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ANALYSIS OF COMMENTS RECEIVED ON ISSUES I THE PETITION TO PROHIBIT THE USE OF ASBESTO

EPA Contract No. 68-02-3861

COMMENT CATALOGUE

Date: April 25, 1985

Submitted to:

USEPA
Office of Toxic Substances
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Washington, DC 20460

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INTRODUCTION

In a December 19, 1984 Federal Register notice, the Environmental Protection Agency invited the public to comment on issues relating to a Natural Resources Defense Council petition to prohibit the use of asbestos in vehicle brakes. This Comment Catalogue contains excerpts from letters received by the EPA in response to the Federal Register notice.

The Comment Catalogue consists of five major sections and several subsections, as shown on the Table of Contents. These sections were formulated after a careful review of the issues raised by the commenters. Included in the appendices are a list of commenters arranged by category, a complete reference list of comments received, and cross references showing where comments for each commenter can be located in the catalogue.

The comments are numbered consecutively from 1 to 90. The reference for each comment is found after the comment itself, and each comment is separated by a horizontal line.

I. IDENTIFICATION AND RECOMMENDATIONS OF COMMENTERS

A. Trade Associations

1. The Asbestos Information Association/North America (AIA/NA), a non-profit organization whose member companies in the United States and Canada are involved in the mining and milling of asbestos and the manufacturing and marketing of asbestos-containing products, welcomes the opportunity to comment on the Environmental Protection Agency's response to a citizens' petition on asbestos which was published in the December 19, 1984 Federal Register.

First, AIA/NA would like to reiterate the position taken in its earlier comments, dated November 28, 1984, on the petition to ban the use of asbestos in brakes. Those comments argued that asbestos should not be banned for the following reasons:

1) Ambient levels of asbestos and the small contribution of brake materials to those levels do not represent an unreasonable risk to the public.

2) The use of asbestos-containing products does not constitute an unreasonable risk to brake maintenance workers and, in addition, EPA should defer to the Occupational Safety and Health Administration on workplace regulation.

3) Substituting materials for which the health effects have not been evaluated and whose use is uncontrolled for asbestos, which is highly regulated, could result in greater health risks to the public and workers.

4) A ban would be contrary to the international consensus on the controlled use of asbestos.

5) The NRDC petition to ban the use of asbestos in brakes is not based on considerations of "unreasonable risk" as required by TSCA, but rather on an approach which advocates a "zero risk" standard for the statute.

Returning to the particular case in point, the Agency comtemplates an action to ban the use of asbestos in brakes in favor of substitute materials. The economic effects of such an action would be certain and substantial. The benefits of such an action, in terms of health effects, are speculative and uncertain, not only because they are of a magnitude that would not be detectable, but also because no consideration is given to the health effects of the substitute materials, which have their own potential for harm. Such an action could not be considered to be a reasonable one, and would not be permitted under TSCA.

Asbestos Information Association, pp. 1, 2-3

2. The Friction Materials Standards Institute, Inc. (FMSI) is a trade association of twenty-two friction materials manufacturers in the United States, with associate Members worldwide. The FMSI has read the petition submitted by the Natural Resources Defense Council (NRDC) to the Environmental Protection Agency (EPA) for the purpose of prohibiting "the use of asbestos in brakes for new cars and trucks and in replacement brakes in existing vehicles."

We wish to comment at this time on certain sections of the petition. While we are not now taking a position for or against said petition, we believe it is important to submit the following comments. Should it be deemed appropriate, these comments may be supplemented at a later date by a more in-depth critique. We will refer to the sections as headed in the NRDC petition.

An immediate ban on the use of asbestos in passenger car and truck brakes cannot be supported because of the importance of safe brake systems on the nation's highways. Brake linings are a safety related product. We stress consideration of these facts:

1. There are legitimate questions on the health hazards of the fibrous substitutes suggested for asbestos replacement in friction materials.

2. There are programs in place by industry to eliminate the use of asbestos in friction materials, and these programs realistically address health, safety, economic, performance, timing, and materials availability issues.

3. The industry must be given time to develop a total line of products which will meet all highway safety requirements.

We believe the industry will accept a properly planned program pointed towards the eventual elimination of asbestos in its products. We urge that EPA study the suggested substitute materials as well as the feasibility, economic impact, realistic necessity - if it exists, and timing requirements appropriate to the elimination of asbestos in friction materials before responding to the petition or proposing a ban on the use of asbestos in friction materials.

Friction Materials Standards Institute, Att. 1, pp. 1, 4-5

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3. I furnish herewith in triplicate, the comments of the Japan Automobile Manufacturers Association, Tokyo, Japan, in connection with the above captioned proceedings.

Based on information received to date, EPA is not prepared to make an unreasonable risk finding for an immediate ban of all uses of asbestos in brakes at this time.

We consider this as an entirely reasonable judgment and agree to such and pay our respect to this.

Taking into consideration the availability of substitute fibers, it is expected that we will encounter difficulties if vehicles decide to adopt the substitute materials. It is recommended that the action to prohibit the use of asbestos presently used as a major brake component and the substitution use of a non-asbestos brake friction material should be phased in smoothly over time granting sufficient lead time at each stage.

Japan Automobile Manufacturers Association, Att. 1, pp. 1, 5

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4. The Motor Vehicle Manufacturers Association of the United States, Inc. (MVMA)* is a non-profit trade association whose members produce more than 98 percent of domestically manufactured motor vehicles and employ nearly 750,000 workers. We are pleased to respond to the December 19, 1984, Federal Register notice in which the Agency invited the public to submit comments on issues relating to the Natural Resources Defense Council asbestos petition.

Based on the available information, MMVA urges EPA to continue its current strategy, as outlined by the Office of Toxic Substances Asbestos Regulatory Program. As outlined under the Toxic Substances Control Act (TSCA), the exercise of authority to regulate a substance under TSCA requires a balancing of societal costs and benefits. In the context of the NRDC petition, an immediate ban on this use of asbestos is not justified. Rather, the OTS regulatory plan to eliminate asbestos over a period of ten years, as substitutes become available, is appropriate.

*MVMA members are AM General Corporation, American Motors Corporation, Chrysler Corporation, Ford Motor Company, General Motors Corporation, International Harvester Company, M.A.N. Truck & Bus Corporation, PACCAR Inc, Volkswagen of America, Inc., and Volvo North America Corporation.

Motor Vehicle Manufacturers Association, pp. 1-2

B. Vehicle Manufacturers

5. In view of the controversy and the problems encountered with the development of asbestos substitutes, Chrysler Corporation believes that it would be inappropriate to prohibit the use of asbestos in brake linings at this time. Chrysler, and we believe the other vehicle manufacturers, are moving to asbestos-free brake lining materials as rapidly as technology will permit. Any regulation will not increase the rate of this changeover and forcing the use of asbestos-free materials at a premature date could very well result in compromises in brake performance which are not in the interest of motor vehicle safety.

In addition to these comments, Chrysler Corporation participated in the development of the comments submitted by the Motor Vehicle Manufacturers Association of the United States. We endorse those comments and by reference incorporate them as a part of our response.

Chrysler Corporation, p.3

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6. Ford Motor Company is not in the brake manufacturing business. We purchase all of our brake systems and parts, both for the assembly of new vehicles and for the aftermarket, from outside manufacturers and suppliers. Whether the "purchased in assembly" parts are used in Company-built cars, light trucks, medium trucks, heavy trucks, agricultural tractors, construction tractors, or for the aftermarket, all of the friction components -- be they pads or shoes -- are manufactured by others.

In considering whether to regulate the use of asbestos in brakes, EPA must be sensitive to this crucial issue. It would be neither cost-effective nor constructive for EPA to force the complete redesign of car and truck brake systems at enormous costs for currently-produced vehicles, or for out-of-production vehicles, for which the consuming public rightfully expects that aftermarket parts will remain available for routine maintenance service at reasonable cost. We thus strongly recommend that EPA not seek to regulate the use of asbestos in the brakes of vehicles which currently are being manufactured, or which formerly were manufactured, with asbestos-containing brake systems.

Ford Motor Company, pp. 1, 2

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7. IH's interest in this rulemaking stems from the fact that it is a leading manufacturer of medium- and heavy-duty trucks and buses in the United States, having the largest share of the market for these products. Moreover, since the January 1985 sale of IH's agricultural equipment operations to Tenneco, Inc., the company is now completely dependent on sales of trucks and medium-duty diesel engines in North America.

IH currently purchases from outside suppliers various components containing asbestos. These include gaskets, clutch facings, sealing materials, and brake assemblies. Because IH is a purchaser, rather than a manufacturer, of asbestos-containing products, it is extremely concerned about the possible effect that a ban on use of products in motor vehicles would have on its product planning and engineering.

RECOMMENDATIONS

1. EPA should thoroughly analyze the health risk from exposure to motor vehicle uses of asbestos, to determine if such uses present a health problem that must be addressed. On this point, IH supports the arguments of the Motor Vehicle Manufacturers Association in its comments on this rulemaking.

2. Any ban on use of asbestos in motor vehicle applications should allow motor vehicle manufacturers sufficient lead time to test and incorporate new materials into their products.

3. In applications where satisfactory substitute materials are not available, either in production or aftermarket usage, EPA should allow exemptions from the rule.

International Harvester, pp. 1, 5-6

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8. Renault agrees that certain types of asbestos consist of fibers which pose a threat when released into the atmosphere, but the asbestos dust emitted by wear of the brake linings is never found in this form. Provided that certain basic precautions are taken, the handling of asbestos brake linings, especially during replacement installation, is also without danger to the installer.

Renault USA, Inc., p. 2

C. Brake Manufacturers

9. The Off-Highway Braking Systems Division of the BFGoodrich Company is a producer of disk brake assemblies for loaders, scrapers and haulage vehicles. We currently purchase individual components, including brake linings. The prime functions performed at the Off-Highway Braking Systems Division are metal component machining and assembly.

With regard to the use of asbestos, BFGoodrich currently uses brake linings which contain asbestos but we perform no grinding or machining operations to the asbestos containing linings.

In summary, BFGoodrich produces brake systems for a small, highly specialized market. The unique friction material requirements of the off-highway market are satisfied, for the most part, by asbestos. BFGoodrich is actively searching for asbestos free substitutes at this time. Finding asbestos free linings to evaluate is difficult due to low volume which causes lining vendors to concentrate their efforts in other areas. There is no asbestos free lining material currently available to replace asbestos linings.

BF Goodrich Company, pp. 1, 2

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10. Motor Wheel Corporation, a wholly-owned subsidiary of The Goodyear Tire & Rubber Company, is a major supplier and manufacturer of wheels and brake products for the passenger car, truck and off-highway vehicle North American markets. As a manufacturer of automobile and truck brake drums we have dynamometer testing experience with both non-asbestos and asbestos lined drums. We have noted several areas deserving of comment and the Agency's concern prior to final rulemaking.

Motor Wheel's testing is not extensive enough to formulate any final conclusions. However, we do recommend extensive testing be undertaken to decisively determine the effect of non-asbestos linings on vehicle brake performance and brake drum life.

Motor Wheel Corporation, pp. 1, 2

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11. Rockwell International is a major manufacturer of foundation brakes for heavy-duty on-highway, off-highway, and military vehicles impacted by the above referenced subject. The foundation brakes which incorporate purchased brake linings are supplied to the vehicle manufacturers who, in turn, integrate the brakes into specific vehicle models and vehicle applications. These vehicles are utilized in the trucking, construction, mass transit, and agricultural industries as well as by the U.S. Department of Defense. Rockwell International is also a manufacturer of other allied heavy-duty vehicle chassis components, such as axles, brake drums, universal joints, and vehicle electronic monitoring systems.

Rockwell requests that the EPA consider the following in any proposal of rulemaking:

- O Establish a phase-in program for NAB lining based on eliminating the largest amount of asbestos in the best possible time frame.

  This should result in a two-stage process with the on-highway trucks and trailers representing 54% of the market as the first stage and where the earliest possibility exists for conversion to NAB lining.

  The second stage should consist of addressing the off-highway brakes, transit coach brakes, and wedge brakes where considerable additional time will be required.

- O Provide adequate monitoring of NAB programs, as they affect the 1) vehicle manufacturers; 2) brake manufacturers; and 3) brake lining manufacturers for the complete range of on- and off-highway, heavy-duty vehicles before establishment of regulatory effective dates.

- O Coordinate the regulations affecting transportation with other appropriate Federal Agencies, principal of which are the Occupational Safety and Health Administration and the National Highway Traffic Safety Administration.

  It should be pointed out that the most critical test for NAB is the dynamometer requirements of the Federal Motor Vehicle Safety Standards. Further, any change to NHTSA Safety Standards can have a monumental impact when attempting conversion to new base brake lining materials.

We feel the suggestions outlined will minimize the asbestos used and enable the heavy-vehicle industry to make the transition from asbestos to non-asbestos material in the most expeditious manner possible.

In conclusion, Rockwell emphasizes that any proposed rulemaking consideration to eliminate or phase out the use of asbestos in the heavy-duty vehicle industry, should recognize that unlike the passenger car industry, asbestos substitutes for the multitude of heavy-duty vehicle applications are only in the early stages of development. Further, the lining suppliers to this industry are limited in number and development capacity.

Rockwell International, pp. 1. 4-5

12. The Wagner Division of Edison International, Inc. ("Wagner") is an assembler of brake products. Wagner buys its friction materials in accordance with performance specifications from outside suppliers.

We would strongly recommend that the EPA not regulate the use of asbestos as a component in brake lining for vehicles based upon the current knowledge available regarding substitutability and risks associated with asbestos in brake lining.

Wagner Division, Att. 1, pp. 1, 6

D. Substitutes Manufacturers

13. We wish to call EPA's attention to the availability of, and to the possible use of low cost, low modulus, industrial grade carbon fibers as a suitable substitute for asbestos in automobile and truck brakes.

Ashland Petroleum Company, p. 1

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14. In a recent copy of the Federal Register the above petition requested data on substitutes developed for asbestos friction products.

Enclosed are articles written by Du Pont on customers who have develop non-asbestos friction products. We hope these articles help clarify the unaswered questions in the article.

Du Pont Canada, Inc., p. 1

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15. These comments are submitted by Engelhard Corporation in response to a request by the Environmental Protection Agency (EPA) for information on asbestos substitutes in automobile and truck brakes. Engelhard manufactures EMCOR® 66 mineral composition, a very effective replacement for asbestos in friction products for automobile, truck, and railroad brakes. EMCOR® 66 is produced from American attapulgite, which has been thoroughly tested and evaluated by independent researchers and has not been found to be associated with either cancer or fibrotic lung disease.

In addition to discussing the performance of EMCOR® 66 as a replacement for asbestos in friction products and the safety of American attapulgite, we also wish to respond to the unsubstantiated, inaccurate, and highly misleading statements and allegations made by certain asbestos product representatives concerning alleged health hazards of asbestos substitutes. We have divided our comments into three sections: Performance Characteristics of EMCOR® 66, Summary of Health Research Conducted on American Attapulgite, and Response to Certain Previous Testimony.

Engelhard urges the EPA to question seriously asbestos product representatives' self-serving allegations that asbestos substitutes have not received adequate testing and scrutiny, or that attapulgite carries the same health hazards as asbestos.

Engelhard believes that American attapulgite has been thoroughly tested and evaluated and does not represent a hazard similar to that presented by asbestos, and Engelhard has submitted these comments in order to clarify the record on American attapuglite. In addition, we hope that the information presented here on the performance of EMCOR® 66 as a friction material component in brake linings will reassure the EPA that feasible substitutes do indeed exist.

Engelhard Corporation, pp. 1, 6-7

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16. Monsanto Company is developing Phosphate Fiber, a novel crystalline fiber form of calcium sodium metaphosphate. The physical properties of Phosphate Fiber suggest it will be useful as a reinforcing fiber in friction materials and other composite products.

Monsanto Company, p. 1

E. Miscellaneous Commenters

17. I am deeply concerned at the Agency decision to grant the NRDC petition to begin an initiative to ban asbestos in brakes. I do not believe that the Agency should take this step, nor is there any reason that it should.

My concerns center on the safety of myself and my family if we are required to experiment with replacement brake materials until a satisfactory replacement is (hopefully) found someday. It might be different if there were some reason to believe that such a ban would have a beneficial effect on some sector of the public, but there is no reason, and the Agency has no supporting data for it to believe that a measurable benefit actually will occur.

The Agency has no data to support a decision to ban asbestos, here or elsewhere. There are no scientific facts to support that even a small portion of the estimated 19.2 lives would be saved if the proposed ban were inflicted. In fact, there is no scientific basis for the risk assessment methodology used to arrive at these estimates. That methodology has been criticized by the courts, the Science Advisory Board, and a large segment of the scientific arena. See the comments in response to 49 FR 46294.

There certainly is no assurance that any new forced substitution of materials would be better than 99.999% successful, day after day, year after year.

We urge the Agency to face up squarely to its responsibility to say no when no is the correct answer and deny the petition to ban asbestos brake linings. The safety of my children and my grandchildren depends on this decision.

John T. Barr, pp. 1, 4

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18. The Center for Environmental Health of the Centers for Disease Control has reviewed the Proposed Rules on Use of Asbestos in Automobile and Truck Brakes, OPTS-211015, which were published in the Federal Register on December 19, 1984, Volume 49, No. 245.

A reduction in ambient air asbestos levels should be encouraged, but the elimination of asbestos in brake pads as a means of accomplishing this goal should be strongly weighed against the safety performance of alternatives.

Center for Environmental Health, p. 1

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19. The members of the Classic Cars Of Ponca City Club are extremely concerned about the recent EPA plan to ban the use of asbestos in car and truck brakes. As owners of antiques, collectors, and special interest automobiles dating back to the 1920's, we strongly object to the use of semimetallic or aramid fiber brakes especially in our older automobiles, which are not equipped with power brakes.

However, we suggest that warning labels be placed on all packages containing asbestos brakes, and proper instructions included in the packages on how to handle asbestos dust when replacing brakes. Such precautions will minimize asbestos fibers ingestion in the lungs, and eventually minimize lung cancer.

Classic Cars of Ponca City, p. 1

II. LEGAL AND POLICY ISSUES

20. The Milford/Stratford Citizens Against Pollution is a local, independent environmental group comprised of reasonable, responsible residents of both communities. The purpose of this letter is to express our legitimate concerns with respect to ambient asbestos concentrations in our neighborhoods, as well as to define the sources of these emissions, and to endorse fully the citizens' petition filed by the National Resources Defense Council to ban the use of asbestos in brakes.

Our group was formed nearly two years ago in direct response to the chronically poor air quality in our neighborhoods, due in most part, to offensive and potentially hazardous emissions from Raymark Corporation (formerly Raybestos-Manhattan), East Main Street, Stratford. Raymark is a primary manufacturer of asbestos-containing brake and gasket friction materials, and one of the largest industrial users of asbestos in this state. The facility is located in the center of densely populated residential areas of both communities. Contiguous to the Raymark facility is the Stratford toll station on Interstate 95.

