PLAINTIFF'S EXHIBIT

UC-167

Protecting The Asbestos Worker

The asbestos industry has invested millions of dollars in equipment and techniques to prevent the inhalation of asbestos dust by workers involved in the mining and milling of asbestos and in the manufacture of asbestos-containing products. Many more millions are earmarked today for continued improvement in the years to come.

Establishing Safe Dust Levels

When asbestos is mined, milled or processed in manufacturing plants, its minute dry fibers become airborne like dust particles. Long exposure to heavy concentrations of asbestos dust has been linked directly to an increased incidence of such diseases as pulmonary fibrosis (asbestosis), bronchogenic carcinoma (lung cancer) and mesothelioma among long time workers in the asbestos industry.

The first epidemiological study of the effects of asbestos dust on workers was reported in 1930. From that time on, it was generally recognized in industry that asbestosis serious enough to interfere with respiratory or cardiovascular functions could be prevented by reducing dust levels to a specified threshold limit value (TLV).

The American Conference of Governmental Industrial Hygienists (ACGIH) set the industry's first standard in 1938 by establishing a threshold limit value of five million particles per cubic foot of air. Independent research supported by the Johns-Manville Corporation concluded at about the same time that a TLV of one million fibers, 10 microns in length or longer, per cubic foot would be an adequate level for safe occupational exposure.

In 1968, the ACGIH established a new standard with a TLV of 12 asbestos fibers, five microns or longer, per cubic centimeter, and this was later modified in 1970 by reducing the time-weighted average to five fibers per cubic centimeter with a maximum or peak of 10 fibers per cubic centimeter at any one time.

This standard was adopted as a temporary measure in 1972 by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor, and is the present accepted level. However, on July 1, 1976 a new standard is scheduled to go into effect that will reduce the TLV to only two asbestos fibers, five microns or longer, per cubic centimeter on a time-weighted average.

Protecting the Worker

While there are many differences of opinion within the medical profession concerning the problem of asbestos and health, it is universally accepted that levels of asbestos dust in the workplace must be kept to a minimum.

Industry has attacked the problem in a number of ways. Typical methods implemented to control dust levels include sophisticated dust collection systems (which combine high-power exhaust fans, duct networks and high-efficiency filters); special methods of waste disposal; use of protective clothing and portable dust respirators; and innovative wetting and dampening methods which minimize dust generated during production.

The asbestos industry has developed a completely automatic fiber bag opening station that will permit workers to open the bags, remove the fiber, dispose of the bags and introduce fiber into the manufacturing process without creating dust. In general, greater use of automation is being sought throughout the asbestos industry to reduce dust levels and to minimize exposure of employees to airborne asbestos fiber.

Basically, the requirements of an effective dust control program are twofold: (1) Design fabrication processes and production equipment so as to minimize dust generation as much as possible; and (2) Implement highly organized programs of industrial maintenance (including hygiene surveys) to insure that safe levels are maintained. Periodic monitoring of dust concentrations should reveal dust levels which exceed the threshold limit value (TLV).

It is obvious that good preventive maintenance must go hand in hand with effective dust control measures if the standards recently announced by OSHA are to be achieved.

OSHA Regulations

On June 7, 1972, the Occupational Safety and Health Administration established by the Williams-Steiger Occupational Safety and Health Act of 1970 issued standards regulating asbestos dust exposures. These occupational standards deal with (1) permissible concentrations of asbestos fibers, (2) methods of compliance, (3) warning signs and labeling of potentially dangerous products, (4) monitoring of dust levels, (5) medical examinations for employees, and (6) recordkeeping by employers. These standards have one basic purpose – to protect employees from exposure to potentially hazardous amounts of asbestos dust in their workplace.

The major obligations placed on employers, and industry in general, by the new standards can be summed up as follows:

A. The employer shall maintain a healthy workplace, making sure that no employee is exposed to concentrations of airborne asbestos fiber in excess of established limits.

B. Where the exposure limits are exceeded, the employee shall be notified in writing of the situation by his employer and shall be informed of corrective measures being undertaken to reduce his exposure to a safe level.

C. Engineering controls and the implementation of safe work practices are the approved permanent methods of correction.

D. While corrective measures are being instituted, the employee shall be protected by other means, such as the wearing of an approved respirator provided by his employer, or by shift rotation.

E. The use of respirators or shift rotation to achieve control is not permitted except (1) during the time required to install engineering controls or implement safe work practices, or (2) in situations where such controls or practices are not technically feasible, or (3) in emergencies.

F. No employee shall be assigned to a task requiring the use of a respirator if his most recent yearly medical examination indicates that he would be unable to function properly while wearing one, or if the wearing of a respirator would endanger the employee's health or safety, or that of another workman on the job.

G. Special protective clothing, change rooms, and separate clothes lockers shall be provided for employees in certain situations.

H. The personal and environmental monitoring of a workplace shall be conducted by the employer to assure that the standards are being met. Employees shall have access to the results of the monitoring of their jobs.

I. Warning signs shall be posted at entrances to areas where dust levels are in excess of the standard.

J. Caution labels shall be placed on any finished asbestos-containing product that is likely to release free asbestos fiber in excess of the standard during handling, application, or fabrication.

K. The employer shall provide yearly medical examinations for employees exposed to concentrations of asbestos dust. Pre-employment and termination medical exams also are required.

L. Upon request, an employee's medical records will be made available to his family physician.

Other requirements included in the standard require that: (1) where respirators are permitted, they must be selected from among types approved by the U.S. Bureau of Mines or the National Institute for Occupational Safety and Health (NIOSH); (2) no asbestos cement, mortar, coating, grout, plaster or similar material containing asbestos can be removed from shipping bags or their containers without being either wetted, enclosed or ventilated; (3) insofar as practicable, asbestos must be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state to reduce fiber emissions unless this would diminish the usefullness of the product; (4) hand tools that may produce or release asbestos fibers in excess

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of the limits must be provided with local exhaust ventilation systems; (5) external work surfaces must be kept free of excessive accumulations of asbestos fiber; (6) waste must be collected in sealed impermeable bags or other closed, impermeable containers.

The Asbestos Industry's Commitment

The asbestos industry is firmly committed to the protection of its employees from health problems related to asbestos dust.

This commitment is evidenced by three major factors:

(1) **Past and Present Research.** The industry has spent millions of dollars to improve mining, milling and manufacturing methods during the past 30 years. Accompanying these advances have been increasingly safer working conditions in mines, factories and at job locations. This work continues unabated. The asbestos industry is working openly and enthusiastically with the Federal government and with independent medical researchers.

(2) **Cooperation in Setting Work-Safety Standards.** The asbestos industry has participated without reserve on government committees, investigative panels and at public hearings to review and improve work-safety regulations and asbestos control standards.

