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General Motors Corporation  
Statement on  
EPA Proposed Asbestos Mining and Import Restrictions and  
Manufacturing, Importation and Processing Prohibitions  
July 16, 1986

Statement for Public Hearing on Asbestos Ban by  
William H. Krebs, Ph.D.  
Director, Toxic Materials Control Activity

I welcome the opportunity to comment on EPA's analysis of the health effects of asbestos as it relates to General Motors use of asbestos-containing friction materials.

The exposure of workers to excessive concentrations of airborne asbestos has long been recognized as an occupational hazard of industrial health significance. Where excessive exposures occur, it is generally recognized that inhalation of asbestos dust causes chronic inflammation of lung tissue and pleural membranes, as well as cancers. Ambient atmospheric levels of asbestos are not a recognized hazard to the public.

All types of asbestos are known to cause the inflammatory changes in the lungs and pleura and lung cancer. However, there is anecdotal, experimental and epidemiological evidence that there are differences in the potential of the different asbestos types to produce disease. Crocidolite is reported to have the greatest potential; amosite in between; and chrysotile being the least.

Of particular interest, and a reason behind the introduction of new regulations, is the relationship between the inhalation of asbestos and cancer, especially mesothelioma. The association between mesothelioma and asbestos first was demonstrated by Wagner et al in 1960. Mesotheliomas are rare, usually rapid, fatal cancers that originate from the surfaces lining the chest or abdominal cavity. From 1960 through 1975, 4,539 mesotheliomas were reported worldwide. Where asbestos exposures were involved, the vast majority of these cancers were in people exposed to crocidolite alone or in combination with other types of asbestos. Importantly, crocidolite, is not a component of brake lining materials.

Furthermore, not all mesotheliomas result from asbestos exposure. According to the American Conference of Governmental Industrial Hygienists, there is a background of spontaneously occurring mesotheliomas that has been estimated to be about ten (10) for males per million people and four (4) for females aged 45 years and older per million people. It is not uncommon for various epidemiologic studies to indicate that 15% or more of the reported mesothelioma cases have no history of ever having been exposed to asbestos.



Whether there is a dose response relationship associated with asbestos has been answered affirmatively by a number of epidemiologic studies. It is clear cut with regard to asbestosis and lung cancer. It is less well established with mesothelioma, but it is nonetheless positive. The existence of a threshold exposure level is not universally agreed upon. However, industrial hygienists, after careful study, have agreed that a threshold concept is consistent with their professional experiences and observations. As Dr. John Higginson once said, and I paraphrase, "For all intents and purposes, asbestos has a practical threshold when one takes into account its biological potency."

Of particular interest is the importance of the biological consequences of fiber morphology and size. Initially, a size limitation was placed on fibers being counted when using the National Institute for Occupational Safety and Health phase contrast method for asbestos. This was done because it was not practical to count shorter fibers with an optical microscope. It is recognized that for every fiber longer than 5 micrometers, there may be many more which are shorter that are not visible. However, there now is considerable experimental evidence to indicate that asbestos fibers shorter than 5 micrometers are not pathogenic. This has important environmental implications.

In the manufacture of friction materials, employee exposures are regulated by the Occupation Safety and Health Administration's Asbestos Standard. In the recent OSHA asbestos rulemaking, many of the studies relied upon by EPA for the ban and phaseout rule were also considered by OSHA. As you know, OSHA adopted practices that allow the controlled use of asbestos while EPA is proposing the material be banned. From the environmental viewpoint, the nature and extent of exposures to airborne levels of brake wear debris to which the public or employees may be exposed is not sufficient to result in disease. Furthermore, exposure to brake wear debris has not been shown by any reliable studies to cause any asbestos-related disease.

Brake linings contain approximately 50% asbestos by weight, all of which is chrysotile. Not only is chrysotile less hazardous than other asbestos types, but in friction materials chrysotile fibers are encapsulated in a solid resin matrix. During the braking process more than 99% of the asbestos fibers by weight in the brake lining mix are transformed into a non-asbestos material, reported by some to be forsterite. Furthermore, most brake wear debris is removed from the brake drum during vehicle operation. Industry studies confirmed by the EPA have shown that the brake debris which was present in the drums at the time of the brake service work contains less than 1% free asbestos by weight. Moreover, the asbestos fibers which were found in the brake wear debris are predominantly submicroscopic. As previously discussed, reliable studies have shown that, generally speaking, only longer asbestos fibers (greater than 5 micrometers in length) result in asbestos-related diseases.

Asbestos-related diseases are known to be dose-related. That is, there must be exposure to respirable asbestos fibers in excessive amounts for sufficient time before an adverse health effect will occur in some of the exposed personnel. There are well accepted exposure standards to which the results of air tests can be compared. These standards are used by the federal and state governments, and represent the concentrations to which employees can be repeatedly exposed, 8 hours per day, 5 days per week, year after year, without experiencing an adverse health effect. Studies of brake servicing operations have shown that the level of exposure to asbestos resulting from such work is well within the accepted exposure range.

My own industrial hygiene air studies conducted in dealership service garages have shown that asbestos exposure from brake wear debris was well below exposure limits in use at the time of the studies and well below exposure limits about to go into effect. The exposure to asbestos of mechanics who regularly perform brake work is of an intermittent nature. These findings have been verified by analysis of industrial hygiene studies conducted by NIOSH.

Brake relining operations were first identified as a possible source of potential excessive exposure to asbestos in reports published in the mid-1970's. Since that time, however, my own studies, as well as reliable reports appearing in literature, have shown that the studies on which the 1974 opinions were based are in error. Even though brakewear debris is known to contain a very minute percentage of asbestos fibers, no asbestos-related disease was found in studies in which animals were administered heavy doses of brake wear debris, and there is no study showing an excess of any asbestos-related disease among mechanics.

Substitute materials for asbestos have unknown toxicological properties. Given the long latency for the pneumoconiosis producing dusts, the introduction of new durable fibrous materials by producers gives the appearance they are "safer" than asbestos. Eventually that may prove to be true, but given the scientific evidence that is available today, General Motors believes that many of the durable fibers which EPA is suggesting be considered as replacement materials have not been studied sufficiently by their manufacturers to assess their safety or to draw comparisons with asbestos.

Suppliers have just begun to initiate experimental studies with a few of these materials. What appears to be occurring is a national movement from regulated to unregulated materials to avoid, among other things, the cost of compliance with workplace controls. This potentially could have tragic consequences. Given the fact that several asbestos substitute materials that were declared safe by EPA have later become the subject of Section 8(e) submissions, General Motors has adopted the following guideline. Until sufficient data are obtained, GM will continue using the environmental controls for asbestos when using substitute durable fibers.

In summary, exposure to asbestos received by the public and employees as a result of exposure to brake relining operations and normal braking operations, are minimal and far below the levels of exposure necessary to cause asbestos-related disease.

Because of the extremely low levels of submicroscopic asbestos present in brake wear debris and the intermittent nature of the exposure involved in brake relining aberrations, it is my opinion that asbestos brake lining and brake relining operations do not present a risk of adverse health consequences to those involved.

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Statement for Public Hearing on Asbestos Ban by  
Robert L. LeFevre  
Manager, Automotive Safety Engineering  
General Motors Environmental Activities Staff

My comments today will address General Motors concerns regarding the potential impact of the proposed rulemaking on the safety of automotive brakes and the compliance of brake systems to safety regulations.

Assuring that vehicles are fitted with brake systems which fully meet the need for motor vehicle safety is a major responsibility of automotive engineers. Since 1968 the National Highway Traffic Safety Administration of the Department of Transportation has been active in establishing Federal Motor Vehicle Safety Standards which prescribe both design and performance specifications for brake systems on new vehicles.

At the present time standard FMVSS 105 regulates hydraulic brakes, and FMVSS 121 addresses air brake systems. In similar ways, brake systems for vehicles which are to be sold in other countries are subject to certain national or regional regulations. As General Motors detailed in its written comments on this asbestos rulemaking, efforts are also underway to reconcile the regulatory differences by developing an internationally harmonized brake standard.

Taken individually or collectively, these standards dictate compliance levels for a multitude of performance characteristic of brake systems and as a result have dominant influence on brake system design decisions. Despite this number of regulations, questions as to what constitutes fully acceptable safety performance for brake systems continue to surface. General Motors and other manufacturers have repeatedly found themselves involved in discussions and debates with the NHTSA Office of Defects Investigations regarding the real-world adequacy of brake systems even though these systems fully conform with all regulatory requirements. In addition to the legal constraints, our customers have additional brake performance expectations in areas such as durability and noise.

Independent of all of the safety regulations, discussions about brake system performance and customer demands, the EPA has proposed to ban asbestos, one of the few materials which has the proven ability to function and survive in the hostile environment of brake systems. This action in essence calls for a forced change in the fundamental composition of most brake friction materials.

Inasmuch as there is no one-for-one substitute for asbestos, this change will require offsetting changes in brake system design. As General Motors advised in its written comments, some of its disc brake pads and virtually all of its drum brake linings are made with asbestos to achieve the essential blend of strength, friction stability and temperature capability. Some other materials have worked well in some applications; however, no effective substitute has been found for other applications.

The elimination of asbestos from the approximately 80 systems which currently use this material would be an enormous undertaking, and total success within the timeframes cited by the agency is not certain. In light of the difficulties which have been encountered in the past in finding materials which will yield system performance meeting all regulatory, safety and customer demands, we must urge the agency to proceed with caution along the lines which we have outlined in our written comments.

