

12-11-73

G. K. SWALLOW

921.

A 474000

IITRI ASBESTOS TESTS FOR FEDERAL E.P.A.

SAMPLES TAKEN ON SAT. DEC. 8, 1973 IIT SET UP 3 STATIONS AS PER ATTACHED ^{"A"} SKETCH. THEY TOOK 2 SAMPLES AT EACH STATION, ONE AT APPROX. 20' HEIGHT AND ONE AT 2 METER HEIGHT. SEE ATTACHED ^{"B"} DRAWINGS ON SET UP.

WEATHER CONDITIONS OBTAINED ^{FROM} WAUKEGAN MEMORIAL AIRPORT - APPROX 3 MI WEST ON DIRECT LINE FROM PLANT.

NOON READINGS - TEMP. 32° - WIND. SSW AT 10-15 MPH. BAR. 30.30
4:00 PM. " " 30° - " SSW " " " 30.25

VISUAL PLUME FROM COMMONWEALTH-EDISON SEEM TO VARY FROM SE TO ^NE TO ^E DURING TEST PERIOD. (11:00 AM - SE - 1:00 PM - NE - 4:00 PM - E.)

PUMPS - B.G.I. - FLOW RATE - 25 TO 30 CFM - WILL VARY DUE TO GENERATOR VOLTAGE. #8 MILIPORE PAPER - 8" X 10".

X OUR SAMPLES WERE TAKEN AT STATION D-1 AND STATION D-2, USED NICLEFORD FILTER PAPER AT 20' AND REGULAR FILTER MEMBRANE PAPER AT 2 METER HEIGHT. COULD NOT PUT BOTH ON 20' POLE DUE TO LACK OF SPACE.

CASSETTES SENT TO D.R. CHRISTENSEN FOR ANALYSIS.

F.J. ANGELOS

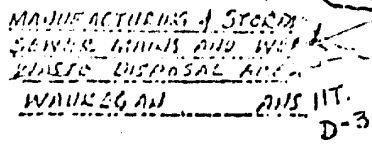
GED. YOU CAN DISCUSS WITH E. FENNER OR GIVE HIM COPY OF THIS NOTE.

THEIR SAMPLES VARIED FROM A LIGHT GRAY TO MED. GRAY DUE TO FLY ASH FROM C. E. CO. TOTAL OF 6 SAMPLES BY IITRI

NO OVERTIME THIS JOB IS GROSS I LEARNED A LOT.

X EAST - Have asked Henry to hold these. They are per your request. I assume you want JFZ to do some-thing with them.

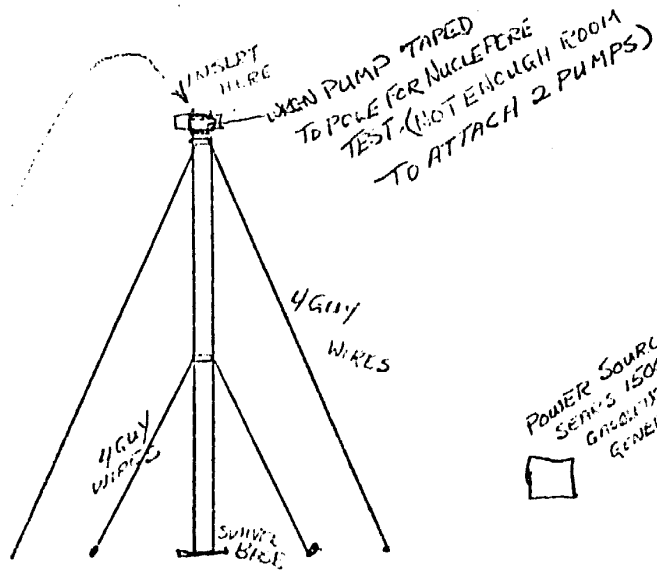
4-1



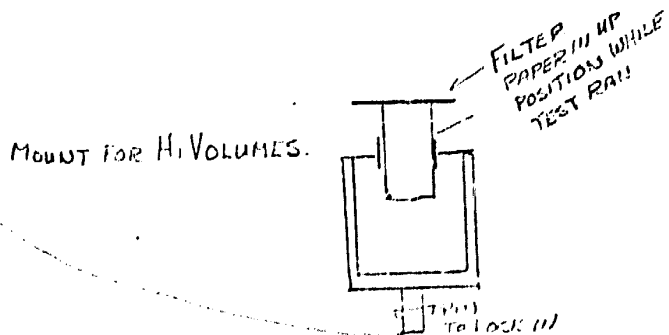
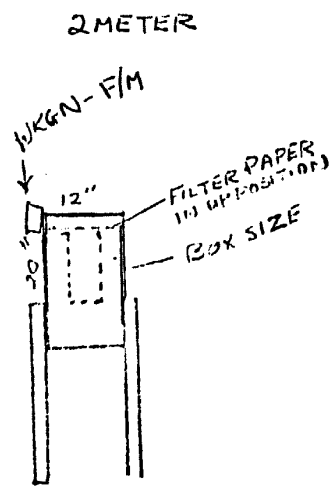
SK-7715

• TACH - "B"

20' HEIGHT SET UP



POWER SOURCE
SERVO'S 1500WATER
GASOLINE
GENERATOR



to L. I. RICHARDS - DENISON

Date: FEBRUARY 10, 1978

From D. R. CHRISTENSEN - R&D

Copies: C. SMITH - DENISON

T. M. FAAS - 3-07

G. L. SWALLOW - 1-06 ✓

Subject: AIRBORNE ASBESTOS SAMPLE - **FITTINGS LATHE OPERATOR** (D-14F)
DENISON PLANT, PIPE DIVISION - 2/8/78

A single sample for airborne asbestos fiber was collected at the Fittings Lathe Operator dust station (D-14F) by Cecil Smith on 2/8 and forwarded to our lab for analysis. This sample yielded a result of 0.1 F/cc. Previous results were: 0.1 F/cc & 0.0 F/cc (11/15-16/77) and 2.3 F/cc (4/21/77).

Low results since the survey of April, 1977 are apparently the result of ventilation improvements at station D-14F.

D. R. Christensen
KJW:DRC

408100

D. NARKUSSON - 2-03

NOV. 5, 1976

W. B. REITZE - 1-06

D. P. CHRISTENSEN - RSD

ASBESTOS EXPOSURE MIXING INSULATION CEMENTS
D. P. CHRISTENSEN'S MEMO TO YOU - OCTOBER 19, 1976

I DO NOT MEAN TO STATE OR INFER THAT THE FIGURES THAT
DEEPLY CHRISTENSEN GAVE YOU OF THE RECENT SAMPLING AT AN
ASBESTOS-CEMENT SIMULATED MIXING SITE ARE IN ANY WAY IN-
ACCURATE.

I WOULD, HOWEVER, LIKE TO POINT OUT THAT CONDITIONS FROM
JOB SITE TO JOB SITE DIFFER. I HAVE HAD CONSIDERABLE
EXPERIENCE DURING MY SELIKOFF DAYS TAKING SAMPLES ON VARIOUS
JOB SITES WHERE CEMENT MIXING WAS IN PROGRESS. MY OWN TEST
RESULTS INDICATED THAT IN SOME CASES THE FIGURES RAN FROM
30 - 40 F/CC FOR LARGE TROUGH MIXING AND UP TO 80 F/CC FOR
THE SMALL PAIL MIXING OPERATIONS WHICH ARE PROBABLY FAR
MORE COMMON THAN THE TROUGH MIXING.

W. B. REITZE

To D. Markussen - 2-03

Date October 19, 1976

From D. R. Christensen - R&D

Copies G. L. Swallow - 1-06 J. H. Zettel - R&D
P. Vite - 3-09 S. Benner - R&D

Subject ASBESTOS EXPOSURE MIXING INSULATION CEMENTS,
SIMULATED 1960's CONDITIONS, 2ND SAMPLING, R&D

The mixing of insulations cement was repeated on October 8, 1976. As everyone is aware, the purpose of these tests were to simulate conditions as they existed in the early 1960's. Consequently, an area inside the Power House was chosen as the mixing site in lieu of the trailers which were returned.

g/10/76) A number of differences existed in this test compared to the last test. For example, the 7M-13 fiber used in this test was pressure packed and willowed which produces a much looser fiber. The fiber was packed in loose plastic bags compared to a tight pack bag initially. Also, the operator mixed 200 lbs of fiber this series, compared to 50 lbs during the first mixing operation. The willowed fiber for this series of tests eliminated the need for the "dry hoeing operation" performed originally.

To determine the operator's exposure and to duplicate sampling procedure as in the 1960's the "Standard Impinger Sampling Method" was employed. The method utilizes a Greenburg-Smith Impinger operated at a flow rate of 1.0 CFM. This is the exact method used in the 1960's for asbestos determination.

Six impinger samples were taken over the approximate 3 hrs of mixing. All six impingers were taken for 15 minutes during the mixing operation, which consisted of: tossing the fiber into a dry tub by hand, distributing the fiber in the tub evenly by hand, adding water from a hose, mixing with a hoe to proper balance, and asiding the cement into a five gallon pail which eventually was dumped outside.

October 19, 1976

The results appear below:

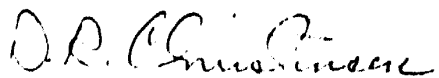
<u>Sample No.</u>	<u>Description</u>	<u>T.L.V. (mppcf)</u>	<u>Results (mppcf)</u>
1	During mixing, 8:45 a.m.	5.0	2.3
2	During mixing, 9:20 a.m.	5.0	2.9
3	During mixing, 10:15 a.m.	5.0	2.9
4	During mixing, 10:45 a.m.	5.0	2.2
5	During mixing, 11:10 a.m.	5.0	2.1
6	During mixing, 11:28 a.m.	5.0	1.8

A second sampling method was employed to have at hand results of the currently accepted OSHA method for asbestos determinations. This method involves the collection of fibers on a filter media at a flow rate of 2.0 liters per minute. A phase contrast microscope is used as the analytical tool.

The results appear below:

<u>Sample No.</u>	<u>Description & Total Sampling Time</u>	<u>T.L.V. (F/cc)</u>	<u>Results (F/cc)</u>
1	During mixing operation (30 min)	2.0	2.0
2	During mixing operation (30 min)	2.0	0.9
3	During mixing operation (60 min)	2.0	1.9
4	During mixing operation (60 min)	2.0	2.6
5	During mixing & clean-up (80 min)	2.0	1.8
6	During mixing & clean-up (80 min)	2.0	2.0

In conclusion, the mixing operation this time appeared much more indicative of 1960's conditions. First, the fiber was not pressure packed (it was willowed) as it was for the original tests, and secondly, the amount of fiber used this time appeared to be closer to what was used in the 1960's.



D. R. Christensen

DAA:DKC:ce

To: D. H. Markusson - 2-03

Date: September 2, 1976

From: D. R. Christensen - R&D

Copies: E. M. Fenner - 4N3 G. L. Swallow - 4N2
W. B. Reitze - 4N2 J. H. Zettel - R&D

Subject: ASBESTOS EXPOSURE WHILE HANDLING THERMOBESTOS
INSULATION AND MIXING INSULATING CEMENTS -
SIMULATED 1960's CONDITIONS

The purpose of these environmental determinations was to simulate and quantiate conditions that existed in the 1960's while sawing THERMOBESTOS pipe insulation and mixing insulating cements.

Two 40 x 8 ft enclosed trailers were rented to be used for storage, sawing and mixing. Sawing, the initial phase of the sampling, was conducted inside the trailer with no mechanical ventilation provided. Slight breezes did provide some natural ventilation through the open rear doors and the partially open side doors.

The sawing phase was done on August 17, 1976. The simulation involved obtaining various sized pieces of THERMOBESTOS pipe insulation from the storage trailer, carrying the material to the second trailer, removing the cloth covering, sawing on a band saw and asiding the cut pieces. This sequence was carried on throughout the day at a pace equivalent to a normal work day.

The environmental sampling was done by three methods. The first method was the "Standard Impinger Sampling Method" which utilizes a Greenburg-Smith impinger operated at a sampling flow rate of 1.0 CFM. This is the method used in the 1960's for asbestos evaluations. The results of these determinations are as follows:

STANDARD IMPINGER SAMPLING METHOD (1960's)

<u>Asbestos Threshold Limit Value (1965)</u>	<u>Test Result</u>
5.0 mppcf*	102.7 mppcf
5.0 mppcf	109.1 mppcf
5.0 mppcf	87.8 mppcf
5.0 mppcf	116.9 mppcf
5.0 mppcf	139.7 mppcf
5.0 mppcf	112.7 mppcf

*Million Particles Per Cubic Foot

The above samples were taken throughout the work day for durations of 15 minutes, as was done in the 1960's.

The second technique used was the currently accepted OSHA method for asbestos exposure determination. This method involves the collection of asbestos on a filter media at a sampling flow rate of 2.0 liters per minute. The results of these determinations are as follows:

CURRENTLY ACCEPTED OSHA METHOD (1976)

<u>Sample Type</u>	<u>Asbestos Threshold Limit Value (1976)</u>	<u>Test Result</u>
Operator, Personal	2.0 F/cc TWA**	14.1 F/cc
	2.0 F/cc	9.9 F/cc
	2.0 F/cc	8.1 F/cc
	2.0 F/cc	7.1 F/cc
	2.0 F/cc	9.2 F/cc
	2.0 F/cc	10.3 F/cc
	2.0 F/cc	13.8 F/cc
	2.0 F/cc	11.3 F/cc
	10.0 F/cc PEAK***	18.5 F/cc
	10.0 F/cc	16.2 F/cc
Area Sample	2.0 F/cc	13.4 F/cc
	2.0 F/cc	6.8 F/cc
	2.0 F/cc	3.5 F/cc
	2.0 F/cc	2.8 F/cc

**Fibers per cubic centimeter, Time Weighted Average

***Peak Exposure (15 minutes)

The third sampling technique is not related to asbestos exposures but is supplied for informative purposes only. This sampling was for silica dust concentration determinations. The results showed that less than 1.0 percent quartz and less than 1.0 percent cristobalite existed in the respirable fraction of the generated dust. Sampling in accordance with the present day silica sampling methods was done with the following results obtained:

CURRENTLY ACCEPTED OSHA METHOD (1976) - SILICA

<u>Silica Threshold Limit Value (1976)</u>	<u>Test Result</u>
5.0 mg/M ³	6.97 mg/M ³
5.0 mg/M ³	20.63 mg/M ³

The **mixing of insulating** cement was done on August 18, 1976. This simulation involved mixing 7M-13 fiber in a 2 x 4 ft trough inside one of the trailers. The sequence of mixing was carried on throughout the day at a pace equivalent to a normal work day. The environmental sampling consisted of the same methods employed when sawing THERMOBESTOS with the exception that no silica work was done. The results of this sampling are as follows:

STANDARD IMPINGER SAMPLING METHOD (1960's)

<u>Asbestos Threshold Limit Value (1965)</u>	<u>Test Result</u>
5.0 mppcf	4.6 mppcf
5.0 mppcf	3.3 mppcf
5.0 mppcf	1.4 mppcf
5.0 mppcf	1.6 mppcf

CURRENTLY ACCEPTED OSHA METHOD (1976)

<u>Sample</u>	<u>Asbestos Threshold Limit Value (1976)</u>	<u>Test Result</u>
Operator	2.0 F/cc TWA	4.8 F/cc
	2.0 F/cc	3.1 F/cc
	2.0 F/cc	5.9 F/cc
	2.0 F/cc	5.5 F/cc
	10.0 F/cc PEAK	6.6 F/cc
	10.0 F/cc	6.6 F/cc
Area	2.0 F/cc	3.6 F/cc
	2.0 F/cc	1.1 F/cc

September 2, 1976

In conclusion, I would like to make a few comments on the authenticity of the simulated conditions of our testing. During the late 1960's and early 1970's I visited several of the insulation warehouse operations in the United States. I believe that our work would represent the worst conditions that existed for sawing material and about average or slightly below average for the cement mixing operation.

D. R. Christensen

D. R. Christensen

ee

BCC: H. M. JACKSON
F. J. SOLON, JR.
C. L. SHECKLER
CARL THOMPSON
DICK DARROW
M. M. SWETONTIC

After discussing with Hugh Jackson and Cliff Sheckler on 5/2/69. I also sent Mr. Ruddy copy of the NIMA booklets, copy of the new tentative standards proposed by the ACGIH and copy of by Dr. Stokinger concerning these standards

202-338-1130

May 1, 1969

Mr. Ned Ruddy
Executive Secretary
Shipbuilders Council
1730 K. Street, N. W.
Washington, D. C.

Dear Ned:

Many thanks for contacting Johns-Manville, through Hill & Knowlton, with regard to the effect of the Walsh-Healy Act upon your industry, with particular regard to the Threshold Limit Values pertaining to asbestos fiber.

As I mentioned, we recently prepared and gave to the Department of Commerce some background material on the various research programs in the area of asbestos and human health that are being sponsored or co-sponsored by Johns-Manville. I am attaching a copy of this material for your use in your discussion with the Labor Department on Monday.

As we agreed on the phone, it is going to take time to develop the necessary techniques and equipment to provide maximum protection to workers who handle and apply asbestos-containing products in the field. The Insulation Industry Hygiene Research Program, described in the attached green six-page report represents, we feel, the proper approach to this problem. Embracing, as it does, science, industry and labor this research program represents a voluntary approach as contrasted to governmental regulation.

If, after reading the attached, you have additional questions, please give me a call.

Sincerely,

W. P. Raines
Director of Public Relations

wpr/eb
att.

(April 11, 1969

JOHNS-MANVILLE COMMENTS FOR DEPARTMENT OF COMMERCE
RE HR 2503: "A bill to promote the safety of workers engaged
in making asbestos products for shipment in commerce, and for other
purposes."

GENERAL

Johns-Manville Corporation and the asbestos industry in general support the objectives of this measure -- "to promote the safety of workers engaged in making asbestos products" -- and are vigorously pursuing programs of health and safety protection in asbestos plants as well as among fabricators and applicators of certain asbestos products.

It should be made clear that the manufacturing, installing, handling and selling of asbestos-containing products per se constitutes no health hazard. However, the industry recognizes, and has long been controlling, occupational conditions where excessive dusts from asbestos may constitute a health hazard for workers exposed to these dusts over extensive periods of time. The manufacturers observe strict health safety practices under such conditions and also actively cooperate with their applicators and fabricators in promoting health safety practices in the use of asbestos products under conditions where dusts might be generated.

SPECIFIC COMMENTS ON PROPOSAL

1. A special bill dealing only with the asbestos industry would be unnecessary, undesirable and duplicative. Congress has before it legislation that would establish federal administrative machinery

for health and safety protection applying to all U.S. industry. HR 3809, the Occupational Safety and Health Act of 1969, is one of several such measures before the House and Senate Labor Committees. These bills would vest authority, in the Department of Labor working with the Department of Health, Education and Welfare. These proposals spell out in some detail the limitations of authority, the methods for setting safety and health standards, and the responsibilities of industry, labor and established standard-setting agencies for cooperating with the federal agencies.

HR 2503 relating only to asbestos would vest all authority in the Department of Health, Education and Welfare, including inspection authority, which would, in effect, duplicate the existing and proposed responsibilities of the Department of Labor.

2. HR 2503 is too broad and non-specific in its provisions. As presently written, its provisions would appear to apply to many small retailers who merchandise such products as roofing, floor tiling, wallboard, or ceiling tile which contain asbestos bonded with other materials, such as cement or plastics. Such items do not constitute a health hazard and yet the provisions of the bill would seem to encompass them.

3. The standard-setting authority that would be granted to the Secretary of Health, Education and Welfare does not provide for orderly consultation with established standard-setting organizations

MORE

or with industry (as is generally recognized as desirable in other Occupational Safety and Health proposals). The fact is that standards for occupational levels of asbestos dusts (Threshold Limit Value) were re-examined and modified in 1968 by the American Conference of Governmental Industrial Hygienists, representing federal, state and municipal governments. These standards are accepted by industry as well as federal and state safety and health officials for enforcing federal and state laws respecting occupational safety and health.

CONCLUSIONS

If Congress decides that legislation should be enacted establishing a federal Occupational Safety and Health Program, the asbestos industry, along with other industries, would be subject to such an Act. This would be the more orderly and acceptable method of procedure -- legislatively, administratively, and from the industry standpoint. A separate act relating only to the asbestos industry is unnecessary and undesirable.

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(For industry health and safety practices, see attachments.)



Johns-Manville

Internal Correspondence

To: G. L. Swallow-GHQ

Date: August 7, 1974

From: R. J. Haegi

Copies: See end of memo

Subject: SEMI-ANNUAL INDUSTRIAL HYGIENE SURVEY
DATED: MAY 23, 1974
DEVELOPMENT DIVISION-MANVILLE ACE

We comment as follows regarding the subject report of Station D16-A over TLV as follows:

This area is a newly established station in which the cores of cut ACE CORSPAN Panels are filled with strips of fiberglass insulation. Apparently, loose asbestos cement dust (from cutting) within the cores is disturbed during this procedure. The plant will investigate the use of a vacuum cleaner to remove the loose dust in the cores, prior to filling them with fiberglass. Also, all operators will be instructed to wear a respirator while performing this operation. A re-test will be requested as soon as the plant feels the condition has been corrected.

R. J. Haegi
R. J. Haegi

cc: R. A. Paddock
→ R. K. Hoagland
J. E. Hesse
D. E. Hillier
E. J. Bulava
D. R. Christensen
W. B. Reitz
M. A. Baloga
file/chrono

mb

Bob. Hoagland -
Bob -
maybe you could
collect fiber, look
the asbestos problem &
make stuffing the
bores easier all the
same time, by using
a vacuum connection
per sketch.

9th.
8/26/74

Rec'd
08/12/74



Johns-Manville

Internal Correspondence

To: F. J. Angelos - Waukegan
E. J. Bulava - Manville
D. R. Christensen - Denver
L. A. Schriver - Lompoc
E. G. Stevens - Jeffrey

Date: November 8, 1973

From: M. A. Baloga - Denver GHQ

Copies: G. L. Swallow
File
Chron

Reorganization

Subject: SEMI-ANNUAL SURVEYS
ASBESTOS STATIONS OVER 2.0 F/cc

As part of our reorganization and revised sampling policy, the semi-annual surveys will consist of sampling all asbestos stations which were over 2.0 F/cc on the most recent survey prior to the semi-annual.

In order to comply with our new reporting format, it is essential that only those stations above 2.0 F/cc be sampled.

If any stations which do not fall into this category are sampled, please be sure to indicate those stations on the data sheets sent to D. R. Christensen. It would also be helpful if the reason for additional sampling were indicated, such as plant request, etc.

mc. B

M. A. Baloga

MAB/jmb



2 - file
Johns-Manville

Internal Correspondence

RVB To: G. L. Swallow

Date: October 1, 1974

From: F. J. Angelos

Copies: D. Christensen
file

Subject: SEMI-ANNUAL INDUSTRIAL HYGIENE SURVEY
WAUKEGAN PIPE DIVISION

The Semi-Annual Industrial Hygiene Survey of Waukegan Pipe was conducted September 9-30, 1974. Only three occupational dust stations (for asbestos) were within the +2.0 F/cc category, i.e. D-25F, D-39F and D-13WE with station D-39F "Saw Booth Helper" not surveyed. (The saw booth was in use however but only one person - the booth operator was necessary for the machining process.)

As requested by C. B. Allen, Plant Manager - stations D-40F "Operator of the Large Slash Saw" and D-25S (formerly D-11A-S) "Operator Receiving Shipment of Blue Asbestos Fiber" were sampled. Several General Area Samples were taken in conjunction with the operator unloading fiber - these samples will be denoted on the final report and will be listed with the operator samples.

At the hygienist's discretion station D-16F "Operator of the Large MOA Lathe" was sampled in addition to a special test (not to be established in the permanent records) was taken at the Pipe blow-off area on the Universal Finishing Lathe.

The four divisional dust collectors were sampled with the results to be included with the final survey report.

Prepared by R. N. VanBendegom

Denver Industrial Hygiene Laboratory.
R & D Center
Date March 28, 1974

- CONFIDENTIAL -

Plant Manager C. B. Allen

ANNUAL INDUSTRIAL HYGIENE SURVEY
DIVISION Pipe PLANT Waukegan

Following is a summary of the Industrial Hygiene Survey conducted 3/11/74.

1. The following stations which were previously over TLV are below TLV in the current survey:

D-29F, D-36F, D-2S

2. The following stations were not operating during the current survey:

None

3. The following stations were found to be over TLV in the current survey:

D-25F, D-39F, D-13WE

4. Number of established sampling stations over TLV previous survey.
5. Number of stations sampled during current survey.
6. Number of surveyed stations above TLV.

ALL DUST	*	NOISE	F/V	TOTAL	ASB. ONLY
6	-	-	0	6	6
6	-	-	0	6	6
3	-	-	0	3	3

* CDCA - Cleaned Dust Control Air

D. R. Christensen

D. R. Christensen
Industrial Hygienist

cc: Manager OEC
Production Manager - K. J. Whalen - 2 South
ORIGINATING FIELD LABORATORY - Waukegan

Form ECD 1A-73

DATE March 28, 1974
 ANNUAL INDUSTRIAL HYGIENE SURVEY
 STATIONS OVER TLV FROM PREVIOUS SURVEY

DIVISION Pipe PLANT Waukegan SURVEY DATE 3/11/74

OCCUPATIONAL DUST

STATION NO.	STATION DESCRIPTION	HAZARD	TLV	CURRENT SURVEY RESULT
<u>D-25F</u>	Operator of Moulding Saw Booth	Asbestos	2.0 10.0	3.6 f/cc (2.8) f/cc
D-29F	Operator of Mono-Saw	Asbestos	2.0 2.0 2.0	0.7 f/cc* 1.2 f/cc 0.2 f/cc
D-36F	Take-Off Operator of Bandsaw	Asbestos	2.0 2.0	0.4 f/cc* 1.0 f/cc
<u>D-39F</u>	Saw Booth Helper	Asbestos	2.0 10.0	2.4 f/cc (2.1)
<u>D-13WE</u>	North Willow Operator for No. 2 Pipe Machine	Asbestos	2.0 2.0	1.9 f/cc* 2.8 f/cc
D-2S	Inspector for Universal Lathe	Asbestos	2.0 2.0	0.3 f/cc* 0.5 f/cc

DNO - Did Not Operate

 - Above TLV

* - Personal Protective Equipment Not Worn

/ \ - Peak Exposure



Johns-Manville

Internal Correspondence

To: C. B. Allen - Waukegan

Date: March 28, 1974

From: D. R. Christensen - R&D Center

Copies:

Subject: SPECIAL SAMPLINGS - WAUKEGAN PLANT, PIPE DIVISION

During the recent Annual Industrial Hygiene Survey conducted the period starting March 11, 1974, a number of airborne dust samples were collected at the discretion of the Industrial Hygienist. The results of these samples follow:

<u>Station</u>	<u>Description</u>	<u>Hazard</u>	<u>TLV</u>	<u>Results</u>
D-35F	Operator Feeding Band-Saw	Asbestos	2.0 2.0	0.6 f/cc 0.5 f/cc
D-10S	GRS - Unloading Box Car of Asbestos Fiber	Asbestos	2.0 2.0	0.6 f/cc 0.5 f/cc
D-11S	Unloader Operator of Asbestos Fiber from Boxcar	Asbestos	2.0 2.0	0.5 f/cc 0.7 f/cc
D-14S	GRS - Silica Unloading from Railroad Car	95% Quartz	2.5 0.10	3.2 mppcf 0.00 mg/m ³
D-22S	Millwright	0% Quartz	50.0 5.00	1.2 mppcf 0.17 mg/m ³

- Above TLV

Please refer any questions pertaining to this special survey work to F. J. Angelos, Industrial Hygienist, Waukegan.

Prepared by: S. Gaburo

D. R. Christensen

jet



Johns-Manville

Internal Correspondence

LOAD ATKINS 1-06
To: ~~Judee Hillman~~ - 4N2

Date: 9-30-77

From: D. R. Christensen - R&D

Copies:

Subject: OCCUPATIONAL ENVIRONMENTAL CONTROL
MONTHLY REPORT - SEPTEMBER 77'

The major work done by the Occupational Environmental Control Department in SEPTs, as follows:

Scheduled Industrial Hygiene Surveys

Field Work at Plants:

McNARY
MARRERO

Industrial Hygiene, Housekeeping, Safety & Community Reports Issued:

McNARY
MARRERO

Special Industrial Hygiene Surveys

Field Work at Plants:

Reports Issued:

Reports Issued:

Miscellaneous

1. 3 1/2 DAY INDUSTRIAL HYGIENE PRACTICES WORKSHOP FOR LOMPAC, WAUKEGAN & MANULAB GIVEN IN DENVER.
2. K.S. WILLIAMS PRESENTED A TALK TO THE COLORADO SAFETY ASSOCIATION ON PERSONAL PROTECTIVE DEVICES.
3. INITIAL START-UP OF GC/MS INSTRUMENTATION.
4. CONDUCTED 1/2 DAY ASBESTOS SEMINAR FOR FIBROTUBO-FIBROLIT, S.A. MADRID, SPAIN
5. PARTICIPATED IN NIOSH QUALITY CONTROL PROGRAM FOR UCM, ORGANICS, SILICA AND ASBESTOS
- 6.



Johns-Manville

Internal Correspondence

To: Judee Hillman - WHQ 1-06

Date: 4-29-77

From: F. J. Angelos - Waukegan

Copies:

Subject: OCCUPATIONAL ENVIRONMENTAL CONTROL
MONTHLY REPORT - APRIL

The major work done by the Occupational Environmental Control Department in APRIL is as follows:

Scheduled Industrial Hygiene Surveys

Field Work at Plants:

✓ WAUKEGAN IPD
✓ ROCKDALE - BMMD (QUARTERLY MDI)

Industrial Hygiene, Housekeeping, Safety & Community Reports Issued:

✓ WAUKEGAN - BMMD
✓ WILTON - IPD - PIPE + PIPE SYSTEMS
✓ ROCKDALE - BMMD (QUARTERLY MDI)

Special Industrial Hygiene Surveys

Field Work at Plants:

✓ WAUKEGAN - P+P SYSTEMS - SAW BOOTH - FORK LIFTS - CARBON MONOXIDE
✓ DEFIANCE - G-30 CARBON BLACK
✓ WAUKEGAN - BMMD - NOISE

Special Industrial Hygiene Surveys

Reports Issued:

DEFIANCE G-30 CARBON BLACK.

Miscellaneous

- X WAUKEGAN - IPD - SUPERVISORS COMPLAINT CARBON MONOXIDE FROM SHIPPERS FORK LIFT TRUCK - HIGH RESULTS IN THE FIREIGHT CAR & OUT OF CAR - RECOMMENDED TRUCK BE PUT OUT OF SERVICE FOR REPAIRS, TRUCK TAKEN TO GARAGE.
- X D.R. CHRISTENSEN - REVIEW MICROSCOPES - COVERED ASBESTOS COUNTING NEW NIOSH PROCEDURES, INSTRUCTIONS ON ANALYSIS OF COAL TAR PITCH - PROCEDURES - COVERED NEW PROCEDURES FOR PLANT MANAGERS BOOKS TO BE COMPUTERIZED.
- X 3 PEOPLE ATTENDED LAKE COUNTY SAFETY ASSOC. MEETING "SAFETY HAZARDS AT GREATER AMERICA AMUSEMENT PARK"
- X F. J. ANGELOS ATTENDING CLASSES "RADIATION SAFETY IN EVENINGS AT NORTHWESTERN UNV. IN CHICAGO.
- ✓ C.M. CARTER & T. GOURLEY ATTENDED OSHA VOLUNTARY COMPLIANCE COURSE ROSEMONT, ILL.
- X YVON L'ARCHEVEQUE ALSO ATTENDING SCHOOL WAS GIVEN A TOUR OF THE WAUKEGAN PLANT.

(OVER).

X SPEC RUN OF FIBER GLASS - TESTING FOR CARBON BLACK
CONDUCTED BY F.J. ANGELOS. ALSO CONDUCTED A CONTROL
RUN THE NEXT DAY. BOTH RUNS MADE AT THE DEFIANCE
PLANT 8

✓ SPEC. TESTS ALSO MADE INSTALLING THE ABOVE RUNS AT A CONSTRUCT
SITE AT MIDLOTHIAN, ILLINOIS,

X PAT SERIES #41 COMPLETED

C O N F I D E N T I A L

Environmental Control Department
Denver GHQ
May 4, 1972

K. J. Whalen - Manville

cc: A. C. Smith
J. E. Hesse
M. Harris
W. A. Sells - Waukegan
R. W. Campbell - Manville
H. M. Jackson
M. B. Jamin - Finderne
D. R. Christensen - Waukegan
R. J. Bernard
File

INDUSTRIAL HYGIENE SURVEY
PIPE DIVISION - WAUKEGAN PLANT
JANUARY 3 - APRIL 10, 1972
W. A. SELLS' LETTER OF APRIL 21, 1972 TO G. L. SWALLOW

Prior to the subject survey the List of Stations Over TLV included 22 occupational dust, 3 CDCA*, 32 noise and 2 fume/vapor for a total of 59 stations over TLV. As a result of the survey and the Plant Manager's comments, we have deleted 2 occupational dust and 2 fume/vapor stations. In addition, 4 noise have been reinstated and 1 new noise station established. Therefore, the List now contains 20 occupational dust, 3 CDCA and 37 noise stations for a total of 60 stations over TLV.

Enclosed is the revised List of Stations Over TLV. Also enclosed is a copy of W. A. Sells' letter and the statistical recap of the survey.