Therefore, in the absence of a viable, effective and comprehensive asbestos enforcement policy by D.E.P., it would appear that the only alternative available to protect our families and heighbors from the risks of asbestos exposure would be an immediate ban on the use of asbestos in the manufacture of brakes. With the understanding that economically and technically feasible, as well as environmentally suitable substitutes are available, the Milford/Stratford Citizens Against Pollution fully support an immediate ban on the use of asbestos in brakes.

We (breathlessly) await E.P.A.'s decision.

Milford/Stratford Citizens Against Pollution, pp. 1, 2-3

A. EPA vs. OSHA as Regulatory Agency

21. In addition, the only significant area where lives might possibly be saved is within the venue of OSHA, and EPA must abrogate Sec. 9 of TSCA to take authority there, because OSHA already is acting on the problem. Thus, EPA has no authority to act in this matter.

John T. Barr, p. 4

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22. EPA should defer to the Occupational Safety and Health Administration on workplace regulation.

Asbestos Information Association, p. 1

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23. The FMSI concerns relate to in-plant regulations versus control of general public exposure to asbestos dust. While one agency has proposed to tighten worker exposure to asbestos, another is being petitioned to eliminate asbestos in friction materials. The disparity between these two situations could well create implementation and economic problems for friction materials manufacturers. If asbestos is to be regulated out of friction materials the manufacturers should not be saddled, in the meantime, with compliance to new tighter regulations of asbestos in the workplace. The industry must know which direction regulatory activity will take.

Friction Materials Standards Institute, Inc., Att. 1, p. 2

B. Demonstration of "Unreasonable Risk"

24. Ambient levels of asbestos and the small contribution of brake materials to those levels do not represent an unreasonable risk to the public.

The use of asbestos-containing products does not constitute an unreasonable risk to brake maintenance workers

The NRDC petition to ban the use of asbestos in brakes is not based on considerations of "unreasonable risk" as required by TSCA, but rather on an approach which advocates a "zero risk" standard for the statute.

Second, AIA/NA wishes to comment on a major omission in the December 19 response, namely, the complete absence of any mention of the potential health effects of substitutes for asbestos in brakes. Any rational system of regulation in which the use of a material or substance may be prohibited for reasons related to an unreasonable risk of injury to health or the environment must include an evaluation of the risks resulting from substitute materials. If this were not the case, it would not be possible to say that any benefit had accrued to society as a result of a regulatory action.

Section 6(c)(C) of the Toxic Substance Control Act (TSCA) specifically cites that substitutes for a substance must be given consideration in the context of section 6 rulemaking:

> (C) the benefits of such substance or mixture for various uses and the availability of substitutes for such uses.

While it may be argued that a consideration of the "availability of substitutes" does not necessitate a consideration of the health effects of the substitutes, the immediately following section, which lists additional factors to be considered, would require an evaluation of substitutes' health effects:

> (D) the reasonably ascertainable economic consequences of the rule, after consideration of the effect on the national economy, small business, technological innovation, <u>the environment</u>, and <u>public health</u>. (emphasis added)

Section (D) is explicit in stating that the environment and public health effects of a rule must be given consideration. If a substance is to be banned in favor of substitute materials, Section 6 (c)(D) requires that the environmental and public health effects of such an action be considered, and such consideration would have to take into account the environmental and public health effects of the substitute materials. Any other course of action would be irrational and not permissible under TSCA.

The entire Toxic Substance Control Act is framed within the context of reasonable regulatory action. It does not permit the regulation of any risk, but only unreasonable risk. The intent of Congress in passing the Act is specific on this issue. Section 3(c) of TSCA, entitled "Intent of Congress," states:

> It is the intent of Congress that the Administrator shall carry out this Act in a reasonable and prudent manner, and that the Administrator shall consider the environmental, economic, and social impact of any action the Administrator takes or proposes to take under this Act.

Returning to the particular case in point, the Agency comtemplates an action to ban the use of asbestos in brakes in favor of substitute materials. The economic effects of such an action would be certain and substantial. The benefits of such an action, in terms of health effects, are speculative and uncertain, not only because they are of a magnitude that would not be detectable, but also because no consideration is given to the health effects of the substitute materials, which have their own potential for harm. Such an action could not be considered to be a reasonable one, and would not be permitted under TSCA.

Asbestos Information Association, pp. 1-3

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25. OSHA now has an emergency temporary standard of 0.5 f/cc. See 48 FR 51086, 29 CFR 1910.1001. This will undoubtedly be reduced at some time in the near future, but again let's use that value for now. OSHA has concluded that at this new level, 1.24% (note the precision of the estimate!) of the workers will develop asbestosis, and 1.7% will develop cancer. This compares to some 25% who will die of cancer from other causes, and includes an elevation by a factor of 10 for the two-thirds of the workers who smoke cigarettes. All in all, it adds up to about a 3% estimated increase in deaths of non-smokers because of this exposure, or about 75 persons. Of course, OSHA uses the same exaggerated upper 95% limit risk assessment which EPA does, and which is known to overestimate the real value by multiple orders of magnitude, see Hoel, et al, Science 219 1032 (1983). However, let's continue to play the game by your rules. Over the life of the next generation of workers, after all those who have experienced past higher exposures are replaced, the imposition of a ban, rather than reliance on the current OSHA exposure limit, will save the lives of about 75 persons, or about one per year. This is using the risk estimate made by OSHA to justify the present temporary standard, and assuming a lifetime exposure at the maximum level.

Now, look at the 550,000 mechanics. Enterline has stated that they are exposed at about 0.3 f/cc, and that this should produce an excess lung cancer death rate of 0.375%. See Session 1, p. 28 in Banbury Report No 9, "Quantification of Occupational Cancer", Peto and Schneiderman, eds., Cold Spring Harbor Laboratory, 1981. At the temporary OSHA standard this would be a 0.225% excess, and applied to 550,000 workers would be 18 lives per year over 70 years, in the next generation of workers.

This, if EPA decides to throw aside Sec. 9 of TSCA, and use Sec. 6 to ban occupational exposure to brake linings, a maximum of 19 lives per year, starting some time in the next century, would be "saved", using, just for the sake of argument, the agency's own methods of calculation. Based on comments made in the NESHAPS rule on benzene, this risk seems to be "too small to warrant Federal regulatory action", 49 FR 23558.

Moving now to the public at large, the national ambient level of asbestos, largely natural, is about 1.5 ng/m^3. See Enterline, JAPCA 33 317 (1983). Enterline says that this is a total cancer risk of 102 x 10^{-6}. The EPA gives a range of risks for exposure to ambient fibers in its Asbestos Health Assessment Update, EPA-600/8-84-003, table 6-1,2. Using the midpoint estimate for non-smokers there is a total added risk of about 103 per 100,000 for a lifetime exposure to 0.01 f/ml., or 300 mg/m^3, to both males and females. At 1.5 mg/m^3 this risk would be about 0.5 per 100,000 or 5 x 10^{-6}. This is about 7 x 10^{-8} per year, or 17 per year for the entire United States. However, brake linings add less than 1% of this ambient asbestos, according to the Notice, so action by EPA here will "save" 0.2 lives per year, beginning some time in the next generation. Certainly, this does not pass the "benzene test".

You will notice that we have used non-smoker data in these estimates. An employee may claim that the employer caused exposure to asbestos, but no employee may claim that the employer required smoking cigarettes.

The danger of smoking in general, and in the presence of asbestos in particular, is sufficiently well known that there is no excuse for an employer bearing the added burden of the risk caused by an employee's smoking.

John T. Barr, pp. 2, 3

III. HAZARDS ASSOCIATED WITH ASBESTOS USE IN BRAKES

A. Epidemiological Evidence and Case Reports

26. Studies have demonstrated that individuals working with insulation asbestos have five times the risk of acquiring lung disease compared with the risk faced by the general population. (McDonald; Malignant Mesothelioma in North America. Cancer 46:1650-1656, 1980). The McDonald study, which reviewed occupational risks associated with malignant mesothelioma for 668 cases in North America recorded in the late 1960's and early 1970's, reflected the following relative occupational risks compared to matched controls:

Insulation	46 x
Production and asbestos manufacture	6 x
Heating trades	4 x
Shipyards	3 x
Construction	3 x
Other -	
Garage workers	1 x
Maintenance	1 x
Transportation Industry	1 x

The mortality study conducted by G. Berry and M.L. Newhouse is also critical in weighing the risks associated with the continued use of asbestos in brake applications. (Newhouse; Mortality of Workers Manufacturing Friction Materials Using Asbestos, British Journal of Industrial Medicine 1983; 40:1-7). The study, conducted over the period 1942 to 1980, was carried out with respect to 13,460 workers of a factory producing friction materials. The only type of asbestos used was chrysotile, except for two periods before 1945. The report concluded that: "Compared with national death rates there were no detectable excesses of deaths due to lung cancer, gastrointestinal cancer or other concerns.... The experience at this factory over a 40 year period showed that chrysotile asbestos was processed with no detectable excess mortality."

Wagner Division, Att. 1, pp. 4-5

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27. The introduction of the NRDC petition emphasizes that the link between asbestos exposure and cancer has been conclusively demonstrated by epidemiologists since the early 1950's. While this may be true for certain occupational exposures of sufficient length and quantity, no association has been demonstrated between exposure to brake dust and cancer.

There is no evidence in the medical literature demonstrating any significant risk from either brief or long-term exposure to friction products.

D. Automobile Maintenance Workers Are At Particular Risk From Exposure To Asbestos Brake Products

This section argues that because of the airborne mobility of these small asbestos fibers from brake linings, a diverse group of people are at risk. The petition includes garage mechanics, bystanders, tool booth operators, families of mechanics and persons living in urban environments as the population at risk.

The only two citations upon which this argument is based are two case reports which purport to document a mesothelioma in a pet whose owner was a mechanic(15) and a brake mechanic's child who had mesothelioma.[16] The latter case is not a published case report, but the footnote indicates that this was communicated in a letter from Barry Castleman to a person or persons unknown. One case report (of a pet) and a letter from Barry Castleman are scant support for the sweeping statements made in this section.

This section concludes by alleging that recent literature "also documents mesothelioma among automobile repair workers." The first literature cited is Greenberg's 1974 report[17] which found one mesothelioma death in a "motor mechanic." Greenberg gives no occupational history for the mechanic.

The other case report cited is that by Langer in 1982[18]. Support for the proposition that there are two additional mesotheliomas in brake mechanics is allegedly found in Castleman's recent book[19] on asbestos and a "personal communication" by Susan Daum to Castleman. Yet, important data on these "cases" are missing, such that verification is not possible from these sources alone.

Thus, there are only two cases of mesothelioma in all of the reported medical literature which allegedly implicate brake dust. One of those (Greenberg) is questionable.

Motor Vehicle Manufacturers Association, Att. 1, pp. 1, 2, 4-5

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28. The Institute does not have epidemiological data to challenge the evidence associating asbestos with lung cancer and mesothelioma. We do wish to point out, however, that the most complete study of the linkage of asbestos to cancer in a friction materials factory concluded that there was no higher incidence of lung cancer in the friction materials cohort so exposed, and that any incremental occurrences of mesothelioma were demonstrated in those exposed also to crocidolite asbestos.

Motor Vehicle Manufacturers Association, Att. 4, p. 2

B. Health Effects of Chrysotile Fiber vs. Other Fiber Types

29. Chrysler Corporation recognizes the fact that exposure to certain levels of asbestos fiber can be a health risk. However, it is generally agreed that the degree of risk is dependent on the type of asbestos fiber. The only type used in the manufacture of brake linings is chrysotile which has been shown to be the least hazardous of the various asbestos forms.

Chrysler Corporation, p. 1

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30. We would also like to point out that the statements by NRDC regarding the risks associated with asbestos fail to take into account the distinction between insulation asbestos, which is not involved in brake application, and chrysotile fibers which are.

Wagner Division, Att. 1, p. 4

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31. While it is known that asbestos is a demonstrated human carcinogen that causes lung cancer and other lung disorders, evidence exists that the toxicity of different forms of asbestos varies substantially.

Two studies, both of which entail extensive surveys of current literature, found differences in the toxicity of various forms of asbestos. Both found crocidolite to be the most toxic and chrysotile to be the least. We have included the comments made to OSHA because differing toxicities of asbestos should be considered as part of the overall evaluation of the risk posed by exposure.

Motor Vehicle Manufacturers Association, p. 2

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32. The assertion is made that "animal inhalation studies demonstrate no significant difference in the effects of various types of asbestos." NRDC cites a 1974 study by Wagner(2) as authority for that statement. The petition neglects to point out that numerous subsequent animal experiments, including the work of Gross,(4,5) demonstrate precisely the opposite. These latter studies would tend to indicate that chrysotile (the only type of asbestos used in brakes) is significantly less pathogenic than other types of asbestos fibers.

Motor Vehicle Manufacturers Association, Att. 1, p. 2

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33. Chrysotile asbestos is the only asbestos type used in brake linings manufactured in the United States. We are aware of only one manufacturer using anthophyllite in a specific clutch application. To the best of our knowledge, crocidolite and amosite are not used by any United States manufacturer of friction materials. A most graphic illustration of the lack of lung cancer for the friction materials manufacturing cohort is shown in publication of the Berry-Newhouse paper in the British Journal of Industrial Medicine "Mortality of Workers Manufacturing Friction Materials Using Asbestos." (Refer to the Berry-Newhouse report cited as Ex. 84-021 in the Emergency Temporaty Standard, page 51114 of November 4, 1983 FEDERAL REGISTER).

Motor Vehicle Manufacturers Association, Att. 4, p. 2

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34. A. OSHA Should Recognize Differences in the Toxicity of Various Forms of Asbestos

The proposed OSHA standard would adopt either a 0.2 or a 0.5 fibres per cubic centimeter (f/cc) permissible exposure limit (PEL) for all forms of asbestos. Substantial evidence exists that the toxicity of different forms of asbestos varies substantially.

In March, 1976, the British Health and Safety Commission formed an advisory committee on asbestos with the following charge:

> "To review the risks to health arising from exposure to asbestos or products containing asbestos including: persons exposed at work; members of the public exposed to asbestos generated from work activities; members of the public exposed to asbestos from consumer products and from asbestos waste; to make recommendations as to whether any further protection is required. The Committee's report would be for the consideration of the HSC and Ministers and would be published."1/

The advisory committee conducted an exhaustive study surveying existing literature and soliciting the testimony and reports of experts in fields related to asbestos.

The final report of the advisory committee discussed the relative potency of various forms of asbestos in producing lung cancer in man.

"Evidence in man about the relationship of fibre type to lung cancer is inconclusive, but where it exists it indicates that exposure to amphiboles crocidolite or amosite (or to mixtures with chrysotile rich in them) has been more dangerous than to chrysotile or anthophyllite alone (Table 15). However, as important gaps in our knowledge of this aspect of the field remain unanswered, the weight which can be attached to this conclusion at present is limited."2/ (The referenced Table 15 appears in this comment as Figure 1.)

Concerning asbestosis in man, the advisory committee's report states:

"Quantitative evidence about impairment of lung function in man in relation to fibre type is limited to one study which suggests that crocidolite may have been more harmful than chrysotile."3/

FIGURE 1

Table 15 (see Vol 2 Table 21) Relative risk of death from respiratory cancer by type of fibre, corrected for differences in cumulative dust exposure (in million particles per cu ft years). After Enterline and Henderson (1973)[86]

Type of fibre	*Respiratory cancer deaths*	*Average cumulative dust exposure*	*Relative risk adjusted for cumulative dust exposure*
Amosite only	4	330	3.9
Chrysotile only	39	244	2.4
Amosite and chrysotile	3	266	1.7
Chrysotile and crocidolite	10	209	5.6
Amosite, chrysotile and crocidolite	2	273	2.4
Any amosite	9	286	2.5
Any chrysotile	54	244	2.6
Any crocidolite	12	229	4.4

Concerning mesothelioma in man, the report states:

"As far is mesothelioma is concerned, evidence from miners: from process workers exposed to a single fiber type: from the distribution of neighbourhood and domestic cases: and from the geography of mesothelioma, when combined, presents a powerful case from four different sources that crocidolite has been more dangerous than chrysotile and anthophyllite. The position of amosite may be intermediate between crocidolite and chrysotile."4/

In addition to these findings, the advisory committee recommended control limits for various types of asbestos as follows: chrysotile--1.0 f/cc, amosite--0.5 f/cc and crocidolite--0.2 f/cc. In addition, the advisory committee recommended a statutory ban on the importation of raw crocidolite fiber.5/

More recently the Canadian Province of Ontario formed a commission similar to the British Advisory Committee to investigate the health consequences of asbestos. The Commission, established in April 1980, went to great lengths in its comprehensive evaluation of asbestos. This involved, by way of illustration, either personally or through their staff, visits to Quebec asbestos mines, to the Mount Sinai School of Medicine in New York, to Ontario manufacturing establishments and to asbestos removal projects. In addition, it undertook a research program which yielded two background papers and ten book-length research studies. Testimony alone before the Commission produced 8,378 pages of transcript, and the Commission's report comprises three volumes in excess of 900 pages.

Among the conclusions of the Commission were the following.

"4. There is strong evidence that crocidolite and amosite fibres tend to be more hazardous than chrysotile fibres, primarily because they are more likely to conform to the most hazardous length and diameter and secondarily because they are more likely to become airborne and hence to be respirable. It is also possible that crocidolite and amosite are more hazardous because of their chemical composition, but this possibility rests in the realm of speculation.

"5. All fibre types can cause all asbestos-related diseases, but mesothelioma is most likely to result from crocidolite exposure, has a strong association with amosite exposure, and has a weak association with chrysotile exposure.

"6. Whatever their type, the likelihood that asbestos fibres of the most hazardous dimensions are respirable is strongly a function of the individual process in which asbestos is being used. Thus, for example, the manufacturer of brake linings, which involves drilling and grinding, is much less likely to generate fibres of hazardous dimensions than textile manufacturing, which involves spinning and weaving."6/

Elsewhere the report states:

"On the basis of this analysis, we conclude that we cannot condone any manufacturing activity that involves the use of crocidolite or amosite asbestos. The use of these two types of asbestos in Ontario should, therefore, be prohibited indefinitely. As for chrysotile, it is necessary to distinguish the industrial processes in which asbestos is being used. The control limit that the Regulation Respecting Asbestos currently applies to all chrysotile processes is 1 f/cc. If this control limit is rigorously observed so that, at the level of an 8-hour time-weighted average, it is rarely exceeded, we calculate that the average level of exposure to which workers will be subjected is no greater than 0.5 f/cc. Our data base permits us to calculate the disease risk encountered by workers in the following industrial processes: mining and milling; general manufacturing, excluding textiles and cement products;

textile manufacturing; and cement products manufacturing. We find in the cases of chrysotile mining and milling and of general chrysotile manufacturing that the disease risk associated with chrysotile exposure under a 1 f/cc control limit, effectively enforced, involves a projected mortality rate well below the mortality rate that results from industrial accidents in all Ontario manufacturing. It therefore falls well within the bounds of societally acceptable industrial risk."

Thus, these two comprehensive studies, both of which entail extensive surveys of current literature, found differences in the toxicity of various forms of asbestos. Both found crocidolite to be the most toxic and chrysotile to be the least.

