4.1.5.3

ASBESTOS TOXICOLOGY

STATUS SUMMARY

October 1972

A14056

ASBESTOS TOXICOLOGY

October, 1972

Introduction

Many people have become justifiably uneasy about the toxicological aspects of asbestos and recent federal regulations regarding its use. Unfortunately, the publicity given to this governmental activity has tended to be of a sensational nature and has done little to place the question of asbestos toxicology in logical perspective. We take this opportunity, therefore, to state our firm belief that Union Carbide Corporation can comply with the regulations. Installation of additional dust control equipment at our plant to achieve compliance is substantially complete. Moreover, we believe that our customers can, without undue burden, comply with these regulations as they apply to their operations.

With regard to the toxicity of asbestos, it is important to note that asbestosis and statistical excess occurrences of bronchogenic carcinoma have occurred only in connection with massive long term exposures to asbestos dust. The risk of this type of exposure is usually in asbestos mines and mills and in manufacturing operations such as floor tile plants where asbestos usage may vary from 15,000 to 30,000 tons per year. The risk of long term massive exposure is generally not typical of operations utilizing the specialty type "Calidria" Asbestos products.

The purpose of this short report, therefore, is to provide the "Calidria" Asbestos user and potential user with a reasonable picture of the toxicology situation and a copy of the final OSHA regulations on asbestos usage. Some limited information on handling procedures and control of dust generated by cutting and grinding that may be of particular interest for the small user is also included.

It would be impractical and redundant for us to attempt to interpret, in a short report, the great mass of published matter, scientific and otherwise, that has appeared on both sides of the asbestos question. Instead, a small number of relevant articles have been selected and arranged by subject. It includes:

Toxicology Information

1. Asbestos and Your Health

   Some direct answers to toxicology questions. Published by the Quebec Asbestos Information Service.

2. Airborne Asbestos

   The Summary and Conclusions section of a comprehensive study on asbestos toxicology by the National Academy of Sciences. The key conclusion is that the general public is in no immediate danger from asbestos which is in sharp contract with much of what appears in the popular press. The complete report is available on request.

A 14056

3. Response to Article in Wall Street Journal

   When the OSHA regulations were published, the Wall Street Journal chose to attack them in an article that presented a very distorted picture of the facts, typical of much of the newspaper coverage of the question. This is the response to the article.

4. Several reprints from recent newspaper articles. Coverage is more objective.

5. The testimony of Dr. Wright before OSHA at the hearings on the proposed regulations.

   This is included for those seriously interested in the background of the toxicology questions.

OSHA Regulations

1. Report Series on OSHA - June 26, 1972

   Industry comment on the regulations and a brief summary of the main features.

2. Safety and Health Reporter - July 17, 1972

   Plans and progress on regulations similar to asbestos on other substances.

3. OSHA Regulations on Asbestos

4. "Calidria" Asbestos Material Safety Data Sheet

Dust Control

1. Transfer Devices

   Two apparatus arrangements developed by Dow Chemical to transfer their light Saran Microballoons. Similar devices have been successful for several small "Calidria" Asbestos users.

2. Vacuum Grinding Equipment

   In some applications plastics containing asbestos are abraided. Small amounts of fiber may be released. Here is one convient way to control the dust.

ASBESTOS AND YOU

The questions people are asking — and the answers

What is asbestos?

Asbestos is a mineral fibre, a hydrated magnesium silicate. There are several different varieties of asbestos. Of these, commercially the most valuable one is chrysotile. The world's three leading producers of chrysotile asbestos are Canada, the USSR and Southern Africa. Of the 4.5 million tons mined in the world each year, the USSR is the principal producer and user, Canada is the largest exporter and the USA is the chief importer. Canada accounts for 35 per cent — 1.6 million tons — of annual world asbestos production, injecting almost a quarter-billion dollars annually into Canada's economy.

Who uses chrysotile asbestos?

Virtually everyone does. You cannot operate a road or rail vehicle, a ship or an aircraft without it. It goes into brake linings, roofing products, sewage systems, floor tiling, electrical insulation, fireproof partitioning, the exteriors of buildings, fire-fighting clothing, lubricants and caulking materials, highway asphalt, rockets and space vehicles, acoustical tiling, as well as steam, gas-turbine and rocket engines. Skyscrapers sit on lead-and-asbestos pillows. Fresh, pure water flows through asbestos-cement pressure pipes. Chrysotile asbestos goes into prefabricated buildings, ships at sea, subway trains, aircraft and submarines. It has literally scores of essential applications in the office, the plant, the suburban home, the downtown apartment. The paper on which this leaflet is printed could not have been produced without asbestos. On every day, in every way, chrysotile asbestos is essential.

What makes asbestos so indispensable?

Asbestos fibres are unique. When they are combined with other materials — and asbestos is rarely, if ever, used by itself — they provide protection from fire, absorption of heat from friction, insulation from heat, cold and noise, reinforcement for plastic and other materials, particularly cement. Or any combination of these. And they do all this at remarkably low cost.

Does asbestos present a hazard to the general public?

No — there is at present no evidence of hazard to the general public from the minute amounts of asbestos that may be present in community air. In an October 1971 publication, **Asbestos — the Need for and Feasibility of Air Pollution Controls,** the U.S. National Academy of Sciences states: "At present, there is no evidence that the small numbers of fibers found in most members of the general population affect health or longevity."

Does asbestos threaten occupational health hazard?

Yes — for many years, it has been recognized that a group of respiratory diseases are related to asbestos. However it is also known that, when these develop, they generally do so only after excessive amounts of asbestos dust are inhaled over a long period. A recent study conducted by McGill University into the health of 10,421 past and present chrysotile asbestos mine workers in Quebec shows that their death-rate from such diseases was in fact lower than that expected for of the rest of the general Quebec populace for the same causes. According to the June 1971 issue of **Archives of Environmental Health,** the death-rate was higher only in the case of workers who, in the course of employment 30-40 years ago, were subjected to heavy chrysotile asbestos dust concentrations.

Is asbestos a major air pollutant?

No — Conducted by an asbestos research group at New York's Mount Sinai Hospital, dust counts in New York City and other urban areas of the U.S. show that asbestos levels in the community air are many times lower than levels considered to be safe for workers who actually handle asbestos. What's more, recent evidence indicates that small amounts of asbestos fibre from natural sources, such as weathering of surface outcrops, have existed in the atmosphere for perhaps millions of years. Humans thus probably evolved into their present form in an atmosphere containing some asbestos.

Is asbestos in brake linings a health hazard?

Hardly any — a study by the U.S. Public Health Service shows that only a tiny fraction of the asbestos in brake linings is released to the air in its original form when brakes are applied. The action of heat converts the rest into forsterite, a non-fibrous, inert and harmless material.

Because the use of asbestos causes disease in the workplace, should it be banned from the community?

No — asbestos concentrations both in the workplace and in community air can be satisfactorily controlled. There is therefore, from a public health standpoint, no reason to ban the use of any asbestos-containing product. In fact, society would surely suffer if deprived of the wide range of asbestos products designed to protect health, life and property.

Do asbestos products cause disease in the general public?

No — there is no evidence, scientific or otherwise, that anyone in the general public has ever contracted any disease from exposure to the minute amounts of asbestos released into community air through the application, use, wearing or weathering of finished asbestos products.

Because of the long latency period of asbestos-related disease, should it be banned from the workplace?

Because of the long latent period of asbestos-related diseases, some cases still occur among long-service employees whose exposures began at a time when little was known of the amount of asbestos a human could tolerate, and when dust control equipment was not as efficient or as widespread as today. With expanding medical knowledge and today's improved dust control measures, however, there is every reason to believe that these cases will decrease in the future and asbestos-related disease will cease to be a occupational problem.

Is asbestos-related disease a problem in Canada?

No — long-term medical studies of workers who are exposed to asbestos in their jobs show that low to moderate levels of exposure do not lead to an increased rate of disease. In these studies, a higher-than-normal incidence of disease was found only among employees exposed to extremely high asbestos concentrations for long periods of time.

Can asbestos fibre be handled and used on the job with perfect safety?

Yes — chrysotile asbestos fibre can be handled and used on the job with perfect safety so long as certain basic precautions are followed. These include the careful handling of containers to prevent spillage, the use of dust control exhaust hoods at all stages of in-plant handling where dust is unavoidably created, the wearing of protective respiratory equipment where necessary, as well as good housekeeping with regard to dust clean-up and disposal procedures.

Is chrysotile asbestos a health hazard outside the workplace?

No — more is known about the potential health hazards of chrysotile asbestos and the proper means for controlling them than is the case with materials that might be used to replace it. It would be unwise to substitute unproven materials, whose health effects are unknown, for chrysotile asbestos which has proved its usefulness to mankind for the past 100 years. For many essential, life-saving uses, chrysotile asbestos is the only material that can do the job.

What is being done about asbestos?

A lot — the Canadian asbestos-mining industry sponsored in the 1930s some of the first studies of asbestos-related disease ever undertaken in North America. These studies provided information that became the basis for environmental control programs in the industry which have been refined and expanded over the years. Millions of dollars have been devoted to sophisticated equipment and techniques aimed at preventing asbestos dust from being inhaled by workers in the mining and milling of chrysotile asbestos and in the manufacture of asbestos-containing products.

Through the Institute of Occupational and Environmental Health in Montreal, the Industrial Hygiene Foundation in Pittsburgh and in various hospitals and universities around the world, the industry has sponsored and continues to support major epidemiological and other research projects designed to identify and eliminate asbestos-related health risks not only for Canada's chrysotile asbestos production workers but also for worldwide fabricators and applicators of finished asbestos-containing products.

What is the bottom line?

Recent public discussion of the health implications of exposure to asbestos dust has led to the unwarranted and erroneous assumption that data on health risks associated with heavy, long-term, on-the-job exposure to asbestos can also be applied to the general public.

The known medical facts, supported by nearly half a century of international studies

and research, are that:

1. **Asbestos-related health risks are basically confined to the job setting. Every step is being taken to eliminate these job-related risks.**

2. **Asbestos-related diseases develop, generally, only after the inhalation of substantial amounts of asbestos dust for a prolonged period of time.**

3. **There is at present no evidence that exposure to the minute amounts of asbestos that may be present in community air present any hazard whatsoever to the general public.**

For further information, please contact:

Quebec Asbestos Information Service,
P.O. Box 1643, Station B, Montreal 110, Que.

Published as a public information aid by the Quebec Asbestos Mining Association on behalf of its member-companies.

Litho in Canada

A14000

A I R B O R N E A S B E S T O S

A Report Prepared by the
Committee on Biologic Effects of Atmospheric
Pollutants
of the
Division of Medical Sciences, National Research
Council

National Academy of Sciences
National Academy of Engineering Washington, D.C. 1971

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

PATHOGENICITY OF ASBESTOS MINERALS

Any of the commercially used asbestos minerals, when inhaled in sufficient numbers, as in uncontrolled occupational exposures, can cause disabling fibrosis of the lungs. An association between occupational exposures to asbestos and bronchogenic carcinoma has been established, but the dose relationship and the role of cofactors have not been defined. Evidence of a causal association between some but not all exposures to asbestos fibers and diffuse malignant mesotheliomas of the pleura and peritoneum is substantial, but evidence of such a relationship with other tumors is inconclusive. Although the different types of asbestos differ in some of their biologic effects, no type can be regarded as free of hazard. The hypothesis that asbestos fibers act as cofactors or carriers of carcinogens is attractive, but as yet unproved.