The composition of brake friction materials used for replacement purposes is also of serious concern to General Motors. As the EPA may be aware the performance of brake systems already operating on the public roads is not regulated, and federal regulations do not even acknowledge replacement brake friction materials. However, our experiences have taught us that replacement materials and systems which have been serviced must provide substantially the same performance as original equipment. If asbestos were to be banned as the agency has proposed and therefore were to be unavailable for use in replacements, it is probable that some applications would require that the sealed hydraulic systems be opened up to replace brake cylinders or other components to compensate for the different friction properties of the substitute materials.

For example, if the substitute materials had 10% lower friction, it might be that the best way to recover the lower system output would be by increasing the size of the wheel cylinders or to change operating pressure. We are convinced that customers would reject such costly part changes. To avoid causing significant changes in brake performance for cars designed to use asbestos friction materials, we urge the EPA to configure any asbestos rule so that it allows existing vehicles which are validated with asbestos linings to be serviced with asbestos linings. We believe that this strategy is consistent with the EPA's intent to curtail the use of asbestos, because these applications for asbestos will subside naturally as the vehicles are retired.

In summary, it is essential that the EPA collaborate with the NHTSA on this rulemaking to assure that any change in brake system performance which is made necessary by an EPA rule regarding asbestos usage is consistent with motor vehicle safety needs. It is important that both the content of any rule and any implementation schedule be responsive to both health and safety needs. Such a joint effort can assure that a potential conflict between NHTSA and EPA regulatory requirements will be avoided.

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Statement for Public Hearing on Asbestos Ban by  
Thomas M. Johnson  
Manager, Brake & Bearing Systems Center  
General Motors Current Product Engineering

General Motors currently has in production approximately 80 unique brake systems. It sells replacement parts for many additional systems including more than 100 for vehicles produced since just 1982. In addition to federal laws governing brake systems, each system must provide vehicle owners with satisfactory performance for a wide array of conditions. A partial listing of customer requirements includes cold performance, hot performance, park brake effectiveness, noise, wear out life, friction stability, corrosion resistance, heat transfer rate, and fade resistance. These brake systems must satisfy customers ranging among the "old man of the mountain" who spends his retirement driving up and down pikes peak every day, rural mail carriers in Minnesota, New York city taxi cabs, and Mojave Desert park rangers. Though colorful to describe, these conditions represent actual brake tests for our vehicles. A more complete list is included in Attachment I.

Each brake system is thoroughly tested to assure that these stringent requirements are met. This testing process involves hundreds of thousands of test miles on hundreds of vehicles. It involves years of fleet testing on public roads as well as scores of tests by Proving Ground testers. This testing is required to satisfy the safety and performance requirements of our customers. As a manufacturer, we provide this level of performance for both OEM and service brake parts for each of these approximately 200 brake systems. Because this process can require up to five years, an abrupt change of the linings on these brake systems can not be made.

As part of its normal product improvement process, GM completes this validation process on about ten new brake systems each year. This process requires about 100 engineers, technicians, and designers dedicated solely to brake system work. In addition, several hundred drivers and testers are required for the road testing of these vehicles. Fortunately, much of the test driving is done on vehicles which have many other parts being tested. However, redesign of vehicle brake systems already in production would require this testing to occur on many vehicles dedicated solely to brake system testing. Thus, if it takes 400 people to validate 10 brake systems per year, it would require an additional 1600 people for five years to redesign and validate 200 existing brake systems. Certainly some economy of scale would reduce this army, but you can see that the effort is formidable. Even neglecting the cost of such an effort, there are not enough trained people to handle an engineering and testing effort of this size.

We have attempted to produce an orderly phaseout of asbestos in the past. In 1979 the GM brake community made it a goal to eliminate asbestos by 1985. This commitment has largely been met on front disk brakes but has not been met on rear drum brakes. The difficulties in changing the rears have been varied and subtle. They include squeal, wear, and friction stability.

In order to completely eliminate asbestos in brake linings, manufacturers, customers and the NHTSA may have to accept some changes in brake performance. For example, if we convince our customers to accept frequent lining changes and periodic replacement of drums, we could probably use some of the non-asbestos European linings. There is a high probability, however, that the customer will tire of the squealing noise and replace his linings with some untested but quiet lining material.

The key point that needs to be made is that even though there are replacements for asbestos, there are no direct substitutes for asbestos. The distinction is that replacement of asbestos linings with non-asbestos linings requires redesign and revalidation of the complete brake system. There are simply no known materials which can be substituted for asbestos with no change in performance. For example, in Attachment II, I have included a list of system changes which might result from a lining change.

In short, the elimination of asbestos friction materials in passenger cars and trucks represents a formidable engineering challenge requiring not only innovation but also invention. As an engineer I can accept that challenge, but only if the timeframe to implement it is realistic, and the process allows a realistic allocation of resources.

BRAKE TESTING CONDUCTED AT GENERAL MOTORS

Brake System Testing Required by Federal Law

- "green" brakes
- driver only stopping distances
- fully laden stopping distances
- fade
- water recovery
- parking brake
- abuse
- failures

Brake System Testing Required by Customer Performance Expectations  
All of the above testing plus:

- durability
- corrosion
- mountains
- noise
- hills
- fade
- vibration
- pulsation
- cold
- snow
- car wash
- hot
- mud intrusion
- brake balance
- stability
- modulation
- pedal feel
- pull
- braking in a turn
- wear
- service
- .
- .
- .

## ATTACHMENT II

### EXAMPLE OF SYSTEM CHANGES THAT MIGHT OCCUR WITH A LINING CHANGE

Assume that a replacement lining has 20 percent less friction than the original:

A larger wheel cylinder would be specified to achieve the required torque output.

A larger wheel cylinder results in more fluid displacement and may require a master cylinder change to obtain the proper pedal travel.

Larger master cylinder may make pedal effort too high necessitating a booster change.

Testing of the vehicle may indicate insufficient park brake capability due to the reduced friction necessitating a park brake cable change.

Increased cable forces may result in park brake strut buckling during abuse tests, necessitating a foundation brake redesign.

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Closing Remarks at Public Hearing on Asbestos Ban by  
Joseph P. Chu, Ph.D., P.E.  
Assistant Director, Plant Environment  
General Motors Environmental Activities Staff

In closing General Motors' statements, I would like to summarize briefly our comments and add some remarks of my own.

I personally believe that, depending upon exposure conditions, any substance may be hazardous and may pose an unacceptable risk to public health and the environment. For example, cyanide is an important industrial chemical which is safe when managed properly. However, when ingested by humans at certain doses, death will occur almost instantly. Similarly, even though water is essential for human survival, a person may die of drowning due to the lack of oxygen caused by an excess quantity of water. Consequently, we ought not propose to ban every substance which is capable of causing harm in order to attempt to create a risk-free society.

In addressing this set of proposed regulations under Section 6 of TSCA, General Motors agrees that asbestos can be hazardous under certain conditions and may pose risk when improperly managed. Therefore, we believe asbestos must be handled with due respect to prevent it from causing any unreasonable risk to public health and the environment.

General Motors objects to the proposed regulations because we do not believe the Administrator has a reasonable basis to conclude that the proposed regulations are necessary. It is important to note that Section 6 of TSCA states:

"If the Administrator finds that there is a reasonable basis to conclude that the manufacture, processing, distribution in commerce, use, or disposal of a chemical substance or mixture, or that any combination of such activities, presents or will present an unreasonable risk of injury to health or the environment, the Administrator shall by rule apply one or more of the following requirements to such substance or mixture to the extent necessary to protect adequately against such risk using the least burdensome requirements: ....."

We believe EPA did not provide a reasonable basis to conclude that all of the to-be-regulated activities presents an unreasonable risk of injury to health or the environment should the current conditions continue.

As a result of increasingly stringent federal regulations of asbestos for the past 15 years, worker exposure to asbestos has been significantly reduced . In addition, asbestos uses in the U.S. have decreased from about 770,000 tons per year for 1971 to about 240,000 tons per year for 1984. It is beyond doubt that fewer people are exposed to asbestos today and such exposures are at much lower levels than in the past.

The basic problem with this proposal is EPA's use of historical risk and injury information that is related to the consequences of uncontrolled, excessive exposures to friable asbestos. This information is of little relevance to the regulation of manufacturing and use of other types of products which produce minimal exposure.

The chrysotile we use is in a friable form only prior to being manufactured into our brake linings. Our manufacturing facilities are stringently controlled for worker protection and emission prevention. The final products contain chrysotile only in non-friable forms. The use, servicing, and final disposal of these products release virtually no friable chrysotile and pose no significant exposure problems.

Reading the statutory language that I quoted previously, General Motors' objection to the proposed regulations is also related to the permit requirements which are not in line with the statutorily mandated "least burdensome requirements."

Under the EPA proposed 10-year phase-down, the mining and importation permit program will last 10 years. This proposed program would affect GM as an importer. I will discuss the burdensome nature of the proposal, based on my experience with some existing EPA permit programs.

In the proposed asbestos ban regulations, Section 763.148 concerns "Issuance of Permits." It would result in the preparation of permit applications by miners and importers, as well as the review, approval, and tracking of permit applications and approvals by EPA. Similar with other permit programs, obviously there will be frequent phone calls and written communications among applicants, EPA, and their consultants and contractors. And there will be unnecessary actions caused by misunderstanding and confusion.

Other proposed permitting requirements, especially when viewed as a whole, are also burdensome, because they include appeals on EPA's decisions, transfer of permits, banking of permits, reporting requirements, enforcement of the permit program, and EPA inspections to verify permit requirements. Each of these requirements will impose burdensome paperwork and administrative efforts on the part of EPA and regulated parties.

We are also very concerned that the 70% reduction in the supply as required by the proposed regulation may not allow General Motors to provide chrysotile containing brake parts for OEM or servicing our customers' existing vehicles.

We believe EPA, in proposing this set of regulations, has incorrectly assumed that asbestos containing parts and non-asbestos containing parts are interchangeable regardless of the design of brake systems. We must point out that any automotive brake system can safely be used only with parts which were designed for it.

