FRICTION MATERIALS STANDARDS INSTITUTE, INC.
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January 8, 1976

Dr. Irving J. Selikoff
Environmental Science Laboratory
100 Street and Fifth Avenue
New York, New York 10029

Attn: Mrs. Kaffenburgh

Gentlemen:

Per our phone conversation of this date, I am forwarding:

1 Photocopy, from Automotive News 1975 Almanac issue (Copyrighted) of table:
"U. S. Motor Vehicle Manufacture , Wholesale Value, and Use, 1904-1974".

1 copy, SAE Paper 730548, "Brake and Clutch Emissions Generated During Vehicle Operation," by Jacko, DuCharme and Somers.

The tabulation appeared in the Automotive News 1975 Almanac Issue:

Automotive News
965 East Jefferson Avenue
Detroit, Michigan 48207

The source of the data was:

Motor Vehicle Manufacturers Association
320 New Center Building
Detroit, Michigan 48202

In my conversation with Mrs. Kaffenburgh, I requested copies of, or reference to, technical papers with data on asbestos fiber counts observed in shops doing work on brakes and/or clutch facings (8 hr TWA counts, or ceiling concentrations).

Sincerely,

FRICTION MATERIALS STANDARDS INSTITUTE

EWD/erc
Enclosure:

E. W. Drislane
Executive Director

## Asbestos exposure during brake-lining maintenance and repair

### Problem:

Brake-linings may contain as much as 50% chrysotile asbestos, and the disintegration of the lining during braking releases fibers, some of which become constituents of brake drum dust. Other fibers are released into the general environment. An investigation was made to obtain information concerning asbestos exposure of automobile and truck maintenance workmen, particularly those responsible for brake-lining work.

Personal air sampling was carried out at various auto repair shops, taxi fleet repair shops and several municipal truck repair shops. It is estimated that there are about 124,000 men in this work in New York City, alone.

The exposure of workers during brake-lining maintainance and repair is of interest as a background to investigation of their health experience. This, in turn, has considerable significance in determining whether brake-lining dust is pathogenic. If it is not, we would have little concern regarding brake-lining dust as a source of general environmental exposure to asbestos. On the other hand, if workers exposed to this dust are found to have asbestos disease, then the effects of exposure of the general population to the same dust, albeit at much lower levels, would have to be further evaluated.

### Materials and methods:

Personal air samples were taken during brake-lining maintenance work. Air samples were also taken at adjacent sites, including customer waiting areas and automobile showrooms. The standard techniques for filter processing and fiber counting which have been adopted by the Occupational Safety and Health Administration of the Department of Labor. Both optical and electron microscopic methods were employed, the latter because the great majority of asbestos fibers were too fine to be detected by optical microscopy. X-ray powder diffraction and microchemical scanning electron microscopic analyses were also utilized to identify chrysotile asbestos in brake drum samples.

Results to date:

Table I shows the levels of asbestos found during the most common operation of brake-lining maintenance. When a brake lining is brought into a repair shop for inspection or replacement, the wheel is removed and all loose dust is removed from the drums and back plates by means of a compressed air jet. The cloud that is produced is visible, and remains so for minutes afterward. There is minimal, if any, effort to control dust in most garages and workmen very rarely wear respirators. Table I shows that fiber counts are high in the operator's area, and that there are moderately high concentrations at least 20 feet away. Background sampling during the same operation shows that immediately after jet air blowing and for at least 14 minutes afterward, there are measurable concentrations. These measurements were taken at varying distances from the operator (from 10 to 75 feet) and show that other people within that perimeter are exposed, including mechanics, shop management, salesmen and customers.

Ten samples of brake drum dust were processed for electron micropsopic examination without changing the size distribution, and asbestos fibers present in the dust were measured. The results are shown in Table II. It was found that most fibers are too small to be seen by optical microscopy; almost all of them were shorter than 0.4$\mu$ in length. Virtually all were of respirable size.

Prior to this study, it had been generally accepted, on the basis of limited data, that asbestos brake-linings are thermally altered to an inert, presumably harmless dust, during braking action. Our observations show that asbestos fibers do survive. This has been found in every brake drum dust sample analyzed by x-ray diffraction, electron microscopy and microchemical scanning electron microscopy.

Table III and IV present data collected during brake lining maintenance operations at the New York City Department of Sanitation truck repair shop. Two important operations are performed in this large shop for reasons of

economy-grinding and bevelling of linings, otherwise generally performed during manufacture. Accordingly, these studies relate to levels of asbestos exposure experienced by workers engaged in manufacturing. New linings are ground to remove imperfections on the surface and used linings are salvaged by grinding the surface to remove grease and dirt fiber concentrations experienced during grinding ranged from approximately 2.0 to 7.0 large (optically visible) fibers/ml of air ($2x10^6$ - $7x10^6$ $/m^3$). The background or area samples for this operation ranged from 1.2 to 0.2 fibers/ml (1.2 - 0.2 x $10^6$ $/m^3$) with a general decrease with increasing distance away from the operator. From six to ten other mechanics would thus be exposed to perhaps about one fiber/ml. A concentration of even one fiber/ml is equivalent to inhaling 8 million large fibers per working day, those longer than 5μ. Much larger numbers of shorter fibers would simultaneously be inhaled.