EVIDENCE OF HUMAN NONOCCUPATIONAL EXPOSURES TO ASBESTOS

The demonstration of ferruginous bodies, similar to those found in asbestos workers, in a large proportion of randomly selected lung specimens in many parts of the world is presumptive evidence that persons with no occupational contact may have inhaled and retained asbestos. Proof has come in some areas with positive identification of chrysotile asbestos fibers. Analyses of community air for asbestos have been too limited to define the sources, concentrations, and distribution of fibers in the environment. The fiber concentrations that have been demonstrated in ambient air are small, compared with those in industry, but data are inadequate for definitive comparisons.

ESTIMATION OF RISK IN HUMAN NONOCCUPATIONAL EXPOSURES TO ASBESTOS

The most important question in the case of persons with nonoccupational exposures to asbestos is whether there is an increased risk of malignancies. Industrial experience indicates that there is no likelihood of significant asbestosis in nonoccupational exposures. The major potential for risk appears to lie in those with indirect occupational contacts, household contacts, or residence in the immediate neighborhood of asbestos sources; and even there, the actual risk is poorly defined. But the fact that there appears to be a gradient of effect in such groups suggests that there are levels of inhaled asbestos without detectable risk. It is not known what range of respirable airborne asbestos fibers will ultimately be found to have no measurable effects on health. At present, there is no evidence that the small numbers of fibers found in most members of the general population affect health or longevity.

NEED FOR AND FEASIBILITY OF CONTROLS

Asbestos is too important in our technology and economy for its essential use to be stopped. But, because of the known serious effects of uncontrolled inhalation of asbestos minerals in industry and uncertainty as to the shape and character of the dose-response curve in man, it would be highly imprudent to permit unrestricted additional contamination of the public environment with asbestos. Continued use at minimal risk to the public requires that the major sources of man-made asbestos emission into the atmosphere be defined and controlled. In the absence of such controls, local fiber concentrations might at times approach those in occupational sites. Analytic methods and epidemiologic data are inadequate for the development of ambient air standards, but emission controls are needed and appear feasible.

Asbestos Information Association/North America

22 East 40th Street
New York, N. Y. 10016
(212) 661-8205

June 15, 1972

The Editor
THE WALL STREET JOURNAL
22 Cortlandt Street
New York, New York 10007

Dear Sir:

It is incumbent upon any newspaper in this country, especially when reporting on an issue relating to occupational or environmental health, to present evidence that is factual, well-researched, and free from distortion, error and any possible taint of sensationalism. This is especially true when the newspaper in question enjoys the high reputation for fairness and accuracy of THE WALL STREET JOURNAL. Unfortunately, these basic precepts of sound journalism were not followed in a recent story in the JOURNAL.

By this we specifically refer to the article on asbestos by Barry Newman that appeared in your June 7 issue, beginning on the front page. The article contains many major errors of fact and interpretation, such that it presents a completely distorted and alarmist picture of the asbestos-health problem in the United States.

The simplest way to demonstrate the truth of this statement is to examine some of the major errors contained in the Newman article.

Mr. Newman began the article with a description of the supposed hazards faced by mechanics who blow asbestos-containing brake lining dust out of brake assemblies with an air hose before replacing the worn linings. Had your reporter investigated this matter with any degree of thoroughness, he would have discovered a number of well established facts, namely that (1) the U.S. Public Health Service conducted a study which showed that less than 1 per cent of the approximately 50 per cent of asbestos in brake linings remains as free fiber in the dust after wear, the rest being converted by the high heat of friction

A 14064

to a non-fibrous non-toxic material called fosterite, and (2) a study by Hickish and Knight, published in the British "Annals of Occupational Hygiene" in January, 1970, established that men engaged in the blow-out procedure described by your reporter had a Time Weighted Average exposure of .68 asbestos fibers per cubic centimeter of air, a level far lower than either the current United States standard of five fibers per cc or the two fiber standard scheduled to go into effect in 1976.

While these studies in combination demonstrate quite conclusively the lack of a hazard for men employed in brake lining maintenance and replacement, of perhaps even more importance in evaluating your reporter's alarmist approach to the subject is the fact that to the best of my knowledge, there have been no published or unpublished studies indicating the existence or even the suspicion of a hazard for these men. The conclusion is inescapable that your reporter selected this example to lead off his story because of its colorful and alarmist nature rather than because of any factual evidence that an actual hazard existed.

In the fourth paragraph of the story, Dr. Irving Selikoff of Mount Sinai Hospital is quoted as predicting 95,000 deaths from asbestos related cancer among the approximately 250,000 men currently employed in the asbestos industry in this country. While Dr. Selikoff is obviously entitled to make whatever predictions he choses, it is only reasonable to expect that a reporter seeking to write a balanced story would submit such a terrifiying prediction to other experts in the field for their comment. Had he done so, your reporter would unquestionably have been told that Dr. Selikoff's prediction is quite exaggerated and without solid foundation. The reason why this is so is quite simple. The two studies upon which Dr. Selikoff's prediction is based were of men employed in the industry for a minimum of 20 years and at a time (the 1930s and 40s) when dust levels were many times higher than they are today. Thus to apply the death rates resulting from long term exposure to dust levels existing 25 and 30 years ago to today's working population is plainly illogical. Had your reporter sought additional comment on Dr. Selikoff's prediction, he would have discovered this fact.

-More-

In the next paragraph, it states that "ordinary people who have come into contact with asbestos in the atmosphere" could be subject to asbestos-related disease. This same idea of a general public hazard is contained in the headline of the story: "Tiny Asbestos Fibers Pose a Health Threat To Workers and Public." While there is some evidence that in years past there may have been some potential hazard to people living in close proximity to uncontrolled asbestos mines and mills, as technology was developed for the control of asbestos dusts in industry from escaping into the community air, these potential hazards have been eliminated. As far as the general public is concerned, there never has been nor is there today a public health hazard as a result of exposure to the very minute amounts of asbestos that have been shown to exist in the ambient air.

This was the basic conclusion reached by a panel of asbestos-health experts convened by the National Academy of Sciences to draft a report to serve as the medical basis for the Federal Environmental Protection Agency national emission standards on asbestos. The report, entitled "Asbestos: The Need for and Feasibility of Air Pollution Controls," states on page 19 that "there are levels of asbestos exposure that will not be associated with any detectable risk. What those levels are is not known, but there is no evidence that persons in the general population -- without occupational, household, or neighborhood exposures -- have any increased risk of neoplasm, even though there may be ferruginous bodies or fibers in their lungs," and in the Conclusion section on page 31 it states: "There is no evidence that the small numbers of fibers found in most members of the general population affect health or longevity."

This booklet has received wide distribution. Had your reporter researched his subject with any degree of thoroughness, he would certainly have been given copies of the report. If he was given a copy, he obviously completely disregarded it.

A little later on in the article your reporter states that "bits of asbestos used in filters for beverage making have been found in wine and beer, for instance, and could be dangerous if swallowed." This same question was raised in Great Britain a few years ago by writers also seeking the sensational rather than the scientific. The furor died

-More-

when it was shown that the total amount of asbestos fiber found in British beer added up to only two-one-thousandths of an ounce in the total United Kingdom beer production of over a thousand million gallons a year. This translates into about five parts per million-million by weight. The additional fact that there is not one shred of evidence that ingesting such infinitesimal amounts of asbestos is in any way hazardous helped allay the fears of the British beer drinking public.

The comment attributed to William Nicholson of Mount Sinai that shaking an asbestos-containing coat could result in "dust levels as high as in an asbestos factory" once again demonstrates your reporter's search for the sensational rather than the factual. Had he chosen to look into the matter of the 200,000 asbestos-containing coats more thoroughly, he would have discovered that the committee appointed by the Food and Drug Administration to investigate the problem concluded in its report that "this single episode of manufacture and sale of asbestos-containing garments did not constitute an 'imminent hazard' as defined by the Food and Drug Administration, and that a recommendation to recover all the garments from the individual purchasers was not warranted." Tests run on the coats by the National Institute of Occupational Safety and Health for the FDA were "deliberately designed to be many orders of magnitude more severe in terms of applying energy to the garments than would be expected in ordinary use by the public." In addition, "a build up of air-borne fibers was encouraged." Despite these severe wear and brushing tests, the amount of free fiber that became air borne was considered by the committee to provide "a wide margin of safety" for the wearer. Thus, while Mr. Nicholson's colorful quote makes attractive copy, it is not supported by sober, scientific fact.

One of the most serious breaches of journalistic ethics is to deliberately quote an individual out of context. This was done in the case of Mr. J. B. Jobe of Johns-Manville, who was quoted as stating at Occupational Safety and Health Administration hearings in Washington in March that it would be "socially irresponsible" to adopt a two fiber occupational standard in the asbestos industry. Mr. Jobe's full statement, which can be found in the official record of the hearing, was as follows: "Where there is no scientifically credible evidence

-More-

demonstrating the necessity of such low standards, it would be socially irresponsible to adopt them." By omitting the first part of Mr. Jobe's comment, the impression is given in the article that Mr. Jobe would be opposed to the two fiber standard on economic grounds, even if it were necessary to adopt such a standard in order to protect the lives of industry workmen. I need not point out the serious harm that could be done to Mr. Jobe's reputation by this out-of-context quote.

Your reporter's next major error is a relatively simple one of misunderstanding, yet had he made any efforts to discuss the situation with industry officials or to visit a manufacturing facility (both of which were offered to your reporter by Johns-Manville), the mistake would not have been made. By this, I refer to those paragraphs in the article in which your reporter states that "the curbing of asbestos contamination is more an exercise in good housekeeping than capital expenditure," and he then goes on to list a half-dozen "staples of such an operation, already in use in many plants." The mistake made by your reporter is that the "staples" he refers to, such as closed plastic bags for mixing cement, vacuum attachments on power saws, etc., are not used in plants where asbestos-containing products are manufactured, but in the construction industry, especially in the application of asbestos-containing insulations in buildings, power plants, etc. Asbestos dusts in manufacturing are controlled not by such devices but by highly sophisticated and expensive bag-house type dust collectors and other similarly costly equipment. One visit to an asbestos manufacturing plant would have clarified this point for Mr. Newman.

A similar error is made by your reporter when he reports that a Mount Sinai survey of 9,400 asbestos workers showed that there was only one dust count taken "in asbestos plants for every 20,000 man-days worked." Dr. Selikoff has reported on similar dust count frequencies for years, but always in reference to the construction industry, never to manufacturing plants, where dust counts are taken on a regular basis in most operations. Perhaps Mr. Newman's confusion arose out of the fact that the term "asbestos workers" when used by Dr. Selikoff refers not to men engaged in the asbestos manufacturing industry, but to those in the insulation application trades, who belong to a union called

the Heat, Frost, Insulation and Asbestos Workers (my underlining), which is commonly referred to as the Asbestos Workers Union. Once again, a more thorough research effort on your reporter's part would have provided him with this information.

Finally, I would like to register a very serious objection to a major error of omission in Mr. Newman's article, as contrasted to those of commission referred to thus far. In the entire article, your reporter makes only one or two passing references to industry efforts to solve its problems in this area, and leaves the distinct but erroneous impression that the industry is trying to get away with doing as little as possible and that it started its control efforts only very recently. Nowhere in the article can be found mention of the vast amount of medical research sponsored, co-sponsored or cooperated in by the industry over the past three or four decades, nor of the vast improvements in dust conditions achieved in manufacturing operations from coast to coast over the years. While information of this nature does not make for alarming headlines, it is as important a part of the overall asbestos-health story as case histories of disease and dire predictions of occupational deaths in the thousands.