(3) **Implementation of Controls.** In the past decade, the industry has spent some $110 million to implement work-safety controls in its mines and plants. At least another $95 million will be spent during the next three or four years to upgrade facilities to meet the standards set by OSHA. Through its organizations – principally the ASBESTOS INFORMATION ASSOCIATION/NORTH AMERICA – the industry shares information on new control technology with its own members, its customers, and small producers and users not associated with its industry groups.

The asbestos industry also is striving for better communication between all concerned parties – workers and their unions, government agencies, basic producers and end users. The ultimate goals are the reduction of dust to a minimum level, the protection of all workers from asbestos-related diseases, and protecting the general public from future exposures to levels of asbestos dust that could be potentially hazardous to health.

Partnership for Prevention–

The Insulation Industry Hygiene Research Program

*Irving J. Selikoff, M.D.**

PARTNERSHIP FOR PREVENTION -- THE INSULATION INDUSTRY HYGIENE RESEARCH PROGRAM

Dr. Irving J. Selikoff, Director, Environmental Sciences Laboratory, Mount Sinai School of Medicine, New York City, and Director of the Insulation Industry Hygiene Research Program, describes this unique cooperative effort by an international labor union, Johns-Manville, science and government to conduct a preventive hygiene research program for insulation workers. Dr. Selikoff explains why the program was needed, how it was formed, and some of its accomplishments.

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OCCUPATIONAL MEDICINE

Partnership for Prevention–
The Insulation Industry Hygiene Research Program

*Irving J. Selikoff, M.D.**

The nation's first cooperative effort by an international labor union, industry, medical science and government to conduct a preventive hygiene research program for insulation workers has been in productive operation for a year and a half. In the development of specific techniques and equipment to control and prevent exposure to dusts, as well as in the experience of cooperative support, the program will have application far beyond the insulation industry.

It is an achievement of modern medical methods and applied industrial hygiene practices that it has been possible in the course of a relatively few years, to detect the long-term effects on workers of an important occupational health hazard, to identify major sources of this hazard, and to take positive steps toward its reduction and, we hope, eventual elimination.

That this required the combined efforts of clinical and epidemiological medicine, the cooperation of an international union and its 18,000 members, and the direct involvement of a major industrial concern and its facilities for applied research should not be surprising.

The Insulation Industry Hygiene Research Program has three major goals: the prevention of dust formation; the control and limitation of dusts that are unavoidable, and preventing inhalation of dust by those exposed to it. The avenues of approach toward these goals involve both human elements – changing work practices of the insulating workmen – and technological elements – changing methods of manufacturing and application of insulating materials.

The program has been functioning for somewhat over a year, and it appears that the threshold of control has been crossed. For example, we have developed a new type of respirator intended specifically for use where fibrous dust generation cannot be avoided. New types of containers for mixing asbestos cements are being used; insulating materials are being coated with a spray that keeps particles from shaking loose during transportation and handling. Prefabricated fittings have been developed that will preclude working with loose materials in tight places. New control methods are being tried for application of sprayed insulation materials on major construction projects. Better methods for collecting and disposing of dust-generating wastes are being tested. Prototype ventilating systems for power saws used in cutting insulating products are proving remarkably effective in preventing production of respirable dusts.

JOINT PROGRAM BEGUN IN 1968

This joint enterprise enlisted the support of the Johns-Manville Corporation, a major producer of insulating materials; the International Association of Heat and Frost Insulators and Asbestos Workers; the Environmental Sciences Laboratory at Mount Sinai School of Medicine; and the Bureau of Occupational Safety and Health of the U.S. Public Health Service. Subsequently, the Sprayed Mineral Fiber Manufacturers Association, Inc. added their participation. The cooperation of insulating contractors throughout the country and regional groups of contractors who are directly involved in all aspects of applying insulating materials, was freely given and appreciated.

For coordination of the program and to assure continuing input of new concepts and new techniques, we established an Advisory Council with representatives of medicine, labor and industry – the elements directly concerned with the application of preventive measures and with their widespread adoption throughout the insulating and related industries.†

While today we can check off the progress already made toward solving some of the occupational health

*Program Director, and Director, Environmental Sciences Laboratory, Mount Sinai School of Medicine of the City University of New York.

†The Advisory Council membership is: Irving J. Selikoff, M.D., Director, Environmental Sciences Laboratory, Mount Sinai School of Medicine (IIHRP Director and Chairman); E. Cuyler Hammond, Sc.D., Vice President, American Cancer Society, New York, N. Y.; Albert Hutchinson, General President, International Association of Heat and Frost Insulators and Asbestos Workers, Washington, D.C.; J.B. Jobe, Vice President, Johns-Manville Corporation, New York, N.Y.; Fred L. Pundsack, Vice President, Research and Development, Johns-Manville Corporation, New York, N.Y., and George W. Wright, M.D., Director of Medical Research, St. Luke's Hospital, Cleveland, Ohio.

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programs and can look ahead with confidence that further strides will be made, it is instructive to review the events leading to the identification of the hazard and to consider why recognition and corrective action was taken only recently. The lessons learned may be applied to other industrial situations.

It is too easy to indulge in what might be called the demonological theory of industrial hygiene history. One version would place the responsibility for early identification of risk and its correction upon industry and then indict it for trading human health for profits. Similarly, the other side of this counterfeit coin puts the blame on organized labor for having been more interested in premium pay for hazardous work than in eliminating known hazards. Both conclusions are too convenient and are essentially erroneous. It is much nearer the truth to say that both industry and labor shared in ignorance and neglect of the problem. Science and medicine are also at fault here for inadequate attention to environmental and occupational health.

In retrospect, however, it is possible to see why recognition was so long in coming. We now know that it may take 20 to 30 or more years from onset of exposure before the effects of this particular hazard begin to manifest themselves in the morbidity and mortality of the workers.

In the asbestos mining and manufacturing industry, the risk of heavy exposure to the occupational dusts had been recognized for some years. And this primary industry has understood the need to install ventilation systems and other dust control devices to reduce the hazard. Experience had indicated that reduction of dust levels and exposures could result in greatly improved health experience among asbestos factory workers.

But the extrapolation of that experience to another classification of workers – specifically those who fabricate and install insulating materials – was a more sophisticated task for clinical medicine and epidemiology.

An immediate problem is that the insulating workers are not a centralized homogeneous group that can be studied at once, but are composed of units of small numbers that do not immediately exhibit conspicous definable trends or patterns of health. For example, the 18.000 unionized insulation workers in this country are dispersed among some 850 employers – an average of 17 workers per employer, with only one-sixth having more than 20 employees regularly. The unions are organized by locals and only two of these locals have as many as 700 members each. Further difficulties were imposed by the fact that 30 or 40 years after an insulation worker had been first exposed, he frequently was retired and no longer easily traceable.

