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March 10, 1972

Arthur M. Goldberg
Hearing Examiner

HEARING ON PROPOSED STANDARD
FOR EXPOSURE TO ASBESTOS DUST
BEGINNING MARCH 14, 1972

I am Clifford L. Sheckler, Chairman of the Safety and Health Committee, National Insulation Manufacturers Association. I am appearing before you today, along with Mr. Spence Royer, representing the National Insulation Manufacturers Association and the National Insulation Contractors Association.

The membership of both Associations wish to express opposition to the proposed standard for asbestos dust as published in the Federal Register, Wednesday, January 12, 1972. Also, we wish to express our opposition to the recommendations of the Advisory Committee on asbestos dust, and the National Institute for Occupational Safety and Health criteria document.

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The National Insulation Manufacturers Association represents the manufacturers of Thermal Insulation products in the United States. The National Insulation Contractors Association represents the major Thermal Mechanical Insulation Contractors engaged in both the construction and shipbuilding industries throughout the United States.

Our comments will be directed specifically to the application of asbestos containing insulation products and not to the manufacturing of such products.

The construction and shipbuilding work currently underway by our Thermal Mechanical Insulation Industry is being done under both government and private contracts. Federally funded contracts involve office buildings, hospitals, schools, libraries, missile facilities, defense projects, dams, airport facilities, rapid transit systems, low rent housing, military housing, air and water pollution projects, shipbuilding and ship repairing for the U. S. Navy - Coast Guard - Merchant Marine and Army.

Private funded contracts include office buildings, hotels, theatres, refineries, power generating plants, chemical plants, other types of industrial plants, housing, University buildings, hospitals, and others.

We, in the thermal mechanical insulation construction industry, excluding the manufacturing of insulation products, and considering only the installation of this material, directly involve approximately 40,000 job opportunities in the United States.

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This industry represents an approximate $700 million gross volume of business annually.

Our industry is comprised of over 1000 contractors. Most of these contractors are small businessmen spread throughout the United States. Mr. Royer, who is here with me today, is one of the small businessmen who will present you with his views.

Our opposition to the asbestos dust standards are based on the fact that they are neither reasonable, practical, feasible, or economically sound. Much of the information for establishing the proposed asbestos dust standards, the NIOSH criteria package, and the Advisory Committee's recommendations, was gathered from experience in this Thermal Mechanical Insulation Industry.

Let us review the course of events concerning the threshold limit value for asbestos dust over the past few years. In 1970 the American Conference of Governmental Industrial Hygienists Threshold Limit Value for Asbestos Dust was published at 5 million particles per cubic foot of air as measured with the impinger method. We were able to work with this standard. At that time the majority of State Departments of Labor and Health maintained the same Asbestos Threshold Limit Value. In December 1970, the Occupational Safety and Health Act became law. In 1971, the first set of safety and health standards became effective. The threshold limit value for asbestos dust then became 12 fibres per milliliter greater than 5 microns in length as measured by the membrane filter. This industry did not question the reduction of the threshold limit value from 5 million particles per cubic foot to 12

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fibres per milliliter, and the complete change of the method for monitoring asbestos dust, instead, we immediately went to work by introducing new methods, equipment, and materials, to reduce dust levels to within the 12 fibre limit. On December 7, 1971, Emergency Asbestos Dust Standards were published in the Federal Register again reducing the Threshold Limit Value for Asbestos Dust from 12 fibres per milliliter greater than 5 microns in length to 5 fibres per milliliter greater than 5 microns in length. On January 12,1972, the proposed asbestos dust regulations, with a Threshold Limit Value of 5 fibres, was published in the Federal Register. Thus far, in conjunction with these proposed regulations, both NIOSH and the Asbestos Advisory Committee have made recommendations for further reduction of the Threshold Limit Value for asbestos dust to 2 fibres per milliliter greater than 5 microns in length. You now have a picture of the inconsistency and uncertainty involved in the establishment of an Asbestos Dust Standard.

From 1970 to-date, a period of just over two years, the Threshold Limit Value for asbestos dust has been changed from 5 MPPCF to 12 fibres, then to 5 fibres, with a current recommendation for a 2 fibre level. With each of these Threshold Limit Value changes there have been many other related requirement changes that add to the total confusion, such as, respiratory equipment, dust collection, vacuum cleaning equipment, and others. The change from 5 MPPCF to 12 fibres has been a costly one. Our industry has, with some difficulty, absorbed this cost. We frankly cannot meet the 5 fibre Emergency Asbestos Standard as currently effective, nor can we absorb the cost of the Emergency or Proposed Asbestos Standard and its related provisions. It is needless to say, therefore,

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that to achieve a 2 fibre standard as recommended by the NIOSH Criteria Package and the Asbestos Advisory Committee, is neither practical, feasible, or economically possible.

Let's carefully examine the reasoning for the erratic revisions of the Asbestos Threshold Limit Value since 1970. As I have already told you, much of the information which contributed to these revisions was gathered from our Thermal Insulation construction industry. At its best, this information is scanty, inconsistent, incomplete and inaccurate. First of all, I told you that at the change of Threshold Limit Value from 5 MPPCF to 5 fibres per milliliter, there was also a change in the method for monitoring asbestos dust from the standard or midget impinger to the membrane filter. There is absolutely no method for correlation between the asbestos dust counts determined by monitoring with the impinger as compared to the membrane filter. It is, therefore, impossible to compare the exposure levels in terms of numbers of fibres per milliliter greater than 5 microns in length with numbers of particles of total dust when using the impinger method. It must be recognized that the impinger method included particulate matter other than asbestos fibre.

Physical examinations on a part of the work force installing Thermal insulation materials have been conducted. The disease involvement determined by these physical examinations has been related to the present day asbestos fibre exposure as monitored by the milapore filter method. These factors can not

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be compared or related. Also, based on supposition and assumption, it was concluded that the exposure levels of men working in construction and shipbuilding before, during, and subsequent to World War II were at the same levels of exposure as is a worker engaged in similar activities today. This hypothesis is not true. The types of materials have changed, the percentage of asbestos contained in thermal insulation products has been reduced, the method of installation has changed, and fabrication equipment has changed. Each of these changes since the early 1940's has contributed in the reduction of dust levels. It is, therefore, illogical to compare disease occurrences which resulted from exposure from 20-30 years ago with dust levels monitored on construction sites within the last several years. It is also illogical to compare our American industry with that of foreign countries.