In conclusion, I hope that this rather lengthly letter has demonstrated quite clearly to you the incomplete, erroneous, sensationalized and distorted manner in which your reporter presented the asbestos-health situation in his article. On behalf of the member companies of the Asbestos Information Association/North America, we request in the interests of fair and balanced journalism, that this letter be printed in its entirety in THE WALL STREET JOURNAL; that the WALL STREET JOURNAL print in its pages an apology for the incomplete and distorted nature of the article; and that you assign a competent writer untainted by the desire for sensationalism to write a balanced article on industry efforts and accomplishments in reducing asbestos-health hazards for workmen throughout the nation.

Very truly yours,

Matthew M. Swetonic

Matthew M. Swetonic
Executive Secretary

A14069

NEW YORK TIMES
7/27/72

Asbestos Exposure Is Linked to Cancer In Cigarette Smoker

By The Associated Press

Two cancer researchers say they have confirmed through human lung cancer cases the theory that occupational exposure to asbestos enhances the cancer-causing effects of cigarette smoke.

Asbestos exposure by itself, they reported yesterday, does not appear to increase the incidence of lung cancer among asbestos workers who do not smoke.

These findings, the researchers said, confirm studies based on such approaches as reviewing medical records but also come from what they describe as the first study they are aware of based on actual lung cancer specimens.

The report in the journal Cancer, a publication of the American Cancer Society, was written by two pathologists, Dr. Milton Kannerstein of the Barnert Memorial Hospital Center in Paterson, N. J., and Dr. Jacob Churg of the Mount Sinai School of Medicine in New York.

The pathologists said they had compared 50 lung cancer cases in patients occupationally exposed to asbestos with 50 matched control cases in persons not exposed to asbestos.

The incidence of lung cancer among cigarette-smoking asbestos workers was 92 times as high as it is for nonsmokers not exposed to asbestos.

"It would appear then," Dr. Kannerstein and Dr. Churg said, "that it is as a cocarcinogen, in combination with cigarette smoking, that asbestos has an effect."

A similar situation has been suggested for lung cancer among uranium miners, they said.

WALL STREET JOURNAL
7/27/72

The link of asbestos to cancer appears to hinge on cigaret smoking. Writing in the journal Cancer, two pathologists said a study of human lung cancer cases had confirmed the theory that occupational exposure to asbestos enhances the cancer-causing effects of cigaret smoke. Asbestos exposure, they said, doesn't appear to increase the incidence of lung cancer among those workers who don't smoke.

THE NATIONAL OBSERVER
Aug. 5, 1972

Cancer researchers investigating the tie between lung cancer and asbestos reported that exposure to the material appeared to increase the likelihood of cancer only if the victims also smoke cigarets. Two pathologists who examined 100 lung-cancer specimens said asbestos by itself did not seem to lead to cancer, but rather enhanced the apparent cancer-causing properties of cigaret smoke.

A14070

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

A14071

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.

A14072

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 arbitrary 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 studies 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 "do no'vo" 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 nonexposed 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 nonexposed 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 population.

A14074

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, brochogenic 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 nonusable 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 nonexposed 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 studies 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 evidences 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 nonexposed populations and exposed populations whose exposures varied in intensity and duration utilized?
4. Was the exposure which was 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.

A 14073

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 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. 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 coworkers, 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 translates into 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 Steward 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 coworkers 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 coexist. 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 judgment 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 circumstances 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 predominantly 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 judgment have a meaningful bearing on the setting of a standard for control of asbestos exposure. Other data does exist but in my judgment 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 uses 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 judgment 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 judgment 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 judgment 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 corelated 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.

A 14090

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 asbestosis referred to were related to what was undoubtedly a variable exposure is not shown. It is very probable that all of these 64 cases occurred 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, then 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 judgment of the authors 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 judgment 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

A-14005

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 curent 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.

A 14006

From OSHA to the Asbestos Industry . . . a new permanent standard

Six months to the day after the Dec. 7, 1971 imposition of a temporary standard, in accordance with the Occupational Safety and Health Act of 1970, the Secretary of Labor issued a permanent standard for exposure to asbestos fibers.

The asbestos industry breathed a sigh of relief; it felt it could exist with this standard.

It is too early to estimate the cost of compliance to the industry or the effect on sales of asbestos products, but it probably will not still the controversy. There are those who seem to forget that the purpose of the asbestos standard, as well as OSHA itself, is to protect the workers, not to punish the industry.

Effective July 7, 1972 the 8-hour time weighted average (TWA) airborne concentration of asbestos fibers to which any employee may be exposed shall not exceed 5 fibers, longer than 5 micrometers, per cubic centimeter. Effective July 1, 1976, the 8-hour TWA will be dropped to 2 fibers per cubic centimeter.

Most medical opinion has been divided between 2-fiber and the 5-fiber standard but not on the danger of exposure to asbestos of high enough intensity and long enough duration. Because of the long lapse in time between onset of exposure and biological manifestations, an accurate measure of exposure of 20 or 30 years ago is not known. Thus, speculation rather than solid evidence has given rise to the dire warnings.

The conflict in medical evidence was resolved in favor of maximum protection for the worker, but with a four year transition period to allow employers to make the necessary changes to meet the more stringent standards. Beyond a doubt there would be few operations that could meet a 2-fiber standard without the allowed transition period. It is also the judgment of the Secretary that no harm is reasonably expected to result from exposure during the transitional period.

However, the New York Times, in a short article on June 6 titled "Asbestos Code Kept Despite Warning" felt that it should take a "cheap shot" at OSHA and the Secretary of Labor. Even the Wall Street Journal in its front page article of June 7 felt that editorially it could mine gold from the asbestos problem. From the start of the article here the Journal reporter fails to realize that asbestos in brake linings changes in composition by heat of friction to far less lethal Fosterite, to his final inaccuracy of quoting "one dust count for every 20,000 man days worked" which refers to the construction industry not to the manufacturing, sensationalism was the key, not accuracy.

The truth is that OSHA and the Secretary Labor in setting this standard have shown courage a wisdom that certainly is too seldom recognized a commended.

The other parts of the standard are of equ importance to the health of the workers, and th also affect the financial condition of the industry.

Labeling of asbestos and asbestos containi products has become to some a "cause celebre" muc as the labeling of cigarettes. Both NIOSH and t Advisory Committee on Asbestos Dust recommend labeling which contained words such as "dange and "cancer" for all asbestos-containing product

The new standard requires a label

CAUTION
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
BREATHING ASBESTOS DUST MAY CAUSE
SERIOUS BODILY HARM

This label is not required where the asbest fibers have been modified by a bonding agent, coa ing, binder, or other material so that during and for seeable use it can become airborne.

Recognition was given in writing the standard the sound engineering principle that protectio against asbestos fibers is best obtained by controllin the dispersion of released fibers in the workplac Thus, respirators and shift rotations can be used on as temporary expediencies until proper engineeri of equipment and sound work practices can be set as a means of standards' compliance.

Additional complications are introduced in the establishment of a single standard that applies both manufacturing of asbestos and asbestos produ and the use of asbestos in construction. The standa applies to all varieties of asbestos and workplaces differing amounts of hazardous exposure.

The Federal Register of June 7, 1972 amen and adds to Section 1910.93. All parts of the p posed standard have been covered in the new stand including: permissible concentrations of asbestos bers; methods of compliance; warning signs; medi examinations and record keeping.

An objective conclusion is that the new p manent standards will provide workers' health pr tection if each worker will observe the requir work practices and if the employers will comp with the standards.

A 74007

Records of monitoring and medical exami tions that are available to OSHA, NIOSH, to the e ployee and his representative, and to the employ provide a system of checks and balances that sho make the results of the standard compliance clea

JOB SAFETY & HEALTH REPORT

• Legislation • Economics • Medicine • Technology

Bi-weekly business newsletter published from the Nation's Capital

Leonard A. Eiserer
Editor and Publisher

Business Publishers, Inc., P.O. Box 1057, Blair Station, Silver Spring, Maryland 20910, (301) 587-6300. Subscription Rate: $60 per year, $35 for six months U.S., Canada and Mexico; $70 per year in all other countries (includes air mail postage). Multiple copy rates on request to Henry E. Kleiner, Jr., Business Manager.

Vol. 2 No. 15 July 17, 1972 Page 141

SLANTS & TRENDS

FIRST YEAR PERFORMANCE of Occupational Safety and Health Administration will be probed by Senate Labor & Welfare Committee in oversight hearings scheduled for July 25-27. Congressional critics will testify July 25, followed by OSHA officials the next day.

OSHA ADMINISTRATOR GEORGE C. GUENTHER stressed Nixon Administration's opposition to exemption of small firms from Federal Job Safety Act, as voted by House and Senate last month (JS&HR, July 3, 1972, p. 131), at press conference July 13. Some of most hazardous work can be in small firms, he noted, promising to ease record-keeping burden for small employers. Instead of arbitrary limit on size of company affected, he suggested Secretary of Labor should be given authority to exempt certain employers at his discretion, thus allowing OSHA to concentrate on worst problems first.

NIOSH PLANS TO ISSUE CRITERIA DOCUMENTS before end of September recommending standards of occupational exposure to cotton dust, ultraviolet radiation, silica, mercury, and bis (chloromethyl) ether. Under development for later issue are criteria on benzene, lead, trichloroethylene, parathion, cadmium, fibrous glass, chromic acid, arsenic, toluene, sulfuric acid, and sulfur dioxide. Document on noise is expected momentarily.

DEMOCRATIC NOMINEE SEN. GEORGE McGOVERN has proposed an 8-point program on job safety and health, including a call for 8,000 Federal OSHA inspectors, plus 4,000 industrial hygienists; full access for workers to complete results of Federal inspections; funds for industrial safety and health training for employes so they can serve as own inspectors; priority on research for new techniques in removing hazards. OSHA now has about 400 compliance officers and inspectors.

Title 29—LABOR

Chapter XVII—Occupational Safety and Health Administration, Department of Labor

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Standard for Exposure to Asbestos Dust

On December 7, 1971, an emergency temporary standard concerning exposure to asbestos fibers was published in the FEDERAL REGISTER (36 F.R. 23207). In accordance with section 6(c)(3) of the Williams-Steiger Occupaional Safety and Health Act of 1970, a notice of proposed rulemaking regarding a permanent standard for exposure to asbestos fibers was published in the FEDERAL REGISTER on January 12, 1972 (37 F.R. 466). The notice invited interested persons to submit both orally and in writing, data, views, and arguments concerning the proposal.

On or about January 24, 1972, the Advisory Committee on Asbestos Dust was established and requested to make written recommendations with regard to the proposed standard on asbestos. On or about February 1, 1972, the Department of Health, Education, and Welfare transmitted to the Secretary of Labor a criteria document containing Recommendations for an Occupational Exposure Standard for Asbestos by the National Institute for Occupational Safety and Health (NIOSH). Public notice was given of the receipt of the recommendations and their availability for inspection and copying. On or about February 25, 1972, the Advisory Committee on Asbestos Dust submitted its written recommendations to the Assistant Secretary of Labor for Occupational Safety and Health.

Pursuant to the notice of rule making, a hearing was held on March 14 through 17, 1972, for the purpose of receiving oral data, views, and arguments concerning the proposed standard. On or about March 31, 1972, the presiding hearing examiner certified to the Assistant Secretary of Labor for Occupational Safety and Health the record of the proceeding. The record includes prehearing written comments, a transcript of the oral presentations made at the hearing, and numerous exhibits received during the course of the hearing or within the period allowed after the close of the hearing.

