FILE NAME: Johns-Manville (JMA)

DATE: 1977-1978

DOC#: JMA123

DOCUMENT DESCRIPTION: Report - Cobra Brake Show Emission Studies with Test Results and Relevant Correspondence

Johns-Manville

Internal Correspondence

AL.1026915 46

E in 157

To: P. Kotin, M.D.

Date: January 20, 1977

From: F. M. Fenner

Copies:

Subject: COBRA BRAKE SHOES

As we discussed this morning it is my opinion that Johns-Manville eventually will be forced into the production of asbestos-free COBRA brake shoes if it wishes to retain its dominant place in the railroad friction materials industry. I base this opinion on the following points.

1. Presently there is a tremendous amount of hysteria and emotion concerning the health effects of exposure to small quantities of airborne asbestos fiber. This has extended to the government regulatory agencies where NIOSH is proposing an airborne exposure limit of 0.1 f/cc 8 hour TWA and 0.5 f/cc ceiling concentration.

2. Experiments by Westinghouse Air Brake have shown that the heat of brake application does not convert all fiber in the brake shoe to an amorphous mineral but that approximately 1% is released to the atmosphere as asbestos fiber.

3. The United Transport Union believes that operating trainmen are being exposed to fibers released from overheated brake shoes, and have requested the Department of Transportation to determine if asbestos-free brake shoes can be provided. This union concern has been conveyed to WABCO and they have recommended to us the development and production of an asbestos-free brake shoe.

4. There is a large potential market ($2.0M) for composition brake shoes in subway use. I understand the mass transit systems in New York City and Atlanta have mandated an asbestos-free shoe.

5. Our major competition, Abex Corp., is presently producing, marketing and extensively advertising an asbestos and lead free composition. A copy of their advertisement is attached.

157

The asbestos-containing product apparently is superior in performance to our experimental asbestos-free composition and to the Abex shoe; but both meet the specifications of the American Association of Railroads.

I understand that Chet Sulewski has recommended that HS&E prepare a program to combat this situation, by convincing all interested parties that no significant health hazard is created by the use of the present COBRA shoe. I am afraid that this would be very difficult to do.

E. M. Tenzer

EMT:jh
Attach.

Walt

564

E. G. WILLCOX

MAY 12, 1976

W. B. REITZE

E. M. FENNER

PRESENTATION FOR WABCO - COBRA

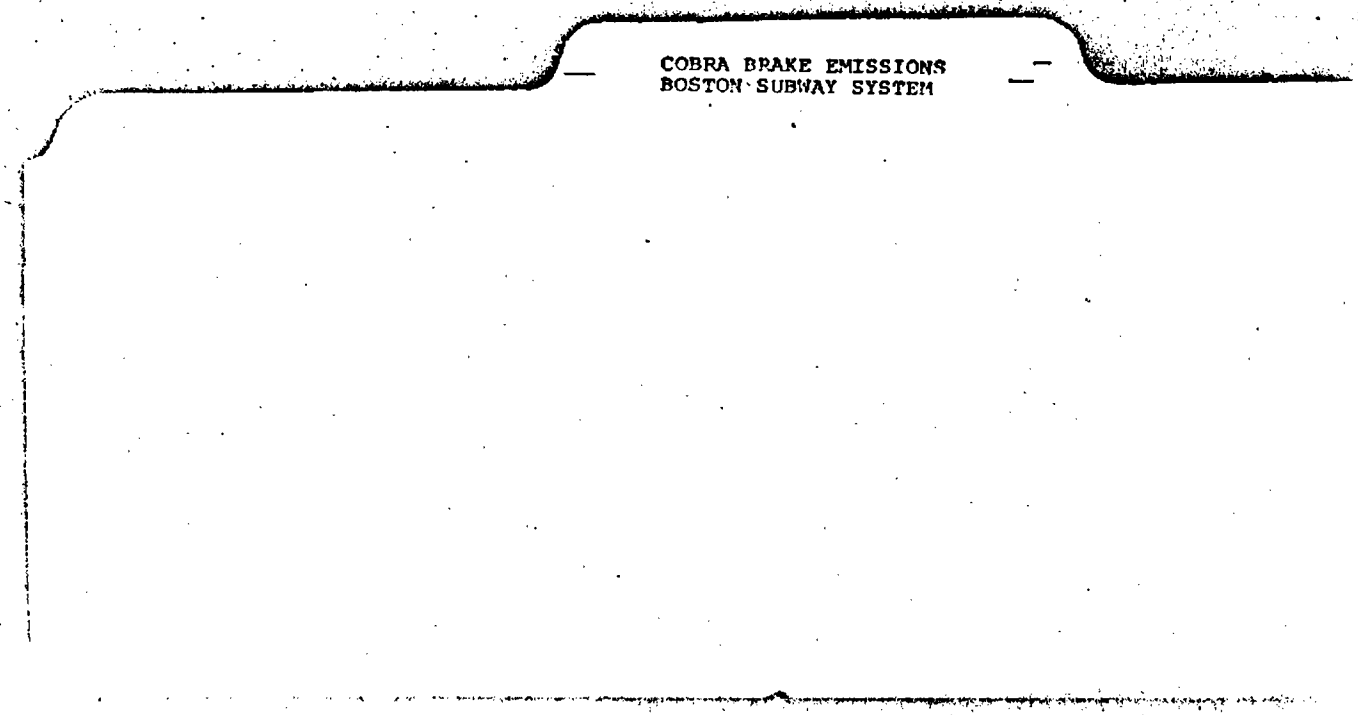
ED FENNER AND I HAVE DISCUSSED THE POSSIBILITY OF A "DOG-AND-PONY SHOW" FOR THE WESTINGHOUSE SALESMEN AND FEEL THAT THIS MIGHT BE SOMEWHAT OF A WASTE OF TIME.