With the full cooperation of the New York area locals of the Heat and Frost Insulators and Asbestos Workers Union, my associates and I set up in 1962 a program to compile the work history and health records of the 632 men who were members of the union on January 1, 1943. Each of these men was traced through 1962. Among these men with exposure of at least 20 years to asbestos and other insulating dusts, there were 255 deaths, 52 more than the expected number based on comparable U.S. mortality figures. Analysis of causes of death revealed 12 due to asbestosis, 42 deaths attributed

FIGURE 1. Members of the Advisory Council of the Insulation Industry Hygiene Research Program joined a team of industrial hygienists on a construction site field trip to observe environmental conditions of insulation workers. From right, Dr. Irving J. Selikoff, Program Director, Dr. E. Cuyler Hammond, Vice President, American Cancer Society, Dr. Fred L. Pundsack, Vice President, Research and Development, Johns-Manville Corporation.

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to lung cancer, and four from mesothelioma, a malignant tumor rarely reported among the general population.[1]

STUDY SHOWS HIGH RISK OF DISEASE

Here we had, then, the first solid evidence that these insulation workers were experiencing exposures to dust inhalation in the basic asbestos industry. Our continuing study of the work and health records of this group of union members confirms the higher risk of respiratory disease and cancer for the insulating workers than exists among the general population.

There were 632 members of the New York area locals of the asbestos insulating workers' union on Dec. 31, 1942. By Dec. 31, 1968, 300 were dead from various causes, including 30 from asbestosis, 72 from lung cancer, and 22 from mesothelioma.[2]

Apart from the occupational hazard, a most significant relationship between lung cancer and the combination of cigarette smoking and insulating work has been revealed. This particular phase of the study started in January 1963 when 370 men of the original 632 were still alive. By November 1, 1969, 36 cases of lung cancer had developed. The group of 283 cigarette smokers contributed all but one of the lung cancer cases. This finding suggests that among these workers who smoke cigarettes, the risk of dying of bronchogenic carcinoma is 92 times that of men who neither smoke cigarettes nor work in the insulating industry.[3] Here obviously is a preventive problem involving the personal habits rather than the work habits of a large group of workmen.

Confronted with the evidence of job exposure to asbestos and other dust hazards, the first urgent task was to seek to identify the sources of exposure. It is known that a large proportion – something over 50% – of the asbestos used in this country for the past 40 years has gone into the construction industry in one form or another. It is fortunate that the greatest part of this has been in products in which the asbestos is "locked in" – that is, it is bound with cement or plastics or other binder so that there is no release, certainly no significant

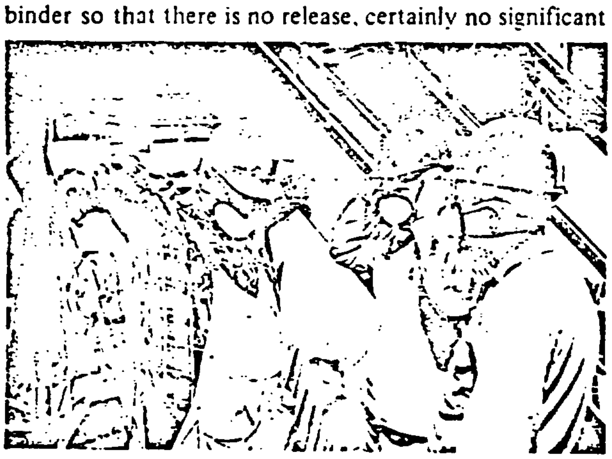

FIGURE 2. Insulating workers, members of the Asbestos Workers Union, test prototype dust masks for efficiency and comfort on Illinois job site. Each of these masks incorporates slight design differences.

FIGURE 3. A proposed method to eliminate a major source of dust at construction sites has been the development of a plastic mixing bag for asbestos cement. Bags are partly filled with dry cement at the factory. Water is added on the job through a valve at the top of the bag which accomodates the nozzle of a hose, and the result is mixed up in the bag.

release, of asbestos fiber in either working areas or general air. Such products as floor tiles, roofing felts, asbestos cement products, siding material, and the like contain the locked-in fibers.

Attention therefore was turned to those insulating products which were capable of generating dusts on the job – through handling, sawing, fabricating, applying, mixing, as with loose asbestos cement, spraying, and waste disposal.

Examination of these activities, where there was obviously generation of dusts, quickly taught us that we were to be concerned with what happens at three levels of exposure: first, the insulating worker who is most directly and intimately subject to dust exposure; secondly, other construction workers who may be working in the vicinity of dust generation or who may be called upon from time to time to come into intimate contact with insulating materials; and third, the nearby ambient air which, under many circumstances, will certainly receive the drift of dusts and fibers from insulating activities.

Our primary concern, of course, is with the insulation worker, not only because we have established the risk for him but because if his exposure is brought under control, then the other problems will be resolved automatically. There is some evidence of increased respiratory disease risk for other construction workers, although we do not know its extent or whether this is because of direct contact with the material or indirect

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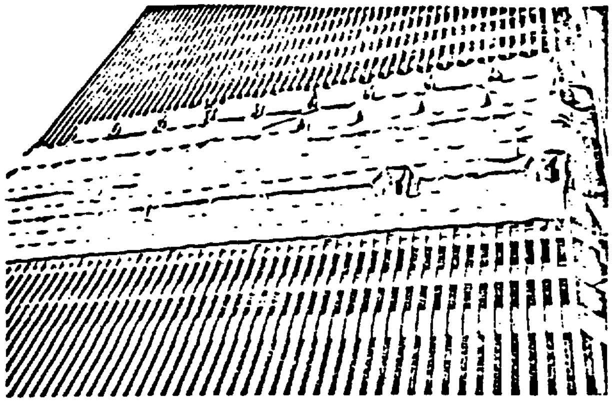


FIGURE 4. Spraying of girders and spandrels with mineral fibers for fire-proofing can be conducted with reduced release of mineral dust into the air through containing the operation behind tarpaulin covers, as shown here on the new World Trade Center building in New York City.