As I said, we have withstood the change from 5 million particles per cubic foot of air to 12 fibres based on insufficient information gathered from small segments of the industry. Although there was no further input of pertinent information, again, based on supposition and assumption, the level was then reduced from 12 fibres to 5 fibres. Now, still based on supposition and assumption, with no further information available, both NIOSH and the Asbestos Advisory Committee are recommending a reduction to 2 fibres. While these reductions in the Threshold Limit Value have been readily forthcoming, the proposed regulations, NIOSH Criteria Package, and the Asbestos Advisory Committee recommendations are completely void of any

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references to prohibiting or restricting workers who are habitual cigarette smokers from working with products containing asbestos fibre. The same studies, upon which much of the emphasis has been placed concerning the reduction of the Threshold Limit Value, also demonstrate drastic effects of cigarette smoking when associated with the pulmonary disease, Asbestosis.

As I told you, we have not achieved the level of 5 fibres. We are making a decided effort to do this. We have problems unique to the construction industry in attempting to comply with the proposed asbestos standards. I am not at this time going to review all of the minute problems involved in the application of these standards, instead, I am going to speak to the economics of achieving this proposed standard of 5 fibres per milliliter 5 microns and greater in length as published in the Federal Register January 12, 1972. We feel, with the economic impact that this regulation will have on the Federal Office of Budget Management, other Federal agencies, including the Armed Services, and on private enterprise, it is worthy of very careful consideration by the Federal Department of Labor.

We brought together a number of the foremost contractors in the Thermal Mechanical Insulation Industry and together we evaluated the cost of complying with the proposed asbestos regulation. This was accomplished by breaking down the regulation into each of its requirements and computing them individually. The requirements were computed individually, included

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monitoring, based on purchasing the monitoring equipment and having the samples analyzed at a private laboratory; respirators of the disposable type; physical examinations; dust collection and vacuum cleaning equipment; warning signs; protective clothing; and work placement. As a base we used a 100-man contracting unit with 25% of the unit working with asbestos containing products. We computed off-job time and lost time productivity at an average construction worker's rate. The total cost for implementing a program to comply with the proposed Asbestos Dust Regulations as published in the January 12, 1972 Federal Register for a 100-man construction unit, 25% of which worked with asbestos containing materials, is $795,375.00 direct expenses per year - $27,740.00 administrative expenses per year, and $16,700.00 of capital expenses, therefore, a total for the 100-man unit, with 25% engaged in work with asbestos containing products, amounts to $839,815.00 increased construction expense for the purpose of complying with the proposed Asbestos Dust Regulation. This represents an increased labor cost of 168% that must be passed on to the customer in order for a contractor to survive. The customer, in many instances, is the Federal Government and the Office of Budget Management. Considering the inadequacy of medical and scientific research information concerning safe exposure levels of asbestos dust, and also considering the supposition and assumpiton on which the proposed Threshold Limit Value is based, it is difficult to imagine a justification for the economic stress this regulation will place upon the construction industry, Federal Government, and private enterprise.

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We respectfully urge the Secretary of Labor to:

1. Reinstate the Threshold Limit Value for Asbestos Dust at 12 fibres per milliliter 5 microns or greater in length, for an interim period.

2. To initiate a comprehensive epidemiological study of the entire asbestos industry as it exists in the United States; and to determine not only the effects of asbestos but also asbestos associated with other airborne contaminants and cigarette smoking.

3. To provide adequate lead time prior to the effective date of reduction of any Threshold Limit Value in order that the construction industry, operating on fixed contracts, can cope economically with the increased costs that such a reduction will create.

4. To provide definitive information concerning the specific requirements of the regulations.

5. Provide our trade associations with representation on future Study and Advisory Committees.

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We, representing the construction industry, have been moving forward to provide safety and health information and implement safer working conditions. We intend to continue and accelerate this program. It is our desire to provide every possible protection for our people.

Thank you for the opportunity of appearing at this public hearing today.

C. L. Sheckler
Chairman, Health and Safety Committee
NATIONAL INSULATION MANUFACTURERS ASSOCIATION
NATIONAL INSULATION CONTRACTORS ASSOCIATION

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Statement by George W. Wright, M.D., Head of the Division of Medical Research in the Dept. of Medicine of St. Luke's Hospital, Cleveland, Ohio

before

U. S. Dept. of Labor, Occupational Safety and Health Hearing on proposed occupational asbestos standard

Washington, D.C.
March 16, 1972

Published by AsbestosClaims.Law
asbestosclaims.law/library/11850/11

My name is George W. Wright. I am the Head of Medical Research in the Department of Medicine of St. Luke's Hospital, Cleveland, Ohio. In 1932 I received the MD degree from Indiana University School of Medicine. After five years of Post Graduate Training in Internal Medicine with special training in pulmonary disease I spent two additional years in research training in the Department of Physiology at Case-Western Reserve University. From 1939 to 1953 I was a member of the Saranac Laboratories of the Trudeau Foundation engaged in studies of the pneumoconiosis, including asbestosis. Since 1953, I have continued this general field of study in my current position.

My statement will be confined to consideration of a single primary question. This question is: What is the quantity or concentration of asbestos, in the air breathed by those engaged in the production, manufacture or use of asbestos products, which can be tolerated for a normally expected work life without risk that such exposure will cause disease? The answer to this question goes to the heart of these hearings. While the question is rather easy to formulate it is difficult though not impossible to answer.

The obligatory information required for developing an answer to the primary question on an acceptable scientific basis is of two categories. One of these essential categories concerns the dose or quantity of asbestos inhaled and the other essential category concerns the biological response. What we need to learn is the dose-risk relationship.

The dose is estimated in terms of concentration of respirable asbestos in the air multiplied by the duration of the

exposure. It is obligatory that we establish a dose, in measurable terms, at which the biological manifestation of disease occurs and then, by observing populations exposed to progressively smaller and smaller doses, determine the level at which the biological reaction to asbestos no longer occurs. To make observations with regard to the various dose levels of different working populations without knowledge of the biological response of these same populations is of no use in answering the primary question. To make observations of the biological response in various working populations without valid knowledge of the different levels of asbestos exposure experienced by these same populations is equally of no use for finding an answer to the primary question. Standards for a safe level of asbestos exposure proposed or set in the absence of reliable and valid data in both of these two categories must be considered empirical and to some degree abritrary and should be recognized as such.

I wish to indicate some of the difficulties encountered in efforts to obtain the information essential for determining what the safe level of asbestos in the occupational environment truly is.

Asbestos is a generic term embracing four varieties that are in common commercial use. Of these, chrysotile is used in largest quantities followed by crocidolite, amosite and anthophylite. Each of these has different chemical and physical attributes. Some working populations are exposed to only one variety of asbestos while others are exposed to two or more simultaneously and in varying proportions. Thus there are several

kinds of populations each exposed in quite different ways to one or more kinds of asbestos, each of which might react biologically in a different manner. Moreover, workers exposed to asbestos are further exposed simultaneously to other airborne agents. In production, manufacturing and utilization processes these may differ greatly. For example, the asbestos producer is exposed to asbestos with minimal coexisting agents while, in contrast, the insulation manufacturer inhales asbestos plus silica plus other pneumoconiosis producing dusts. Insulation applicators inhale these materials plus a variety of additional agents present in whatever the environment is in the place where he is working at that time. Attention to such coexisting agents has been ignored in most studies, especially those of insulation workers. Variations of type of fiber and the circumstances surrounding their use must be taken into account in answering the primary question and would suggest the possibility that different standards might be rational in order to meet different conditions of use of asbestos.

