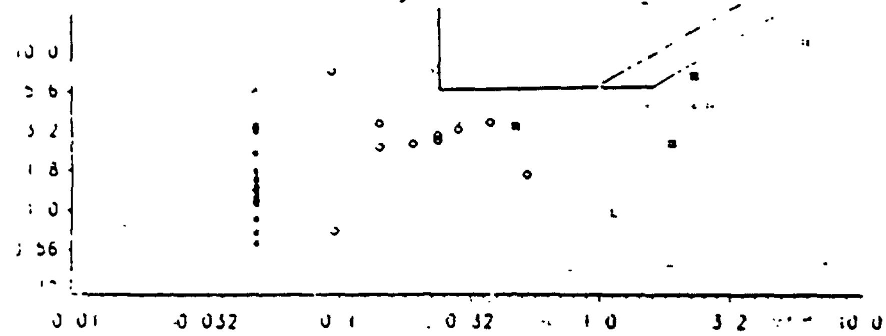
Clearly there would not be a large number of PCM fibers on any one filter. The mean concentration for these samples was 0.01 as/cc.

—— PCM METHOD 7400	1 CHRYSOTILE F	1 CHRYSOTILE B
1 CHRYSOTILE M	1 CHRYSOTILE C	1 AMPHIBOLE F
1 AMPHIBOLE B	1 AMPHIBOLE M	1 AMPHIBOLE C
1 AMBIGUOUS F	1 AMBIGUOUS B	1 AMBIGUOUS M
1 AMBIGUOUS C	1 NON ASBESTOS F	1 NON ASBESTOS B
1 NON ASBESTOS M	1 NON ASBESTOS C	

PLOT OF STRUCTURES

BY LENGTH AND DIAMETER

STRUCTURE LENGTH, MICROMETERS



POST AREA C

STRUCTURE DIAMETER, MICROMETERS

AHERA TEM METHOD/ CUSTOM GLOVEGAB

This slide shows the size distribution of asbestos structures from all five post-removal aggressive samples. The region outlined in the upper right quarter defines the ranges visible to PCM analysis for a 3:1 and 5:1 aspect ratio.

Clearly there would not be a large number of PCM fibers on any one filter. The mean concentration for these samples was 0.0065 as/cc.

—— PCM METHOD 7400	• • • I CHRYSOTILE F	o ● ● I CHRYSOTILE U
◆ ◆ I CHRYSOTILE M	■ ■ ■ I CHRYSOTILE C	x x x I AMPHIBOLE I
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8 8 I AMBIGUOUS F	o ● ● I AMBIGUOUS B	Z Z Z I AMBIGUOUS M
C C I AMBIGUOUS C	N N N I NON ASBESTOS F	V V V I NON ASBESTOS U
W W I NON ASBESTOS M	Y Y Y I NON ASBESTOS C	

EFFICACY CONCLUSIONS
NEGATIVE AIR METHODS

- THIS UNIT MET THE OSHA PEL AND NIOSH REL FOR CONTROL OF WORKERS EXPOSURE TO ASBESTOS.
- FURTHER STUDY OF THIS CONTROL, UNDER VARIED WORK CONDITIONS, IS RECOMMENDED.

CUSTOM NEGATIVE-AIR BAG/ INTERSCIENCE RESEARCH.