The Hazards of Asbestos for Brake Mechanics

BARRY CASTLEMAN, LUCILLE A. CAMAROTA, ALBERT J. FRITSCH, SUSAN MAZZOCCHI, and ROBERT G. CRAWLEY

ASBESTOS is the generic name of a group of hydrated magnesium silicate mineral fibers. There are two groups of these minerals—serpentine (chrysotile) and amphibole (amosite, crocidolite, anthophyllite, tremolite, and actinolite). Ninety-five percent of the world's asbestos production is chrysotile.

Reports of epidemiologic and pathological studies *(1–4)* reveal that occupational exposure to commercial asbestos minerals enhances the likelihood of a number of diseases—asbestosis and cancers of the lung, pleura, peritoneum, larynx, and gastrointestinal tract. The time from onset of exposure to the time of clinically apparent disease is usually more than 20 years. Cancer from asbestos is not limited to workers who handle the material. There are also reports of pleural and peritoneal mesothelioma (tumors rarely seen in the general population) in persons with family, or neighborhood, or indirect occupational exposure to asbestos *(4–7)*.

Mesothelioma was the cause of death of a man who had regularly sanded vinyl asbestos floor tile *(8)*. Under simulated conditions of this man's work, a maximum asbestos dust concentration of 1.3 fibers per ml (fibers longer than 5 microns) was found in air samples passed through membrane filters worn by a person sanding vinyl asbestos *(8)*. The type of asbestos now used in domestic floor tile is chrysotile—the same as that used in brake friction materials, according to the Asbestos Information Association. A case of mesothelioma in a brake mechanic has been reported *(9)*.

Commercial friction materials used in the United States for braking passenger cars and trucks contain an average composition of 50 percent chrysotile by weight *(10)*. Asbestos has been used for brake drum linings, disk pads, and clutch facings for the past 50 years. Jacko and DuCharme *(11)* estimated that the United States annually uses 103 million pounds of asbestos for brake friction materials and 4.5 million pounds in automotive clutch friction materials.

In 1968 Lynch reported that because of the heat of friction caused by braking, almost all of the asbestos in brake linings is transformed to a nonfibrous mineral, and a small fraction of asbestos escapes as free fiber *(12)*. Jacko and co-workers determined that vehicles in this country emit 158,000 pounds of asbestos per year, of which 11.2 percent is retained in the brake and disposed of during service *(13)*.

Brake mechanics have low and intermittent exposure to asbestos. This exposure has been reported to be 0.79 fiber per ml time-weighted average (fibers longer than 5 microns), with peaks up to 7 fibers per ml when brake parts are being cleaned *(14)*. The standard method for removing dust from brake parts is to blow it out with a

Mr. Castleman, an environmental engineer, was with the Center for Science in the Public Interest when this paper was prepared; he is now with the Maryland Public Interest Research Group. Dr. Fritsch is director of the Center for Science in the Public Interest. Ms. Camarota is an occupational health nurse, District of Columbia Department of Human Resources. Ms. Mazzocchi was a research associate, Environmental Cancer Research Project, Environmental Sciences Laboratory, Mount Sinai School of Medicine, New York City. Mr. Crawley is a sanitarian, Baltimore County Department of Health.

Tearsheet requests to Barry Castleman, Maryland Public Interest Research Group, 3110 New Main Dining Hall, University of Maryland, College Park, Md. 20742.

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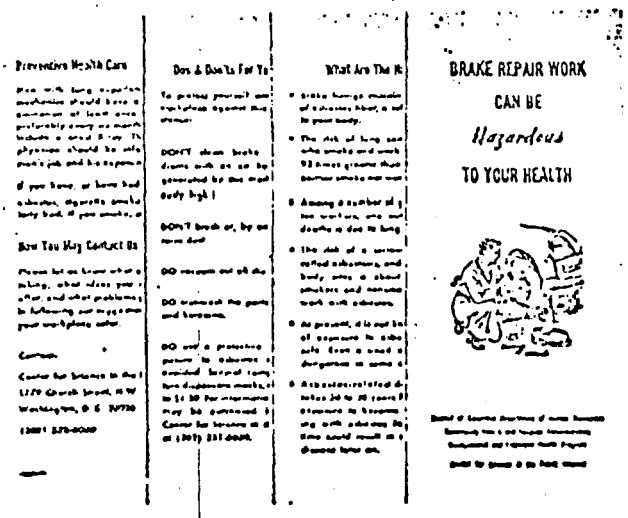
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compressed air hose. In 1970 several reports (*14–18*) described the levels of exposure of brake mechanics to asbestos; alternative friction materials, and specific changes in brake repair practices which would reduce the levels of exposure.

Baltimore and Washington Studies

In December 1972, the Baltimore County Department of Health mailed a 1-page mimeographed circular to about 130 establishments which provide brake repair service. These businesses included new car and truck dealerships, certified motor vehicle inspection stations, and other concerns advertising brake repair as a specialty. Some of the establishments initially contacted had either gone out of business or replied that they do not do brake repairs. The circular warned that inhalation of the dust from brake cleaning could cause serious diseases, including cancer, and advised vacuuming brakes of accumulated dust. Additional measures suggested were improved ventilation and the use of face masks (*19*). Two student volunteers went to 100 of the places on the mailing list 4 months later to ask shop managers what methods they were using in brake repair.