There are four, totally different biological phenomena or diseases thought to be related in some way to the inhalation of asbestos fiber. These are pulmonary fibrosis, bronchogenic cancer, thickening of the pleura, and mesothelioma. Not a single one of these diseases is peculiarly related to or caused solely by the inhalation of asbestos fiber. Each of these four diseases occurs de novo or for other reasons in persons who have never been exposed occupationally to asbestos. The fact is, the biological reaction attributable to asbestos is not a

specific kind of disease induced solely by asbestos. Instead, the biological reaction to asbestos manifests itself by the fact that in some populations occupationally exposed to asbestos, there is, in contrast to non-exposed populations, an excess occurrence of one or more of the four previously mentioned diseases. To determine the safe level for the use of asbestos, we are required to demonstrate the level of exposure to asbestos at which no excess of disease develops when the exposed population is compared to a non-exposed population. In order to establish a safe level we must examine suitable control populations not exposed to asbestos, but age matched and residence matched, from which population one can learn the frequency of occurrence of the specific diseases in question. In addition, we must examine an exposed population, which can be ranked in various levels of exposure, in order to learn at what level an excess of these diseases occur in the exposed populatior The observation of a biological abnormality in only one or two persons who have been exposed to the inhalation of asbestos fibers does not permit a comparison to suitable control groups or afford contrasting exposure values. Such observations are of no use for determining a safe level standard. Isolated case reports of mesothelioma, bronchogenic cancer or pulmonary fibrosis in individuals who may also have had an exposure to the inhalation of asbestos fiber are of no use in setting a safe standard for asbestos based upon sound scientific principles. Larger populations in which only the frequency of occurrence of disease is reported, without the necessary data indicating ranges of exposure and in which no attempt to relate variations of exposure to disease is made, fall into the same non-

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usable category for setting a valid safe level. This is not to say that observations in such groups are of no value for other purposes, but the issue should not be confused by introducing data from such inadequate studies into considerations of safe levels of asbestos exposure. Suitable control populations made up of individuals in sufficient number who were never exposed to the occupational inhalation of asbestos fiber and occupational groups whose exposures are demonstrated to have wide variation are difficult to obtain but absolutely essential for our purpose. The absence of this kind of control data, excused or overlooked on the basis that it cannot be obtained, is an unacceptable condition if the safe level standard is alleged to be set on the basis of universally accepted scientific principles.

There is difficulty also with assessing the frequency of occurrence of the diseases thought to be related under some circumstances to the inhalation of asbestos fiber. There is disagreement as to the criteria for a valid diagnosis of mesothelioma. The criteria for a diagnosis of "asbestosis", especially in its least severe manifestation, are not generally agreed upon. The use of the chest x-ray for diagnosing the early manifestation of asbestosis is a case in point. A recent report by Murphy and his co-workers of a study of employees in a shipyard demonstrated that twenty percent of the control, or non-exposed population gave evidence of x-ray abnormalities which, if observed in the exposed population in the absence of controls, in all probability would have been interpreted as being evidence of the effect of the inhalation of asbestos fibers. In a population

which has been exposed to asbestos inhalation, it is very tempting to ascribe any departure from a perfect appearance in the chest roentgenogram to the occupational exposure, and indeed, in some studie this has been done. It is imperative to recognize that some persons who have never had an occupational exposure to asbestos will show the same x-ray shadows that have been interpreted by some as evidence of asbestosis in populations exposed to the inhalations of asbestos fiber. Studies such as those by Murphy et al exemplify the necessity of having suitable controls included in epidemiological studies bearing on the determination of a safe standard for asbestos.

There are still other difficulties having to do with establishing the dose-risk relationship. The health effects of asbestos inhalation are both dose and lapse-time related. Overt evidences of asbestosis do not appear until years after the initiation of the exposure. The interval between onset of exposure and its effect is even greater for the development of bronchogenic cancer or mesothelioma. This interval ranges between twenty and forty years. Because of the long time lapse between the initiation of exposure and the manifestation of injury, the incidence of disease occurring in populations now under study is the result of, and must be related to, exposures which took place twenty to forty years or more ago. To relate exposure measured only in the past five or so years to the current frequency of development of disease which actually was induced by exposure occurring years earlier, is a serious error. During the past twenty-five to thirty years there have been many technicological changes in the production, manufacture and use of asbestos containing material. In many situations there is much

less asbestos now being incorporated in the material than was true twenty or more years ago. In addition, there has been a progressive dust control effort to reduce the concentration of airborne asbestos in mines, mills and manufacturing establishments in a deliberate attempt to reduce and abolish asbestos related disease. So much has been accomplished in this direction by technicological change and systematic asbestos control efforts, that contemporary measurements of occupational environments cannot be accepted as representative of conditions twenty to forty years ago.

To summarize this part of my statement I strongly urge that when data offered in support of setting a safe level standard is being judged, one should ask the following questions:

1. What were the different kinds and proportions of asbestos used and what were the coexisting agents to which workers were exposed in the different occupations?
2. What were the specific criteria and methods used, and were they adequate for making a diagnosis of the biological reaction attributed to the inhalation of asbestos?
3. Were suitable controls in the sense of non-exposed populations and exposed populations whose exposures varied in intensity and duration utilized?
4. Was the exposure [redacted] actually responsible for the disease properly determined or were contemporary dust estimates inappropriately applied to disease which was in fact the result of exposure years ago?

The demands inherent in these questions pose formidable obstacles to arriving at a scientifically valid single number which will indicate the concentration of occupational airborne asbestos that can be tolerated with safety for the customary duration of employment. In spite of this, as I will show later, there are substantial data which will satisfy the requirements posed by these questions and which can be used for the purpose of determining at least a first approximation to the safe level of occupational exposure to airborne asbestos.

We must now examine the various established and proposed standards for a safe level of asbestos in the occupational environment, in the light of the just discussed requirements as to data needed for setting a standard on a sound scientific basis. Systematic efforts to reduce the amount of asbestos in the air of working places by governmental directive was made in the factories of Great Britain beginning in 1931. No numerical standard for this purpose was set, but Statuatory Rules and Orders were promulgated. Later, on the basis of limited data relating impinger dust counts to x-ray abnormalities in several asbestos textile factories of the USA, Sayers and Dreeson suggested a numerical standard of five mp/ft^3 as a tentative safe level. This was the limit adopted by the American Congress of Governmental Industrial Hygienists in 1946. Utilizing the conversion data for textile mills published by Lynch and Ayers of the U. S. Public Health Service, five mp/ft^3 is the equivalent of approximately thirty fibers/cc.