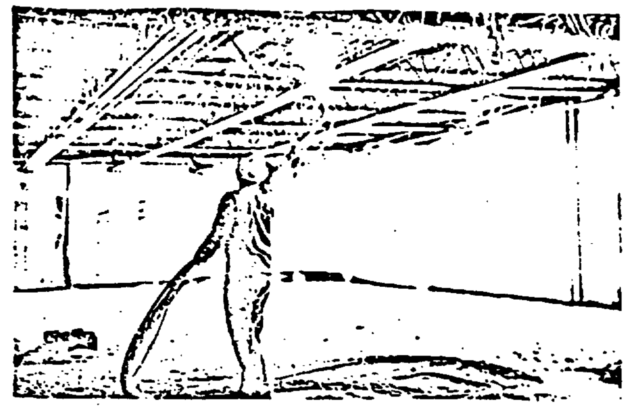


FIGURE 5. An inside view of the spraying of ceiling joists with mineral fiber at the World Trade Center Building. The spray area is sealed from other work areas at the elevator shafts as well as at the windows. The operator wears a respirator.

exposure in the vicinity of insulating work. And while there is at present no evidence of community risk from asbestos fibers in the ambient air, it is only prudent, especially with our concern for reducing general air pollution, that job-generated dusts and fibers be prevented from drifting into the community air.

Much of the technology for dust prevention and control was developed and used in many mines and plants; the technique for adapting these to the particular jobs and job-sites of insulation workers continues to present challenges. We are currently required to work toward these related goals simultaneously – the prevention of dust inhalation by workers who are now exposed, the limitation of dusts that are presently unavoidable, and ultimately, the prevention of dust formation.

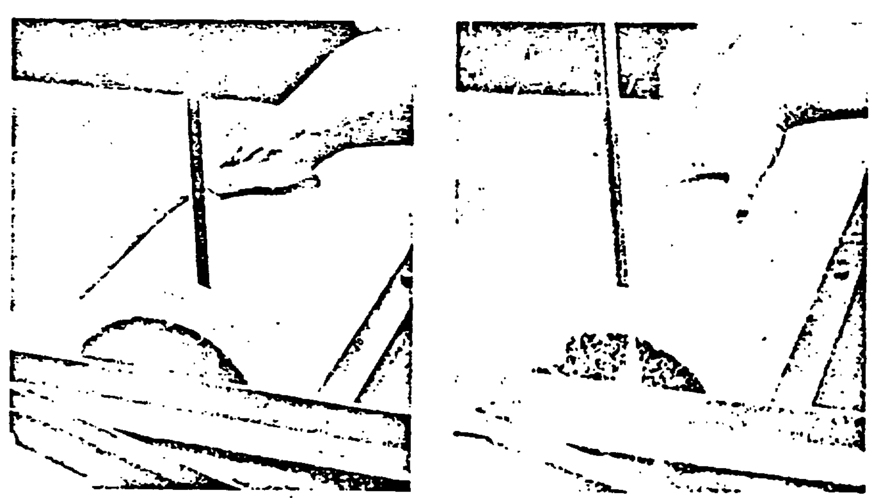
SAFE PRACTICES BEING DEVELOPED

Immediate protection against dust inhalation was among the more urgent problems. Although various respirators and dust masks had long been provided for those working in heavy concentrations of asbestos and other dusts, we found in actual practice only 4% of union members surveyed said they always used a mask on a dusty job and almost 30% said they never used such protection. We immediately turned our efforts toward developing a new type of respirator – one that would not only be effective against the fibers and dusts generated in insulating work but, more importantly, one that would meet the workers' requirements of comfort, convenience, and good vision.

We have not yet achieved our goal, but we are perfecting a new type disposable mask that is specifically designed to meet the requirements of those who will wear it. The first field use tests in the spring of 1969 revealed some shortcomings that sent us back to the design laboratory. We are confident that the result will be a respirator that will be more acceptable to insulating workers and that may be adapted for many other occupations where breathing masks are required – but too seldom worn. As our colleague, Dr. Cuyler Hammond, has said, it is far better to have a mask that is 100% used, even if not fully effective, than one that is fully effective but never used! We are developing a mask that will be both effective and worn.

What we aim to achieve is a working environment in

FIGURE 6. A newly-developed portable suction attachment for portable power saws on construction sites is nearly 100% effective in collecting dust. In the picture on the left, a section of asbestos pipe covering is being cut with the use of the suction attachment. The picture on the right shows the dust which would be released into the air if the attachment was not used.



which dusts are so fully controlled that respirators may never be necessary. One stumbling block has been that in installing insulation it is necessary to mix some asbestos cement on the job site. This is spread and applied to seal joints and to fill in corners where pre-fabricated material is not practical. Previous and present practices call for mixing this combination of asbestos and cement or other binding materials in open troughs or mixing bins. Almost every step in this process generates some dusts – from the emptying of bags to the mixing of the material with water. At present, we are testing two different methods of packing an asbestos-cement mixture so that the water can be poured *into* the container and wetted down into the so-called "mud" without generating dust. We know that this will work, and it is merely a matter of determining practical sizes of containers, the best material for the bags, and the most convenient means of applying the water and mixing within the bags.

Many insulation fittings are manufactured at a plant, packed and shipped in containers that are opened at the job site. It was found that these fittings were shedding during the handling, so that the containers themselves were emitting dusts and the fittings continued to shed during handling. Industry research laboratories developed a method of spraying these fittings with a wax-like substance before packaging. This dust-suppressing spray method, developed at the Johns-Manville Research and Engineering Center, prevents the dust from shaking loose and has, therefore, provided another means by which we *prevent* the generation of dust – our ultimate objective.

Although shaping and fabricating of insulating materials is sometimes done in shops that are fitted with special dust-collecting devices, there continues to be much individual sawing on the job site – either with hand or power saws, which have not had dust collectors. We posed this problem to makers of portable power saws. Now there are pilot models of power saws with suction attachments that are nearly 100% efficient in dust prevention.

Even as these positive and constructive steps are being developed, we discover that new and difficult questions arise. Monitoring for dust counts still needs refinement – and we do not actually know what the minimum necessary level is. Therefore, we seek to achieve as near zero generation as possible. Attention has been turned to the collection, transportation and disposal of construction wastes – which in New York City alone amounts to some 2,000 tons a day. The manufacturers and applicators of sprayed insulating materials are developing new methods and work practices to contain the dusts involved in this operation. Shipyards pose special problems that our technical people are studying.

And there is still the practical problem of making sure that the new methods and techniques are adopted by employers and workers and applied to their daily procedures. Fortunately, we are getting excellent response from contractors and contracting groups, and the participation of union members is assured. Each union member contributed $10 to help support the program (it is thus *his* program!). A quarterly report of progress is published, and is sent to each union member, to contractors, other union groups, industrial hygienists, educators, physicians and other scientists, and government officials involved in occupational health activities.

This partnership for research into prevention of the occupational health hazards of the insulating industry – forged by labor, industry, science and government – has proved useful. It is possible that it will provide a key to similar partnerships in other industries where occupational health problems exist.