As we pointed out previously, General Motors has developed and put into use brake systems that do not use asbestos. Our development of new brake systems and new material applications continues. However, we cannot predict when we can invent and when new materials will be discovered or developed which will permit us to use non-asbestos parts in all of our brake systems. This is especially true for heavy duty trucks.

Therefore, considering the safety of our customers and the the general public, we are obligated to continue production of chrysotile containing parts for servicing vehicles requiring such parts throughout their useful life. In addition, as we have pointed out, the current health risk of asbestos in motor vehicle applications, contrary to EPA's estimate, is insignificant.

General Motors does not believe there is a need for the EPA proposed phaseout of asbestos. If the EPA acts, however, General Motors recommends that a ban on asbestos friction materials for motor vehicles not take effect until after a period of ten years; and, that the EPA permanently exempt aftermarket brake linings. The details of these and other General Motors recommendations have been previously submitted in our written comments.

This concludes our remarks. We would be pleased to answer any questions the panel might have.

MR. Dull. Thank you. Thank you, Dr. Chu.

We will begin questioning with this end of the table.

Amy, do you have any questions?

MS. Moll. I'm just going to address my questions to the whole panel and whoever wants to answer can go right ahead.

Regarding your comment that safety risks would be created by the premature elimination of all asbestos friction materials in motor vehicles, does GM believe that the National Highway Traffic Safety Administration would allow auto manufacturers to provide unsafe, non-asbestos brakes on new vehicles?

MR. LeFevre. I doubt that there is really much question regarding an answer. Not only must vehicles meet all the regulatory requirements, but there are customer expectations that also have to be satisfied. And even if the NHTSA was to remain silent with regard to a change in a particular performance characteristic, the product liability for them creates a very effective check and balance.

MS. Moll. Okay, thank you.

What additional regulations does GM think NHTSA should be implementing to regulate original equipment and replace new market brakes?

MR. LeFevre. As a general comment, we've got an abundance of regulations already. I'm not sure that I would

1 vote for additional regulations, if you're asking me to  
2 vote on that question.

3 MS. Moll. Not even for the replacement market?

4 MR. LeFevre. It is a very, very difficult and complex  
5 question. It's not one that I think could be resolved in  
6 discussion here this morning.

7 The definition of friction material characteristics  
8 that could be defined in terms that the aftermarket could  
9 subscribe to, is not something that is available on the  
10 table today.

11 We, and I suspect all manufacturers of motor vehicles,  
12 have their own specifications for friction materials, but as  
13 a general comment, there are no really standardized, or no  
14 universally accepted tests that are -- that could be built  
15 into a regulation as you'll see it here today. There's an  
16 awful lot of detail that would have to be developed.

17 Whether or not a viable regulation would emerge from  
18 that process, at this point would be open to speculation.

19 MS. Moll. Okay. What categories of automotive brake  
20 systems and vehicles does GM market in Europe? For example,  
21 do you market passenger cars, light trucks and vans, heavy  
22 trucks? What types of vehicles?

23 MR. LeFevre. Well, General Motors certainly does  
24 market -- I don't honestly know whether we market any heavy  
25 trucks in Europe or not. Do you remember, Dr. Chu?

1 Certainly passenger cars and light trucks. There are some  
2 vehicles, for example, that are exported from this country  
3 to Europe, and of course, we do have operations in Europe  
4 where vehicles are manufactured for that market.

5 Did that answer your question, please?

6 MS. Moll. Yeah, that's sufficient.

7 I wanted to ask you to comment on a comment that was  
8 made in Dupont's written submission where they said that  
9 Ford and General Motors already make asbestos free models  
10 in Europe. What types of cars, or what types of vehicles  
11 are they referring to in that comment? Do you know?

12 MR. LeFevre. I cannot be sure what Dupont's testimony  
13 was, or precisely what they are alluding to. We do have  
14 some non-asbestos materials. Mr. Johnson, you might feel  
15 more qualified to speak of the product in that regard.

16 MR. Johnson. Yes. I believe Opal has several of its  
17 vehicles that are now being sold with asbestos free brake  
18 linings. They would typically be passenger cars in many  
19 of their size categories.

20 As I pointed out, however, the Europeans have  
21 significantly different service requirements or customer  
22 expectations of service than we have here in the United  
23 States, and we feel our customers would not be very willing  
24 to accept the European levels of service.

25 MS. Moll. Are their motor vehicle safety standards

1 any different than they are in the U.S.?

2 MR. LeFevre. There are differences between the European  
3 regulations and those in this country, yes.

4 MS. Moll. So does that account also for some of the  
5 difference in marketing products that --

6 MR. LeFevre. It is an influence, for sure, yes.

7 I think as Mr. Johnson tried to point out, the --  
8 perhaps as a bit of an amusing perspective on that, most  
9 -- as we perceive it, the European customer generally speaking  
10 would perceive that brake squeel is really quite an acceptable  
11 characteristic. As a matter of fact, it perhaps is evidence  
12 that the brake system is working.

13 In this country I think most of us would share, even  
14 for our own personal experience, that brake squeel is not  
15 a desirable characteristic. I think we have perhaps -- all  
16 of us have passed taxicabs on the corner and heard their  
17 brakes squeel and wonder why the guy doesn't get the brakes  
18 fixed. It is a characteristic that U.S. customers as a  
19 general comment find very, very undesirable, and we work hard  
20 in view and development work to try to assure that that  
21 characteristic is minimized, and if possible, eliminated.

22 MS. Moll. Is there some criteria or some means in the  
23 motor vehicle safety standards in the U.S. to provide for  
24 noise free brakes? Or is that just a customer requirement?

25 MR. LeFevre. The noise is a customer expectation.

1 I would like to think that brake squeel wouldn't get to be  
2 an issue such that the City of New York with its noise  
3 regulations would begin to get into that question. But  
4 it's a customer expectation kind of a consideration.

5 MS. Moll. Yes, okay.

6 Back on GM's marketing in Europe, I have a few  
7 questions here regarding the European regulations on asbestos  
8 brakes.

9 Would the Swedish ban on asbestos lined brakes about  
10 to take effect on January 1st, does GM plan to remain in or  
11 withdraw from the Swedish market?

12 MR. LeFevre. As Mr. Johnson shared, we do have a  
13 number of products that are produced by our Opal subsidiary  
14 in Germany that do use asbestos free friction materials,  
15 and we would expect that those would be viable products for  
16 the Swedish market.

17 Unless we successfully find substitutes for asbestos,  
18 and there are some in some applications, as I shared in my  
19 testimony, there would be some products that we would perhaps  
20 today sell in Sweden that would no longer be permitted to be  
21 sold in that country.

22 MS. Moll. On your Opals, are those -- those cars have  
23 non-asbestos drum brake linings, or are they four wheel --

24 MR. LeFevre. Yes.

25 MS. Moll. Okay.

MR. LeFevre. They have both, as a matter of fact, to anticipate your second question.

Some of them are four wheel disc brake applications, but there are some with drum brake applications.

MS. Moll. I guess that takes care of those.

Just following up on that last question there, has GM considered using more widely the four wheel disc brake system in which case I presume that you could have asbestos free models in the U.S.?

MR. LeFevre. We do have some four wheel disc brake applications, and those are under study. They are a viable design for some product platforms, for some particular designs. For other products we don't consider them the best brake system for those applications.

Tom, do you have any thoughts on that?

MR. Johnson. Yes. I guess I'd like to add that it's not a simple substitution to substitute a disc brake for a drum brake. For instance, some of our cars have as little as ten percent of the braking effort on the rears during normal driving if the rears have to take 30 percent of the braking effort if parked on a hill, for park brake requirements. It's very difficult to make a disc brake satisfy the low output requirements for normal driving, and the high output requirements for the parking requirements.

Additionally, there is significant cooling problems to cool disc brakes way back in the rear, so you cannot simply substitute a drum for a disc brake, or a disc for a drum.

MS. Moll. It would involve a lot more -- I know it would basically be redesign of the car.

MR. LeFevre. An example of that that specifically comes to mind is that the GM Corvette is, in fact, fitted with four wheel disc brakes. The actual brake lining material that interfaces with the rotor is, in fact -- the contact surface is, in fact, a semi-metallic material on those vehicles; however, because of a temperature that those brakes operate under, under some operating conditions those linings are manufactured with an asbestos underlayer that does help to provide a thermal insulation so that you don't boil the brake fluid. The vehicle is also fitted with a small outboard drum brake assembly to meet the parking brake requirements. The drum brake having asbestos linings.

So while the basic system, in fact, has the capability, you end up finding yourself back into a corner again.

MS. Moll. You mentioned that GM is still using -- I think you said about on 15 percent of your cars asbestos disc brakes. Now, I assume that you weren't --

MR. LeFevre. Fifty.

MS. Moll. Is that --

MR. Johnson. Most of our front disc brakes are all non-asbestos.

MS. Moll. Oh, okay. So it's just the rear disc brakes that might be asbestos?

MR. Johnson. That's correct. There may be asbestos --

DR. Krebs. Rear drum brakes.

MR. Johnson. Rear drum brakes, yes.

MS. Moll. Excuse me?

MR. Johnson. I misunderstood the question.

MS. Moll. So you're saying that all of the disc brakes used on the front wheels are non-asbestos then?

MR. Johnson. On non-asbestos friction materials some may have an asbestos underlayer for insulation.

MS. Moll. And then -- sorry. I haven't gotten this quite clear.

And then on the rear brakes, if you use disc brakes, they may be asbestos?

MR. Johnson. They may be asbestos, or they may be metallic, depending on the particular application, right.

MS. Moll. Okay. I think I got it now.