These same conclusions are reflected in foreign occupational health standards studies. This is apparent if one refers to "Permissible Exposure Limits of Foreign Countries in 1983," Table 2 in the preamble to the proposed OSHA standard (49 FR 14135). Britain, Finland, Ontario (Canada), Sweden and the European Economic Community all have occupational health standards which apply the most stringent limit to crocidolite and the most lenient to chrysotile.

Motor Vehicle Manufacturers Association, Att. 2, pp. 1-6

C. Asbestos Release from Brakes - Properties, Amounts and Toxicology

35. Renault agrees that certain types of asbestos consist of fibers which pose a threat when released into the atmosphere, but the asbestos dust emitted by wear of the brake linings is never found in this form. Provided that certain basic precautions are taken, the handling of asbestos brake linings, especially during replacement installation, is also without danger to the installer.

Renault USA, Inc., p. 2

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36. Moreover, there is evidence that the physical and chemical characteristics of the material released to the atmosphere as brake linings wear are not asbestiform in nature. Research conducted by the National Institute for Occupational Safety and Health (NIOSH) has indicated that this material is predominantly a thermally degraded compound and is almost entirely non-fibrous. Until there is better evidence that the material released during braking is indeed asbestiform in nature, we do not believe that the EPA should impose a regulation prohibiting the use of asbestos in motor vehicle brake linings.

Chrysler Corporation, p. 1

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37. <u>Health Risks From Asbestos Brake Products</u>

This section begins by asserting that brakes create "substantial exposures" to asbestos which constitute "a serious health threat" not only to brake workers, but to the general public. No scientific basis is referenced for this broad statement.

The petition asserts that "numerous studies" have shown that "a fraction" of asbestos fibers survive the braking process. The reader of this sentence might draw the conclusion that this "fraction" is a significant one. The petition neglects to indicate that the three principal studies on the subject indicated precisely the opposite. Anderson(7) found less than .02 percent of the fibers survived the friction process; Lynch(8) found less than 1 percent; and Jacko(9) found less than .3

percent. More than 99 percent of the fibers are transformed, in the friction process, into a nonasbestos, nonfibrous dust.

This section stresses the danger of asbestos fibers in ambient air, particularly in urban areas where asbestos levels are increasing. A private letter from Dr. Wm. Nicholson of Mt. Sinai, New York City, is cited as authority for the proposition that this increased asbestos content in ambient air is from automobile brakes. This conclusion is not based upon any published evidence. In fact, there are several references[20, 21] which indicate that less than 1 percent of asbestos fibers in city core districts originated from disc brake wear.

The petition discusses the Jacko (Bendix) study[9] and cites it for the proposition that American vehicles release approximately 158,000 pounds per year of asbestos into the atmosphere. This misrepresents Jacko's findings. 158,000 pounds represents the total estimated asbestos emissions potentially produced from brake linings by the friction process. Only 3.2 percent, or 5,060 pounds, of that was found by Jacko to be airborne asbestos fibers. 85.6 percent of the asbestos emissions do not remain suspended and dropout from the atmosphere.

This section goes on to discuss Rohl's[10] 1976 study on the asbestos content of brake dust. It notes that Rohl found that more than 80 percent of the surviving fibers were 0.4 micron in length, but fails to mention that such short fibers are considered by many respected medical authorities not to be pathogenic at all.[11, 12]

This section of the petition concludes with the sentence that, "the problem of exposure to dangerous levels of asbestos during brake servicing is substantial" and that "(T)he small asbestos fibers from brake wear can easily penetrate throughout the respiratory system and also migrate to other organs in the body."

The conclusion is not supported by studies which indicate that the smaller fibers present during brake servicing are less likely to be deposited in the lung and more likely to be removed by macrophages.[10, 11, 12]

Motor Vehicle Manufacturers Association, Att. 1, pp. 3-4

38. II. RESEARCH DATA AVAILABLE IN JAPAN ON ASBESTOS FIBER DENSITY

The results of research into the asbestos fiber density in the atmosphere are reported in the U.S. Similar research has also been carried out in Japan. One representative study which has been released to the public is that carried out by the JAPAN AUTOMOBILE RESEARCH CENTER.

This study measured the asbestos fibers content in worn powders by means of a bench brake test. It complements test results already conducted on 142 samples for general environmental conditions and the labor environment. The results are as follows:

(a) The asbestos fibers content in the brake is 60% (Gravity ratio) while, that in worn powders is 0.12% (Gravity ratio).

(b) The asbestos fiber density in the atmosphere under general environmental conditions indicates a density of 0 - 0.46 pieces/L. The measurements were obtained in the following areas: intersecting points in Tokyo metropolitan city, at tollgates on highways and other general urban districts. The asbestos fiber density in the labors environment indicates a density of 0.27

pieces/L which represents a close approximation to the general environment, although it is concerned only with one repair shop.

The asbestos density in the environment obtained in this study indicated a very low value when compared with that of an asbestos density standard in a dusty environment (2000 pcs/L) (Director of Labor Standard Bureau No. Circular 408). Therefore, it is concluded that under those circumstances, no serious problems exist.

The asbestos fibers mentioned represent fibers with a length greater than Sum and have a length to diameter ratio, equal to or greater than 3 to 1.

Japan Automobile Manufacturers Association, Att. 1, pp. 1-3

39. The use of asbestos in brakes may result in higher levels of asbetos fibers in the ambient air.
Asbestos is a demonstrated human carcinogen, causing lung cancer if the human being exposed to it is not adequately protected.

Classic Cars of Ponca City, p. 1

40. In their report "Monitored Asbestos Concentrations in Connecticut", Bruckman and Rubino describe an ambient air asbestos survey which was conducted between 1974 and 1977 in order to "define the magnitude of the health hazard posed by airborne asbestos fibers in Connecticut." (The report cites a ten-fold increase in the asbestos-induced mesothelioma incidence rate in Connecticut since 1940). The data was collected in an effort to promulgate a numerical standard for ambient asbestos concentrations, since "in the judgment of the Connecticut D.E.P. a 'no visible emission' asbestos air quality standard does not provide the State's residents with an adequate degree of protection from this carcinogenic substance." Incidentally, the proposed numerical standard of 30 ng/m^3 was never promulgated.

Bruckman and Rubino reported 30-day average values below 10 ng/m^3 for urban and rural locations removed from known stationary sources of asbestos emissions. However, near each of the industrial users of asbestos, values above 30 ng/m^3 were detected. For the three toll stations monitored, those two removed from industrial asbestos users were elevated (10-25 ng/m^3), but the Stratford toll station showed a 20-day average of 41 ng/m^3, with traffic nearly identical to one of the other toll stations monitored. Certainly the heightened asbestos concentration at the Stratford toll cannot be attributed only to braking vehicles. In their report, Bruckman and Rubino noted that this "highest measured concentration for the entire survey was recorded at the monitoring site located adjacent to an urban toll station and one of the largest industrial users of asbestos in the state."

Raymark has been cited three times in the past eighteen months by Connecticut State Department of Environmental Protection personnel for asbestos emissions violations of the Federal N.E.S.H.A.P. Amendment to the Asbestos Standard. (Copies of these notices of violation are enclosed for your information). Inasmuch as our group contends (as do Bruckman and Rubino) that the Federal asbestos standard of "no visible emissions to the unaided eye" is inadequate to protect the public, then certainly repeated asbestos emissions violations by Raymark comprise a tangible threat to the health of all residents living in the vicinity of Raymark's manufacturing facility. These periodic visible asbestos emissions violations, in conjunction with "not visible" fugitive dust emissions which most certainly occur as a result of poor maintenance, careless handling procedures, and innate efficiency restrictions on Raymark's dry dust collection system, combined with airborne asbestos fibers resulting from braking vehicles at the Stratford tolls, expose residents of Stratford and Milford to an unreasonable, even dangerous, degree of risk.

Milford/Stratford Citizens Against Pollution, pp. 1-2

IV. SUBSTITUTES

A. Emcor 66

(1) Applications and Performance

41. Engelhard manufactures EMCOR® 66 mineral composition, a very effective replacement for asbestos in friction products for automobile, truck, and railroad brakes.

PERFORMANCE CHARACTERISTICS OF EMCOR® 66

For the friction industry, more than just the health and safety aspects of asbestos are motivating asbestos substitution. Although any substitute used must also be proven to be safe, improved performance is another key issue. Driven by pressure to reduce component weight and size, automobile manufacturers are designing braking systems lighter and smaller. As a result, the friction surface must withstand higher application pressures and temperatures.

Engelhard manufactures EMCOR® 66 ultra-short fibers with the specific requirements of the friction industry in mind. EMCOR® 66 ultra-short fibers offer a lower volatile matter content than asbestos and, therefore, offer greater heat stability. The oil absorption of EMCOR® 66 is equivalent to the grades of asbestos used in friction compounds. The abrasion and hardness rating of EMCOR® 66 (Moh hardness -- which should be lower than that of the metal surface on which the brake lining engages) is lower than virtually all other non-organic components in friction compounds, including asbestos. Unlike some other substitute materials, EMCOR® 66 does not cause high noise levels or unusual brake wear.

Engelhard Corporation, pp. 1-2

(2) Commercial Feasibility/Availability

42. Present reserves of American attapulgite are sufficient to meet market demand for use in brake systems for at least the next 40-50 years. Therefore, a consistent, long-term supply of this material should be available to the friction industry.

Engelhard Corporation, p. 2

(3) Cost

43. **Finally, it is less expensive than other substitutes.**

Engelhard Corporation, p. 2

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(4) Health Effects

44. SUMMARY OF HEALTH RESEARCH CONDUCTED ON AMERICAN ATTAPULGITE

Background

American attapulgite is a sorptive mineral which has been mined and processed in and around Attapulgus, GA, since 1920. American attapulgite has been used commercially for over 60 years in a wide variety of applications, including as an adsorbent and thickening agent, and recently has been introduced as a replacement for asbestos friction materials.

American attapulgite is composed of ultra-short fibers. Samples of American attapulgite were analyzed for particle size by the National Institute for Occupational Safety & Health (NIOSH) and found to have an average length of only 0.5 micrometers (µm).[1] In fact, over fifty percent of the particles were found to be less than 0.4 µm in length. The very longest single fiber measured was only 2.5 µm.

In contrast, material from some other parts of the world which have similar chemical composition and crystalline structure, have dramatically different particle morphologies and, in particular, substantially greater particle lengths. For example, attapulgite from Torrejon, Spain, was found to range between 2 and 8 µm in particle length with an average length of 3.5 µm. In addition, 62.5 percent of the Russian material, called palygorskite after the Ural mining district where it is located, was shown to be longer than 2 µm; 30 percent of this material was found to be longer than 5 µm.[2]

To our knowledge, all attapulgite used in this country is mined and processed domestically, in and around the town of Attapulgus, GA. Therefore, all attapulgite encountered in the U.S. is composed of very short particles, similar to those which were studied by NIOSH. As many prominent scientists, as well as government agencies, believe that the potential health hazard of a fibrous material is determined by the number of long particles (longer than 5 µm) present in the material, any health research on other, longer materials is not applicable to either American attapulgite or the American environment.

Health Effects Research on American Attapulgite

NIOSH has been conducting both mortality and morbidity studies of American attapulgite workers since 1975. Its research has involved more than 2,300 workers mining and processing attapulgite since 1940. We understand that reports of these studies will be issued within the next 12 months. NIOSH has informally advised Engelhard Corporation that exposure to its attapulgite was not found to be associated with either cancer or fibrogenic lung disease and that there was no relation between pulmonary function and cumulative dust exposure.

In addition, the research of eminent American and European scientists, conducting independent experiments on laboratory animals and cell simulations, have been reported to confirm that American attapulgite is neither carcinogenic nor fibrogenic. For example, Stanton's animal implantation work showed that the rate of tumorigenesis for two samples of American attapulgite was not different than that for negative controls.[3]

More recently, Prof. Pott of the University of Dusseldorf Medical Institute for Environmental Hygiene, who has studied Russian palygorksite, French attapulgite, and American attapulgite, has shown that only the long Russian palygorskite was tumorigenic in laboratory animals. The American and French attapulgite, both of which are short, were found not to be different than the negative controls. Although this information has not yet been published, Dr. Pott has provided the results of his research on American attapulgite to NIOSH and is committed, we understand, to publishing these results in the near future.

Further, in evaluating a life span animal feeding study, using mice and 1 percent and 3 percent attapulgite, Prof. D. Schmahl of the Institute of Toxicology in Heidelberg, West Germany, concluded that there was no evidence that attapulgite was carcinogenic.[4]

Looking at the in vitro effects, Lipkin, of the National Cancer Institute, studied the effect of French and American attapulgite on macrophage-like cells. Using several samples of attapulgite, Lipkin found the results to be uniformly negative, i.e. there was no evidence of cell toxicity as measured by reduction in cell number over a 72-hour period in any of his experiments.[5] He has also shown that this cell model correlates well with the in vivo studies conducted by Dr. Merle Stanton.[6]

Likewise, Woodworth, Mossman, and Craighead, of the University of Vermont, who studied the ability of attapulgite and other minerals to cause metaplastic changes in the tracheal mucosa of the Syrian hamster, found American attapulgite not to be statistically different than negative controls.[7]

In sum, the available epidemiological and experimental data concerning potential health effects of American attapulgite, all of which was developed by researchers independent of Engelhard, uniformly indicates that American attapulgite is <u>not</u> carcinogenic or tumorigenic and does not cause pulmonary dysfunction.

Based upon the foregoing discussions on the effectiveness and safety of one asbestos replacement, we believe that testimony to the contrary presented by certain individuals is unsubstantiated, incorrect, and very misleading. In particular, we take great exception to the comments of Mr. E.W. Drislane of the Friction Materials Standards Institute, Inc.

On Page 3 of a letter to the EPA, dated November 13, 1984, Mr. Drislane made the following statement:

> "Sufficient data is not available at this time on the substitute materials to state that they do not pose a hazard in the workplace environment or to the general public."

As discussed earlier, this statement is simply not true for American attapulgite.

On the same page of his letter, Mr. Drislane quotes a reference from the 1984 Report by the Royal Commission on Matters of Health and Safety Arising From the Use of Asbestos In Ontario.[8] That quote, as well as other sections of the Royal Commission's report, clearly reaffirms the well-recognized concept that hazards of asbestos are related to particle length longer than 5 µm. As discussed here earlier, American attapulgite is composed entirely of particles much shorter than this minimum critical length.

A second quotation referenced by Mr. Drislane, which was made by Dr. Pelnar of the Institut De L'Amiante (The Asbestos Institute in Quebec, Canada), alleges that attapulgite is one of several fibrous materials which contain fibers longer than 8 µm and which have caused mesothelioma in laboratory animals. This is a reference to Dr. Pott's 1974 study of Russian palygorskite -- a much longer fiber material of no commerical value -- which cannot be associated with American attapulgite. As discussed earlier, Dr. Pott's more recent study with American attapulgite demonstrated that Engelhard's material does not cause mesothelioma.

Therefore, we believe that Mr. Drislane's conclusion that, "There are legitimate questions on the health hazards of the fibrous substitutes suggested for asbestos replacement in friction materials." is unsubstantiated and highly misleading. Engelhard Corportion urges the EPA to seriously question the validity of these remarks.

Likewise, in a letter submitted to the EPA by Dr. Arthur M. Langer, dated December 7, 1984, Dr Langer asks, "Where are the data to show that substitute friction product materials are 'safe'?" From the information supplied earlier, we believe this data does indeed exist for American attapulgite.

Another inaccuracy is contained in a letter, dated November 28, 1984, in which B.J. Pigg submitted to the EPA comments by the Asbestos Information Association (AIA). On Page 20 of these comments, the AIA states that the Danish government "has established an all-fiber regulatory standard to assure that any fiber use is closely controlled." Dr. Schaich Fries of the Danish National Institute of Occupational Health, has informed Engelhard that the Danish Government does not, in fact, consider our attapulgite a fiber regulated similarly to asbestos. We hope the EPA will recognize this distinction as well. American attapulgite does not share the hazardous properties of asbestos.

CONCLUSION

Engelhard urges the EPA to question seriously asbestos product representatives' self-serving allegations that asbestos substitutes have not received adequate testing and scrutiny, or that attapulgite carries the same health hazards as asbestos.

Engelhard believes that American attapulgite has been thoroughly tested and evaluated and does not represent a hazard similar to that presented by asbestos, and Engelhard has submitted these comments in order to clarify the record on American attapuglite. In addition, we hope that the information presented here on the performance of EMCOR® 66 as a friction material component in brake linings will reassure the EPA that feasible substitutes do indeed exist.

Engelhard Corporation, pp. 2-7

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(5) Experience

45. EMCOR® 66 ultra-short fibers have been evaluated, purchased, used commercially, and recommended by firms worldwide that produce either friction compounds or raw materials for the friction industry. There are several firms in Europe that actively purchase and use EMCOR® 66 in automotive friction compounds. In the United States, Friction Division Products Company, Incorporated, Trenton, NJ, has approved a friction compound containing EMCOR® 66 ultra-short fibers for a Ford Motor Company OEM (Original Equipment Market) automotive brake lining. Schenectady Chemicals, Incorporated, Schenectady, NY, a leading supplier of phenolic resins to the friction industry, recommends EMCOR® 66 ultra-short fibers to its customers. Manufacturers of such diverse friction products as friction papers for heavy equipment wet brakes and elevator brakes have approved and now purchase EMCOR® 66 ultra-short fibers.

Engelhard Corporation, p. 2

B. Phosphate Fiber

(1) Applications and Performance

46. Monsanto Company is developing Phosphate Fiber, a novel crystalline fiber form of calcium sodium metaphosphate. The physical properties of Phosphate Fiber suggest it will be useful as a reinforcing fiber in friction materials and other composite products. We have introduced Phosphate Fiber samples to the worldwide friction industry for the purpose of evaluating this product's cost-effectiveness and market potential. While these evaluations are still in progress, early indications are that Phosphate Fiber will prove valuable as a full or partial replacement for asbestos in brake compounds.

EFFICACY IN FRICTION MATERIALS

Monsanto has developed and tested prototype friction compounds containing Phosphate Fiber. In addition, friction material manufacturers around the world have completed some of the evaluative studies required to prove the cost effectiveness of Phosphate Fiber in brakes. Manufacturer testing has included bench and pilot scale compounding trials, bench performance tests (on so called Chase or FAST machines), full scale dynamometer evaluations, and performance trials using instrumented test automobiles. This work has demonstrated the following performance advantages for friction materials containing Phosphate Fiber:

- Compound Processing

  Phosphate Fiber compounds are easily processed using typical, existing manufacturing equipment. The fiber is compatible with the full range of friction compound ingredients. It is homogeneously dispersed in the finished compound resulting in low performance variability among batches.

- Thermal Resistance

  Phosphate Fiber maintains fibrous morphology and its native properties up to a temperature of 740 C (1365 F). It is therefore more thermally stable than glass fiber, aramid fibers, and chrysotile asbestos. Phosphate Fiber should provide reinforcement in the brake compound even at the higher temperatures experienced under severe braking conditions.