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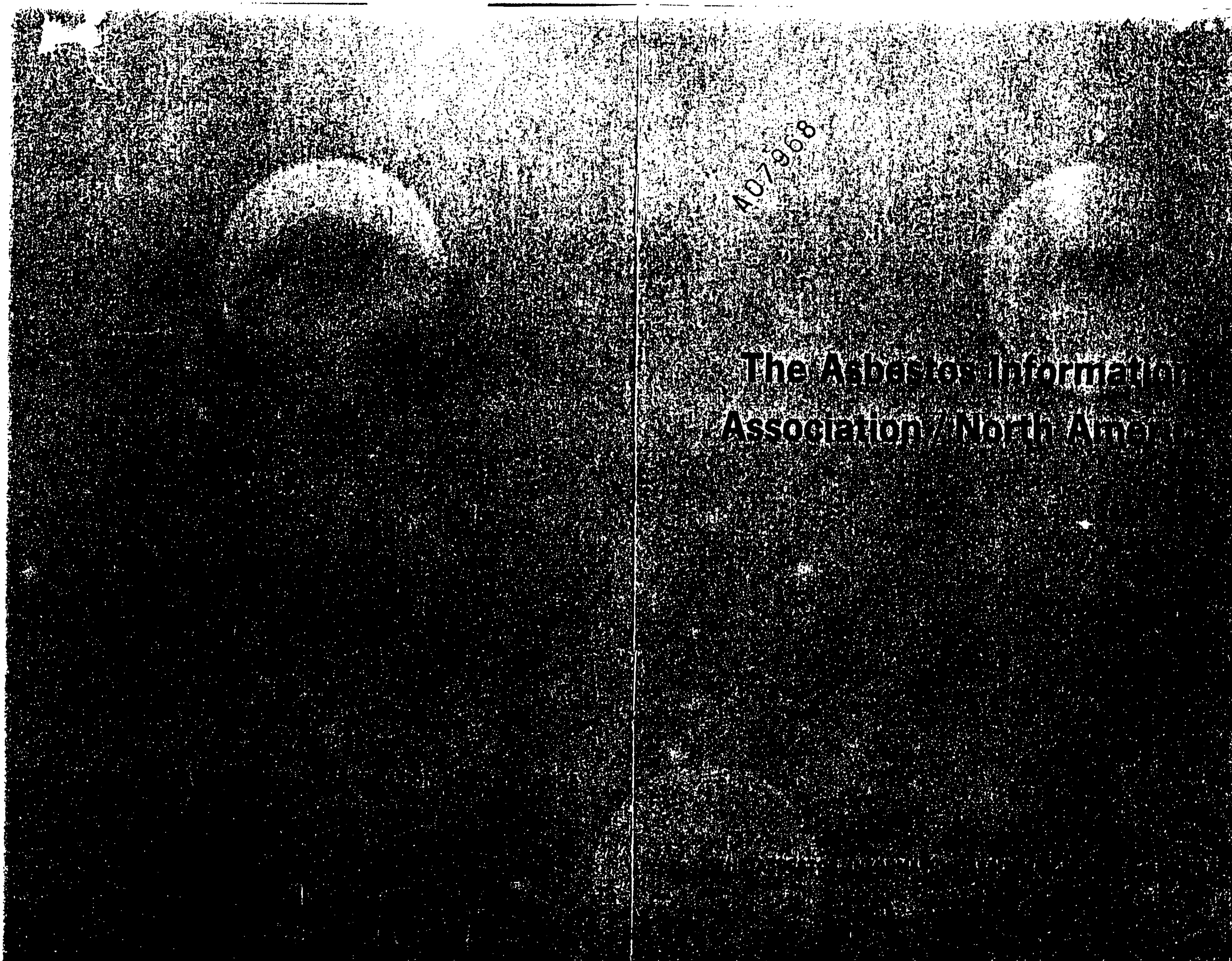

The Asbestos Informatio
Association / North Ame

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The Asbestos Information Association/North America

In recent years, new findings relating prolonged inhalation of asbestos fibers to various occupational health hazards have created understandable public and governmental concern. This concern, nurtured by lack of information on the true nature and extent of these hazards, has at times created an emotional and irrational attitude toward asbestos in all its forms and applications.

Members of most producer and user companies, which have for some time implemented worker-protection procedures, individually attempted to provide facts to the press, government and public about the nature and extent of asbestos health problems and efforts to correct them. However, the industry lacked a single, constantly available source able to provide authoritative information on asbestos-health in the United States and Canada.

This situation was changed with the formation of the ASBESTOS INFORMATION ASSOCIATION/NORTH AMERICA (AIA/NA) in December 1970. Its objectives are:

1. To provide industry-wide information on asbestos and health, and on industry efforts to eliminate existing hazards;

2. To cooperate with governmental agencies in developing and implementing industry-wide standards for worker protection and for the control of asbestos dust emissions into the community air;

3. To exchange information on methods and techniques of asbestos dust control;

4. To correct misleading and uninformed reportage on asbestos-health problems;

5. To publicize the unique benefits and importance of asbestos in protecting human life and property.

The AIA/NA is governed by a Board of Directors comprised of representatives from all member companies. Day-to-day activities are conducted by an Executive Committee, which consults with member company industrial hygienists and environmental control experts, legal counsel and medical consultants whenever necessary. The chief staff officer is the Executive Secretary, Matthew M. Swetonic, who functions from AIA/NA headquarters, 22 East 40th Street, New York, New York 10016.

In its first two years of existence, the AIA has, among its many activities, conducted a full day seminar on asbestos-health for industry officials; nominated industry environmental control specialists to sit on governmental advisory committees examining (1) occupational hazards of asbestos, and (2) ambient air emissions; testified at both Federal Environmental Protection Agency and Department of Labor hearings on asbestos; sponsored technical research into the reliability of the method currently being used to measure asbestos concentrations in the workplace; provided speakers for seminars on occupational health, and developed informational programs to keep the industry fully aware of all new developments, whether medical, governmental or technical, concerning asbestos-health.

The AIA/NA, since the promulgation of the OSHA occupational health standards on asbestos in mid-1972, has devoted much of its efforts to assisting the member companies and others within the industry with their compliance programs. A five booklet OSHA compliance manual developed and produced by the AIA/NA was scheduled for publication in mid 1973.

The AIA/NA has also provided information on asbestos-health to the press, medical researchers, federal government officials and agencies, such as the Food and Drug Administration, the Department of Labor, the Department of the Interior, the EPA, and also to officials at the state and local governmental levels. It has attended and participated in local, regional and international conferences on asbestos-health, and

also maintains a close working relationship with other asbestos industry groups, including the Asbestos Textile Institute, Asbestos Cement Products Association, Friction Materials Standards Institute, the British Asbestos Information Committee and Asbestosis Research Council, and similar groups in France, the Benelux countries, and Scandinavia.