WHAT WE WOULD SUGGEST IS THE PREPARATION OF A WHITE PAPER WHICH WOULD REVIEW THE SCIENTIFIC DATA THAT IS AVAILABLE ON BRAKE SHOE DEGRADATION PRODUCTS. WE KNOW OF SEVERAL STUDIES PERFORMED ON CONVENTIONAL BRAKE SHOES--ONE BY BENDIX CORPORATION, ONE BY THE FORD CORPORATION, AND ANOTHER BY JEREMIAH LYNCH AT NIOSH. ALL OF THESE PAPERS REACH THE SAME CONCLUSION--BRAKE DRUM POLLUTANTS ARE EXTREMELY MINIMAL. I AM ALSO VAGUELY FAMILIAR WITH THE PAPER THAT YOU MENTIONED REGARDING THE TESTS RUN AT R&D ON COBRA. IF YOU WOULD SUPPLY US WITH A COPY OF THIS PAPER, WE WILL BEGIN IMMEDIATELY TO PREPARE SUCH A SCIENTIFIC WHITE PAPER.

W. B. REITZE

this is the project
I briefly mentioned yesterday.

Ed
5/13


COBRA BRAKE EMISSIONS
BOSTON SUBWAY SYSTEM

COBRA BRAKE SHOE EMISSION STUDIES

A review of scientific studies designed to measure the asbestos dust emissions from the wearing of COBRA brake shoes indicates that fiber release is minimal and of no consequence to human health.

In early 1977, the Industrial Hygiene section of Johns-Manville conducted COBRA brake emission studies on the Boston (Massachusetts) Rapid Transit System. The vast majority of rail cars used in that system utilize COBRA brake shoes. Because most of that Boston system is underground, it was felt that potential air contamination would be more marked than in above ground systems, thereby providing a more stringent test.

With the cooperation of Boston transit officials and representatives from the Westinghouse Air Brake Division, industrial hygienists conducted monitoring tests to find both the most representative exposures and the potentially highest exposures. Personal monitors were placed adjacent to operators of the cars, such as the motormen, as well as passengers. Other monitors were placed nearest the brakes on the cars, elsewhere in the passenger compartments, and on the station platforms. Samples also were taken in the system's maintenance shops during actual maintenance and repair procedures where the exposure potential was the greatest.

5/1/78

Analysis of the samples was conducted according to government approved procedures, including analysis by light microscope and transmission electron microscopy. Overall, the fiber levels found at the various monitoring stations could not be easily distinguished from those existing in ambient air samples taken in five areas in and around Boston. Some of the samples contained less asbestos fiber than was found naturally in the air outside the city. Every reading was at least 50 times lower than the permissible exposure levels set by the Federal Government to protect asbestos workers. And, in the majority of samples, the asbestos fiber levels actually were hundreds to a thousand times lower than OSHA's occupational exposure levels. In some instances, there was no detectable level of asbestos fiber in the areas monitored.

This series of monitoring tests was in relative agreement with similar studies conducted in 1971 by the Westinghouse Air Brake Division. Their study was run on a dynamometer in Wilmerding, Pennsylvania and simulated various service conditions. Four different test phases were run: (1) Passenger car simulation; (2) Commuter run simulation; (3) Grade simulation; and (4) Heavy freight simulation. Material worn from the brakes was submitted for chemical and electron microscope analysis and separated into airborne and non-airborne fractions by air elutriation.