- Strength/Durability

  Friction materials containing Phosphate Fiber exhibit excellent cured strength and acceptable uncured or "green" strength. Brake durability in the tests completed to date has been adequate.

- Friction Performance

  Brake compounds made with Phosphate Fiber have exhibited friction levels in the desired range (friction coefficients between .2 and .5). More importantly, the friction coefficients of these compounds are stable over a broad temperature range, and show controlled fade at elevated temperatures.

Monsanto Company, pp. 1-4

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(2) Commercial Feasibility/ Availability

47. Monsanto operates a pilot facility for the purposes of process development and production of typical Phosphate Fiber samples to support industry evaluations. Pilot plant capacity is adequate for satisfying initial market development requirements.

A larger, interim commercial Phosphate Fiber plant is proposed for 1987 or 1988. This plant will be located in the United States and will have production capacity of up to 5 million pounds per year. As market demand for Phosphate Fiber grows, we plan to make additional investments in worldwide capacity.

Monsanto Company, p. 2

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(3) Cost

48. Monsanto's pricing plan for Phosphate Fiber is not formally established. However, we estimate that Phosphate Fiber market price will be in the range of $1 to $2 per pound. Interim commercial product price will fall in the upper end of this range. As this business grows, Phosphate Fiber price will tend toward the lower end of this range.

Monsanto Company, p. 2

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(4) Health Effects

49. Phosphate Fiber is composed of polyphosphate chains. Polyphosphates are known to be hydrolyzed in living systems via enzymatic mechanisms. While the Phosphate Fiber product contains some fibers in the respirable size class, these fibers should be hydrolyzed by living cells. Thus Phosphate Fiber should exhibit important health advantages compared to other biologically durable organic and inorganic respirable fibers.

Monsanto is undertaking an extensive biological testing program prior to full commercialization to establish that the health safety risks associated with Phosphate Fiber are acceptably small. The main tests included in our safety assessment program are:

- 2 Year Intrapleural Implant in Rats
- 2 Year Chronic Inhalation in Rats
- 6 Month Tracheal Instillation in Rats

Monsanto Company, p. 2

C. Carboflex

(1) Applications and Performance

50. We wish to call EPA's attention to the availability of, and to the possible use of low cost, low modulus, industrial grade carbon fibers as a suitable substitute for asbestos in automobile and truck brakes.

Carbon fibers have been evaluated, and are being used in brake applications for aerospace, military and commercial aircraft, racing cars, off-road vehicle and industrial and now to some extent in automotive uses, in proprietary formulations. Here carbon fiber properties of high strength, good wear resistance, good frictional properties, good binding qualities, high heat conductance, high thermal stability, oxidation resistance, and low weight make them most attractive. Carbon/carbon fiber composites are considered the material of choice for high performance military and commercial aircrafts brakes.

Ashland's contacts in brake manufacture also indicate that carbon fibers can and are competitive, to an extent, with asbestos, performance-wise, and that neither retooling or special processing techniques would necessarily be required to permit substitution of carbon fibers for asbestos.

Ashland Petroleum Company, pp. 1, 2

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51. Carbon fibers are materials currently used in a number of industrial applications calling for high strength and low weight. Examples of its use today include graphite tennis rackets, golf clubs, and aircraft parts. However, growth of this market has been limited by the cost of producing high performance fibers used in these applications.

Ashland's carbon fibers are produced at considerably lower cost and are intended for general applications where specifications are less severe. This production breakthrough should help the market expand.

Anticipated new markets for general purpose fibers include fillers for polymers, engineering plastics, brake linings, high temperature thermal and sound insulation, other temperature applications replacing asbestos, automotive parts, construction materials, carbon/carbon fiber composites, and a variety of military applications.

Ashland Petroleum Company, Att. 1, pp. 1-2

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(2) Commercial Feasibility/Availability

52. Ashland presently has the capability of producing 30 tons/year of general purpose carbon fiber (GPCF) and will expand production to 100 tons/year in the fall of 1985.

Ashland Petroleum Company, p. 1

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(3) Cost

53. Ashland's carbon fibers are marketed under the tradename CARBOFLEX™, range in price from $10 to $12 per pound, and come in the forms of nonwoven mat, chopped (1/8" to 1/2" lengths), and ground or milled (100 to 400 microns average length).

In the past, the unavailability of low cost fibers has been a deterrent to their exploitation in automotive brake applications, although in brake pad formulations, we understand that the amount of fiber is rather low in composition. Because we manufacture a proprietary raw material, from which we produce our fiber, and which is sufficient to produce up to 50 million pounds per year of fiber, the potential exists for an even less expensive fiber if produced in much large volumes. Ashland is dedicated to a continuing effort of further improvements in cost performance so as to enhance the effectiveness of carbon fiber.

Ashland Petroleum Company, p. 1

D. Kevlar Aramid

(1) Applications and Performance

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The high temperature stability, strength and insulation characteristics of "Kevlar" have made it the preferred product in many applications where asbestos replacement is sought. Among them are transmission clutch facings, brake linings, gaskets, tires, conveyor belting and high temperature resistant apparel.

Two years ago, after an extensive development program, and with the help of Du Pont Canada, Canadian Metallic launched a premium-priced line of "Super-Nova" brake linings which proved to last up to four time the life of conventional asbestos linings. "Some trucks have clocked more than 200,000 miles on 'Super-Novas' with a wear of less than 0.10 inch per 100,000 miles," says Anderson.

Now, Canadian Metallic has launched its "Nova II" asbestos-free brake linings.

"The 'Nova II' incorporates a lesser amount of 'Kevlar' and is designed particularly for truck fleets whose owners are concerned with environmental problems related to asbestos and who want linings that will last longer," says Beri.

The new linings were subjected to demanding field tests before market introduction. "We placed test sets on underground scoop trams used by a Sudbury mining company where the brakes would be innundated with water and sticky mud. So far they have more than six months of continuous service with no problems," says Anderson.

Overall, Canadian Metallic is confident of excellent customer experience for the "Nova II" line. Field testing shows, for instance that brake drums are left unscored after up to 100,000 miles of use.

Du Pont Canada, Inc., Att. 2, pp. 2, 3, 4

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A Better Brake Block

"The 'SuperNova' is a premium brake block that conservatively offers at least eight times the performance life of conventional asbestos brake blocks," boasts Michael Beri, president of Canadian Metallic. "It also delivers twice the brake life of semi-metallic blocks, and doesn't score the brake drums the way semi-metallics generally do. In all respects, it's the enduring, high-performance brake block we set out to formulate five years ago."

It was in 1980 that Beri began focusing on "Kevlar", an aramid fiber made only by Du Pont, as the reinforcing core of a high-performance, long-lasting brake block. The high-tech track record of "Kevlar"—its demonstrated strength, low weight, abrasion resistance and outstanding thermal properties in applications ranging from aircraft and rockets to boat hulls and protective body armor—suggested a promising candidate for friction products subjected to intense heat and pressure. Following two years of trying and testing formulations, Canadian Metallic went commercial with its "SuperNova" brake blocks in October 1982. An early priority was to demonstrate the brake-life superiority of the new blocks through comparative data generated in the field.

Hayes-Dana, Inc., a supplier of truck trailer axle components, was signed on as a major Canadian distributor for the new non-asbestos brake blocks. Doug Angus of Hayes-Dana supplied "SuperNova" blocks to a number of trucking operations for field tests.

In April 1983, "SuperNova" brake blocks were mounted on the two drive axles of one of Arrow Bulk's Kenworth tractors, and on the three axles of a Knight end-dump trailer. New Kelsey brake drums also were installed at the start of the trial. Four times each day, this rig made the journey to the Ashcroft siding and back. After eight weeks of service, reports Jones, a visual inspection revealed that the blocks still had 75 percent useful lining life remaining. At this point, he adds, three or four replacement sets of asbestos blocks would have been installed due to block disintegration

Blocks, Drums Fine At 12 Weeks

Hubs and drum assemblies were pulled at 12 weeks. No disintegration of the "SuperNova" blocks; close to 50 percent of lining life remaining; drum surfaces smooth with no scoring. "With semi-metallics," says Jones, "we'd have been replacing both blocks and drums by this time. The 'SuperNova' blocks were fine, so we put them back on the wheels to see how long they really would last."

In January 1984, nine months and 65,000 miles after the start of the trial, the center axle wheels on the trailer were realigned. No new blocks or drums were required. In February, with 72,000 miles logged, all four truck wheels were realigned. Brake blocks and drums still were compatible and serviceable. It wasn't until mid-April 1984, after 90,000 miles of hauling, that Arrow Bulk finally replaced the brake blocks and drums on the rear axles of the trailer.

In addition to extended performance life, brakes reinforced with "Kevlar" (1) recover well with controlled fade, (2) help minimize cracking around rivet holes, (3) won't glaze or smear because "Kevlar" doesn't melt as glass fiber does, and (4) won't rust since "Kevlar" is nonmetallic.

Du Pont Canada, Inc., Att. 1, pp. 2-4

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"Improved performance has made the aramid-reinforced product successful," says Canparts president Bill Bartels. "We've sold more than 300 000 pads to North American rebuilders and distributors.

"Based on our lab test results, wear rate for the projected life of the pads made with "Kevlar" is only 10 - 12 percent, the same as semi-metallics, compared with an 18 - 25 percent wear rate for asbestos products," adds Bartels.

Canparts' CAF-681-FF material has several advantages over semi-metallics, as well. Unlike semi-metallics the new pad linings are not detrimental to rotor surfaces and do not rust under rivet heads. The pads greatly reduce transmission of heat to brake fluid, and they are not prone to brake squeal or dusting.

"Kevlar" was chosen for its unique combination of high tensile strength, high resistance to wear, non-abrasiveness, and excellent high temperature performance. It can also be used with existing manufacturing equipment.

"One of the most attractive advantages of "Kevlar" is its processibility," says Arnold Salt, co-principal with Canparts and a formulator with 40 years experience. "We have had no problems using the aramid fiber with our existing equipment."

Du Pont Canada, Inc., Att. 3, pp. 1-2

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Du Pont's "Kevlar" aramid fibre is now being incorporated in industrial brake blocks, used to control the tensioning of yarn twisting machines at one of Canada's largest synthetic rope and twine manufacturing companies, Poli-Twine, a division of Niagara Structural Steel, (St. Catharines) Ltd., a Tecsyn International Company.

The results are reduced costs, increased productivity and fewer plant environmental concerns.

Du Pont Canada, Inc., Att. 4, p. 1

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Already established as a high-quality, high-service supplier to the heavy-duty parts distribution industry, Canadian Metallic's tough brake linings are also being specified by several original equipment makers including Trailmobile, Fruehauf and axle manufacturers Hayes Dana & Ingersoll Machine Tool Company.

"Buyers of 'Super-Nova' and 'Nova II' linings are our best salesmen," says Anderson. "One customer tells a non-user, who tries them, who tells another non-user, who tries them, and so on. Our 'Kevlar' based products have had outstanding acceptance. We are now operating three shifts a day, six days a week and nearly 60% of our gross business comes from products incorporating Du Pont aramid fibre."

The company's complete line of friction products will eventually be free of all asbestos reinforcement with "Kevlar" being substituted throughout, Beri confirms. "We now have the technology to blend 'Kevlar' with appropriate resins according to end-use application regardless of friction classification," he says.

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Du Pont Canada, Inc., Att. 3, pp. 3-4

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(4) Experience

(See comments 54-57 on Applications and Performance.)

E. Substitutes in General - Availability, Performance, Health Effects, Safety

64. This report identifies applications for which asbestos has been or is used in motor vehicle systems and components and discusses the performance and customer acceptance criteria that led to the selection of asbestos for those applications. Alternative materials for those applications are examined in relation to selection criteria, vehicle design changes necessary to accommodate the substitution and the effect on vehicle performance including compliance with safety and other governmental regulations.

I. General Discussion

A. Characteristics of Asbestos and the Difficulties of Finding Acceptable Substitutes

The advantageous characteristics asbestos imparts to products used in the motor vehicle industry include:

- fire resistance
- thermal and chemical stability
- structural and flex strength
- moisture resistance
- dielectric strength
- low cost
- good friction and wear properties
- permeability

There are few alternate materials which have the total combination of these desirable characteristics. Developing and approving acceptable substitute materials is a task requiring extensive research and testing programs. The many different potential substitute materials must be evaluated over the wide range of environmental conditions under which a motor vehicle operates. In addition, the "ripple effect" of a substitution must be investigated to be sure the performance of other vehicle components is not adversely affected. This is further complicated by the variety of materials used on our many different vehicles and the many customized applications.

(1) Applications and Performance

50. We wish to call EPA's attention to the availability of, and to the possible use of low cost, low modulus, industrial grade carbon fibers as a suitable substitute for asbestos in automobile and truck brakes.

Carbon fibers have been evaluated, and are being used in brake applications for aerospace, military and commercial aircraft, racing cars, off-road vehicle and industrial and now to some extent in automotive uses, in proprietary formulations. Here carbon fiber properties of high strength, good wear resistance, good frictional properties, good binding qualities, high heat conductance, high thermal stability, oxidation resistance, and low weight make them most attractive. Carbon/carbon fiber composites are considered the material of choice for high performance military and commercial aircrafts brakes.

Ashland's contacts in brake manufacture also indicate that carbon fibers can and are competitive, to an extent, with asbestos, performance-wise, and that neither retooling or special processing techniques would necessarily be required to permit substitution of carbon fibers for asbestos.

Ashland Petroleum Company, pp. 1, 2

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51. Carbon fibers are materials currently used in a number of industrial applications calling for high strength and low weight. Examples of its use today include graphite tennis rackets, golf clubs, and aircraft parts. However, growth of this market has been limited by the cost of producing high performance fibers used in these applications.

Ashland's carbon fibers are produced at considerably lower cost and are intended for general applications where specifications are less severe. This production breakthrough should help the market expand.

Anticipated new markets for general purpose fibers include fillers for polymers, engineering plastics, brake linings, high temperature thermal and sound insulation, other temperature applications replacing asbestos, automotive parts, construction materials, carbon/carbon fiber composites, and a variety of military applications.

Ashland Petroleum Company, Att. 1, pp. 1-2

(2) Commercial Feasibility/Availability

52. Ashland presently has the capability of producing 30 tons/year of general purpose carbon fiber (GPCF) and will expand production to 100 tons/year in the fall of 1985.

Ashland Petroleum Company, p. 1

(3) Cost

53. Ashland's carbon fibers are marketed under the tradename CARBOFLEX™, range in price from $10 to $12 per pound, and come in the forms of nonwoven mat, chopped (1/8" to 1/2" lengths), and ground or milled (100 to 400 microns average length).

In the past, the unavailability of low cost fibers has been a deterrent to their exploitation in automotive brake applications, although in brake pad formulations, we understand that the amount of fiber is rather low in composition. Because we manufacture a proprietary raw material, from which we produce our fiber, and which is sufficient to produce up to 50 million pounds per year of fiber, the potential exists for an even less expensive fiber if produced in much large volumes. Ashland is dedicated to a continuing effort of further improvements in cost performance so as to enhance the effectiveness of carbon fiber.

Ashland Petroleum Company, p. 1

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B. <u>Need for Systems Evaluation of Potential Substitutes</u>

For the majority of current applications (other than brakes), many substitutes for asbestos may be available. This is a generalization and is conditioned by product- and application-specific constraints. In most cases, the asbestos-containing material was part of a larger system (e.g., asbestos head gaskets are a portion of the larger system, the engine). Thus the question of suitable substitutes must be approached on a total system basis. A direct substitution of some other fiber for asbestos is often not feasible without modification of a larger system. While substitutes exist, there is still a substantial research/design/testing effort required before substitute materials can be released for full production. Further, substitution must be approached on a product-by-product, function-by-function basis. In this way, the asbestos substitute can be fully evaluated for performance in the vehicle (including safety-related concerns and consumer acceptability). Health, safety and environmental factors related to substitute usage during vehicle manufacture must also be fully evaluated. MVMA cautions against inadequate consideration of all factors involved with a substitute material. <u>A substitute which results in unacceptable vehicle performance or safety, or is more harmful than asbestos to workers, is an unacceptable substitute.</u>

Asbestos offers a unique combination of properties in a single material. Not all of the properties can be matched with a single substitute, therefore, total system redesign may be required to achieve the desired result. Ripple effects must also be considered, i.e., if the new part has a different size or shape, must other components or subassemblies be redesigned to accommodate the new part? Once a potential system is designed, it must be performance tested and, if the substitute meets the performance criteria mass production, methods must be devised. All this necessitates a considerable design engineering and testing effort.

C. <u>Status of Substitute Availability</u>

- Brakes -

One of the primary applications for asbestos in our industry is brake lining materials. The suitability of brake linings to the great variety of cars, multi-purpose passenger vehicles, light trucks, vans, medium and heavy duty trucks, tractors and buses requires extensive development. Brake systems are required to meet a variety of Federal and State regulatory requirements including FMVSS 121 (Air Brakes) and 105 (Hydraulic Brakes), BMCS regulations and various state laws.

Many vehicle manufacturers are dependent upon brake and lining suppliers to develop, produce and initially screen new materials. The rate of development of these new materials is not only limited to available expertise, but to the laboratory and vehicle equipment as well as manpower at vendors. Until these materials are developed, the vehicle manufacturers can do little. Substitution will lead in disc brake pads. Drum brake linings for passenger cars and light trucks can probably be asbestos free in the next several years. Heavy truck drum brake systems, however, will take longer.

In addition to the obvious need to stop the vehicle safely, each supplier and manufacturer has requirements which he deems to be important and must be met. Among these are:

Requirements	Leading Lining Material
1. Acceptable Lining Life - Lining materials must provide the customer with acceptable lining life in the great variety of uses to which vehicles are put.	Semi-Met
2. Acceptable Drum and Rotor Life - Brake materials must be compatible with drums or rotors they contact and not cause excessive wear, grooving or cracking.	Asbestos
3. Structural Strength - Linings must have sufficient strength to prevent cracking, chipping, flaking and delamination (shearing) in their various strenuous uses. The capability to tolerate flexure of its supporting elements is an essential requirement.	Asbestos
4. Green or Preburnish Performance - Linings must provide reasonable performance and stability when new.	Semi-Met

5.	Water Recovery - Lining materials must be able to provide adequate performance when exposed to water and to recover the initial performance and stability within a short time.	Semi-Met
6.	Fade Resistance - Linings must provide adequate performance and stability when subjected to high temperatures and then cooled. They should provide approximately their original ambient performance after being exposed to temperatures as high as 1200°F.	Semi-Met
7.	Parking Capability - Linings must provide sufficient static retarding force to support grade holding demanded of the parking brake system.	Either, with slight edge to asbestos
8.	Dimensional Stability - Lining material must not swell at high temperatures or when exposed to moisture or undergo length or width dimensional changes that could result in structural cracks.	No problem
9.	Performance Consistency - Lining material performance must be relatively consistent over a wide range of temperatures and operational conditions.	Either
10.	Low Temperature - Materials must provide acceptable performance and durability at low ambient temperatures and on the first daily brake application.	Asbestos
11.	Lining Attachment (to its support element) - Current methods may not be suitable for new materials. This interface could require additional development and testing.	Asbestos

In addition, the customer demands a number of things from brakes and linings, including:

Requirements	Leading Lining Material
1. Absence of Noise - Noisy brakes and linings generate driver and community complaints and therefore cannot be tolerated.	Either
2. Modulation and Control - Drivers demand brakes and linings which provide performance and control with reasonable pedal efforts under all conditions of load and traction.	Asbestos
3. Lining and Drum/Rotor Life - Customers demand long service life in a variety of vocational uses, environmental conditions, duty cycles and geographical locations.	Lining-Semi-Met

To meet all these real needs and requirements is an extemely difficult, laborious task involving many development hours. Materials must be subjected to a great variety of test conditions. The problem is complicated further by the variety of brakes - both in size and type - that this industry uses in many different vehicles and customized applications.