AIA/NA Membership List

Amatex Corporation
Atlas Asbestos Company
Cassiar Asbestos Corp., Ltd.
Cement Asbestos Products Company (CAPCO)
Certain-teed Products Corp.
Congoleum Industries, Inc.
The Flintkote Company
GAF Corp.
Jim Walter Corp.
Johns-Manville Corp.
Kentile Floors, Inc.
National Association of Filter Manufacturers
National Gypsum Company
Nicolet Industries, Inc.
North American Asbestos Corp.
H. K. Porter Company
Raybestos-Manhattan, Inc.
Supradur Manufacturing Corp.
Union Carbide Corp.,
Uvalde Rock Asphalt Company

ASBESTOS INFORMATION ASSOCIATION

1 February 1974

The Editor
"Time"
Time and Life Building
Rockefeller Center
New York, N. Y. 10020

Dear Sir:

The article, "Death from Dust", January 28, describing conditions at an asbestos insulation plant in Tyler, Texas, should not be viewed as reflective of the situation existing in the vast majority of asbestos manufacturing plants in the United States.

For many years, the industry has recognized the potential serious health hazards of excessive asbestos inhalation and has installed sophisticated control equipment and instituted improved work practices to reduce dust concentrations to acceptable levels so as to provide a safe and healthy working environment for industry employees. In addition, the asbestos industry throughout the world is conducting, sponsoring, or cooperating in extensive medical and technical research to learn even more about the health hazards of asbestos and the means for their control.

Sincerely,

R. H. Mereness
Executive Director

RHM/cg

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Asbestos health question perplexes experts

When asked to comment on research directions before an international conference on the biological effects of ingested asbestos in Durham, N.C., last month, Dr. Paul F. Holt of Reading University, England, summed up the feeling of the whole conference in his response. The main question to be investigated, he said, is: Does asbestos matter, or doesn't it?

Coming after more than 40 years of published research on the biological effects of asbestos—research that has been greatly intensified over the past 10 years in the U.S. and abroad—this seems a very preliminary question to still be under investigation. Nevertheless, although asbestos is known to cause severe lung damage and to raise the likelihood of certain cancers developing following heavy exposures, the effect of smaller doses on the general population isn't at all clear.

It seems very farfetched that asbestos could be dangerous, Dr. Holt says, but if it is, then everyone is in very serious trouble. And indeed they would be. It seems likely that asbestos occurs naturally in much of the drinking water in the U.S. Environmental exposure to it is increased by filtration of certain beverages and pharmaceuticals through asbestos filters. Used extensively in construction for its fireproofing qualities, asbestos contaminates the air in most office buildings and stores. An examination of lung sections of people living and working in New York City has shown some fibers in the lungs of every person examined. Similar results probably could be found in any other urban area in the nation.

Clearly, there is a need to determine whether this constant and widespread exposure is hazardous. To help evaluate the danger associated with asbestos exposure as it is now understood and to examine new directions in research to enable a more complete understanding of the effects of asbestos ingestion and exposure, the National Institute of Environmental Health Sciences and the Environmental Protection Agency sponsored last month's conference. Attended by some 130 scientists and public health officials from 12 countries, the conference emphasized the limited amount of information available on the effects of low-level, prolonged exposure. The scientists also pointed out how difficult it is to obtain accurate information on these effects.

There are three serious difficulties in determining the effects of asbestos on human health, the conference speakers agreed:

- The term asbestos itself is misleading, for it encompasses a whole group of minerals that are distinct from each other in chemical composition, particle size, and probably biological effect.
- Many of these particles are so small that detection is extremely difficult and time consuming, placing restraints on the scope of research that can be reasonably undertaken.
- Perhaps the most serious difficulty in asbestos research, however, is the very long period between initial exposure and evidence of biological effects. In the case of mesothelioma, an asbestos-induced cancer of the linings of the abdomen and chest, this time period is usually 25 to 35 years.

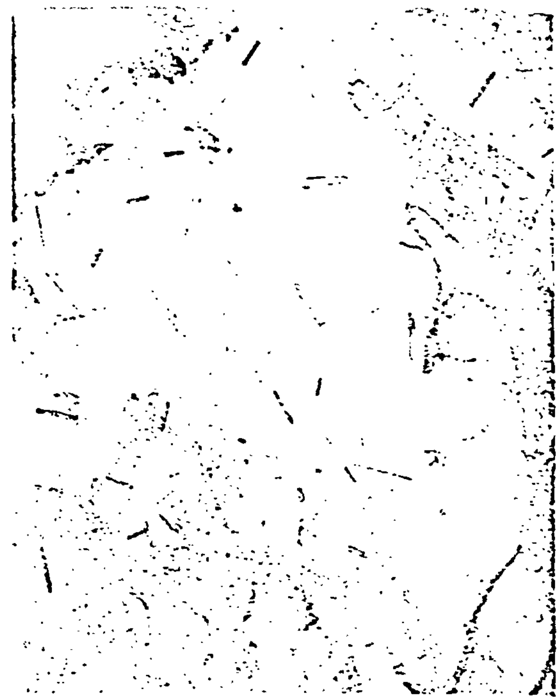
Asbestos is any of several silicate minerals existing in fibrous form. The *Federal Register* lists six main types of asbestos mineral, each with its own chemical composition. To add further confusion, each of these chemical forms exists in both a fibrous or "asbestiform" variety and in a nonfibrous type that is sometimes considered an asbestos mineral and sometimes not.

Chrysotile asbestos is the most distinct asbestos form and the one most widely used in industry. A magnesium silicate hydroxide, chrysotile exists in nature as a bundle of very small fibrils, each less than 5 microns in length and about 0.2 micron in diameter. These fibrils are hollow, and their large surface area and relatively high surface charge allow for great adsorption of trace metal ions to these particles.

The other asbestos minerals, collectively referred to as the amphibole minerals, have a significantly larger fiber diameter and are solid fibers. They have sodium, calcium, and iron occurring in their lattice structures, in addition to magnesium and randomly substituted trace metal ions. Although not used as extensively for industrial purposes, the amphibole minerals commonly are found as contaminants of talc, chrysotile, and other widely used minerals.

Chrysotile fibrils are too small to be detected by conventional optical microscopy. To identify these particles positively, Dr. Arthur M. Langer of Mt. Sinai School of Medicine in New York City explains, a combination of transmission electron microscopy, selected area diffraction, and microchemical analysis is needed. Others believe that scanning electron microscopes could be useful in detecting chrysotile in combination with some type of chemical identification, but all agree that the main drawback to any detection technique that requires electron microscopy is the time involved for each analysis—about one man-day per sample. Any investigation of the occurrence of asbestos in the general population or in the environment must consequently be very limited in scope.