In almost all cases, less than 1 per cent of the original asbestos fiber in the formula remained as recognizable chrysotile fiber in the wear dust. Additionally, in every instance, less than 1/2

of one per cent of the original fiber remained as recognizable in the fraction of the dust that is potentially airborne.

From a health standpoint, there is no medical evidence to indicate that the minute amounts of asbestos worn from brake shoes is of any consequence to human health. However, persons involved in the repair, maintenance or replacement of brake linings containing asbestos should take precautions to prevent dust generation and inhalation. Use of appropriate respiratory protection may be necessary in such instances. Air blowing procedures should never be used to remove dust; the use of a vacuum system is recommended. Grinding equipment should be ventilated with exhaust systems. Compliance with proper work procedures should prevent dust generation and exposures.

ASBESTOS FIBER COUNTS

PERSONAL TESTS

NUMBER	LOCATION	VOLUME, liters	DATE	RESULTS f/cc
P1-A	Motorman/Guard Car No. 1518	216	3/29/77	0.0038
P1-B	"	264	3/29/77	0.0062
P1-C	"	240	3/29/77	0.0069
P1-D	"	260	3/29/77	0.0063
P1-E	"	330	3/29/77	0.0050
P2-A	Motorman/Guard Car No. 1523	220	3/29/77	0.0075
P2-B	"	260	3/29/77	0.0032
P2-C	"	240	3/29/77	0.0034
P2-D	"	260	3/29/77	0.0050
P2-E	"	330	3/29/77	0.0025
P3-A	Outside Car No. 1518 -	218	3/29/77	0.023
P3-B	" Near Brake	262	3/29/77	0.0031
P3-C	"	240	3/29/77	N. D. *
P3-D	"	320	3/29/77	0.0077
P3-E	"	270	3/29/77	0.0030
P4-A	Passenger In Car No. 1518	216	3/29/77	0.0076
P4-B	"	264	3/29/77	N. D. *
P4-C	"	240	3/29/77	0.021
P4-D	"	260	3/29/77	0.0032
P4-E	"	330	3/29/77	0.0050
P5-A	Park St. Station-Ctr. of Platform	180	3/29/77	0.014
P5-B	"	180	3/29/77	0.0091
P5-C	"	180	3/29/77	0.0091
P5-D	"	180	3/29/77	0.0091
P5-E	"	120	3/29/77	0.021
P5-F	"	30	3/29/77	0.027
P6-A	Park St. Station-So. End	180	3/29/77	0.0091
P6-B	"	180	3/29/77	0.0046
P6-C	"	180	3/29/77	0.0091
P6-D	"	180	3/29/77	0.018
P6-E	"	120	3/29/77	0.0091
P6-F	"	30	3/29/77	0.027
P7-A	Park St. Station-No. End	60	3/30/77	0.014
P7-B	"	56	3/30/77	0.059
P7-C	"	60	3/30/77	N. D. *
P7-D	"	58	3/30/77	0.043
P8-A	Cabot Car House-Inspection Area	356	3/30/77	N. D. *
P8-B	"	250	3/30/77	0.0033
P8-C	"	170	3/30/77	0.0097
P9-A	Cabot Car House-E. Maint.Area	360	3/30/77	N. D. *
P9-B	"	250	3/30/77	0.0033
P9-C	"	170	3/30/77	N. D. *

* None Detected

BOSTON SUBWAY SYSTEM
ASBESTOS FIBER COUNTS

HIGH VOLUME TESTS

NUMBER	LOCATION	VOLUME, M^3	DATE	RESULTS F/cc
H1-A	Inside Car No. 1518	90.6	3/29/77	0.0017
H1-B	"	83.7	3/29/77	0.0019
H1-C	"	78.5	3/29/77	0.0020
H1-D	"	81.3	3/29/77	0.0019
H1-E	"	100.4	3/29/77	0.0031
H2-A	Park St. Station-No. End	94.3	3/29/77	0.0033
H2-B	"	62.9	3/29/77	N. D. *
H2-C	"	31.4	3/29/77	N. D. *
H2-D	"	19.6	3/30/77	N. D. *
H2-E	"	18.3	3/30/77	N. D. *
H2-F	"	19.6	3/30/77	0.016
H2-G	"	19.0	3/30/77	N. D. *
H3-A	Ambient Air-Cabot Yard	726.2	3/29/77	0.0002
H3-B	"	167.3	3/30/77	0.0037
H3-C	"	97.9	3/30/77	0.0048
H3-D	"	81.6	3/30/77	0.0038

* None Detected

Johns-Manville

Internal Correspondence

To: G. L. Swallow - 1-06

Date: March 16,1978

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

Copies: P. Kotin, M.D. - 1-06
W. B. Reitze - 1-06
W. I. Graham - 3-05
J. P. Leineweber - 1-06
S. Speil - R&D
S. B. Spencer - R&D