Stations Deleted from the List of Stations Over TLV

Occupational Dust

D-11F Hawthorne Lathe Operator - South Side

The plant states this station is permanently corrected. Therefore, we have deleted it based on the last six survey results which were under TLV.

* Cleaned Dust Control Air.

C O N F I D E N T I A L

K. J. Whalen - Manville
May 4, 1972
Page 2

Stations Deleted From the List of Stations Over TLV (Cont'd.)

Occupational Dust (Cont'd.)

D-12F Hydrotester Operator on Hawthorne Lathe

We have also deleted this station based on the last five survey results.

Fume/Vapor

V-2WE #3 Pipe Machine Cleaning Screens With Acid

Based on a time-weighted scale, this station is well below the allowable limits. We have, therefore, removed it from the List.

V-3WE #4 Pipe Machine Cleaning Screens With Acid

Upon judging this station on the newly promulgated Federal Regulations, it is well below the allowable. We have deleted it from the List.

Stations Remaining on the List of Stations Over TLV

Occupational Dust

D-7F Monolithic Lathe #3709

The last three survey results indicate readings well below the TLV. We look forward to deleting it next survey if the counts remain below.

D-8F Drag Saw Col. B-20 Operator

First reading taken with large diameter pipe. Second reading taken on smaller diameter pipe. Experience shows that dust counts vary according to the pipe diameters. Experience also relates that larger pipe generally record the higher counts. We are glad to note that respirators are continuing to be used.

D-9F DeWalt Saw #3824-0200 Col. B-16 Operator

Same comments as for D-7F.

C O N F I D E N T I A L

K. J. Whalen - Manville
May 4, 1972
Page 3

Stations Remaining on the List of Stations Over TLV

Occupational Dust (Cont'd.)

D-13F Small Coupling Cut-off Col. C-25 Operator

The re-ocating and subsequent exhaust set-up has significantly reduced counts. After another helpfully low count next survey, this station is ready for deletion from the List.

D-15F Large Coupling Cut-off #3603-0200

With the elimination of the sweeping process now effective, we can also look for this station to be deleted next survey.

D-20F Bayard Lathe - #3300-0002 Col. E-27

According to the Hygienist, large amounts of dust are visible when pipe is machined. Evidently the dust is blown away before it gets to the operator's breathing zone. If the low readings continue during next survey, we will look forward to deleting this station.

D-21F Slash Saw #3818-0001 Operator

No comment.

D-22F Non-Pressure Pipe Lathe #3500-0001 South Side Opr.

First sample taken on 6" type 5 Air Dust Pipe. Second sample taken on a clean-up cycle. Air used to blow dust from machine.

D-24F Take-off Man for Non-Pressure Pipe Lathes

Respirators are required until the station is permanently corrected.

D-25F Moulding Saw Booth Operator

The continued use of respirators should be encouraged.

D-26F Operator of Radial Drill Webo #3806

The drill is now hooked to an exhaust system. The past four counts have been well below the TLV. We look forward to deleting it after the next survey.

C O N F I D E N T I A L

K. J. Whalen - Manville
May 4, 1972
Page 4

Stations Remaining on the List of Stations Over TLV

Occupational Dust (Cont'd.)

D-1WE Machine Tender #2 Pipe Machine

The Hygienist reports a much improved working atmosphere at the #2 Pipe Machine. However, respirators should be required until the plant reports the station permanently corrected.

D-13WE North Willow #2 Machine Operator

Improved housekeeping should be instituted at the Willows. The Hygienist reports floor and machine surfaces covered with asbestos fiber. The continued use of respirators is required.

D-15WE South Willow #3 Machine Operator

Improved housekeeping should also be instituted here. Again, the floors are reported to have accumulation of fiber. Bag opening and disposal are a problem. The continued use of respirators is required.

D-16WE Transite Pipe Scrap Grinder Between #3 and #4 Pipe Machine

A significant reduction has been noted over the past 4 surveys. A continued low reading will offer this station for deletion next survey.

D-5S Service Utility Man Dust House South and Northeast Houses

Respirators should be continued until the plant reports the station as permanently corrected.

D-10S GRS - Unloading Box Car of Asbestos Fiber

D-11S Unloading Box Car of Asbestos Fiber

We are glad to note the excellent condition of the box car. We will look forward to deleting these stations next survey if the conditions and the counts remain the same.

D-12S Ball Mill - GRS

During the next regularly scheduled survey, the Hygienist will be advised to check exposure based on an 8-hour time-weighted basis.

D-14S Silica Unloading Area

No comment.

C O N F I D E N T I A L

K. J. Whalen - Manville

Page 5

May 4, 1972

Stations Remaining on the List of Stations Over TLV (Cont'd.)

CDCA

D-2DH Parson Collector South Side Northeast of Building

D-3DH Parson Collector North Side Northeast of Building

The Hygienist reports that the Dust Houses are contracted to be rebuilt. He also reports that after completion, the Dust Houses should be in excellent condition. We look forward to completion of the work contracted.

D-SDH NEGATIVE COLLECTOR FOR THE WILLOWS #1 COMPARTMENT

Noise

✓ N-1F Boring Mill

Station reinstated as of January 3, 1972. The Hygienist has not observed hearing protection during the 1972 survey. Hearing protection is essential until the station has been permanently corrected.

✓ N-2F #3609 Boring Mill

We are leaving this station on the List even though it is below the TLV. The hygienist reports there was very little background noise during sample.

✓ N-3F #3712 Lathe at A-18 Col.

No comment.

- ✓ N-4F #7195 Lathe at A-19 Col.
- ✓ N-5F #566 Lathe at A-20 Col.
- ✓ N-6F #3824 Saw Near B-16 Col. DeWalt
- ✓ N-8F #7671 Lathe at Col. B-20
- ✓ N-9F Radial Drill
- ✓ N-10F Drag Saw
- ✓ N-11F #3400-0100 Lathe
- ✓ N-12F G.R.S. Epoxy Area
- ✓ N-13F So. Side #3300-0003 Hawthorne Lathe
- ✓ N-14F Hydro-Tester While Hawthorne Lathe Runs
- ✓ N-15F Belling Unit While Hawthorne Lathe Runs
- ✓ N-16F Coupling Cut-off Saw #4856 Col. 25-C

Because the noise generated from the finishing end of a pipe plant is variable, it is impossible to time weigh the exposure with the present equipment.

In all but two areas, hearing protection is worn. Station N9-F had a dBA reading of 118 dB. Hearing protection is required until the noise level can be reduced.

C O N F I D E N T I A L

K. J. Whalen - Manville
Page 6
May 4, 1972

Stations Remaining on the List of Stations Over TLV (Cont'd.)

✓ N-17F MOA Lathe Approx. 5 ft North of Operator

Reinstated as of 1/3/72. Additional noise level was coming from the truck traffic and the curing tanks.

N18-F So. Side of Wet Saw #3818-0400

✓ N-19F UPL Approx. 10 ft Northwest of Operator

✓ N-20F Belling Unit Behind UPL - North side 5 ft from Operator

✓ N-21F 3818 Saw Northeast of D-31 Col.

✓ N-22F So. Side #5905 Lathe Between Cols. 26-E & 27-E

✓ N-23F So. Side #4836 Universal Lathe

✓ N-24F G.R.S. Beller and Tester Operator

✓ N-25F West Side of #3500-0002 Lathe

✓ N-26F Non-Pressure Lathe #3500-0001

✓ N-27F #3500-0001 Lathe Between F-30 & G-30 Col.

✓ N-29F Under Drain Drill Press

Because the noise generated from the Finishing End of a Pipe Plant is variable, it is impossible to time weigh exposures with the present equipment.

✓ N-1WE Valve Operators Area Northwest End of #2 Pipe Machine

Reinstated as of 1/3/72. Hearing protection should be continued until station is permanently corrected.

✓ N-3WE Gauger Operator Station Northwest Side of #3 Pipe Machine

No comment.

✓ N-4WE T.O. End of #3 Pipe Machine

No comment.

✓ N-7WE West Side of 0314 Scrap Grinder

When grinding the noise level goes up very substantially.

✓ N-8WE Center Willows

No comment.

C O N F I D E N T I A L

K. J. Whalen - Manville
Page 7
May 4, 1972

Stations Remaining on the List of Stations Over TLV (Cont'd.)

Noise (Cont'd.)

N-2S Just Outside Doorway to Office in Ball Mill Room

This area will be tested on an 8 hour time-weighted basis next survey.

N-3S - 2602 Propane Truck

N-4S #1340 Fork Truck

No comment.

N-5S #3736 Propane Truck Platform

Truck driver travels throughout plant, thus he is exposed to a variation of noise levels.

N-6S #2690 Hyster Fork Truck

No comment.

G. L. Swallow
G. L. Swallow

DAA/ems

Attachs.



Johns-Manville

Spec Fiber Manville
Internal Correspondence

To: E. J. Bulava - Manville

Date: September 19, 1974

From: G. L. Swallow - 4 North

Copies: D. R. Christensen - R&D
W. B. Reitze - 4 North
E. J. Mitchell - 2 South

File & Chron

Subject: HANDLING GOVERNMENT SURPLUS CROCIDOLITE & AMOSITE FIBER

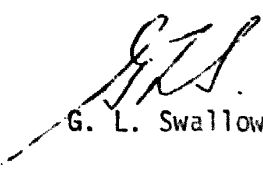
Jack Mitchell reports that he has received a number of reports from various pipe plants stating that based on a visual evaluation, some of the Government surplus shipments of amosite or crocidolite appear to be considerably dustier and dirtier than those which you sampled a month or two ago.

The shipments under discussion and those which you sampled were of fiber in jute bags shipped on "pallet boxes".

In view of our concern for this situation, please repeat the work you formerly did, sampling either crocidolite or amosite, whichever is available. Also, please attempt to find a time when some of the poorer pallet box loads are being handled and transported.

Sampling should be done during unloading of fiber from the truck or rail car, during handling and transportation of fiber from the warehouse to the willows, and during the feeding of this fiber to the willows.

By copy of this letter to Denny Christensen, I request that he phone results of his counts to me as soon as they are available, in addition to issuing his normal report.


G. L. Swallow

GLS/jmb



file - Wau
Johns-Manville

Internal Correspondence

To: See Below

Date: October 3, 1974

From: D. R. Christensen - R&D Center

Copies:

Waukegan

Subject: WAUKEGAN PLANTS - OSHA INDUSTRIAL HYGIENE INSPECTION -
JOHNS-MANVILLE SIMULTANEOUS SAMPLING

TO:

C. R. Wikel - Waukegan
C. B. Allen - Waukegan
R. Winkworth - Waukegan
F. J. Angelos - Waukegan
W. B. Reitze - 4 North
G. L. Swallow - 4 North
M. A. Baloga - 4 North

An OSHA industrial hygiene crew conducted sampling to determine exposures to asbestos and quartz at the Waukegan location during the weeks of September 16 and 23, 1974. The Johns-Manville Industrial Hygiene Department, in the person of F. J. Angelos, sampled simultaneously with OSHA to enable us a means of checking results obtained by the OSHA crew.

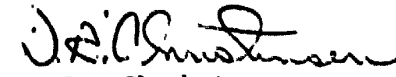
Three tests for benzene vapor were taken by OSHA that J-M was unable to sample simultaneously because of lack of identical sampling equipment.

Presented in the following data sheets are simultaneous sampling results and also results from previous J-M sampling done at the selected Waukegan locations. This is presented to enable you a comparison of the latest result and those of the recent past.

The respirable gravimetric sampling of OSHA was done by use of silver membrane filter media. This enables determination of both the quantitative (mg/m^3) and qualitative (% quartz) data in a single sample. J-M at present cannot sample by this method consequently the simultaneous sampling result is only quantitative (mg/m^3) in nature.

Page 2
October 3, 1974

The J-M TLV data shows what has normally been found at the station in previous survey work.


D. R. Christensen

jes

To: N. B. Scheffel - 2 West

Date: October 29, 1974

From: G. L. Swallow - 4 North

Copies: W. B. Reitze - 4 North
E. M. Fenner - 4 North
D. R. Christensen - R&DD. A. Aldinger - R&D
T. E. Remmers - 2 West
F. J. Angelos - Waukegan**File
Chron**Subject: PAPER MILL TALC USAGE
NORTHWEST PAPER COMPANY, POMONA, CALIFORNIAReference: MY LETTER DATED OCTOBER 7, 1974
D. R. CHRISTENSEN'S LETTER DATED OCTOBER 18, 1974

Enclosed is a copy of D. R. Christensen's letter of October 18, which is largely self explanatory.

The results of the fiber counts are given and as you can readily see, represent levels considerably higher than you and I had anticipated. Only one, the area sample between the two pulpers, is above the present Federal Asbestos TLV. However, this is basically irrelevant in that you hope to demonstrate that fiber levels, when handling J-M talc properly, are well below the future TLV of 2.0 F/cc.

In our conversation of October 17, I passed on to you Doug Aldinger's comments regarding the poor housekeeping evident throughout the area, the lack of effective ventilation, and the handling methods employed. Regarding this latter, you will recall that the operator at the Skip Hoist regularly dumps bales of pulp on top of unopened J-M talc bags. Given this treatment, a large amount of talc dust is expelled from the bags despite the fact that they are not open. These points are further covered in the enclosed letter.

As we have already discussed, we believe that the results you anticipated are achievable at the Northwest Paper Company if they modified their work practices and improved both their housekeeping and dust control.

As you know, we are on stand-by to do additional sampling in Dayton, Ohio and Park Falls, Wisconsin. The results of these surveys may give you the ammunition needed to encourage our customers to improve their dust situation.

Although our sampling was by prior agreement for fibers only, Doug Aldinger made the point that the general nuisance dust level was such that Northwest Paper Company would probably be in trouble if sampled on that basis alone. I would think that would be a very useful argument in attempting to convince Northwest that they should take measures to correct their present dust conditions.

GLS
G. L. Swallow
GLS/jmb

To: G. L. Swallow - 4 North

Date: October 18, 1974

From: D. R. Christensen - R&D Ctr

Copies:

Subject: MEMBRANE FILTER SAMPLES
NORTHWEST PAPER COMPANY - MINERALS DIVISION

On October 15, 1974, membrane filter samples were taken at Northwest Paper Company, Pomona, California, to determine the atmospheric concentration of Asbestiform fiber.

A total of fourteen (14) samples were taken in the paper mill with the emphasis on the Hydropulper area.

All samples were taken with MSA Model G pumps calibrated to 2.0 L/m. The filters were millipore type AA 37mm diameter and 0.8µ pore size. This is the currently prescribed NIOSH method for fiber sampling.

Listed below are the results:

<u>Station Description</u>	<u>Results (F/cc)</u>	<u>TLV (F/cc)</u>
Fork Truck Driver (Serves #4 PM)	2.9	5.0
	1.3	5.0
Beaterman	0.4	5.0
	0.7	5.0
Pulper Operator	2.1	5.0
	0.8	5.0
Utility Man	1.6	5.0
	0.9	5.0
Area Sample - between two pulpers	5.4*	5.0
Machine Tender - #4 PM	0.9	5.0
Fork Truck Driver (serves #3 PM)	0.3	5.0
Upwind Sample - inside plant	0.5	5.0
Upwind Sample - outside plant	0.1	5.0
Wet End Centra Cleaner Area	0.1	5.0
Machine Room - #4 PM		

* The area sample between the beaters was the only sample which exceeded the 5.0 F/cc TLV.

October 18, 1974

A brief job description of the Utility Man, Beaterman and the Pulper Operator as I saw it may help at this point.

The Utility Man works on the ground level with the Fork Truck Drivers in the loading of the skip hoist. The Utility Man loads the bagged products, clay, talc, by hand which are on pallets in the area. The Fork Truck Driver loads the pulp and bulk paper directly into the hoist from the truck.

The Beaterman is the crew leader who works on the platform where the hydropulpers are located. He weighs dyes and generally runs the wet-end.

The Pulper Operator is on the platform also. His duties appeared to be similar to the Beaterman's. Occasionally, he is required to climb on the pulpers to push ingredients that didn't dump from the skip hoist into the pulper.

The loading of the skip hoist on ground level causes heavy dust. The sequence of raw material which is loaded into the skip hoist may well determine the dustiness of the area. For example, if talc and clay were added first and then the pulp and bulk paper were pushed on top of it, a much greater concentration would result than if the process were reversed. Also, the ventilation located on the platform does not extend to the skip hoist area.

Excessive dust appears on the platform which is caused by the dumping of the skip hoist into the hydropulpers. The ventilation system on the platform and over the hydropulpers may as well not exist. The system, at best, is inadequate. The lack of proper ventilation causes the entire wet-end to fill up with dust. The predominant air movement is from the wet-end to the finishing end.

Two bulk samples were submitted to the Analytical Chemistry Section for a quantitative tremolite fiber content. The results will be available the week of October 21, 1974. According to N. Schneffel, the tremolite content of Cyclosorb is in the 5 percent range and Cyclofill is in the 30-40 percent range.

Number 3 paper machine uses 40 lb of Cyclosorb only. However, Number 4 paper machine uses 300 lb of Cyclofill and 40 lb of Cyclosorb.

Housekeeping by Johns-Manville standards is poor. The skip hoist track is loaded with a thick layer of powder as is the shed between the two skip hoists.

D. R. Christensen
D. R. Christensen

jmw

Environmental Control Department
Denver - GHQ
January 13, 1975

Per General

TO: N. B. Scheffel - 2 West

FROM: G. L. Swallow - 4 North

COPIES: W. B. Reitze - 4 North
E. M. Fenner - 4 North
D. R. Christensen - R&D
T. E. Remmers - 2 West

File
Chron

SUBJECT: INDUSTRIAL HYGIENE SURVEY -
POTLATCH CORPORATION,
NORTHWEST PAPER DIVISION,
POMONA PLANT

Logged

On December 11, 1974, an Industrial Hygiene survey was conducted at Potlatch Corporation's Pomona, California, paper mill facility. The objective of this survey was to evaluate airborne dust levels, in the respirable particle size range, throughout the plant. In order to accomplish this purpose, a series of twelve respirable gravimetric and three high-volume air samples were collected for subsequent qualitative/quantitative analyses.

X-ray diffraction analysis of the high-volume samples for percent silica (quartz) content yielded the following:

<u>Area</u>	<u>% Quartz</u>	<u>TLV (mg/M³)</u>
Wet End - Refiner Area	2	2.50
Skip Loading Shack	1	3.33
Area Between Two Hydropulpers	0	5.00

The particular TLV (Threshold Limit Value) to be used is derived from the formula:

$$TLV = \frac{10}{\% \text{ SiO}_2 + 2}$$

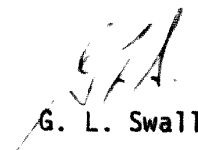
INDUSTRIAL HYGIENE SURVEY - POTLATCH CORPORATION
NORTHWEST PAPER DIVISION, POMONA PLANT
January 13, 1975
Page Two

The results of the twelve respirable gravimetric samples taken to quantify the dust concentrations in terms of mg/M^3 (milligrams per cubic meter) of air appear below.

<u>Location</u>	<u>Result</u>	<u>TLV</u>
Skip Loading Shack	0.38	3.33 mg/M^3
No. 3 Fork Lift Operator	0.42	3.33 mg/M^3
Pulp Utility Man	1.88	3.33 mg/M^3
Starch Feeding Station (Outside of Paper Mill Building)	1.28	3.33 mg/M^3
Area Between Two Hydro- Pulpers (General Area Sample)	0.30 1.45	5.00 mg/M^3 5.00 mg/M^3
Beater Operator	0.08 0.27	5.00 mg/M^3 5.00 mg/M^3
Wet End - Refiner Area (General Area Sample)	0.27	2.50 mg/M^3
No. 3 Rewinder Control Operator	0.11	2.50 mg/M^3
No. 3 Machine Tender	0.24	2.50 mg/M^3
No. 4 Machine Tender	0.67	2.50 mg/M^3

When comparing these results with their respective TLV's, it can be seen that all sampled areas are well below the limit. The highest result obtained ($1.88 \text{ mg}/\text{M}^3$) only reached slightly over half of its permissible TLV.

The respirable gravimetric sampling technique has superseded the former impinger method which is currently being phased out. The respirable gravimetric procedure has been proposed by NIOSH (National Institute for Occupational Safety and Health) as the method for evaluation of airborne quartz concentrations. In anticipation of this method becoming law, it has been used as the criterion in this survey.


G. L. Swallow

KJW:GLS/jmb



Johns-Manville

Research and Development Center

Report No. 259-10

Date July 10, 1978

Title: FIELD EVALUATION OF HAND TOOLS FOR THE DUST-FREE FABRICATION OF ASBESTOS-CEMENT

SUMMARY

Tools for the cutting and drilling of asbestos-cement were evaluated on the job site on June 13 and 14, 1978 at the State of Utah Trade and Technical College, Phase II, located in Orem, Utah. These tools were designed and tested at Research. The purpose of this work was to generate field dust counts and record workers reaction to the tools.

Personnel present during this operation were the author and:

D. R. Christensen	J.M. - Health, Safety, and Environment
R. Cordova	J.M. - Health, Safety, and Environment
B. Bullough	Bullough Asbestos - Supplier
L. Henriksen	Western States Industries - Contractor
G. M. Maestas	Industrial Hygienist, Bureau of Radiation and Occupational Health, State of Utah
R. Micale	J.M. - Denver Sales

Tools evaluated included a portable power saw with shroud and a hand drill with shroud, both used with a Nilfisk vacuum cleaner. Also used was a nibbler using a hand drill as a power source. The highest dust count recorded was 0.38 fibers/cc which is an average of all equipment run. While this gives a strong indication everything is well, another job site should be found to evaluate each tool separately.

These field data confirm the lab work which indicated the satisfactory performance of these power tools. Hand tools (clippers, saw, scoring knife, etc.) were not tested but workmen thought they might be acceptable for use on thinner material (1/4 in. or less).

I would recommend additional testing be done at a job site where fabricating conditions are more severe.

Contents: Summary, Discussion, Conclusions, Recommendations and Appendix.

Reported by

G. R. Bauman

G. R. Bauman

Asbestos and Mineral Technology

ck

Distribution on reverse

Confidential — not for general distribution or republication

Attachment

CRMC-Christensen-Micro-000042

Distribution:

F. L. Pundsack - 1-04 (S)
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G. R. Bauman (2)
R&D Information Center (4)

KEYWORDS

Asbestos
Asbestos-Cement
Environmental Health
Dust
Dust Collection
Fabrication



Johns-Manville

Internal Correspondence

To L. I. Richards - Denison

Date: May 3, 1978

From G. L. Swallow - R&D

Copies: W. B. Reitze - 1-06
D. R. Christensen - R&DW. Paul - 1-06
T. M. Faas - 3-07
C. R. Smith - DenisonSubject DUST SAMPLE - FITTINGS LATHE - DENISON
YOUR LETTER APRIL 12, 1978 TO D. R. CHRISTENSEN

In the final paragraph of your subject letter you refer to eliminating the fittings lathe operator asbestos dust station from the "monthly reporting status" and the requirement for wearing protective clothing and a respirator.

We have discussed this with Dr. Paul who agrees with your request.

If you have not already received the results of your sample, you will in the very near future.


G. L. Swallow

sl



Johns-Manville

JUN 13 1979

Internal Correspondence

To: C. J. Sulewski 3-15
From: W. B. Reitze 1-06
Copies: ✓ P. Kotin, M.D. 1-06

Date: June 13, 1979

*L. I have discussed this with Sulewski
I will talk to Reitze*

Subject: DUST CONTROL FOR REFRACTORY FIBER FURNACE - R&D

Your memo dated March 25 regarding the above subject has been brought to my attention, and the purpose of this memo is to give you additional information and request that you pursue your stated decision to get more facts and possibly consider alternate methods for controlling this situation.

On the afternoon of June 12, I visited R&D with our hygienist, Denny Christensen, and Ed McMahon of the Research staff. We inspected the refractory fiber furnace, which was in limited operation at the time, and also climbed to the roof and visually inspected emissions from the stacks.

There are two separate but related problems, one dealing with the indoor employee workplace exposure and the other dealing with emissions from our stacks to ambient air.

The indoor situation must be reviewed both in terms of visual inspection and the existing industrial hygiene reports. As I am sure you are aware, industrial hygiene surveys have been done and have indicated that the workers can be exposed to levels of free crystalline silica (quartz) as high as ten to fifteen times the recognized TLV for quartz. It is true that respiratory protective devices are used, at least to a limited extent. During my visit I noticed several of the workers wearing respiratory protective devices, but during much of the time the supervisor of the operation wore his respirator around his neck rather than over his mouth and nose. I understand that this is the general rule and that not all people on the platform or in the surrounding area wear respiratory protective devices 100% of the time. With **free crystalline silica** levels as high as they are, respiratory protective devices should be mandatory for all people assigned to this area, both above and below the platform. While the mandatory wearing of respiratory protective devices will protect our people on an interim basis, OSHA does not permit its use for the long term if engineering technology is available to control the process. OSHA does, however, have a provision which states that personal protective devices are acceptable if it is an emergency situation--a little used and infrequent process. As I read this, we do not qualify for this sporadic use provision. Visual inspection of the area indicated much dust

on the platform, below the platform, and in many areas of the fire test room. I have been told that there are a number of complaints from employees who work near this operation regarding the dusty conditions which generally exist in the fire test room when the process is operating.

Emissions to ambient air present another series of problems. First of all, we should consider the fact that when we originally applied for permits for the Research and Development Center we promised the state people that we would not be emitting any significant amount of pollutants to the air. Emissions from the stack may not be in line with our promises. A second and extremely valid point is that these emissions from the stack are visible both to our employees and to our neighbors. Either group could trigger an inspection by state or federal people merely by a simple telephone call. Once this telephone call is made and the first inspector from a regulatory agency arrives at the Research and Development Center, our problems begin in earnest. In light of J-M's less than sterling reputation among the residents of the Ken-Caryl ranch, such a phone call to a regulatory agency is a real possibility. I will not speculate on the consequences of such an inspection but only say that it could have a far-reaching effect upon not only our new building operation but also our existing facilities. If there was ever a time for maintaining a low profile, this is it. By this, I am not stating nor intimating that we are injuring any of our neighbors because of stack emissions; in fact, I firmly believe we are not. However, compliance with regulatory agencies is not always related to health problems.

In summation, I would like to make the following recommendations.

1. The enforced mandatory wearing of respiratory protective devices by all persons at or near the refractory furnace. This will serve as an interim measure only and should protect our employees from the existing extremely hazardous health condition.
2. That further engineering studies be made immediately to determine other feasible and perhaps more economical methods for control. The fact that the possibility exists that this operation will be moved to the new facility within a year or two is not sufficient cause to delay.

C. J. Sulewski
June 13, 1979
Page 3

3. That all due care be taken to reduce stack emissions to a bare minimum, so as not to trigger an inspection by a regulatory agency.

I would be most happy to sit down with you and discuss this in greater detail at your convenience.



W. B. Reitze

bcc: Denny Christensen



Johns-Manville

Internal Correspondence

To: W.B. Reitze 1-06

Date: March 16, 1978

From: D.R. Christensen R&D

Copies: G.L. Swallow 1-06

Subject: INTERNATIONAL DIVISION
ALMERIA AND MEISA OPERATIONS
RESPIRATOR PROGRAMS

The cover letters accompanying the Almeria and Meisa Industrial Hygiene Survey reports both mention the need for a comprehensive respiratory protection program. I think a good point for the plants to begin at would be a set of recommendations from your office.

In talking with Bill Farrell in Mexico City I do remember him mentioning the MSA disposable respirator approved for Asbestos handling and that he was having considerable trouble obtaining information on it's application. I think anything that we could do in Denver might mean a much earlier implementation in Mexico.

The severity of the cristobalite exposures is overwhelming and prompts our immediate attention.

Denny

Johns-Manville

Internal Correspondence

To D. R. Christenson Date June 15, 1978

From F. D'Ovidio
V. E. Wolkodoff

Copies See Below

Subject TEM AND OPTICAL ANALYSES OF MILLIPORE FILTERS FOR PERCENTAGES OF
ASBESTOS FIBER TYPES, PIPE DIVISIONS OF MANVILLE, GREEN COVE
SPRINGS, AND WAUKEGAN
M-274 - M-307 - M-311

TEM analyses conducted by intercepting at least 100 fibers and in conjunction with electron diffraction patterns and chemistry by energy dispersive spectrometry. Optical method according to "Identification of Chrysotile, Amosite, and Crocidolite Fibers by Optical Mineralogy Without Benefit of Refractive Index Oils. Leitz Orthoplan Petrographic Microscope, 500 X" by V. E. Wolkodoff October 28, 1974. Also, based on intercepting at least 100 fibers. By optical methods, fibers down to 0.5 μ m in diameter sometimes could be resolved and determined whereas by TEM and EDS, fibers as small as 0.02 μ m in diameter could be verified easily. Since TEM detects and verifies extremely fine fibers (not detectable in the visible spectrum) there is no reason as to why percentages determined by the two methods should agree.

Percentages of each asbestos type and sample identification are listed in Tables 1, 2 and 3.

F. D'Ovidio
F. D'Ovidio

V. E. Wolkodoff
V. E. Wolkodoff

vm

cc:

Dr. G. Wright	- 1-06
G. L. Swallow	- 1-06
E. J. Bulava	- Manville
F. J. Angelos	- Waukegan
S. Speil	- R&D
S. B. Spencer	- R&D

Table 1
TEM and Optical Results, Manville Plant,
February 23, 1978

Sample Identification	Microscopy Mode	% Chrysotile	% Crocidolite	% Amosite
D11-W	TEM	66	26	8
D12-W	Optical	65	14	21
D15-F	Optical	55	29	16
D19-F	TEM	81	15	4
D55-F	Optical	36	51	13

Table 2
TEM and Optical Results, Green Cove Springs,
April 7, 1978

Sample Identification	Microscopy Mode	% Chrysotile	% Crocidolite	% Amosite
D1-T	TEM	64	12	24
D1-T	Optical	12	4	84
D3-T	Optical	36	18	46
D7-1	Optical	26	18	56
D8-T-A	Optical	25	67	8
D13-T	TEM	81	17	2

Table 3
TEM and Optical Results, Waukegan Plant,
April 14, 1978

Sample Identification	Microscopy Mode	% Chrysotile	% Crocidolite	% Amosite
#1	TEM	77	23	ND
#4	Optical	35	65	ND
#7	Optical	34	66	ND
#10-2	TEM	81	19	ND
#11	Optical	25	75	ND



Johns-Manville

Internal Correspondence

To L. A. Schriver - Lompoc Date June 15, 1978

From F. D'Ovidio - R&D
V. E. Wolkodoff - R&D

Copies Dr. G. Wright - 1-06 D. R. Christensen - R&D
G. L. Swallow - 1-06 S. B. Spencer - R&D

Subject PETROGRAPHIC ANALYSES OF ASBESTOS FIBERS IN AIRBORNE DUST ON
MILLIPORE AA FILTERS, WEEK OF JANUARY 30, 1978, STOCKTON PIPE
PLANT SURVEY.
M-267

Rather than report crocidolite fiber percentages only, it was just as easy to verify other types of fiber by petrographic techniques and list their percentages also. Please refer to your letter to V. Wolkodoff dated February 14, 1978.

Sample identification and results are summarized in Table 1.


F. D'Ovidio


V. E. Wolkodoff

vm

NB 4873, pg. 54, 55

JM Johns-Manville

File
Internal Correspondence

To H. J. Young

Date October 1, 1982

OCT 1 1982
From G. L. Swallow

Copies D. R. Christensen

Subject **RESPIRATORS - TORONTO AND JEFFREY**

The question was raised at both Toronto and Jeffrey as to why they could not continue to use the **3M 8710 respirator** rather than the **9920 respirator**.

At Jeffrey the questioner was Jim Deacon. He was specific in noting that those who preferred the 8710 were people who typically used the respirator only a small portion of the day and therefore found the lack of an exhalation valve to be no problem. The cost factor was also of interest. It is said that the typical would-be wearer of an 8710 respirator has it issued to him, uses it briefly then throws it away. When this happens frequently the differential cost can be significant.

Jim Deacon also asked whether the 3M 9920 couldn't be used for welding (longer term use) in place of the **MSA 45-7117** with a **6MA 464807 canister**. **We were interrupted before the end of this conversation** and he never had a chance to explain the reasons for this request. Perhaps your knowledge of the two respirators will make that clear.



Johns-Manville

Internal Correspondence

To E. J. Bulava - Manville
C. M. Carter - Waukegan
D. R. Christensen - R-24
L. A. Schriver - Lompoc
E. G. Stevens - Toronto

Date February 15, 1982

From G. L. Swallow 1-06

W. B. Reitze 1-06

Copies H. J. Young 1-06

Subject RESPIRATORY PROTECTION PROGRAM
ED BULAVA'S MEMO OF FEBRUARY 5th - HELEN YOUNG'S LETTER
FEBRUARY 9, 1982

Enclosed are copies of the captioned letters.

I believe the questions raised by Ed and Helen's answers are of interest to us all.

Please review both the questions and answers for your information. If there are any questions, please let me know and I will either answer them or refer them to Helen.