Amphibole asbestos fibers are larger. But they also require sublight microscopes for careful examination and cannot be positively identified without additional microchemical or selective area diffraction analysis.



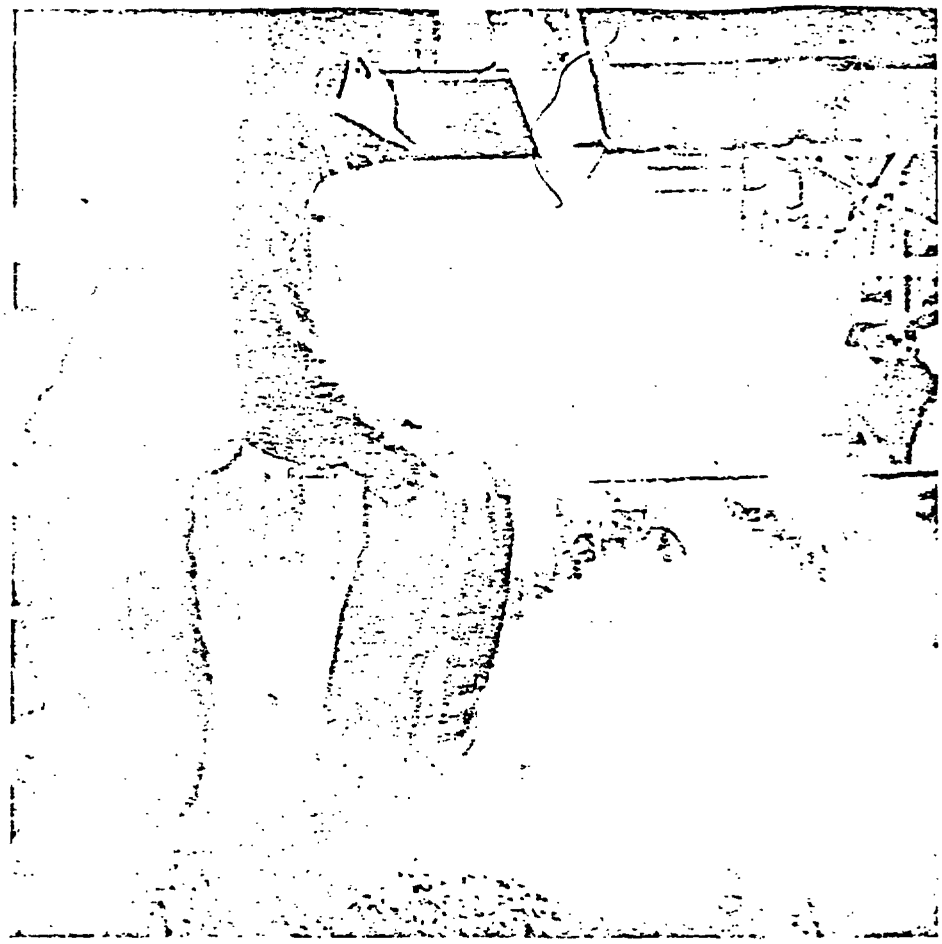
Chrysotile fibers in lung tissue

The research workers at the conference expressed great hope that advances in automated analysis would make more extensive sampling possible by cutting down on the time required for analyzing each sample. Dr. Eugene P. White of Pennsylvania State University, for example, described a computerized system for examining small particles using a scanning electron microscope that is currently used in his laboratory for analysis of coal mine dust.

The most serious deterrent to understanding the biological effect of ingested and inhaled asbestos, however, is the long incubation period of certain asbestos-induced effects. Asbestos workers in the shipbuilding industry in the U.K. in the 1930's began to develop statistically high incidences of the previously rare cancer form mesothelioma in the late 1950's, more than 20 years after their asbestos exposure. Since that time, many other cases of the disease have been reported in patients who worked with asbestos 25 to 35 years earlier.

Dr. Irving J. Selikoff, director of the Environmental Health Sciences Center at Mt. Sinai School of Medicine, presented data to the conference from several mortality studies of occupationally exposed asbestos workers in New York and New Jersey. His studies show increases in interthoracic cancer and mesothelioma more than 20 years after heavy asbestos exposure.

In addition, he found that although lung cancer deaths did not appear to be more frequent among nonsmoking asbestos workers than among the general nonsmoking population, they were very much more frequent among smoking asbestos workers than among other smokers. In one study of 17,800 asbestos insulation workers, of whom 9590



Asbestos cement worker wears mask to screen out chrysotile fibers

were smokers, there were five to six times the predicted number of deaths from lung cancer among the smokers. A smaller study of insulation workers in New York showed 10 times the expected number of deaths caused by lung cancer among the workers who smoked cigarettes.

The question of most concern to public health officials, and the area of most intensive research at present, is the effect of asbestos exposure at intermediate levels and the effect of low-level exposure to asbestos in combination with low levels of other carcinogens that are often present in the environment.

Research on these questions takes two directions. The most reliable information on the health hazard of asbestos to man will come from one of the research directions, studies of the effect of the mineral on man himself. Thus, the studies that Dr. Selikoff and his associates have begun on asbestos workers in New York and New Jersey are being continued and expanded. Dr. Selikoff points out that there are some cases of mesothelioma in New Jersey that cannot be traced to any asbestos exposure. These are being further investigated to see if a cause for them can be found. Multiple effect correlations, such as that between cigarette smoking and asbestos fiber inhalation, are being looked for also.

Dr. Ian Webster of the National Research Institute for Occupational Diseases in Johannesburg, Republic of South Africa, told the conference of a massive effort by the South African government to establish the danger of asbestos exposure. South Africa mines both amphibole and chrysotile types of asbestos. The government hopes to conduct mortality studies on all of the workers in these mines since 1953.

Most of the workers come from nomadic groups living in the desert regions of South Africa. They work in the mines for brief periods then return to their homes, making them very difficult to keep track of. Nevertheless, the government hopes to be able to follow a substantial number of these workers and determine, at the very least, which asbestos forms are the most dangerous ones.

The other direction of current asbestos research uses laboratory animals to study details of the effect of the fibers on tissues. The drawbacks of making inferences from animal models were repeatedly pointed out by speakers at the conference. Especially in cancer research, different animal species often respond substantially differently to the same agent. Consequently, many different animal models must be used and compared if animal response is to be reliably extrapolated to humans.