The proposed standard dealt with (1) permissible concentrations of asbestos fibers; (2) methods of compliance; (3) warning signs; (4) monitoring; (5) medical examinations; and (6) recordkeeping. Each of these major proposals elicited comments, arguments, objections, and counterproposals. They all have been examined and considered.

1. *Acceptable concentrations of asbestos dust.* The proposed standard would limit occupational exposure to 8-hour time-weighted average (TWA) airborne concentrations of asbestos dust not exceeding five fibers longer than five micrometers per milliliter. Concentrations above five fibers but not to exceed 10 fibers (ceiling concentration) would be permitted up to 15 minutes in an hour, but for not more than 5 hours in any one 8-hour day.

NIOSH in effect has recommended that the five-fiber TWA and 10-fiber peak concentrations be permitted only for 2 years; thereafter, TWA concentrations should be not more than 2 fibers per cubic centimeter ($cm.^3$) of air, and peak concentrations should not exceed 10 fibers/$cm.^3$, with no time restriction. Numerous objections and counterproposals have been made, with regard to both the limits of asbestos fiber concentrations and the time periods to comply with them. Some, for example, have recommended return to a 12-fiber standard of an earlier day; i.e., a level adopted under the Walsh-Healey Public Contracts Act in 1969. Others have recommended a two-fiber standard to become effective in 6 months, then a one-fiber standard for 2 years, and finally a zero-fiber standard after 3 years. These recommendations give a fair indication of the wide spread of the counterproposals.

No one has disputed that exposure to asbestos of high enough intensity and long enough duration is causally related to asbestosis and cancers. The dispute is as to the determination of a specific level below which exposure is safe. Various studies attempting to establish quantitative relations between specific levels of exposure to asbestos fibers and the appearance of adverse biological manifestations, such as asbestosis, lung cancers, and mesothelioma, have given rise to controversy as to the validity of the measuring techniques used and the reliability of the relations attempted to be established. Because of the long lapse of time between onset of exposure and biological manifestations, we have now evidence of the consequences of exposure, but we do not have, in general, accurate measures of the levels of exposure occurring 20 or 30 years ago, which have given rise to these consequences. There are also controversies concerning the relative toxicity of the various kinds of asbestos, and varying hazards in different workplaces.

It is fair to say that the controversy has centered in the area between a two-fiber TWA concentration and five-fiber TWA concentration, with variations on the time needed for compliance. Many employers support a five-fiber TWA. Most medical opinion is divided between a two-fiber standard and a five-fiber standard.

In view of the undisputed grave consequences from exposure to asbestos fibers, it is essential that the exposure be regulated now, on the basis of the best evidence available now, even though it may not be as good as scientifically desirable. An asbestos standard can be reevaluated in the light of the results of ongoing studies, and future studies, but cannot wait for them. Lives of employees are at stake.

It is concluded that there should be one minimum standard of exposure to asbestos applicable to all workplaces exposed to any kind, or mixture of kinds, of asbestos. Reasons of practical administration preclude a variety of standards for different kinds of asbestos and of workplaces. Also, while the evidence tends to show that crocidolite, for instance, is more harmful than chrysotile, the evidence is not sufficient to establish separate standards for varieties of asbestos.

Because there must be one standard governing exposure to all varieties of asbestos, and in workplaces apparently more hazardous than others; because some present employees with regular exposure to asbestos have probably already accumulated great doses of asbestos fibers, due to higher levels of exposure in the past; because it appears that levels of exposure which may be safe with regard to asbestosis are not safe with regard to mesothelioma; because the statute requires the protection of every employee, even of one who may have regular exposure to asbestos during a working life which may reach, or even exceed, 40 years; and because of several other considerations which have been urged and are reflected in the record of the proceeding, the conflict in the medical evidence is resolved in favor of the health of employees. As of July 1, 1976, TWA concentrations of asbestos fibers longer than 5 micrometers will not be allowed to exceed two fibers cc., with a ceiling value of 10 fibers/cc. The current TWA concentrations of five fibers, and

A 14009

ceiling concentrations of 10 fibers/cc, will be permitted until July 1, 1976, during what will be a transitional period deemed necessary to allow employers to make the needed changes for coming into compliance with the more stringent standard.

The record shows that the many work operations subject to the single asbestos standard (textile, manufacturing, industrial, and marine installation, etc.) will meet varying degrees of difficulty in complying with the standard. In some plants, extensive redesign and relocation of equipment may be needed. It appears, however, the delay in the effective date of the two-fiber standard will provide all employers a reasonable time to comply. At the same time, so long as the ceiling limit is complied with, no harm is reasonably expected to result from exposures during the transitional period.

2. *Methods of compliance.* It has been pointed out by many persons, that protection against asbestos fibers is best obtained by controlling the generation of fibers first, and secondly, by controlling the dispersion of released fibers into the ambient air of the workplaces. Therefore, the standard requires feasible technological controls and appropriate work practices as the primary means of compliance. Rotation of employees as a way of meeting the TWA concentration requirement is allowed only in stated exceptional circumstances, because, as a general rule, it would be difficult to implement. Personal protective equipment, such as respirators, cannot be relied upon because, among other reasons, they may be so uncomfortable as to be burdensome, except for short periods of time. Therefore, it is expected that respirators and shift rotation will be used during the period necessary to install engineering controls and to train employees in sound work practices, but, after technological compliance has been achieved, their use must be limited to special work situations and emergencies. Where both are practicable, shift rotation is required.

3. *Labeling.* The proposed standard stopped short of requiring labeling asbestos and asbestos-containing products. The proposed standard would have required only warning signs at locations where asbestos hazards are present. However, labeling, rather than warning signs, has proved to be a point of controversy. Both NIOSH and the Advisory Committee on Asbestos Dust recommended labels for asbestos products and containers, and these recommendations became very controversial in the course of the proceeding. Many counterproposals have been made as to the language of the warning as well as to the products to be subject to the labelling requirements. Employers, in general, strongly contend that (1) finished products which effectively entrap asbestos fibers, so that these would not be released in the normal use of the products, should not be required to be labeled, and (2) words such as "danger" and "cancer" are unwarrantedly alarming.

Both contentions have merit, and the standard has been changed accordingly.

4. *Monitoring.* The proposed standard would have required personal monitoring and environmental monitoring. Many issues have been raised concerning the availability and reliability of measuring instruments, frequency of monitoring, and conditions in which monitoring should be required. The adopted standard takes the objections into consideration. It requires periodic monitoring at intervals no longer than 6 months, thus allowing considerable time and discretion, and prescribes the use of the membrane filter method, which is an acceptable method for determination of asbestos fibers.

It has also been recommended that employees or their representatives should have an opportunity to observe the monitoring. The recommendation has been accepted.

5. *Medical examinations.* The proposed standard would only require an appropriate medical examination on a periodic basis. The generality of the proposal has attracted many objections and also many helpful comments. The recommendations of NIOSH and of the Advisory Committee on Asbestos Dust were much more specific with respect to both frequency and type of medical examinations to be required. The comments vary as to the class of employees to be examined and as to the frequency of the examinations.

The adopted standard requires medical examinations both at the beginning and the termination of employments exposed to concentrations of asbestos fibers, and also requires annual medical examinations of every employee exposed to airborne concentrations of asbestos. It has been pointed out that in certain industries, such as construction, an employee may work for several employers during the same year. Accordingly, the standard does not require either preemployment, or termination, or periodic examinaton of any employee who has been examined in accordance with the standard within the past year.

One question which has been raised goes to whether the employer or the employee should be allowed to choose the examining physician. The standard gives the option to the employer. Since some employers already have a medical examination program in operation, and, also, have medical departments with some expertise in the diagnosis of abestos-related diseases, it seems more reasonable to permit them to utilize the present programs and expertise, than to permit an employee to choose a private general practitioner.

6. *Records.* The standard, as proposed and as adopted, requires maintenance of records of monitoring and of medical examinations. Most of the controversy in this area has revolved around the question whether an employer should be allowed to have access to the results of the required medical examinations. The apprehension of those who have argued against employer access is based on the expectation that some employers will use the medical examinations as a means of screening employment applicants, and worse, as grounds for discharging current employees, who show signs of being affected by exposure to asbestos. Since the purpose of the medical examinations is to monitor the health of employees exposed to the hazards of abestos, employees cannot in reason be granted the privilege of refusing to disclose to their employers results of occupational exposure. It does not make sense to require employers to provide medical examinations if they cannot know and use the results of the examinations. For these reasons the standard provides that employers may have a restricted access to some medical information.

On the other hand, there is no intention to allow employers to abuse medical information obtained pursuant to the Act, to the detriment of employees. Therefore, the administration of the medical records requirement will be closely watched, and, in cases of abuse, appropriate action will be considered.

The issues discussed above are believed to be the major ones. Numerous other issues have been raised in the rulemaking proceedings. Some have been referred to incidentally. Many recommendations, for instance, about work practices, are so obviously meritorious that their adoption needs no exposition here. Other recommendations and many objections have not been adopted for a variety of reasons which should be manifest. Several, for instance, have recommended the use of respirators only pursuant to a variance, or in cases of emergency and occasional short-term exposures. The recommendation with respect to variances undoubtedly has many merits, but is considered administratively impractical.

Accordingly, after consideration of the whole record of the proceeding, and pursuant to sections 6 (b) and (c) and 8(c) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593, 1596, 1599; 29 U.S.C. 655, 657), 29 CFR 1910.4, and to Secretary of Labor's Order No. 12–71 (36 F.R. 8754), Part 1910 of Title 29 of the Code of Federal Regulations is amended as set forth below.

(1) Section 1910.93 is amended by revising Table G–3 to read as follows:

§ 1910.93 Air contaminants.

• • • • •

TABLE G-3—MINERAL DUSTS

Substance	Mppcf	Mg/M³
Silica:		
Crystalline:		
Quartz (respirable)	250 [1]	10mg/M³ [=]
	%SiO₂+5	%SiO₂+2
Quartz (total dust)		$/mg/M³
		%SiO₂+2
Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz.		
Tridymite: Use ½ the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth	20	80mg/M³
		%SiO₂
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc	20	
Portland cement	50	
Graphite (natural)	15	
Coal dust (respirable fraction less than 5% SiO₂)		2.4mg/M³ or
For more than 5% SiO₂		10mg/M³
		%SiO₂+2
Inert or Nuisance Dust:		
Respirable fraction	15	5mg/M³
Total dust	50	15mg/M³

NOTE: Conversion factors—
mppcf×35.3=million particles per cubic meter
=particles per c.c.

[1] Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

[2] The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.

[3] As determined by the membrane filter method at 430× phase contrast magnification.

[=] Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5.0	25
10	0

The measurements under this note refer to the use of an AEC instrument. If the respirable fraction of coal dust is determined with a MRE the figure corresponding to that of 2.4 Mg/M³ in the table for coal dust is 4.5 Mg/M³.

2. A new § 1910.93a is added to Part 1910, reading as follows:

§ 1910.93a Asbestos.

(a) *Definitions.* For the purpose of this section, (1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) *Permissible exposure to airborne concentrations of asbestos fibers*—(1) *Standard effective July 7, 1972.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) *Standard effective July 1, 1976.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) *Ceiling concentration.* No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) *Methods of compliance*—(1) *Engineering methods.* (i) *Engineering controls.* Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) *Local exhaust ventilation.* (a) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2–1971, which is incorporated by reference herein.

(b) See § 1910.6 concerning the availability of ANSI Z9.2–1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(iii) *Particular tools.* All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(2) *Work practices*—(i) *Wet methods.* Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) *Particular products and operations.* No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) *Spraying, demolition, or removal.* Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d)(2)(iii) of this section and with special clothing in accordance with paragraph (d)(3) of this section.