Johns-Manville

Internal Correspondence

FEB 12 1982

To G. L. Swallow

Date February 9, 1982

From H. J. Young

Copies File

Subject **RESPIRATORY PROTECTION PROGRAM**
MEMO OF 2/5/82 FROM E. BULAVA

- 1) The onus should be put on the plant manager regarding the Respiratory Protection Program where voluntary wearers are an issue. I believe the same standard should apply to all wearers, but enforcement would be difficult if a respirator is worn but not really required. It should be pointed out that the respirator's effectiveness is greatly diminished if not worn properly, clean, etc., and that using poor techniques could, through example, indirectly influence the effectiveness of the program for "required" wearers.
- 2) A brochure is being prepared for use in conjunction with the film "Mask of Life", and should be ready for distribution in the next month or so.
- 3) I mentioned two methods for qualitative fit-testing (noted on page 7 of 1/4/82 memo on Respiratory Protection Program). There are others, and information can be obtained from various respirator companies. A fit-testing chamber is unnecessary since we are not required to do quantitative fit-testing. Each location is responsible for determining how many kits are needed, etc.
- 4) It will be difficult to fit-test single use respirators and yet we must. Please refer again to page 7. I suggest 3M Face Fit Kit - Brand 9912.
- 5) The OSHA standard says yes.

John -

There are a
few more
questions with
regard to the
Respiratory Protection
program.

Can you
supply answers?

We may as well
advise all sales,
not just... Ex. Sales.

George
2/1/82

TO: G.L. SWALLOW

FROM: E.J. BULAVA

SUBJECT: RESPIRATORY PROTECTION PROGRAM

FEB 8 1982

2/5/82

IN REFERENCE TO THE RESPIRATORY PROTECTION PROGRAM PACKAGE DATED JANUARY 4, 1982, I WOULD LIKE TO HAVE THE FOLLOWING POINTS ANSWERED OR CLARIFIED:

1. IF A RESPIRATOR IS NOT REQUIRED, BUT RATHER DESIRED, WHAT AREAS (IF ANY) OF THE PROGRAM CAN YOU DEPART FROM? FOR EXAMPLE, RESPIRATOR SELECTION, RELOADS, TRAINING, FIT, ETC.
2. IS THE FILM "MASK OF LIFE" ALL ENCOMPASSING ON TRAINING ITEMS REQUIRED? ARE OTHER MEANS EXPECTED AS BROCHURES, SLIDES, SAFETY MEETINGS?
3. THERE ARE NO CURRENT FIT-TEST ATMOSPHERIC CHAMBERS THAT I AM AWARE OF (AT LEAST IN OUR AREA PLANTS). AT LEAST ONE KIT APPEARS NECESSARY IN EVERY LOCATION. HOW AND WHEN WILL ALL PLANTS OBTAIN THESE? IN LARGER PLANTS (I.E. MANVILLE, WAUKESHA) IS ONE NEEDED IN EACH BUILDING? EACH COORDINATOR?
4. SINGLE-USE RESPIRATORS REQUIRE SPECIAL FIT-TEST KIT. WHO IS SUGGESTED SUPPLIER?

(2)

5. APPENDIX I - 1910.134 (b)(5) STATES THAT
RESPIRATORS MUST BE CLEANED AT LEAST DAILY.
IS THIS TRUE?

THANKS,

EJB



Johns-Manville

file
Internal Correspondence

To 52, 551, NUR (U.S. and Canada)

Date January 4, 1982

From H. J. Young, 1-06

Copies W. B. Reitze, 1-06

* See attached

Subject **RESPIRATORY PROTECTION PROGRAM**

The Manville Respiratory Protection Program for operating subsidiaries includes essential elements consistent with federal regulation and sound occupational health concepts, and is designed for protection of workers against breathing air which may contain harmful substances.

It should be noted that OSHA continues to require reduction of air contamination levels through engineering controls and process design. Respirators are to be used in the interim period while making corrections or when controlling through engineering methods is technologically infeasible.

OSHA requires written standard operating procedures governing the selection and use of respirators, and for compliance purposes, you may wish to retain the attached in your files. This should be considered a replacement for the sections relevant to respirators in the Manual of Standard Practices, Safety and Health, SH-302, Rev. 1/79, 4/79. (See Appendix I for OSHA Standard.)

Selection of Respirators

Factors which determine selection of respiratory devices include the nature of the hazard, severity of hazard, type of contaminant, period of exposure, distance from respirable air, and activity of wearer.

Respirators can be classified into three categories by the breathing pattern during use. If negative pressure is created inside the facepiece or the inlet covering of a respirator during inhalation, it is considered a negative pressure device (-), such as non-powered air-purifying respirators, supplied air respirator or self-contained breathing apparatus (SCBA) operated in demand mode. If positive pressure is maintained inside

the facepiece or inlet covering of the respirator during inhalation, it is considered a positive pressure device (+), such as powered air-purifying respirators, supplied air respirators or SCBA operated in pressure-demand mode. The third type is the atmospheric pressure device (0) which maintains atmospheric pressure inside the facepiece or inlet covering of the respirator such as the continuous flow supplied air respirator. See Appendix II for classification of respiratory hazards and Appendix III for a general guide for respirator selection.

Appendix IV is the newly revised corporate approved list of respiratory protection to be used by the operating subsidiaries of Manville Corporation. All are current models, have NIOSH approval, and are adequate for providing safe coverage for the substances for which they are intended. Only these respirators should be used. (Note: Due to inconsistencies and product changes, Norton respirators are not included on approved list.)

Administrative Responsibilities

To ensure appropriate coordination of requirements and procedures of the OSHA Standard and the Respiratory Protection Program, responsibility should be assigned to a specific individual at each location who will:

- 1) Assess hazards and correlate industrial hygiene reports to respirator need.
- 2) Maintain specific operating procedures for location.
- 3) Maintain all records: Industrial hygiene reports, respirator care and maintenance records, medical approval and job assignment information.
- 4) Coordinate equipment purchases, maintenance, cleaning, storage and training.

See Appendix V for examples of forms that may be used in the administration of the Respiratory Protection Program. These forms are taken from the American Industrial Hygiene Association Manual on Respiratory Protection and may be adopted for your use. (Incidentally, this manual is an excellent resource for all aspects of the program.)

Medical Assessment of Respiratory Wearers

OSHA requires that no employee be assigned to a job

requiring respirator usage unless the person is physically able to perform the work and use the equipment. (1910.134(a)(10)) See Appendix VI for medical guidelines regarding use.

The local physician will determine pertinent health and physical conditions based on the employee's medical history, and a physical examination that emphasizes cardiovascular and pulmonary systems. A PA chest x-ray and pulmonary function study (FVC, FEV₁, calculation of predicted values and the FEV₁/FVC ratio, and comparison of determined values to the predicted) should also be performed. An EKG may also be included if indicated for employees 45 years and over.

The respirator user's medical status should be reviewed as follows: Prior to assignment to positions requiring use of respiratory equipment (plant physician may okay an employee for respirator use if the physical examination has been within last twelve months). Re-examination for employees under age 40 is to be done every three years, age 40-49 every two years and over age 50 annually.

Documentation should be made in the medical record regarding the employee's ability to wear a respirator, and the information passed on to the designated coordinator of the Respiratory Protection Program.

Training

Workers and supervisors should be trained in basic respiratory protection practices.

Supervisors should be aware of the structure and operation of Respiratory Protection Program and the nature and extent of respiratory hazards to which workers may be exposed. Selection and use of respirators used to protect workers against exposure as well as legal requirements relative to the use of respirators are also important concepts for those with supervisory responsibilities.

Workers should understand the importance of correct usage of respirators, type required, and the capacities and limitations. Discussion of the need for respirators, with emphasis on engineering corrections in progress should occur between the worker and supervisor or program coordinator. Instruction in wearing respirator, fit and maintenance must be given. Before using, workers should have the opportunity to handle the respirator, have it fit properly, test the seal, wear it in normal air to become familiar, and wear it in a test atmosphere. (1910.134(e)(5)). See Appendix VII for company policy regarding failure to wear or improper wearing of respirators.

The film "The Mask of Life" is available to you on a "loan" basis and may be obtained by contacting P. Ludwick, Health Programs Coordinator at mail stop 1-06 or Ext. 3324. A brochure that accompanies the film is presently being designed and will be available within the next few months.

Respirator Fit-Testing

Fit-testing is required by OSHA (29 CFR 1910.134 (e)(5)). However, because compliance procedures were not well defined, OSHA issued an enforcement policy (CPL 2-2.29) that describes items compliance officers should consider when inspecting for compliance to the respirator standard. This directive is repeated here for your information.

- "F. Enforcement Policy. When issuing citations for violations of 29 CFR 1910.134 (e)(5), use the following guidelines:
1. Respirators must be fit-tested.
 2. A "test atmosphere" must be applied to assess the quality of fit.
 3. The fit-test must be applied to each and every employee required to wear a respirator.
 4. The fit-testing requirement applies to all negative pressure respirators including SINGLE-USE RESPIRATORS.
 5. The "test atmosphere" must be applied using recognized qualitative fit-testing procedures utilizing iso-amyl acetate, irritant smoke, etc.; or quantitative fit-testing using DOP, NaCl, etc.
 6. Items F.1.-5. above shall be part of the training required in 29 CFR 1910.134 (b)(3), "The user shall be instructed and trained in the proper use of respirators and their limitations."
 7. Cite "serious" when F.1.-5. above, is not implemented, if the toxic substance is classified as "serious" in the Industrial Hygiene Field Operations Manual (IHFOM), Chapter II."

It should be noted that since many of the substances monitored by Manville industrial hygienists

would carry a health code denoting a "serious" substance, the potential for receiving a "serious" citation exists if the Respiratory Protection Program is not in place.

Quantitative/Qualitative Fit-Testing

The two types of fit-testing methods in assessing respirator fit are quantitative and qualitative.

According to the Regional (VIII) Consultant to Occupational Safety and Health and others, quantitative fit-testing procedures should be applied where arsenic, lead, acrylonitrile, radioactivity or other highly toxic materials are used. This type of testing requires an elaborate and expensive testing system which exceeds requirements relative to respirator usage in Manville operating subsidiaries.

Qualitative fit-testing procedures should be applied for substances except those mentioned above, and is the method to use within company locations. Several procedures are described below. As you will note, while the OSHA Standard is silent on the preferred testing method, the compliance directive explicitly states use of iso-amyl acetate, irritant smoke, etc.

Qualitative Fit-Testing

For gross determination of fit:

- 1) Negative Pressure Test. The wearer can perform this test alone in the field. It consists of merely closing off the inlets of the canister, cartridge(s) or filter(s) by covering with the palm(s) or replacing the seals over the canister or cartridge inlets, or by squeezing breathing tubes so that air cannot pass; inhaling gently so the facepiece collapses slightly; and holding the breath for ten seconds. If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator is probably tight enough.
- 2) Positive Pressure Test. This test is very much like the negative pressure test. It is conducted by closing off the exhalation valve and exhaling gently into the facepiece. The fit is considered satisfactory

if slight positive pressure can be built up inside the facepiece without any evidence of outward leakage. For some respirators, this method requires the wearer to remove the exhalation valve cover and then carefully replace it after the test, often a most difficult task which can disturb the respirator fit even more than does the negative pressure test. If removing and replacing the valve cover is required, this test should be used sparingly. For respirators whose valve covers have a single small port that can be covered by the palm or finger, this test is easy. It should be performed just before entering any hazardous atmosphere.

Use of test agent:

There are three qualitative methods used in industry today that generate a test atmosphere around the respirator attempting to concentrate it around the sealing area. If a significant leak exists, the wearer senses the presence of the test agent; if the test agent is not detected, the respirator is judged to have an adequate fit.

- 1) Iso-amyl acetate or banana oil test. Iso-amyl acetate is a liquid having the strong odor of bananas. The test atmosphere is usually generated by slowly passing a swab wet with the chemical around the sealing surface of the respirator. The test atmosphere challenges each general sealing area of the respirator during the inhalation cycle of respiration-the time when leakage will most likely occur. If the wearer detects the odor, the leak is judged excessive. To utilize this test, the respirator must be air supplied or be equipped with a purifying element capable of removing organic vapors from the test atmosphere.
- 2) Irritant smoke test. This method is commonly used with air supplied respirators or air-purifying respirators equipped with efficient air-purifying elements. The "smoke" is generated by aspirating moist room air through a stannic chloride ventilation testing tube. The smoke consists of hydrolyzed stannic chloride (HCL on a very small oxide particle). The smoke is detected around the sealing

surface of the respirator in a manner similar to the iso-amyl acetate test. If a leak is present, the wearer detects it by reacting to the irritation, usually with an involuntary cough. Any detection of the irritant is judged proof of unacceptable leakage.

- 3) Saccharin test. This method may be used on any air supplied respiratory or air-purifying respirator equipped with any air-purifying element approved to remove any particulate hazard. The test atmosphere is generated by nebulizing a saturated water solution of the sodium salt of saccharin. Again, the sealing edge of the respirator is challenged as before, and the wearer breathes through his mouth throughout the test. If a significant leak is present, the wearer will detect the sweet taste. Any sweet taste during the test is judged proof of unacceptable leakage.

Fit-Test Kits/Modifications

An adequate qualitative fit-test kit may be purchased from 3M Company: Brand 9912, Qualitative Face Fit Kit.

In response to a question regarding the necessity of and procedure for fit-testing single use respirators, the area Director of OSHA, Savannah, Georgia, offers the following:

"Qualitative fit testing single use respirators is required and an employer would be subject to a citation for failure to fit test.

The current available method for qualitatively fit testing single use respirators involves spraying a saturated saccharin solution around the mask using a nebulizer. If the mask leaks, the individual will be able to taste the saccharin. (He must keep his mouth slightly open during the test.) A kit can be made by buying a asthma inhaler and saccharin from a drugstore or one may be purchased from some of the respirator suppliers.

If using a 3M single use respirator, an alternative to the above method would be to

purchase a modified 3M respirator with a high efficiency filter. Irritant smoke could then be used to perform a qualitative test."

Cleaning, Maintenance, Storage

A respirator inspection and maintenance program must be implemented for each location.

Inspection of facepiece, valves, connecting tubes, canisters and filters for such things as cracks, tears, dirt and broken or missing parts, etc. is necessary to ensure optimum effectiveness of the respirator.

Cleaning can be accomplished in a variety of ways: From hand washing with detergent and warm water to use of washing machines or dishwashers. Disinfection is not necessary when respirator is worn by the same person. Thorough rinsing is extremely important in the prevention of dermatitis. Respirators may be placed on a surface or be hung up to dry. Storage should be in a clean, dry location away from direct sunlight. (1910.134 (f)(1-5))

Program Evaluation

Respirator use should be monitored frequently, and the program evaluated on the basis of overall effectiveness of the combined components in ensuring that employees are protected from respiratory hazards.

Internal Correspondence

11/11/82

Date November 11, 1982

WFL

To H. J. Young - Denver 1-06

From Wanda Foster - Toronto Plant

Copies: W. Reitze - Denver 1-06

Subject: **DISPOSABLE RESPIRATORS**

During the course of his recent visit, D. Christensen inquired why we were not using the respirators issued by 3M, 9900, 9910, or 9920, as noted in your correspondence of January, 1982. We must admit that this detail was completely overlooked.

At Toronto Plant we do not have any stations over the TLV, however, because of the silica exposure several of our employees prefer to wear a respirator at certain work stations and we have been supplying them with the 8710.

After having this brought to our attention, we decided that a trial usage period should be conducted with a few employees to give them the opportunity of deciding which of the two respirators (9900 or 9920) would be most acceptable and comfortable to wear, keeping in mind that we were going to have to change to these respirators and that we wished to carry an inventory of only one style.

The results were as follows:-

- 9900 - All 4 employees felt that this respirator is too hard to breathe through, and also that they were too heavy.
- 9920 - All 4 employees were impressed with it, with one complaint that the binding was too hard and irritating to the face.

The 9920 was ordered for all employees and following a further assessment period, we received the following comments:-

- They are irritating to the face.
- Perspiration caused by the heavy physical work our employees are required to do, is absorbed into the mask, thus making the mask heavier and more irritating to the face.
- Harder to draw air in - the exhalation valve makes breathing out much easier.

NOV 11 1982

Cont'd.....

Page 2.

Our plant physician experimented and wore the respirator for a 1/2 hour while doing some desk work. He found it very difficult to breathe, it was hot and irritated his face. It was his opinion that anyone of our employees performing physical labour, would have extreme difficulty functioning with this respirator.

We therefore request an exception to let our employees wear the 8710.

1. We are below the TLV and therefore not required to wear respirators.
2. Because the 8710 is easier to function with in our particular operation, and more comfortable to wear, the employees are more likely to wear protection and wear it properly.

May we have your comments and approval?



Wanda Foster

/rw

Manville

Internal Correspondence

To: See below

Date: February 14, 1983

From: D. R. Christensen 1-06

Copies

Subject: INFORMATION UPDATE

I am enclosing four documents prepared through the office of Dr. Leineweber relating to toxicology of various materials handled in the Manville operations. You may be familiar with these publications. In any case, I think they will be a valuable addition to your library materials.

Three of the papers deal with fiber toxicology: 1) "Dust Chemistry and Physics: Mineral and Vitreous Fibres;" 2) "Fiber Toxicology;" and 3) "Vitreous Insulations: Are They Hazardous?" The final paper is a review and analysis of the formaldehyde problem published somewhat recently for general corporate information. I hope you find these documents as interesting and useful as I have.

E. J. Bulava - Manville
C. M. Carter - Waukegan
R. C. Cordova - R-24
C. L. Pauley - Lompoc
R. Alie - Jeffrey
E. G. Stevens - Toronto
F. Class - Wissembourg



Johns-Manville

Internal Correspondence

To: See below

Date: April 28, 1983

From: W. B. Reitze *WBR*

Copies:

Subject: MALPRACTICE INSURANCE - JOB DESCRIPTIONS

After a long talk with Mel Furman regarding our malpractice insurance coverage, he advised me that it would be in our best interests to revise all the job descriptions of our headquarters people. It is doubtful that the physician at the location (Dick Liss) or any of the location nurses will have to revise their job descriptions, but those too should be reviewed.

The biggest weakness in the existing job descriptions is that they do not spell out in great enough detail the fact that those of us who are attached to the headquarters function also provide medical, health, industrial hygiene and technical health information not only to employees of the corporation but also to customers who fabricate our product, consumers who use our product, and various contacts at trade associations. For the most part, our plant staffs provide information only to employees and therefore would be covered under the indemnification clauses.

Those persons on the headquarters staff that would be most affected would be:

W. B. Reitze
R. Anderson
H. J. Young
P. L. Ludwick
J. P. Leineweber
K. J. Roberts
D. R. Christensen
All industrial hygienists
(regardless of location)

Please give examples, where possible, of situations where outside advice would be furnished.

Please try to have these to me by May 15.

TO: R. Anderson, M.D.
D. R. Burford
G. R. Chase
D. R. Christensen
J. P. Leineweber
D. E. Noyes

Copy that will discuss the maintenance

C. C. Swettenham —
Bridgman

Maintenance
Workers

Asbestos
General

Dec 3, 1973.

Maintenance Workers Asbestos Exposure.

Your letter of Nov 27, 1973.

We would make the following comments in reply to
your letter regarding the completeness of our maintenance
personnel surveyed at Bethune. (This probably applies to all surveys)

1. We have never sampled maintenance people
as completely as production personnel. They do
not fall into the Dust Station concept as easily
as production people, and are thus harder to setup
so that they can be resurveyed.
2. Maintenance people are harder to find to put
the gauge on them at the start, and just as hard to find
to remove the gauge at the pre set times.
3. Welders have a lot of equipment with them
any way, and are like other crafts, reluctant to
add additional equipment - even a gauge and membrane.
Also the carbon from welding generally masks the
membrane so that you cannot count the fibres
accurately.
4. Other crafts are frequently working with a welder,
or a welder is in the area, so that their membranes
are spoiled also.

5. Frequently the maintenance man is working in a confined location on the back, side, stomach or all three. If he knows he will assume these positions then he will not wear a pump. If he does wear a pump under these conditions frequently the hose or membrane will be disengaged or the pump suited turned off.

6. A maintenance survey thus requires close supervision on the part of the hygienist. Under these conditions it is difficult to evaluate the workers normal exposure, as he will either avoid dust or make sure you get something to count. Few workers will work normally while under close supervision.

In Summary.

A. It is comparatively easy to pick an ideal or idealized inspector, etc. but difficult to evaluate many of the other non-descriptive maintenance jobs.

B. The error from welding means that many samples are ruined.

C. Maintenance workers are exposed to very high and very low exposures during a day. These peaks and valleys vary from day to day. Short sampling is the only method of obtaining the mean exposure.

D. This type of survey is very time consuming
/ J. Christensen.



Johns-Manville

Internal Correspondence

To E. J. Bulava - Manville
F. J. Angelos - Waukegan

Date November 9, 1973

From D. A. Aldinger - Denver GHQ

- CONFIDENTIAL -

Copies: G. L. Swallow - Denver GHQ
M. A. Baloga - Denver GHQ

D. R. Christensen - Denver R&D
File & Chron

Subject MAINTENANCE WORKERS' ASBESTOS EXPOSURE

Based on the information extracted from the Manville and Waukegan Industrial Hygiene records concerning asbestos exposure to maintenance workers, it is apparent that more testing should be initiated so we may accurately evaluate the maintenance workers' exposure. Medical records to date reveal a higher incidence of disease among maintenance workers than anyone originally anticipated.

Although the information is not conclusive, there appears to be a trend toward higher exposures to maintenance workers when maintenance is performed outside the shop area.

In conjunction with this letter, we will be corresponding with the plant managers at Manville and Waukegan to inform them of our intention to gather more information on maintenance workers' activities and exposure. We will leave it up to you to correspond with the away plants to advise them of our intention to gather more information on maintenance workers, prior to your regularly scheduled survey.


D. A. Aldinger

DAA/jmb

Environmental Control Department
Denver - GHQ
April 10, 1973

B/W 6/11/73
- CONFIDENTIAL

A. W. Jung - Manville IPD
C. F. Luquer - Manville RPD
N. Pontus - Manville P/E
F. Henry - Manville Pipe

cc: D. E. Hillier
E. J. Bulava
M. A. Baloga/File
Chron

ASBESTOS DUST SAMPLING MAINTENANCE WORKERS

For approximately 18 months we have been attempting to obtain a representative cross-section of our various maintenance activities, with regard to the asbestos dust exposures involved.

Because much of this work is done only occasionally, sometimes on an emergency basis, and in many different locations, it is extremely difficult to know in advance what maintenance work is being done, and thus be prepared to take the necessary samples.

The statistics on pneumoconiosis at Manville clearly show the involvement of maintenance people. In order to better protect our employees, we must have a better understanding of those jobs which present potential health hazards.

We solicit your active participation and cooperation by advising the Eastern Area Laboratory (E. J. Bulava) whenever possible, of impending maintenance work, which may involve an asbestos dust exposure. Our Industrial Hygiene group will make every effort to sample during these activities and will, over a period of months, build up a back-log of information regarding these hazards.

G. L. Swallow

GLS/jbs

*10/23 - getting some better info now!
10/23 - discussed with Doug - asked for ideas on how to utilize program.
10/26 - Confers with Doug 10/30.
11/2 - Doug got out of it - meeting with station - says "Wash."
11/8 - Doug has little more to go*

Environmental Control Department
Denver - GHQ
March 29, 1973

E. J. Bulava

cc: File
Chron

SEMI-ANNUAL REVIEW OF ASBESTOS DUST STATIONS
YOUR LETTER TO H. PONTUS, DATED 12/07/73

In the above referenced letter, you expressed a desire to provide more extensive dust station coverage at Hanville's Asbestos Division. I would like to know how this project is progressing.

G. L. Swallow
GLS/jbs



Johns-Manville

File Pipe DM
Internal Correspondence

To: F. J. Angelos
E. J. Bulava
D. R. Christensen
L. A. Schriver

Date: February 15, 1979

From: G. L. Swallow

Copies: E. G. Stevens
W. B. Reitze

W. E. Volwiler
T. M. Paas

Subject: MONTHLY ENVIRONMENTAL CONTROL REPORTS
ASBESTOS CEMENT PIPE PLANTS
W. E. VOLWILER'S LETTER FEBRUARY 9, 1979

Enclosed is a copy of the subject letter together with an example of the "stations over TLV" report being established.

Please note that among other things, this report is to take the place of the corrective action report we have requested subsequent to each Industrial Hygiene Survey. Since the new report will be monthly and will include the corrective action status for all stations over TLV, it should improve the monitoring of corrective actions taken.


G. L. Swallow

sl

Enclosures

Johns-Manville

Internal Correspondence

To: G. L. SWALLOW - 1-06 WIK

Date: FEBRUARY 28, 1977

From: D. R. CHRISTENSEN - R&D

Copy to: T. C. McGETTIGAN - 3-N (PLAZA)
J. F. HERR - R&D

W. H. KETZKE - 1-06 WIK
E. M. FENNER - 1-06 WIK

Subject: INDUSTRIAL HYGIENE SURVEY - POWERS REGULATOR COMPANY
TRANSITUBE DIVISION, DENVER, COLORADO
FEBRUARY 23, 1977

A special Industrial Hygiene survey was recently conducted at the Powers Regulator Company Kingston Street warehouse in Denver on 2/23 by K. J. Williams with the help of Mr. Jim Brietske, Product Engineer for Powers. The object of this survey was to determine the environmental impact, if any, when Transite Korduct (J-M) pipe containing asbestos fiber has been substituted for PVC pipe in the company's pneumatic tube systems. Particular interest in the potential for expulsion of asbestos fibers, dislodged from the Korduct pipe interior by attrition from frequent "carrier" travel, into the workplace was indicated.

For the purposes of environmental testing, a model Courier brand "point-to-point" system equipped with Korduct piping was installed in the Kingston Street warehouse. The system consisted of seven joined 10' lengths of 4" diameter Transite Korduct (Type 1/B TEL) anchored horizontally on a warehouse wall approximately 15' above the floor connected at both ends of the total 70' pipe run to 90° Transite bends (48" radius) having a downward orientation, as depicted in the attached drawing. As the drawing shows, all piping connected below the 90° bends was made of PVC. The entire system measured about 100' in length. The end of the system having the air moving equipment (blower) is commonly known as the "local" station. The opposite end of the system is referred to as the "remote" station. The carrier is transported by vacuum to the station nearest the blower and by pressure to the station farthest from the blower. Both stations have a sliding sleeve covering an access port for carrier entry and removal. The system blower delivered approximately 1.5 p.s.i. pressure and 120 CFM volume. A one-way carrier trip took about 6 seconds to complete.

Two types of carrier wear bands were used on different carriers at certain stages of the tests as outlined below. One was made of acrylic carpeting and the other of a material called VELCRO. Tests of carrier band durability were in progress during the

Page Two

environmental testing. The carrier wear bands were apparently not an important factor in influencing test results. The carriers were operated through the pneumatic tube system on a continuous back-and-forth basis during the sampling period. Since these systems are rarely used on a completely continuous basis in actual field use, these tests should have represented a maximum air contamination condition. 400+ carrier round trips were made during the 5½ hours of consecutive testing.

The only significant difference between the model pneumatic tube system and a similar one in field use was that the Pressure Relief Valve shown in the drawing as being on the horizontal pipe run, was actually located vertically at the "remote" end of the system (see drawing). This modified arrangement should not have made any real difference in observed dust levels.

<u>SAMPLE LOCATION</u>	<u>SAMPLE DURATION</u>	<u>RESULT</u>
1' from "local" end blower exhaust point in center of air stream (i.e., axially).	2 hours	0.0 F/cc
	2 "	<0.1 F/cc
	1½ "	<0.1 F/cc
Area sample in vicinity of "local" end sliding sleeve (operator's position).	2 "	0.0 F/cc
	2 "	0.0 F/cc
	1½ "	0.0 F/cc
Area sample 10' from "local" end blower.	2 "	<0.1 F/cc
	2 "	0.0 F/cc
Area sample 20' from "local" end blower.	2 "	0.0 F/cc
	2 "	<0.1 F/cc
1' from "remote" end pressure relief valve exhaust point in center of air stream (i.e., axially).	2 "	<0.1 F/cc
	2 "	0.0 F/cc
	1½ "	0.0 F/cc
Area sample in vicinity of "remote" end sliding sleeve (operator's position).	2 "	0.0 F/cc
	2 "	0.0 F/cc
	1½ "	0.0 F/cc
Background area samples in warehouse area approximately 75' south of primary sampling area.	1½ "	<0.1 F/cc
	1½ "	<0.1 F/cc

The above results were obtained using the standard Millipore filter sampling/phase contrast microscopy analysis technique called for by NIOSH. Results shown as <0.1 F/cc (fibers/cubic centimeter) were

TRANSITUBE DIVISION, DENVER, COLORADO
FEBRUARY 23, 1977

Page Three

actually small fractions of 0.1 F/cc but were reported this way so as to avoid implying a technique precision that does not exist. Based on the foregoing test results, the particular "point-to-point" system tested should be considered an almost fiber-free operation. All results are well below any currently existing or proposed occupational health standards for airborne asbestos fibers.

These test results should represent a typical operating condition for a well-worn (i.e., several thousand completed carrier trips through the system) pneumatic tube system containing Transite Korduct piping. However, a problem may exist during the initial shakedown operation of a new system based on reported observation (not tested) of a light visible dust coating on carriers probably developing from residual dust on Korduct interiors left during pipe manufacture. Perhaps a washing or cleaning of pipe interiors during fabrication in J-M plants would alleviate this potential dust source. At any rate, the observed dust source should definitely not be ignored.


D. R. CHRISTENSEN
KJW:DRC
Attachment

Manville Service Corporation
Ken-Caryl Ranch P.O. Box 5108
Denver, Colorado 80217
303 978-2000

Manville

December 3, 1982

Nicholas J. Bluchyj
Suite 509
Crystal Plaza 4
1745 Jefferson Davis Highway
Arlington, VA 22202

Dear Mr. Bluchyj:

Data developed by the Johns-Manville Research & Development Center to determine airborne concentrations of asbestos dust when fabricating asbestos cement products with hand tools is enclosed.

Table A gives dust counts, f/cc, when the fabrication was done in a test chamber. Table B shows counts when the work was done in an open room.

Tables 1 and 2 essentially repeat the data given in Tables A and B. They are included here because they add some information (cutting rate).

The tables are followed by description and photos of the tools tested.

Some comments regarding the tests are as follows:

The test chamber is a glove box approximately 30 inches high, 30 inches wide, and 8 feet long. Air is drawn into one end of the chamber, through the area in which the cutting is taking place, and exits at the other end of the chamber carrying light dusts to the baghouse. Baffles inside the chamber direct the dust-laden air past a dust sampler (open face membrane filter) so that the dust generated during the fabricating operation is monitored.

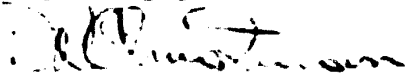
It should be noted that a great deal of work was done during each test, i.e., 4 holes drilled/minute, 18 linear inches cut/minutes, etc. This rate of fabrication is probably higher than would be encountered in the field, and thus, represents a most severe test condition.

Nicholas J. Bluchy
December 3, 1982
Page 2

The results shown in Tables A and 1 represent dust concentrated in a small volume of air carried directly past the samples, giving higher readings than ever encountered in an open area.

In addition to the Johns-Manville data, we have German data covering a handsaw, hood scribe and nippers, hand scribe, hand clippers, hand drill, parallel shears and hood rasp. The results are shown on Table C, with pictures of the tools following. Also refer to the Annex (Testing Procedure) in the AIA Catalogue of Tools.

Very truly yours,



D. R. Christensen, C.I.E.
Manager-In-Training
Occupational Environmental Control
Health, Safety & Environment Department

TABLE A

**TOOLS FOR ASBESTOS CEMENT FABRICATION
TEST CHAMBER (1/4-INCH FLEXBOARD)**

Tool Description	Tool Conditions	Test Duration (Min.)	Work Done	Material Pulverized (gm)	Pulverized Mat'ls Captured (percent)¹	Dust Count (f/cc)	Remarks
Handsaw (Sternit Sag No. 80010)	No vacuum pickup	15	53.5 inches	31	6	0.3	Much debris laborious
Hand rasp	No vacuum pickup	15	225 strokes	17	18	0.8	Much debris

¹Fine material captured by baghouse and/or vacuum cleaner as a percentage of total material pulverized.

TABLE B

**TOOLS FOR ASBESTOS-CEMENT FABRICATION
OPEN ROOM (1/4-INCH FLEXBOARD)**

Tool Description	Test Conditions	Test Duration (Min)	Work Done	Dust Count (f/cc)		Remarks
				Area	Pers.	
Handsaw (Eternit Sag No. 80810)	No vacuum pickup	15	53.5 inches	---	0.1	Much debris
Hand Clippers (Eternit Saks No. 80805)	No vacuum pickup	15	270 inches	0.0	0.3	(1/8 inch A/C)
Scoring Knife (Eternit HiscoKniv No. 80800)	No vacuum pickup	15	272 inches	---	0.8	(1/8 inch A/C)
Hand rasp	No vacuum pickup	40	600 strokes	0.1	0.1	Much debris

TABLE C

TOOL Type, Details	MATERIAL WORKED AT Type, Thickness, etc.	CUTTING CAPACITY m/h, etc.	OPERATION TIME OF TOOL (%)	CONC. £/cm	COMMENTS
HAND SAW	Profile 5, cross cut	16 m/h	23	0.9	
HAND SCRIBERS + NIPPERS	Profile 5, mitring, overlapping 20 cm	60 pieces/h	8.5	0.6	
HAND SCRIBER	Profile 5, longitudinal cut	100 m/h	25	1.0	Problem handling and breaking
	Glass 4 mm	165 m/h	61	1.7	Problem handling and breaking; high working time (61%), not occurring in practice
HAND CLIPPERS				0.1	
HAND DRILL				<0.5	
ANVIL AND AX				<0.5	
PARALLEL SHEARS				<0.5	
HAND RASP				<0.5	
KNIFE RIP				<0.5	
HIDDLER, DEWEENT SHEAR, MODEL 1014	Glass 4 mm	37 m/h	21	0.5	
	Glass 6 mm	37 m/h	23	0.6	
HIDDLER, DANGLIP MODEL B L G	Profile 5, cross cut	21 m/h	16	0.3	

APPENDIX I

TABLE 1. RESULTS OF DUST TESTS CONDUCTED IN DUST TEST CHAMBER (1)

Tool Description	Test Conditions	Test Duration (Min.)	Material Pulverized by Tool			Percent Pulverized Material Captured (2)	Dust Count (#/cc)	Remarks
			No. Holes, No. In., Etc.	Holes Or In./Min.	Material Pulverized Total Or On/Min.			
Hi-Cut Band Saw (Harnit Bag No. 89810)	No shroud, no dust pickup	15	53.5 inches	35.7 inches	31 2.1	6	0.3	Laborious. Coarse dust fell to bottom of chamber, a potential clean-up problem.