On the durability of the non-asbestos brakes, you mentioned that if you can convince your customers to accept frequent lining changes and periodic replacement of drums, we could probably use some of the non-asbestos European linings.

3           So this seems to sort of contradict what Dupont has  
4           said about the durability of the Kevlar-based linings. In  
5           their written submission they said that while the initial  
6           cost of the non-asbestos friction products made with Kevlar  
7           may be higher, the premium is offset somewhat by significantly  
8           longer wear life for the friction element and mating metal  
9           part. Can you comment on that?

10           MR. Johnson. I'm not at all familiar with Dupont's  
11           studies. I think I've seen studies that has shown European  
12           non-asbestos linings, particularly ones containing what they  
13           call multi-fiber materials to have lower wear resistance  
14           than materials that U.S. customers are accustomed to.

15           MS. Moll. So what types of fibers --

16           MR. Johnson. I believe they are the aromat type  
17           Kevlar fibers. But they also include brass and other  
18           materials that are not typically used in the United States.

19           MS. Moll. You mentioned that where non-asbestos drum  
20           brake linings might be used in the aftermarket, that there  
21           may need to be significant changes in the brake system,  
22           made in the brake system.

23           Are you aware of whether or not this has been done,  
24           whether in the cases where the non-asbestos drum brake  
25           linings have been used in some of the brake work in the U.S.  
26           whether that's -- there have had to have been those other  
27           system changes that you refer to? Because we do have some

1 indication that Sears has done some work using non-asbestos  
2 drum brake linings. I was wondering if you have any  
3 information on that.

4 MR. LeFevre. Our understanding is that the vehicles  
5 that are serviced in the aftermarket are, generally speaking,  
6 serviced only by replacing those components which the  
7 customer requests to have replaced, or which are obviously  
8 deteriorated as a result of wear or abuse, or what have you.  
9 But generally speaking, I frankly would be very surprised  
10 if the aftermarket was to go in and to service a vehicle  
11 and change wheel cylinder sizes, or change system operating  
12 pressures. First off, I don't think they would have a good  
13 idea of what changes they might make, or that would be  
14 acceptable. I think it would be an ill-advised area for a  
15 component manufacturer to get into unless he was going to  
16 accept the responsibility for trying to revalidate the entire  
17 system.

18 So I doubt very much that that happens in the  
19 aftermarket. Within General Motors that's why we urge the  
20 use of genuine GM replacement parts in servicing our vehicles  
21 to assure that such changes are not needed to compensate  
22 for changes in friction properties.

23 MS. Moll. I have some questions regarding the number  
24 of brake systems that you say would need to be redeveloped  
25 to accommodate non-asbestos friction products, or non-

asbestos brakes.

1           You say that GM currently has in production approximately  
2           80 unique brake systems. Can you break that down by  
3           how many are for passenger cars, or how many are for trucks,  
4           and various --

5           MR. Johnson. Yes. The vast majority of those are for  
6           passenger cars. The principal reason for the large number  
7           of brake systems is because of the stringent requirements  
8           both from federal law and our customers' requirements.

9           For instance, on our mid-sized passenger front wheel  
10          drive cars alone, our so-called A bodies, we have seven  
11          unique brake systems for just one size vehicle, and it's in  
12          order to span the different option requirements, as well as  
13          the change in weight from driver only to the fully laden  
14          position.

15          So I would say of that probably 90 percent are for  
16          passenger cars, and maybe only ten or so systems are for  
17          light trucks.

18          MS. Moll. Okay.

19          That's all I have. Thank you.

20          MR. Dull. John?

21          MR. Rigby. I'll have a few questions.

22          First to follow-up on what Amy Moll already asked,  
23          would you perhaps provide us with more specific data  
24          concerning the problem, or perhaps a problem, of substituting  
25

1 for asbestos brakes in the automobile aftermarket? We're  
2 in a situation now where we've received a number of comments  
3 from automobile manufacturers saying that this is undesirable.  
4 On the other hand, a number of comments from other groups  
5 saying that it is perfectly safe and desirable. And does GM,  
6 or perhaps another auto company, have something more  
7 specific they can submit to us on this issue?

8 MR. Johnson. I guess I don't have any more specific  
9 information other than to reiterate the fact that we give  
10 our brake systems an extremely thorough testing program  
11 before we release them to the public. These testing programs  
12 encompass a large number of events that can occur in  
13 customer service. I don't believe are addressed in the  
14 testing applications of many of the aftermarket linings.

15 MR. Rigby. I'd like to ask a few questions now  
16 concerning labeling.

17 You know in the proposal itself we put in a labeling  
18 option. And I was wondering what GM's position would be on  
19 labeling the component parts in the automobile? Do you  
20 think it is feasible or desirable?

21 MR. LeFevre. As a general comment, we see frankly  
22 little value in the prospect of actually labeling the  
23 parts themselves. If the objective of the proposal is to  
24 advise the user of those components, let us say the mechanics  
25 of those components, about the presence of asbestos in those

1 products when they are new, then we believe that that  
2 can be, and is being, very effectively addressed by labeling  
3 on the package in which the replacement part is marketed.

4 If the thought is to label the part to advise the  
5 mechanic who is servicing the vehicle after X miles, we  
6 doubt that such labeling would really serve -- labeling of  
7 that part when it is new would serve much of a useful  
8 purpose.

9 First off, the generally hostile environment in which  
10 the, let's say, brake linings, or clutches, or similar  
11 components would work, if you like, is sufficiently -  
12 unfriendly, whatever labels are in there are going to be  
13 either defaced, destroyed, lost, or what have you, so that  
14 when the vehicle gets around to servicing the labeling  
15 isn't going to be there anyway.

16 Secondly, the relatively small surface areas upon  
17 which such labeling could be put generally is not going  
18 to be -- we believe not going to be effective.

19 MR. Rigby. What does GM think about perhaps including  
20 a statement in the owner's manual, or some similar statement,  
21 given to the person when he or she purchases a car about  
22 the asbestos containing parts?

23 MR. LeFevre. Certainly if the ultimate decision was  
24 that an advisory statement in the owner's manual was  
25 worthwhile, it obviously could be included. I personally

1 would doubt that there would be much value in that.

2 In all sincerity, one of the challenges that we  
3 continually find ourselves faced with is how to get owners  
4 to read the owner's manual. I would ask when was the last  
5 time you read your owner's manual? Did you read it when  
6 you took delivery of the car, and have you read it since?  
7 You don't need to answer the question.

8 (Laughter)

9 MR. Rigby. A somewhat similar question again on this  
10 labeling issue before I put it to rest. What do you think  
11 about including a label on some standard place in the car,  
12 perhaps the inside of the door, where we see a number of  
13 other labels perhaps concerning pollution devices?

14 I'm just going through the whole concept here of  
15 possible ways of labeling on an automobile, practical ways  
16 of doing so.

17 MR. LeFevre. I think as a general comment, one needs  
18 to again identify what is the precise purpose of a particular  
19 label; what is the objective that we're trying to serve,  
20 and what is the risk which we are trying to warn the people  
21 who are at risk?

22 I think if we can understand precisely what that  
23 objective is, what that goal is, then I think we can make  
24 assessments. In all sincerity, the goals that I can think  
25 of that might be served, I find little use in actually

putting labels in owner's manuals, putting them on the parts.  
I'm not even sure of -- that labels as a general comment  
are a very effective tool. It could be put on the door.  
We're getting to the point where there's not a whole lot of  
real estate left there, but there's always more.

MR. Rigby. I'll leave this subject now.

I notice in your oral testimony at least, you didn't  
address the issue of replacing asbestos in gaskets. Would  
you like to comment briefly on that, the potential for  
doing so?

MR. LeFevre. In our written comments we did expressively  
cite that one area of concern that we do have involves  
replacement gaskets for aircraft engine high temperature  
applications.

We believe that it is foreseeable that in time  
replacement gaskets for new engines could be developed  
and fully validated, and could function quite satisfactorily.

We think that there are some serious questions  
associated with attempting to replace asbestos gaskets that  
are in service on aircraft engines that are already out in  
the world, to replace those with non-asbestos or gasket  
materials. We think that there are some risks associated  
with that. Of course, those engines have to be certified  
when they are serviced, and one has to be assured that the  
performance of those gaskets are fully acceptable.

1 In terms of the other applications, be they sealers,  
2 or undercoatings, or clutches, or exhaust system gaskets,  
3 things of that sort, probably in time the viable substitute  
4 materials for those can be developed. Again, we would  
5 hope that the benefits associated with applying resources  
6 in that area would be carefully examined because I'm not  
7 sure there's a whole lot of good to be gotten out of it.

8 MR. Rigby. What problems, if any, does GM foresee  
9 in meeting the new OSHA asbestos standard with the PEL  
10 of 0.2 fibers per cubic centimeter?

11 DR. Krebs. Of course, the standard is still under  
12 review internally within General Motors, so I can't comment  
13 specifically on what difficulties we anticipate we might  
14 encounter other than to say that our overall asbestos  
15 levels as measured within the breathing zones of employees  
16 are generally in the vicinity of .2 or lower. We do have  
17 those excursions that are higher, although at this point  
18 I'm not prepared to tell you at which locations those might  
19 be, and what kind of complications we might have.

20 MR. Dull. Do you have any sort of internal report  
21 that might have this sort of information?

22 DR. Krebs. Not at this time we would have a specific  
23 report that would deal with that subject.

24 MR. Rigby. I know in your oral testimony and your  
25 written comments you raised a lot of practical problems with

the permitting system. Would GM then prefer one of the alternatives that is addressed in the preamble involving a staged ban of asbestos products that is set in a time period by which certain categories of parts would be banned with an exemption process?