In 1968 the British Occupational Hygiene Society suggested numerical guides aimed at reducing the risk of developing asbestosis.

The suggested guides indicate that those concentrations, averaged over a three month period below 2 fiber/cc ought to be considered low, and that over the course of 50 years of employment, 100 fiber years is the level below which there would be less than a 1% chance of developing asbestosis as defined chiefly by the presence of rales. If asbestosis is defined by x-ray abnormality, the level becomes 135 fiber years. In 1968 the ACGIH changed its recommended standard to a TWA of 2 mp/ft^3, or twelve fibers/cc. In 1970 this Committee decided to change the standard to 5 fibers/cc, which is equivalent to less than 1.0 mp/ft^3. Several months ago OSHA set an emergency standard of 5 fibers/cc, and within the past few days NIOSH now proposes a standard of 2 fibers/cc.

What is the scientific basis for these various standards? The standard proposed by Sayers and Dreeson did attempt to relate dose of dust containing asbestos, as measured by the midget impinger to the risk of developing pulmonary abnormalities in terms of abnormal x-ray patterns. Their study showed a higher frequency of abnormal x-ray patterns in those most heavily exposed as contrasted to those less exposed. They found no excess of abnormal chest x-ray patterns in those workers exposed to less than 5 mp/ft^3. Hence their suggested standard of 5 mp/ft^3. We now know, however, that the population studied was not observed long enough for the full range of disease to develop. The authors appreciated this possibility and proposed the standard as being a tentative one. In retrospect we know that the standard, although it led to marked lessening of the dustiness in some occupations, was not adequately based and the passage of time has demonstrated it to be an inadequate standard.

The numbers proposed by the British Occupational Hygiene Society are based on a study of 290 male employees from a single asbestos textile mill. Their employment began after 1933, all had worked for at least ten years, and the exposure period extended from 1933 until 1966. The indicator of disease was basal rales and x-ray changes. No measurements of dustiness in this mill were available prior to 1950. Membrane fiber counts done in the modern manner were used only in the last year of the study and these served as the factor for converting previous counts using other methods to an expression in terms of fibers. To obtain an index of exposure for the period between 1933 and 1950 - a crucial period of exposure - the first measurements made in 1950 were raised by 50%. No evidence was given for using this very slight augmentation. Studies in other textile factories such as those by Sayers and Dreeson indicate that when ventilation controls were first applied in their textile mills the dust counts dropped 1,000% or more. One would assume that the same happened in this British textile mill. The seventeen years of exposure during that most crucial period between 1933 and 1950 would appear to have been substantially underestimated. This study, in spite of its less than adequate scientific base is important because it was the first attempt after 1938 to set numerical guidelines for the prevention of asbestosis. The number of persons in the study is very small; the criteria for disease, especially basal rales, not universally accepted; and the estimate of dustiness seriously lacking in rigor. The estimate of dustiness was on the low side for the reasons that I have already mentioned and, in addition, because no attempt was made to further

adjust for the longer working hours and hence of exposure during the war and earlier years. In spite of all of this, the study is a first approximation to a solution of a problem for which there were essentially no other available data in 1968 upon which to attempt a dose-risk estimate. It is my understanding that the enforcement agency of Great Britain looks upon these standards as guidelines and not as rigid requirements for all circumstances in which asbestos is used. Thus, they recognize the incomplete nature of the data used in developing the numbers.

The lowering of the 1938 standard from 5, to 2 mp/ft^3 and 12 fibers per cc, adopted by the ACGIH in 1968 appears to have been based in part upon the data underlying the British proposal and also upon the fact that there was a growing awareness that the old standard of 1938 was not universally effective. The further lowering to 5 fibers/cc was not based upon new scientific data, but appeared to have been made to establish a margin or "factor of safety". In a personal communication from Dr. Herbert Stockinger, Head of the Division of Laboratory and Criteria Development of the National Institute of Occupational Safety and Health and Chairman of the Committee on Threshold Limit Values of the American Conference of Government Industrial Hygienist, I am informed that four months ago, in November of 1971, the Committee of the ACGIH reviewed the standard of 5 fibers/cc and found no evidence to indicate that it should be changed. There are several relatively current studies which support this decision.

I would now like to discuss five of these supporting studies. Murphy et al, in December of 1971 published data on workers exposed

over a period of approximately thirty-five years as pipe coverers in new ship construction. The authors demonstrate that no evidence of asbestosis was found until at least 60 million particles per cubic foot years of exposure had been exceeded. This would indicate that for a forty year period of employment, 1.5 million particles per cubic foot would be the value below which no asbestosis occurred. The report indicated that the actual occurrence of asbestosis was restricted almost solely to those exposed to more than 75 million particles per cubic foot years, which would be close to a value of 2.0 million particles per cubic foot for those employed for forty years. Utilizing a conservative number to convert particles to fibers per cc, one arrives at a level of 5 fibers or more as being that below which no asbestosis was observed. If one utilizes their konimeter data, one can, by suitable calculations, estimate that the average exposure for these workmen was in the neighborhood of 8 fibers per cc, and this too would suggest that a number of 5 or more fibers per cc would have been the level below which no evidence of asbestosis developed. This study indicates, not only that the old standard of 5 mp/ft^3 is unsafe but also that a standard of 5 fibers/cc will prevent asbestosis in employees working for forty years or more.

An extensive and detailed study of a population comprising thousands of workers in the mining and milling of chrysotile in eastern Canada conducted over the past few years by Dr. Corbett McDonald and his associates is of great importance in our considerations because this study has dust counts going back many years and chest roentgenograms available from approximately 1935 to date.

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Dr. McDonald will report on these studies at these hearings. It is my understanding that these studies support the conclusion that those individuals exposed in these occupations for forty or more years would have to be exposed to higher than 6 fibers/cc in order to reveal any evidences of asbestosis.

Becklake and her co-workers, utilizing a segment of the population from McDonald's larger study, have demonstrated that in those individuals who have been employed for long periods of time in the mining and milling of chrysotile asbestos and who do not even show evidence of x-ray changes, the accumulated exposure must have been more than 110 mp/ft^3 years before the most sophisticated techniques can detect evidence of those physiologic changes thought to develop in response to inhalation of asbestos. These data suggest that something larger than 2.5 million particles per cubic foot over a forty year period can be tolerated without even the most subtle manifestations of asbestos exposure. This number would translate into something between five and 10 fibers per cubic centimeter.