(1) Test conditions - Vacuum cleaner air velocity pressure = 3.0 to 3.2 in. Hg. Air velocity pressure through chamber (measured in downstream duct).

(2) Amount captured by vacuum pickup (major) or baghouse (minor) as a percent of material pulverized by tool.

NOTE: Material being fabricated is flat asbestos-cement sheet, 1/4 in. thick.

APPENDIX I

TABLE 2. RESULTS OF DUST TESTS CONDUCTED IN OPEN ROOM

Tool Description	Test Conditions	Test Duration (Min.)	Material Fabricated			Dust Counts (Fibers/cc)		Remarks
			Type	Quantity	Quantity Per Min.	Area	Personal	
Worcon Hand-saw (Eternit Sng No. 80818)	Blade No. 56-10. No dust collection.	15	1/4 in. Flat A/C	53.5 in.	3.57 in.	None taken	0.1	Much coarse material fell to floor, a potential cleanup problem.
Worcon Hand Clippers (Eternit Saks No. 80805)	No dust collection.	15	1/8 in.	270 in.	18.0 in.	0.0	0.3	Some coarse material fell to floor.
Worcon Scoring Knife (Eternit Hissatniv No. 80808)	No dust collection.	15	1/8 in.	272 in.	18.1 in.	None taken	0.0	

CATALOGUE OF TOOLS

for working with asbestos cement products on site

CONTENTS

Asbestos Cement Building Products

Section 1 — Hand-operated tools

Section 2 — Power tools without dust
extraction equipment
(tools to be used in the
open air or for
intermittent periods
indoors are marked (*))

Section 3 — Power tools with dust

extraction equipment
Section 4 — Dust extraction
equipment

Asbestos Cement Pipes

(Tools without dust extraction
equipment)

Section 5 — Low-speed dry-operating
tools

Annex

Testing procedure

1. HAND-OPERATED TOOLS

Caution: Information on these tools
may be obtained from national
asbestos control products



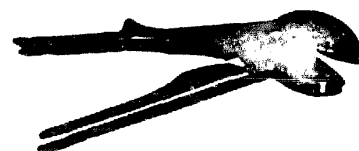
1.1 Scraper
removing corrugated sheets
corrugated tiles in corrugated sheets
cutting flat sheets up to 6 mm



1.2 Hand Saw
up to 20 mm non compressed AC
products
up to 6 mm compressed AC
products



1.3 Rippers
trimming sheets (after scribing) up to
8 mm



1.4 Hand Clippers
cutting up to 6 mm non-compressed
sheets
cutting up to 3 mm compressed
sheets



1.5 Hand Drill
for drilling all AC products using
standard metal drills or
carbide-tipped drills



1.6 Horse and Sister's Hammer
hoisting and cutting slates on the roof



1.7 Parallel Shears
cutting slates and flat sheets up to
900 mm long
punching holes up to 8 mm thick



1.8 Hand Rasp
edge finishing

2. POWER TOOLS WITHOUT DUST EXTRACTION EQUIPMENT

(Tools to be used in the open air or for intermittent periods indoors are marked (*))



2.1 Draenert Shear — Model 1014 DRALO 1013 (2.1)

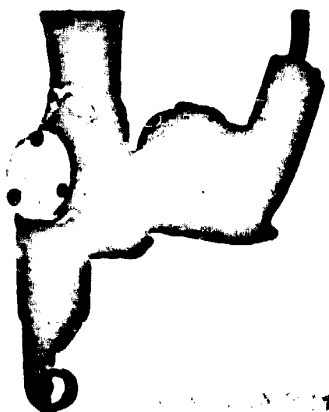
Description: Specific tool (Nibbler)

Use

for cutting flat sheets up to 6 mm
for radius cutting, ≥ 150 mm

Manufacturer

Maas Draenert
Gartenstrasse 15-17
7301 Denkendorf, Esslingen-Neckar
West Germany



2.2 Denclip — Model 8 L G

Description: Specific tool (Nibbler)
using the motor of an electric drill
(BOSCH 1113)

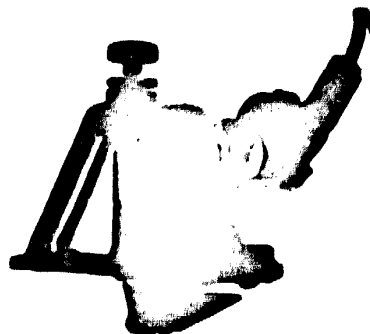
Power: 340 W
Speed: 570 rpm

Use

for cutting corrugated sheets up to
8 mm

Sole distributors

Dansk Eternit Fabrik A/S
P.O. Box 763
DK 9100 Aalborg
Denmark
Telephone: (08) 12 11 22
Telex: 6 97 24 Eterni DK



2.3 Denclip — Model PL

Description: Specific tool (Nibbler)
using the motor of an electric drill
(BOSCH 1113)

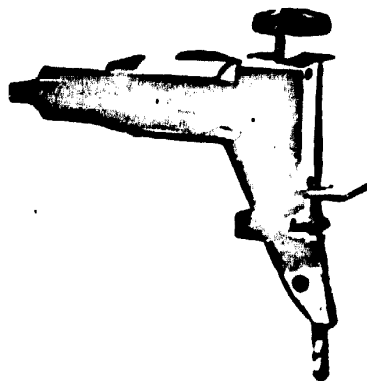
Power: 340 W
Speed: 570 rpm

Use

for cutting flat sheets up to 10 mm

Sole distributors

Dansk Eternit Fabrik A/S
P.O. Box 763
DK 9100 Aalborg
Denmark
Telephone: (08) 12 11 22
Telex: 6 97 24 Eterni DK



(*) 2.4 Fein Jig Saw — Model AST 638

Description

Power: 280 W
Speed: 1600 strokes/min
with guiding device
with tungsten carbide tipped teeth
blade (Ref. Biedron HL 130)

Use

for mitering corrugated sheets
for cross cutting corrugated sheets
for longitudinal cutting corrugated
sheet
hole cutting and cutouts (radius
50 mm and more)

Manufacturers

Driving engine
C & E Fein GmbH
Postfach 172
7000 Stuttgart
West Germany

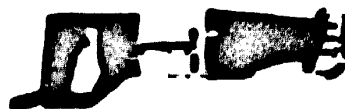
Special guiding device
Heymann
Brighauschstrasse 35
404 Neuss
West Germany

Special blade

Biedron KG
Am Sonnenberg 23
4630 Bochum 5
West Germany

Distributor

Wirtschaftsverband
Adolfstrasse 1 E V
P.O. Box 110620
D 1000 Berlin 11
West Germany
Telephone: 030 34 85 411
Telex: 0181221



(*) 2.5 Milners Falls Super Saw — Model SP 588 R

Description

Power: 580 W
Reciprocating speed: 2500
strokes/min
Blades: G 1034 and G 6034

Use

for mitering and cross-cutting corrugated
sheet

Manufacturer

Ingersoll-Rand Tool Co.
Milners Falls Tool Division
South Deerfield,
Massachusetts,
U.S.A.

Distributor for Europe

Messrs. Prothman Ltd
Bathampton Trading Estate
Yale,
Bristol,
U.K.
Telephone: 0454 319548

Other blades: Carbide-tipped blade
Cat No 887973 in 1/2 61

Manufacturer and distributor for

United States
The Henry G. Thompson Co.,
Branford
Connecticut
U.S.A.

Distributor for all other countries

Milford Saws Ltd
Unit 2
Overthorpe Road Industrial Estate
Banbury,
Oxon
U.K.
Telephone: 0285 52405

ORIGINAL INVOICE

12

MINE SAFETY APPLIANCES CO.
POST OFFICE BOX 360838 M
PITTSBURGH, PA. 15230

DEPT. NO. 4656640099

2621052

PHONE - 412-241-5900

400 PENN CENTER BOULEVARD, PITTSBURGH, PA. 15235

SHIPPED FROM	FOB	TERMS	CUSTOMER ORDER NO.	REQ. NO.	DATE	MSA ORDER NO.
39190 SALT LAKE	FUB SHPT	NET 30 DAYS	Z 27 2184 3	9-13-3		263326

JOHNSMANVILLE CORP
GREENWOOD PLAZA
DENVER COLO 80217JOHNS MANVILLE CORP
10100 UTE ST
JEFFERSON COUNTY COLO
ATTN D CHRISTENSEN

FUTCHKO

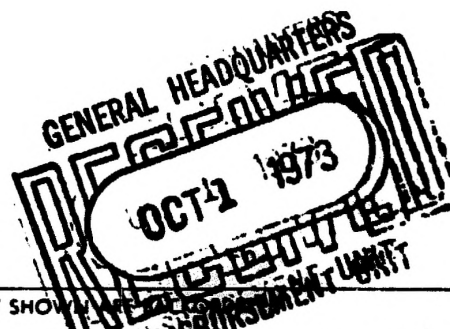
COPIES	RENEG.		TERR.	ST.	CNTY.	CITY	IND.	K	N	CC	TAX CODE	EC	INVOICE DATE	INVOICE NO.
			1811	005	059	0000	0000				12		9-19-73	09/58854/3
SHIPPED V.I.A.						B/L NO.				DATE SHIPPED		SALESMAN		DIST.
RIO GRANDE						220781				9-17-73		J.T.LEECH		SLC

CATALOG NO.	MINOR P. C.	DESCRIPTION	QUANTITY SHIPPED	UNIT PRICE	AMOUNT
10 96000	09	RESPIRATOR DUSTFACE 77	8	5.670 EA	45.36
10 96106	17	FILTER 50/PKG DF 77	2	9.500 EA	19.00
08 456058	10	PUMP ASSEMBLY, MONITAIRE, MODEL G	13	168.000 EA	2,184.00
03 456059	10	BATTERY CHARGER ASSEMBLY MODEL G	15	42.000 EA	630.00
08 456243	10	HOLDER ASSEMBLY, CYCLONE FILTER MOUNT	8	35.000 EA	280.00
					***** 3,158.36
					STATE TAXABLE 3,158.36
					STATE TAX 94.75
					PAY THIS AMOUNT 3,253.11

X00092 - 7c 11990 - 2 - 3,158. -
Y00092 - 63910 - 2 - .36
X07192 - 88812 - 2 - 94.75

NOV 573 51895

CHECK NO.

WE HEREBY CERTIFY THAT AMOUNTS INVOICED
HEREIN DO NOT EXCEED THE LOWER OF (1) THE
CONTRACT PRICE, OR (2) MAXIMUM LEVELS ES-
TABLISHED IN ACCORDANCE WITH CURRENT
PRICE REGULATIONS.ITEMS NOT SHOWN ARE NOT INCLUDED IN THIS INVOICE
UNLESS NOTIFIED WITHIN THIRTY DAYS REGARDING SHORTAGE OR NON-DELIVERY OF SHIPMENT, CLAIMS CANNOT BE HONORED.WE HEREBY CERTIFY THAT THESE GOODS WERE PRODUCED IN COMPLIANCE WITH ALL APPLICABLE REQUIREMENTS OF SECTIONS 4, 7, AND 12 OF THE FAIR LABOR STANDARDS
ACT OF 1938, AS AMENDED, AND OF REGULATIONS AND ORDERS OF THE ADMINISTRATOR OF THE WAGE AND HOUR DIVISION ISSUED UNDER SECTION 14 THEREOF.

26007

Department of Health, Education and Welfare
CDC, NIOSH

Minutes of Meeting Between Johns-
Manville and NIOSH Concerning Asbestos Fiber
Sampling and Analysis

Rockville, Maryland

February 1, 1977

Minutes Prepared By
John M. Dement

Attendees
See Attachment I

Vern Rose, Director, Division of Criteria Documentation and Standards Development, NIOSH welcomed the attendees and introduced the NIOSH personnel in attendance. Mr. Rose stated that minutes would be kept and circulated to all attending parties to be certain that the minutes properly reflect the disposition of points discussed. He then turned the meeting over to Dr. Kotin of Johns-Manville.

Dr. Kotin stated that he viewed this as a technical meeting to discuss measurement techniques for asbestos as mentioned in his letter to Dr. Finklea. Dr. Kotin introduced Johns-Manville personnel in attendance.

Richard Carter of Johns-Manville stated that Johns-Manville was concerned about the accuracy of the asbestos fiber sampling and analysis method at the level recommended by NIOSH. Mr. Carter stated that they were particularly concerned as to the use of this method for compliance purposes and referenced Johns-Manville's comments to the OSHA Docket Office submitted

in April 1976 (Attachment II). This document concluded that the phase contrast counting method was not sufficient to distinguish between 0.5 and 2.0 fibers/cc.

Dr. Chase next stated that the recently released NIOSH document on asbestos referenced a NIOSH document, TR84, concerning asbestos fiber sampling and analysis. Dr. Chase asked if this document had yet been published as he had received several copies labeled as "draft".

Nelson Leidel next stated that the NIOSH asbestos analytical method had been released as a NIOSH Analytical Method (PCA&M No. 239). Mr. Leidel stated that the NIOSH document, TR84, had not yet been published. He distributed the most recent draft to interested parties (Attachment III). Mr. Leidel stated that the counting rules had been changed slightly to eliminate a potential counting bias.

Dr. Chase maintained that a bias could still exist when counting curved fibers.

Mr. Leidel next asked why Johns-Manville had not attempted to contact him directly concerning the precision and accuracy of the NIOSH method as he was senior author on the NIOSH document. Dr. Kotin and Dr. Chase apologized that a discussion with him had not taken place. Dr. Chase stated that he had attempted, unsuccessfully, to contact Mr. Leidel.

Mr. Rose reiterated that the purpose for the meeting was to discuss asbestos sampling methods recommended by NIOSH including the basic approach and the precision and accuracy.

Mr. Leidel next discussed, in some length, the March 1976 draft of TR84 which had been distributed. He stated that all available literature concerning the precision and accuracy of asbestos fiber sampling and analysis including all sources of variability was reviewed. He stated that, after this review, he was still convinced that a coefficient of variation (C.V.) for the entire sampling process could best be estimated at 0.22. Mr. Leidel stated that the C.V. was only used for decisions of compliance versus non-compliance and asked what Johns-Manville would consider an appropriate C.V.

Dr. Chase stated that the C.V. should be applied with reason in decisions of compliance. Dr. Chase stated that he felt that a single value for the C.V. for the entire monitoring process may not be appropriate. He further stated that he was concerned with the inherent variability of the entire process starting with collection of the sample in the field. Dr. Chase maintained that NIOSH was considering only counting variability.

Ken Busch next questioned what Johns-Manville considered error in the method. He stated that experimental error (inter-lab) should not be considered. Mr. Busch stated that the NIOSH Proficiency Analytical Testing Program (PAT) included some laboratories which may not be properly using the prescribed NIOSH methods; therefore, results from these labs should not be used for establishing error in the method. Mr. Leidel stated that spot checks by NIOSH personnel had shown considerable variation in the methods used. John Dement also pointed out that samples prepared for PAT, by ultrasoneration, were much finer in diameter and therefore more difficult to count than actual samples collected in industrial operations.

Dr. Chase asked if NIOSH considered only variability in the method after the sample had reached the lab and asked if variations within OSHA's Salt Lake City lab were considered in the document prepared by NIOSH. Dr. Chase maintained that NIOSH placed considerable weight on the study conducted by Conway and Holland (prepared for the Asbestos Information Association) which considered only within filter and counter variation.

Ken Busch stated that full-period (or consecutive full-period) breathing zone samples represent unbiased estimates of time-weighted-average concentrations and that spatial and time variations should not be included in error estimates. John Dement pointed out that a study conducted by NIOSH and presented by Weidner at the 1972 American Industrial Hygiene Conference had confirmed that breathing zone samples were unbiased.

Dr. Chase again emphasized extreme variations with actual field samples citing Part III of the study by Rajhans and Bragg where side-by-side measurements were taken.

Nelson Leidel pointed out that the Rajhans and Bragg study was difficult to interpret in that only standard deviations were reported. Mr. Leidel stated that the C.V. was a better measure of variability. Mr. Leidel also questioned if the Rajhans study included temporal variations.

Dr. Chase maintained that Part III of the Rajhans study showed differences between controlled and non-controlled conditions.

Nelson Leidel pointed out that field variations should only include errors in sample volume (pump error). Mr. Leidel pointed out that some of the

samples collected by Johns-Manville, reported in their submission to the OSHA Docket Officer and used to calculate C.V.'s, did not follow the NIOSH method in that fiber densities (fibers/field) were very low.

Dr. Chase maintained that the counting Poisson error was important but a minor source of variation. He stated that various sampling times were used for the Johns-Manville study and that sampling time was left to the judgement of the industrial hygienist.

Both Dr. Finkler and Vern Rose asked if 8-hour samples were taken and, if so, were these data analyzed separately from the other data in the statistical analysis performed by Johns-Manville.

Dr. Chase and Denny Christensen stated that only one set of the Johns-Manville samples were collected over an 8-hour period. Denny Christensen stated that difficulty was often experienced in taking extended period samples because contamination by other particulates occurred.

Nelson Leidel asked if the field hygienist collecting the Johns-Manville samples were given the NIOSH report defining minimum sampling times. Mr. Rose also inquired as to the experience level of the hygienist.

Denny Christensen stated that all hygienist were aware of and familiar with the NIOSH report and that all had 7-10 years industrial hygiene experience.

Vern Rose pointed out that samples 1,4,8,9,10 in the Johns-Manville report had concentrations less than 0.5 fibers/cc and that the C.V.'s ranged from 0.3 to

0.6. Mr. Rose questioned, based on this data, if one could not tell the difference between 0.5 and 2.0 fibers/cc as claimed by Johns-Manville in its report. Mr. Rose asked the Johns-Manville attendees what upper range for the C.V. they considered would include all values for C.V.'s obtained.

Dr. Chase stated that he had no estimate as the observed values for the C.V. were extremely variable. Dr. Chase maintained that insufficient data were available for this estimate and that he would make no inference with only a few samples.

Nelson Leidel pointed out that 30 samples with a high number of degrees of freedom were available from the Johns-Manville study. Mr. Leidel asked if an analysis of variance exercise would not be fruitful.

Vern Rose pointed out that the highest C.V. observed was 0.7 and most ranged from 0.5 to 0.6.

Dr. Chase stated that the Johns-Manville study, which covered few industrial operations, was not sufficient for an overall analysis covering the entire industry. Dr. Chase stated that the Rajhans' study (Part I), where identical fields were counted, gave a C.V. up to 0.2.

Nelson Leidel asked if Johns-Manville had performed an analysis of the C.V.'s from data in Table II and III of the study published by Ortiz. Mr. Leidel pointed out that these data, which analyzed both between counter and intra-filter variability, show C.V. values to range from 0.13 to 0.27 with an average of 0.20 to 0.22. Mr. Leidel also stated that these counters were inexperienced.

Both Dr. Kotin and Dr. Chase maintained that these data were only illustrative and non-conclusive. Dr. Kotin also stated that the Los Alamos had been performing dust counting for several years.

After a short break, the meeting was again turned over to Dr. Kotin of Johns-Manville. Dr. Kotin stated that he wished to get the meeting out of a "sparring arena". He stated that Dr. Chase had serious concerns regarding the variability in the entire series of events concerning asbestos fiber sampling. Dr. Kotin stated that, if NIOSH was convinced that these variables were insignificant, the meeting should stop.

Nelson Leidel next asked the Johns-Manville attendees how decisions as to compliance and non-compliance were made from data gathered during Johns-Manville's own sampling program. Vern Rose asked if a C.V. for the asbestos sampling method was used for these decisions and, if so, what value for the C.V. did Johns-Manville use.

Both Denny Christensen and Dr. Chase stated that actual values from the sample results were used with no statistical treatment of the data. Mr. Christensen stated that no single value was used for an operation and that all operations were sampled 4-12 times per year.

Ken Busch pointed out that, if Johns-Manville believed that the C.V. for the asbestos sampling method were as high as 0.6 as they had stated, with a result of 1.4 fibers/cc, actual exposure levels may be as high as 3.0 fibers/cc. Mr. Busch stated that Johns-Manville's failure to use the C.V. in their estimates of compliance and non-compliance must indicate confidence in their sample data.

Dr. Kotin stated that fiber levels in most Johns-Manville operations were less than 2.0 fibers/cc and that most were below 0.5 fibers/cc.

Mr. Christensen again stressed that multiple samples were taken at each sample site over a year period. Dr. Chase again stressed that all components of variability in the field sampling method should be considered.

Both Nelson Leidel and Ken Busch asked Dr. Chase to explain which components of variability were not considered in the NIOSH analysis.

Dr. Chase stated that the Johns-Manville study was only interested in demonstrating variability to be expected from actual field samples; therefore, no analysis was undertaken to isolate major components of variability.

Vern Rose stated that NIOSH would not recommend to OSHA that statistical techniques not be used for compliance/non-compliance situations.

Richard Carter stated that OSHA standards are enforced in an absolute sense without taking into account sample variability.

Dr. Kotin conceded that NIOSH had investigated sources of variability in the asbestos sampling method and that differences expressed at the present meeting were differences in scientific interpretation of data. Dr. Kotin offered

Johns-Manville's assistance in collecting any additional data that NIOSH might desire concerning asbestos sampling methods. Dr. Kotin questioned if the NIOSH recommended standard of 0.1 fibers/cc was not really an euphemism for zero exposures.

Dr. Finklea stated that zero exposures were certainly a goal and product substitution should be of major concern.

The meeting closed with Vern Rose thanking all attendees for their participation.

ATTACHMENT I**Attendees**

Name	Organization	Telephone
Dr. John Finklea	Director, NIOSH	301/443-1530
Nelson A. Leidel	NIOSH Grad. Trainee	617/732-1167
Dr. Paul Kotin	V.P. Johns-Manville	
Dr. J.H. Wills	DCDSD, NIOSH	
Paul Schulte	DCDSD, NIOSH	513/684-8210
John M. Dement	DSHEFS, NIOSH	513/684-3255
Kenneth A. Busch	DTS, NIOSH	513/684-8306
Dr. Jon R. May	DCDSD, NIOSH	301/443-5290
Dr. Irwin P. Baumel	CDB/DCDSD, NIOSH	301/443-4216
Dick Carter	Johns-Manville	303/979-1000
Dr. Jerry Chase	Johns-Manville	303/979-1000
D.R. Christensen	Johns-Manville	303/979-1000 Ex. 4583
Vernon E. Rose	DCDSD, NIOSH	301/443-3680
Ralph Zumwalde	DSHEFS, NIOSH	513/684-3255

MONITORING AND MEASURING AIRBORNE CONCENTRATIONS OF ASBESTOS FIBERSSummary

From a workplace monitoring point of view, an air environment containing 0.5 fibers/cc definitely cannot be distinguished from one of 2.0 fibers/cc with only one or a few determinations, and may not be distinguishable even with many determinations. This conclusion is apparent if the available literature on segments of the monitoring process is critically reviewed, and the conclusion is inevitable if the new theoretical and, most importantly, actual workplace sampling results presented here are added to our limited knowledge of the entire monitoring process.

It is well documented that neither OSHA nor NIOSH clearly understand the "accuracy and precision" of the entire field monitoring process. Citing inadequate and inappropriate data, NIOSH has drawn conclusions that are obviously contradicted not only by previous and newly available studies, but even by other NIOSH data and studies.

Bias from two sources is shown to be present in the monitoring for airborne asbestos fibers: (1) trained, experienced hygienists show large differences in interpreting and counting fibers, even when looking at identical fields of view in the same microscope, and (2) the recommended fiber counting rules have built-in, theoretically proven, biases.

Empirical evidence of large differences between laboratories has been presented. The most relevant data for the investigation of the "accuracy and precision" of the entire monitoring process have been taken from a study of actual workplace simultaneous sampling carried out by Johns-Manville. The decision to undertake such a study was made because of the lack of adequate, appropriate information pertinent to the OSHA proposal to monitor accurately at 0.5 fiber/cc.

A solution frequently offered to improve the precision of the entire monitoring process is to increase the number of microscope fields and/or fibers counted. Theoretical analysis, utilizing empirical results from controlled laboratory experiments and actual workplace sampling, shows that this expensive time-consuming effort would produce a minor measurable or noticeable improvement. Thus, not only is the recommended monitoring method inadequate to monitor a difference between 0.5 f/cc and 2.0 f/cc in the field, but also there are no known modifications to the method that would permit such monitoring.

Introduction

The Occupational Safety and Health Administration's Notice of Proposed Rulemaking -- Occupational Exposure to Asbestos as

published in the Federal Register on October 9, 1975, states in paragraph (e), Monitoring, that: 'The purpose of all monitoring required by this paragraph is to measure accurately the airborne concentrations of asbestos fibers in a workplace to which employees would be exposed if they worked in the area without the use of personal protective equipment, such as respirators. Monitoring shall be performed in a manner reasonably calculated to satisfy this purpose.' (emphasis added)

It is our judgment that the accuracy of the complete monitoring and measurement process has not been adequately studied and, as will be shown, is not clearly understood by either OSHA or NIOSH. Conclusions and recommendations have been made using inadequate and inappropriate data.

The technology that would permit a determination of the true accuracy of the complete process for the monitoring and measurement of airborne asbestos fibers, that is, to determine the closeness of a sampled value to the true airborne fiber concentration, does not exist. In other words, it is not possible to create an airborne asbestos dust cloud with known fiber concentrations, and to monitor that dust cloud using workplace techniques, and thus, to compare the estimate of the airborne fiber concentration, using workplace techniques, with the true airborne fiber concentration. Even though such knowledge of the accuracy of the process would be most desirable, the absence of such knowledge does not preclude its use for some purposes of airborne fiber estimation techniques. Nevertheless, the absence of knowledge of the true accuracy of the method for monitoring and measuring the concentration of airborne asbestos fibers makes it imperative that the limitations of the monitoring and measurement process be clearly understood. It is not sufficient to know that currently measured levels of airborne fibers appear in a general fashion to follow directional differences in the visual or conceptual estimates of the airborne fiber concentrations. A knowledge of the magnitude of the actual inherent variables associated with the monitoring and measurement of airborne asbestos fibers in working environments is essential for the rational use of the complete monitoring process to regulate working environments. Otherwise we will be misled and deluded by a false sense of the meaning of a "measurement" as made by current methods.

Since we do not have an absolute "yardstick" by which to measure airborne asbestos fiber concentrations, it is useful to seek answers to the hypothetical question: What is the valid meaning of a single or even several measurements of the workplace asbestos fiber concentration? Suppose a large number of qualified industrial hygienists were to independently monitor the same work location, at the same instant on the same day: What distribution of the estimates of the airborne asbestos fiber concentration would be observed?

Such a knowledge of the distribution of estimates the individual hygienists would arrive at using their own equipment, calibrations, preparation and counting would give insight on the "empirical precision" of the entire monitoring process. By the "entire monitoring process," we mean the techniques and equipment used to both monitor and measure airborne concentrations of asbestos. By "empirical precision" we mean the variability of repeated measurements taken under equivalent workplace conditions. (The standard deviation is often used to express precision.) Defined in this manner, it is possible to investigate the variability of the entire process for the estimation of airborne asbestos fiber concentrations without knowledge of the "true" airborne asbestos fiber concentrations. Thus, if all hygienists were to arrive always at the same estimate of airborne fibers when sampling under equivalent conditions, the monitoring process would be considered to be very "empirically precise or repeatable," even if it is impossible to determine how "truly accurate or precise" the estimates are relative to the true but unknown airborne asbestos fiber concentrations. The true "accuracy or precision" of any measurement process is generally defined only by the closeness of the measured or computed value to the true value. Our technical inability to determine the true accuracy or precision of the entire asbestos monitoring process makes a determination of the empirical precision of the entire monitoring process imperative before it is possible for employers to monitor for compliance with a standard and for regulating agencies to monitor for compliance, no-compliance decisions. The determination of the empirical precision of the entire monitoring process must be done by actual field (i.e. workplace) sampling. The results from a study designed and conducted by Johns-Manville to offer much-needed information on the empirical precision of the process is presented in later sections.

The first section following the Introduction presents and contrasts pertinent paragraphs from the current and proposed OSHA standards for exposure to asbestos. In the second section, the NIOSH monitoring and measurement procedure recommended in the proposed regulations is briefly reviewed. The sections following that present and discuss empirical evidence on various components of the entire airborne asbestos fiber monitoring process. For example, hygienists differ substantially in their interpretation of identical information. The Johns-Manville factory sampling study results are presented and discussed in a subsequent section. Finally, new theoretical results are presented. The concluding section summarizes the information and implications of this discussion and presentation.

OSHA Standards for Occupational Exposure to Asbestos -- Current and Proposed

The following sections dealing with the permissible exposure limits and monitoring requirements for airborne asbestos fiber concentrations have been reproduced from the current and proposed Part 1910 of the Occupational Safety and Health Standards. The current Standard information is on the left, the proposed is on the right.

Permissible Exposure Limits

Current

(b) Permissible exposure to airborne concentrations of asbestos fibers.

(1) Standard effective July 7, 1972. The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) Standard effective July 1, 1976. The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) Ceiling concentration. No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

Proposal

(c) *Permissible exposure to airborne concentrations of asbestos fibers—(1) 8-hour time-weighted average concentration.* No employee may be exposed to an 8-hour time-weighted average airborne concentration of asbestos fibers in excess of 0.5 fiber per cubic centimeter (or 500,000 fibers per cubic meter) of air, as determined on the basis of a 40-hour work week and by the method prescribed in paragraph (e)(3) of this section.

(2) *Ceiling concentration.* No employee may be exposed to airborne concentrations of asbestos fibers in excess of 5 fibers per cubic centimeter (or 5 million fibers per cubic meter) of air, as determined over a period up to 15 minutes, by the method prescribed in paragraph (e)(3) of this section.

Monitoring Requirements

Current

(e) Method of measurement.

All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 × (magnification) (4 millimeter objective) with phase contrast illumination.

(f) Monitoring.

(1) **Initial determinations.** Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) Personal monitoring.

(i) **Samples** shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) **Sampling frequency and patterns.** After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at

intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

Proposal

(3) **Method of measurement.** All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 × (magnification) (4 millimeter objective) with phase contrast illumination.

(e) **Monitoring.** The purpose of all monitoring required by this paragraph is to measure accurately the airborne concentrations of asbestos fibers in a workplace to which employees would be exposed if they worked in the area without the use of personal protective equipment, such as respirators. Monitoring shall be performed in a manner reasonably calculated to satisfy this purpose. It may not be necessary to monitor every employee exposed to airborne concentrations of asbestos fibers in order to satisfy the purposes of this paragraph. For instance, the employee, or his working location, likely to be exposed to the highest airborne concentration of asbestos fibers in a work area may be deemed a representative of all the employees in the area. An employee in one shift may be deemed a representative of all employees in other shifts who, because they perform the same operation or are stationary in the same area, or for other relevant reasons, may reasonably be considered to have the same level of exposure as the representative employee. However, the results of a monitoring of a representative employee shall be deemed to apply, and to indicate the exposure level of, all employees represented.

(1) **Initial.** Every employer shall cause every place of employment where asbestos fibers may be released to be monitored in such a manner as to determine whether employees are exposed to concentrations of asbestos fibers in excess of either of the two limits prescribed in paragraph (c) of this section. If either limit is exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (1) of this section.

Monitoring Requirements (continued)

Current

(3) Environmental monitoring.

(i) Samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

Proposal

(2) Frequency. (i) If monitoring shows that an employee's exposure is above either limit prescribed in paragraph (c) of this section, the monitoring shall be repeated every month, except as otherwise provided in paragraph (e) (2) (ii) of this section.

(ii) If monitoring shows that an employee's exposure is below both limits prescribed in paragraph (c) of this section, the monitoring shall be repeated every three months, except as otherwise provided in paragraph (e) (2) (i) or (e) (2) (iii), or (e) (2) (iv) of this section.

(iii) If two consecutive monitorings made at least 5 days, but not more than 3 months apart, show that an employee's exposure is below both limits prescribed in paragraph (c) of this section, monitoring need not be repeated, except as otherwise provided in paragraph (e) (2) (iv) of this section.

(iv) Whenever an employer has reason to believe that an employee's level of exposure has changed because of a change in production, process, controls, or other relevant factors, the employee shall be monitored as soon as practicable, and thereafter paragraphs (e) (2) (i), (e) (2) (ii), or (e) (2) (iii) shall apply.

In addition to the changes which can be contrasted above, the October 9, 1975 OSHA proposal contains appendices with the following clarifications:

Appendix B -- Substance Technical Guidelines

Proposal

IV. MONITORING AND MEASUREMENT PROCEDURES

A. General

Measurements taken for the purpose of determining employee exposure are best taken in a fashion such that the average 8-hour exposure may be determined from a single sample or two (2) 4-hour samples. Short time interval samples (up to 30 minutes) may also be used to determine the average exposure level if a minimum of five (5) measurements are taken in random manner over the 8-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that workshift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

The concentration of dust in the air in which a worker is exposed will vary, depending upon the nature of the operation and upon the type of work performed by the operator and the position of the operator relative to the source of the dust. The amount of dust inhaled by a worker can vary daily, seasonally, and with the weather. In order to obtain representative samples of workers' exposures, it is necessary to collect samples under varying conditions of weather, on different days, and at different times during a shift.