DR. Chu. What we said, we think if EPA's insisting of a ban, we think for the friction products for automotive use should at least give us a ten year time before than ban really having this type of application. We don't think this application causes any problems.

MR. Rigby. I may have misunderstood you. Did you say two years?

DR. Chu. Ten years.

MR. Rigby. Ten. Thank you.

DR. Chu. Sorry about that. I'm an immigrant.

MR. Rigby. To address that then briefly, we've gotten quite a number of comments from other automobile companies and quite a few of them think that they can make a changeover if necessary within five years, except possibly in some cases for truck brakes.

Do you think if the rule went through with a five year phase out, do you think GM could meet that?

DR. Chu. No, but I think Mr. Johnson or Mr. LeFevre has an answer.

MR. LeFevre. As we had stated in our written testimony,

and as I stated in my oral testimony this morning, we're not confident that the complete elimination of asbestos can be accomplished for all applications within even the ten year phase down period that is proposed by the EPA.

Again, if the agency was to proceed with its rulemaking, we believe that definite progress could be made in that direction, but we have made some sincere attempts to phase asbestos out of some of our applications, and as Mr. Johnson shared in his comments, we've made significant success on disc brake applications. We have had significantly less success in drum brake applications. It would not be reasonable for us to sit here this morning and to share with you that if the EPA was to promulgate a rule banning asbestos within X number of years, that we'll just simply proceed with inventing the new solutions and that will solve it.

That was why we included in our written comments the explicit request to our proposal that the exemption process should include provisions which would allow for those applications where viable substitutes are not identified in time to meet the phase down schedule that an exemption would be obtainable for those.

I don't believe it would be responsible as we see it to sit here and to suggest that it will be accomplished in five years. We've considered that very carefully. We trust that others who have commented differently have

considered it with equal care.

MR. Johnson. If I might add to that, as I said in my testimony, five years ago we were confident too that we could eliminate asbestos in five years, and made that statement.

Speaking from experience, we were not successful. I can't speak for some of the other domestic auto companies, but it's my knowledge that they don't have a very large number of non-asbestos drum brake applications out there, and they may be as confident as we were five years ago. And they have a major test program ahead of them as well.

MR. Rigby. And one other question. This concerns a comment that perhaps GM has some knowledge about this one area.

We received one comment about the potential exposure, the potential release of asbestos in the ambient air during the shredding of automobiles.

I presume based on his comment that when automobiles are shredded the asbestos parts remain in them, and presuming there are no controls or adequate controls to the actual shredding facility, it could be released into the ambient air then?

DR. Krebs. I'm not familiar with the specific shredding operation that you're referring to, but speculating that the shredding process would be to reduce the motor vehicle

1 to smaller pieces as opposed then to finally divide into  
2 dust. I would expect if, in fact, there was asbestos  
3 containing parts still present, that the likelihood of a  
4 release that would be measurable occurring would be minimal  
5 and probably non-existent.

6 MR. Rigby. Thank you. I have no further questions.

7 MR. Dull. Michael?

8 MR. Winer. No questions.

9 MR. Dull. Lynn?

10 MS. Delpire. I have a question for Dr. Krebs.

11 In your oral statement you mentioned industrial hygiene  
12 studies that you found both in brake shops and in brake  
13 relining operations, and the brake relining operations  
14 you clearly said that -- clearly suggest that those  
15 measurements were taken a number of years ago.

16 I was interested in when the measurements were taken  
17 in garages for the brake operations, and what types of  
18 work practices might have been in effect when those  
19 measurements were taken.

20 DR. Krebs. The studies that I was specifically  
21 referring to occurred in the middle 1970's. The work --  
22 at that time the content of the brake lining segments was  
23 principally in asbestos.

24 The work practices that were employed were those that  
25 were then and still today presently recommended in the

1 brake service manual.

2 Does that address your question?

3 MS. Delpire. So there wouldn't be anything like  
4 air hosing brake dust, or maybe there would?

5 DR. Krebs. Those written studies that I was referring  
6 to did not measure or evaluate the exposure of airborne  
7 dust using an air lance. We do have language in our  
8 brake service manual that discourages that practice.

9 But to address the subject of brake dust, as I said  
10 in my testimony, 99 percent of the brake drum dust which  
11 if you had occasion to look at a wheel during servicing,  
12 would -- might amount to as much as maybe a teaspoon or  
13 a tablespoon full of collected dust inside a drum, is --  
14 less than one percent of that is unchanged asbestos.

15 Furthermore, if it did become airborne, the air studies  
16 that have been made of those dusts, and electromicroscope  
17 studies that have been made, have shown that these particles  
18 were of such a small size as not to be detected by the  
19 recommended analytic procedure as given by NIOSH.

20 So the dust that did become airborne had a very low  
21 asbestos content to begin with, and then we have a size  
22 that is below the size that wouldn't be evaluated by NIOSH.

23 MS. Delpire. But in these studies you did, did you  
24 find asbestos by the NIOSH method?

25 DR. Krebs. Asbestos was measured at some aspects of

the operation, but the tide weighted average measurements are those very samples that were collected for the duration of the operation. As I recall, ranged from none detected to hundredths of a fiber, as a test result.

And, as I further said, my study results were verified by a whole series of studies that I believe you may have copies of, but if not, they are available to you, that NIOSH has conducted as a part of field studies wherein they did such of the same kinds of things that I did, and their test results certainly go right along with the ones that I did.

MS. Delpire. Thank you. I have no further questions.

MR. Dull. Bruce?

MR. Sidwell. I have several questions for Dr. Krebs.

First question is basically of a clerical nature.

There are very few references, as might be expected, in oral testimony, and I wanted to find out if, in fact, General Motors has submitted in writing -- either alluded to citations, or have submitted in your written comments, all of the studies that General Motors considers are relevant to the health issues.

DR. Krebs. Well, we certainly have not submitted citations for all of the studies that we consider relevant. As you know, there is a very large body of information that deals with various aspects of the asbestos question. That

body of information has been accumulating for a number of decades.

So we certainly have not included a full listing of all those relevant studies.

MR. Sidwell. You mentioned early on that there appears to be a body of evidence that suggests that chrysotile is less hazardous than crocidolite. Is it your opinion upon reading the literature that crocidolite then is actually a more hazardous substance than chrysotile?

DR. Krebs. Yes, that's my opinion.

MR. Sidwell. You mentioned various epidemiological studies that indicate that 15 percent or more of the reported mesothelioma cases have no history of ever having been exposed to asbestos. We've been hearing testimony that exposure to asbestos is ubiquitous, and that it's found in lungs whenever looked for. I was wondering how one might confirm that no exposure to asbestos has actually existed in these particular cases of mesothelioma?

DR. Krebs. Well, you pose a very good question, and one that has plagued all of us. With respect to the spontaneous occurrence of mesothelioma, as you know, one of the techniques used in epidemiology is to rely on self-reported work history. And in those cases where mesothelioma has occurred, there have been studies that have been conducted by a number of people whose names

escape me right at the moment, but I can provide you at a later time, where there was no known occupational exposure to asbestos.

The numbers that are typically being referred to in mesothelioma registers are that a third of the mesotheliomas have definite occupational exposure, a third have a probable exposure, and one third are unknown. The 15 percent which the ACGIH reported in its documentation of threshold limit values is probably being very conservative.

MR. Sidwell. Basically what you're talking about then is the ability to rule out possible exposure from occupational activities?

DR. Krebs. Well, that goes hand in glove though with the basic operating premise of industrial health that one must have sufficient excessive exposures, that is, a sufficient dose, in order to potentiate disease.

If you talk about asbestos being ubiquitous, asbestos is present upon thorough examination probably in all of our lungs, and indeed, according to some, is floating right here in this room at this time.

MR. Sidwell. Perhaps a related question we can get to is you indicate that a number of studies show a -- suggest that those response from asbestos, those response in terms of disease, lung cancer, asbestosis, and to some extent, mesothelioma, cancer theory in this particular case

1 seems to indicate that you would -- you might continue to  
2 see disease even at low exposure.

3 You mentioned that there might be a practical threshold.  
4 I wonder if you could expand on your definition of what a  
5 practical threshold would actually be like.

6 DR. Krebs. Well, what I'm referring to there really is  
7 not my definition but the one of John Higginson. He  
8 explained it best in Science Magazine several years ago when  
9 the whole subject of chemical carcinogenesis was being  
10 widely debated.

11 What he was saying was, and my own practical experience,  
12 has shown that to be the same, that asbestos does not  
13 seem to be a potent carcinogen. Therefore, if, in fact,  
14 there is a low level of exposure, and, if, in fact, the  
15 clearance mechanisms within the lung do work as they are  
16 supposed to, then the likelihood of disease developing and  
17 a dose accumulating, is next to impossible during a normal  
18 lifetime.

19 Now, on the other hand, if the -- depending on what  
20 those exposures are, and depending on the effectiveness of  
21 the first mechanisms, if the person lived to be a couple  
22 hundred years old that might be a different story. But, of  
23 course, we don't have any evidence to examine that other  
24 than to speculate.

25 So that's really what I'm referring to when I perhaps

state in my own words what I perceive to be Dr. Higginson's discussion of that topic.

MR. Sidwell. A little later on I guess in a related manner, related kind of a tone, you mention that from the environmental viewpoint, the nature and extent of exposures to airborne levels of brake wear debris to which the public or employees may be exposed, is not sufficient to result in disease.

And have you personally reviewed -- we've been receiving reports of mesothelioma from friction worker exposure, both from brake mechanics, also related to brake manufacture, and I was wondering if you had personally reviewed this information, and whether you had any comments on those types of studies?

DR. Krebs. I've not reviewed your studies. I have conducted my own in General Motors friction material plants. And I have anecdotal evidence and reports about the outcomes of exposures in our facilities.