In the fall of 1971 at the Fourth International Congress on Pneumoconiosis, held in Bucharest, Dr. McDonald updated his previously reported large study and reaffirmed that an excess of bronchogenic cancer did not occur in the workers in mining and milling of chrysotile asbestos until an exposure equivalent to 200 million particles per cubic foot years was exceeded. This is equivalent to 5 million particles per cubic foot for forty years. It indicates that in the mining and milling of chrysotile an excess of bronchogenic cancer would not be demonstrable in those individuals who were exposed to less than 5 million

particles per cubic foot. This is equivalent to 10 or more fibers per cc. This most important finding supports the view held by Stewart and others that an excess of bronchogenic cancer occurs only in those who have manifestations of asbestosis and that the standard adequate to protect against bronchogenic cancer is a larger number than that required to protect against asbestosis.

Recently, Enterline and his co-workers have reported the results of a study of retirees employed in various asbestos-using manufacturing processes including textiles and where the exposure was different from that in mining and milling because of the inclusion of exposure to crocidolite and amosite as well as other agents which might co-exist. This study shows, and I quote "there appeared to be no direct relationship between asbestos dust exposure and respiratory cancer below 125 million particles per cubic foot years. Important increments in respiratory cancer mortality apparently occurred somewhere between 100 and 200 million particles per cubic foot years' exposure". This would indicate that exposure to 3 million particles per cubic foot would be tolerated for a forty year period without a risk of excess bronchogenic cancer in these types of occupations. Using the conversion factor suggested by Lynch et al, this is equivalent to 18 fibers/cc.

This series of studies indicates that a lower standard is required to protect against pulmonary fibrosis or asbestosis than to protect against bronchogenic cancer. These five studies offer strong support for the position taken by the American Conference of Governmental Industrial Hygienists that there is no need to lower the standard below 5 fibers/cc in order to protect against pulmonary fibrosis or bronchogenic cancer.

In my judgement, we have no specific information of a suitable scientific nature expressing the dose-risk relationship for mesothelioma. Isolated case reports of mesothelioma are of no value in establishing a dose-risk relationship. Equally useless for this purpose are the data offered in studies of insulation workers, asbestos miners and millers, workers in asbestos using manufacturing, domestic exposures and neighborhood exposures. Not a single one of these studies offers data comparing variable exposures to the incidence of mesothelioma and they are therefore of no use for establishing a safe level of asbestos in the occupational environment. These studies do indicate that in some circumstances the risk is present but none speak to the question of the safe level on scientifically acceptable grounds. Nevertheless, these studies of larger numbers of cases of mesothelioma suggest that, in some circumstances the exposure to asbestos which may be related to the development of mesothelioma might be less than that required to produce asbestosis or an excess of bronchogenic cancer. One factor, which has been demonstrated with respect to the relationship between mesothelioma and inhalation of asbestos is of the utmost importance. In all of those circumstances where a strong relationship between mesothelioma and the inhalation of asbestos is suspected, two varieties of asbestos, namely crocidolite and amosite, invariably have been implicated either alone or combined. This is the case in the excess occurrence of mesothelioma among crocidolite miners, asbestos using insulation workers, workers in asbestos textile and insulation manufacturing and in a large multiproduct asbestos using manufacturing plant in the USA. In most of these circum-

stances there has been a mixed exposure and chrysotile has also been present. In striking contrast, however, when exposure has been solely to chrysotile, as in mining and milling of chrysotile, the frequency of occurrence of mesothelioma has either not been increased or increased only to the very slightest degree. The virtual absence of an excess of mesothelioma in populations exposed solely to chrysotile has been reported by Gilson, Vigliani, Wagner and McDonald on the basis of separate studies. With respect to anthophylite, no excess of mesothelioma has ever been reported. On the basis of information currently in hand, therefore, mesothelioma appears to be predominently linked with exposures to crocidolite or amosite but the dose relationships are unknown.

The studies referred to thus far are the only ones ~~that~~ I am aware of which in my judgement have a meaningful bearing on the setting of a standard for control of asbestos exposure. Other data does exist but in my judgement it does not conform to those criteria, universally agreed upon, for a sound scientific basis upon which to predicate a safe standard.

There is an abundant other body of data which indicates that the prolonged inhalation of asbestos fibers above some level is hazardous, that the biological effect is dose related but that many of the workers exposed for a lifetime never do develop asbestos related disease. This data indicates clearly that past exposures in some occupations, as for example the mining and milling of chrysotile were far less hazardous than exposures in asbestos textile manufacture or the insulation workers'trade and possibly in other occupations as well. The reasons for these differences are

not entirely resolved at this time. Until recently the insulation trade used much more amosite than chrysotile and in some work, especially in England, large amounts of crocidolite have been used. There are coexisting agents in the insulation trade which are not present in mining and milling of chrysotile. The peak exposures appear to be much higher in the insulation trades than in mining, milling or manufacturing. Peak exposures may be much more hazardous than lower levels of prolonged exposure. Fiber counts in the insulation trade in shipbuilding in Great Britain and in construction in Finland ranged from twenty to hundreds of fibers/cc depending upon the kind of work being done. Fiber counts in the construction industry in this country currently indicate somewhat lower TWA levels but intermittent high peaks of exposure. For example, during the mixing of asbestos cement, dust counts commonly as high as 75 fibers/cc during a 5 to 10 minute period are reached as often as 5 times or more a day. Unfortunately, there are no data in the insulation worker trade that compare degrees of exposure over a period of many years to the biological manifestations of excess disease. Until this is available, there is no way of utilizing data from these trades to establish a standard for the control of asbestos inhalation.

There is every indication that the levels of exposure should be lowered, especially the peak levels, but whether or not a lower TWA standard is needed in the insulation trade than in the other trades remains unsettled. There is substantial reason to believe that crocidolite and amosite should be controlled more stringently than is chrysotile. There is also reason to believe that the geometric conformation of the fibers in the mining and milling of

chrysotile may be different from those fibers generated subsequently in manufacture and use of asbestos. Moreover, the fibers of crocidolite and amosite even in mining have a different geometric configuration, as actually observed by Timbrell in airborne specimens, from that of some forms of chrysotile. For these reasons the pulmonary retention of chrysotile may be substantially less than for other varieties of asbestos or for the kinds of fibers generated in other occupations than mining and milling. Animal experiments have demonstrated this to be true.

On the basis of data now available and adequate for the purpose, I wish to indicate that in my judgement a standard of five fibers/cc TWA with peaks not to exceed 10 fibers/cc, such as recommended by OSHA in its present standard and by the ACGIH constitutes a level which will protect against the development of asbestosis and bronchogenic cancer and includes a safety factor since it is a level substantially below that which has been demonstrated to be associated unequivocally with an excess of these two abnormalities. There is evidence relating crocidolite and possibly amosite to excess mesothelioma which suggest that a more rigorous control of amosite or crocidolite would be justified. For this reason it may be rational to have different standards covering different occupations depending upon the variety of asbestos used.