Government regulations have further increased the need on heavy trucks to customize brakes and brake systems. Prior to FMVSS 121, manufacturers used one brake size and torque capacity for many axle capacities and applications. That practice has been curtailed by FMVSS 121's dynamometer requirement and the possibility of reimposed stopping distances as part of this regulation. FMVSS 105/75 subjects passenger car, MPV and light truck brake systems to severe duty cycles and temperatures which result in very rigorous demands on the brake lining materials.

Lining material selection involves many engineering, consumer and regulatory considerations. Governmental regulatory agencies such as OSHA must realize that many differing materials will be required to replace the great variety of asbestos linings manufacturers currently use. There appear to be a few acceptable non-asbestos lining materials available today for disc brake pads and some passenger car drum brake linings. The processing of non-asbestos materials may require different manufacturing equipment and techniques because of clumping and chemistry changes, mixer speeds have to be varied and pressure changes made. It will take time to develop these techniques, controls and the machines to support industry volumes. Some of the non-asbestos disc pads used by vehicle manufacturers still incorporate an asbestos backing for reasons explained later in the general discussion on brake friction materials.

Brake components such as linings have high exposure in the safety compliance, recall and product liability areas. Therefore, vehicle manufacturers must be certain they are not correcting one problem and creating another. It should be pointed out that this was exactly the case with FMVSS 121. The performance levels and effective date mandated by that standard generated the hasty development of components which were unacceptable to the consumer and which introduced new performance problems. If justification is found for a change of this magnitude, sufficient time must be provided to assure that existing linings will not be replaced with others the consumer will not accept.

Linings are a key factor in any brake design and asbestos is a key factor in many lining materials. If asbestos is eliminated from brake linings, manufacturers must retest and requalify every vehicle brake application currently using asbestos.

Summary and Conclusions

For the majority of the asbestos applications in motor vehicles, acceptable substitute materials are in varying stages of development. It is possible that many substitutions, i.e., fillers and sealers, can be accomplished in the next few years. However, there are certain critical uses of asbestos for which finding acceptable substitutes will take considerably longer. These are heavy truck brake linings and engine preformed gaskets. These special applications will require system redesign to accommodate the properties of non-asbestos materials.

II. Specific Vehicle Applications

B. Friction Products - Brakes, Passenger Cars & Trucks

Discussion

Friction materials for automotive brakes are complex composites containing three general types of ingredient materials: reinforcing fibers; modifiers that adjust or maintain friction level, wear rate and noise properties; and organic resin binders. Historically, the foundation or major constituent of automotive friction materials has been chrysotile asbestos fiber, so chosen because of thermal stability, friction level, reinforcing properties, availability and relatively low cost. Semi-metallic non-asbestos friction materials were originally developed to meet higher capacity and temperature requirements for heavy-duty and front wheel disc brakes. Disc brake systems using semi-metallic lining are now successfully used for a wide range of vehicles. Passenger cars, light trucks and multi-purpose passenger vehicles with completely non-asbestos brakes will require further development of non-asbestos drum brake shoes, a much more difficult set of design, materials and manufacturing problems that existed for disc pads. Substitution is especially difficult for dual servo type drum brake systems which are predominant on rear wheel drive vehicles because these systems require highly consistant friction coefficient for smooth application.

Most hydraulic disc brake shoe and lining assemblies contain an asbestos backing material. The primary reasons are to control heat transfer and to aid in attachment of the lining to the metal shoe. Eliminating the asbestos backing material requires considerable development in order to maintain attachment strength and control heat transfer to the brake fluid.

Control of the various materials in a lining is critical. Wear problems are currently being encountered due to impurities found in a key ingredient. Control of materials and processes continues to be a challenge.

Considerable resources are currently being expended to correct field problems with noise and low temperature wear.

Heavy Trucks - Air Brake Liners and Blocks

Non-asbestos blocks have been found to crack and delaminate. This condition causes user concern. In addition, since non-asbestos materials do not have the flexure strength of asbestos materials, shoe rigidity and dimensional accuracy become new challenges to be resolved from a manufacturing,

Substitute Materials

Major types of non-asbestos brake formulations are:

1. Organics using combinations of other fibrous materials, such as fiberglass and mixed compounds of calcium silicate, aramids, reinforcing fibers as substitutes for asbestos in formulations that use an organic resin binder.

2. Semi-metallics - consisting of steel wool, sponge iron, graphite, ceramic powder and other substances in a phenolic resin binder.

3. Sintered-metal and ceramic powders, as well as inorganic friction modifiers, fused together under extremely high temperature and pressure.

Organic materials have the least cost, the easiest lining attachment and the greatest structural strength. However, their wear rate and fade resistance are the poorest. Lining swell can also be a problem. Organic materials are used primarily for drum brake systems.

Semi-metallic linings have better wear and fade characteristics than organic materials. However, they cost more and have less static retarding force and generally require an asbestos backing material in order to insure adequate attachment shear strength on disc pads. Lining swell generally is not a concern.

Sintered metal materials are very costly, extremely difficult to attach to a shoe, and have the poorest flexure tolerance. However, they have the best wear rate and fade resistance at high temperatures. Static retarding and pre-burnish performance are also problems with these materials.

Motor Vehicle Manufacturers Association, Att. 3, pp. 1-12

65. This industry is regulated, its products being one of the critical materials in hydraulic and air brake systems. Brake linings used in new vehicle brake systems must undergo lengthy qualification and certification tests by the producer and customer before release. Formula or significant processing changes on released products cannot be put in effect without requalification and recertification. There is also considerable lead time involved when formula or processing change is planned. Change is not only time-consuming but it is costly. Development of a new formula along with the required testing for compliance with either DOT Standard 105 (Hydraulic Brake Systems) or 121 (Air Brake Systems) and moving the product into production can cost in excess of $250,000, and product or process modification costs may also approach this figure.

Products using substitute materials have a material cost two to three times the cost of the asbestos based product being replaced. The cost increase is not limited to material costs. Most substitute materials require substantial capital equipment investment as well as additional labor cost. While there has been progress in the automotive on-highway market, the industrial off-highway market is almost an entirely different market. One cannot substitute certain fibers in friction products used in underground mining equipment for fear of a spark-induced explosion. The friction material used in overhead cranes handling hot metal or heavy loads may not accept a substitute material without adding another hazard. These off-highway friction products have requirements above and beyond normal highway usage and must be tailored to the product line.

Motor Vehicle Manufacturers Association, Att. 4, pp. 1-2

66. Further, the availability of economically and technologically feasible substitutes for asbestos is an issue in which the friction materials manufacturers are deeply involved. The identification of such substitutes is a major ongoing program with the manufacturers, and is not a completed program at this point in time.

Total endorsement of Section V-B of the petition is not appropriate, since friction materials manufacturers produce disc pads and drum segments for passenger cars and light to medium trucks, as well as brake blocks for heavy trucks. The claims made in Section V-B relate to brake blocks and cannot be endorsed for all product lines. Further, actual experience to date has proven that substantial processing modifications and new equipment are required for the asbestos substitute materials.

The advantages of semi-metallic brake linings cited in Section V-A are not necessarily supported by test results generated by friction materials manufacturers. While certain of these claimed advantages may be true where the application generates high braking temperatures, they are not necessarily true for the average consumer.

Sufficient data is not available at this time on the substitute materials to state that they do not pose a hazard in the workplace environment or to the general public. We wish to cite a recent study by the (Canadian) Royal Commission on Matters of Health and Safety Arising from Use of Asbestos in Ontario, and an earlier paper on Non-asbestos Related Malignant Mesothelioma.

These comments follow:

> ...If the production of substitute fibres in the future should increase the exposure of workers to long, thin, durable fibres of dimensions similar to those we have found hazardous for asbestos, we cannot be sure that serious health consequences would not result. In the face of the existing evidence, we believe it would be risky to allow the exposure of workers to respirable fibres longer than 5 microns, with small diameters, of any material, if those fibres are likely to be very durable in the lungs.[1]
>
> It has been generally accepted now that the fibre which is carcinogenic is a durable long and thin fibre, the diameter of less than 1.5 micron and length of more than 8 micron appearing critical. A number of fibrous materials other than asbestos can appear in this size and shape and indeed have thus been established as cause of mesothelioma in animals, such as: glass fibres, aluminum oxide, tremolite, attapulgite, dawsonite, silicon carbide and potassium titanate.[2]

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[1]Report of the Royal Commission of Matters of Health and Safety Arising from the Use of Asbestos in Ontario (1984) Ontario Ministry of the Attorney General, Toronto

[2]Non-asbestos Related Malignant Mesothelioma - A Review of the Scientific and Medical Literature, Premysl V. Pelnar, MD, citing a paper by Stanton, Layard, Tegeris, Miller, May and Kent that appeared in the J. Natl. Cancer Inst., March 1977

Friction Materials Standards Institute, Inc., Att. 1, pp. 2-4

67. Effective substitutes may not be available for certain applications of asbestos in brakes and substitutes for other applications are not available in sufficient quantities because of limited production capacity.

III. POSSIBLE SUBSTITUTE FOR ASBESTOS

Possible substitutes for asbestos are represented by the following materials: alamid fiber, glass fiber, and various inorganic fibers and steel fiber. However, the safety of these fibers for human health is not yet proved. When asbestos is substituted, the following conditions will exist:

(a) Disc brake pad

From a viewpoint of securing a long brake life, the semi-metallic pads are adopted to certain types of vehicles, especially passenger vehicles. However, as EPA pointed out, the semi-metallic pad is characterized as having a coefficient of friction which varies with temperature. Therefore, it is not suitable for all types of vehicles. Further, the asbestos contained friction materials are used as a heat barrier. However, such materials cannot become a real non-asbestos friction material unless the heat barrier is non-asbestos. Another type of disc brake pad contains the parking brake built-in. This rod is provided not only with the capability required for normal service brake but also with that for the parking brake. In other words, for this rod, the coefficient value of friction fluctuating in regard to the temperature change is low, for this reason, very few disc brakes adopt this type of semi-metallic rod.

(b) Lining for drum

No substitute is available in Japan at this moment.

(c) Substitute for asbestos now under development

(1) Disc brake pad

Besides the above semi-metallic pad, the friction material applying different non-asbestos fiber is now under development. However, it is expected that such material will be applied to various kinds of vehicles after the mid 1990's. As as result, it is expected that price increases will follow.

(2) Lining for drum

For this item, non-asbestos brake using different fibers is now under development but wide scale commercial use of non-asbestos brake pads in vehicles is not expected until on or after the mid 1990's because of the unavoidable rise in prices for these pads until then. In any event, in order to use non-asbestos substitutes in various types of equipment, additional equipment or renewal of equipment will be required. Taking into consideration the availability of substitute fibers, it is expected that we will encounter difficulties if vehicles decide to adopt the substitute materials. It is recommended that the action to prohibit the use of asbestos presently used as a major brake component and the substitution use of a non-asbestos brake friction material should be phased in smoothly over time granting sufficient lead time at each stage.

Japan Automobile Manufacturers Association, Att. 1, pp. 1, 3-5

68. Even though these many uncertainties exist, we are committed to the elimination of asbestos from brake linings installed on the vehicles we manufacture.

We have been working diligently for a number of years with the major brake lining suppliers in the U.S. in an effort to find substitute materials for brake linings which do not contain asbestos. Our experience to date shows that the development of substitute materials is a very difficult and time consuming task. It has been fraught with numerous problems, many of which are recognized in the subject notice. Because of the unresolved problems associated with many currently available substitute materials, we cannot project at this time when our suppliers will be able to provide satisfactory asbestos-free brake linings for incorporation on all of our vehicles.

The development of satisfactory asbestos-free brake lining materials will take time. Over the years consumers in the U.S. have developed the expectation that vehicle brake systems will provide safe, reliable performance during many miles of operation without maintenance and will be noise-free. Many years were required for vehicle manufacturers and suppliers to develop the expertise required to provide asbestos lining compounds which meet these consumer demands and our stringent safety and performance requirements under the multitude of widely differing environmental and driving conditions experienced in the U.S. These lining materials also had to be engineered to provide balanced and consistent stopping ability under all types of vehicle loading conditions, under a very wide variety of brake temperature conditions and with "green" and used linings.

New asbestos-free brake lining compounds and formulations must be developed to meet these same objectives. Because brake performance is important to vehicle safety, it must not be compromised by a premature switch to substitute materials. Some substitute materials have been developed and the use of asbestos material has been substantially reduced, but there is still much more work to be done before it can be totally eliminated. Currently, all but one vehicle that Chrysler manufactures has semi-metallic front disc brake pads. However, we must still depend on asbestos as an underlayer medium on most applications to eliminate stress cracks that appear during the bonding or riveting of the friction material to the brake pad support plate. No entirely satisfactory material has been found to date which will provide the cushioning effect provided by the thin asbestos-based underlayer material. Alternate materials for the underlayer are being evaluated in hopes of producing pads which are completely free of asbestos.

We are working to employ asbestos-free substitute linings on new model vehicles as part of the design and development process. This process has not been without problems, however. Recently we were forced to revert to asbestos-containing brake linings on two soon-to-be-introduced vehicles because of heavy disc brake rotor scoring and inconsistent brake performance with asbestos substitutes. These difficulties appeared very late in the vehicles' development program and may ultimately cause a production delay. However, asbestos-free linings are planned for several other applications on 1986 model year vehicles. Because of weight distribution, suspension characteristics and other factors, each vehicle has unique braking system requirements. Consequently, a particular lining formulation that is acceptable on one vehicle may prove to be unacceptable on another.

In view of the complexity involved with the development of a new brake system, we begin nearly three years before the first vehicle rolls off the assembly line. The first step in the process is the establishment of vehicle performance goals and objectives. These include all the requirements of Federal Motor Vehicle Safety Standard 105, a minimum brake lining life of 50,000 miles under normal driving conditions, and noise-free operation for the life of the vehicle. These criterion along with other design parameters are conveyed to our friction material suppliers for candidate material selection. During this critical period of development, we are literally totally dependent on the recommendations they provide. Controlled laboratory tests narrow the field of candidates to the final material to be used. Vigorous tests during highway, city traffic, and mountain grade driving fine tune the system to ensure that it will meet our stringent safety and performance requirements and consumers' demands for quiet, effective and trouble-free performance.

Chrysler Corporation, pp. 1-3

69. Our suppliers tell us that they are now in the process of phasing out the use of asbestos in the friction products that they supply to us. We understand that by 1990, most if not all of these products will be asbestos-free; as new car and truck lines are phased in, asbestos-containing systems are being phased out. Despite some technical problems that remain, we understand that good progress is being made.

Ford Motor Company, p. 1

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70. IH currently purchases from outside suppliers various components containing asbestos. These include gaskets, clutch facings, sealing materials, and brake assemblies. Because IH is a purchaser, rather than a manufacturer, of asbestos-containing products, it is extremely concerned about the possible effect that a ban on use of products in motor vehicles would have on its product planning and engineering.

If EPA prohibits use of asbestos-containing components, IH will need considerable lead time to identify, test, and adapt its products to the use of asbestos substitutes--before the prohibition takes effect. The attached letter, dated March 8, 1984, to one of IH's brake suppliers, is submitted (as Attachment A) with these comments as an illustration of the magnitude of the task facing vehicle manufacturers and their suppliers, as well as the amount of lead time needed to incorporate the substitute products into the vehicle after qualified substitutes are found.

IH has already expended considerable effort to work with its component suppliers to identify and test non-asbestos substitutes. However, much more needs to be done, because safe, durable, and competitively priced non-asbestos substitutes have not been found for all asbestos-containing components in all types of brakes. This is all the more true because many of these components are subject to Federal Motor Vehicle Safety Standards, which require a high level of performance and reliability.

EXPERIENCE TO DATE WITH SUBSTITUTE MATERIALS

IH's experience with non-asbestos, current-production hydraulic disc brake linings dates back to 1976. Non-asbestos hydraulic disc brake pads were first released for production in 1980. During the past three years, IH has worked directly with its brake suppliers to find, qualify, and incorporate non-asbestos linings into additional types of brake assemblies. So far, however, regular production hydraulic service brakes, air brakes, and driveline parking brakes still contain asbestos.

Despite numerous articles in the trade press claiming exceptional durability for non-asbestos brake linings, IH has not always found these claims to be true. While laboratory wear tests of non-asbestos brake linings have shown good durability, field tests (i.e., tests in actual use) have revealed structural problems (such a delamination, material breakdown and metal pickup) in some formulations, and shortened drum lives in others.

IH believes that reports of the availability of suitable, reliable, and safe substitutes for asbestos-containing brake linings have been overly optimistic and may have misled customers, government agencies, and the general public. IH is deeply concerned that EPA might consider banning further use of all asbestos-containing components, regardless of whether suitable, reliable and safe substitutes have been found. If such a ban is put into place, IH would recommend allowing exceptions to the ban unless and until qualified substitute materials are found and can be incorporated into products.

Although the search for suitable substitutes in all applications has still not met with total success, IH continues to be actively involved in programs to test new lining formulations. As an example, the previously mentioned March 8, 1984 letter details IH's program for qualifying non-asbestos materials for foundation air brakes in tractor applications. However, this program covers only one type of brake system in one application.

The basic types of truck brake systems include air-actuated cam, wedge and disc brakes, and hydraulic drum and disc brakes. Each system must be tested in both tractor and straight-truck applications. The wide range of braking requirements in trucks stems from the tremendous variety of uses to which trucks may be put, from over-the-highway line-haul tractor operations to intra-city delivery, garbage and dump trucks, and severe-service applications such as oilfield, logging and mining operations. Each type of brake system is employed because it does the job more effectively in that particular application than any other type of system.