(d) *Personal protective equipment*—(1) Compliance with the exposure limits prescribed by paragraph (b) of this section may not be achieved by the use of respirators or shift rotation of employees, except:

(i) During the time period necessary to install the engineering controls and to institute the work practices required by paragraph (c) of this section;

(ii) In work situations in which the methods prescribed in paragraph (c) of this section are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by subdivisions (i), (ii), or (iii) of this subparagraph, and both are practicable, personnel rotation shall be preferred and used.

(2) Where a respirator is permitted by subparagraph (1) of this paragraph, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 F.R. 6244, Mar. 25, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

(i) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in subdivision (ii) or (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) *Powered air purifying respirators.* A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in subdivision (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) *Type "C" supplied-air respirators, continuous flow or pressure-demand class.* A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) *Establishment of a respirator program.* (a) The employer shall establish a respirator program in accordance with

A 14101

the requirements of the American National Standards Practices for Respiratory Protection, ANSI Z88.2–1969, which is incorporated by reference herein.

b. See § 1910.6 concerning the availability of ANSI Z88.2–1969 and the maintenance of an historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(c) No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) Special clothing: The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) Change rooms: (i) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) Clothes lockers: The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) Laundering: (*a*) Laundering of asbestos contaminated clothing shall be done so as to prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(*b*) Any employer who gives asbestos-contaminated clothing to another person for laundering shall inform such person of the requirement in (*a*) of this subdivision to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(c) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400–450 × (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring*—(1) *Initial determinations.* Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) *Personal monitoring*—(i) Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porossity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) *Environmental monitoring*—(i) samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) *Employee observation of monitoring.* Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) *Caution signs and labels.* (1) *Caution signs.* (i) *Posting.* Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(ii) *Sign specifications.* The warning signs required by subdivision (i) of this subparagraph shall conform to the requirements of 20" x 14" vertical format signs specified in § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	*Notation*
Asbestos	1" Sans Serif, Gothic or Block.
Dust Hazard	¾" Sans Serif, Gothic or Block.
Avoid Breathing Dust	¼" Gothic.
Wear Assigned Protective Equipment.	¼" Gothic.
Do Not Remain In Area Unless Your Work Requires It.	¼" Gothic.
Breathing Asbestos Dust May Be Hazardous To Your Health.	14 point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) *Caution labels*—(i) *Labeling.* Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) *Label specifications.* The caution labels required by subdivision (i) of this subparagraph shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers
Avoid Creating Dust
Breathing Asbestos Dust May Cause Serious Bodily Harm

(h) *Housekeeping*—(1) *Cleaning.* All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(i) *Recordkeeping*—(1) *Exposure records.* Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 3 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National

A 14102

Institute for Occupational Safety and Health, and to authorized representatives of either.

(2) *Employee access.* Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this paragraph, which indicates the employee's own exposure to asbestos fibers.

(3) *Employee notification.* Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) *Medical examinations*—(1) *General.* The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) *Preplacement.* The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(3) *Annual examinations.* On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(4) *Termination of employment.* The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(5) *Recent examinations.* No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

(6) *Medical records*—(i) *Maintenance.* Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) *Access.* The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

3. A new § 1910.19 is added to Subpart B of Part 1910, reading as follows:

§ 1910.19 Asbestos dust.

Section 1910.93a shall apply to the exposure of every employee to asbestos dust in every employment and place of employment covered by § 1910.12, § 1910.13, § 1910.14, § 1910.15, or § 1910.16, in lieu of any different standard on exposure to asbestos dust which would otherwise be applicable by virtue of any of those sections.

Effective date. Paragraph (b)(2) of § 1910.93a shall become effective July 1, 1976. All other provisions of §§ 1919.93a, 1910.93, and 1910.19 shall become effective July 7, 1972. The current emergency temporary standard remains in effect until July 7, 1972.

(Secs. 6, 8, 84 Stat. 1593, 1598; 29 U.S.C. 655, 657; 29 CFR 1910.4; Secretary of Labor's Order No. 12-71, 36 F.R. 8754)

Signed at Washington, D.C., this 2d day of June 1972.

G. C. GUENTHER,
Assistant Secretary of Labor.

[FR Doc.72-8574 Filed 6-6-72;8:48 am]

A 14103

Material Safety Data

September 1, 1972

UNION CARBIDE CORPORATION • 4625 ROYAL AVENUE • NIAGARA FALLS, NEW YORK • 14302

TELEPHONE: (716) 285-3311 EXT. 6567

PRODUCT: Chrysotile Asbestos **CHEMICAL FORMULA:** $Mg_6(OH)_8Si_4O_{10}$

TRADE NAMES: "Calidria" Asbestos

I. PHYSICAL DATA

BOILING POINT AND MELTING POINT: Not Pertinent

SPECIFIC GRAVITY ($H_2O = 1$): 2.45

VOLATILE CONTENT: Absorbed Water 1 – 4% By Weight. Structural Water Approximately 13% by Weight.

APPEARANCE: Pellets or Fine White Powder. No odor. Very Slight Solubility in Water.

II. HAZARDOUS INGREDIENTS

Not Applicable.

III. FIRE AND EXPLOSION HAZARD DATA

Material is not Combustible. No Fire or Explosion Hazard.

IV. REACTIVITY DATA

INERT MATERIAL: No Decomposition or Polymerization Conditions.

V. HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE TO AIRBORNE CONCENTRATION:

The current standard of the Occupational Safety and Health Act of 1970 contains the following exposure limits:

"The 8-hour time-weighted average airborne concentration of asbestos fibers to which employees are exposed shall not exceed 5 fibers per milliliter greater than 5 microns in length, as determined by the membrane filter method at 400-450X magnification (4 millimeter objective) phase contrast illumination. No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers per milliliter, longer than 5 microns." (Federal Register – Vol. 37, June 7, 1972, page 11320).

EFFECTS OF OVER EXPOSURE: Prolonged over exposure may result in lung damage.

EMERGENCY AND FIRST AID PROCEDURES: Not applicable. Material has no acute toxicity.

VI. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Avoid inhalation of dust. Remove spilled material by vacuum cleaner or by water wash.

WASTE DISPOSAL METHOD:

If reasonably foreseeable handling will not produce airborne concentrations in excess of exposure limits, no special procedures are required. When limits are likely to be exceeded, waste and scrap shall be collected and disposed of in impermeable sealed bags or other closed, impermeable containers, suitably labelled.

A 14104

CALIDRIA ASBESTOS - TYPICAL CHEMICAL ANALYSIS

Component	Weight %
MgO	41.9
SiO_2	41.8
Al_2O_3	0.5
Fe	1.4
Ca	0.075
Co	0.012
Cr	0.15
Cu	0.005
Ni	0.22
Se	<0.001
Loss on Ignition (CO_2 & H_2O)	13.5

CALIDRIA ASBESTOS - TYPICAL SPECTROGRAPHIC ANALYSIS

Component	Detection Limit, Wt. %	Analysis, Wt. %
Ag	0.001	0.0002-0.002
Al	0.003	0.08-0.8
As	0.01	N.D.(2)
Au	0.002	N.D.
B	0.006	N.D.
Ba	0.003	N.D.
Be	0.001	N.D.
Bi	0.005	N.D.
Ca	0.002	0.008-0.08
Cb	0.006	N.D.
Cd	0.01	N.D.
Co	0.01	0.008-0.08
Cr	0.003	0.02-0.2
Cs	N.A.(1)	----
Cu	0.001	0.004-0.04
Fe	0.006	0.8-8.0
Ga	0.01	N.D.
Ge	0.005	N.D.
Hf	0.03	N.D.
Hg	0.02	N.D.
In	0.03	N.D.
Ir	0.03	N.D.
K	N.A.	----
La	0.01	N.D.
Li	0.1	N.D.
Mg	0.001	Major
Mn	0.003	0.008-0.08
Mo	0.003	N.D.
Na	0.03	N.D.
Ni	0.003	0.08-0.8
Os	0.03	N.D.
P	0.08	N.D.
Pb	0.003	N.D.
Pd	0.005	N.D.
Pt	0.005	N.D.
Rb	N.A.	----
Re	0.03	N.D.
Rh	0.02	N.D.
Ra	0.03	N.D.
Sb	0.01	N.D.
Sc	0.01	N.D.
Se	----	<0.001(3)
Si	0.001	Major
Sn	0.002	N.D.
Sr	0.01	N.D.
Ta	0.01	N.D.
Te	0.05	N.D.
Th	0.03	N.D.
Ti	0.003	0.004-0.04
Tl	0.2	N.D.
U	0.1	N.D.
V	0.003	N.D.
W	0.01	N.D.
Y	0.01	N.D.
Yb	0.01	N.D.
Zn	0.02	N.D.
Zr	0.006	N.D.

(1) N.A. - Not analyzed.

(2) N.D. - Not detected.

(3) By chemical analysis.