Since I am in disagreement with the recommendation of the Criteria Document that two fibers/cc be established as the safe level of occupational airborne asbestos, it is incumbent upon me to indicate the important points of my disagreement.

In my opinion it is incumbent upon the authors of the Criteria Document to present evidence, which will meet the requirements for scientific validity, in support of their proposal to change the standard and to establish a new one. In the entire document I do not find reference to a single study containing data which will, on the one hand meet the criteria of scientific validity for setting standards and, on the other, support the need to change the standard from 5 fibers/cc or to set it at 2 fibers/cc. In fact, the Criteria Document explicitly says on page 10 of section 5 "The number of studies that have collected both environmental and medical data and with a significant number of exposed workers, is not sufficient to establish a meaningful standard based upon firm scientific data". In other words, the authors of the Criteria Document do not provide any scientific data upon which to base their proposal to change the standard from 5 to 2 fibers/cc or to support the choice of a standard of 2 fibers/cc. The failure to provide this support, in my judgement casts the most serious doubts upon the validity of the proposals.

I am in complete disagreement with the Criteria Document with respect to its expressed opinion that the data relating exposure to biological reaction is inadequate to establish a meaningful standard at this time. While the evidence may not be as far reaching as we would like, it is scientifically valid and adequate to support as a first approximation the opinion that the present standard, established by OSHA several months ago at 5 fibers/cc TWA and peaks not to exceed 10 fibers/cc should not be lowered but left as it is. I have cited the studies supporting this opinion.

Lacking dose-risk relationship data adequate to support the proposal of 2 fibers/cc, the Criteria Document appears to promote an aura of extreme toxicity of asbestos fibers in order to justify the new level. This is done chiefly by citing isolated case reports. In my judgement an inordinate amount of weight is given to isolated case reports which, though of interest and some importance, have no possible utility in setting a numerical standard. Their use in the Criteria Document is doubly difficult to accept in view of the fact that on page 24 of Section III there is the following statement "Isolated clinical case reports are difficult to interpret in terms of dose-time response relationship and can only be used to indicate other possible problem areas and to highlight what may prove to be practicable areas for further study".

An attempt to convey the implication of extreme toxicity of asbestos is again made on page 7 of Section 3 by reference to a study of 232 former employees in a plant that manufactured insulation. This study, by Selikoff, is quoted as revealing four employees who developed x-ray evidence of asbestosis after only one day of exposure to asbestos. Observation of a control group for comparison to those who had been exposed, is totally absent from the Tables for this study that are shown in the Criteria Document. Murphy's study of pipe-coverers, referred to earlier in this statement, demonstrates beyond doubt that in any adult population not exposed occupationally to asbestos there will be some individuals with x-ray shadows that could be interpreted as evidence of slight asbestosis. In the absence of suitable controls, Selikoff's study cannot, on scientific grounds, be interpreted to prove that one day of exposure to asbestos causes

asbestosis. To do so on the basis of the data shown is epidemiologically unsound and to cite this study as evidence of extreme toxicity of asbestos is completely unwarranted.

The manner in which reports and data of different investigators throughout the world are utilized and criticized does not appear to be uniform in this document. For example, the comprehensive review of the epidemiology of asbestos related cancers by Wagner et al, published in 1971 is not referred to. The report by McDonald et al of an extensive epidemiologic study relating dose to risk in 11,788 workers employed in the Quebec chrysotile asbestos mining industry is not discussed in the Criteria Document. This study, published in June, 1971 is the single most detailed and complete study in the world's literature of the dose-risk relationship of one kind of population exposed to airborne asbestos. The only reference made in the Criteria Document to this study, pages 18 and 20 of Section 3, is a criticism of a "progress report" given by McDonald at the Bucharest meeting in September of 1971. One would think that a study of this magnitude would require discussion in a document intended to be a fully developed presentation of the evidence supporting recommendations of such great importance.

It is difficult to understand why McDonald's report is criticized, as stated at the top of page 20 of Section 3, because of the conversion of numbers of particles to numbers of fibers. Particles are converted to fibers by the British Occupational Hygiene Society in developing their standard and at no place in the Criteria Document, pertaining to the British recommendation, does one see a questioning of that procedure. If it is acceptable in the one circumstance it should be acceptable in the other.

It is even more difficult to understand the criticism expressed in the last sentence of the 1st paragraph on page 20 of Section 3 to the effect that the McDonald study lacks the evidence necessary to make general comparisons with the data of other reported work. The published paper by McDonalds' group contains the complete biological data and the required exposure data expressed in mp/ft^3. This is substantially more data than that furnished by others since it relates exposure to biological effect in the same population whereas other studies such as those of insulation workers do not in any way provide this co-related data. The index of dustiness used in the McDonald report is the same as in those of Murphy et al, Decoufle-Enterline and Williams, all of which are quoted in this document. The criticism that McDonald did not indicate the details of the method used for converting particles/ft^3 to fibers/cc could easily have been answered by a letter or a telephone call, if the authors of the Criteria Document had been desirous of making the comparisons.

Much weight is given to an unpublished paper by Williams, et al from the Pennsylvania Department of Health. One wonders why, in such an important document as the NIOSH Criteria Package, the crude data of the Williams' study was not shown in the tables of the Criteria Document. The way in which the sixty-four cases of asbestos referred to were related to what was undoubtedly a variable exposure is not shown. It is very probable that all of these 64 cases occurre in those who were most highly exposed, very possibly in the neighborhood of five million or more particles per cubic foot. The failure to handle such data in the conventional dose-risk relationship is a serious error.

Inordinate and unwarranted attention is given to contemporary dust counts. The impression is given that these present day counts represent the conditions that existed over the past 40 years. While this may not be intended, more care should have been taken to indicate that the counts were substantially higher in the past, especially in manufacturing places where effort toward controlling exposures by exhaust ventilation, etc. has been expended in the past 30 years. In addition, the reduction of the amount of asbestos contained in manufactured materials has further reduced the exposures, particularly in asbestos insulation workers.

Most of the counts in the tables of this document are expressed as averages, as for example, Tables 13 and 14 pertaining to exposures of insulation workers. This is an inadequate way to display data, since it can give misleading information by masking high exposures if there are a large number of low exposures to dilute the high ones. Biological effects are much more likely to occur in those persons heavily exposed than in those with low exposure, thus, averages of all exposures have little meaning or use in determining the dose-risk relationship.