The percentage of working time spent on different tasks will affect the concentration of dust the worker inhales since the different tasks usually result in exposure to different concentrations. The percentage can be determined from work schedules and by observation of work routines.

The concentration of any air contaminant resulting from an industrial operation also varies with time. Therefore, a longer sampling time will better approximate the actual average.

With the following recommended sampling procedure, it is possible to collect samples at the workers' breathing zones for periods from 4 to 8 hours, thus permitting the evaluation of average exposures for a half or full 8-hour shift—a desirable and recommended procedure. Furthermore, dust exposures of a more normal work pattern result from the use of personal samplers.

B. Recommended method

The recommended sampling and evaluation method is described in a paper "USPHS/NIOSH Membrane Filter Method for Evaluating Airborne Asbestos Fibers" by Nelson A. Laidel, Stephen G. Bayer and Ralph D. Zumwalt, U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, Ohio 45202 (in press). A brief summary is given below.

Samples are collected by drawing air through a cellulose ester membrane filter by means of a battery powered personal sampling pump. The filter, after collection of the sample, is transformed from an opaque solid to a transparent, optically homogenous gel. The fibers are sized and counted by phase-contrast microscopy at 400-480X magnification.

A comparison of the current and proposed OSHA asbestos regulations reveals:

- 1) The proposal lowers the TWA airborne fiber concentration from 2 f/cc (scheduled for July 1, 1976) to 0.5 f/cc.
- 2) The proposal lowers the permissible ceiling concentration from 10 f/cc to 5 f/cc.
- 3) The current regulations require that "samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers." This is replaced in the proposed regulations by Appendix B which specifically recommends full shift sampling (or a minimum of 5 measurements over the 8-hour work shift).
- 4) Appendix B in the proposal specifically references a NIOSH document for the recommended sampling and evaluation method. Specifically this paper is entitled, "USPHS/NIOSH Membrane Fiber Method for Evaluating Airborne Asbestos Fibers," by Nelson A. Leidel, Stephen G. Bayer and Ralph D. Zumwalde (in press). Two drafts of this document, one dated 11/73 (and stamped SUBMITTED FOR PUBLICATION) and the other dated NOVEMBER 1975 (and stamped DRAFT) have been used for this discussion.

NIOSH Document Cited and Recommended in Appendix B of OSHA (1975) Proposal

The NIOSH document prepared by Leidel, Bayer and Zumwalde contains detailed sections such as Apparatus, Reagents, Sampling and Calibration. The following sections. I Scope and II Summary of Method are from the November 1975 Draft of that document:

USPHS/NIOSH MEMBRANE FILTER METHOD FOR EVALUATING
AIRBORNE ASBESTOS FIBERS

I SCOPE

A. This method describes the equipment and procedures for collecting, mounting, sizing, and counting asbestos fibers on cellulose ester membrane filters in the evaluation of breathing zone samples of airborne asbestos fibers. The purpose of the method is to determine an employee's exposure to airborne asbestos fibers. The method is primarily a personal monitoring technique, but can be used for area monitoring.

B. The method has been successfully applied using 37 mm Millipore AA filters and small battery operated personal sampling pumps at a flow rate of 1.0 to 2.5 liters per minute (lpm) for time periods of a few minutes to 150 minutes at concentrations of 1 to 20 fibers (longer than 5 micrometers)/cubic centimeter. Large deviations from these conditions may result in samples with either too few or too many fibers, which will yield air concentration estimates of low statistical precision and accuracy.

C. This method considers only fibers with a length to width ratio of 3 to 1 or greater and a length greater than 5 micrometers.

II SUMMARY OF METHOD

The sample is collected by drawing air through a membrane filter by means of a battery powered personal sampling pump. The filter is transformed from an opaque solid membrane to a transparent, optically homogeneous gel. The fibers are sized and counted by phase-contrast microscope at 400-450X magnification.

Specific attention must be directed to paragraph I-B which states: "The method has been successfully applied... for time periods of a few minutes to 150 minutes at concentrations of 1 to 20 fibers (longer than 5 micrometers)/cubic centimeter. Large deviations from these conditions may result in samples with either too few or too many fibers, which will yield air concentration estimates of low statistical precision and accuracy. (emphasis added) Incredibly, the 1975 OSHA proposal on asbestos recommends a NIOSH document on measuring airborne asbestos fiber concentrations that specifically concludes there is low statistical precision and accuracy below airborne fiber concentrations of 1.0 fiber/cc, while proposing to monitor and measure fiber concentrations "accurately" at and below the proposed standard of 0.5 fiber/cc. It is obvious that OSHA was negligent in its responsibility to stay abreast of the technology and scientific knowledge related to monitoring and measuring airborne asbestos fibers. Furthermore, it will be clearly documented later in this report that NIOSH has even overstated the precision (claiming it is better than is supported by any available data) of the entire monitoring and measuring procedure for airborne asbestos fibers in the range where NIOSH claims it "has been successfully applied," by referencing inadequate and inappropriate studies.

The following additional sections from the Leidel et al NIOSH document are pertinent to discussions in the following and later sections of this report.

USPHS/NIOSH MEMBRANE FILTER METHOD (continued)
XI PROCEDURE

D. Achieving Comparable Results

1. Size only fibers with a length to width ratio greater than or equal to 3:1.

2. Count only fibers greater than 5 micrometers in length. (Be as accurate as possible in accepting or rejecting fibers near this length). Measure curved fibers along the curve to estimate the total length.

3. Count as many fields as necessary to yield a total count of at least 100 fibers. Exceptions: a) count as least 20 fields even if you count more than 100 fibers, and b) stop at 100 fields even if you haven't reached 100 fibers.

4. Select the field of view without looking through the microscope's eyepieces to eliminate unconsciously selecting "heavy" or "light" areas.

5. The fields are selected along the entire length of a radial line running between the outside perimeter and the tip of the wedge.

6. When an agglomerate (mass of material) covers a significant portion of the field of view (approx. 1/6 or greater) reject the field and select another. (Do not include it in the number of fields counted.) However, report the fact as it may have meaning to sampling or medical personnel.

7. Bundles of fibers are counted as one fiber unless both ends of a fiber crossing another can be clearly resolved.

8. For fibers that cross either one or two sides of the counting field, the following procedure is used to obtain a representative count. First, arbitrarily select: a) the left and bottom sides, and b) the upper and lower left corners and vertical direction as "decision aids."

Then count any fiber greater than 5 micrometers in length, but only if the fiber:

- a. lies entirely within the counting area or,
- b. crosses the left or bottom sides, or
- c. crosses the upper or lower left corners, or
- d. crosses both the top and bottom sides.

Reject and do not count all other fibers. Refer to Figures 4 through 9.

XIII PRECISION AND ACCURACY

A. An accuracy and precision study of the membrane filter counting procedure for asbestos has been conducted by Conway and Holland(12). They conducted an intralaboratory study involving six counters. Three of the counters were experienced while the other three had only a short familiarization with the rules for fiber counting. The conclusions of the study included:

1. The precision of the procedure for filters not containing an abundance of fine fibers can be estimated by a standard deviation of 16.2%. This value includes variation among counters and observed interaction effects.
2. The accuracy of the procedure for similar filters may be estimated for a 100-fiber count by a standard deviation of 21.4%. This assumes that the contribution of the overall variance from the nonuniform fiber distribution is additive.
3. The fiber concentration varies significantly between angular sectors on a given filter. Where approximately 100 fibers are counted, the standard deviation of the fiber count distribution for the whole filter appears to be represented by $1.6 \cdot (n)^{1/2}$, rather than $(n)^{1/2}$ which is a property of the Poisson distribution, where (n) is the total number of fibers counted.
4. A high percentage of very fine fibers on the filter can significantly affect the standard deviation and confidence limits for counts by different counters. After combining variations in fiber concentrations over the entire filter with those for different counters it was concluded:
 - a. For filters with a low concentration of the fibers, the standard deviation is estimated at 21% and the 95% confidence interval is $\pm 43\%$.
 - b. For filters with a high concentration of fine fibers, the standard deviation is estimated at 25% and the 95% confidence interval is $\pm 50\%$.

B. Lynch, Kronoveter, and Leidel(13) have also reported on the precision of the method. Their intralaboratory study utilized the data from a large number of dust counts made by different methods by experienced counters over a period of years in an epidemiologic study of the asbestos products industry. They concluded that the standard deviation of counts of fibers longer than 5 micrometers on membrane filters could be estimated from the relation $\sigma = (n)^{0.591}$. Thus for counts of about 100 fibers, the standard deviation could be estimated at about 15.2% and the 95% confidence limits at $\pm 30.4\%$. These values are lower than the precision values reported by Conway and Holland(12).

C. Systematic inaccuracies can be introduced by the improper choice of microscope or by not checking a particular individual's counts in relation to other counters. Leidel and Busch(14) found that one particular microscope tested yielded counts that were approximately 45% higher on the average than counts from four other microscopes in a phase contrast microscope evaluation. Also, one particular counter produced counts that were 27% higher on the average. Leidel and Busch(14) concluded that a significant difference in asbestos fiber counts can result when the same filters are counted on different makes and models of microscopes. Significant differences can also exist between trained counters. They concluded that any laboratory counting asbestos on membrane filters should be part of an interlaboratory collaborative quality program. This participation will insure that: 1) equipment is properly adjusted and calibrated; 2) counters are properly trained and their counting efficiency is continually evaluated; and 3) comparable results are obtained from each laboratory. This type of quality control program is conducted by NIOSH as the Proficiency Analytical Testing (PAT) program. The PAT program is used by the AIHA as part of their Laboratory Accreditation Program which is partially funded by NIOSH.

A Basic Problem in Counting -- Counter Bias

Referring to Section XI-D, Achieving Comparable Results, reproduced from the NIOSH document in the last section, it would appear on first reading that there is little room for differences between counters as to what is a "countable fiber" and the number of "countable fibers" within a single microscope field of view. In fact differences in interpretation between counters in this regard is a major problem and can, by itself, account for the variation ascribed to the entire monitoring and measuring procedure in Section XIII, PRECISION AND ACCURACY (also reproduced in the last section), of that same NIOSH document. The gross misrepresentation of the precision and accuracy of the entire asbestos monitoring procedure will be dealt with in more detail in a later section of this report. First, let us review the basic problem of counter bias. Differences between counters have been investigated in a variety of studies under different circumstances. However, the best illustration of counter bias is given by Ortiz et al (1975). Table IV from that paper is reproduced below:

TABLE IV
Asbestos Count Data
Four Counters Each Counting the Same
Twenty-Five Fields
(Fibers/mm² Filter Area)

Counters	Sample A	Sample B
1	1034	1966
2	862	2276
3	1000	1862
4	1414	2739
Avg.:	1078	2216
Std. Deviation (σ):	236	403
Coef. of Variation:	0.22	0.18

The four counters each viewed the same 25 microscope fields from sample A (a filter sample) and the same 25 microscope fields from sample B. In other words, a field of view was selected and, without changing the field of view, each of the four counters independently interpreted and counted the asbestos fibers in the field. Using the 0.0029 mm^2 from Table V of that paper, 1000 fibers/ mm^2 corresponds to an average of 2.9 fibers/field and 73 total fibers; 2000 fibers/ mm^2 corresponds to an average of 5.8 fibers/field and 146 total fibers, etc. Referring to sample A results in Table IV above, counters 1,2,3 and 4 counted 75, 62, 73 and 103 total fibers, respectively, while looking at the same 25 fields! Sample B results are similar. The sample coefficients of variation (standard deviation divided by the mean) for observer bias alone were 0.22 (22%) and 0.18 (18%) for samples A and B respectively from Table IV. Referring to Section XIII, PRECISION and ACCURACY, from Leidel et al, coefficients of variation for the entire asbestos counting process are estimated at .25 (25%) and less. Paragraph B of Section XIII, reproduced in the last section of this report, referenced a report by Lynch, Kronoveter and Leidel (unpublished NIOSH report) that estimated the coefficient of variation at about .152 (15.2%) for counts of about 100 fibers. The information contained in the NIOSH-supported study by Ortiz et al (1975) is clearly inconsistent with the estimate taken from the unpublished NIOSH report by Lynch et al. While it must be emphasized that two filters and four counters can only illustrate, not prove, these results do clearly demonstrate the "state of the art." Also, the filters used in the Ortiz et al (1975) study were prepared in liquid (toluene) suspensions, not airborne; therefore other contaminants that frequently are present in the workplace are missing. It is reasonable to speculate that "dirtier" filters, such as filters with other airborne contaminants, would only increase difficulties in reader interpretation and possible bias. When two or more people view identical information, but report different findings or interpretations, it is obvious that the report of a single individual must be viewed in the framework of all possible viewers, not as if a "unique" report (which would be the case if everyone would report the same interpretation) had been given. The work described by Ortiz et al (1975) was "supported" by the National Institute for Occupational Safety and Health. These authors developed techniques to filter liquid suspensions to provide chrysotile asbestos standards for a laboratory proficiency testing program (Proficiency Analytical Testing -- PAT) initiated by NIOSH.

Counter Bias Plus Microscope Intra-Filter Sample Variation

The data presented in the last section were collected from counters interpreting the same microscopic fields of view. Therefore the only variable present was counter bias. However if we add a second variable factor, that is, permit each of the counters to randomly select their fields of view, as is the case in actual field performance, the variation in estimated fiber concentration between counters will be greater than when observer

bias is the only variable factor present.

It must be kept in mind that we are still discussing only sources of error that arise after the filter sample has been collected and a segment of the filter has been mounted on a microscope slide.

Table I from Ortiz et al (1975) is presented below:

TABLE I				
Asbestos Count Data Series 149-152				
(Fibers/mm ² Filter area)				
Counter	Sample Identification Code			
	15-A	15-B	15-C	15-D
1	706	961	1233	2294
2	863	1233	1216	1882
3	1000	1627	2216	3039
4	470	627	940	1353
Average:	760	1118	1373	2142
σ :	227	426	398	711
Coef. Var.:	0.30	0.38	0.44	0.33
Av. Coef. Var.:	0.36			

Table I illustrates typical count data obtained on four separate filter samples (15-A, 15-B, 15-C, 15-D) containing four different asbestos fiber concentrations prepared using the authors' technique to filter liquid suspensions. In this case, each counter was required to randomly select their fields for microscopic review. The differences in asbestos fiber counts between counters are substantially greater than the differences reported in Table IV. For example, the sample coefficients of variation range from .30 (30%) to .44 (44%) in Table I, in contrast to .18 (18%) and .22 (22%) in Table IV. It must be emphasized that the small number of samples used here to illustrate counting problems cannot be interpreted as proof that the coefficient of variation should be one value rather than another. In fact, it is questionable that a single coefficient of variation is appropriate in all situations.

To conclude this section, we quote again from Ortiz et al (1975): "Extensive fiber count data from the quality control program outlined previously has demonstrated that under the ideal conditions of several experienced counters counting the same wedges, using the same optics, variations as large as $\pm 50\%$ are observed, with typical variation on the order of $\pm 30\%$." (emphasis added)

Interlaboratory Counting -- NIOSH PAT Program

The paper of Ortiz et al (1975) documented the technique used to produce "identical and predictable sample standards for use in the NIOSH PAT (Proficiency Analytical Testing) program. We have seen in the preceding comments that observers counting the same

fields (or same filters) from filters produced for that program give dramatically different results.

The 37th round of the NIOSH PAT program has been completed and the summary results have been returned to the participating laboratories. Four asbestos filter samples, prepared using the technique described by Ortiz et al (1975), are sent, along with samples of other contaminants such as lead and silica, to each participating laboratory for each round. (Each laboratory analyzes only the contaminants of interest to its program.) For each round, NIOSH identifies the filters as #1, #2, #3, and #4. The #1 filters for all laboratories for a given round are prepared from a single asbestos fiber solution to be as "identical" as possible. The #2 filters for all laboratories for a given round are prepared from another asbestos fiber solution to be as "identical" as possible, but to give "predictable" fiber concentrations different from the #1 filters. The process is repeated for #3 and #4.

Each participating laboratory returns a single evaluation for each filter, even if several evaluations are done on each filter. Beginning with PAT Round 36, summary results for each filter set (i.e. the set of all #1 filters, the set of all #2 filters, etc.) have been prepared and circulated. Prior to Round 36, the four filter sets for each round were not summarized separately. The asbestos summaries from Rounds 36 and 37 are given in the enclosed table.

NIOSH PAT Rounds 36 & 37
Asbestos Fibers/mm²

<u>PAT Round</u>	<u>Filter No.</u>	<u>No. of Labs*</u>	<u>Arithmetic Mean</u>	<u>Standard Deviation</u>	<u>Coef. of Variation</u>
36	#1	76	1020	562	.55
36	#2	76	1932	1154	.60
36	#3	76	1084	558	.51
36	#4	76	2718	1276	.47
37	#1	74	2760	1278	.46
37	#2	74	1194	540	.45
37	#3	74	2826	1230	.44
37	#4	74	1434	724	.50

*After "outliers" have been removed.

Eighty-four (84) laboratories submitted the readings for all four filters in Round 36, but 8 (9.5%) were not included by NIOSH because they were judged "outliers" (essentially, this happens when some or all of a laboratory's readings are too high or too low when compared with the other laboratories; formally, NIOSH is looking at both intra- and inter-laboratory variation) by the present NIOSH criteria. In Round 37, 4 of 78 (5.1%) laboratory results were judged too extreme (i.e. "outliers"), giving the 74 in the summary table. Extreme readings could be caused by a "bad" filter or the counter (or counters) in a participating laboratory. The documentation of the filter preparation technique by Ortiz et al (1975) suggests that laboratories, not filters, are "outliers." Would these laboratories be recognized as "outliers", and the data therefrom discarded, under actual OSHA field monitoring conditions?

The results from the PAT program tell us that even after removing the 5 to 10 percent most "extreme" laboratories, coefficients of variation as high as .60 (60%) were observed. The fiber counts are reported in fibers/mm² in the PAT program. This is logical because the receiving laboratory can only report the fiber density on the filters. Consider the following hypothetical example, using a lognormal distribution for laboratory counts, to relate fiber/mm² to airborne fiber/cc:

If an 8-hour sample is taken at 2 liters/minute in an environment with an airborne asbestos fiber concentration of 1 fiber/cc, the average fiber concentration on the filter is 1123 fibers/mm². Using a coefficient of variation of 0.60 (60%), the lognormal approximation gives over 6 percent of the laboratories reporting fibers/cc greater than 2.

The lognormal approximation was used because the NIOSH PAT communications have reported that it is a reasonable approximation after outliers are removed. Essentially, the above example means that under the ideal laboratory preparation conditions of the PAT program, NIOSH is finding interlaboratory differences in counting to such an extent that if an 8-hour sample at a 1 fiber/cc airborne fiber concentration were to be taken, more than 6 percent of the good (i.e. not outlier) laboratories would report an estimated fiber/cc greater than 2. This is ignoring 5 to 10 percent of the laboratories giving "extreme" results. Thus, considering all laboratories in the PAT program, perhaps as high as 16 percent would report greater than 2 fibers/cc! This is a 100-percent variation on the high side!

Considering that the filters in the program are produced under controlled conditions, it is apparent that the difficulties in monitoring actual work conditions will result in even greater differences between laboratories. Also, considering the fact that some laboratories may report the average of more than one hygienist (at least one laboratory, Johns-Manville, does), the very real possibility exists that differences between all

Interlaboratory Comparisons of Counts from Factory Samples

Beckett and Attfield (1974) reported the results of a small scale interlaboratory counting study. Tables 2(a) and (b) from that study are reproduced below. All slides reported below were actual airborne concentrations of asbestos fibers taken from a factory environment, except those originating at laboratory G, which were UICC chrysotile.

TABLE 2 (a). RESULTS OF SLIDE EXCHANGE BETWEEN EXPERIENCED LABORATORIES: REPORTED RESULTS FOR CHRYSOTILE ASBESTOS

Slide identification Originating laboratory	Density	Reported counts for each laboratory (10 ³ fibres/cm ²)									
		1	F 2	3	G 1	2	3	H 1	2	3	K 1
F	Light	3.1 f		2.6 f		3.16 f					
	Medium	5.1 f		5.1 f		4.9 f					
	Dense	88.0 g		52.5 g		34.0 g					
F	Light	2.6 f		2.2 f							4.1 g
	Medium	8.9 f		10.7 f							15.2 g
	Dense	65.0 g		42.0 g							47.0 g
G*	Light				1.62 f		2.64 f				10.3 g
	Medium				72.0 g		59.0 g				157.0 g
	Dense				52.6 g		143.0 g				80.0 g
H	Light					3.9 g		1.9 g		1.38 g	
	Medium					4.25 g		2.06 g		1.54 g	
	Dense					66.5 g		46.1 g		85.5 g	
H	Light		1.2 f					2.7 g		n.a.	
	Medium		1.7 f					3.1 g		n.a.	
	Dense		10.7 f					16.6 g		n.a.	
K	Light								1.82 g		2.29 g
	Medium								9.05 g		15.9 g
	Dense								33.5 g		59.0 g

TABLE 2 (b). RESULTS OF SLIDE EXCHANGE BETWEEN EXPERIENCED LABORATORIES: REPORTED RESULTS FOR ANOSITE ASBESTOS

Slide identification Originating laboratory	Density	Reported counts for each laboratory (10 ³ fibres/cm ²)								
		G ^a 1	2	3	J 1	2	3	K 1	2	3
J	Light		1.08 f		1.37 f		1.06 f			
	Medium		4.6 g		2.75 f		3.09 f			
	Dense		6.57 g		6.35 f		5.76 f			
J	Light				3.19 f		3.78 f		4.35 g	
	Medium				6.50 f		6.29 f		8.1 g	
	Dense				8.95 f		7.99 f		9.6 g	
K	Light		1.6 f					2.36 g		2.05 g
	Medium		6.1 f					4.10 g	10.1 g	10.5 g
	Dense		95.0 g					9.56 g		84.4 g

Key: 1. Initial count. 2. Count by recipient laboratory. 3. Repeat count by the originating laboratory. g Grid method of counting. f Full field method. n.a. No count available. *UICC.

hygienists in all the laboratories are greater than the available interlaboratory differences.

The tables should be read as follows: All fiber counts in a single row have been made from the same microscope slide. The numbers at the top of the columns indicate the first, second or third reading from a slide. The f and g represent the full field of view and grid methods of counting, respectively. Consider the first row H (Originating Laboratory) Medium (Density) in Table 2(a). The entry 2.06g (under H,1) indicates an initial reading (for a slide) of $2.06 \times 10^3 = 2,060$ fibres/cm² (or 20.6 fibres/mm²) using the grid (g) method of counting. That slide was sent to laboratory G (under G,2) and the entry is 4.25g giving 4,250 fibres/cm² (42.5 fibres/mm²) using the grid method of counting. The slide was then returned to laboratory H and the final (3rd) count is in column H,3 or 1.54g (i.e. 1,540 fibres/cm² or 15.4 fibres/mm²). A review of the tables will reveal that differences between two laboratories reading the same slide frequently were more than 50 percent of the original reading.

The limited data obtained and reported on the above tables were analyzed by the authors using an additive linear (using logarithms) model. The results of that analysis are difficult to describe without a detailed description of the analysis technique and the results naturally are dependent on the assumptions. (For example, a constant coefficient of variation of the raw count, before taking logarithms, is a questionable assumption we will discuss later.) The data are presented here to illustrate that the limited information currently available in the literature illustrates the problem of the counting portion of the monitoring process. One additional conclusion of the authors concerns counting with the grid method and the full field of view method. The data suggested that counting using the full field of view results in lower counts than the grid method. While this question is still under investigation, theoretical evidence will be given later to support that suggestion.

NIOSH Misrepresentation of the Precision of the Entire Asbestos Monitoring Process

Much of the discussion thus far in this report has dealt with data related in some way to NIOSH. This is not surprising considering that NIOSH (1) recommends procedures. (2) trains personnel and (3) maintains the analysis laboratory for OSHA, for monitoring airborne asbestos fibers.

Some of the visible NIOSH effort, such as the PAT program, is highly commendable. However, some of the NIOSH reports are, at best, inadequate. Furthermore NIOSH is responsible for generating considerable confusion and misunderstanding concerning the precision, true or empirical, of the entire asbestos monitoring process. In that regard, the following data have been taken from Table 2 of Leidel and Busch (1975):

Table 2. Coefficients of Variation for Some Sampling/Analytical Procedures.

<u>Sampling/Analytical</u>	<u>C.V.</u>
Asbestos (Sampling/counting)	0.22

The meaning of the above entry, 0.22, for the asbestos sampling/counting coefficient of variation in the context of the Leidel and Busch (1975) report can best be illustrated by an example:

Suppose a qualified industrial hygienist were to collect a full-period (8-hour) sample in a workplace with an actual airborne asbestos fiber concentration of 1 fiber/cc. According to the Leidel and Busch (1975) report, the standard deviation of the entire asbestos monitoring procedure is $0.22 \times 1 = 0.22$ fiber/cc. Furthermore, the report contends that the chance of an estimate of the fibers/cc airborne concentration above 1.44 fibers/cc is approximately 0.025 (2.5%) and the chance that the estimate will be greater than 2.0 fibers/cc is essentially zero (less than 0.0001 by their model).

The question must be asked: How could the NIOSH authors arrive at such an unsupportable conclusion which is so clearly contradicted by even other NIOSH publications? Recall the hypothetical example derived from data from the controlled conditions of the NIOSH PAT program: an airborne asbestos fiber concentration of 1 fiber/cc would result in 6 to 16 percent of the laboratories giving estimates greater than 2.0 fibers/cc. NIOSH has reported (given in an earlier section of this report) in its PAT program, coefficients of variation in excess of 50 percent (0.50) when comparing the counting results from different laboratories from the solution-prepared samples. Those coefficients of variation were obtained after 5 to 10 percent of the extreme ("outliers") laboratories were removed. As already reported here, Ortiz, et al (1975), a NIOSH-supported research endeavor, reported a coefficient of variation for four counters of approximately 20 percent (C.V. = 0.20) for interpreting and counting identical fields of view on the same microscope!

It is truly inconceivable that Leidel and Busch (1975) could have arrived at such a conclusion. An examination of the "support" that Leidel and Busch give for their coefficient of variation of 0.22 reveals that they referenced: Leidel, N.A., Bayer, S.G., and R.D. Zumwalde, "USPHS/NIOSH Membrane Filter Method for Evaluating Airborne Asbestos Fibers." USPHS. NIOSH Tr-84 (1973).

This reference is an earlier version (that has remained essentially unchanged) of the NIOSH document recommended in the October 1975 OSHA asbestos proposal. Tracing the "support" back further through the Leidel, Bayer and Zumwalde report, two references are given: (1) Conway and Holland (1973) and (2) Lynch, Kronoveter and Leidel (NIOSH unpublished report TX-83). Examination of these two references leads to even more astonishing facts.

The Conway and Holland report was on a limited intra-laboratory counting study utilizing six counters (3 experienced, 3 inexperienced) and only three filters! To even suggest that the variability reported by Conway and Holland (from counters counting from the same filter) is the same as the variability for the entire monitoring process is indicative of a complete lack of understanding of the entire asbestos monitoring problem in the workplace.

The Lynch, Kronoveter and Leidel study utilized a large number of asbestos fiber counts from one laboratory. However, they were looking at variation within each filter and relating it to the mean fiber concentration on the same filter. The fact that they found less variability than Conway and Holland reported is not surprising, since they were studying only part of the factors considered by Conway and Holland. The Lynch, Kronoveter and Leidel study is even more inappropriate than the Conway and Holland study for expressing the precision of the asbestos monitoring problem under field conditions

NIOSH has an obligation to publish competent scientific reports. The complete lack of scientific rigor just discussed is inexcusable and grossly misleading.

The most recent draft of the Leidel, Bayer and Zumwalde report (dated November, 1975) continues to reference the two reports by Conway and Holland, and Lynch, Kronoveter and Leidel. However, it is now noted that microscopes and counters can contribute to the variation, and a third reference by Leidel and Busch is given. Incredibly, it is concluded that participation in the NIOSH PAT program will essentially remove this source of variation. It is obvious that the real scope of the problem was still not clearly understood by the authors in November 1975.

Variation of the Entire Monitoring Process in the Workplace

It has already been noted that the precision of the entire sampling/analytic airborne asbestos monitoring process can only be determined by evaluating differences between simultaneous replications from the initial preparation of the airborne sampling apparatus (i.e. filter preparation, pump calibration, etc.) on through to the preparation of the microscope slide, interpreting and counting fibers, and calculating the estimate. In the previous section of this report, we illustrated the inapplicable

and unrealistic restrictions posed by considering only intralaboratory differences between counters once the sampled filter has reached the laboratory and has been mounted on a microscope slide, or intra-filter variation from a single reading of a slide. The problems posed by sampling in the workplace must also be considered.

Rajhans and Bragg (1975) reported on a study under both controlled laboratory conditions and field (actual factory) conditions. Series III of the study by Rajhans and Bragg consisted of data from a total of five work stations which were sampled from four plants. Seven simultaneous paired samples were taken with the sampling devices approximately 6 inches apart over an 8-hour shift in Plant A, an asbestos-cement pipe plant. Five samples were taken at each of two locations over a period of 75 minutes in Plant B, a brake-lining plant. Seven sets of paired samples were taken at the breathing zone level over a period of 105 minutes in Plant C, a brake-lining and disc pads plant. Four sets of paired samples were taken over 60 minutes in Plant D, which manufactures brake linings.

The collection of simultaneous infield samples is essential to evaluate the empirical precision of the total monitoring process. Unfortunately, the infield study of Rajhans and Bragg (1975) was conducted utilizing different pump flow rates, time limits, etc., than those followed under recommended OSHA/NIOSH procedures in the U.S. Therefore, the results of this study are of limited use in evaluating the empirical precision of the entire monitoring process as performed in the U.S. For example, all tests in Series III were 15-minute samples at pump flow rates of 3 liters/minute. Three liters /minute exceeds the upper pump flow of 2 and 2.5 liters/minute of the British and NIOSH recommendations, respectively. All samples in Series III were taken and counted by the same operator, thus removing the variable factor of interoperator error from the results. The range of fibers/ml (i.e. fibers/cc) counted in Series III is from less than 1 to 4, as can be seen from Figure 5 reproduced below:

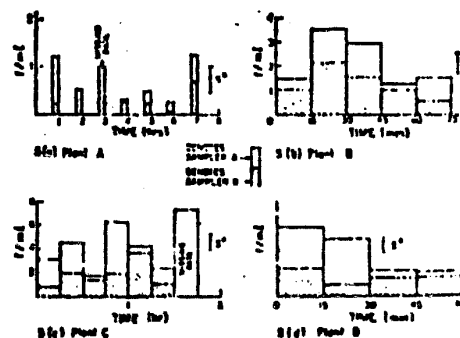


Figure 5 - Air concentration variation with time (Varying scales).

Keeping in mind that the results of the study by Rajhans and Bragg were collected under conditions unique to that study, nevertheless, their conclusion that "it would seem unlikely that the present technique would result in a standard deviation less than 0.5 f/ml" is important to note. Their conclusion that the standard method is sufficiently precise for industrial measurements," is difficult to challenge if for no other reason than the lack of a practical alternative method. In addition, their conclusion must also be qualified in the light of the data of that study, as the authors have done. Although it may be difficult to challenge the conclusion that "the standard method is sufficiently precise for industrial measurements," we, on the other hand, wish to say there are no data available to support a conclusion that the standard method is sufficiently precise for regulatory purposes (compliance enforcement), particularly at airborne concentrations below 2 fibers/cc. For example, using the authors' lower bound of 0.5 fiber/ml for the standard deviation, elementary knowledge of empirical and theoretical distributions associated with airborne asbestos fiber monitoring will show that sample fiber counts in excess of 2 fibers/ml are to be commonly expected even if the overall average is in the range of 0.5 fiber/ml. (E.g. a lognormal distribution with mean and standard deviation of 0.5 and 0.5, respectively, has about 5 percent of the distribution beyond 2.0.)

A NEW STUDY ON THE EMPIRICAL PRECISION OF THE ENTIRE MONITORING PROCESS

Introduction

The lack of available information on the entire workplace monitoring process led to the Johns-Manville decision to carry out a study under field conditions.

Johns-Manville has five Industrial Hygiene Laboratories (4 in the

U.S. and 1 in Canada), all staffed with trained and experienced asbestos-counting hygienists. Between December 1975 and March 1976, samples were collected using static sampling under various factory conditions and analyzed. Static sampling was used for several reasons. In the first place, it is impractical to attach several pumps and filters to the same employee. Also, to achieve the fiber counts in the desired ranges with and without other airborne contaminants, it was sometimes necessary to sample in areas where employees are not routinely working. In addition, sampling was done in areas void of locally erratic air currents. All of these constraining factors support the belief that personal sampling would have resulted in more, not less, variation. In other words, the simultaneous factory sampling in this study was conducted under somewhat "ideal" workplace conditions.

Design

Ten sample locations were selected to give a variety of airborne asbestos fiber concentrations and other contaminants. A variety of sampling times were also selected, with several consecutive sampling periods for some locations. The ten sample locations and the number of samples and sampling times are described in Table 1. Six simultaneous samples were taken at every sampling location for each sample time period. The filters were fixed in a generally circular pattern and separated by 4 to 6 inches. Pump calibrations (2 l/min) were performed before and after the tests (pump calibration was not done after sample number 1, but was performed on all subsequent samples).