A similar study was started in Washington, D.C., in August 1973. This work was conducted by the Center for Science in the Public Interest and the District of Columbia Department of Human Resources. Of 186 brake service establishments initially contacted, 120 were followed up. Several new methods were tried in order to improve the effectiveness of the warning. The warning leaflet was more eye-catching and readable than the paragraph-form sheet used in Baltimore; the leaflets were handed out by an occupational health nurse to the mechanics themselves—none were mailed; and followup to ascertain the degree of effectiveness was conducted by the same nurse who interviewed the repair shop managers. The Washington study was also featured in a local television program at the time the leaflets were first handed out.



To assure that students trained in brake repair by public vocational schools would learn proper methods, health officials met with appropriate school officials in both locations. At the time they were contacted, school officials in Baltimore and Washington reported that the schools were teaching the "blow out" method of brake dust removal to the trainees.

The standard method of cleaning brakes is "blowing out" with a compressed air hose. In Baltimore, 65 percent (65 per 100) of the brake repair establishments contacted were using this method at the time they received the warning circulars. In Washington, the figure was 91 percent (110 of 120). Most of the managers and workers interviewed had never heard about the hazardous potential of brake dust. Predictably, the responses ranged from annoyance to appreciation.

Of the 65 places in Baltimore initially blowing out brakes, 11 were using either vacuum or wet brushing methods at the time of followup. Four others were still blowing out brakes, but had improved ventilation or provided dust masks, or both, to reduce workers' exposures.

In Washington, only two establishments had changed to wet brushing, but none were vacuuming brakes. Four others provided face masks. Interestingly, two others decided to change brake shoes in all brake repairs, thereby simplifying the problem of dust removal and reducing the mechanics' exposures.

The degree of improvement, indexed by the percentage of establishments converting from blowing out brakes to safer techniques after a single warning, was 23 percent in Baltimore County and 7 percent in Washington. This disparity probably arises more from differences in the methods of the studies than from differences in the study groups.

It may be critically important to approach management at the outset in order to enlist the cooperation needed to implement any changes in practice. A mechanic who is approached directly with a warning may simply disregard it. The mechanic might reason that if the dust were really dangerous, there would be a law requiring the use of preferred methods in brake repair. And the employer, if not asked to participate from the beginning, may well conclude that he need not be concerned with the matter. The failure to involve management may be the main reason why the Washington study produced less gratifying results than the Baltimore study.

Brake warning programs consisting merely of mailed warning notices require little manpower, compared to other health programs. Also, the effort to implement safe techniques in public vocational schools is time well spent.

Conclusion

Over a 7-year period ending in 1976 (*20,21*), the U.S. standard for time-averaged exposure to asbestos will have been reduced from 5 million particles per cubic

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foot of air to 2 fibers per ml (fibers longer than 5 microns). For asbestos textile plants, this reduction is about 18-fold (*22*). Present and scheduled standards claim only to protect workers against asbestosis, the disease for which the dose-response relationship is most quantitatively known. The British standards for chrysotile and amosite asbestos, which are comparable to the asbestos standard scheduled to take effect in the United States in 1976, do not purport to provide protection against increased risk of cancer (*23,24*).

Previously studied cohorts of asbestos workers were exposed to time-averaged concentrations greater than 2 fibers per ml (fibers longer than 5 microns). Current studies of cohorts with time-averaged exposure on the order of 1 fiber per ml (greater than 5 microns in length) may provide evidence of hazard at that level. In view of alarming preliminary findings of pulmonary fibrosis in such a cohort, the National Institute of Occupational Safety and Health has suggested to the Department of Labor that consideration be given to further lowering of the asbestos standard (*25*).

The average brake mechanic is not aware of the potential hazard of airborne brake dust. Nor is he quick to change time-hardened habits when warned of dangers if he cannot feel their effects. Nonetheless, substantial reduction in asbestos exposures during brake repair can be achieved by simple changes in technique, with the use of equipment already available in most brake service establishments.

In view of the tendency of the accumulating literature to reveal cancer induction from asbestos at progressively lower levels of exposure, mechanics should be advised not to blow out brake parts and to use instead methods which create less airborne dust. The manufacturers of automotive friction materials could easily attach a clear hazard warning to every item sold.

The limited success of both the Baltimore and Washington studies shows the limited efficacy of voluntary compliance with health warnings—the shop managers and the mechanics simply do not have the same regard for a warning that they have for a regulation. The margin of safety, if any, provided by the current asbestos standards has been sharply criticized as insufficient (*26*). While it is advisable that brake mechanics at least be warned of the potential hazard of their work, it is also apparent that blowing out brakes will be a common practice so long as health regulations permit it.

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