It is not possible to evaluate fully the exposures from the data shown in some of the Tables of this document. For this we need to know not only the TWA's but also the peaks, the number of observations and the conditions of the environment during the time of sampling. This criticism is especially pertinent to the exposures of insulation workers shown in Table 14. The insulation worker experiences great variability with respect to job conditions, to a large degree dictated by the volume of the space in which he works and by natural ventilation as well as the kind of work he is doing

at the time. Dust counts under all sorts of conditions, and peak as well as TWA exposures must be measured before the insulation worker's exposure can be portrayed. With respect to Table 14, it is surprising that the job of "cement mixing", notoriously characterized by peaks of exposure as high as 75 fibers/cc for periods of 5 to 10 minutes several times a day, is omitted.

The summary, on page 16 of Section 5, describing the basis for the new standard recommended by the Criteria Document is confusing and inconsistent. I quote from the second paragraph, "evidence indicates that past and current standards for fiber concentrations in the working places where asbestos fibers occur, though undoubtedly contributing to reduction of the severity and frequency of asbestosis, have not provided complete protection from exposure to asbestos, necessitating development of a new standard". There is evidence that asbestosis developed under some circumstances, in places thought to have an average exposure of five million particles per cubic foot, or in modern parlance, thirty fibers/cc. This was the standard set in 1938. The ACGIH created a new lower standard in 1968 and another still lower, introducing a safety factor in 1970. The British Occupational Hygiene Society suggested numbers that might serve as a standard in 1968. The current standard in the USA set by OSHA is five fibers/cc, and was set only a few months ago. If there is to be a new standard it will be one set since a few months ago, or at most, set since three years ago. The statement in the Criteria Document, to which I have just referred, indicates that the authors have evidence that the standard recommended by ACGIH in 1968 has been inadequate and has not provided complete protection and hence a new standard is needed. The authors of the Criteria Document

should be required to give that evidence and it is obvious that they have not. Could it be that they are referring to the fact that the standard set in 1938 is inadequate and that a better standard is needed? If so, a lower standard was provided in 1968 and still lower in 1970, and it is this standard which was promulgated as an "emergency standard" by OSHA. It is this OSHA standard for which I believe there is substantial factual evidence of a supportive nature.

An even more serious inconsistency is demonstrated on page 16 of Section 5. Close examination of Items a, b, c, and d reveals in unequivocal terms, that in the judgement of the authors of the Criteria Document there are no scientifically usable data on which to base a standard. Nevertheless, without such data they decide that the current standard must be changed and moreover recommend precisely what the new one should be. There is a strong inference from the second paragraph of page 17, Section 5 that one and perhaps the chief reason for setting the recommended standard at two fibers/cc is that the British have recommended such a standard. I disagree with the concept, if actually intended, that this represents a scientifically valid reason for recommending such a standard. Moreover, it is my understanding that the British did not set a standard in the same sense that it is intended to be used under the new Occupational Safety and Health Act. The British standard is a series of numbers proposed to furnish a guideline with a wide range of personal judgement on the part of their inspectors as to the need for corrective measures when these numbers are exceeded. Under our act it is my interpretation that a standard is to be set which, if not complied with, places the operator under certain penalties. To my mind the two conditions are utterly different.

SUMMARY

In this statement I have described the kind of data required for characterizing the dose-risk relationship in such a manner, that it can be used for setting an occupational standard for airborne asbestos on a scientific rather than an arbitrary basis. Because of the difficulties described, much of the data now extant, concerning asbestos associated disease, is of no use for setting a standard. Isolated case reports and data giving exposures or biological effects without relating the two in the same population are examples of this kind of unusable information. Unfortunately, much of the data now available is competent only to say that asbestos is more or is less hazardous in different groups and that the exposure is varied. Nevertheless, although not numerous, there are specific data competent to speak to dose-risk relationship and these can be used for our purpose. I have cited these.

I have indicated the reasons for my opinion that the Criteria Document has failed to do that which is incumbent upon it, namely, to provide sound scientific evidence to support their request for a change from the OSHA emergency standard and for a new standard of 2 fibers/cc TWA and peaks not to exceed 10 fibers/cc.

I disagree with the view of the Criteria Document that there are no scientifically obtained data adequate for the purpose of setting a standard. I have cited the studies which I believe are scientifically valid and adequate for setting a first approximation to a standard or safe level of airborne asbestos in occupational environments. In my opinion, these studies fully support the

current OSHA temporary standard of 5 fibers/cc TWA with peaks not to exceed 10 fibers/cc and the recent decision of the ACGIH that there is no need to change from this standard. It should be emphasized that prior to 1940 and for some years thereafter, when many of those persons now developing disease were actually being exposed, the dust counts in mining, milling and manufacturing commonly were in the range of 10 to 100 mp/ft^3. This was most likely equivalent to 30 to 600 fibers/cc. There is no evidence that exposures during that period for insulation workers was substantially lower and, on the basis of British and Finnish data, it was in that range. It is clear then, that the current OSHA temporary standard represents a tremendous reduction from the dust levels of previous years and, in my opinion, includes a substantial safety factor. I believe this level will protect workers, using asbestos over a forty year or more span of employment, from developing asbestosis or experiencing an excess of bronchogenic cancer. If crocidolite and perhaps amosite are more stringently controlled, the liability of experiencing mesothelioma will be markedly reduced and probably abolished.

STATEMENT OF HENRY B. MORENO
SENIOR OPERATING VICE PRESIDENT
OF JOHNS-MANVILLE CORPORATION
BEFORE THE U. S. DEPARTMENT OF LABOR
HEARING ON PROPOSED OCCUPATIONAL
ASBESTOS STANDARDS
WASHINGTON, D. C.
MARCH 16, 1972

My name is Henry B. Moreno, and I am the Senior Operating Vice President of Johns-Manville responsible for the Company's Industrial and International Divisions.

I am a graduate of the University of Southern California, with a Bachelor's Degree in Electrical Engineering and postgraduate work both at that institution and at the Harvard Business School. For the past twenty-two years, I have held various sales, marketing, production, general management and senior management positions with Johns-Manville.

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As our testimony thus far has indicated, we support the present emergency standards if they are modified as suggested by my Johns-Manville associates here today.

I would like to address my remarks primarily to the engineering problems involved and the economic impact of implementing the standards. I will do this by relating personal experiences and by presenting other information that we have developed for this hearing.

Five years ago, I was given responsibility for our Packings and Friction Materials Division. This is the division in our Company which has many of the asbestos handling problems, especially in its asbestos textiles and friction material operations.

During those five years and right up to the present time, I have devoted a great portion of my time personally to improving in-plant environmental conditions for our employees, particularly those working with asbestos fiber. For the last four years, our goal has been to bring all of our operations to a Threshold Limit Value of five to six fibers per cc, which is half of the previous TLV standard of twelve fibers per cc.

Since we at Johns-Manville began our active dust control program many years ago, to the best of my knowledge we have, in all modesty, moved far ahead of most other asbestos users in solving environmental problems. Perhaps a specific example will help give some insight to our activities.