The filters were coded and one from each set of six simultaneous filters was sent to each laboratory (the sixth filter has been retained for possible further investigation). Each of the 15 participating hygienists prepared and counted a slide from the filter sent to his or her laboratory. They were asked to follow their usual procedure in the hope that the results would be typical of their routine counting standards.

Representativeness of Participants in This Study

How do the counters participating in this study compare with counters in other laboratories? The main laboratory of the five (laboratory C) participates in the NIOSH PAT program. The PAT filters received by laboratory C are cut into five segments, one segment going to each of the other four laboratories. The filter segments are mounted and counted at the receiving laboratories for an intracompany control program. (Only one reading for each filter can be returned to NIOSH for the PAT program.) Results from the 37th round in the PAT program were received during March 1976. Evaluation of the readers participating in this study (one reader, EJB, did not count), using the NIOSH criteria for rejecting outliers, revealed that none would be rejected. As a group, and individually, the participants tend to count above the PAT program average, but not so that they would be judged outliers (extreme

readings) using the NIOSH criteria. Thus it would appear that the participants in the study now reporting conform to the general class of those comprising the NIOSH PAT program.

Results

The asbestos fiber count from the ten sample locations described in Table 1 are given in Tables 2 through 11, respectively, in the attached appendix. For example, from Table 1, Sample No. 2 was taken from a location 4 feet from an extruder. Three consecutive sets of six filters were used. The first six filters ran for 91 minutes, the second set of six ran for 110 minutes and the third set of filters ran for 115 minutes. One filter from each set was labeled B and sent to the laboratory with reader TFA. Table 3 contains the count data for these three filters for reader TFA. Reading across the row: TFA counted a total of 98 fibers longer than 5 microns in 100 fields of view from the 91-minute filter sample; TFA counted a total of 104 fibers longer than 5 microns in 87 fields of view from the 110-minute filter sample. etc. The entry under F/ML after each filter's fields and fibers count is the estimated airborne fiber count for that reader and filter. For example, the 87 fields and 104 fibers longer than 5 microns for reader TFA from the 110-minute filter from Sample 2 (Table 3) gives an estimated fiber/ml of $104 \times 855 / (110 \times 2000 \times 87 \times .00297) = 1.56$, where $.00297 \text{ mm}^2$ is the area of the counting field for the microscope used in the count. Blank adjustment was not made. All entries in the tables have been rounded to the first decimal. Where several consecutive sets of six filters were taken at a sample location, the estimates of the airborne asbestos fiber concentrations were averaged, weighting each estimate by the time of the sample. The entry in the column for TWA/F/ML is the resulting time-weighted average. For reader TFA in Table 3, this calculation is illustrated by:

$$\frac{91 \times 1.6 + 110 \times 1.6 + 115 \times 1.9}{91 + 110 + 115} = 1.7$$

(The actual calculations were made with rounding done only at the final answer.)

Continuing with the use of Table 3, Sample 2 as an example. three hygienists (readers) independently prepared and counted a segment from each filter A (i.e. readers EJB, LJG and WCBB). Two readers independently prepared and counted a segment from each filter B. etc. The combined use of Table 1 and Tables 2 through 11 will give the data for all readers and filters in this study.

The data have not been "cleaned up" to conform to exact counting

rules. When a reader counted too few filters or fields, that information has been recorded and utilized. Examples of such counts are to be found in Table 4, Sample 3.

Some samples that were taken under very clean (i.e. no other airborne contaminant in the vicinity) conditions resulted in low variation in the final estimates. Sample 1 (Table 2) is a good example. The estimates of airborne fibers/ml (i.e. fibers/cc) ranged from 0.1 to 0.5. Other samples, taken under conditions where other airborne contaminants make fiber interpretation and counting more difficult (these conditions are perhaps the most representative of industrial settings) resulted in very large differences between readers. Sample 2, Table 3, is a good example. The estimates of fibers/ml (i.e. fibers/cc) ranged from 0.5 to 6.1. Sample 5, Table 6, estimates ranged from 1.0 f/ml to 4.4 f/ml. The selection of summary statistics for the data in Tables 1 through 11 is somewhat arbitrary. Formally, the estimates of airborne asbestos fiber concentrations could be viewed as an analysis of variance problem. Considering the filters and readers as "random" factors (effects in statistical jargon), we have an unbalanced one-way random (Model II or components of variance) effects model. Under these assumptions, the total sum of squares about the mean divided by one fewer than the total number of readers gives a conservative estimate of the variance (as a measure of precision) of the total monitoring procedure. This calculation has been used to give the standard deviations of the samples in Table 12 for the 10 samples described in Table 1. The individual sample arithmetic averages, coefficients of variation, medians, and low and high estimates are also given in Table 12. For example, Sample No. 2 gave an average estimate of 1.5 f/ml. The sample standard deviation, described earlier, is 1.5 f/ml. The ratio of the standard deviation divided by the average is 1.00 (100%), the sample coefficient of variation for Sample 2. The median count of 1.1 f/ml is lower than the average of 1.5 f/ml. This is a characteristic of data "skewed to the higher values" and is often found with the measurement of airborne contaminants. This is one reason the lognormal is often used to approximate the empirical distributions. It can be seen from Table 12 that for every sample, the median is equal to or less than the average.

Discussion and Conclusions -- J-M Study

Although a number of individual estimates were in the 0.5 f/ml to 0.9 f/ml range, we did not achieve an overall average for any one sample in that range. (One sample, No. 6 did have a sample median in the 0.5 f/ml to 0.9 f/ml range.) Nevertheless, the study clearly illustrates the conclusions we have been building toward throughout this report.

The true accuracy and precision of the entire monitoring process alleged by NIOSH is clearly not supported by the data presented from this study. It has been shown that other NIOSH data also do

not support the claimed accuracy and precision. It is obvious that to propose the use of a single coefficient of variation to describe the entire monitoring process in all environments is to ignore the facts. The variation of the entire monitoring process depends on many factors, among them and perhaps most importantly other airborne contaminants so commonly present in those factory settings being monitored. Although more data are needed to verify it, logic would dictate that "all other factors being equal," those uncontrollable variables in the entire monitoring process would cause the coefficient of variation to increase for smaller airborne asbestos fiber concentrations. This points out the fact that it becomes virtually impossible to monitor in the framework of compliance to a standard in the range below 2.0 f/ml.

The basic data and conclusions from this study have been presented here. It is obvious that more detailed analyses and summaries can be given. The study will later be detailed and submitted to a refereed professional journal for publication.

THEORY

Introduction and Summary

The following two sections develop theoretical aspects of the USPHS/NIOSH recommended method of counting that, to our knowledge, have not been presented previously. Theoretical knowledge of the separate components of the entire asbestos monitoring system is a prerequisite to an understanding of the system in its entirety.

It is necessary to assume at least an elementary knowledge of calculus and probability in the two theoretical sections. As with the asbestos workplace monitoring study, these results will be rewritten for consideration for publication in a refereed professional journal.

The first theory section shows that the recommended counting rule intrinsically will result in too many fibers being counted. The magnitude of the possible bias is large when compared with the variation attributed to the entire asbestos monitoring process by NIOSH.

The second theory section also shows a bias in the estimation of the airborne asbestos fiber concentration. This bias, while small, also tends to estimate the f/cc too high. The most important result of this second theory section shows that only a minor measurable or noticeable improvement would be produced by increasing the number of microscope fields and/or fibers counted.

Theory: The Probability that a Fiber is Counted,
Bias in the Counting Rule

The purpose of this section is to prove that the probability that a fiber is counted increases with the length of the fiber. This in turn, results in a bias in the estimate of the average number of air-borne asbestos fibers longer than 5 microns per milliliter of air. An understanding of the theoretical aspects of the entire monitoring process is essential for its use in a compliance, no-compliance framework.

The USPHS/NIOSH recommended method of counting, with a calibrated reticle (covering only part of the entire area visible in the microscope field of view) is:

For fibers that cross either one or two sides of the counting field, the following procedure is used to obtain a representative count. First, arbitrarily select: a) the left and bottom sides, and b) the upper and lower left corners and vertical direction as "decision aids."

Then count any fiber greater than 5 micrometers in length, but only if the fiber:

- a) lies entirely within the counting area or,
- b) crosses the left or bottom sides, or
- c) crosses the upper or lower left corners, or
- d) crosses both the top and bottom sides.

Reject and do not count all other fibers.

Define:

LS = length of a side of the counting field (assumed a square)

LF = length of a fiber (assumed straight for this discussion)

θ = angle the fiber makes with the bottom side of the counting field.

Select a point of the viewing field, say the lower right hand corner. While keeping the angle θ constant, we wish to characterize the area described by the lower right hand corner for all possible locations of the view field. (A fiber of no length, i.e. point, will result in an area equal to $(LS)^2$.)

Several cases need to be considered:

Case I: $LF \leq LS$ (i.e. the fiber is shorter than a side of the viewing area.)

The area described by a corner of the viewing field is given by,

$$A(\theta) = (LS)^2 + \sin(2\theta)/4$$

Integrating over θ (i.e. a fiber can fall on a filter in any position, all equally likely)

$$\int_0^{\pi/2} 2 \frac{A(\theta)}{\pi} d\theta = (LS)^2 + (LF)^2/(2\pi)$$

Case II: $LS < LF \leq \sqrt{2} LS$ (i.e. the fiber is longer than a side of the viewing area but shorter than the diagonal)

If $0 \leq \theta \leq \cos^{-1}(LS/LF)$, the area described by a corner of the viewing field is given by:

$$A_1(\theta) = (LS)^2 + (LS)(LF) \sin(\theta) - (LS)^2 \tan(\theta)/2$$

If $\cos^{-1}(LS/LF) < \theta \leq \sin^{-1}(LS/LF)$, the area is given by:

$$A_1(\theta) = (LS)^2 + (LF)^2 \sin(2\theta)/4$$

If $\sin^{-1}(LS/LF) < \theta \leq \pi/2$, the area is given by:

$$A_1(\theta) = (LS)(LF) \sin(\theta) + (LS)^2 \cotn(\theta)/2$$

As in Case I, integrating over θ we have

$$\int_0^{\pi/2} 2A(\theta) d\theta = (2/\pi) \{ (LS)(LF) - (LS)^2 + (LS)((LF)^2)^{1/2} \\ + (LS)^2 \sin^{-1}(LS/LF) + (LF)^2 \cos(2 \cos^{-1}(LS/LF))/8 \\ - (LF)^2 \cos(2 \sin^{-1}(LS/LF))/8 \}$$

Case III: $\sqrt{2} LS < LF$

If $0 \leq \theta \leq \pi/4$, the area is given by

$$A_2(\theta) = (LS)^2 + (LS)(LF) \sin(\theta) - (LS)^2 \tan(\theta)/2.$$

If $\pi/4 < \theta \leq \pi/2$, the area is given by

$$A_2(\theta) = (LS)(LF) \sin(\theta) + (LS)^2 \cot(\theta)/2$$

Integrating, we obtain

$$\int_0^{\pi/2} \frac{2A_2(\theta)}{\pi} d\theta = \frac{(LS)^2}{2} + \frac{2(LS)(LF)}{\pi}$$

Using the areas for the 3 cases, we can construct the following table:

Area/ (LS)² for Selected Values of LF; LS = 50 μ

LF	Case No.	Area/(LS) ²
5 μ	I	1.002
10 μ	I	1.006
20 μ	I	1.025
30 μ	I	1.057
40 μ	I	1.102
50 μ	I/II	1.159
60 μ	II	1.266
70 μ	II/III	1.400
80 μ	III	1.519

Essentially, the table tells us that a 40 μ fiber has about 10% more probability of being "counted" than a 5 μ fiber; an 80 μ fiber has about 50% more probability of being "counted" than a 5 μ fiber; etc. Thus, if the "true" concentration of fibers is 1.0 fibers/field and all the fibers are 5 μ long, the average counted would be 1.002 fibers/field. On the other hand, if the "true" concentration of fibers is 1.0 fibers/field and all the fibers are 80 μ long, the average counted would be 1.519 fibers/field. The actual distribution of fiber lengths will determine how biased the sample estimate will be.

We have been discussing the USPHS/NIOSH recommended counting rule. The recommendation of the joint AIHA-ACGIH Aerosol Hazards Evaluation Committee (1975) results in a greater bias. One remedy for the bias is to only count a fiber if the mid-point of the fiber is in the viewing field (this would require the use of a wide angle ocular instead

of a high point ocular).

The magnitude of the possible bias can be a sizeable portion of the variation attributed to the entire asbestos monitoring by NIOSH. There is clearly a need for more theoretical and empirical studies on the entire asbestos monitoring method.

Theory: The Stopping Rule, Expected Value, Variance
and Coefficient of Variation

Recalling the USPHS/NIOSH recommended method of counting:

Count as many fields as necessary to yield a total count of at least 100 fibers. Exceptions: a) count at least 20 fields even if you count more than 100 fibers, and b) stop at 100 fields even if you haven't reached 100 fibers.

In other words: 1) count 20 fields, then 2) stop if you have counted at least 100 fibers, otherwise continue counting fields until you get either 10 or more fibers or 100 fields, whichever comes first.

Define the following:

T = total count of fibers > 5 microns

N = total number of fields counted ($20 \leq N \leq 100$)

F = T/N, average fiber count in fibers > 5 microns/field

A = area of counting field of a calibrated reticle expressed in mm²/field

V = MP, total volume of air drawn through the filter, in milliliters (ml), where

M = number of minutes for the sample, and

P = pump volume/minute (in ml)

C = true average airborne count in fibers > 5 microns/ml

On the average, the number of ml of air 'passing through' each segment of the filter equal to a field of view (A) is given by:

$$\frac{M \cdot P \cdot A}{855} = \frac{V \cdot A}{855},$$

where 855 mm² is the effective filter area for a 37mm diameter filter.

For example, a 240 minute (4 hr.) sample taken at a pump setting of 2 liter/minute results in 1.404 ml. of air passing through an area equal to .0025 mm², when A = .0025 mm². Therefore, if the average airborne fiber count > 5 microns per ml of air is C, the average fiber count in fibers > 5 microns/field is (1.404)C.

It follows that, if we count T fibers in N fields of view, our sample estimates of C, denoted by $\hat{C}$, is (unadjusted for blanks):

$$\begin{aligned}\hat{C} &= (T/N) / (V \cdot A / 855) \\ &= (855 / V \cdot A) \cdot F \\ &= K \cdot F,\end{aligned}$$

Assume for now that K is known without error (that assumption will be relaxed later). We can express the mean and variance of $\hat{C}$ as

$$\begin{aligned}E(\hat{C}) &= K \cdot E(F) \\ \text{Var}(\hat{C}) &= K^2 \text{Var}(F)\end{aligned}$$

and the coefficient of variation as

$$\begin{aligned}\text{Coef. Var.}(\hat{C}) &= \sqrt{\text{Var}(\hat{C})} / E(\hat{C}) \\ &= \sqrt{\text{Var}(F)} / E(F) \\ &= \sqrt{\text{Var}(T/N)} / E(T/N).\end{aligned}$$

Following this line of reasoning it is easy to fall into the trap of assuming that "counting" the fibers is the major source of error. Unfortunately, that is not true, since the unconditional variation and expectation involve all those factors that influence T and N, beginning with the selection of a clean filter, on through to the "selection" of a counter (hygienist) and the actual "counting". Empirical evidence overwhelmingly shows that consideration of the counting error, conditional on all of the other factors, is not the major source of variation. In fact, we will be able to illustrate how futile and misleading counting more fields and/or fibers can possibly be, by combining theoretical and empirical results.

The distribution of the fibers on the filter has been investigated in a variety of ways. Various comparisons with the Poisson (so called 'uniform') distribution have been made by Lynch, Kronoveter and Leidel (unpublished NIOSH Tr-83), Conway and Holland (1973), Rajhans and Bragg (1975) and Harness (1973). Bartosiewicz (1973) also looked at the distribution of the fibers on the filters. Generally, the intra-filter variation is greater than predicted by the Poisson distribution (that is the basis for the variation incorrectly attributed to the entire monitoring process by Leidel

et al (1975)). Harness (1973), however, states: "the dust particles on well-prepared membrane filters are deposited approximately according to the Poisson Law." It will be informative to evaluate the coefficient of variation assuming that the fibers have a Poisson distribution, with parameter λ , where λ is the mean number of fibers on an area of the filter equal to A. Therefore, letting X be the number of fibers in a randomly selected field:

$$P(X = K) = \lambda^K e^{-\lambda} / K!, K = 0, 1, \dots$$

If the number of fields is fixed, say N' then

$$\begin{aligned} E(F) &= E(T/N') \\ &= \lambda \end{aligned}$$

$$\text{Var}(F) = \lambda/N'$$

and

$$\text{Coef. Var } (\hat{C}) = 1/\sqrt{\lambda N'}$$

This means that if we fixed the number of microscope fields to count, instead of allowing N to be between 20 and 100, the coefficient of variation of the estimate of the airborne asbestos fiber concentration is $(\lambda N')^{-1/2}$, where $\lambda N'$ represents the expected total number of fibers longer than 5 microns. Thus, hypothetically, if we knew λ , the average fibers/field, and selected N' such that $\lambda N' = 100$, the coefficient of variation for $\hat{C}$ is equal to 0.10 (10%). Of course, allowing N to be fixed is artificial, since the stopping rule allows N to range from 20 to 100. Because N is not fixed, the distribution of T, the total number of fibers counted, is not Poisson, even if the fibers are distributed 'uniformly' on the filter. In other words, even if the distribution of fibers/field is Poisson, the fact that the numerator and denominator in F (i.e. T and N, respectively) are both 'random' must be taken into account. Continuing with the assumption that the fibers/field follow a Poisson distribution with parameter λ , the probability that only 20 fields are counted is given by the probability of 100 or more fibers, which is,

$$\sum_{K=100}^{\infty} \frac{(20 \lambda)^K e^{-20\lambda}}{K!} = 1 - \sum_{K=0}^{99} \frac{(20 \lambda)^K e^{-20\lambda}}{K!}$$

For any $20 < N \leq 100$, we stop counting if we have 100 or more fibers and we had fewer than 100 fibers at $N-1$ fields. The probability that we stop at N fields with $K \geq 100$ fibers is,

Intuitively, the slight bias is accounted for by the rule that allows a counter to "go over" the 100 fiber limit, but not to "go under" unless 100 fields are reached.

Thus, if all other errors were negligible, and the fibers followed a Poisson distribution, the coefficient of variation of the entire process (to estimate C, the airborne fiber concentration) would be around 10%.

Turning to empirical evidence, the fiber distributions seem to give coefficients of variation somewhere between the theoretical 0.10 and 0.20 (The NIOSH intra-laboratory study estimated approximately 0.15.) This is for the intra-filter variation alone. Elsewhere in this report we have seen empirical coefficients of variation for the entire monitoring process frequently at 0.5 and above.

Return now to our earlier assumption that K was known without error. In fact, K is also random. If we assume that K and F are statistically independent, we have

$$E(\hat{C}) = E(K) E(F)$$

$$\begin{aligned} \text{Var}(\hat{C}) &= E(K^2)\text{Var}(F) + E^2(F)\text{Var}(K) \\ &\geq E^2(K) \text{Var}(F) + E^2(F) \text{Var}(K). \end{aligned}$$

The coefficient of variation for $\hat{C}$ is thus given a lower bound of,

$$\begin{aligned} \text{Coef Var}(\hat{C}) &\geq \frac{\{ E^2(K) \cdot \text{Var}(F) + E^2(F) \text{Var}(K) \}^{\frac{1}{2}}}{E(K) \cdot E(F)} \\ &= \left[\frac{\text{Var}(F)}{E^2(F)} + \frac{\text{Var}(K)}{E^2(K)} \right]^{\frac{1}{2}} \end{aligned}$$

It is well documented that counters interpret and count differently, laboratories differ, etc. To identify that source of variation in the above equation, we can write:

$$\text{Var}(F) = \text{Var}(F)_d + \text{Var}(F)_o ,$$

where $\text{Var}(F)_d$ is the 'distribution variance' we investigated earlier which, when used with $E(F)$ gave a coefficient of variation between 0.10 and 0.20 and $\text{Var}(F)_o$ is the 'other' variation in F . We thus have,

$$\text{coef. Var } (\hat{C}) > \left[\frac{\text{Var}(F)_d}{E^2(F)} + B \right]^{1/2}$$

where B simply represents $\text{Var}(F)_o / E^2(F)$ plus $\text{Var}(K) / E^2(K)$, the components of the coefficient of variation of C not accounted for by $\text{Var}(F)_d / E^2(F)$, discussed earlier in detail.

Taking $\text{Var}(F)_d / E^2(F)$ to be $(0.10)^2$ and $(0.20)^2$ (the range discussed earlier), and the commonly found empirical coefficient of variation for $\hat{C}$ of 0.5, we find $B \leq 0.24$ and $B \leq 0.21$, respectively. The inequality was due to the use of $E(K^2) > E^2(K)$, which is true for all distributions. Using another inequality, $\text{Var}(F)_o \geq 0$, we can write

$$\text{coef. Var}(\hat{C}) \geq \left[\frac{(E(K^2) \text{Var}(F)_d + E(K^2) - 1)}{E^2(K) E^2(F)} \right]^{1/2}$$

which gives

$$\frac{E(K^2)}{E^2(K)} \leq 1.25$$

for $\text{Coef Var}(\hat{C}) = 0.50$. This in turn gives lower bounds for B of $B > 0.2375$ and $B > 0.20$ for $\text{Var}(F)_d / E^2(F)$ equal to $(0.10)^2$ and $(0.20)^2$, respectively.

Taking the upper value of $(0.20)^2$ for $\text{Var}(F)_d / E^2(F)$, $0.20 \leq B \leq 0.21$. Therefore, if we eliminate the intra-filter distribution error entirely (i.e. $\text{Var}(F)_d = 0$), but keep the other errors between filters, counters, pumps, laboratories, etc, we get

$$0.447 \leq \text{Coef. Var}(\hat{C}) \leq 0.458.$$

(Thus, even taking the extreme value of 0.20 (20%) for the intra-filter fiber coefficient of variation, we see that counting many, many more fields results in a reduction of the coefficient of variation for $\hat{C}$ from 0.50 to about 0.45. More realistic values result in an even smaller improvement.)

Summarizing:

- 1) There is a small but real bias in the estimation of C ($\hat{C}$) due to the stopping rule, assuming a Poisson distribution for the fibers on the filter. Because of the stopping rule, this slight bias is conjectured present regardless of the distribution.
- 2) Assuming only the statistical independence of V and A (the total air volume and the area of the counting field) and F , by combining theoretical and empirical evidence it was proven that counting more fields and/or fibers is not the answer to reducing the coefficient of variation of the sample estimate, C , of the airborne fiber concentration. The independence assumption was one of convenience, the same conclusion would be reached with weaker assumptions, due to small intrafilter variation and large variation inherent in the entire monitoring process.

DISCUSSION AND CONCLUSIONS -- COMPLETE REPORT

In this discussion of the inherent "final number" variation of the entire asbestos monitoring process, we have shown that the problem has been misrepresented and misunderstood. While it may be the best practical method available, it has very limited empirical precision, particularly in lower ranges of airborne fibers. An actual airborne fiber concentration of 0.5 f/cc will routinely produce sample counts of 2.0 f/cc or more.

A solution frequently offered to improve the precision of the entire monitoring process is to increase the number of microscope fields and/or fibers counted. This is an expensive time-consuming effort that perpetuates the misconception that variation of the distribution of fibers on the filter and microscope slide is the only source of variation of any importance. There have been many studies directed at the question of the distribution of fibers on the filter. Are they uniformly distributed (Poisson) or not? We have not dealt with this in detail because it represents only a part of the entire monitoring process. However, we have seen how the inappropriate use of intra-filter variation by Leidel et al resulted in a single coefficient of variation for the entire asbestos monitoring process that was completely unrealistic.

What interpretation can be given to one or a few determinations for the airborne concentration of asbestos fibers in the workplace? It was stated in the Introduction and it warrants repeating in the Conclusion: the technology that would permit a determination of the "true accuracy and precision" for the entire monitoring process for airborne asbestos fibers does not exist. Therefore, it is necessary to interpret workplace estimates (i.e. field sample determinations) of airborne asbestos fiber concentrations in the framework of the "empirical precision" of the entire monitoring process. Controlled laboratory studies, theoretical investigations and, most importantly, actual workplace sampling have shown that, while the mean or median of numerous simultaneous samples may be near a particular number, for example 0.5 fiber/cc, the range of individual estimates taken at the same time and place will be commonly found above 2.0 fibers/cc. The converse is also true. While the mean or median of several simultaneous samples may be near 2.0 fibers/cc, the individual estimates commonly will be found at and below 0.5 fiber/cc. Thus, from a field monitoring point of view, 0.5 fiber/cc definitely cannot be distinguished from 2.0 fibers/cc using only one or a few determinations, and may not be distinguishable even with many determinations. The OSHA proposal to lower the permissible exposure limit from 2.0 fibers longer than 5 microns/cc to 0.5 fiber longer than 5 microns/cc with the expectation of reliably distinguishing between the two conditions in the workplace is clearly unrealistic and without foundation. It is impossible to monitor for the difference between 0.5 f/cc and 2.0 f/cc in the workplace using a monitoring process that cannot distinguish between 0.5 f/cc and 2.0 f/cc!

TABLE 1. Airborne Asbestos Fiber Sample Locations and Durations: Sampling done December 1975 - January, 1976 in Multi-product Industrial Complex: All pumps Calibrated at 2 liter/minute.

Sample No.	Location	No. of Consecutive Sets of 6 filters	Sample Durations (Minutes)
1	Dust collector-clean side	1	375
2	Near extruder (4)	3	91,110,115
3	Beater platform-papermill	1	183
4	Wearing loom-rear	1*	115
5	Paper machine take-off	1	121
6	Willow	5	59,80,80,66,59
7	Between beaters	5	68,84,85,81,80
8	Near winding roll (4')	5	68,81,90,75,84
9	Lath Inspector's Area	5	73,75,102,73,72
10	UPL Inspector's Area	5	70,75,106,69,72

* One pump stopped, only 5 filters in set.

Table 2. Sample 1;

Filter /Reader	FLDS	FIBERS	F/ML
✓ A / EJB	100	44	.2
✓ A / J B	100	55	.2
✓ A / LJC	100	38	.2
✓ A / WCB	100	53	.2
✓ B / RVB	80	100	.5
✓ B / TFA	100	76	.3
✓ C / DAA	100	41	.2
✓ C / DRC	100	44	.2
✓ C / KJA	100	62	.2
✓ C / S G	100	54	.2
✓ D / C P	100	20	.1
✓ D / MVD	100	38	.2
✓ E / RLG	100	52	.2
✓ E / YLA	100	93	.3

Table 3. Sample 2

Filter /Reader	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	TWAF/ML
✓ A / EJB	100	29	.5	✓ 100	42	.6	✓ 100	57	.8	.7
✓ A / LJC	100	34	.6	✓ 100	34	.5	✓ 100	82	1.2	.8
✓ A / WCB	100	56	1.0	✓ 100	36	.5	✓ 100	78	1.1	.9
✓ B / RVB	100	92	1.5	✓ 92	100	1.4	✓ 51	106	2.6	1.9
✓ B / TFA	100	93	1.6	✓ 97	104	1.6	✓ 67	100	1.9	1.7
✓ C / DAA	100	53	.8	✓ 100	69	.9	✓ 80	103	1.6	1.1
✓ C / DRC	100	42	.7	✓ 100	58	.7	✓ 100	49	.6	.7
✓ C / KJA	100	49	.8	✓ 100	104	1.3	✓ 100	104	1.3	1.1
✓ C / S G	100	40	.6	✓ 100	87	1.1	✓ 100	124	1.5	1.1
✓ D / C P				✓ 100	53	.8	✓ 100	20	.3	.5
✓ D / MVD	100	30	.5	✓ 100	47	.7	✓ 100	15	.2	.5
✓ E / RLG	100	75	1.2	✓ 68	100	1.9	✓ 60	101	2.0	1.7
✓ E / YLA	50	126	3.9	✓ 25	127	6.5	✓ 25	153	7.4	6.1

Table 4. Sample 5

Filter /Reader	FLOS	FIBERS	F/ML
A / EJB	20	106	4.8
A / J B	20	97	4.4
A / LJG	20	84	3.8
A / WCB	20	97	4.4
B / RVB	10	100	7.9
B / TFA	32	102	2.5
C / DAA	20	120	4.6
C / DRC	20	119	4.6
C / KJW	20	100	3.9
C / S G	20	143	5.5
D / C P	13	104	7.2
D / MVD	20	107	4.8
E / RLG	20	153	5.8
E / YLA	25	262	8.8

Table 5. Sample 6

Filter /Reader	FLOS	FIBERS	F/ML
A / EJB	100	9	.1
A / J B	100	4	.1
A / LJG	100	9	.1
A / WCB	100	11	.2
B / RVB	100	19	.2
B / TFA	100	6	.1
C / DAA	100	12	.1
C / DRC	100	10	.1
C / KJW	100	5	.1
C / S G	100	7	.1
D / C P	100	7	.1
D / MVD	100	12	.2
E / RLG	100	15	.2
E / YLA	100	10	.1

Table 6. Sample 7

Filter /Reader	FLOS	FIBERS	F/ML
A / EJB	100	101	1.4
A / J B	100	86	1.2
A / JRG	100	76	1.0
A / LJG	100	86	1.2
A / WCB	100	105	1.4
B / RVB	43	104	2.9
B / TFA	51	101	2.4
C / DRC	57	106	2.2
C / KJW	59	102	2.1
C / S G	100	105	1.2
D / MVD	100	77	1.0
E / RLG	55	101	2.1
E / YLA	50	109	4.4

Table 7. Sample B																
Filter /Reader	9			10			11			12						
	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	THAF/ML
A / EJB	✓100	28	.8	✓100	35	.7	✓100	25	.5	✓100	18	.4	✓100	9	.3	.5
A / J B	✓100	34	.9	✓100	30	.6	✓100	14	.3	✓100	13	.3	✓100	10	.3	.5
A / JRG	✓100	26	.7	✓100	26	.5	✓100	15	.3	✓100	12	.3	✓100	4	.1	.4
A / LJG	✓100	29	.8	✓100	33	.7	✓100	20	.4	✓100	17	.4	✓100	13	.4	.5
A / WCB	✓100	29	.8	✓100	35	.7	✓100	18	.4	✓100	23	.6	✓100	10	.3	.5
B / RVB	✓84	101	2.9	✓71	100	2.5	✓76	107	2.5	✓95	100	2.3	✓100	73	1.8	2.4
B / TFA	✓100	34	.8	✓100	40	.7	✓100	23	.4	✓100	29	.6	✓100	31	.8	.7
C / DAA	✓100	38	.9	✓100	62	1.1	✓100	33	.6	✓100	30	.6	✓100	19	.5	.7
C / D&C	✓100	27	.6	✓100	61	1.1	✓100	30	.5	✓100	12	.3	✓100	8	.2	.6
C / KJA	✓100	43	1.0	✓100	65	1.1	✓100	26	.5	✓100	23	.5	✓100	11	.3	.7
C / S G	✓100	38	.9	✓100	75	1.3	✓100	20	.4	✓100	35	.7	✓100	16	.4	.8
D / C P	✓100	62	1.7	✓100	40	.8	✓100	31	.6	✓100	15	.4	✓100	9	.3	.8
D / MVD	✓78	100	3.6	✓75	103	2.8	✓52	100	4.0	✓100	76	1.9	✓100	17	.5	2.6
E / RLG	✓95	100	2.5	✓79	100	2.2	✓100	71	1.2	✓100	46	1.0	✓100	23	.5	1.5
E / YLA	✓100	115	2.7	✓100	74	1.5	✓100	42	.8	✓100	29	.7	✓100	20	.5	1.2

**Filter
/Reader**

CRMC-Christensen-Micro-000144

Table 9. Sample 19

Filter / Reader	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	TWAF/ML
A / EJB	✓100	25	.6	✓100	31	.6	✓100	24	.4	✓100	22	.5	✓100	14	.3	.5
A / J.B	✓100	13	.3	✓100	15	.3	✓100	18	.3	✓100	17	.4	✓100	12	.2	.3
A / JAG	✓100	18	.4	✓100	15	.3	✓100	10	.2	✓100	21	.5	✓100	19	.4	.3
A / JJS	✓100	30	.7	✓100	21	.4	✓100	22	.4	✓100	28	.6	✓100	23	.5	.5
A / WCB	✓100	18	.4	✓100	27	.5	✓100	32	.5	✓100	21	.5	✓100	11	.2	.5
B / RVB	✓100	21	.4	✓100	31	.6	✓100	25	.4	✓100	25	.5	✓100	23	.4	.5
B / TFA	✓100	37	.8	✓100	43	.8	✓100	29	.5	✓100	29	.6	✓100	21	.4	.6
C / DAA	✓100	25	.5	✓100	17	.3	✓100	21	.3	✓100	10	.2	✓100	34	.6	.4
C / DKC	✓100	30	.6	✓100	29	.5	✓100	29	.5	✓100	5	.1	✓100	27	.5	.4
C / KJW	✓100	16	.3	✓100	15	.3	✓100	22	.3	✓100	2	.0	✓100	27	.5	.3
C / S G	✓100	28	.6	✓100	25	.4	✓100	27	.4	✓100	6	.1	✓100	26	.4	.4
D / C P							✓100	8	.1	✓100	17	.4	✓100	27	.5	.3
D / MVD	✓100	15	.4	✓100	12	.2	✓100	8	.1	✓100	11	.2	✓100	16	.3	.3
E / RLG	✓100	30	.6	✓100	14	.2	✓100	25	.4	✓100	6	.1	✓100	25	.4	.4
E / YLA	✓100	33	.8	✓100	27	.5	✓100	26	.5	✓100	6	.1	✓100	29	.6	.5

Table 10. Sample **23**

Filter /Reader	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	FLDS	FIBERS	F/ML	TWAF/ML
✓ / EJB	✓ 100	7	.2	✓ 100	9	.2	✓ 100	8	.1	✓ 100	9	.2	✓ 100	12	.3	.2
✓ / J B	✓ 100	8	.2	✓ 100	5	.1	✓ 100	12	.2	✓ 100	7	.2	✓ 100	16	.4	.2
✓ / JRG	✓ 100	10	.2	✓ 100	15	.3	✓ 100	6	.1	✓ 100	5	.1	✓ 100	9	.2	.2
✓ / LJC	✓ 100	5	.1	✓ 100	6	.1	✓ 100	15	.2	✓ 100	16	.4	✓ 100	18	.4	.2
✓ / WCB	✓ 100	6	.1	✓ 100	4	.1	✓ 100	12	.2	✓ 100	7	.2	✓ 100	15	.3	.2
✓ / RVB	✓ 100	11	.2	✓ 100	9	.2	✓ 100	16	.2	✓ 100	21	.4	✓ 100	22	.4	.3
✓ / TFA	✓ 100	22	.4	✓ 100	27	.5	✓ 100	39	.6	✓ 100	12	.2	✓ 100	42	.8	.5
C / DAA	✓ 100	11	.2	✓ 100	13	.2	✓ 100	18	.2	✓ 100	7	.1	✓ 100	19	.4	.2
C / DRC	✓ 100	11	.2	✓ 100	10	.2	✓ 100	11	.2	✓ 100	5	.1	✓ 100	11	.2	.2
C / KJA	✓ 100	7	.1	✓ 100	7	.1	✓ 100	18	.2	✓ 100	18	.3	✓ 100	10	.2	.2
C / S G	✓ 100	5	.1	✓ 100	13	.2	✓ 100	10	.1	✓ 100	14	.3	✓ 100	21	.4	.2
D / C P	✓ 100	9	.2	✓ 100	9	.2	✓ 100	16	.3	✓ 100	4	.1	✓ 100	17	.4	.2
D / HVD	✓ 100	10	.2	✓ 100	40	.9	✓ 100	72	1.2	✓ 100	4	.1	✓ 100	12	.3	.6
E / RLC	✓ 100	18	.2	✓ 100	27	.5	✓ 100	24	.3	✓ 100	22	.4	✓ 100	44	.9	.4
E / YLA	✓ 100	28	.4	✓ 100	24	.5	✓ 100	42	.6	✓ 100	25	.6	✓ 100	65	1.5	.7

Table 11. Sample **28**Filter
/Reader

FLDS FIBERS F/ML

FLDS FIBERS F/ML

FLDS FIBERS F/ML

FLDS FIBERS F/ML

FLDS FIBERS F/ML

FLDS FIBERS F/ML

TWAF/ML

A / EJB 100 11 .3 100 16 .4 100 13 .2 100 9 .2 100 13 .3 .3

A / J B 100 7 .2 100 18 .4 100 16 .2 100 16 .4 100 9 .2 .3

A / JRG 100 5 .1 100 7 .2 100 8 .1 100 10 .2 100 8 .2 .2

A / LJG 100 11 .3 100 24 .5 100 17 .3 100 14 .3 100 22 .5 .4

A / WCB 100 13 .3 100 12 .3 100 18 .3 100 14 .3 100 5 .1 .3

B / RVB 100 14 .3 100 14 .3 100 23 .3 100 19 .4 100 10 .2 .3

B / TFA 100 33 .7 100 41 .8 100 36 .5 100 8 .2 100 25 .5 .5

C / DAA 100 27 .5 100 32 .6 100 24 .3 100 21 .4 100 19 .4 .4

C / CRC 100 11 .2 100 14 .3 100 11 .1 100 9 .2 100 7 .1 .2

C / KJA 100 19 .4 100 19 .4 100 27 .4 100 13 .3 100 25 .5 .4

C / S G 100 7 .1 100 19 .4 100 12 .2 100 5 .1 100 21 .4 .2

D / C P 100 13 .3 100 13 .3 100 15 .2 100 14 .3 100 14 .3 .3

D / MVD 100 13 .3 100 21 .5 100 12 .2 100 25 .6 100 17 .4 .4

E / RLG 100 12 .2 100 46 .9 100 42 .6 100 39 .8 100 30 .6 .6

E / YLA 100 6 .1 100 17 .4 100 57 .9 100 10 .2 100 22 .5 .5

TABLE 12: Sample Averages, Standard Deviations, Coefficient of Variation, Median, Low count and High Count For Samples given in Tables 2-11.