Subject: COBRA BRAKE EMISSIONS STUDY, BOSTON SUBWAY SYSTEM, TEM ANALYSIS OF NINE SAMPLES, M-109

SUMMARY

Nine samples were analyzed by TEM for chrysotile fibers on Millipore filters by direct transfer method in connection with COBRA Brake Emissions Study, Boston Subway System. Free fibers were detected in 4 samples. Clumps with chrysotile fibers were detected in 7 samples. The fibers are essentially fibrils with an average diameter of 325 Å and an average length of about 0.231 µm. For samples containing chrysotile, the F/cc values range from 0.0501 to 1.0863 and clumps/cc range from 0.0752 to 0.4345.

REFERENCES

A. Hand written letter to J. P. Leineweber from E. Bulava, April 5, 1977, Subject - MBTA Samples.

B. Letter to W. I. Graham from G. L. Swallow, May 20, 1977, on COBRA Brake Emissions, Boston Subway System.

C. Letter to G. L. Swallow from E. J. Bulava, June 29, 1977, same subject.

D. Letter to G. L. Swallow from V. E. Wolkodoff, July 1, 1977, Interim Report, COBRA Brake Emissions, Boston Subway System.

E. Letter to G. L. Swallow from V. E. Wolkodoff, July 8, 1977, Addendum to Interim Report above.

TEXT

On July 14, 1977, G. L. Swallow, J. P. Leineweber and V. E. Wolkodoff met to determine which additional samples were to be analyzed by TEM to supplement the above letter-reports. Nine samples were selected and analyzed using the new Philips EM-400 whereas all previous samples were analyzed using the RCA EMU 3-B without benefit of high magnification, high resolution, good beam penetration, electron diffraction and energy dispersive spectrometry for analysis of elements based on X-rays. Sample identification is presented in Table I.

The method used for the preparation of TEM grids is the same as recited previously but with an additional step of gelatinizing the Millipore cut-out on the Cu grid by exposure to methyl ethyl ketone (approximately 15 minutes, cold-finger trap) and then placing the grid in conventional sohxlet extractor for final filter digestion by hot acetone fumes for 15 minutes. This method was used to negate as much as possible rip-tear reactions between organic compounds trapped in the air sample filter and normal acetone digestion.

Athene-type 200-mesh TEM copper grids were employed and a grid opening, or window, measures 81 by 81 μm. Ten or twenty windows, selected completely at random, were systematically viewed at nominal 48,000X magnification.

Previous data submitted to you on this study were based on morphological characteristics of chrysotile asbestos whereas with the new Philips EM-400, only fibers positively identified by electron diffraction, often with EDS chemical analysis, were counted. Previously, clumps were essentially opaque but now with exceptionally greater penetrating power, considerable time and effort were spent on these masses to confirm the presence of chrysotile.

The definition of free chrysotile fiber is one that is truly isolated and has been confirmed positively by electron diffraction. Clump is defined as a mass of material moderately to tightly knit and from which or within which one or more, usually many more, chrysotile fibers can be detected morphologically and confirmed by electron diffraction and/or EDS (energy dispersive spectrometry). No statement is made or implied as to the nature of these masses. However, clumps with chrysotile are significant, and are included in the computations separately. The purpose of these analyses is to detect and quantify chrysotile regardless of its morphology and dimensions. Table 2 summarizes number of windows read, and number of free fibers and clumps encountered.

Refer to Figure 1 which shows a typical free chrysotile fiber measuring 291Å by 0.292 μm and Figure 2 which is the electron diffraction pattern of this particular fiber. A somewhat typical clump with chrysotile fibers is shown in Figure 3. In the readings, the analyst is plagued with fibers or fiber masses (Refer to Figure 3) which prove to be non-asbestos, electron diffraction patterns are very, very weak and not indexable but definitely not chrysotile asbestos, and chemically characterized by several elements none of which predominate. By EDS it is not uncommon

for the spikes to be very weak and include Ca, Al, Si, Mg, Na, Fe and other elements. No statement is made as to the nature of this material.

A summary of results of greatest interest to you is presented in Table 3 (F/cc, etc).

All chrysotile fibers encountered were measured and are listed in Table 4.

V. E. Wolkodoff F. D'Ovidio

vm

NB 7801 p 6-9
NB 4580 p 60, 61
NB 4873 p 11-14, 17-20

TABLE 1

Identification of Samples for TEM Analysis, COBRA Brake Emissions Study, Boston Subway System (MBTA), Samples Received From E. Bulava, Manville, N.J.