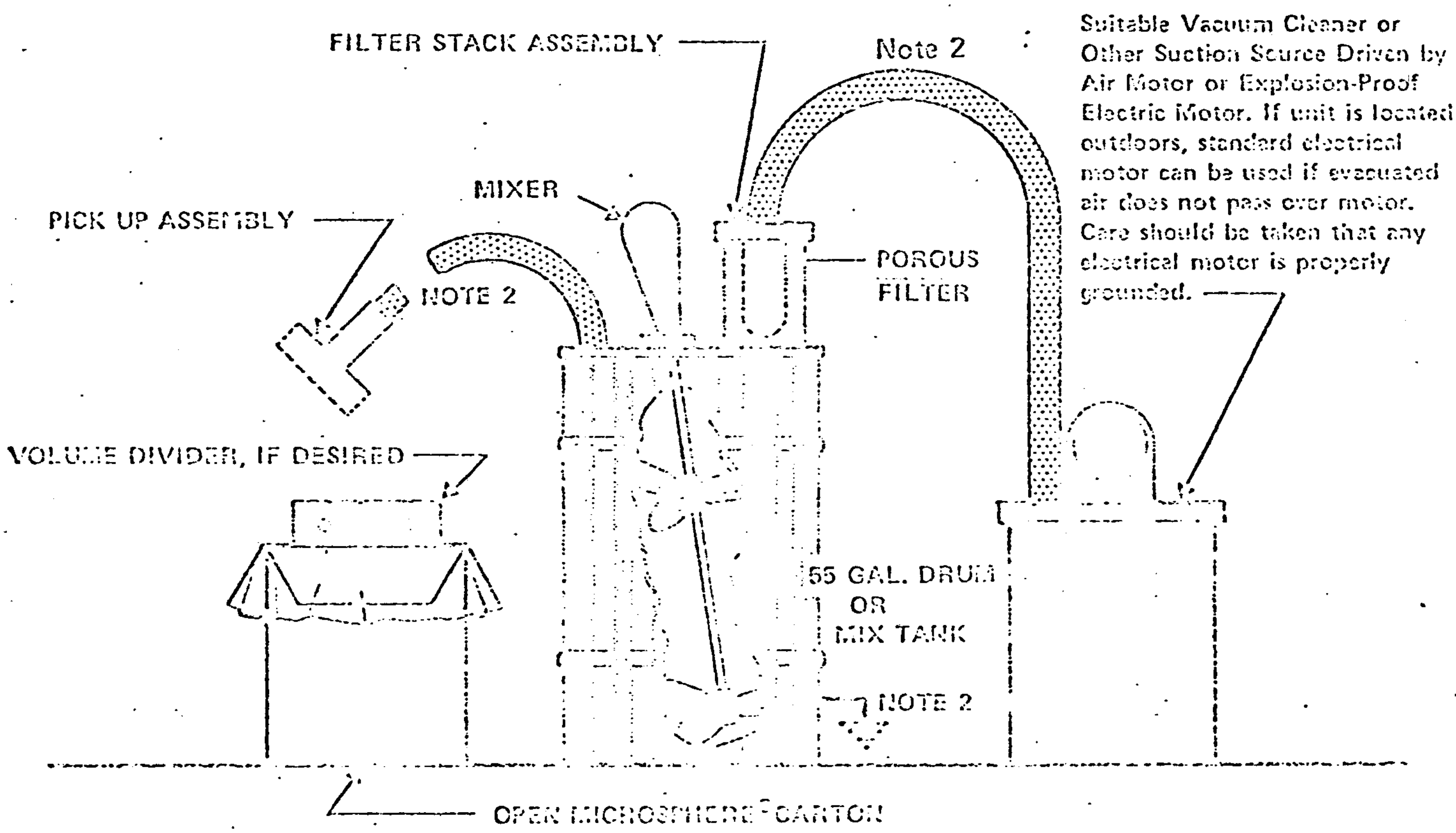
A 14105

THOMAS F. ANDERSON
RESINS TECHNICAL SERVICE & DEVELOPMENT

DOW CHEMICAL U.S.A. DESIGNED PRODUCTS DEPARTMENT
L1603 713-233-1672 FREEPORT, TEXAS 77541

Saran Microspheres - Vacuum Transfer System

BECAUSE THE DRY EXPANDED SARAN MICROSPHERES, XD-7051.04, ARE VERY SMALL AND VERY LIGHT (ca .6 pcf BULK DENSITY), THEY TEND TO DUST[1] VERY EASILY AND BE HARD TO HANDLE. IT HAS BEEN FOUND THAT XD-7051.04 CAN BE TRANSFERRED FROM THE PACKING CARTON TO A MIXING CONTAINER VERY READILY USING A VACUUM TRANSFER SYSTEM AS DESCRIBED BELOW.



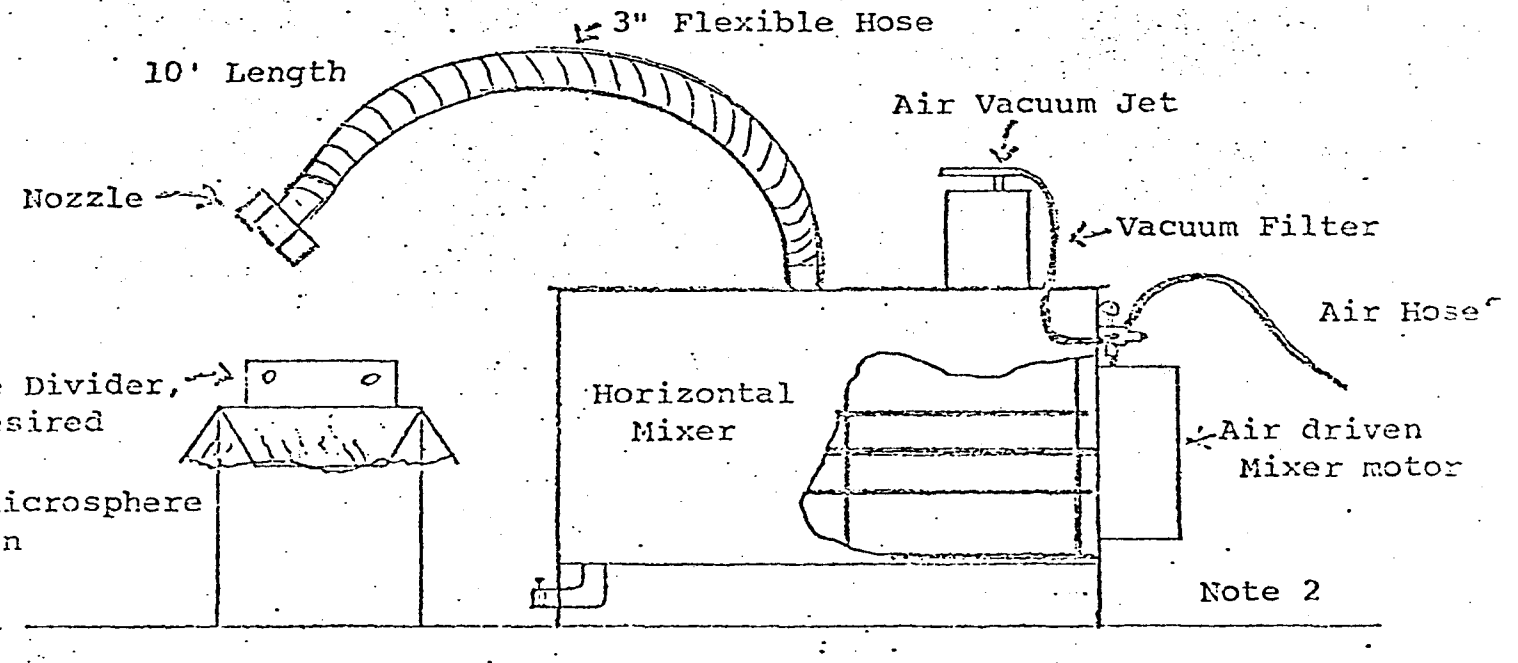
[1]SEE TECHNICAL BULLETIN SARAN MICROSPHERES-SAFETY AND HEALTH CONSIDERATIONS.

[2]PICK UP ASSEMBLY, DRUM OR MIX TANK, FILTER, & VACUUM UNIT SHOULD ALL BE CONNECTED WITH METAL HOSE OR GROUNDING WIRE AND COMPLETE SYSTEM GROUNDED TO MINIMIZE STATIC ACCUMULATION.

DEVELOPMENTAL PRODUCTS technical data

SARAN MICROSPHERES - VACUUM TRANSFER SYSTEM

Because the dry expanded saran microspheres, XD-7051.04, are very small and very light (ca. 6 pcf bulk density), they tend to dust[1] very easily and be hard to handle. It has been found that XD-7051.04 can be transferred from the packing carton to a mixing container very readily using a vacuum transfer system as described below.

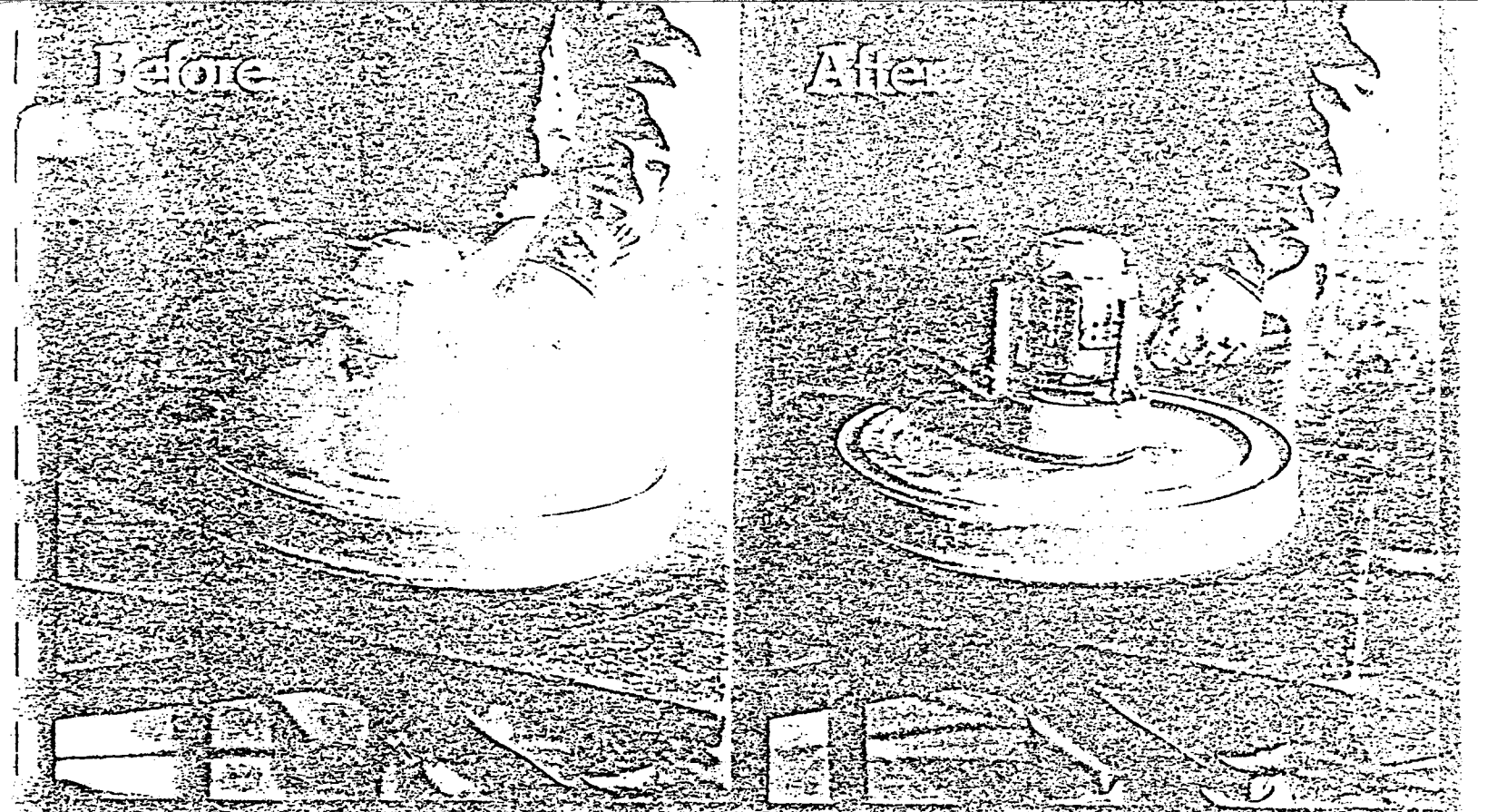


[1] See Technical Bulletin Saran Microspherres--Safety and Health Considerations.

[2] Pick up assembly, drum or mix tank, filter, & vacuum unit should all be connected with metal hose or grounding wire and complete system grounded to minimize static accumulation.

A 14107

THE DOW CHEMICAL COMPANY
DESIGNED PRODUCTS DEPARTMENT • MIDLAND, MICHIGAN 48640



DUSTUCTOR®

Low Volume High Velocity Dust Control Systems

J. P. ELLIOTT ASSOCIATES, INC.
6789 Main Street
Buffalo, New York 14221

A14108

HOFFMAN AIR APPLIANCE

A 4108

DUST COLLECTION AS A PROFIT MAKER

Dustuctor® systems offer immediate, effective control over the hazardous and costly problems of dust created by portable grinders, pneumatic chisels, wire brushes, sanders and other tools — even ultra high speed air driven tools used to work heavy metals such as uranium. By the use of patented nozzles and hoods, fitted to individual tools, Dustuctor equipment traps breathing zone dust in the dangerous under 10 micron range at the source, and conveys it through small diameter tubing to a high efficiency separator. The small sized, lightweight extraction heads and integrated system design make Dustuctor highly flexible and maneuverable — it becomes, essentially, a part of the tool itself.

All this means decided advantages in terms of installation and operation costs. Unlike high-volume low vacuum systems, Dustuctor does not require massive ductwork or provisions for large amounts of make-up air. The system removes only the dust — it does not draw out substantial volumes of conditioned air in the summer, or heated air in winter. The problem of negative pressure is eliminated. You don't need special grinding rooms. And reduced costs plus effective production means more profit.