Sample No.	Average	Std. Dev.	Coef.of var.	Median	Low	High
1	.22	.09	.42	.19	.09	.5
2	1.5	1.5	1.00	1.1	.5	6.1
3	5.1	1.6	.31	4.7	2.5	8.0
4	.13	.05	.40	.13	.06	.24
5	1.8	.9	.50	1.5	1.0	4.4
6	1.0	.7	.70	.7	0.4	2.6
7	4.8	1.1	.23	4.8	2.1	6.7
8	.4	.09	.22	.4	.3	.6
9	.3	.17	.55	.2	.2	.7
10	.3	.13	.37	.3	.2	.6

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To: G. L. Swallow - Denver 1-06

Date: December 6, 1978

From: E. J. Bulava - Manville

Copies: W. B. Reitze - Denver 1-06
N. B. Scheffel - Denver 3-15

Subject: INDUSTRIAL HYGIENE SURVEY
-FLANDERS FILTER - WASHINGTON, N.C.-

The Industrial Hygiene Survey of Flanders Filter, Inc. was conducted on October 17 & 18, 1978, by L.J. Greco. The survey consisted of sixteen samples taken at eleven different locations to determine the occupational exposure to asbestos and microfiber.

The asbestos samples were analyzed optically at 400X and have been reported in terms of fibers per cubic centimeter (F/cc), which is then compared to a 2.0 F/cc TLV. The microfiber samples were analyzed using two distinct types of techniques. First, glass fibers were evaluated in the same manner as for asbestos fiber dust concentrations, but a TLV of 3.0 F/cc is shown for fiberglass dust concentrations. The second utilizes a gravimetric type technique, a weight/ volume result in milligrams per cubic meter (mg/M³) with a 5.00 mg/M³ TLV. Ten of the sixteen samples taken, were evaluated for percent asbestos and microfiber content. The Johns-Manville R & D Center Microscopy Lab, performed the analysis. For details see attached letter.

On October 17, 1978 samples on F800 Filter Media were taken. The product contains both asbestos and microfiber. The following day samples were taken on #700 Filter Media (Pleather), which contains only microfiber. Before sampling began on the second day, each area was cleaned.

The results of the samples were as follows:

D-1 Mixer Operator

Employees: J. Ivey
D. Grimes

Personal samples taken while mixing. Slight visible dust when operator weighs out asbestos fiber-North American asbestos, C10F713 and micro-fiber-Johns-Manville, 104, 106, 110, 112. A 3-M 8710 respirator was worn.

Date	Result	TLV	% Asbestos	% Microfiber
10/17/78	6.9	3.0 F/cc	94	6
	0.36	5.0 mg/M ³		
10/18/78	0.5	3.0 F/cc	0	100
	1.28	5.0 mg/M ³		

D-2 Corrugator Machine Operator

Employee: C. Nagorski

Personal sample taken while operator was feeding asbestos paper-G.A.F.,

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D-2 (con't)

type E-503-HS into Machine. Very slight airborne dust. No respirator was worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>
10/17/78	0.4	20 F/cc

D-3 Weave Operator

Employees: C. Canady, Jr.
K. Mayo

Personal tests taken while operator was weaving in separators. Slight airborne dust. No respirator worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>	<u>% Asbestos</u>	<u>% Microfiber</u>
10/17/78	1.0	3.0 F/cc	2	98
	1.77	5.00 mg/M ³		
10/18/78	1.0	3.0 F/cc	0	100
	0.51	5.00 mg/M ³		

D-4 Band Saw Operator

Employee: M. Weatherington

Personal samples taken while cutting filter media to correct size. Slight to moderate airborne dust. Ventilation system present at saw. No respirator was worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>	<u>% Asbestos</u>	<u>% Microfiber</u>
10/17/78	5.9	3.0 F/cc	1	99
	2.52	5.00 mg/M ³		
10/18/78	1.1	3.0 F/cc	1	99
	1.08	5.00 mg/M ³		

D-5 Clamper Operator

Employees: B. Wooten
L. Danson

Personal samples taken while operator assembled filter box. Very slight airborne dust. No respirator was worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>	<u>% Asbestos</u>	<u>% Microfiber</u>
10/17/78	0.6	3.0 F/cc	1	99
	0.54	5.00 mg/M ³		
10/18/78	0.6	3.0 F/cc	-	-
	0.50	5.00 mg/M ³		

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G. L. Swallow

D-6 Slitter Operator

Employee: F. Kwiatowski

Personal sample taken while operator was slitting asbestos paper - G.A.F., type E-503-HS on slitter. Slight airborne dust present. No respirator was worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>
10/17/78	0.5	2.0 F/cc

D-7 Testing Area Operator

Employee: Tien Pham

Personal test taken while operator was testing F800 Filters. Very slight airborne dust. No respirator was worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>	<u>% Asbestos</u>	<u>% Microfiber</u>
10/17/78	0.2	3.0 F/cc	0	100
	1.21	5.00 mg/M ³		

D-8 Testing #2 Operator

Employee: C. Bembridge

Personal test taken while operator was checking GQT Hepa filters 24" x 48" x 6 3/8", non-asbestos product. Very slight airborne dust. No respirator was worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>
10/17/78	<0.1	3.0 F/cc
	0.99	5.00 mg/M ³

D-9 Paper Mill Operator

Employee: H. Lewis

Personal samples taken on Mill operator. Slight airborne dust present. No respirator was worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>	<u>% Asbestos</u>	<u>% Microfiber</u>
10/17/78	0.4	3.0 F/cc	0	100
	0.52	5.00 mg/M ³		
10/18/78	0.4	3.0 F/cc	-	-
	0.39	5.00 mg/M ³		

D-10 Clean Room

Area sample was taken in constructed clean room with Hepa filters enclosed in ceiling, non-asbestos filters.

<u>Date</u>	<u>Result</u>	<u>TLV</u>
10/17/78	0.0	3.0 F/cc
	0.03	5.00 mg/M ³

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D-11 Bandsaw Operator - Production # 2 Employee: F. Ross

Personal sample taken while operator was trimming #700 superflow filters.
Moderate to excessive visible dust. No respirator was worn.

<u>Date</u>	<u>Result</u>	<u>TLV</u>	<u>% Asbestos</u>	<u>% Microfiber</u>
10/18/78.	7.3 1.79	3.0 F/cc 5.00 mg/M ³	0	100

E. J. Bulava
E. J. Bulava



Johns-Manville

Internal Correspondence

To: E. J. Bulava - Mvl Date: December 1, 1978

From: V. E. Wolkodoff - R&D

Copies: G. L. Swallow - 1-06 S. B. Spencer - R&D
D. R. Christensen - R&D F. D'Ovidio - R&D

Subject: PERCENTAGE OF CROCIDOLITE FIBERS IN THE
PRESENCE OF GLASS MICRO-FIBERS, 0.8 μ m AA
MILLIPORE FILTERS, FLANDERS PLANT,
M78-471

- A. Per your request, Millipore filters from the Flanders plant were analyzed for percentages of "blue" fiber by optical mineralogy. The filters were collapsed and clarified by our standard technique and analyzed at 500X (Leitz Orthoplan) to be compatible with your NIOSH phase contrast microscopy method. If this were not a study of a clean-out method, I would have recommended TEM since so many of the crocidolite fibers were barely detectable (0.2 to 0.3 μ m in diameter) under conditions of best or highest resolution (100X oil immersion objective with use of a condenser having a numerical aperture of 1.30).

Sample Nos. 3714, 3713, 3712, 3711, 3709, and 3708 were collected on October 17, 1978 whereas the remainder were collected on October 18, 1978.

- B. The results are as follows:

Sample No.	Percentage Crocidolite Fibers	Percentage Microfibers
3714	94	6
3713	2	98
3712	ND	100
3711	1	99
3709	1	99
3708	ND	100
3703	ND	100
3707	ND	100
3702	1	99
3717	ND	100
Blank	ND	ND

ND = Not Detected

C. I would like to mention that the following filters contained chrysotile fibers and possibly amosite as well:

3714
3713
3711
3709
3707

Vlad W.

V. E. Wolkodoff

vm

NB 4873, pgs. 130 - 131



Johns-Manville

Internal Correspondence

To G. L. Swallow - Denver 1-07 Date: March 7, 1978

From E. J. Bulava - Manville ✓

Copies:

Subject INDUSTRIAL HYGIENE SURVEY
HOLLINGSWORTH & VOSE COMPANY
WEST GROTON AND EAST WALPOLE, MASS.

The Industrial Hygiene Survey of the Hollingsworth & Vose facilities was conducted on February 2, 1978 and February 28, 1978 by L. J. Greco.

The survey at the West Groton Plant consisted of two locations: Beater Operator and Slitter Operator. An extensive survey was made at each location in question to obtain the respirable dust and fiberglass concentrations.

Until a final version of the silica dust standard is published in the Federal Register, sampling results may be reported in two ways. Both results are determined from a single respirable gravimetric test. The first is in terms of milligrams per cubic meter (mg/M^3) which is obtained by weighing the filter before and after sampling. The second silica method yields a microgram per cubic meter ($\mu\text{g}/\text{M}^3$) result, based against a TLV of $100 \mu\text{g}/\text{M}^3$ of quartz.

Two distinct types of sampling techniques were used in determining the fiberglass exposure. Once again a single membrane filter is employed to yield a count of glass fibers and a gravimetric result. The current NIOSH procedure sets a limit by count of 3.0 fibers per cubic centimeter (F/cc) and by total dust weight of $5.00 \text{ mg}/\text{M}^3$.

Samples were also taken at the two locations using Nuclepore Filters. These tests are being analyzed by electron microscopy and will be reported separately.

Following are the descriptions and results pertinent to the two locations sampled.

D1-WG Beater Operator

Employee: John Froias

Date: 2/2/78

Operator feeds raw materials into beater. Materials fed during the samples were J-M Microfiber #104, #106, #110 and PPG's DE Fiber. Product being made was HB5106.

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D1-WG (cont'd)

<u>Hazard</u>	<u>TLV</u>	<u>Survey Result</u>
<33% Quartz	>0.29	0.05 mg/M ³
Quartz	100	<17.04 µg/M ³
Fiberglass	3.0	0.7 F/cc
Fiberglass	5.00	0.47 mg/M ³

D2-WG Slitter Operator

Employee: Dan Curran

Date: 2/2/78

Operator slitting HB5106 Filter Paper to match order.

<u>Hazard</u>	<u>TLV</u>	<u>Survey Result</u>
<52.6% Quartz	>0.18	0.03 mg/M ³
Quartz	100	<16.56 µg/M ³
Fiberglass	3.0	<0.1 F/cc
Fiberglass	5.00	0.15 mg/M ³

At the East Walpole Plant the sampling was performed in seven locations: Chisel Truck Driver, Beater Operator, Beater Area, Winder and Slitter Area - Near Scale, #2 Machine Winder and Slitter Operator, #2 Machine Tender Area and Warehouse Storage Area. All tests were taken for asbestos fiber exposure. The results of the tests were as follows:

D1-EW Chisel Truck Driver

Employee: Boley Zebrowski

Truck Driver supplies Beater Operator with Paperbestos No. 5.

<u>Date</u>	<u>TLV</u>	<u>Survey Result</u>
2/22/78	2.0	0.1 F/cc
2/22/78	2.0	<0.1 F/cc

D2-EW Beater Operator

Employee: Joe Conley

The Paperbestos Fiber (No. 5) used comes in pulverizable bags. This enables the operator to dump a

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G. L. Swallow

D2-EW (cont'd)

pallet load of fiber into the beater without opening any of the bags.

<u>Date</u>	<u>TLV</u>	<u>Survey Result</u>
2/22/78	2.0	0.1 F/cc
2/22/78	2.0	0.1 F/cc

D3-EW Beater Area

Area sample set up where Paperbestos Fiber (No. 5) is being dumped into beater.

<u>Date</u>	<u>TLV</u>	<u>Survey Result</u>
2/22/78	2.0	0.1 F/cc
2/22/78	2.0	0.1 F/cc

D4-EW No. 2 Machine - Tender Area

The Tender services the entire line in case of a breakdown.

<u>Date</u>	<u>TLV</u>	<u>Survey Result</u>
2/22/78	2.0	0.1 F/cc
2/22/78	2.0	<0.1 F/cc

D5-EW No. 2 Machine - Winder and Slitter Operator

Operator winding and slitting A4221 Gasket Paper.

<u>Date</u>	<u>TLV</u>	<u>Survey Result</u>
2/22/78	2.0	0.1 F/cc
2/22/78	2.0	0.1 F/cc

D6-EW Winder and Slitter Area - Near Scale

Area sample taken near the scale of the Winder and Slitter area.

<u>Date</u>	<u>TLV</u>	<u>Survey Result</u>
2/22/78	2.0	0.2 F/cc
2/22/78	2.0	0.1 F/cc

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D7-EW Warehouse Storage Area

Samples taken in fiber storage area, No. 5 Paperbestos.

<u>Date</u>	<u>TLV</u>	<u>Survey Result</u>
2/22/78	2.0	0.2 F/cc
2/22/78	2.0	0.2 F/cc

Test results of the previously mentioned areas at the East Walpole Plant were all found to be considerably below the asbestos fiber Threshold Limit Value. All the tests were taken while A4221 Gasket Paper was being made.

E. J. Bulava

To: G. L. Swallow - Denver 1-06 Date: December 16, 1977

From: E. J. Bulava - Manville

Copies:

Subject: INDUSTRIAL HYGIENE SURVEY
C. H. DEXTER COMPANY
WINDSOR LOCKS, CONNECTICUT

The Industrial Hygiene Survey of the C. H. Dexter plant was conducted on October 26, 1977, by L. J. Greco. The survey consisted of three locations: Beater Operator, #2 Machine Take-Off Operator, and Slitter Operator. An extensive survey was made at each location in question to obtain the respirable dust and fiberglass concentrations.

Until a final version of the silica dust standard is published in the Federal Register, sampling results may be reported in two ways. Both results are determined from a single respirable gravimetric test. The first is in terms of milligrams per cubic meter (mg/M^3) which is obtained by weighing the filter before and after sampling. The second silica method yields a microgram per cubic meter ($\mu\text{g}/\text{M}^3$) result, based against a TLV of $100 \mu\text{g}/\text{M}^3$ of quartz.

Two distinct types of sampling techniques were used in determining the fiberglass exposure. Once again a single membrane filter is employed to yield a count of glass fibers and a gravimetric result. The current NIOSH procedure sets a limit by count of 3.0 fibers per cubic centimeter (F/cc) and by total dust weight of $5.00 \text{ mg}/\text{M}^3$.

Following are the descriptions and results pertinent to the three locations sampled.

D-1 Beater Operator

Employee: Rich Chabot and Bill Meyers Date: 10/26/77

Operator feeds raw materials into beater. Materials fed during the samples were Kuralow Staple, Tempostran and Chopped Strand. The operator wore a 3M respirator.

<u>Hazard</u>	<u>TLV</u>	<u>Survey Result</u>
25% Quartz	0.37	0.10 mg/M^3
Quartz	100	25.64 $\mu\text{g}/\text{M}^3$
Fiberglass	3.0	1.2 F/cc
Fiberglass	5.00	0.24 mg/M^3

Page Two
December 16, 1977

G. L. Swallow

D-2 #2 Machine Take-Off Operator

Employee: John Scirica and Ed Pagani Date: 10/26/77

Operator winds up the filter paper and then brings roll to slitter room. No respirator worn by operator.

<u>Hazard</u>	<u>TLV</u>	<u>Survey Results</u>
<16.9% Quartz	<0.53	0.07 mg/M ³
Quartz	100	<11.67 µg/M ³
Fiberglass	3.0	0.1 F/cc
Fiberglass	5.00	0.08 mg/M ³

D-3 Slitter Operator

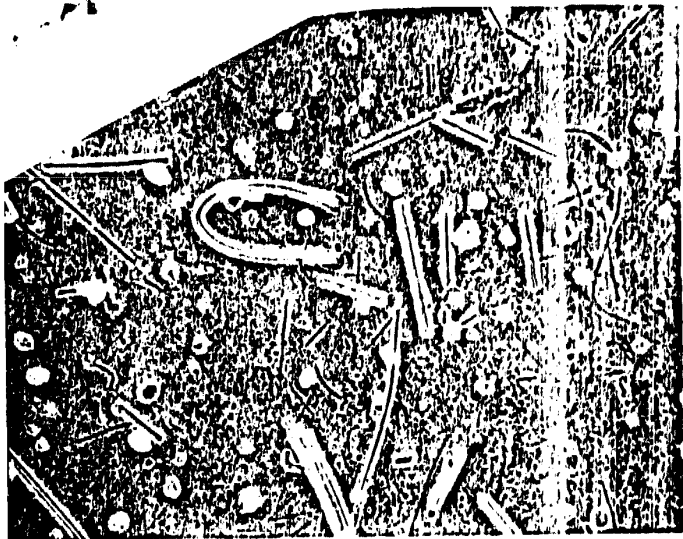
Employee: D. Bruce and J. Moskwa Date: 10/26/77

Operator slitting filter paper roll to match order. Slitting room is totally enclosed. No respirator worn by operator.

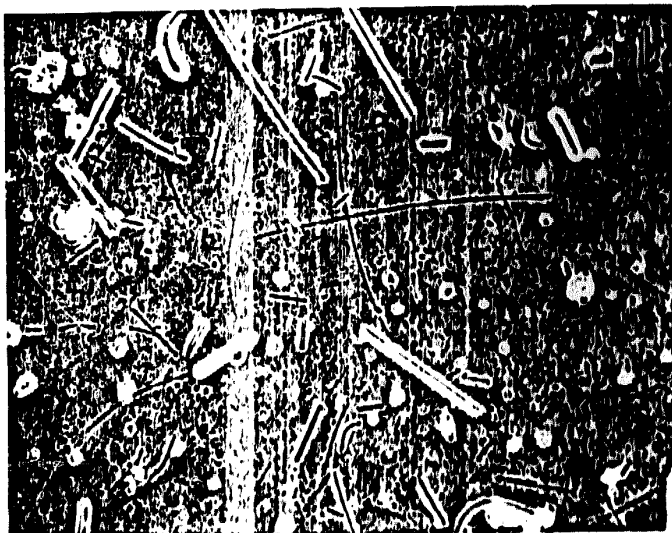
<u>Hazard</u>	<u>TLV</u>	<u>Survey Results</u>
<1.0% Quartz	5.00	0.07 mg/M ³
Quartz	100	N.D.
Fiberglass	3.0	0.2 F/cc
Fiberglass	5.00	0.05 mg/M ³

Samples were also taken at the three locations using Nucle-
pore filters. These tests are being analyzed by electron
microscopy and will be reported separately.

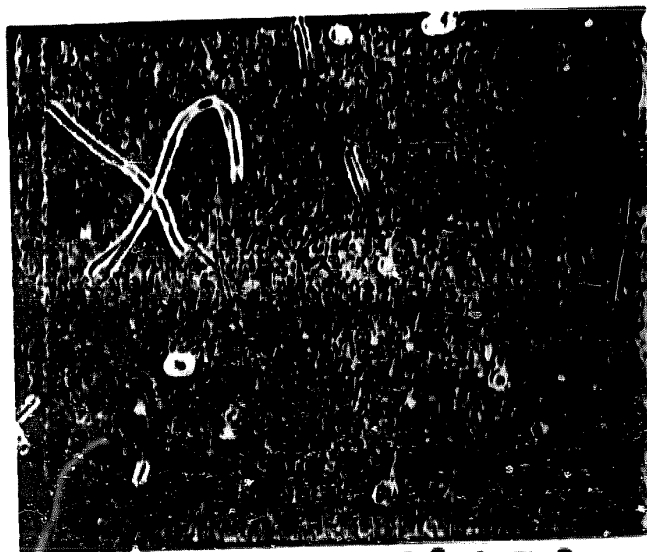
E. J. Bulava
E. J. Bulava



BEATER OPERATOR



TAKE-OFF OPERATOR



SLITTER OPERATOR

Manville

Internal Correspondence

To Attendees

Date December 21, 1982

From K. A. Roberts - 1-06

Copies D. Christensen - 1-06
W. A. Sells - 2-03

J. Hulce - 3-09

Subject MINUTES OF LABELING REVIEW COMMITTEE MEETING
DECEMBER 10, 1982

A meeting of the Labeling Review Committee was held on December 10, 1982. Attending were J. P. Leineveber, R. Anderson, M.D., G. W. Wright, M.D., W. B. Reitze, S. Deshetler, A. L. Masters, G. E. Faas, J. E. Crawford, D. H. Markussan, P. Kotin, M.D., J. Brown, R. M. Hutchison, B. Bryan and K. A. Roberts. Areas of discussion included:

Assignments:

FIBER GLASS

RFA

The RFA for home insulation has been approved and the new plastic bags containing the caution label are being phased into use.

The RFA for industrial products, air filtration and mat is being circulated for approval. HS&E has approved.

International

Brown

Jeff Brown will contact Fred Schlachter regarding the Committee's decision to insist upon the use of the caution worldwide. The Committee accepts the concept of having the international label refer to "all types and makes of fiber glass..."

F/G Health & Safety Brochure

The Committee approved the full version of the proposed brochure (Form 64B) feeling that the abbreviated version would not accomplish the objective of fully informing the user.

Initially, the brochure will not be translated due to the difficulty of adequately translating a technical work. Copies will be provided to all international locations with a request that HS&E be provided with a list of all recipients of the brochure to ensure that they can be copied with updated information.

Leineveber

J. P. Leineveber will work with the F/G advertising manager to have the brochure printed.

shall be used." in the first sentence of paragraph (K)(i).
§ 1910.261. With the remainder of the first sentence and the third sentence being combined into one.

106. Remove paragraph (K)(4)(i) of § 1910.261.

107. Remove the second sentence of paragraph (K)(4)(ii) of § 1910.261.

108. Remove paragraph (K)(4)(iv) of § 1910.261.

109. Remove the second sentence of paragraph (K)(17) of § 1910.261.

170. Remove the third sentence of paragraph (K)(18) of § 1910.261.

171. Remove paragraph (O)(9)(iii) of § 1910.261.

172. Remove the phrase, "and buildings should be designed with explosion relief," in paragraph (K)(1)(iii) of § 1910.261.

173. Remove the phrase, "and should be replaced when necessary," in the second sentence of paragraph (G)(12)(iii) of § 1910.261.

174. Remove paragraph (K)(14)(iv) of § 1910.261.

175. Remove paragraph (K)(19)(i) of § 1910.261.

176. Remove paragraph (K)(19)(ii) of § 1910.261.

177. Remove the second sentence of paragraph (K)(11) of § 1910.261.

178. Remove the second sentence of paragraph (K)(3)(v) of § 1910.261.

179. Remove paragraph (K)(4)(v) of § 1910.261.

180. Remove paragraph (K)(3) of § 1910.261.

181. Remove the second and third sentences of paragraph (K)(18) of § 1910.261.

182. Remove paragraph (K)(19)(ii) of § 1910.261.

183. Remove paragraph (K)(19)(ii) of § 1910.261.

184. Remove the first sentence of paragraph (K)(22) of § 1910.261.

185. Remove paragraph (K)(20)(ii) of § 1910.261.

186. Remove the first and third sentences of paragraph (K)(20) of § 1910.261.

187. Remove the second sentence of paragraph (K)(20) of § 1910.261.

188. Remove the third sentence of paragraph (K)(20) of § 1910.261.

189. Remove the phrase, "and should not be operated at a speed greater than," and "which," in the first sentence of paragraph (K)(1)(iv) of § 1910.262.

190. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

191. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

192. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

193. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

194. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

195. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

196. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

197. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

198. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

199. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

200. Remove the second sentence of paragraph (K)(1)(iv) of § 1910.262.

Amendment [Amended]

101. Remove the second sentence of paragraph (K)(11) of § 1910.261.

102. Remove the second and third sentences of paragraph (K)(1)(iv)(c) of § 1910.261.

103. Remove paragraph (K)(12)(i) of § 1910.261.

104. Remove paragraph (K)(20)(i) of § 1910.261.

105. Remove paragraph (K)(20)(ii) of § 1910.261.

106. Remove paragraph (K)(20)(iii) of § 1910.261.

107. Remove paragraph (K)(20)(iv) of § 1910.261.

108. Remove paragraph (K)(20)(v) of § 1910.261.

109. Remove paragraph (K)(20)(vi) of § 1910.261.

110. Remove paragraph (K)(20)(vii) of § 1910.261.

111. Remove paragraph (K)(20)(viii) of § 1910.261.

112. Remove paragraph (K)(20)(ix) of § 1910.261.

113. Remove paragraph (K)(20)(x) of § 1910.261.

114. Remove paragraph (K)(20)(xi) of § 1910.261.

115. Remove paragraph (K)(20)(xii) of § 1910.261.

116. Remove paragraph (K)(20)(xiii) of § 1910.261.

117. Remove paragraph (K)(20)(xiv) of § 1910.261.

118. Remove paragraph (K)(20)(xv) of § 1910.261.

119. Remove paragraph (K)(20)(xvi) of § 1910.261.

120. Remove paragraph (K)(20)(xvii) of § 1910.261.

121. Remove paragraph (K)(20)(xviii) of § 1910.261.

122. Remove paragraph (K)(20)(xix) of § 1910.261.

123. Remove paragraph (K)(20)(xx) of § 1910.261.

124. Remove paragraph (K)(20)(xxi) of § 1910.261.

125. Remove paragraph (K)(20)(xxii) of § 1910.261.

126. Remove paragraph (K)(20)(xxiii) of § 1910.261.

127. Remove paragraph (K)(20)(xxiv) of § 1910.261.

128. Remove paragraph (K)(20)(xxv) of § 1910.261.

129. Remove paragraph (K)(20)(xxvi) of § 1910.261.

130. Remove paragraph (K)(20)(xxvii) of § 1910.261.

131. Remove paragraph (K)(20)(xxviii) of § 1910.261.

132. Remove paragraph (K)(20)(xxix) of § 1910.261.

133. Remove paragraph (K)(20)(xxx) of § 1910.261.

134. Remove paragraph (K)(20)(xxxi) of § 1910.261.

135. Remove paragraph (K)(20)(xxxii) of § 1910.261.

136. Remove paragraph (K)(20)(xxxiii) of § 1910.261.

137. Remove paragraph (K)(20)(xxxiv) of § 1910.261.

138. Remove paragraph (K)(20)(xxxv) of § 1910.261.

139. Remove paragraph (K)(20)(xxxvi) of § 1910.261.

Amendment [Amended]

101. Remove the second sentence of paragraph (K)(11) of § 1910.261.

102. Remove the second and third sentences of paragraph (K)(1)(iv)(c) of § 1910.261.

103. Remove paragraph (K)(12)(i) of § 1910.261.

104. Remove paragraph (K)(20)(i) of § 1910.261.

105. Remove paragraph (K)(20)(ii) of § 1910.261.

106. Remove paragraph (K)(20)(iii) of § 1910.261.

107. Remove paragraph (K)(20)(iv) of § 1910.261.

108. Remove paragraph (K)(20)(v) of § 1910.261.

109. Remove paragraph (K)(20)(vi) of § 1910.261.

110. Remove paragraph (K)(20)(vii) of § 1910.261.

111. Remove paragraph (K)(20)(viii) of § 1910.261.

112. Remove paragraph (K)(20)(ix) of § 1910.261.

113. Remove paragraph (K)(20)(x) of § 1910.261.

114. Remove paragraph (K)(20)(xi) of § 1910.261.

115. Remove paragraph (K)(20)(xii) of § 1910.261.

116. Remove paragraph (K)(20)(xiii) of § 1910.261.

117. Remove paragraph (K)(20)(xiv) of § 1910.261.

118. Remove paragraph (K)(20)(xv) of § 1910.261.

119. Remove paragraph (K)(20)(xvi) of § 1910.261.

120. Remove paragraph (K)(20)(xvii) of § 1910.261.

121. Remove paragraph (K)(20)(xviii) of § 1910.261.

122. Remove paragraph (K)(20)(xix) of § 1910.261.

123. Remove paragraph (K)(20)(xx) of § 1910.261.

124. Remove paragraph (K)(20)(xxi) of § 1910.261.

125. Remove paragraph (K)(20)(xxii) of § 1910.261.

126. Remove paragraph (K)(20)(xxiii) of § 1910.261.

127. Remove paragraph (K)(20)(xxiv) of § 1910.261.

128. Remove paragraph (K)(20)(xxv) of § 1910.261.

129. Remove paragraph (K)(20)(xxvi) of § 1910.261.

130. Remove paragraph (K)(20)(xxvii) of § 1910.261.

131. Remove paragraph (K)(20)(xxviii) of § 1910.261.

132. Remove paragraph (K)(20)(xxix) of § 1910.261.

133. Remove paragraph (K)(20)(xxx) of § 1910.261.

134. Remove paragraph (K)(20)(xxxi) of § 1910.261.

135. Remove paragraph (K)(20)(xxxii) of § 1910.261.

136. Remove paragraph (K)(20)(xxxiii) of § 1910.261.

137. Remove paragraph (K)(20)(xxxiv) of § 1910.261.

138. Remove paragraph (K)(20)(xxxv) of § 1910.261.

139. Remove paragraph (K)(20)(xxxvi) of § 1910.261.

now covered asphalt fumes. Although this published interpretation did not specifically include the term "asphalt fumes," an earlier reference in OSHA Program Directive #72-31 (July 5, 1972) indicated that § 1910.1000 was intended to apply to asphalt fumes. The Agency incorporated asphalt fumes into this definition because asphalt is a complex mixture of materials, including polycyclic aromatic hydrocarbons such as anthracene, acridine, pyrene, chrysene, phenanthrene and benzo(a)pyrene, that are referenced in Table Z-1 under coal tar pitch volatiles. Many of these same polycyclic hydrocarbons may be detected in the volatile emissions from both asphalt and coal tar pitch.