Animal studies seem to show that although inhaled asbestos can be found in the diaphragm, liver, and the epidermal layer close to the gastrointestinal tract, ingested asbestos is very poorly absorbed, if at all, through the lining of the stomach and colon. Dr. John M. G. Davis of the Institute of Occupational Medicine, Edinburgh, Scotland, could detect no asbestos passing through the stomach or intestinal walls of rabbits fed asbestos fibers in his laboratory. However, Dr. R. D. Pontefract of the Canadian Food Research Laboratories injected an asbestos sample directly into the stomachs of laboratory animals and was able to detect about 0.1% of his sample in the epiderm. In studies with baboons, Dr. Webster found that very little ingested asbestos penetrates the walls of the stomach and colon and that almost all that does is of the smaller chrysotile type. Studies with inhaled asbestos also show that the fiber that is absorbed is predominantly the chrysotile type.

Conclusive evidence on the effect of environmental levels of asbestos on man, or even reliable estimates of what that level is, will not be available for some time. In the meantime, current asbestos exposure may be causing cancers that will not be detectable until the next century. Thus, representatives of regulatory agencies present at the conference agree with asbestos research workers that asbestos presents too much of a threat to human health to be used indiscriminately until conclusive evidence is available. There is not yet complete agreement, however, on what sort of regulation should be implemented.

Dr. William Eisenberg of the Food and Drug Administration explains that it is not possible for FDA to run electron microscopy analyses of all the potential sources of asbestos contamination under its jurisdiction. At present, analysis by polarized light microscopy is used to determine purity of foods and drugs, even though this method probably misses many of the smaller and more easily absorbed asbestos fibers that may be present in these materials. FDA's main concern, according to Dr. Eisenberg, is with parenteral drugs rather than with substances that enter the body through the gastrointestinal tract, since relatively small amounts of ingested asbestos appear to penetrate the body. Last September FDA began taking steps to eliminate the use of asbestos filters in the production of parenteral drugs.

EPA's Gordon Everett calls for standardization of reporting data so that the necessarily limited amount of data collected in each study can be usefully compared with results from other studies. He points out that information on the biological effects of asbestos is very limited and that the effects of many asbestos substitutes have not been investigated at all. Before asbestos use is banned, it should be certain that a safer alternative is available, he cautions.

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Calidria ASBESTOS

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GRINDING CALIDRIA ASBESTOS PELLETS

The following discussion is intended to assist in equipment selection and planning for use of CALIDRIA Asbestos products in pellet form, to take advantage of their higher bulk density, dust-free nature, and free-flowing properties.

The pellets are cylindrical, about 3/8 in. diameter and up to 3/4 in. long. Bulk density is about 44 lb. per cubic foot. No additives or binders are used; they are held together by natural forces. For some applications, a cracked pellet form is available, in which the pellets have been crushed to minus 3 mesh. Either form has a negligible amount of minus 325 mesh dust, which is the important fraction in airborne contamination.

For size analysis of the ground products, we recommend wet screening by either the Bauer-McNett method or by hand-jigging. Some operator training is necessary in the latter method to obtain reproducible results, particularly in the finer mesh sizes.

Storing and feeding pellets is simplified by their free-flowing, non-abrasive nature. Cone-bottom bins or hoppers with a 90° included angle are self-emptying. Almost any feeding and conveying equipment will work with asbestos pellets. For accurate feeding, a screw feeder or weigh-belt feeder is preferred, rather than vibrating feeders. The pellets can be air conveyed, but due to their granular nature, high air to solids ratios are required and some dust will be generated. Pellets are available in bulk hopper cars holding up to 90 tons, and in 50 lb. or 100 lb. multiwall paper bags. Arrangements can be made for other containers to suit customer requirements.

Dry grinding may be done in a variety of equipment: disc mills, grate hammer mills, air-swept mills, etc. Disc mills are suited to coarser grinds and have the advantage of requiring a minimum of air cleaning equipment. Grate hammer mills, such as the Jeffrey and the Mikro-P, are versatile in application and produce a minimum of "tramp" oversize, but dust collection is necessary and screen maintenance can be a problem, particularly if an extremely fine grind is desired. Air-swept mills, such as the Raymond Vertical and the Bauer Hurricane, are well suited to medium and fine grinding in production operations. Table I summarizes some of the factors involved in selecting dry grinding equipment.

A particularly effective wet grinder for pumpable slurries consists of a high-speed (16,000 FPM tip speed) vertical hammer mill, such as a Reitz, with the grinding chamber enclosed by grooved hard alloy liner plates. Asbestos and process liquid are introduced at the bottom and overflow the top of the grinding chamber. Screen maintenance problems are eliminated, and the grind can be controlled by varying feed consistency, hammer spacing, and residence time.

R.E.Byrne/bsn
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Asbestos beefs up plastics and adhesives to extend their use

Highway markers are bonded with inexpensive, asbestos-modified adhesives. Two components are mixed and dispensed from cart before applying reflectant.

The first single-crystal whiskers to be used by man were asbestos. Since the whiskers' high strength was first measured in a laboratory, scientists have been trying to find ways to harness the potential of asbestos in structural materials.

The tensile strength of single crystals of asbestos has been measured at more than 800,000 psi—as strong as the strongest glass filaments. But so far, strengths achieved in composites do not go beyond those achieved with glass-mat reinforcements.

The thorn to date. One of the chief drawbacks of asbestos has been the inability of researchers to incorporate homogeneously more than 10% to 20% asbestos with structural resins. With only 4% or 5%, resin mixtures become unmanageably viscous.

But this very deficiency is being turned to advantage by Union Carbide chemists, who have developed a number of thixotropic uses for their new resin-grade of chrysotile asbestos. The Union Carbide material, because of its high purity and fine particle size, is easier to incorporate in resinous compounds. Union Carbide's filler is cheaper than other thixotropic agents.

Opening new fields. Union Carbide mines an area in California. Asbestos was discovered there just a few years ago, and it is believed to be the largest source of high-purity asbestos ore in the world. The extra-high purity of this grade has opened up a whole new range of uses for asbestos.

An important difference in the California grade of asbestos is its random orientation, which permits the wet-processing system. Wet-processing breaks up individual fibers into easy-to-handle dust-free pellets. The separation of fibers yields a more efficient reinforcing effect in resin-based products.

Another application for asbestos is as a reinforcement for thermoplastics. Adding 20% asbestos to Nylon 6 doubles both the flexural and tensile strength of the unreinforced material. The increase matches the strength improvement obtained with chopped-glass fibers.

Saving money. Most other applications for the new grade of asbestos have been in viscosity-control uses such as with epoxy and polyester compounds. Of course, some reinforcing effect also results.

For example, traffic-marker adhesives based on epoxy resins have been made 60¢ to 70¢/lb. cheaper by using the asbestos thickener.

About 30 gm of adhesive are used by the State of California's Highway Dept. in putting down round-button pavement markers. About 3 million of these markers will be applied by the end of this year: The use of asbestos has added up to some important savings for the California tax payer. **(2.127)**

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