Now, let's not confuse the kinds of exposures and the kinds of measured results that are occurring. In the occupational situation we are dealing with the receipt of bulk raw asbestos fiber that is clearly distinguishable under optical phase microscopy. And by the body evidence that I depend upon, is of a size to have biological consequence.

1           We have a large number of studies where the people who  
2 are exposed day after day, week after week, year after year,  
3 to varying amounts of asbestos, and depending upon the time  
4 in their working history, and the time in the history of  
5 this country, would determine what the levels of those  
6 exposures might have been.

7           As you know, the country had as a threshold limit  
8 value guideline a value of 5 million particles per cubic  
9 foot of air. That was a standard that was enforced from  
10 the late 1930's until the early 1970's, and is a level which  
11 was developed using a different sampling technique, and a  
12 different analytical protocol, but I think that those of us  
13 who are concerned with the subject of evaluation of  
14 atmosphere would say that the results at the 5 million  
15 particle per cubic foot of air, or the 5 million particles  
16 per cubic foot of air standard, is a heck of a lot more  
17 fibrous than .2 fibers, as presently given.

18           And yet even with our operations, having kept within  
19 those guidelines for all the many years that General Motors  
20 has been making brake linings, we have had seemingly no  
21 apparent difficulties.

22           Now, with respect to brake mechanics, I know, as I said  
23 before, of no reliable studies that have shown where brake  
24 mechanics have been solely exposed to asbestos for brake  
25 linings and they've developed XYZ types of asbestos-related

diseases. There always seems to be a confounding aspect.

Now, with respect to the environmental portion of your question, as you know, ambient air studies from an analysis of suspected particulate matter is reported not in fibers but in mamalgrams, and there is no standard to compare those results to other than to have a series of air results collected throughout the United States and to say City A has a higher, the same, or lower level than C, B, or D. But as to what its biological significance is, I leave to you, ladies and gentlemen, the answer from me, I don't know.

4A

MR. Sidwell. This is a question for Dr. Krebs, but it may be for someone else on the panel.

Has there been any use of treated chrysotile experimented with by General Motors? Treated chrysotile and chrysotile phosphates, or some of the other treated varieties?

DR. Krebs. I can answer part of that question, but perhaps others would like to follow up.

To the best of my knowledge, chrysotile phosphate has not been used or studied within General Motors, to the best of my knowledge.

MR. Sidwell. Did you or General Motors comment on the recent -- well, actually it's a review of the health effects of asbestos that was authored by Dr. Nicholson for EPA? Did General Motors comment on it? It was called an Asbestos

1 Health Update, and appeared in -- it was submitted to the  
2 public for their comment in 1984, and I wondered if  
3 General Motors or you had commented on it at that time?

4 DR. Krebs. I have read a wide variety of articles  
5 authored by Dr. Nicholson. I don't recall that particular  
6 article, and I don't believe that we commented on it.  
7 But I would defer to my colleagues.

8 MR. Sidwell. Did you comment on the National Research  
9 Council document on non-occupational exposures to asbestos  
10 formed fibers?

11 DR. Krebs. I really don't recall.

12 MR. Sidwell. One last question. In your opinion,  
13 what kinds of toxicity testing of substitutes might be  
14 considered adequate as preliminary kinds of screening?

15 In other words, there are possibilities of using  
16 in vitro methods, there are possibilities of using animal  
17 studies of various nature. Which kinds of tests do you  
18 believe in your opinion are adequate?

19 DR. Krebs. Well, of course, I understand the dilemma  
20 that we are all in when we try to evaluate new materials,  
21 and let me try to answer your question as reasonably as  
22 possible.

23 Ideally, of course, we would like to have a lifetime  
24 of human study. That, of course, is an impossibility.  
25 But what we do think would be appropriate is to have

multiple in vitro and in -- studies conducted by a wide variety of participants within the scientific community using their best scientific knowledge to make the assessment about the potential toxicity of these materials.

We don't think a single study is adequate to rule out all possible hazards, or to -- well, to rule out all possible hazards.

MR. Sidwell. Do you have any opinion on the relative value of an injection study versus an inhalation study in animals?

DR. Krebs. Well, certainly. In fact, in my own doctoral research involved injection studies, and as long as one takes into account that the natural biological barriers are being bypassed with injection studies, those studies, depending upon what you're looking for, may reveal information.

On the other hand, ideally inhalation studies would be the studies of choice providing one is using the proper test animal for the material that's under test.

MR. Sidwell. If an injection study were to give a negative, do you think that would be sufficient?

DR. Krebs. I don't believe that any single study in any single protocol is sufficient to completely rule out a material.

1 MR. Sidwell. Thank you.

2 MR. Dull. Joe?

3 MR. DeSantis. I just have a few questions that I  
4 would address to the panel and you can decide who should  
5 answer.

6 You mentioned in your oral testimony that in 1979 GM  
7 had a goal of eliminating asbestos by 1985. Could you  
8 clarify what your current policy is?

9 MR. Johnson. Our current policy is to make all new  
10 vehicle designs with non-asbestos friction materials, if  
11 possible.

12 MR. DeSantis. In view of the concerns that you've  
13 expressed for other durable fibers, and as well, I believe,  
14 in a testimony that indicates you think asbestos can be  
15 controlled, can you explain why your current policy is to  
16 eliminate asbestos in all new vehicles?

17 MR. Johnson. I think for the very reason we're sitting  
18 here. We see in a large push on the agency to eliminate  
19 asbestos, we'd like to be able to anticipate the need and  
20 not get hit with crash programs late in the process.

21 MR. DeSantis. Given that your intentions are to  
22 eliminate asbestos in new model vehicles, how important is  
23 the aspect of the new model approached in terms of the  
24 schedule that you think is achievable in replacing  
25 asbestos?

MR. Johnson. If I understand correctly, I believe  
Dr. Chu pointed out that given a ten year time span we  
probably would have a turnover of most of our new brake  
systems. That still leaves unanswered the question of  
service lining materials and what best to do with service  
lining materials.

MR. LeFevre. I would -- I do feel it important though  
to repeat the comment I made a few minutes ago on the  
studies, that as Dr. Chu said, the ten year time period  
would appear to be the most practicable -- would be a  
more practicable time period than any of the other options  
that are lying on the table. But we remained concerned  
that as Mr. Johnson said, we made a commitment to ourselves,  
and for that matter, we made a commitment to the record,  
that we were going to get out of asbestos by 1985, and we  
didn't get it done.

We do believe it's essential that there be provisions  
within the exemption process that says if we give it our  
best shot and it doesn't work, there has to be some kind of  
a way of dealing with the situation other than to end up  
closing plants and putting people out of work, and  
discontinuing production on certain product lines.

MR. DeSantis. You had mentioned that it was GM policy  
to use the same environmental controls on all fibers as  
used on asbestos. Do you know of any exposure data on other

1 fibers that relate to manufacturing activity and servicing  
2 activities?

DR. Krebs. Could you repeat your question?

3 MR. DeSantis. Yes. You mentioned it was GM policy  
4 to use the same types of environmental controls on all  
5 fibers that you use on asbestos. I was wondering whether  
6 or not you had any exposure data on other fibers that would  
7 be helpful in looking at what types of concentrations  
8 you saw in manufacturing activities, as well as in servicing  
9 activities in friction materials.

10 DR. Krebs. As specifically relates to friction -  
11 materials, no, we do not yet have additional air test  
12 data because we have not yet developed those products.  
13 But as we heard yesterday, Nuturn Corporation has been  
14 involved the production, manufacture of asbestos substitutes,  
15 and they have found indeed that in the production study  
16 there feels to be more dusty than was the case for the  
17 comparable asbestos situation.

18 Now, I'm not sure what I know when I'm telling you  
19 that, but we all heard that said yesterday.

20 MR. DeSantis. Do you have any information or data  
21 that relates to whether or not there have been any safety  
22 problems associated with aftermarket friction materials  
23 being used in vehicles that were perhaps not compatible,  
24 or did not contain asbestos, that may have resulted in any

type of safety problems?

DR. Chu. Howard has been --

MR. Silverman. We couldn't possibly begin to test all the aftermarket lining and all the different combinations of partial replacements of systems and total replacements of systems. We do know and I think you'll find that NHTSA is in agreement, that there are changes in performance with some replacement parts, whether all those -- we're not saying that all those are critical, but we think that is important that that factor be considered.

MR. DeSantis. Thank you.

MR. Dull. Alan?

There are a number of questions from the audience. From S. Houston of -- affiliation, address the general panel.

Sweden has recently indicated its intention to ban the import of many manufactured cars containing asbestos brake linings for reasons related to worker and public health and safety.

Question. Do you believe that this is a justifiable action?

It sounds like one for you, Mr. Chu, actually.

DR. Chu. I had some conversation and have reviewed that information from the Swedish government, but I never see their scientific justification, that's why we're

wondering how to comment because we don't see any background documents to justify that. So we have to say we can't comment. We don't know about the justifying.

MR. Dull. As a follow-up question, what implications do you think actions like Sweden's will have on international trade?

MR. LeFevre. I think it's quite foreseeable that it can have only the effect of curtailing international trade with regard to products that are viable for sale in their country.

Apparently they have decided as a nation that that's a tradeoff that they're prepared to accept.

MR. Dull. A question from Douglas Greenhouse of the National Automobile Dealers Association addressed to Dr. Krebs.

Based on your testimony on the composition and potential health effect of brake residues, please characterize 1) the degree of protection offered by the .2 fiber per cc OSHA standard? And I'll do the second part after you answer that.

DR. Krebs. The question really does not bear on -- or the statement does not bear on the question because the -- from -- based on my air test results, and those of others, the exposure levels that are received by brake mechanics within dealerships is significantly below .2.