In a letter dated October 18, 1973, the American Petroleum Institute (API) recommended to OSHA that the definition of coal tar pitch volatiles be amended to refer only to those distillations that are destructive, such as occur from coal or wood distillation, and not the common petroleum distillations that are nondestructive. Subsequently, on August 1, 1975, the Asphalt Institute endorsed the 1973 letter from API and recommended deletion of the standard insofar as it applied to materials not containing significant amounts of hazardous fused polycyclic hydrocarbons. It was the Asphalt Institute's view also that the inclusion of the word destructive would correct the interpretation rendered by OSHA.

In September 1977, the National Institute for Occupational Safety and Health (NIOSH) submitted a criteria document for a recommended standard for occupational exposure to asphalt fumes. That document stated that the toxic effects produced by asphalt, tars, and pitches are quantitatively and qualitatively different. Based on these findings, NIOSH recommended a ceiling concentration limit of 5 mg/m³, based on total particulates, for asphalt fumes.

On February 23, 1978, the Asphalt Institute wrote OSHA urging that asphalt fumes and CTPV be differentiated and that NIOSH's recommended standards be adopted. In a letter dated September 7, 1979, the Agency addressed the Asphalt Institute's recommendations. The Agency acknowledged that asphalt and coal tar pitch may be produced differently and have different uses and properties, but reiterated that both are complex polycyclic aromatic hydrocarbons. Further, the OSHA letter described the air sampling techniques for asphalt and CTPV and the limited circumstances under which citations for violations of 29 CFR 1910.1002 would be issued, as follows:

(1) At the time of inspection employees are found to be exposed to volatile emissions from distillation residues of coal, petroleum, wood, or other organic matter, and

(2) Samples obtained to determine employee exposure to the volatile emissions are found to contain more than 0.3 mg of benzene-soluble material per cubic meter of air, and

(3) Laboratory analysis of the benzene-soluble fraction described in (2) confirms the presence of benzo(a)pyrene and/or one or more of the five additionally named fused polycyclic hydrocarbons to which the standard refers: anthracene, acridine, pyrene, chrysene and phenanthrene.

On June 2, 1980, the Asphalt Institute submitted to OSHA a formal petition requesting that the 0.3 mg/m³ level be declared unenforceable and inapplicable to asphalt fumes and that 29 CFR 1910.1002 be amended to exclude asphalt. The petition also requested a rulemaking to amend 29 CFR 1910.1000 to establish an occupational health standard for exposure to asphalt fumes of 5 mg/m³ as recommended in the NIOSH criteria document and ACGIH's 1971 TLV documentation. That petition was denied on November 23, 1980, by Assistant Secretary Bingham who reiterated the rationale for the interpretation of CTPV that was given in the November 21, 1972 (37 FR 24749) preamble explanation and repeated the limited circumstances that would result in citations.

On April 24, 1981, the Asphalt Institute filed a petition for reconsideration of the Assistant Secretary's denial. It asked the Assistant Secretary to overrule and withdraw the response on the ground that the decision was contrary to law. It also asked for confirmation that 29 CFR 1910.1000 is inapplicable and unenforceable as to asphalt fumes because 29 CFR 1910.1002 was issued without notice and comment. The Asphalt Institute also requested that OSHA amend 29 CFR 1910.1002 to exclude asphalt and that rulemaking procedures be instituted to establish the 5 mg/m³ limit for asphalt fumes.

In reviewing the appeal submitted by the Asphalt Institute, as well as evaluating the NIOSH and ACGIH data and the circumstances surrounding the original interpretation, OSHA has found that its 1972 interpretation of CTPV was not consistent with what ACGIH intended to cover as a coal tar pitch volatile when it adopted its 1929 TLV. This is supported by the adoption in 1971 of an ACGIH TLV for asphalt fumes and its accompanying documentation. ACGIH adopted this TLV based on its explanation that

Asphalt is a native mixture of hydrocarbons which occurs as an amorphous, brownish black solid or semisolid. It results from evaporation of the lighter hydrocarbons from petroleum and partial oxidation of residues. Petroleum asphalt thus is to be differentiated from tar or pitch, which results from the destructive distillation of coal.

Thus OSHA believes that the original ACGIH 1929 standard for CTPV, which was adopted by OSHA in 1971, was not intended to cover asphalt and that OSHA's 1972 interpretation was therefore in error. In addition, OSHA has not successfully enforced this interpretation. To correct this interpretation of CTPV, OSHA intends to amend the definition of coal tar pitch volatiles by deleting the reference to "petroleum, wood, and other organic matter." As amended, the interpretation would read:

As used in § 1910.1000 (Table Z-1) coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal.

While petroleum asphalt will no longer be covered by the coal tar pitch volatiles standard under this interpretation, OSHA considers asphalt fumes to present a recognized hazard to exposed employees and is studying what regulatory response is most appropriate to protect employees from this hazard. In the interim, OSHA may use Section 5(c)(1) of the Act (general duty clause) to provide protection to employees from exposure to asphalt fumes. OSHA's Instruction CPL 230 dated March 17, 1982, contains Agency guidelines for enforcement of Section 5(c)(1).

Summary of Regulatory Impact Assessment and Regulatory Flexibility Certification

The potential economic effects of modifying the interpretation of this regulation have been reviewed. The Secretary has determined that this proposed modification is not a "major" action as defined by Executive Order 12291, Section 1(b). The Secretary also certifies that the action will have no significant economic impact on a substantial number of small entities as defined by the Regulatory Flexibility Act of 1980 (U.S.C. Title 5). The foregoing determinations are based on the following analysis.

1. *Production and use.* Both coal tar pitch and asphalt are produced as by-products of major industrial processes. Coal tar pitch is a distillate of coke which is used in steel production. Asphalt is the residue of petroleum refining. Consequently, the volatility of both products is tied more closely to

demand for steel and petroleum than to direct demand for asphalt or coal tar pitch. In economic terms, the products are supply inelastic.

Asphalt and coal tar pitch are directly competitive in roofing applications and, to a lesser extent, for highway patching and repair. Even in these weather-proofing applications, the two products are not perfect substitutes because coal tar pitch is more pliable and resistant to temperature changes and weather erosion than asphalt. Although coal tar pitch is 50 percent more expensive than asphalt, many builders elect to use coal tar pitch for roofing in the belief that the life cycle costs are less and that the reduced risk of building damage due to roof leaks justifies the greater initial investment.

2. Effects on Competition. Any change in the competitive position of the two products would result from a reappraisal of their relative safety by the products' users. If the modification of the interpretation of the CTPV regulation results in a new impression that asphalt is much safer, the result might be an increased demand for asphalt and a decreased demand for coal tar pitch. Since the supply of neither product can be expected to vary with demand, for the reasons already stated, the relative prices will vary with change in demand.

Price shifts will also be limited by the fact that neither asphalt nor coal tar pitch is predominantly used for roofing applications. Approximately 20 percent of asphalt is used for roofing while less than 10 percent of coal tar pitch is used for roofing. Thus relative prices will be governed by other markets in which the products do not compete directly.

There is no evidence that OSHA compliance costs are a significant aspect in the price of asphalt roofing, or that this action will result in decreased protection for asphalt roofers. The primary determinant of the amount of asphalt fumes is the temperature of the asphalt during its application. Since the temperature of the asphalt must also be controlled to assure proper viscosity, there is no apparent incentive to reduce costs at the expense of worker protection. The cost of applying roofs will not change as a result of this action.

3. No Significant Impacts on Small Entities or the Economy. Since the total 1980 sales of coal tar pitch were approximately \$245.0 million, of which less than 10 percent was used in roofing, it is clear that the proposed action is not "major", as defined by Executive Order 12291. There also will be no significant impact on a substantial number of small entities because roofing contractors have the technology and equipment to

apply either product with virtually no changeover costs.

Public Participation

Since this is a modification of an interpretation, notice and comment would not ordinarily be required under either the Administrative Procedure Act (APA) or section 6(b) of the Occupational Safety and Health Act. However, since this interpretation has been followed since 1972 and was published and codified in the CFR, OSHA has decided to give notice and to invite public comment on the proposed amendment. OSHA wishes to allow those who are familiar with 29 CFR 1910.1002 and have relied on OSHA's interpretation an opportunity to address the intended modification.

Interested persons are invited to submit written data, views and arguments concerning the issues raised in this notice. The comments must be received by August 26, 1982, and submitted in quadruplicate to the Docket Officer, Docket H-385, Room 8-6212, Occupational Safety and Health Administration, U.S. Department of Labor, 3rd Street and Constitution Avenue, NW., Washington, D.C. 20210.

The data, views, and arguments that are submitted will be available for public inspection and copying at the above address. All timely submissions as well as all prior petitions and requests will be reviewed and will be made part of the record of this proceeding.

List of Subjects in 29 CFR 1910

Chemicals, Coal tar, Health, Occupational safety and health.

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Accordingly, pursuant to section 6(g) of the Act, it is proposed to revise 29 CFR 1910.1002 to read as follows:

§ 1910.1002 Coal tar pitch volatility: Interpretation of term.

As used in § 1910.1002 (Table Z-1), coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal.

Authority

This document was prepared under the direction of Thomas G. Aushier, Assistant Secretary of Labor for Occupational Safety and Health, 200 Constitution Avenue, NW., Washington, D.C. 20210.

(Sec. 6 of Act, 29 USC 655; 29 U.S.C. 655; 29 U.S.C. 655; Secretary of Labor's Order No. 6-78 (41 FR 44444))

Signed at Washington, D.C. this 21st day of May 1982.

Thomas G. Aushier,
Assistant Secretary of Labor.

(P) 200-1425 (P) 200-1425 (P) 200-1425
GALLIE CODE 4510-02-0

Mine Safety and Health Administration

30 CFR Parts 55 and 57

Review of Metal and Nonmetal Standards; Extension of Comment Period

AGENCY: Mine Safety and Health Administration, Labor.

ACTION: Notice to extend period for public comment.

SUMMARY: The Mine Safety and Health Administration (MSHA) is extending to June 30, 1982, the period for public comment on metal and nonmetal standards which were the subject of recent public conferences.

DATE: Comments must be received on or before June 30, 1982.

ADDRESS: Office of Standards, Regulations and Variances, MSHA, Room 631, 4015 Wilson Boulevard, Arlington, Virginia 22204.

FOR FURTHER INFORMATION CONTACT: Patrick W. Silvey, Acting Director, Office of Standards, Regulations and Variances, MSHA, (703) 235-2616.

SUPPLEMENTARY INFORMATION: On March 8, 1982 (47 FR 10150), MSHA announced a series of informal public conferences to discuss issues relating to certain standards in 30 CFR Parts 55 and 57 as part of a comprehensive review of safety and health standards that apply to the metal and nonmetal mining and milling industry. These standards address hazards concerning ground control (section 55), fire prevention and control (section 56), air quality (section 57), explosives (section 58), loading, hauling, dumping (section 59), electricity (section 60), use of equipment (section 61), and noisy mines (section 62). MSHA established June 4, 1982 as the date for submission of additional written comments. However, due to requests from several interested parties, MSHA has decided to extend the public comment period to June 30, 1982. All members of the mining community are encouraged to submit additional comments.

During these conferences, several participants urged MSHA to prepare and submit a pre-proposal draft rule for each of the sections selected for review, in consideration of OSHA

file - Marrero - Conner -



Internal Correspondence

To: G. L. Swallow - 4N2
J. N. Siegfried - 4N2

Date: March 23, 1976

From: D. R. Christensen - R&D

Copies: E. J. Riley - Marrero

Subject: **PICTURES AND FIBER COUNTS, ASBESTOS CEMENT MOUND,**
MISSISSIPPI RIVER BANK - MARRERO, L.A. PLANT,
BUILDING MATERIALS MANUFACTURING DIVISION

The pictures and sample results listed in the attached appendices were requested by you as a possible factor in any litigation that may arise from the impending sale of the property.

The attached Appendices, A, B, C, and D, detail results of the above mentioned requests. The special work was done in conjunction with the regularly scheduled survey conducted the week of February 23, 1976.

Appendage A, Pages 1 through 5, are pictures of the **Asbestos Cement Mound** on the banks of the Mississippi River just north of the plant. The pictures tend to show the litter, the lack of vegetation, distances and heights and the erosion that has and is taking place. **Doug Aldinger was amazed at the size of the mound and the debris scattered about.**

Appendage B, describes from what general direction the pictures were taken. Upwind, downwind, on and off the Mound pictures were taken.

Appendage C, is a rough drawing of the Mound in relation to size, distance from road, height as compared to the natural bank, etc.

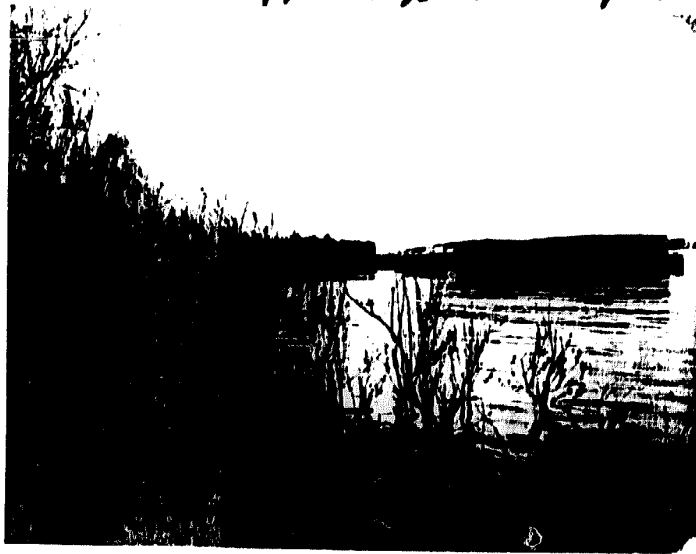
Appendage D, are the results of the **fiber counts taken upwind, downwind and on the Mound.** Although the day was relatively calm, a prevailing breeze was blowing from the Northwest at the time of the sampling. The filters left on the Mound attracted some curiosity seekers, for one of the filters had a finger print on it. This however, did not interfere with the analytical procedure.

DRC
D. R. Christensen

DAA:DRC

ee

CRMC-Christensen-Micro-000168



1



2



3



4



5



6



7



8



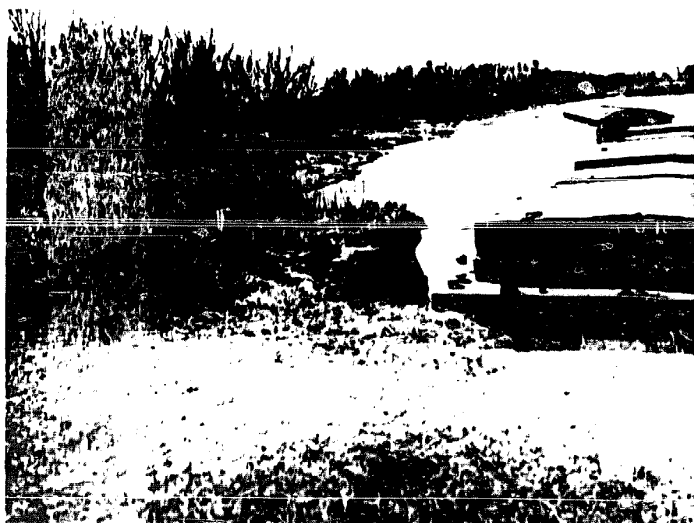
9



#10



#11



#12



#13



#14

Appendage "B"

ASBESTOS CEMENT MOUND ON RIVER BATTURE NORTH OF PLANT

- No. 1 - Looking west toward mound.
- No. 2 - Looking west toward mound.
- No. 3,
4, 5 - Looking east toward mound, approximately 18 ft
difference between natural bank and mound.
- No. 6 - Looking south toward plant (background).
- No. 7 - On mound looking toward river.
- No. 8 - West of mound on levee toward river and mound.
- No. 9 - Looking west from mound, notice debris in area also
notice erosion that is taking place. Large chunks
are about to be washed away.
- No. 10 - Also looking west from mound - debris scattering
the area. Sample pumps circled.
- No. 11 - Looking east from mound.
- No. 12 - Looking west from mound.
- No. 13 - Large chunks of the mound that has fallen into the
river.
- No. 14 - Same as No. 9.

JOHNS-MANVILLE CORP.
ENGINEERING DEPARTMENT

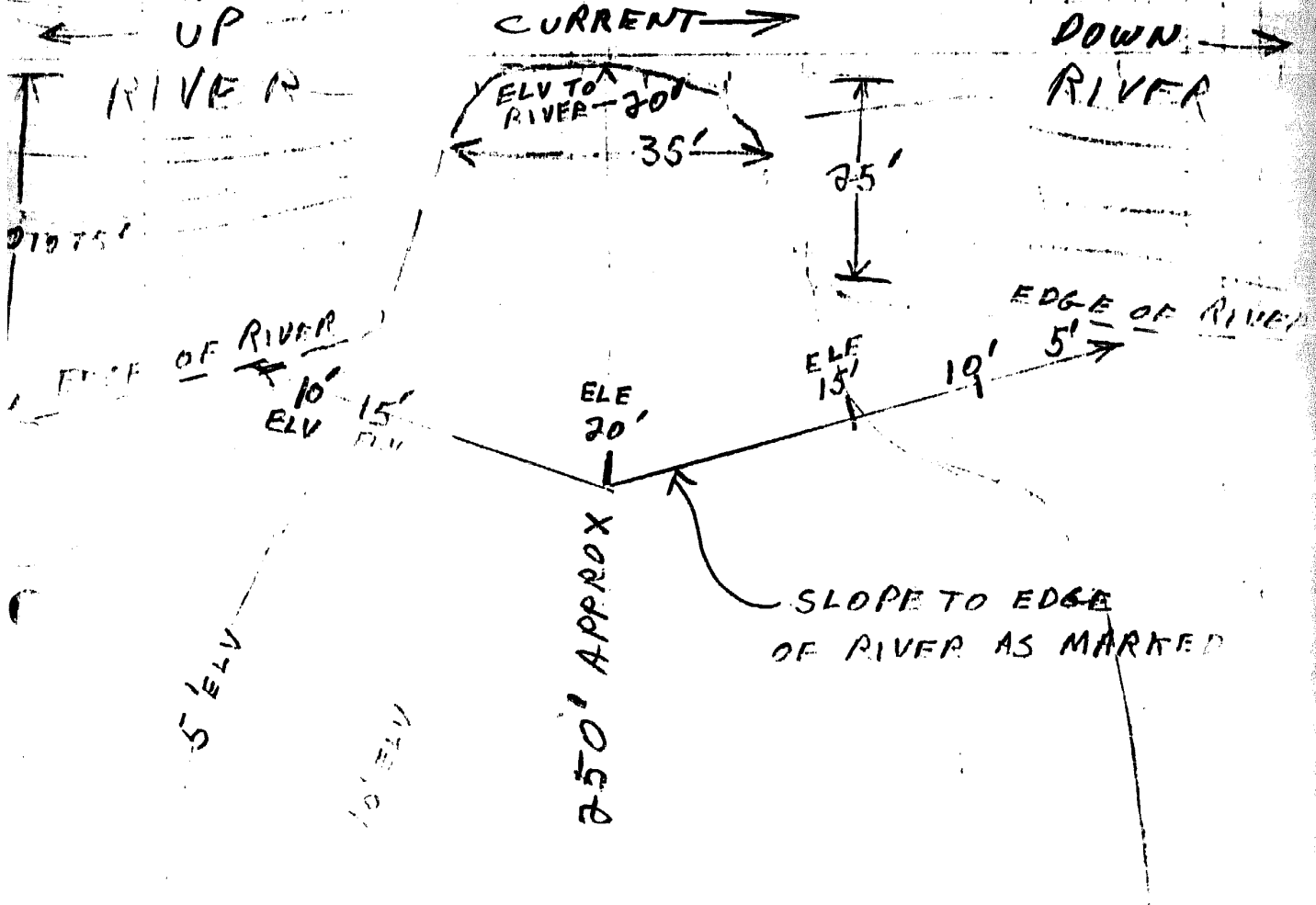
Appendix "C"

PROJECT NO.

PLANT MARREDO SHEET OF

SUBJECT SWIM OF ASBESTOS - DATE FEB 26 1976

CEMENT MOULD ON RIVER
BATTURE NORTH OF PLANT PREPARED BY T. J. GUCCIA



APPROX 150' TO 200'

ELV AT BASE OF V LEVEE APPROX 15'

CROWN OF LEVEE APPROX 20' - 25'

RIVER ROAD

NOT TO SCALE

APPENDAGE D

DATE	SAMPLE DESCRIPTION	TIME(min.)	RESULTS(F/cc)	* T.L.V. (F/cc)
2-26-76	On asbestos Cement Mound	350	0.04 0.02	5.00 5.00
2-26-76	Approx. 600' Downwind From Mound	360	0.02 0.03	5.00 5.00
2-26-76	Approx. 50 yards Up- wind From Mound	360	0.01 0.00	5.00 5.00

* T.L.V. Of 5.00 F/cc is due to the fact that any exposures are not occupational in nature.

Title: EVALUATION OF TOOLS FOR THE DUST-FREE FABRICATION OF ASBESTOS-CEMENT

SUMMARY

Tests have been run to determine the amount of dust generated when drilling asbestos-cement sheets with twist drills and a reamer submitted by Dave Lucy. The tests were run with no dust collection, in the test chamber described in Report 411-1050.

The two 1/8-inch carbide tipped twist drills from the Cleveland Twist Drill Company were compared to a 1/8-inch carbide tipped masonry drill from Star Expansion Company, using a 1/4-inch Black and Deck drill. Flat asbestos-cement, 1/4-inch thick, was processed at a rate of 4 holes per minute. The membrane filter was located downstream of the sample being fabricated in the dust box. The Cleveland bits penetrated the material much faster and emitted less fine dust than the common masonry bit. Dust counts for the Cleveland bits were 0.6 and 0.1 f/cc compared to 1.3 f/cc for the control masonry bit.

The carbon steel taper reamer, also from the Cleveland Twist Drill Company was compared to a 9/16-inch carbide tipped Star masonry bit. A 1/4-inch pilot hole was drilled and then reamed to 9/16-inch with the Cleveland tool at a rate of 1.3 holes per minute. Both the Cleveland reamer and 9/16-inch masonry bit gave dust counts of 0.6 f/cc but much dust was deposited on the floor of the chamber.

It is recommended that the reamer should not be used without dust control because of its visible dustiness. The Cleveland 1/8-inch twist drills are much more superior to common masonry bits for penetration of material and reduction of fine dust. Even though the dust counts were well below the OSHA 2.0 f/cc acceptance level, it is recommended that the Cape Drill Shroud, with Nilfisk vacuum be used at all times to eliminate all fine dust.

Contents: Summary and Appendix.

Reported by

G. R. Bauman

G. R. Bauman

Asbestos & Mineral Technology

Notebook 4735, p. 75

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R&D Information Center (4)

KEYWORDS

Asbestos
Asbestos-Cement
Environmental Health
Fabrication
Dust
Dust Collection

RECEIVED
JUN 1971

APPENDIX

TABLE 1. RESULTS OF DUST TESTS

	Test Conditions ¹	Test Duration (min)	Material Pulverized by Tool				Percent Pulverized Material Captured	Dust Count f/cc	Remarks
			No. Holes	Holes/Min	Material Pulverized				
					Total gm	gm/min.			
Drill - Black & Decker 1/8-inch Carbide Tipped Masonry Bit (#1405-0)	No dust control	15	60	4.0	10	0.67	40.0	1.8	Visible Dust
Drill - Black & Decker 1/8-inch No. 725 Carbide Tipped Cleveland Twist Drill (#27-EDP-48847)	No dust collection	15	60	4.0	9	0.6	16.67	9.1	Visible Dust
Drill - Black & Decker 1/8-inch No. 725 Carbide Tipped Cleveland Twist Drill (#25-6021-0149)	No dust collection	15	60	4.0	8	0.53	25.0	0.6	Visible Dust
Drill - Black & Decker 9/16-inch Carbide Tipped Masonry Bit (#1445-0)	No dust collection	15	20	1.3	46	3.07	6.52	0.6	Visible Coarse Dust Fell to Bottom of Chamber
Drill - Black & Decker 1/4-inch Masonry Bit Pilot Cleveland Carbon Steel Reamer to 9/16-inch (#142 R)	No dust collection	15	20	1.3	47	3.13	6.38	0.6	Much Fine Dust Fell to Bottom of Chamber

¹ Test Conditions - Air velocity pressure through chamber (measured in ft/min) at 1/4-inch H₂O
 Note: Material being fabricated is flat asbestos-cement sheet, 1/4-inch thick.



Johns-Manville

Internal Correspondence

To
F. J. Angelos
E. J. Bulava
D. R. Christensen
L. A. Schriver

Date: February 15, 1979

From G. L. Swallow

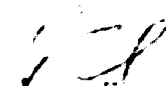
Copies
E. G. Stevens
W. B. Reitze

W. E. Volwiler
T. M. Paas

Subject MONTHLY ENVIRONMENTAL CONTROL REPORTS
ASBESTOS CEMENT PIPE PLANTS
W. E. VOLWILER'S LETTER FEBRUARY 9, 1979

Enclosed is a copy of the subject letter together with an example of the "stations over TLV" report being established.

Please note that among other things, this report is to take the place of the corrective action report we have requested subsequent to each Industrial Hygiene Survey. Since the new report will be monthly and will include the corrective action status for all stations over TLV, it should improve the monitoring of corrective actions taken.


G. L. Swallow

sl

Enclosures

AA 105

CLP ✓



Internal Correspondence

Johns-Manville

F. J. Angelos

E. J. Bulava

D. R. Christensen ~~Andy Wilson~~

To: L. A. Schriver

Bob Fuhs

Date: November 21, 1978

E. G. Stevens

J. Brederode

From: G. L. Swallow

Copies: W. B. Reitze

Subject: **CIRCULAR SAW FOR DRY-CUTTING CORRUGATED A/C SHEET**
R&D REPORT E411-1063

You will all be interested in the enclosed report showing the construction of Circular Saw which has proven very successful in dry cutting corrugated Asbestos Cement sheet while still maintaining low airborne concentration of Asbestos Fiber.

Since **field cutting of A/C sheets is common** at essentially all locations, I request that you call this equipment to the attention of Plant Managers and Plant Engineers during your regular visits. I would also suggest that you be specifically on the look-out for cutting practices which could be improved with the use of this equipment.

G. L. ~~Swallow~~ LARRY SCHRIVER

sl

Enclosure

DEC 11 1978

~~LESS DISCUS~~
~~LARRY~~
~~12-7-78~~



Johns-Manville

Internal Correspondence

To: F. J. Angelos - Haskagan
E. J. Bulava - Manville
D. R. Christensen - R&D
L. A. Schriver - Lompoc
E. G. Stevens - Jeffrey✓

Date: October 7, 1975

From: G. L. Swallow - 4M

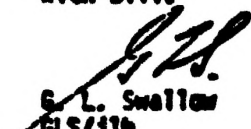
Captain: W. B. Reitze - 4M
GLS

Subject: NEW RESPIRATORY PROTECTIVE DEVICE

During my visit with Ed Bulava, he inquired about a new **Welsh respirator** which plant personnel had been inquiring about.

Evidently, these inquiries were a result of the Health, Safety & Environment Bulletin recently issued by W. B. Reitze. A copy is enclosed for your information.

If you have any questions, please let me know and I will take them up with Bill.


G. L. Swallow
GLS/jlh
Attachment

Environmental Control Department
Denver - GHQ
January 21, 1974

- CONFIDENTIAL -

K. Jones - Coalinga

cc: W. E. VanDerbeek - 2 West
R. E. Sampson - Jeffrey
J. E. Hesse - 5 North
D. E. Hillier - 4 North
L. A. Schriver - Lompoc
D. R. Christensen - R&D
G. L. Swallow/File

SEMI-ANNUAL INDUSTRIAL HYGIENE SURVEY
ASBESTOS FIBER DIVISION - COALINGA MINE
SURVEY DATE DECEMBER 17, 1973

Attached are the results of the Semi-Annual Industrial Hygiene survey conducted at Coalinga during the week of December 17, 1973. In a Semi-Annual survey, only those asbestos stations above 2.0 F/cc in the previous survey are checked.

As a result of this survey there are 12 Occupational Dust stations above the TLV. Three stations were not operating.

Dust counts taken on December 17 were generally lower than those taken on December 18, as reflected by a deterioration in the appearance of the mill between the two days. On December 18, leaks developed on the second and third floors and air sifter doors and boots began leaking. One leak was covered with a burlap bag. The average of all samples taken on December 17 was 3.6 F/cc, versus 5.7 F/cc for samples taken on the next day. A visible dust deposit was noted on floors, stairwells, and overhead structures.

Please note that personal protective equipment was not worn at any of the stations above the TLV. The use of this equipment should be enforced.

In your quarterly response to the Manager, Occupational Environmental Control, please comment on corrective action taken or planned for all asbestos stations over the TLV plus those stations that were not operating. Your next response is due February 15, 1974.

M. A. Baloga
M. A. Baloga

MAB/jmb
Attachments

prim H
no change
over if photo
be sent down
LAST
CEANING
WHL

AFFIDAVIT

STATE OF COLORADO)
) ss.
COUNTY OF ADAMS)

I, Margaret J. Baumgardner, being of full age and first duly sworn do hereby state:

1. I am not a party to this action. I have personal knowledge of the facts set forth in this affidavit, and if called as a witness, I could and would competently testify as to the truth of the matters set forth herein.

2. I am the Research Coordinator for the Claims Resolution Management Corporation ("CRMC"), a wholly owned subsidiary of the Manville Personal Injury Settlement Trust ("Trust"). The CRMC was created in December 1998 and is staffed by former Trust employees. On January 1, 1999, CRMC began providing claims resolution facility services to the Trust.

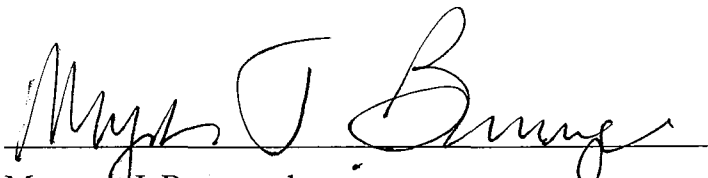
3. In this position, I manage the Asbestos Claims Research Facility ("Facility"), a document and records repository located at 3390 Peoria Street, Suite 304, Aurora, Colorado. The Facility contains the business records including but not limited to correspondence, memoranda, reports, records and data compilations ("record") of Manville Corporation or related entities ("Manville"), generally, as well as Manville records relevant to litigation of asbestos liability. The Trust has managed and operated the Facility from November 28, 1988, the date on which the Manville bankruptcy plan was consummated.

4. My experience and familiarity with the documents at the Facility began in 1983 while working for Manville. In my work as a paralegal for Manville, I assisted in locating, indexing and packing many of the records which became the foundation documents for the Facility. I continued to work for Manville until September 1987. From March 1988 to September 1988, I was hired to supervise and assist in the indexing of the first 20,000 boxes which were turned over to the Trust in November 1988. From September 1988 to January 1989, I assisted in the privilege review of documents to be given to the Trust. From November 1988 to April 1994, I worked for Freeborn & Peters and was put in charge of the Facility, managing all productions and "new" acquisitions. In September 1995, I was hired by the Trust to manage the Facility. In December 1998, I was hired by

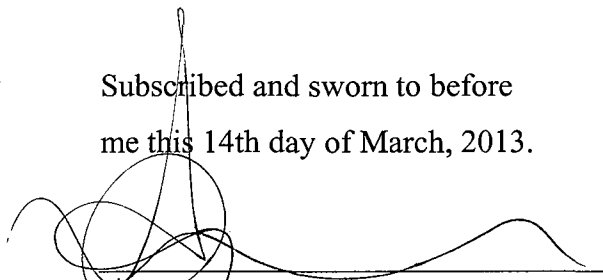
the CRMC to manage the Facility for the Trust. Accordingly, I am personally familiar with many of the records stored at the Facility, as well as how the records have been gathered.

5. To the best of my knowledge, information and belief, I certify that these records were made at or near the time by, or from information transmitted by, a person with knowledge, were kept in the course of the regularly conducted business activity of Manville, and it was the regular practice and the business activity of Manville to make the records.

6. Attached are documents found among the microfilm collections at the Facility. These documents, bates labeled CRMC-Christensen-Micro-000001 through CRMC-Christensen-Micro-000183, are true and correct copies of documents found at the Facility.


Margaret J. Baumgardner

Subscribed and sworn to before
me this 14th day of March, 2013.


Notary Public

AMY W BENHAM
NOTARY PUBLIC
STATE OF COLORADO
MY COMMISSION EXPIRES 05-23-2016