One of our largest plants is located in Manville, New Jersey. It is a multi-product plant containing, among other things, a fairly extensive, integrated textile operation.

I first visited the Manville Plant in 1949. Even though we were unaware of specific health hazards, I can remember the high visability of dust which clouded the ambient air inside the textile building. The personal sampler method of measuring dust was not available then, but certainly—if we could have measured them by that method—we would have determined that the counts around some equipment were over one hundred fibers per cc.

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The next time I saw the operation was several years later during the 1960's. By that time, great improvements had taken place as a result of the studies and developments Mr. Jobe discussed in his testimony. Extensive dust collecting systems were operating, and the plant was using much cleaner asbestos fiber now available because of improved equipment at the mines in Canada.

When I assumed responsibility for the Packings and Friction Materials Division late 1967, the Manville textile operation was included. Maximum dust counts were about thirty fibers per cc. When we embarked upon our program to reduce all counts to five to six fibers per cc, it soon became apparent that we had reached the practical limit of improving the system

by collecting dust and other similar mechanical means. A complete redesign of process and equipment was mandatory. We assembled a team of the best experts available within our Company and talked to manufacturers in both the United States and Europe to determine if improved asbestos textile machinery was available that would perform within the dust levels we had specified. After several months, it was determined that if improved equipment were to be made available, we would have to design it ourselves. This we proceeded to do, and after a three year concentrated program, we have completed the installation of specially designed equipment and processes which in many cases are substantially different from what we had before and the methods currently being used by other asbestos textile producers.

Even though our operating costs have risen over fifty percent due to our stringent operating procedures, we are quite pleased with the results. One can now look down the full length of the approximately 900 foot building through nearly crystal clear air. This is a dramatic improvement from the appearance three years ago and fantastic considering the operation as I first viewed it in the late forties. Our dust counts are now all below five fibers per cc. Note I said five, not two, fibers per cc. If we are required to operate at the two fibers per cc level, I can see no other solution for us but to shut down some equipment. Having brought the counts from one hundred to below five fibers per cc has been a major accomplishment, particularly when

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one considers that medical results that concern us all were incurred under the former more dusty operating conditions and not under our current modern methods.

I have selected the textile operation for my comments today because that is one which required a great portion of my personal effort and is typical of our Corporate program. We are working on all of our other product lines as well. Asbestos is used in a wide variety of applications, each requiring specific process and equipment design. We could cite instances involving friction materials which pose as complex a problem as the textile operation did. In operations where equipment redesign is not sufficient to reduce

dust counts to an acceptable level, complete and sometimes radical changes must be employed. These changes most often alter the finished product substantially. When the properties of a high performance friction material are changed for instance, extensive testing in laboratories and in the field must be conducted in order to be certain that the product will perform as required under all conditions, as a failure might cost hundreds of lives. Can you imagine, for instance, a one hundred car freight train operating with unproven brake linings? Or a water pipe that has exploded because of inadequate fiber reinforcement? In some cases, material tests and validations require as much as four to five years. It is obvious then that protecting our environment is a constant and evolutionary process, not one

which could be sanely implemented by abrupt and severe legislation.

What is the current status of our dust control program? In spite of our know-how and our concerted effort and a capital expenditure outlay of some twenty million dollars, I must say to you that twenty percent of our sampled dust stations company-wide are still operating over five fibers per cc. More importantly, because we have been unable to reach our desired goal for dust control in a number of our operations, we have discontinued the production of over five million dollars worth of asbestos-containing products annually and have thus had to put over three hundred workers into the unemployed ranks.

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As I said before, all of our work has been directed toward attaining a TLV of five to six fibers per cc because our experience and medical advice indicates that this is the most practical approach to providing a safe environmental atmosphere for our workers.

To do this requires extensive engineering. For this reason — to reach a TLV of five fibers per cc actually means designing equipment which will operate at about a three fiber per cc level because we must allow for measurement inaccuracies, human error, maintenance, and climatic variations.

The cost of redesigning and building equipment to operate at lower dust levels increases exponentially— not in a linear fashion. If the TLV were to be set

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at two fibers per cc, it would require capital expenditures of twelve million dollars and additional operating costs of five million dollars per year to bring our operations to the two fiber per cc level, assuming we could develop the capability to do so.

At the present time, approximately half of our present dust stations show consistent readings over two fibers per cc. Included in this group are five manufacturing plants, involving approximately eleven hundred workers. As we see it now, it would not be economically feasible for Johns-Manville to attempt to operate these plants at a standard of two fibers per cc. We estimate that eleven hundred workers would be out of jobs at those locations. And when you add supporting sales, clerical,

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research and administrative personnel, we're talking about a total of some sixteen hundred employees who would have to join the unemployed.

Since Johns-Manville is quite typical of thousands of other asbestos product manufacturers and users in the United States—except that many of them have not yet begun to implement dust control programs—it is obvious that the overall effect of lowering the present Threshold Limit to two fibers per cc would have a very substantial effect on our nation's economy.

I would ask this question: "Where will our customers obtain these materials that we no longer produce?"

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In the case of the products we have phased out so far, there have been two sources; one, other manufacturers in the United States—whom I've indicated have about the same dust counts now that Johns-Manville did before our dust control program began—and two, foreign producers. Presently, there are substantial and increasing quantities of fabricated asbestos materials being imported into the U. S. from Japan, Taiwan and South America. Some of our own surplus equipment has been sold to a company in India, so we presume that India and possibly other Asian countries will increase their production and sale of asbestos materials to our country as it becomes more uneconomical to make these products inside the United States.

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Attempting to achieve a standard of two fibers per cc will cost American industry millions of dollars in increased operation costs and, unfortunately, cause a significant number of jobs to be shifted to foreign workers for whom, in many areas, no environmental standards whatsoever will apply.

The present emergency standards—with modifications—provide a good margin of safety and, based on our experience, are attainable in most manufacturing operations if the producers are given a reasonable time to design and install the necessary equipment and implement process changes.

The establishment of a more stringent standard and the requirement of unnecessarily frightening labels,

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as commented on by Dr. Pundsack, would merely cause mass confusion and perhaps irreparable harm to many very reputable companies. In addition, it would have catastrophic effects on the very people OSHA and American industry are attempting to protect. And, unfortunately, would not solve the total human environmental problems because we would simply be shifting the problem to other workers in the world, solely because of unrealistic and unnecessary regulations.

In conclusion, I want to say this quite directly— with no scientifically credible evidence to prove the need for such a low TLV standard of two fibers per cc, it would be nothing less than complete social irresponsibility to adopt it.

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We believe the Department of Labor must establish standards that are practical and realistic.

On behalf of myself and my associates, thank you for permitting us to testify today.

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