So I'm not sure what bearing the .2 fiber has on that operation.

MR. Dull. Then as the second part of that question, again with the same premise based on your testimony on the composition, potential health effect of brake residues, please characterize General Motors' educational and training efforts for brake repair replacement workers, including shop manuals, references, labeling, bulletins, et cetera.

DR. Krebs. I'm not sure I'm in a position to answer that question adequately other than to say, as had been previously testified to here today, we do have warning labels on our aftermarket parts; we do have statements within our brake service manual that address that subject. We also have participated with some trade associations, and with the federal government for the development of educational materials. But going beyond that, I really can't say what else the corporation has done because I don't know.

MR. Dull. Anyone else want to respond?

(No response.)

MR. Dull. A question from Tricia Patrikios of the Milford-Stratford Citizens Against Pollution.

Why would GM wish to phase out asbestos use by 1985?

MR. Johnson. Again, I think I answered that question previously. We see a lot of impending regulation on asbestos, and we hoped to anticipate the need for changes rather than

having crash programs at the last minute.

MR. Dull. A question for Dr. Krebs from I believe it's Dennis O'Connor.

What study indicates that asbestos fibers shorter than 5 microns are not pathogenic?

DR. Krebs. EPA has been provided with information, I understand, from JMG Davis wherein that statement is made. I presume that could be made available to Mr. O'Connor.

MR. Dull. O'Connor, yes.

A series of questions from Dr. Larry Castleman representing the Natural Resources Defense Council.

Is it General Motors' position that brake repair workers are properly protected today against asbestos by OSHA or anyone else?

DR. Krebs. I guess I should respond to that. Providing the brake service techniques that are recommended by General Motors are followed, we believe, in fact, that they are.

MR. Dull. A question for Dr. Krebs again from Dr. Castleman.

You indicated that brake repair workers don't develop asbestos disease. Are you aware of the clinical studies on mechanics by Lorimar and other medical doctors at Mt. Sinai School of Medicine published ten years ago?

DR. Krebs. Yes, I am aware of those studies, and I am also aware that there were follow-up studies under that

published by Dr. Nicholson wherein there were statements made that, in fact, what I've said is true.

MR. Dull. Are you aware of the mesothelioma cases in brake workers reported by Drs. Langer and I believe it's McCaughey, in 1982, and Dr. Ziem in 1984?

DR. Krebs. Perhaps if we could have more specific information about the specific cases in mind. I do know of one case reported by Dr. Langer that, in fact, was reported to be a brake mechanic exposure which, in fact, was not true. I do not know of the other two cases that you have asked me about.

MR. Dull. Is General Motors aware of any cases for concern about health hazards of its non-asbestos semi-metallic brakes? And I believe that question again is directed to Dr. Krebs from Dr. Castleman.

DR. Krebs. Could you read that question again, please.

MR. Dull. Certainly.

Is General Motors aware of any cases for concern about health hazards of its non-asbestos semi-metallic brakes?

DR. Krebs. The semi-metallic brakes, of course, are composed of a variety of materials each of which have appropriate threshold limit values to which we would control employee exposures.

The General Motors Research Laboratories in its Biomedical Sciences Department has studied the health effects

1 of semi-metallic materials and has verified the hypothesis  
2 that there was no unusual health effect associated with them.

3 MR. Dull. Continuing with questions from Dr. Castleman  
4 for Mr. LeFevre, is it true that semi-metallic brakes  
5 work at least as well as asbestos brakes and last longer?

6 MR. LeFevre. The principal reason for moving to the  
7 semi-metallic brakes did not really have as much to do with  
8 removal of asbestos as it did to improve the performance  
9 of the brake systems. Very stringent requirements for  
10 fade characteristics in semi-metallic brakes have better  
11 fade resistance characteristics than asbestos linings.  
12 That's the principal reason driving the semi-metallic  
13 linings.

14 It's principally a requirement of the front brakes  
15 because the front brakes do most of the braking under fade  
16 type conditions.

17 MR. Dull. As part of the same question, do semi-  
18 metallics also carry higher purchase price?

19 MR. Johnson. I guess I'm not aware of the prices.

20 MR. Dull. Anyone on the panel answer that question?

21 MR. Johnson. You know, it's important to deal with  
22 the entire system price, not any one specific quantity.  
23 I just have no information on it.

24 MR. LeFevre. There is one other question that I think  
25 has to be at least in the minds of some, and that is if

semi-mets do, in fact, work as well as they do in disc brake applications, why are they not used on a more universal basis? It does, in fact, have to be used very selectively. While it does have good faith properties, semi-mets have to be applied very skillfully to avoid noise problems, and generally speaking, semi-met friction materials tend to exhibit less flexibility. And drum applications tend to flex linings more than disc brake applications do, everything else being equal. It's always risky, of course, to generalize.

But they can be used in some drum applications, but that's been one of the main difficulties of trying to make it work in those situations.

MR. Dull. All right. A fairly long question from Dr. Castleman.

How come Volvo and Saab in Sweden already have eliminated asbestos from automobile brakes. Toyota says it could live with a ban on asbestos in car brakes in five years. Brake manufacturers Abex and Scan-Pac and trucking firm, Freight Liner Corporation, say they can do without asbestos in new and aftermarket brakes now or in the near future, but General Motors' experts of all kinds are brought here today solely to maintain all of the reasons why asbestos either isn't a hazard or can't be replaced?

MR. Silverman. May I suggest to ask the other

1 companies about the basis for their opinions?

2 MR. Dull. Anyone else want to respond to that question  
3 on the panel?

4 DR. Krebs. I guess we have answered it.

5 MR. Dull. Moving onto another question from Dr.  
6 Castleman.

7 Why no construction proposal for acknowledgement of  
8 the prudent asbestos hazard to brake mechanics which EPA  
9 unquestionably accepts?

10 MR. Silverman. Is that a question?

11 MR. Dull. Yes, I think it is.

12 MR. Silverman. Well, there was a question mark at the  
13 end of it, but otherwise was it a question?

14 I don't think any of those assumptions -- I don't think  
15 we agree with any of those assumptions.

16 MR. Dull. What measures does GM take, if any, to  
17 warn brake mechanics about safe practices to use in hazards  
18 in their work? Some of these questions may have been  
19 answered in part before.

20 MR. LeFevre. I think that question has been answered.

21 DR. Krebs. We answered that question, I believe.

22 MR. Dull. What warning labeling is used on GM's  
23 packages of friction products or tags on the friction  
24 products?

25 MR. LeFevre. I think we have answered that. I cannot

quote you word for word, but there are labels that are on the packages in which friction materials are marketed, GM markets.

MR. Dull. What measures, if any, does GM take to warn parts shops and other commercial customers about the safeguards needed when grinding or beveling brake parts?

MR. LeFevre. The instructions which we make available to our own General Motors dealerships are obviously available to those people out there in the world to avail themselves of it if they believe that's appropriate to their operations.

MR. Dull. Is the profit margin lower on asbestos free brakes than on asbestos brakes for applications where either could be used?

MR. LeFevre. I think as Mr. Johnson has shared a few moments ago, the multitude of the customer expectations, and regulatory requirements that a brake system has to measure up to -- have so much more influence over the design of a brake system, and the selection of the material, that I believe to isolate the question of cost is frankly potentially a misleading kind of a question. It is a consideration, but it is not the dominant consideration in making a friction material selection.

MR. Dull. Would General Motors prefer the option of licensing brake repair and requiring the use of enclosed

systems equipped with vacuum systems and heat the filters  
as a tradeoff for allowing more time to substitute asbestos  
in brakes?

(Pause)

MR. LeFevre. The question obviously is quite an  
open-ended question. I think it's not at all clear what  
those licensing provisions would consist of.

Dr. Krebs has also spoken of the need to deal with  
the true health risk associated with workplace exposures,  
and I think that that question kind of presumes that there  
is, in fact, an unacceptable risk, so, therefore, we must  
accept one of those two options. I don't subscribe to that  
premise.

MR. Dull. All right. Finally a set of related  
questions from Dr. Castleman addressed to Dr. Krebs.

You referred to apparently "no apparent difficulty"  
among GM workers manufacturing friction materials.

How long has General Motors and its predecessors  
manufactured friction products?

DR. Krebs. To the best of my knowledge, General Motors  
has been engaged in friction material manufacture since  
1939. I have no information as to the time prior to that  
that brake manufacture has been in progress.

MR. Dull. Are there any published studies about the  
health outcome you described in General Motors' friction

1 plant employees?

2 DR. Krebs. No, there are no studies discussing the  
3 health outcome of General Motors' employees specifically.

4 MR. Dull. Has General Motors ever conducted  
5 epidemiological, pathological, or clinical studies  
6 regarding the possibility of an asbestos disease risk in  
7 brake repair workers?

8 DR. Krebs. In brake repair workers?

9 MR. Dull. In brake repair workers.

10 DR. Krebs. No, we have not, because brake repair  
11 workers are, typically speaking, not General Motors employees.

12 MR. Dull. All right. I believe John Rigby has a  
13 final question?

14 MR. Rigby. Yes. This, in part, I guess addresses  
15 Dr. Castleman's concern. I wanted to ask you a few  
16 questions concerning possible regulatory options that GM  
17 might support.

18 In listening to your testimony about the need to wait  
19 until the vehicle design changes take place before  
20 substituting non-asbestos brake systems, I wonder if GM  
21 would support a rule that would ban asbestos in all newly  
22 designed automobiles?

23 MR. LeFevre. I think in our prepared testimony we  
24 had offered the thought that if the rulemaking was to  
25 proceed calling for the ban of asbestos from new vehicle

1 applications ten years after the rule was finalized,  
2 that that would be a more practicable approach than any  
3 of those that are currently on the table.