In the past eight years, IH has evaluated several dozen non-asbestos lining formulations for disc brakes. So far, only one has been found to be acceptable for production use. Our first series of cam drum brake tests started in 1983. These tests were terminated in early 1984 due to unacceptable results. We are currently performing a second series of tests with the best available materials on cam-braked trucks and tractors. This testing program, which began with truck tractors, was expanded in the fall of 1984 to testing of buses and medium-duty (Class 6 and 7 GVWR) straight trucks. The test series involves the following phases:

1. Screening tests of lining materials by suppliers, including dynamometer certification, torque capacity, structural integrity and wear;

2. Vehicle tests at the IH Proving Grounds, including tests of vehicle performance, grade holding, and compatibility compared to asbestos linings;

3. Field tests of selected fleets of approximately 20 tractors.

Currently, we are in the third phase, field testing, which was begun in the fall of 1984. In order to accumulate the minimum 150,000 miles required, this phase will have to last until March 1986. However, IH is concerned even at this relatively early stage in the field testing, that this test series may also turn out unsatisfactory results. Recent inspections of brake systems on the test fleet show that iron brake drum material is being transferred to and embedded in the brake block. This accelerated scoring seriously shortens the life of the drum.

FURTHER TESTING NEEDS

As a result of this development, IH believes it may not have found a suitable non-asbestos brake lining substitute even by March 1986, and further development and testing will be necessary after that date. In addition, it should be emphasized that once a suitable substitute has been found through this testing program, another two years is required to release specifications, procure material, schedule, and begin production with these materials. The enclosed time-line chart (Attachment B) shows graphically the number of steps that must be taken and the amount of time required for each stage of the process.

It should be emphasized that this testing program covers air-cam brakes only. This system is used on the greatest number of vehicles produced by IH. However, substitute materials must still be found for other brake systems used by a smaller number of vehicles, such as wedge and off-highway cam brakes. So far, test materials have not yet been developed for these brake systems. IH is concerned that the low volumes involved with these systems may not provide enough economic incentive for brake manufacturers to perform the necessary research and development on substitute materials.

Asbestos-containing materials will also have to be replaced in driveline parking brake applications. These brakes, which are used with all IH hydraulic service brake systems, are drum brakes located behind the transmission and are designed to restrain the driveline upon actuation of a hand lever. In this application structural integrity is crucial for linings because they must meet requirements for grade holding in order to be certified to Federal Motor Vehicle Safety Standard (FMVSS) 105.

Finally, while it is true that all IH hydraulic-braked vehicles use non-asbestos linings in disc-type service brakes, disc pads currently use an insulating layer of asbestos-containing material approximately 1/16th of an inch thick between the wear material and the steel backing plate. IH's suppliers are currently testing possible substitute materials with the improved structural strength needed to bond the non-asbestos wear material to the steel backing plate and to act as a thermobarrier.

At this point, however, IH does not know how long it will take to develop and qualify a satisfactory substitute material for the insulating layer of asbestos in hydraulic brake disc pads. Once the field testing of substitute materials is completed, it will take another year for IH actually to incorporate these materials into its products through the design, engineering and manufacturing process.

CONCLUSIONS

In recent years, IH has voluntarily eliminated use of asbestos in most clutch facings and has eliminated approximately 90 percent of the asbestos in hydraulic service brakes. IH's continuing effort to develop asbestos-free cam brake friction materials demonstrates a commitment to elimination of all asbestos from our products consistent with preventing any degradation of production performance. Although a federal mandate could spur the introduction of more substitute material candidates by the materials manufacturers, heavy-duty vehicle manufacturers such as IH will require between three and a half and four years of lead time to test and incorporate new materials into their products--assuming such new materials are developed.

In summary, IH would make the following points:

1. IH's non-asbestos substitution program is proceeding as rapidly as new qualified substitutes are made available to it.

2. Substitute materials suitable for all vehicle applications have not yet been found.

3. For economic reasons, substitute materials may not become available for aftermarket service parts.

4. IH will need three and a half to four years of lead time to develop and produce vehicles with qualified substitute materials.

International Harvester, pp. 1-5

ATTACHMENT A

INTERNATIONAL HARVESTER

March 8, 1984

·71.

Mr.
Eaton
P.O. Box 595
Galesburg, MI 49053

RE: Non-Asbestos Brake Lining For Tractor Application

Dear

As you know, IH has a program to evaluate non-asbestos linings on tractors for fiscal year 1984. Over the last several years OSHA has lowered the exposure limit of asbestos in the workplace. Recently they proposed to reduce the PEL (permissible exposure level) to .5f/cc. In addition, they intend to explore the feasibility of even lower limits of .2f/cc and .1f/cc. All this has encouraged lining manufacturers to focus nearly all their development dollars on non-asbestos materials. Presently there is virtually no new developments with conventional asbestos based materials. Our work to date has consisted of evaluating approximately 30 field test installations with various materials along with proposed tractor/trailer combination tests at our test track.

Recently, however, we learned under field conditions that all non-asbestos submissions failed to live up to advertised claims and desired customer expectations. As a result, in order to correct these problems all submissions are undergoing compounding changes in one form or another. The new materials, if approved, will then make our non-asbestos field test obsolete. Based on this we have decided to temporarily stop and completely reassess our goals and the administration of this program. The goals and guidelines are:

1. IH remains committed to pursue the qualification and release of non-asbestos materials on tractor models in an expeditious manner.

2. The non-asbestos lining evaluation is starting over with all lining suppliers back to "square one". Before any material will be accepted at IH for controlled vehicle tests or fleet tests, the dynamometer screening results must have been approved by our brake suppliers.

3. The material has to provide equal to or hopefully superior lining and drum life characteristics when compared to ABB 551-C.

4. The material has to have minimum coefficient of friction and yet be certifiable.

5. We are willing to consider "AL" changes in order to achieve maximum life, dyno performance, and standardization. In addition, we are willing to consider rerating an axle in order to certify the longest life materials.

6. Front and rear materials do not have to be the same.

7. The lining manufacturer has to convince the brake supplier that their material is worthy of further consideration during the screening phase of the evaluation. Communication, however, during the screening phase should not be limited to only the lining and brake supplier. I do want to be made aware of all developments which include test results, failures, compound changes, etc. This information can be transmitted to me by either the lining manufacturer or the brake manufacturer or both.

8. Coverage:

AXLE RATING(#)	LOAD RANGE(#)	CURRENT PROD BRK SIZES & LININGS	CURRENT PROD. PWR	R. RADIUS RANGE (")
12,000	8,100-12,000	15x4 (551-C)	20x5-1/2	18.6-21.1
20,000	16,160-20,000	16-1/2x7 (D39A)	30x5-1/2	18.6-21.1

Screening Phase

The brake suppliers are to screen potential candidates and make their recommendations. After screening, the number of lining candidates will be reduced to a maximum of two. The materials selected will then advance to the IH vehicle and fleet test phase. The screening test by lining manufacturers and brake suppliers is to include.

1) Dynamometer certification
2) Torque curves
3) Wear test
4) Structural integrity
5) Lining sample tests

In order to compare the various linings, an effort was made to standardize the tests of 1, 2, 3, & 4 as much as possible. Test 5, Lining Sample Tests, are in some cases proprietary procedures required by each brake manufacturer. They include specific gravity, gogan hardness, acetone extraction, swell, growth, fast and chase test, lining stability, Mu vs. temperature, pressure, and speed. The results are to be reported to me similar to 1, 2, 3, and 4.

1. Dynamometer Certification (Run per FMVSS-121): Report 50 mph retardation, fade, and recovery. Note that all dynamometer tests are to be conducted with:
   a) Rolling Radius Range 18.6"-21.1"
   b) Cast drums
      - Front drum weight 55-65 lbs.
      - Rear drum weight 105-115 lbs.
   c) Cam rotation - same

2. Torque Curves: Run 20, 50, and 60 mph at axle rated loads of 12,000 lbs. front and 20,000 lbs. rear. Plot chamber pressure vs. torque.

3. Wear vs. Temperature:
   a) Measure weight of each shoe and lining assembly to the nearest gram.
   b) Measure shoe table and lining thickness in six equally spaced locations per block
   c) Measure drum inside diameter at open end, center, and closed end. Repeat at 90° from first measurement.
   d) Install thermocouple in the center of each block -- recess in lining .040"
   e) Air flow should be set at 2200 ft/min at 75° to 100°F
   f) Run all snubs from 40 mph to 20 mph at 7 ft/sec^2. Axle load for fronts is to be 12,000 lbs. and 20,000 lbs. for rears.
   g) Condition for wear test by running the lower portion of 121 burnish. 200 stops from 40-0 mph @ 10 ft/sec^2. - IBT 315°F to 385°F.
   h) Run 2,000 snubs at 250°F, 1,000 snubs at 350°F, 1,000 snubs at 450°F, 1,000 snubs at 600°F, and 1,000 snubs at 250°F.
   i) Measure and weigh shoes and drums between each temperature interval including burnish. Note lining and drum condition. Report wear in weight of material lost and/or amount of material worn. Reseat the lining thermocouples to .040" depth after each measurement.

4) Structural Integrity:
   a) Static Test: Place lining with ends down, arc up, on a flat surface or parallel blocks. Apply a downward force at the center of the arc. Record force (lbs.) and deflection (in.) to break lining. Compare with 551-C and D39A.
   b) Dynamic Test: We are currently working with the brake supplier to develop and verify a dynamic lining structural evaluation at high temperatures (approx. 500-550°F). This should be resolved in approximately two weeks.

July 1, 1984 (or before) - Begin submission of final screening data from the brake suppliers to IH. Finalize by August 1:
October 1, 1984 - IH vehicle tests complete
November 1, 1984 - IH field test installations complete
March 1, 1986 - Field tests complete (150,000 mile test)
April 1, 1986 - IH Engineering non-asbestos material recommendation

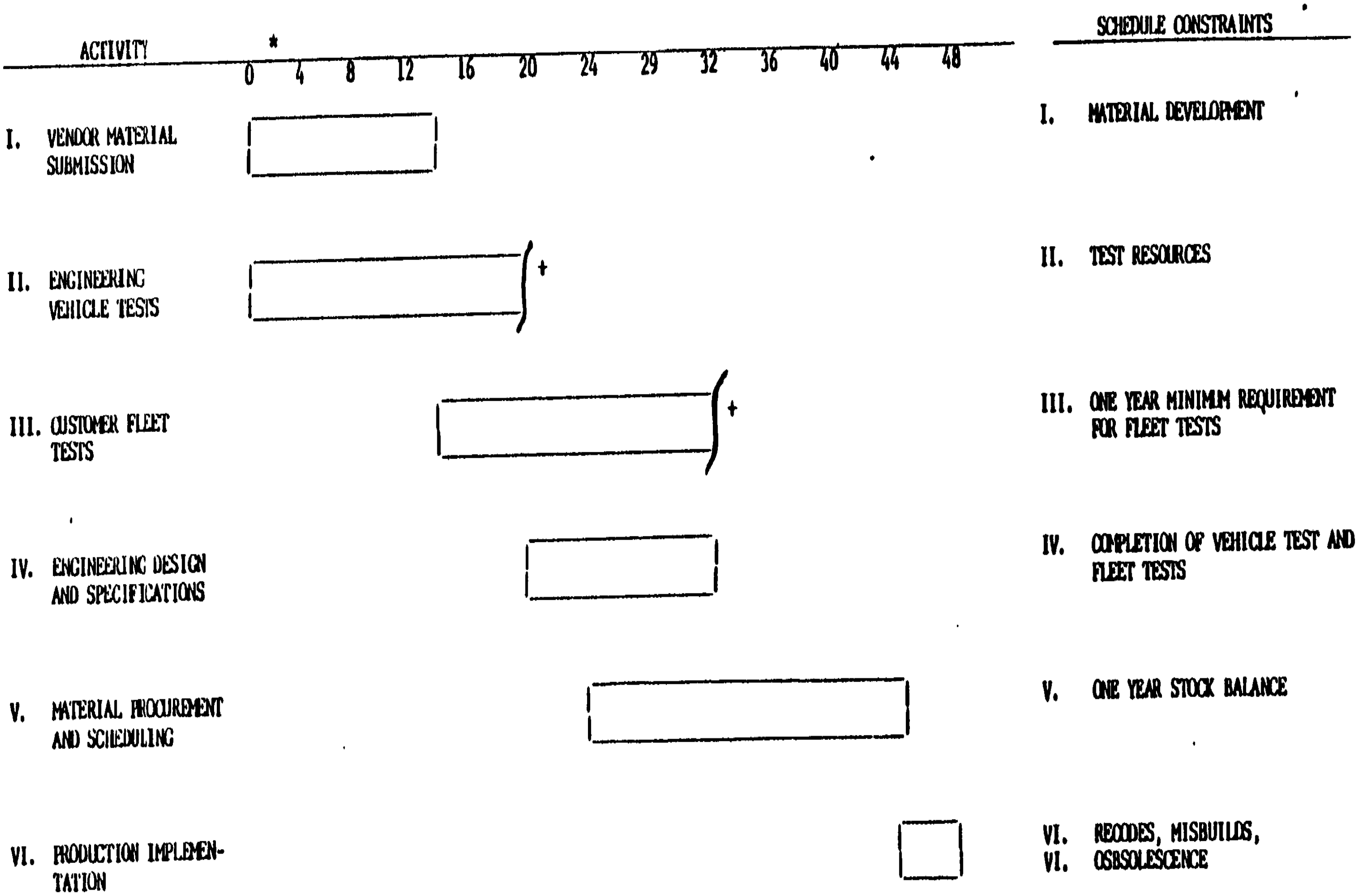
Meeting this tight schedule is extremely critical in order for the timely completion of our vehicle tests. Also it is our goal to obtain approximately 100,000-150,000 miles on each field test unit. Please indicate your willingness to participate in this program and meet the timeframe indicated in a letter to me no later than March 20, 1984.

Sincerely,

Project Engineer
Foundation Brakes

ATTACHMENT B

SCHEDULE FOR ELIMINATION OF ASBESTOS FROM BRAKE LININGS AFTER SUCCESSFUL MATERIAL DEVELOPMENT



* MONTHS FROM PROMULGATION OF FINAL RULES

+ A FAILURE HERE WOULD FORCE SCHEDULE BACK TO ZERO MONTH AWAITING NEW SUBMISSION OF MATERIAL FROM VENDOR.

72. As a manufacturer of automobile and truck brake drums we have dynamometer testing experience with both non-asbestos and asbestos lined drums. We have noted several areas deserving of comment and the Agency's concern prior to final rulemaking.

First, truck brake drums with non-asbestos linings appear to be more load sensitive than ones with asbestos linings. Our testing indicates medium friction non-asbestos linings may not have as high a load rating as medium friction asbestos type linings.

In order to meet dynamometer requirements of FMVSS 121 for effectiveness, fade, and recovery a higher friction rating for non-asbestos linings will be required than for asbestos lined drums with a given axle load. What we have seen would indicate that for equivalent friction ratings, non-asbestos linings seem to be less effective than asbestos type.

A less effective lining means that for given vehicle deceleration the air pressure required to effectuate a stop will increase. Further, with increased pressure required to brake it can be expected that the fatigue life of the brake drum will proportionately decrease. Further, there will result, in all probability, an increase in the percentage of cracked brake drums as a result of increased use of non-asbestos linings as used in current configuration and material specifications.

On the other hand, Motor Wheel Corporation has also noted that because of reduced aggressiveness of non-asbestos linings, brake drums will, according to our dynamometer tests, have an increased wear life. This increased wear life, however, is only beneficial if the brake drums do not crack.

Motor Wheel's testing is not extensive enough to formulate any final conclusions. However, we do recommend extensive testing be undertaken to decisively determine the effect of non-asbestos linings on vehicle brake performance and brake drum life.

Motor Wheel Corporation, pp. 1-2

73. General

It is Rockwell International's experience that economically and technically feasible asbestos substitutes are not developed, qualified, and available to cover the spectrum of vehicle brake applications. Rockwell has had a substantial program underway to incorporate non-asbestos materials in the production of heavy-duty vehicle brakes. This program includes test and evaluation of both prototype and production non-asbestos brake lining. The non-asbestos lining formulations and brake applications must not only meet our internal test requirements and the requirements of our brake customers, but also the specific requirements of the National Highway Traffic Safety Administration's Federal Motor Vehicle Safety Standard No. 121 (49 CFR-571.121). Rockwell International, however, as a purchaser of brake blocks and other lining materials for inclusion in foundation brakes, is limited by the availability of non-asbestos materials developed by the brake lining manufacturers.

In many instances, non-asbestos brake lining is unavailable to us because the materials are not fully developed at this time. Basically, the problem has been in finding materials to meet the test, performance, and durability requirements for many heavy-duty vehicle applications. Rockwell has experienced unacceptable durability and performance problems with a number of the non-asbestos formulations furnished for on- and off-highway vehicle test programs.

It should be pointed out that it takes as much time for development, test, and qualification for each of the small volume vehicle requirements as it does for the very high volume vehicles.

The following two sections, Rockwell Non-Asbestos Lining Program for On-Highway Heavy-Duty Vehicles and Rockwell Non-Asbestos Lining Programs for Off-Highway Heavy-Duty Vehicles will summarize the current status of our non-asbestos development.

Rockwell Non-Asbestos (NAB) Lining Program for On-Highway Heavy-Duty Vehicles

As shown on Exhibit I, attached, the average yearly production estimate of heavy-duty vehicles is approximately 652,000 units. Of that number, approximately 56% are on-highway vehicles. These on-highway vehicles encompass three market segments and include heavy-duty on-highway trucks and trailers and transit and intercity coaches.

Our NAB lining development for the on-highway vehicle market has been in process for over five years in conjunction with our lining suppliers and our heavy-duty truck, bus, and trailer manufacturing customers which include Mack, Ford, Kenworth, IH, GMC Truck and Bus, Freightliner, Peterbilt, TMC (Greyhound), Trailmobile, Great Dane, and Budd. Our NAB program consists of our internal test programs for performance and durability as well as the qualification of Rockwell brakes with NAB lining under the provisions of

FMVSS No. 121. During this period, four replacement NAB lining formulations have been identified, tested, and integrated into on-highway vehicle applications and certified to the requirements of FMVSS No. 121. This represents significant NAB substitute progress as these applications include potentially high volume application areas. On the other hand, however, we utilize over 24 asbestos-type formulations, from primarily two brake lining suppliers for our complete on-highway brake requirements. Therefore, numerous additional lining formulations must be developed and certified to satisfy all on-highway vehicle demands. The certification of the base formulations must be made on a wide range of vehicle applications with different braking systems and different basic foundation brakes, including cam drum brakes, wedge drum brakes, and disc brakes.

It should also be pointed out that in certain on-highway vehicle categories, such as mass transit coaches and wedge-braked trucks or trailers, the NAB linings required for the demands of these applications are in the undeveloped category at this time. These vehicles represent a relatively small but important portion of all the on-highway vehicle market.

For the majority of on-highway applications, NAB materials are being developed that can, over a reasonable period of testing, qualification, and NAB lining production build-up, replace asbestos in the major portion of the heavy-duty commercial vehicle market. This would include on-highway trucks and on-highway trailers as shown on Exhibit I, which total approximately 54% of the heavy-duty vehicle market. As stated, however, we would currently exclude wedge-braked trucks and trailers as well as transit and intercity coaches which, as a group, represent a small portion of the on-highway market.