Table IV shows fiber concentrations measured during bevelling of new truck brake-linings. The lining edge is bevelled on a grinding wheel, so that the brake will grip properly. Concentrations were very high, ranging from 32 to 72 fibers/ml, and background counts were measurable up to 30 feet away.

Significance:

The data indicate that, during brake-lining maintenance and repair, workmen in garages, service stations and brake repair shops are exposed to asbestos and thus may be subject to serious cancer risk. Others, at some distance from the repair work, are perhaps subject to the same hazard. These environmental measurements will be of value in considering the health experience of brake-lining repair workers, as a background to evaluation of the importance of asbestos from brake-linings as a factor in general community asbestos air pollution.

Publications:

To be published.

Investigators:

A. M. Langer, Ph.D., A. Rohl, Ph.D., Mary S. Wolff, Ph.D.

Support:

Health Research Council: U-1272.
Research Fellowship Award - ES 02565
Career Scientist Award - ES 44812

Period:

1973

Table I

PERSONAL SAMPLES - AUTOMOBILE BRAKE SERVICE

| Operation | Distance | Concentration (fibers/ml.) * |
|---|---|---|
| Blowing dust out of drum brakes | 3-5 ft. | 13.6 |
| " " " " " " | " | 29.4 |
| " " " " " " | " | 6.6 |
| " " " " " " | " | 13.6 |
| " " " " " " | 5-10ft. | 3.8 |
| " " " " " " | " | 2.0 |
| " " " " " " | " | 4.2 |
| " " " " " " | 10-20ft. | 0.4 |
| " " " " " " | " | 4.8 |

BACKGROUND SAMPLES - AUTOMOBILE BRAKE SERVICE

| Operation | Distance from Operation | Time Lapse | Concentration (fibers/ml.) |
|---|---|---|---|
| Blowing dust out of drum brakes | 10 ft. | 0 min. | 0.3 |
| " " " " " " | 20 ft. | 0 min. | 0.8 |
| " " " " " " | 12 ft. | 5 min. | 0.2 |
| " " " " " " | 50 ft. | 5 min. | 0.1 |
| " " " " " " | 65 ft. | 7 min. | 0.1 |
| " " " " " " | 75 ft. | 14 min. | 0.1 |

* Only fibers longer than 5μ were counted, by phase microscopy at 400x.

Table II

SIZE DISTRIBUTION OF CHRYSOTILE FIBERS IN BRAKE DRUM DUST

Fibers counted and sized at 42,000 X

(all fibers have diameters from 250Å to 500Å)

| Sample | 750-1500Å | 1500-2250Å | 2250-3000Å | 3000-3750Å | Total |
|---|---|---|---|---|---|
| 1 | 40% | 34% | 11% | 11% | 96% |
| 2 | 32 | 23 | 32 | - | 87 |
| 3 | 20 | 25 | 25 | - | 70 |
| 4 | 26 | 37 | 26 | 7 | 96 |
| 5 | 57 | 17 | 4 | - | 78 |
| 6 | 23 | 9 | 12 | 12 | 56 |
| 7 | 50 | 26 | 21 | 2 | 99 |
| 8 | 29 | 30 | 21 | 17 | 97 |
| 9 | 6 | 41 | 18 | 10 | 75 |
| 10 | 11 | 6 | 31 | 31 | 79 |

Table I.1

PERSONAL SAMPLES - TRUCK BRAKE SERVICE

| Operation | Concentration (fibers/ml.) |
|---|---|
| Renewing used linings by grinding | 2.7 |
| " " " " " | 7.0 |
| " " " " " | 2.2 |
| " " " " " | 4.1 |
| " " " " " | 5.0 |
| " " " " " | 4.7 |
| " " " " " | 5.6 |
| " " " " " | 1.7 |
| " " " " " | 2.5 |
| " " " " " | 2.0 |

BACKGROUND SAMPLES - TRUCK BRAKE SERVICE

| Operation | Distance | Concentration (fibers/ml.) |
|---|---|---|
| Background to grinding used linings | 10 ft. | 1.2 |
| " " " " " | 10 ft. | 1.7 |
| " " " " " | 25 ft. | 1.0 |
| " " " " " | 25 ft. | 0.6 |
| " " " " " | 60 ft. | 0.2 |

Table IV

PERSONAL SAMPLES - TRUCK BRAKE SERVICE

| Operation | Concentration (fibers/ml.) |
|---|---|
| Bevelling new linings | 31.7 |
| " " " | 23.7 |
| " " " | 32.7 |
| " " " | 72.0 |
| " " " | 26.3 |

BACKGROUND SAMPLES - TRUCK BRAKE SERVICE

| Operation | Distance | Concentration (fibers/ml.) |
|---|---|---|
| Background to bevelling linings | 8 ft. | 0.6 |
| " " " " | 12 ft. | 0.5 |
| " " " " | 12 ft. | 0.3 |
| " " " " | 30 ft. | 0.3 |

PERSONAL SAMPLES - TRUCK BRAKE SERVICE

| Operation | Concentration (fibers/ml.) |
|---|---|
| Punching rivets into brake lining | 1.9 |
| " " " " " | 2.0 |
| Chipping rust off used brake drums | 2.4 |
| Sweeping floor around grinder | 3.6 |
| Background taken 15 ft. away during sweeping | 3.1 |