Sample No.	Description	Volume of Air Through Filter	Date of Sampling
P-2D	Motorman/Guard, Car No. 1523	260 liters	3/29/77
P-3D	Outside Car, No. 1518, Near Brake	320 liters	3/29/77
P-4D	Passenger in Car, No. 1518	260 liters	3/29/77
P-5D	Park St. Station, Center of Platform	180 liters	3/29/77
P-6D	Park St. Station, South End	180 liters	3/29/77
P-7C	Park St. Station, North End	60 liters	3/30/77
P-8B	Cabot Car House, Inspection Area	250 liters	3/30/77
P-9B	Cabot Car House, Maintenance Area	360 liters	3/30/77
H-3C	Ambient Air, Cabot Yard	97.9 cubic meters	3/30/77

1. All P numbers are personal samples collected on 37 mm diameter Millipore AA 0.8 micron filters.
2. Sample H-3C is high volume samples collected on 8 by 10 inch Millipore filter.

TABLE 2

Free crystalline chrysotile fibers and clumps with chrysotile encountered in TEM Analysis, COSRA Brake Emissions Study, Boston Subway System, March 29 - 30, 1977.

Sample No.	No. of TEM Grid Openings (81 by 81 μm) Scanned at 48,000X	No. of Free Fibers Encountered	No. of Clumps Encountered
P-2D	10	1	2
P-3D	10	ND	8
P-4D	20	ND	3
P-5D	10	ND	6
P-6D	10	9	2
P-7C	10	5	1
P-8B	10	ND	ND
P-9B	10	11	4
H-3C	10	ND	ND

ND = None Detected

TABLE 3

Summary of Results by TEM Analysis, COBRA Brake Emissions Study, Boston Subway System, March 29 - 30, 1977.

Sample No.	Free Chrysotile Fibers/cc	Avg. Fiber Diameter, Å	Avg. Fiber Length, μm	Clumps/cc
P-2D	0.0501	208	0.249	0.1002
P-3D	ND	-	-	0.3259
P-4D	ND	-	-	0.0752
P-5D	ND	-	-	0.4345
P-6D	0.6513	436	0.231	0.1448
P-7C	1.0863*	1207**	3.244**	0.2172
P-8B	ND	-	-	ND
P-9B	0.5735	328	0.189	0.2085
H-3C	ND	-	-	ND

* Only 60 liters of air filtered through sample.

**High values due to presence of one relatively large fiber with diameter of 5000 Å and length of 15.334 μm. If this large fiber is not taken into account, the average diameter is 259 Å and the average length is 0.22 μm.

NB. One micrometer = 10,000 Å

TABLE 4

Diameter and length of each free Chrysotile fiber encountered in TEM Analysis.

Sample No.		Diameter, Å	Length, µm	Diameter, Å	Length, µm
P-2D		208	0.249	-	-
P-6D	1.	250	0.244	6. 562	0.219
	2.	624	0.237	7. 520	0.208
	3.	360	0.223	8. 270	0.110
	4.	630	0.415	9. 229	0.169
	5.	478	0.256	-	-
P-7C	1.	291	0.292	4. 312	0.250
	2.	208	0.145	5. 5000	15.334
	3.	225	0.201	-	-
P-9B	1.	464	0.203	7. 420	0.104
	2.	312	0.312	8. 290	0.115
	3.	416	0.208	9. 270	0.175
	4.	400	0.208	10. 350	0.190
	5.	208	0.145	11. 225	0.110
	6.	200	0.312	-	-