Rockwell Non-Asbestos (NAB) Lining Program for Off-Highway Heavy-Duty Vehicles

The typical yearly production estimate of vehicles that falls into the category of off-highway is approximately 44% of the heavy-duty vehicle market. This includes such vehicles as cement mixer trucks, earth-moving vehicles, crane carriers, ore haulers, lift trucks,and agricultural vehicles. This program has also been underway for over five years with our lining suppliers and such major off-highway customrs as Caterpillar, FMC, Grove, Allis-Chalmers, and John Deere.

As of this time, we have been unable to find NAB materials which are equivalent in performance and/or durability to asbestos-based linings required to satisfy most off-highway braking requirements. The off-highway vehicle braking requirements are generally quite severe. These vehicles cover a wide range of vocations from industrial lift trucks to giant ore haulers. The vehicles vary as to width, length, and centers of gravity as well as loadings and operating conditions, all impacting brakes.

Much of our brake lining suppliers' NAB development and, in turn, Rockwell's NAB lining qualification to date, have involved low and medium friction level classification applications to the higher volume on-highway trucks and trailers. While the result is converting the largest vehicle category in the shortest time to NAB materials, it must be recognized that considerable development, test, and qualification still is ahead for the off-highway vehicles as well as certain on-highway vehicles such as transit coaches.

Rockwell has just begun receiving supplier-devleoped, higher-friction NAB materials for test and certification. Completion of this process to cover the complete spectrum of specialty vehicles is a number of years away.

Summary and Recommendations

The NHTSA Federal Motor Vehicle Safety Standard No. 121 for air-braked vehicles initiated in the early 1970's required brake certification to the existing asbestos-based commercial vehicle brakes. Even with the already existing asbestos lining formulations, it required an extended period of time to qualify and certify brakes and brake applications covering the multitude of heavy-duty commercial vehicles. Adding the need to develop and test complete new material formulations (NAB) results in a task that is a greater time consumer. Part of the time consuming complexity is the large number of vehicle manufacturers, a greater number than normally understood. These exceed over three hundred in number and range from very large truck manufacturers to small specialty vehicle manufacturers.

Rockwell estimates that within the next several years, it will be in a position to offer NAB medium friction lining formulations to our vehicle manufacturers for most of the high volume on-highway, heavy-duty truck and trailer brakes. This would assume that the upstream lining manufacturers continue their substitute NAB formulation efforts and then can furnish quantities of NAB materials. Considerable, additional time, however, will be required to complete work on the higher friction NAB formulations for the wide variety of vehicles such as buses and the large off-highway vehicles.

Rockwell International is: 1) continuing to expand its NAB lining applications and production releases based on the four high volume, on-highway material formulations already approved; 2) continuing to test and evaluate new on-highway NAB lining formulations in the engineering and development mode; 3) initiating off-highway prototype NAB lining field test programs on haulers, loaders, forklifts; 4) continuing to aggressively support vehicle manufacturers' field test programs; and 5) accelerating test efforts on newly developed NAB materials in order to expand the application approval base.

YEARLY PRODUCTION ESTIMATE

OF THE HEAVY-DUTY VEHICLE MARKET

652,000 UNITS *

Includes:

- On Highway Heavy-Duty Trucks

  Air-braked straight trucks; air-braked truck-tractors; air-braked fire engines; air-braked military trucks; etc.

- On-Highway Heavy-Duty Trailers

  Air-braked vans; air-braked reefers; air-braked flat beds; air-braked liquid tankers; etc.

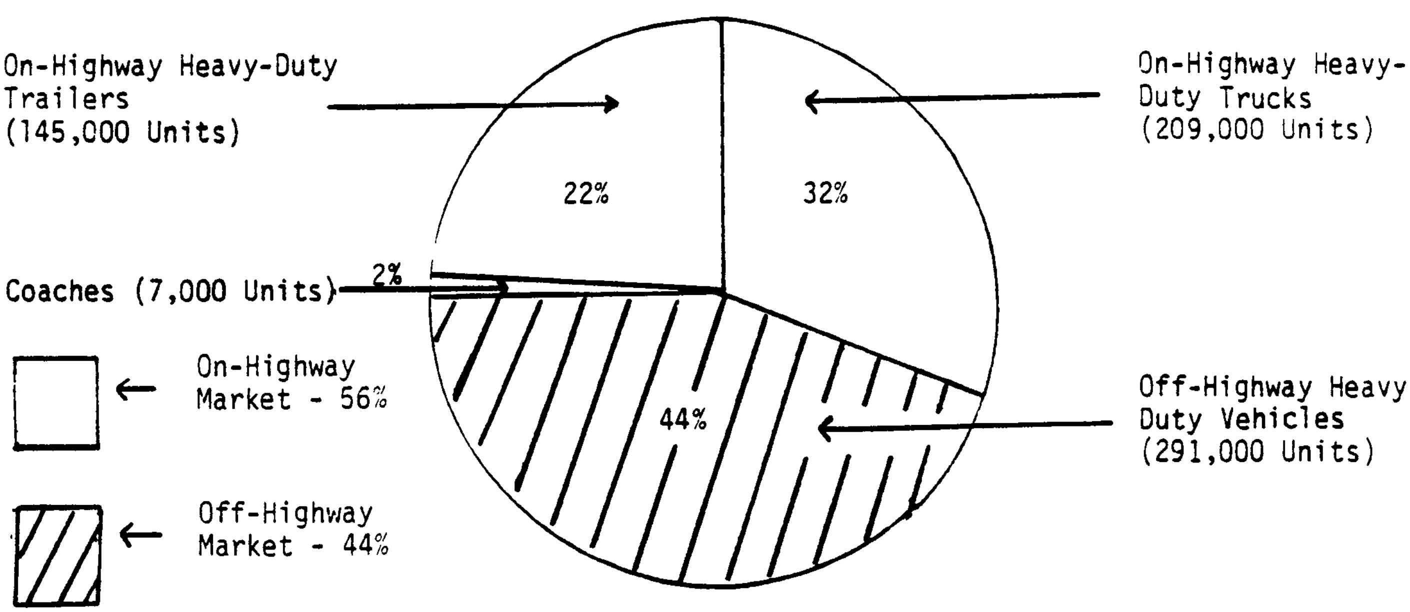
- Coaches

  Air-braked transit coaches; air-braked intercity coaches.

- Off-Highway Heavy-Duty Vehicles

  (Some move from site-to-site on the highways.) Air-braked mixer trucks; air-braked crane carriers; ore haulers; lift trucks; earth-moving vehicles; agricultural vehicles; etc. **

MARKET SEGMENTS



* Based on an average production year in each category.

** Some of these large vehicles incorporate drum or disc hydraulic foundation brakes.

Rockwell International, pp. 1-6

74. BFGoodrich uses several types of brake lining other than asbestos containing linings in our brake systems including resin bonded metallic and sintered linings. Due to the performance and wear characteristics of the various linings used in our brake systems and our customer requirements we currently supply about 80% of our systems with asbestos containing linings, 15% with resin bonded metallic linings and 5% with sintered metallic linings.

Our Division has an ongoing program to evaluate new types of asbestos free lining materials. To date we have not been able to find suitable asbestos free substitutes for the asbestos containing linings used today in the majority of our braking systems.

The major stumbling block in finding acceptable asbestos free linings for use in our braking systems has been inferior performance and wear characteristics versus asbestos containing linings. The asbestos free linings evaluated to date fade more than asbestos containing linings. Both characteristics are undesirable.

A second hurdle is in finding asbestos free lining materials to evaluate. The off-highway segment of the automotive market is a very small segment of the total market and there is little research aimed at producing an asbestos free alternate lining for this market.

BF Goodrich Company, pp. 1-2

75. In determining whether a product is a suitable substitute for asbestos in brake applications, the factors to be taken into account include the constant coefficient of friction, the rate of wear, the thermal stability, the strength, the absence of scoring to the drum or rotor, the noise generated by and the cost of the products being compared.

From our research, asbestos has certain unique qualities which have, as of 1985, not yet been duplicated for most brake applications in terms of friction performance, thermal stability, wear resistance, strength and cost. See, e.g., Loken, Halvary "Asbestos Free Brakes and Dry Clutches Reinforced with Kevlar Aramid Fiber", Paper 800667, SAE (1980).

We understand that the asbestos fiber in friction materials for brake application is chrysotile. That fiber has special characteristics including its ability to stiffen and strengthen the resin matrix which makes up the brake lining and can maintain these properties even under high temperatures. Pye, A.M., "A Review of Asbestos Substitute Materials in Industrial Applications", Journal of Haz. Matls., 3 125-147 (1979).

High wear on brake linings may cause what is termed glazing which can cause a reduction in the coefficient of friction. This reduction is avoided by allowing for a slow alteration in the brake lining materials. The chemical change brought about by heat to chrysotile fibers restores the friction surface so as to reduce or eliminate the glazing effect. Nicholson, W., "Investigation of Health Hazards in Brake Lining Repair and

Maintenance Workers Occupationally Exposed to Asbestos: Task I - Brake Materials, Products and Usage". Draft report submitted to OSHA by Environmental Sciences Laboratory, Mt. Sinai School of Medicine, New York (January, 1979).

The possible substitutes for asbestos in brake applications, semi-metallics and organic fibers, are substantially more expensive than asbestos. Further, semi-metallics cause greater rotor or drum wear and are quite noisy. Aramid fibers tend to clump thereby requiring certain mixing procedures. (Loken, SAE (1980). The petition of the Natural Resources Defense Council ("NRDC") misstates the facts when at page fifteen of the Petition it asserts that "aramid-reinforced brakes have the same basic formulation as asbestos brakes" and, therefore, "production techniques already developed for asbestos brake manufacture can easily be retained." It is important to note that NRDC's support for the quoted phrases is Loken. However, Loken offers no support for the NRDC assertion.

Other possible substitutes include glass (which can melt at high temperatures reached in normal brake applications and be converted through the heat to a form of lubricant); vermiculite (which is platy rather than fibrous and, therefore, does not have the capacity to strengthen the resin mix which asbestos does); and silicon nitride and carbon/carbon composites (which have limited specialized applications, such as the Concorde SST or racing cars, and are very expensive).

The foregoing research does not suggest the absence of progress in attempting to find substitutes for asbestos in brake applications. For example, semi-metallics have been substituted for asbestos in disc brakes (front brakes) in downsized cars. However, they are not suitable for rear drum brakes on most American cars and trucks because they cannot be processed into the required arcuate shape. In any event, more testing must be done on semi-metallics before they could be regarded as safe substitutes for asbestos in brake applications.

With respect to the substitutability of other products for asbestos in brake applications, we enclose a portion of a report prepared by John W. Kourik, Chief Engineer, Brake Products and presented to the 1980 Society of Engineers Congress in Detroit, Michigan. Mr. Kourik concludes that while efforts are being made to find replacements for asbestos in brake applications, those efforts have not yet been achieved.

In determining whether to cause the discontinuance of asbestos in brake applications, the EPA must take into account not only the uncertainty associated with the health risks claimed to be attributable to exposure to asbestos but also the fact that there is yet no reliable substitute for asbestos as a component for brake lining in most brake applications. To accept substitutes without thoughtful and reliable testing programs invites a significant safety hazard for drivers and passengers of vehicles and bystanders as well. Moreover, it is neither prudent nor cost-effective for EPA to require a complete substitute for asbestos on all brake applications. Brake systems are very sophisticated and contain many components, each of which must have characteristics perfectly compatible with the characteristics of the other components. One cannot reliably remove one component of a brake system, (such as friction material containing asbestos) and replace it with another without considering the effect such substitute will have on the brake system's performance, coefficient of friction, durability, maintenance requirements and noise production.

Wagner Division, Att. 1, pp. 1-6

76. WAGNER

CONSIDERATION ON REGULATING THE COMPOSITION OF BRAKE LINING

John W. Kourik
Chief Engineer, Brake Products
Wagner Electric Corporation

1980 SAE Congress

Detroit, Michigan
February 25, 1980

STATE-OF-THE-ART OF NON-ASBESTOS LINING

The most recent press (industry) releases and magazine articles imply that there is an almost immediate capability to eliminate asbestos from brake lining. Such claims are not representative of the true state-of-the-art from non-asbestos linings. We base this belief on the small number of test materials that we have had from lining manufacturers. We'll help you look at the overall scope of the market and the need to evaluate the success or failure of the tests of these materials before concurring in the validity of the development claims. We also must determine their true availability based on committed tooling by the manufacturer and use these findings to see if we can procure the material needed to service a very extensive market.

Let's look at the number of applications that need to be covered by friction materials in the braking area only. 2 Friction requirements are different for a variety of vehicles because of the different types of applications, the speeds at which they operate, the frequency of brake applications, the type or service and the durability needed to have long intervals between relining and servicing.

Wagner is extensively involved in supplying original equipment brake assemblies, aftermarket linings and replacement shoe and lining assemblies.

Our aftermarket program is one example of the complexity of a changeover. We require 216 dimensionally unique segments for drum brakes and 134 unique disc pads for our passenger car replacement program even though this program already incorporates a high degree of standardization and simplification.

We have surveyed our current varieties of lining compounds and the sources for these materials. In these several categories we have a total of 50 materials that we purchase from 10 different sources.

ORIG. EQUIPMENT + AFTERMARKET APPLICATIONS	NUMBER OF LINING	
	COMPOUNDS	SOURCES
PASSENGER CAR	20	5
TRUCK SEGMENTS	18	5
TRUCK BLOCKS	16	6
CUMULATIVE	50	10

Let's look at the characteristics that are needed for OEM and replacement materials. Most of these are self-explanatory.

DESIRABLE CHARACTERISTICS
OF A SUITABLE LINING MATERIAL

STRUCTURALLY SOUND

LONG DRUM/ROTOR LIFE

LONG WEARING

CONSISTENT FRICTION - HOT & COLD

ACCEPTABLE NOISE LEVEL

NO MORNING SICKNESS *

ACCEPTABLE WATER RECOVERY

PHYSICAL FLEXIBILITY FOR ATTACHMENT TO SHOES USING STANDARDIZING SEGMENTS

LIGHT WEIGHT

* Erratic braking or "grabby" lock up on first stops.

Now consider the variety of brake designs used on old and new vehicles.

PASSENGER CAR & TRUCK HYDRAULIC BRAKE TYPES	TRUCK, TRACTOR & TRAILER AIR BRAKE TYPES	INDUSTRIAL BRAKES (EXTERNAL)
NON-SERVO	CAM	AIR
SERVO	DISC	HYDRAULIC
DISC	WEDGE	SPRING/SOLENOID

There is considerable technical literature available on the subject of brake goemetry and effect of friction materials on design, performance and speed sensitivity. We have submitted several of these and their bibliographics to the EPA/CPSC dockets for reference purposes.

Considering all of the above brake types it appears likely that only the passenger car and light truck disc brakes will have a suitable non-asbestos friction material available in the reasonably near future.

There will be a long transition as development efforts continue to be directed towards the availability of

(1) a substitute material that will allow vehicles to remain at or exceed today's safety level,

(2) a suitable substitute for current asbestos based materials at a reasonable cost,

(3) a long wearing lining material that also causes minimal drum wear or little rotor wear.

At this time we have an insufficient number of samples to predict a realistic target date for conversion to non-asbestos strip, segment or block material. We expect this to be at least several years away. We look with askance at the press releases extolling the imminent availability of non-asbestos lining materials without citing the limited number of applications covered.

Wagner Division, Att. 2, pp. 1-5

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77. The grand total of lives saved if EPA grants the petition now is 19.2, 19 in the occupational field and 0.2 in the general public.

How sure must EPA be that there is a satisfactory substitute for asbestos brake materials to make a decision on less than 20 lives per year?

There are about 10^8 motor vehicles on the road, traveling about 10^4 miles per year each. My experience has been that a car needs new brakes at about 4×10^4 miles. This calculates to 25×10^6 brake jobs per year. Let us assume that it takes ten catastrophic brake failures to cause a fatality. I expect that the actual number is somewhat less. Thus, 200 added failures out of 25×10^6 brake jobs will exactly balance the "savings" postulated from the proposed ban. That requires a confidence of 99.9992% that any proposed substitute is at least equal to asbestos as a brake material. Does the Agency have that confidence, or data to suggest that such a conclusion is secure?

There certainly is no assurance that any new forced substitution of materials would be better than 99.999% successful, day after day, year after year.

John T. Barr, pp. 2-3, 4

78. Finally, testimony submitted to the EPA primarily in 1984 is sharply critical of semi-metallic friction compounds, in general. These compounds represent the "first generation" of asbestos-free friction materials that has experienced wide distribution. While analysis of individual semi-metallic formulations and commerical products is valuable, the EPA should not rely entirely on evaluations made on earlier models. Rather, it should contact firms whose entire business, or the majority of their business, depends upon manufacturing semi-metallic friction products. Such companies market and sell products to customers worldwide with primary emphasis on Canada, Europe, and the United States. These firms' technical perspectives on the advantages, disadvantages, and state of the art in semi-metallic brakes may differ from the previous EPA testimony.

Engelhard Corporation, p. 6

79. We believe that it is useful for your agency to encourage the development of nonasbestos brakes, but not at the expense of brake performance. In only one of the vehicle brake categories, light and medium disc brake pads, did you feel that a satisfactory performance record was evident for nonasbestos brakes. The other vehicle brake categories did not have sufficient experience with the performance record or found that the products performed erratically.

Motor vehicles are the leading cause of death from injury. They are the leading causes of loss of life from age 1 to 44 and the leading cause of loss of preretirement years of life in the United States. Even a small amount of erratic brake performance could easily outweigh the potential morbidity and mortality saved by reducing ambient air asbestos by 0.23 to 1.3 percent. Much of this decrease could be gained by adequate work practices during mechanical servicing of brakes.

A reduction in ambient air asbestos levels should be encouraged, but the elimination of asbestos in brake pads as a means of accomplishing this goal should be strongly weighed against the safety performance of alternatives.

Center for Environmental Health, p. 1

F. Special Considerations for Existing Vehicles

80. The matter of replacement brake linings for older model vehicles still in service warrants additional discussion. The general control approach to asbestos in brake linings is to develop substitutes. This approach is acceptable for new vehicle designs because brake systems can be engineered around the characteristics of the substitute. Substituting asbestos-free brake linings without redesigning the brake system may result in reduced lining durability, adverse effects on other brake system components and even increased stopping distance. Thus, using asbestos substitutes in brake linings without carefully evaluating the consequences could result in trading reduced health risks for increased traffic safety problems. Accordingly, the continued use of asbestos-containing replacement brake linings with proper control measures may be a neccessary alternative for the period of time vehicles with asbestos dependent brake systems are a significant segment of the vehicle population.

Motor Vehicle Manufacturers Association, Att. 2, pp. 13-14

81. As owners of antiques, collectors, and special interest automobiles dating back to the 1920's, we strongly object to the use of semimetallic or aramid fiber brakes especially in our older automobiles, which are not equipped with power brakes. These non-asbestos brakes do not provide adequate stopping distance when they are cold, and this is much more pronounced in cars equipped with front disc brakes. Furthermore, semimetallic and aramid fiber brakes cost two to three times more than asbestos brakes, which would put a hardship on some of our members who own several older automobiles.

