



75 E. MAIN STREET
STRATFORD CT 06-97

RESEARCH & DEVELOPMENT
LABORATORY

PLAINTIFF'S
EXHIBIT
FD-354

September 29, 1980

John L. McDermott, Esq.
McDermott and McGre
64 Main Street
Millburn, New Jersey 07041

Re: Raybestos-Manhattan, Inc. - Asbestos Litigation

Gentlemen:

You have asked that I review the function of brake lining and the contribution of asbestos to that function. You have also asked whether there have, over the years, been reasonable substitutes for asbestos in brake linings. In addition, you have asked me to identify the type of asbestos used by Raybestos-Manhattan in its brake products.

Simply stated, the function of brakes is to stop the vehicle or machine. The brake lining, a major component of the brakes, performs that function by converting the energy of momentum into heat and dissipating that heat into the atmosphere. The key is heat because the power input under emergency conditions can lead to serious safety problems unless the brakes are properly designed and in good working order. While brakes are unseen by most drivers, their function is critical for both commercial and personal vehicles. This reliance on brakes to perform safely even under conditions of severe thermal and mechanical stress requires extensive development effort and thorough testing before the products are released to production.

This critical safety related function of brake lining has lead the federal government and several states to establish rigid standards for brake effectiveness on cars and trucks. In addition to the requirements for strength and heat resistance, brake lining must possess several other characteristics to perform effectively. The hardness must be carefully controlled so that the lining material will wear and regenerate the surface during use. The rate of wear must be sufficiently low that the linings exhibit good durability. The material must have adequate friction level to stop the vehicle and this friction must be stable under a wide range of conditions. In addition, the material must be formulated in such a manner that it will be quiet and not wear or score the drum.

Most brake lining materials consist of a mixture of a fibrous reinforcement, a variety of friction/wear/noise modifying agents and a heat resistant binder to hold the composite together. The raw materials are mixed together and molded to a final shape under heat and pressure. Finally, the part is baked at high temperature to develop optimum strength and heat resistance. The importance of strength and heat

R001 1009

A RAYBESTOS-MANHATTAN COMPANY

61

PRODUCED BY FORD

SCF-ALLF-08280

John L. McDermott, Esq.
September 29, 1980
Page Two

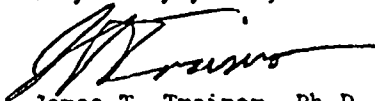
resistance cannot be overly emphasized because the material must not crush or shear off the backing plate under severe temperature and pressure conditions.

Optimizing the brake lining material for all of the above performance criteria requires careful selection of each raw material and extensive experimentation to insure that each is used in the proper amount. It should be noted that during the manufacture of brake lining, the raw materials are subjected to heat and pressure so that the binder will uniformly coat all the other ingredients. This is essential to achieve the required strength, but it also serves to encapsulate the fibers and hold them in place.

Asbestos is a major component of brake linings. The asbestos content of brake linings manufactured by Raybestos-Manhattan is about 40 to 60 weight percent. Asbestos is a high strength, heat resistant fiber with excellent processing characteristics. Unlike many other high strength, heat resistant fibers such as fiberglass, asbestos does not melt or soften at high temperatures. Rather, it stays in a solid form and is converted by heat into a non fibrous mineral particle called forsterite. We do not have to get into the chemistry of this transformation, but it is somewhat analogous to the conversion of wood fibers to charcoal. The important point is the fact that it does not melt at high temperatures because this can cause smearing and brake failure under severe service conditions. Another unique characteristic of asbestos is that its hardness is slightly less than that of cast iron used in brake drums so that it does not cause drum wear.

In conclusion, asbestos is a significant component of brake lining and no other fiber has the requisite characteristics to directly replace asbestos in this application. Finally, chrysotile is the only type of asbestos fiber used by Raybestos-Manhattan in its manufacture of brake lining materials.

Very truly yours,



James T. Trainor, Ph.D.
Manager, Stratford Laboratory

8001 1010

PRODUCED BY FORD