One Micrometer = 10,000 Å

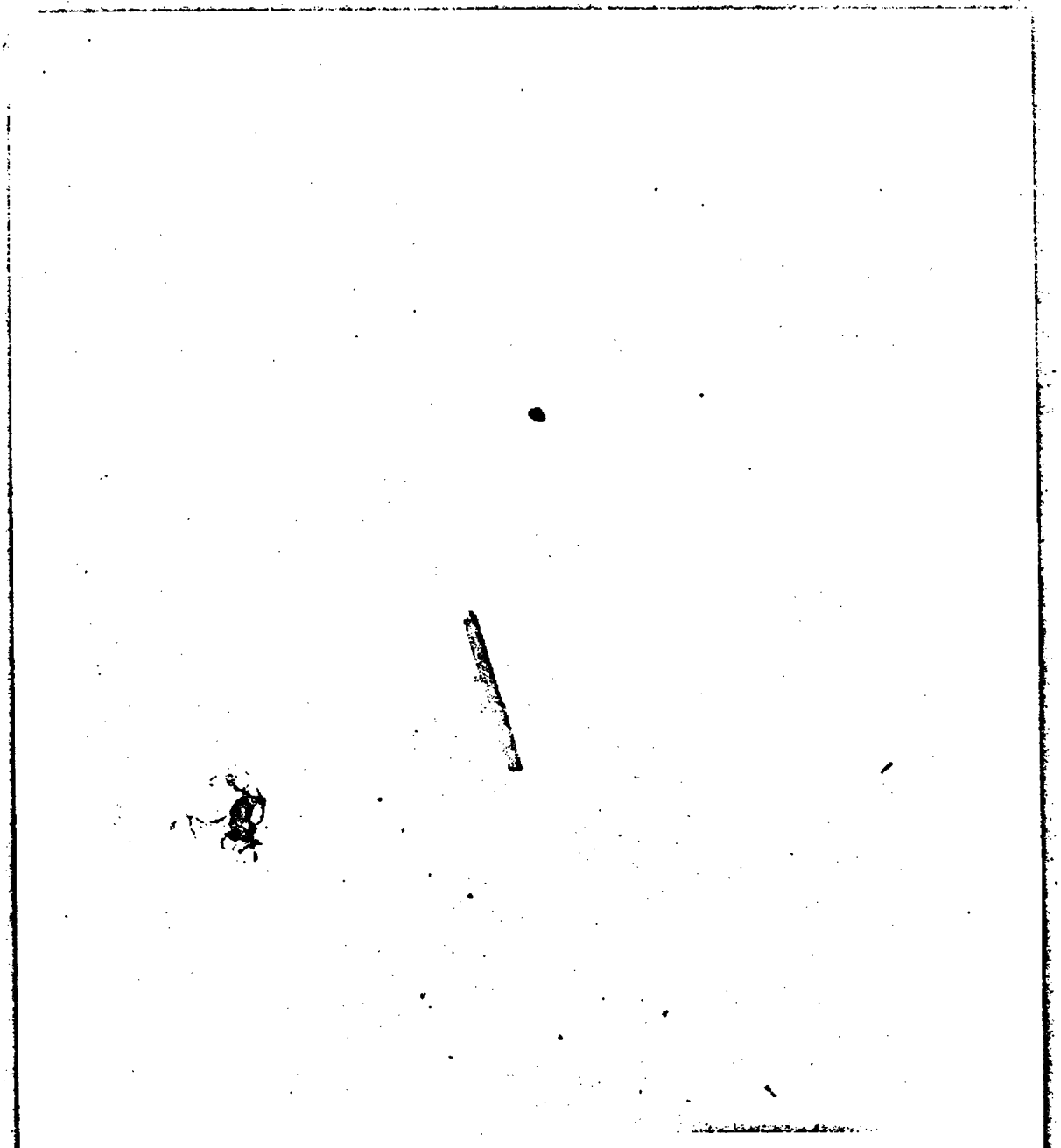


Fig. 1 FREE CHRYSOTILE FIBER, 291Å BY 0.292 μm, SAMPLE NO. P-7C

TEM-0221 120,000X