Classic Cars of Ponca City, p. 1

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82. POTENTIAL IMPACT ON SERVICE PARTS

The possibility of a total ban on asbestos-containing components raises another concern, that of the impact of such a ban on the availability of after-market service parts, if worn-out asbestos-containing components must in the future be replaced with non-asbestos-containing components.

Aftermarket demand for service parts steadily decreases as the age of a vehicle increases beyond the peak service years. IH fears that parts suppliers will not be willing to spend the resources necessary to develop and produce asbestos-free substitutes for shrinking markets for "out-of-production" brakes. There simply may be no economic justification for such an investment.

International Harvester, p. 5

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83. Asbestos-free replacement products are available on the market, some of which are of satisfactory quality, but these always have a lower friction coefficient; use of these products is therefore only possible on brakes which provide for this installation from the outset.

It is not always possible to accomodate brakes capable of being fitted with asbestos-free linings on small vehicles. On in-use vehicles, asbestos linings must never be replaced by asbestos-free linings: this could substantially modify braking performance (either immediately, or following partial wear) and could therefore entail considerable risks to safety.

Renault USA, Inc., p. 2

84. Vehicles in use

There are more than five-hundred brake and brake lining sizes*/ designed for vehicles still in use that must be serviced. It would be a monumental task with substantial economic involvement for service part suppliers to develop non-asbestos replacements for those applications.

Motor Vehicle Manufacturers Association, Att. 3, p. 8

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85. One particular problem that concerns us and that we feel must be highlighted is the continued availability of asbestos-containing parts for vehicles currently in production, or no longer in production, which employ such parts. Ford Motor Company, through its Parts and Service Division, is a major marketer of aftermarket disc and drum brakes and related brake system parts.

Currently, the Company's aftermarket parts distribution system has on hand some 51,000 asbestos brake parts in stock at eight depots in the U.S. and Canada. These parts involve 192 different brake system designs. We supply these parts (mostly pads, shoes, discs, and drums) for cars and trucks produced by the Company between 1957-1985 -- a period of 28 years. It is imperative that parts for these vehicles continue to be available to our dealers and customers for the remainder of the product's useful life, and that any regulatory program envisioned by EPA not interfere with that need.

Car and truck brakes are sophisticated systems made up of parts which are carefully matched to function compatibly with each other, so as to provide appropriate braking characteristics for their vehicles under a wide range of operating conditions. A brake system is not simply a collection of disparate parts -- pads, shoes, discs, drums, etc. The pads and shoes of car and truck braking systems that use asbestos friction materials have very different properties from the pads and shoes of those that do not contain asbestos. One cannot simply use a non-asbestos substitute brake shoe in conjunction with a drum that was designed for an asbestos-containing friction material. Likewise, a disc brake that was designed for a semi-metallic friction material will not perform satisfactorily if an asbestos-containing pad is substituted. A whole host of performance, noise, durability, and other problems may occur if a friction material is introduced into a system which was not designed to employ it.

Ford Motor Company, p. 2

V. CRITICISMS OF NRDC PETITION AND EPA RESPONSE

A. NRDC Petition

86.

COMMENTS ON THE NRDC PETITION TO THE ENVIRONMENTAL PROTECTION AGENCY TO BAN THE USE OF ASBESTOS IN AUTOMOBILE BRAKES

PETITION SECTION: I. INTRODUCTION

The introduction of the NRDC petition emphasizes that the link between asbestos exposure and cancer has been conclusively demonstrated by epidemiologists since the early 1950's. While this may be true for certain occupational exposures of sufficient length and quantity, no association has been demonstrated between exposure to brake dust and cancer.

The introduction expresses an underlying assumption that "no 'safe threshold' levels of exposure to asbestos can be established." This is an assumption which is the subject of intense debate in the occupational health community and is directly contrary to the assumption made by NIOSH in establishing threshold limit values.

The second expressed assumption of the introduction is that "feasible substitutes are available" for use in brake linings. However, as discussed in other portions of our submission, this is not completely true.

PETITION SECTION: IV. THE CONTINUED USE OF ASBESTOS IN VEHICLE BRAKE LININGS POSES AN UNREASONABLE RISK TO HEALTH

The petition asserts that "asbestos is one of the largest single causes of environmental human cancer in the United States." No reference is cited to support this claim. There is no reference because asbestos has not been associated with human cancer outside of specific occupational settings. The leading environmental causes of cancer are smoking, diet and other lifestyle factors,(1) not asbestos.

The 1978 Health, Education and Welfare paper cited announcing that 17 percent of cancer deaths over the next several decades is an unpublished, scientifically inconsistent and frequently inaccurate document. The report remains non-peer reviewed and unaccepted in the scientific community.[3]

A. **Increased Risk of Disease**

This section stresses the mortality statistics associated with asbestos-related disease. The studies from which the statistics are taken relate to insulation workers and are not relevant in the context of friction materials. It is the amount and length of exposure that is significant, not the exposure per se.[6]

The assertion is made that "animal inhalation studies demonstrate no significant difference in the effects of various types of asbestos." NRDC cites a 1974 study by Wagner[2] as authority for that statement. The petition neglects to point out that numerous subsequent animal experiments, including the work of Gross,[4,5] demonstrate precisely the opposite. These latter studies would tend to indicate that chrysotile (the only type of asbestos used in brakes) is significantly less pathogenic than other types of asbestos fibers.

B. **Brief and Long-Term Exposure to Asbestos**

This section stresses that both brief and long-term exposures can result in asbestos-related disease. Again, none of the sources cited has anything to do with friction products. There is no evidence in the medical literature demonstrating any significant risk from either brief or long-term exposure to friction products.

C. Health Risks From Asbestos Brake Products

This section begins by asserting that brakes create "substantial exposures" to asbestos which constitute "a serious health threat" not only to brake workers, but to the general public. No scientific basis is referenced for this broad statement.

The petition asserts that "numerous studies" have shown that "a fraction" of asbestos fibers survive the braking process. The reader of this sentence might draw the conclusion that this "fraction" is a significant one. The petition neglects to indicate that the three principal studies on the subject indicated precisely the opposite. Anderson[7] found less than .02 percent of the fibers survived the friction process; Lynch[8] found less than 1 percent; and Jacko[9] found less than .3 percent. More than 99 percent of the fibers are transformed, in the friction process, into a nonasbestos, nonfibrous dust.

This section stresses the danger of asbestos fibers in ambient air, particularly in urban areas where asbestos levels are increasing. A private letter from Dr. Wm. Nicholson of Mt. Sinai, New York City, is cited as authority for the proposition that this increased asbestos content in ambient air is from automobile brakes. This conclusion is not based upon any published evidence. In fact, there are several references[20, 21] which indicate that less than 1 percent of asbestos fibers in city core districts originated from disc brake wear.

The petition discusses the Jacko (Bendix) study[9] and cites it for the proposition that American vehicles release approximately 158,000 pounds per year of asbestos into the atmosphere. This misrepresents Jacko's findings. 158,000 pounds represents the total estimated asbestos emissions potentially produced from brake linings by the friction process. Only 3.2 percent, or 5,060 pounds, of that was found by Jacko to be airborne asbestos fibers. 85.6 percent of the asbestos emissions do not remain suspended and dropout from the atmosphere.

This section goes on to discuss Rohl's[10] 1976 study on the asbestos content of brake dust. It notes that Rohl found that more than 80 percent of the surviving fibers were 0.4 micron in length, but fails to mention that such short fibers are considered by many respected medical authorities not to be pathogenic at all.[11, 12]

This section of the petition concludes with the sentence that, "the problem of exposure to dangerous levels of asbestos during brake servicing is substantial" and that "(T)he small asbestos fibers from brake wear can easily penetrate throughout the respiratory system and also migrate to other organs in the body."

The conclusion is not supported by studies which indicate that the smaller fibers present during brake servicing are less likely to be deposited in the lung and more likely to be removed by macrophages.[10, 11, 12]

D. Automobile Maintenance Workers Are At Particular Risk From Exposure To Asbestos Brake Products

This section argues that because of the airborne mobility of these small asbestos fibers from brake linings, a diverse group of people are at risk. The petition includes garage mechanics, bystanders, tool booth operators, families of mechanics and persons living in urban environments as the population at risk.

The only two citations upon which this argument is based are two case reports which purport to document a mesothelioma in a pet whose owner was a mechanic[15] and a brake mechanic's child who had mesothelioma.[16] The latter case is not a published case report, but the footnote indicates that this was communicated in a letter from Barry Castleman to a person or persons unknown. One case report (of a pet) and a letter from Barry Castleman are scant support for the sweeping statements made in this section.

This section concludes by alleging that recent literature "also documents mesothelioma among automobile repair workers." The first literature cited is Greenberg's 1974 report[17] which found one mesothelioma death in a "motor mechanic." Greenberg gives no occupational history for the mechanic.

The other case report cited is that by Langer in 1982[18]. Support for the proposition that there are two additional mesotheliomas in brake mechanics is allegedly found in Castleman's recent book[19] on asbestos and a "personal communication" by Susan Daum to Castleman. Yet, important data on these "cases" are missing, such that verification is not possible from these sources alone.

Thus, there are only two cases of mesothelioma in all of the reported medical literature which allegedly implicate brake dust. One of those (Greenberg) is questionable.

RTP/lb

87. I - INTRODUCTION

The stated reasons for the submission of the petition do not appear to be based upon irrefutable evidence. Whether or not the occupational asbestos standards and/or the national emissions standards are insufficient to protect against unreasonable risk posed by asbestos in brakes is highly debatable. Further, the availability of economically and technologically feasible substitutes for asbestos is an issue in which the friction materials manufacturers are deeply involved. The identification of such substitutes is a major ongoing program with the manufacturers, and is not a completed program at this point in time.

II - JURISDICTION

The FMSI concerns relate to in-plant regulations versus control of general public exposure to asbestos dust. While one agency has proposed to tighten worker exposure to asbestos, another is being petitioned to eliminate asbestos in friction materials. The disparity between these two situations could well create implementation and economic problems for friction materials manufacturers. If asbestos is to be regulated out of friction materials the manufacturers should not be saddled, in the meantime, with compliance to new tighter regulations of asbestos in the workplace. The industry must know which direction regulatory activity will take.

III - DESCRIPTION OF PETITIONER

No comment.

IV - CONTINUED USE OF ASBESTOS...POSES AN UNREASONABLE RISK TO HEALTH

The FMSI does not necessarily agree with the credibility of the conclusions drawn from the evidence presented on friction materials in this section. Therefore, the FMSI reserves the right to comment in detail on this section at some future date.

V - SUBSTITUTES

Sufficient data is not available at this time on the substitute materials to state that they do not pose a hazard in the workplace environment or to the general public. We wish to cite a recent study by the (Canadian) Royal Commission on Matters of Health and Safety Arising from Use of Asbestos in Ontario, and an earlier paper on Non-asbestos Related Malignant Mesothelioma.

These comments follow:

> ...If the production of substitute fibres in the future should increase the exposure of workers to long, thin, durable fibres of dimensions similar to those we have found hazardous for asbestos, we cannot be sure that serious health consequences would not result. In the face of the existing evidence, we believe it would be risky to allow the exposure of workers to respirable fibres longer than 5 microns, with small diameters, of any material, if those fibres are likely to be very durable in the lungs.[1]
>
> It has been generally accepted now that the fibre which is carcinogenic is a durable long and thin fibre, the diameter of less than 1.5 micron and length of more than 8 micron appearing critical. A number of fibrous materials other than asbestos can appear in this size and shape and indeed have thus been established as cause of mesothelioma in animals, such as: glass fibres, aluminum oxide, tremolite, attapulgite, dawsonite, silicon carbide and potassium titanate.[2]

The advantages of semi-metallic brake linings cited in Section V-A are not necessarily supported by test results generated by friction materials manufacturers. While certain of these claimed advantages may be true where the application generates high braking temperatures, they are not necessarily true for the average consumer.

Total endorsement of Section V-B of the petition is not appropriate, since friction materials manufacturers produce disc pads and drum segments for passenger cars and light to medium trucks, as well as brake blocks for heavy trucks. The claims made in Section V-B relate to brake blocks and cannot be endorsed for all product lines. Further, actual experience to date has proven that substantial processing modifications and new equipment are required for the asbestos substitute materials.

VI - <u>A REQUIREMENT UNDER THE TOXIC SUBSTANCES CONTROL ACT...</u>

No comment.

VII - <u>CONCLUSION</u>

No comment.

Friction Materials Standards Institute, Inc., Att. 1, pp. 1-4

88. The petition of the Natural Resources Defense Council ("NRDC") misstates the facts when at page fifteen of the Petition it asserts that "aramid-reinforced brakes have the same basic formulation as asbestos brakes" and, therefore, "production techniques already developed for asbestos brake manufacture can easily be retained." It is important to note that NRDC's support for the quoted phrases is Loken. However, Loken offers no support for the NRDC assertion.

We would also like to point out that the statements by NRDC regarding the risks associated with asbestos fail to take into account the distinction between insulation asbestos, which is not involved in brake application, and chrysotile fibers which are.

Wagner Division, Att. 1, pp. 3, 5

B. EPA Response

89. Second, AIA/NA wishes to comment on a major omission in the December 19 response, namely, the complete absence of any mention of the potential health effects of substitutes for asbestos in brakes. Any rational system of regulation in which the use of a material or substance may be prohibited for reasons related to an unreasonable risk of injury to health or the environment must include an evaluation of the risks resulting from substitute materials. If this were not the case, it would not be possible to say that any benefit had accrued to society as a result of a regulatory action.

Section 6(c)(C) of the Toxic Substance Control Act (TSCA) specifically cites that substitutes for a substance must be given consideration in the context of section 6 rulemaking:

> (C) the benefits of such substance or mixture for various uses and the availability of substitutes for such uses.

While it may be argued that a consideration of the "availability of substitutes" does not necessitate a consideration of the health effects of the substitutes, the immediately following section, which lists additional factors to be considered, would require an evaluation of substitutes' health effects:

> (D) the reasonably ascertainable economic consequences of the rule, after consideration of the effect on the national economy, small business, technological innovation, <u>the environment</u>, and <u>public health</u>. (emphasis added)

Section (D) is explicit in stating that the environment and public health effects of a rule must be given consideration. If a substance is to be banned in favor of substitute materials, Section 6 (c)(D) requires that the environmental and public health effects of such an action be considered, and such consideration would have to take into account the environmental and public health effects of the substitute materials. Any other course of action would be irrational and not permissible under TSCA.

The entire Toxic Substance Control Act is framed within the context of <u>reasonable</u> regulatory action. It does not permit the regulation of <u>any</u> risk, but only <u>unreasonable</u> risk. The intent of Congress in passing the Act is specific on this issue. Section 3(c) of TSCA, entitled "Intent of Congress," states:

> It is the intent of Congress that the Administrator shall carry out this Act in a reasonable and prudent manner, and that the Administrator shall consider the environmental, economic, and social impact of any action the Administrator takes or proposes to take under this Act.

90. The Notice points out that there are 2,750 employees potentially exposed during brake manufacture, and 550,000 during servicing and repair. This last figure is greatly exaggerated for almost no one repairs or services brake linings any more. They are simply replaced, and the old ones are discarded, with minimal exposure, but let's play the game by your rules and go with that number.

John T. Barr, p. 1

APPENDIX A - LIST OF COMMENTERS

TRADE ASSOCIATIONS

Asbestos Information Association/North America
Friction Materials Standards Institute, Inc.
Japan Automobile Manufacturers Association
Motor Vehicle Manufacturers Association

VEHICLE MANUFACTURERS

Chrysler Corporation
Ford Motor Company
International Harvester
Renault USA, Inc.

BRAKE MANUFACTURERS

BF Goodrich Company
Motor Wheel Corporation
Rockwell International
Wagner Division

SUBSTITUTES MANUFACTURERS

Ashland Petroleum Company
Du Pont Canada, Inc.
Engelhard Corporation
Monsanto Company

MISCELLANEOUS

John T. Barr
Center for Environmental Health
Classic Cars of Ponca City
Milford/Stratford Citizens Against Pollution

APPENDIX B - REFERENCES

Asbestos Information Association/North America
- Letter to EPA dated March 7, 1985

Ashland Petroleum Company
- Letter to EPA dated March 14, 1985
- Attachment 1-"News From Ashland Petroleum Company," Press release, February 8, 1985
- "Carboflex," Product catalogue

Barr, John T.
- Letter to EPA dated January 15, 1985

BF Goodrich Company
- Letter to EPA dated March 5, 1985

Center for Environmental Health, Department of Health and Human Services
- Letter to EPA dated February 6, 1985

Chrysler Corporation
- Letter to EPA dated March 13, 1985

Classic Cars of Ponca City
- Letter to EPA dated March 7, 1985

Du Pont Canada, Inc.
- Letter to EPA dated January 23, 1985
- Attachment 1 - "Breakthrough in Brake Performance," Du Pont Magazine
- Attachment 2 - "Kevlar Demand High, Canadian Metallic Sales Up," Du Pont News, August 1984
- Attachment 3 - "Non-Asbestos Disc Brake Pad Wears Like Semi-Metallic, Not Detrimental to Rotor Surfaces," Du Pont News
- Attachment 4 - "Kevlar Relieves Tension Headache for Belleville Rope-Maker," Du Pont News, June 1984

Engelhard Corporation
- Letter to EPA dated March 13, 1985

Ford Motor Company
- Letter to EPA dated March 15, 1985

Friction Materials Standards Institute, Inc.
- Letter to EPA dated March 13, 1985
- Attachment 1 - Letter to EPA dated November 13, 1984

International Harvester
- Letter to EPA dated March 15, 1985
- Attachment 1 - Letter to Mr. Eaton dated March 8, 1984

Japan Automobile Manufacturers Association
- Letter from Tanaka, Walders & Ritger dated March 22, 1985
- Attachment 1 - Comments of the Japan Automobile Manufacturers Association

Milford/Stratford Citizens Against Pollution
- Letter to EPA dated March 12, 1985

Monsanto Company
- Letter to EPA dated March 15, 1985

Motor Vehicle Manufacturers Association
- Letter to EPA dated March 15, 1985
- Attachment 1 - "Comments on the NRDC Petition to the EPA to Ban the Use of Asbestos in Automobile Brakes"
- Attachment 2 - "Comments on Proposed Asbestos Standard of the Occupational Safety and Health Administration," May 24, 1984
- Attachment 3 - "Alternatives to the Uses of Asbestos in Motor Vehicles," revised March 1985
- Attachment 4 - Letter from the Friction Materials Standards Institute to U.S. Department of Labor, May 22, 1984

Motor Wheel Corporation
- Letter to EPA dated March 14, 1985

Renault USA, Inc.
- Letter to EPA dated February 21, 1985

Rockwell International
- Letter to EPA dated March 18, 1985
- Attachment 1 - Letter to U.S. Department of Labor, May 25, 1984

Wagner Division, Edison International, Inc.
- Letter from McDermott, Will & Emery to EPA dated April 4, 1985
- Attachment 1 - "Response of Wagner Division of Edison International, Inc. to the Petition of the NRDC re Asbestos Brakes"
- Attachment 2 - "Consideration on Regulating the Composition of Brake Lining," February 25, 1980

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DRAFT

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