4 As we have stated previously though, success in that  
5 effort is not certain, and we continue to believe that there  
6 must be provisions within the exemption system to provide  
7 for those cases where success is not realized.

8 MR. Rigby. But since as you previously state you are  
9 not using asbestos in newly designed automobiles, such a  
10 requirement would have no practicable impact on GM.

11 MR. Silverman. I don't think you can conclude that.  
12 First, there are designs that are about to come out that  
13 it would be-- that kind of rule was to go into effect  
14 immediately it would be too late to change.

15 Second, while attempts have been made to have non-  
16 asbestos linings in new vehicles in the past few years,  
17 that is not -- especially in the rear drums, without much  
18 success.

19 DR. Chu. I think the key point is while sitting here  
20 six people trying to guess what the definition of newly  
21 designed vehicle really is, I think if we see some proposal  
22 maybe we'll be able to respond much better.

23 MR. Rigby. Okay, that seems fine.

24 So that -- I'll ask one other one. Ms. Moll is  
25 preparing another question.

Also I notice in your prepared testimony, rather your previously submitted written comments, GM encouraged us to choose an alternative that was discussed in the regulatory impact analysis, but wasn't actually summarized in our preamble, concerning a ban of asbestos construction products and asbestos clothing.

I take that to mean that GM would support at least that much of a ban, or surely would not oppose it?

DR. Chu. Yes. I look for our experts in that field.

MR. LeFevre. I think that it would not -- we would not feel in a position to take exception to that particular rulemaking. I think certainly others are far more qualified to speak to that issue.

MR. Rigby. Thank you. I believe Ms. Moll has one more question.

MR. Dull. Amy, do you have a question?

MS. Moll. You mention in your written comments that action by the National Highway Traffic Safety Administration may further complicate the search for non-asbestos linings. Can you elaborate a little bit on what it is that they are planning to do and how that's going to impact us?

MR. Johnson. Yes. The NHTSA has proposed rulemaking that would significantly alter the standards by which we design our brakes. Their original proposal was called Federal Motor Vehicle Safety Standard 135, and it is

1 scheduled to go into effect in 1982 or 1983, depending on  
2 timing of its -- 1992 or 1993.

MR. LeFevre. If I might offer, that particular proposal  
3 is the NHTSA's response to an international effort that has  
4 been going on for several years to develop a harmonized  
5 standard that will address, if not eliminate, the multitude  
6 of differences between European and U.S. regulatory  
7 requirements.

8 That particular rulemaking has proven to be dramatically  
9 more stringent, we believe, than the NHTSA intended it to  
10 be, and proposes a level of stringency that very, very few  
11 vehicles would, in fact, would be able to meet if it was  
12 to be promulgated.

13 It is, in fact, a proposal, if I might clarify Mr.  
14 Johnson's point, it is not scheduled to go into effect, but  
15 as proposed by the NHTSA, the effective date would be 1992.

16 That rulemaking is under study by the agency, and  
17 I believe the public record would indicate that they  
18 anticipate a supplemental notice of proposed rulemaking  
19 near the end of this year, and we would be hopeful that  
20 that harmonization effort could proceed, but there are some  
21 very serious, serious challenges that are posed as it was  
22 proposed last year.

23 MS. Moll. What sorts of problems do you anticipate  
24 in meeting that? What requirements -- or particular

requirements in that new standard or proposed standard are  
you referring to that you would have particular problems  
with, and would you have those problems with the current  
systems that you have with the current asbestos brake  
systems that you have, as well as with new non-asbestos  
brake systems?

MR. LeFevre. The proposed FMVSS 135 puts very, very  
heavy emphasis on brake balance; that is, front to rear  
brake distribution. It proposes some very stringent  
controls on that.

In contrast to that, FMVSS 105, the current passenger  
car and light truck hydraulic brake standard, places  
primary emphasis on vehicle stopping distance. Those  
two requirements tend to conflict with each other. It's  
not absolutely clear, and we can spend some time discussing  
that if it would be of assistance to the EPA.

There are very, very stringent fade and recovery  
provisions that cause us some very, very serious concern.  
I would offer as a data point, in our detailed response  
to the proposal on 135, which we submitted to the NHTSA  
on January 13th, and which was attached to our comments  
on the asbestos rulemaking, we made the point in there that  
General Motors has tested end-to-end a total of seven of our  
vehicles to try to cover the full continual of vehicles  
which we produce.

1           Ranging all the way from small sporty cars all the way  
2   to six passenger family cars, of that population of seven  
3   cars that we tested, there was only one vehicle in that  
4   fleet that we found that would, in fact, comply, and that  
5   was the innerlock brake system equipped Corvette, low  
6   center of gravity, minimal lightly loaded to fully laded  
7   operating conditions, minimal dynamic weight transfer,  
8   nice, big, wide gummy tires. That car will stop on a dime.  
9   And that car was able to meet 135. The only one in the  
10   fleet that could meet.

11           Those were vehicles that are designed, manufactured,  
12   and certified as fully complying with FMVSS 105. That's  
13   the basis of our saying that 135 is dramatically more  
14   stringent.

15           MS. Moll. So you said the only one that complied is  
16   the Corvette?

17           MR. LeFevre. Corvette, yes.

18           MS. Moll. Was the four wheel disc brake system?

19           MR. LeFevre. Yes.

20           MS. Moll. The four wheel disc brake system that has  
21   all non --

22           MR. LeFevre. That was not -- please don't pick out  
23   one characteristic. That does have four wheel disc brakes.  
24   It also has a very low center of gravity. It has minimal  
25   dynamic weight transfer, it has minimal -- difference

between lightly loaded and fully laden conditions, and it's also fitted with an innerlock brake system.

All of those issues contributed to the ability of that vehicle to comply, not just its having four wheel disc brakes.

MS. Moll. So does GM anticipate if this standard were to go through that they would have to try to design disc -- four wheel disc brake innerlock systems like the one that they have on the Corvette in order to meet it?

MR. LeFevre. Four wheel disc brakes with innerlock systems does not account for the dynamic weight transfer or the change in vehicle loading from driver only to full six passengers.

We have said to the NHTSA that if, in fact, 135 is what they believe they're going to go with, or stay with 105, then we would both stay with the current law and forget about international harmonization. 135 is not viable. It's not close. It has to be melted down and repoured.

MS. Moll. Okay. Thank you.

MR. Dull. Any further questions from the panel?  
Any written questions from the audience?

(No response.)

MR. Dull. All right. I'll try to answer this last question, which is the handwriting is somewhat illegible, so I'll do the best I can and see if we come up with

1 something you can respond to.

2 From Dr. I believe Heddinger from Ashland, if front  
3 wheel brakes do 80 percent of the braking and all are  
4 non-asbestos containing brakes, and since less than 50  
5 percent of the brakes are drum brakes and produce 20 percent  
6 of the braking effort, then we must be discussing a problem  
7 that seems to be cloudy.

8 It appears to mean that the problem is strictly in  
9 drum brake development. It would seem that a slight  
10 reduction in efficiency of the 20-20 braking power would  
11 not be serious. Twenty percent braking power would not be  
12 serious.

13 Can General Motors shed more light on the problem?

14 MR. LeFevre. That is a very, very complex issue.  
15 I'm not sure that we'll be able to satisfy the EPA with  
16 regard to that to any level of detail. But let me offer  
17 just a couple of thoughts.

18 Not only do the current regulations, specifically in  
19 VSS 105, establish very stringent stopping distance  
20 requirements for the fully operational system, but that it  
21 also requires performance with these -- half of the system  
22 disabled.

23 There are also the parking brake requirements on such  
24 vehicles.

25 I think the questioner is suggesting that perhaps one

could simply sacrifice some of the performance capability on the rear of the vehicle, perhaps just make it up on the front end of the vehicle, and maybe we really wouldn't have a problem.

The interrelationship between fade and recovery between green brake performance; that is, the performance of the brake system as the vehicle rolls right out of the dealership, which is a regulated requirement, the partial system performance requirements, that is, with half working and half non-working, with the power assist disabled, with the parking brake requirements. There are a multitude -- and I think those were included in the attachment to Mr. Johnson's oral comments. Do, in fact, create a very closely meshed set of requirements, and for one to pick a single requirement out and attempt to describe or to modify one requirement and say that that takes care of the problem just simply doesn't work.

I'm reminded of an analogy that an associate of Mr. Johnson's used in some discussions that we had recently with the NHTSA on the subject of 135. In sharing that the interrelationship among the components on that standard, or for that matter any of the brake standards, perhaps could be described as kind of reaching into a bowl of spaghetti to pull out one string of spaghetti, and you keep pulling, and you keep pulling, and you keep pulling, and

pretty soon you end up with a whole bowl of spaghetti.

It's all one continuous issue. It's all intertwined.

You cannot take out the issue of brake friction material composition and simply put another material in there and say that takes care of the problem. It doesn't work.

MR. Dull. All right. Any other questions from the panel and any other questions from the audience in writing?

(No response.)

MR. Dull. All right. In that case I would like to thank Dr. Chu, the members of your panel, and the General Motors Corporation for appearing here today, and patiently answering all of these questions.

Let's turn now to the schedule. Originally at 11:30 the Milford-Stratford Citizens Against Pollution was scheduled to appear. They very kindly agreed to testify this afternoon after lunch instead of this morning.

I'm also informed that the United Steel Workers of America will not be testifying today. And if that information is incorrect, I need to know about it as soon as possible.

So what we will do is we will break for lunch now and we will begin at a quarter of 2:00, 1:45, with the Milford-Stratford Citizens Against Pollution.

(Whereupon, at 12:12 p.m., the hearing was recessed, to reconvene at 1:45 p.m., this same day, July 16, 1986.)