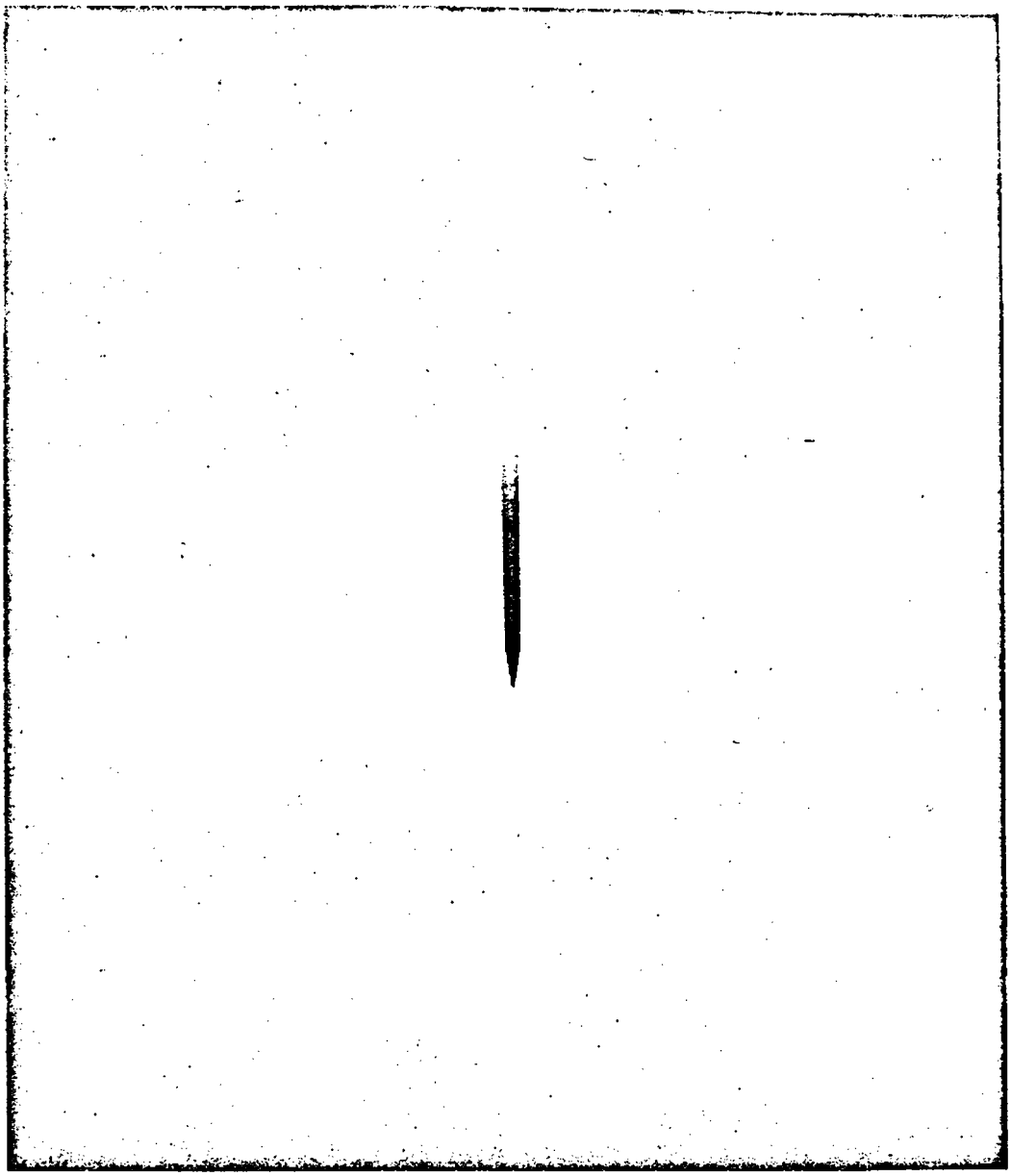


Fig. 2 ELECTRON DIFFRACTION PATTERN
OF FIBER IN Fig. 1

TEM-0223 40X

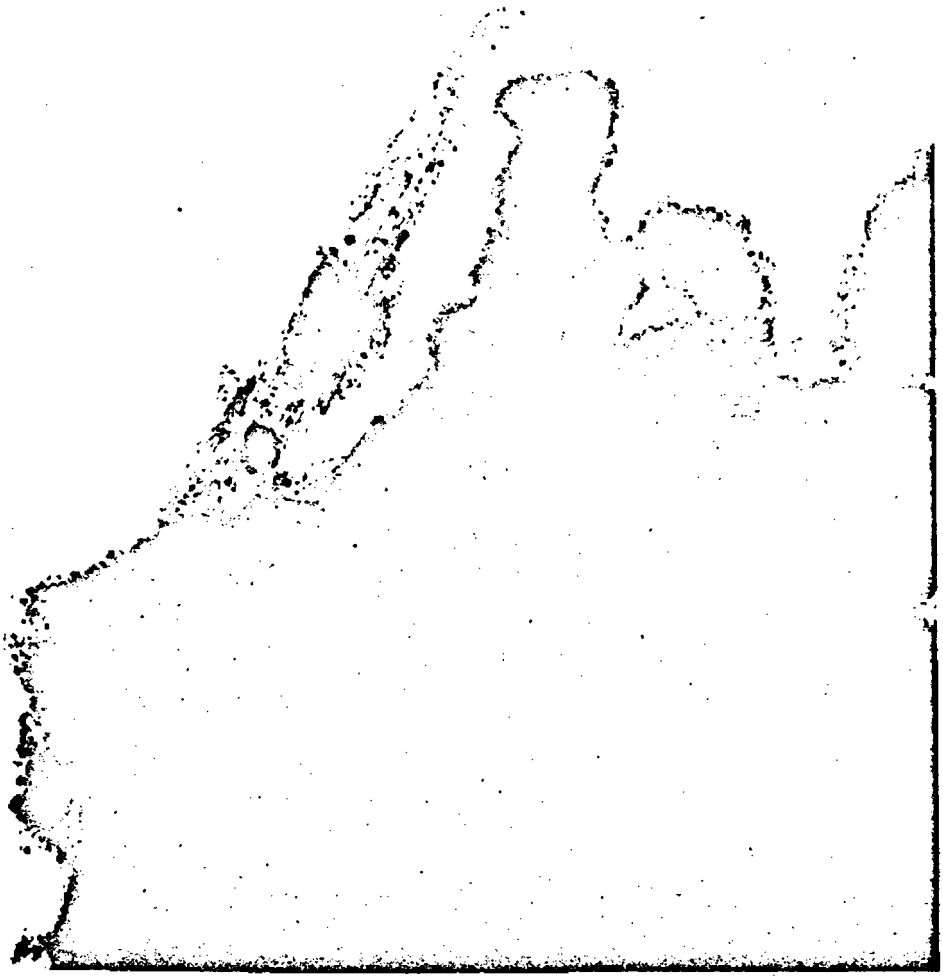


Fig. 3 CLUMP WITH CHRYSOTILE FIBERS,