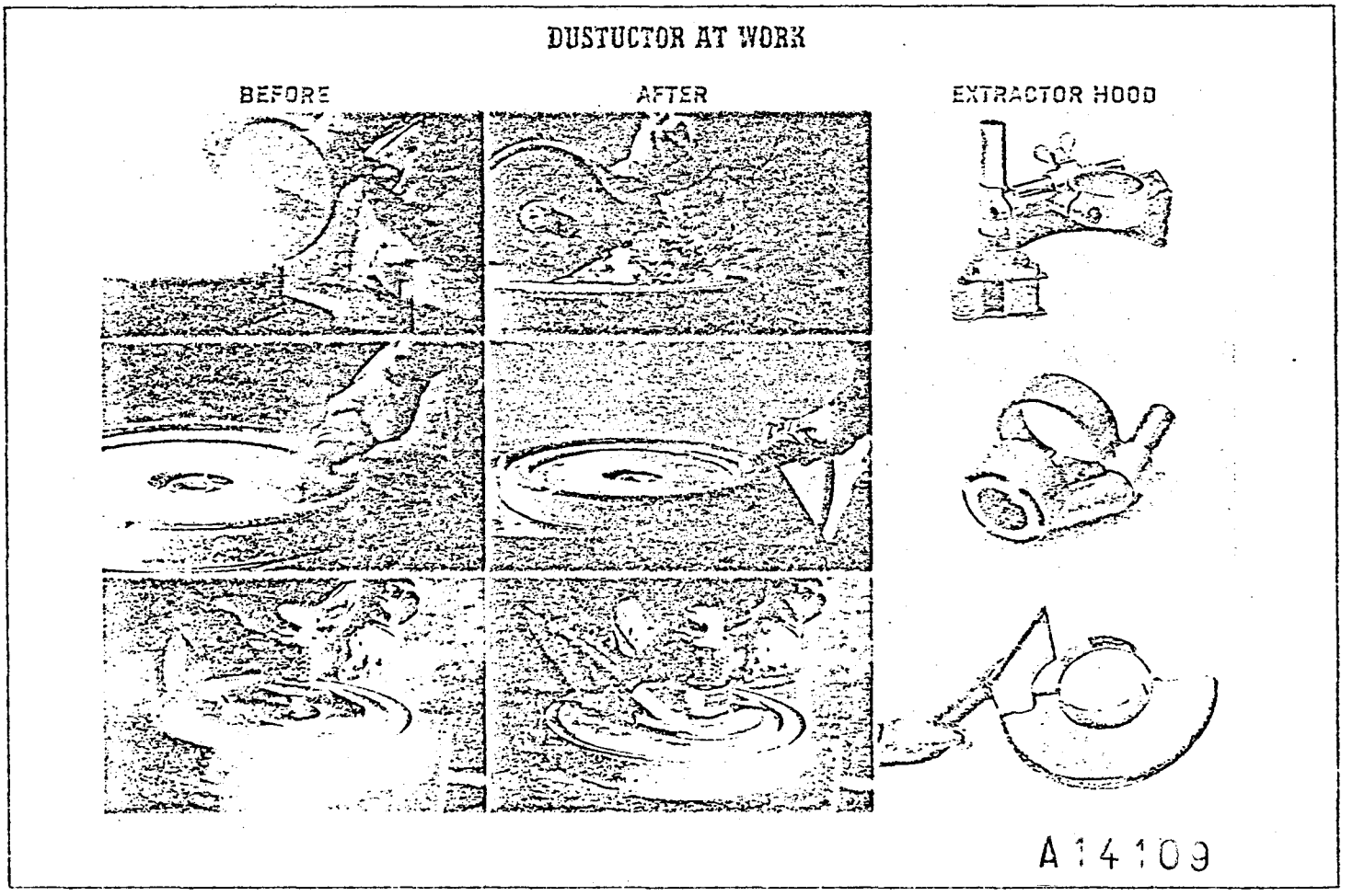
HEALTH HAZARDS REDUCED

Dustuctor system performance is highly efficient. Silicosis, asbestosis, and berylliosis threats are significantly reduced. Various other nuisance dusts which cause seemingly inert pneumoconioses are also brought largely under control with Dustuctor systems. A short technical description of Dustuctor is provided under the heading "Low Volume — High Velocity Exhaust Systems" in "Industrial Ventilation, A Manual of Recommended Practice" published by the American Conference of Governmental Industrial Hygienists.

Dustuctor offers the additional advantage of service as a heavy duty vacuum cleaning system. Shake-out sand spills, blasting grit or welding flux recovery, ore dust spillage from conveyors, batch conveying, and many other in-plant problems can be handled. These miscellaneous duties can usually be accomplished by a simple change of accessories on the piping system.

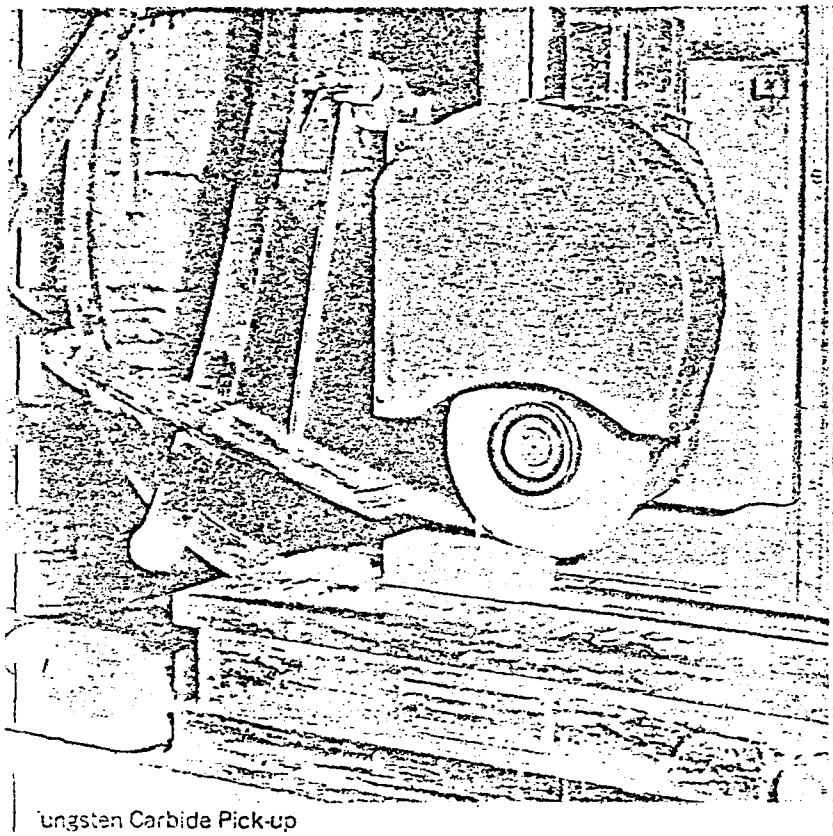
Several hundred world-wide installations have proven the effectiveness of our Low Volume High Velocity dust control system. Let a Hoffman representative show you how you can reduce costs, cut down on operational hazards, and increase productivity, with the unique Dustuctor system.

Low volume high velocity dust collection systems for portable hand-held tools



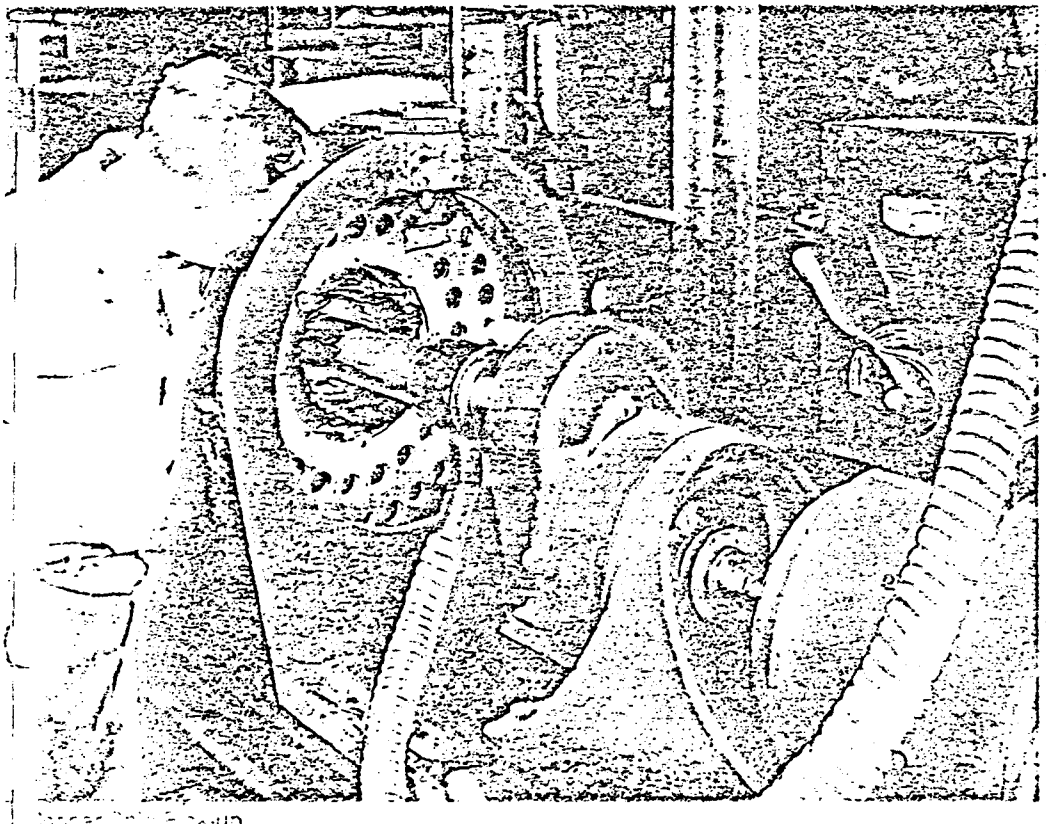
USERS: A S & R • BOEING • CANADA IRON FOUNDRIES • CATERPILLAR • DENVER POST • GM • GE • B. F. GOODRICH • HONEYWELL • KROGER CO. • LEVER BRO. • MARTIN CO. • MERGENTHALER LINOTYPE • PEERLESS POTTERY, INC. • CHARLES PFIZER • RAYTHEON • REMINGTON ARMS • S.N.S.O. ROYAL ORDNANCE FACTORY • STAUFFER • UNION CARBIDE • VICKERS-ARMSTRONG, LTD. • WATERTOWN ARSENAL • WESTINGHOUSE

MATERIAL CONTROLLED/RECOVERED ALUMINUM CHIPS • ASPIRIN DUST • BERYLLIUM DUST • BRASS CHIPS • CARBON DUST • CEMENT CHIPS • CERAMIC DUST • CIRCUIT BOARD DUST • COPPER CHIPS • DETERGENT DUST • EXPLOSIVES • FIBER GLASS DUST • GRAPHITE BEARING DUST • OIL VAPOR • PAPER DUST • PHARMACEUTICAL TABLETING DUST • PLASTIC CHIPS • PORCELAIN FRIT • SILICA DUST • DRINK MIX • TUNGSTEN CARBIDE DUST • URANIUM CHIPS & DUST