SAMPLE NO. P-3D

TEM-0241 120,000X

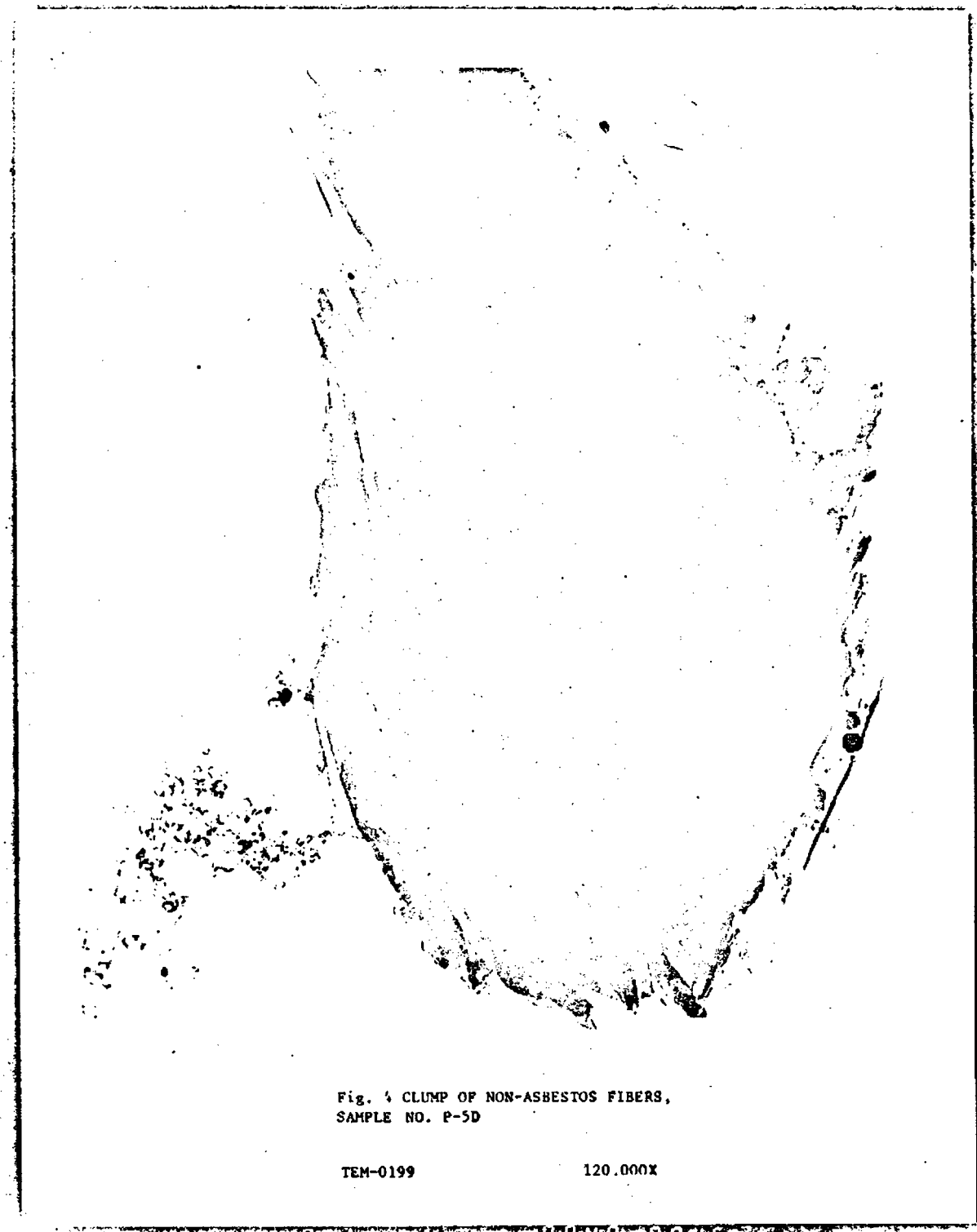


Fig. 4 CLUMP OF NON-ASBESTOS FIBERS,
SAMPLE NO. P-5D

TEM-0199 120,000X