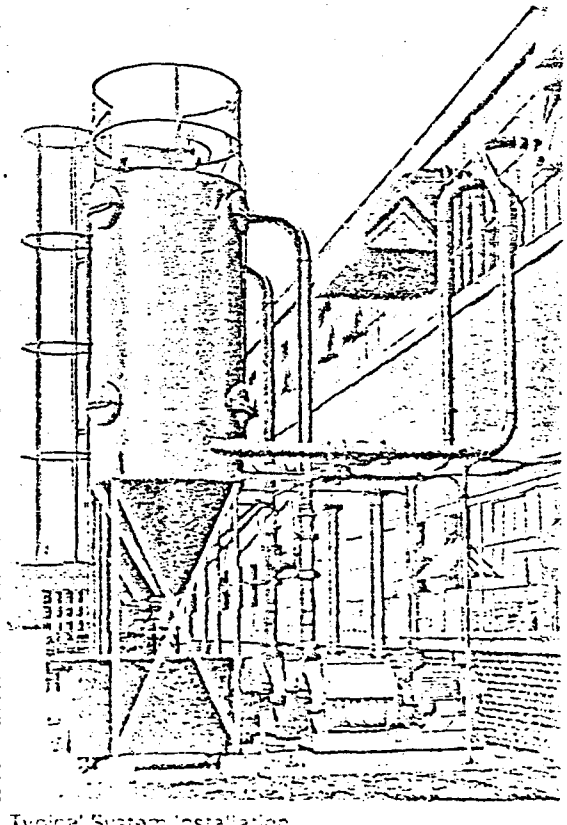


ungsten Carbide Pick-up

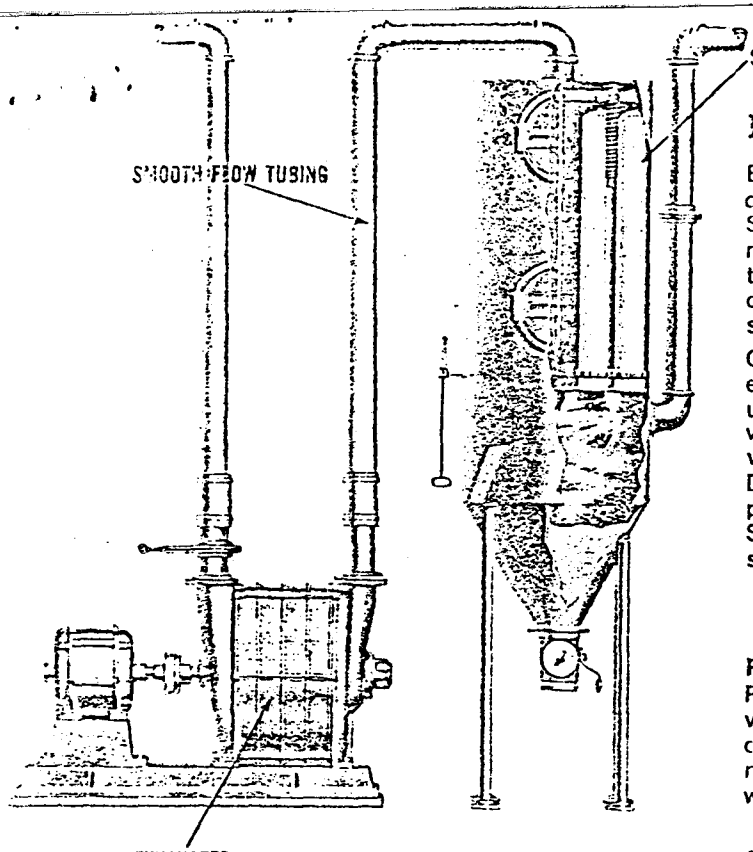
Rocket Propellant Pick-up



Dozer Belt Pick-up



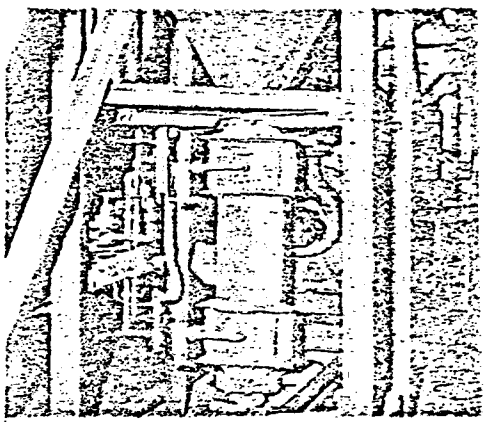
Typical System Installation



PICKUP POWER TO 12" HG

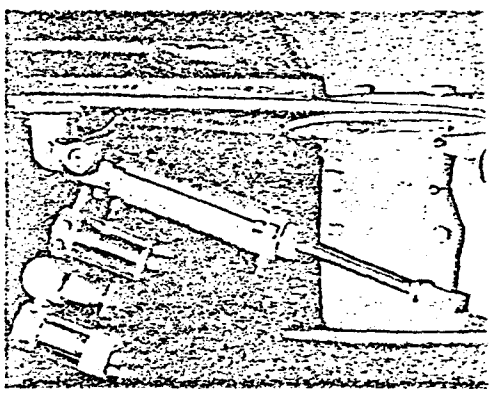
Basic equipment for a typical vacuum cleaning system consists of a centrifugal exhauster connected to a separator. Smooth Flow tubing or steel pipe carries the dust/air mixture to the separator. The tubing extends throughout the plant, with inlet valves at locations where collection is desired. A large selection of hose and tools is available to suit your application.

Of proven cast-iron, four-bearing heavy-duty design, Hoffman exhausters permit continuous unattended operation at volumes up to 13,000 Cfm, vacuum to 12" hg. Dynamically balanced rotors provide for smooth running. Standard motors and drive shafts are used.



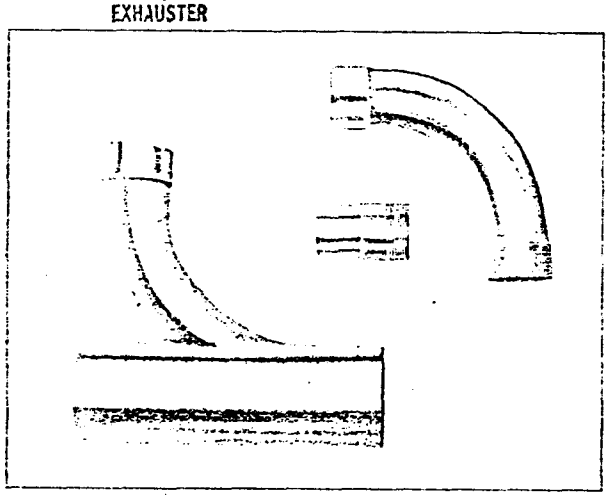
PERISTALTIC VALVE

Patented Rubber diaphragm valve continuously discharges abrasive materials which would wreck a rotary feeder.



HINGE VALVE

Unique valve for batch discharge. Flap is a cast iron spherical section with linkage arranged to be self-compensating for wear. Seals against a rubber gasket placed out of the normal flow of material. Available in manually operated version, or air operated, as shown.

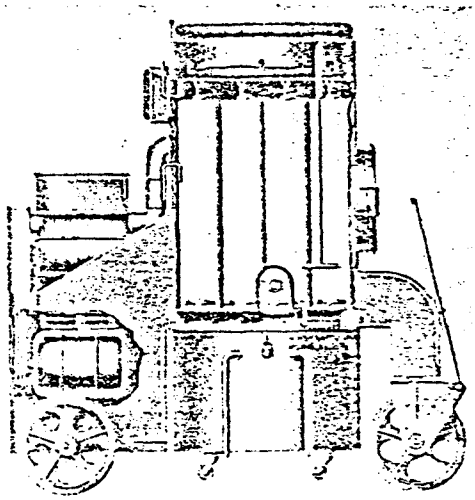


SMOOTH-FLOW®

Smooth-Flow pneumatic tubing and fittings have slip-fit joints . . . no threads. They are easily installed by non-technical personnel, with every joint fastened airtight with an adhesive or tape on the bell and tube fitting. Hoffman Smooth-Flow piping assures you of full suction power from the vacuum machine to the point of work.

HEAVY-DUTY INDUSTRIAL PORTABLE VACUUM UNITS

Hoffman heavy-duty portable vacuum cleaners through 15 HP. Mobility and flexibility enable the operator to do a thorough job of dust collecting or vacuum cleaning. Typical of the Hoffman portable units is the 10 HP Hoffco-Vac 100 developing 8.5" hg suction. Filtering area is 63 sq. ft. Removable dust bucket has a capacity of 7.5 cu. ft.



ENGINEERING SERVICE

Hoffman Application Engineers are located in every major city in the United States and, through subsidiary and affiliated companies, in Canada, Latin America and Europe. These men are specialists. They will focus Hoffman's 50 years of experience on your individual needs — and can save you time and money. You will find their names in Thomas Register and the Yellow Pages of your phone directory, or you may contact us for the engineer serving you. There is no charge, no obligation, for their service.

HOFFMAN

DIVISION OF CLARKSON INDUSTRIES, INC.

USA/Air Appliance Department
Hoffman Industries
103 Fourth Avenue
New York, New York 10003
TEL: 212-677-3500

CANADA/Hoffman Industries of Canada Limited
58 Bertal Road, Toronto 15, Ontario
TEL: 416-763-3528

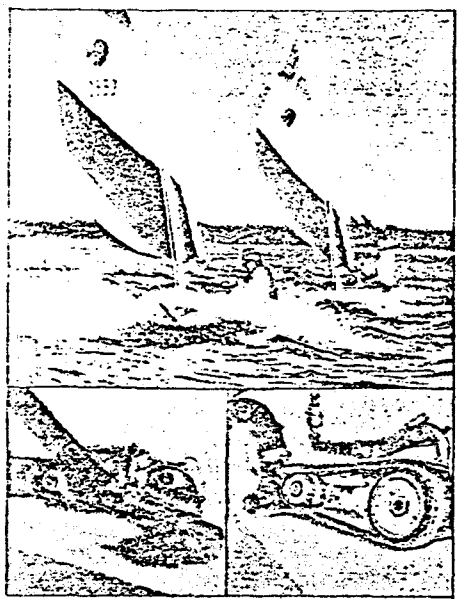
ENGLAND/Hoffman Air & Filtration Systems Ltd
Howard House — Lloyd Street
Altrincham, Cheshire/TEL: 061-928-7402

OFFICES/PLANTS: UNITED STATES, CANADA, ENGLAND, GERMANY, FRANCE, SWITZERLAND, ITALY, MEXICO

Dusthoff systems and AMF Alcort turned a dirty job into a clean one, compatible with the pleasure craft Alcort manufactures.

The use of disk sanders and belt sanders in preparing fiberglass surfaces on Alcort's Sunfish, Sailfish, and Flyingfish lines was a messy, dirty operation for the tool operators. Dust floating throughout the plant also created problems.

Working with Hoffman engineers, Alcort's manufacturing-engineering department installed two High Velocity DUSTHOFF Vacuum Systems with special intakes that fit right on the sanders. The final pick-up hoods in this case were manufactured by Alcort to meet their own special requirements. Result: Total control of respirable dust and highly effective control of large dust particles. The DUSTHOFF systems eliminated the problem of floating dust and made the sanders' jobs a lot cleaner.



This is just one of the thousands of problems created by dust generating tools and machinery that High Velocity DUSTHOFF Vacuum Systems can solve. If you have a problem even remotely related, contact your nearest Hoffman Application Engineer. Look him up in the yellow pages, or contact Hoffman directly. Hoffman Dust Control Systems, 103 Fourth Ave., New York, New York 10003.

HOFFMAN
DUST CONTROL SYSTEMS

A Division of CLARKSON INDUSTRIES, INC.