Johns-Manville JM
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# Asbestos and Health

## INTRODUCTION

Asbestos, known since antiquity, has widespread and important applications in our modern industrial society. The increased use of asbestos in the 20th century has led to recognition of the need to augment the efforts to cope with occupational hazards associated with the inhalation of excessive amounts of asbestos dust. This paper summarizes the essential uses of asbestos, the known facts about health problems associated with occupational exposure to asbestos dust, and the research being conducted to identify and reduce these health risks.

## ASBESTOS – AN ESSENTIAL PRODUCT

Asbestos has many essential functions in construction, in industry and in transportation. Over the years fire-resistant asbestos has saved thousands of lives and much valuable property. For safety, fire prevention and durability, products containing asbestos are used in schools, houses, theaters, office and other public buildings, spacecraft, furnaces, boilers and firefighting equipment. The brakes on automobiles, trucks, buses and trains are dependable because asbestos is a major component of brake linings.

## WHAT IS ASBESTOS?

Asbestos is the name given a family of mineral fibers, including four commercially significant varieties – **chrysotile, crocidolite, amosite** and **anthophyllite** – each of which differs from the others, physically and chemically. Studies of the relationship between asbestos and health demonstrate the importance of these differences.[1]

These mineral fibers can be divided into two main classes on the basis of their crystalline structures: serpentine asbestos and amphibole asbestos. *Chrysotile*, a flexible white magnesium silicate which can be attacked by acids, and which is the only fiber that carries a positive charge in water, is the lone member of the serpentine class. It has one major difference from the other asbestos minerals; it's generally curly rather than straight and because it is flexible it can be bent into a "U" shape. These characteristics mean that this fiber does not penetrate as deeply into the lung as do the other varieties. The other commercially significant varieties are all amphiboles. *Crocidolite* is a blue ferrous sodium silicate which is acid resistant and less flexible than chrysotile. *Amosite* is a brown ferrous magnesium silicate which is brittle and easily pulverized. *Anthophyllite* is a white magnesium silicate which is brittle and acid resistant.

## NO HEALTH RISKS FOR THE GENERAL PUBLIC

In this expanding industrial society, many substances and materials that could pose health and safety hazards to industrial workers under certain conditions do not, in their finished form, carry any risks to the public. This is the situation with asbestos fiber. Research in industry on asbestos exposure has shown that there are occupational health risks associated with on-the-job inhalation of excessive amounts of asbestos dust. Also, in some circumstances in the past, there has been risk to persons living in the immediate vicinity of factories using asbestos, and to members of families of wage earners who worked in occupational exposures and brought home excessive amounts of asbestos dust on their clothes.

However, there is *no evidence* either from experience or from scientific study that anyone in the general public has ever contracted any disease from exposure to the wearing or weathering of brake linings, floor tile, roofing, wall or ceiling panels, or similar asbestos-containing items.[2] In such products, the asbestos fibers are bound with cement, plastics or other binding materials, and are not released in significant amounts in normal use.

Studies of asbestos fiber concentrations in the public air have shown them to be very low – in the order of 1/100 (0.05 asbestos fibers per cubic centimeter of air) of the maximum allowable for occupational exposures (5 fibers per cc).

The application of automobile and truck brakes does not release significant quantities of asbestos fiber to the atmosphere. Only a small fraction of the asbestos in brakes is dispersed as fiber.[4] The remainder is converted by the heat of brake application to a nonfibrous mineral, *forsterite*.

With increasing scientific interest in general air pollution problems, one of many questions being studied is whether city dwellers may be exposed to some asbestos fibers along with other dusts that are known to be in the ambient air. Further attention to this question was aroused by reports of the find-

ing of a scant number of so-called "ferruginous (iron-like) bodies" in the autopsied lungs of some city dwellers. These microscopic bodies are composed of protein and iron pigment deposited over specks of fibrous materials that may remain in the lungs. Urban dwellers are exposed to the dust of more than a hundred different types of fiber, other than asbestos, many of which can form the core of ferruginous bodies.

Similar bodies are also found in the lungs of workers who are exposed occupationally to asbestos fibers. In such cases, they are called "asbestos bodies." This term is sometimes still mistakenly used to designate a ferruginous body, even if the central core material has not been identified as an asbestos fiber.[3]

The number of ferruginous (asbestos) bodies found in people occupationally exposed is *many times greater* than the number found in the lungs of urban dwellers. It is important to remember that the presence of the few ferruginous bodies found in the various random autopsy studies of city dwellers had no connection with either the cause of death or with any history or symptoms of pulmonary disease among the subjects, but only reflected the chance inhalation of some fibrous material in the urban air.[2]

*While research continues on the subject, the facts thus far strongly indicate that the sweeping inferences that have been made with regard to the possible dangers of public asbestos air pollution are unjustified.*

## KNOWN AND SUSPECTED OCCUPATIONAL RISKS

**Asbestosis:** The industry long ago recognized the risk of a particular lung disease called asbestosis among some workers and took steps to safeguard employees. This non-cancerous disease is brought on only after inhalation of heavy concentrations of asbestos dust generally over a period of many years.[5]

Asbestosis is one of the lung diseases classified as "pneumoconioses." Among others are silicosis, from crystalline silica dust; byssinosis from cotton dust; talcosis from talc; and anthracosis from coal dust. These are considered industrial health risks against which the various industries have developed protection for the worker.

For years, the asbestos industry has taken protective measures to reduce exposures to asbestos dust and reduce the risk of developing asbestosis among workers. Practices for handling asbestos fibers have been developed to minimize generation of dust. Complex dust suppression and control systems to prevent dissemination of dust are installed in many operations. Approved respirators are required for workers where dusts are unavoidable. When used properly, these measures have been shown to afford completely effective protection.

**Bronchogenic (Lung) Cancer:** A number of medical studies have reported an association between asbestosis and an increased risk of a certain type of lung cancer (bronchogenic). Although the number of these cases among asbestos industry workers is only a small fraction of the total employed, the industry considers the problem a serious one. It has become the subject of considerable scientific research through statistical, clinical and pathological studies of exposed workers; through experimental studies with laboratory animals; and through studies of the physical and chemical nature of asbestos and associated minerals. Among areas of investigation are the time-dose relationship; the effect of different varieties of asbestos; the effect of excessive asbestos inhalation combined with other factors such as cigarette smoking and co-existing trace metals.

The belief that asbestos fibers do not by themselves cause lung cancer was reinforced by a 1967 study indicating that exposure to asbestos among insulating workers greatly increased the risk of lung cancer but *only* among cigarette smokers. *Among insulation workers who were nonsmokers, the study showed no more than the expected rate of lung cancer.*[6] *This conclusion was re-confirmed by a study completed in 1972.*[7]

**Mesothelioma:** Also under study is a rare disease called mesothelioma, a tumor of the chest and abdominal cavity which is different from bronchogenic lung cancer. Recently, investigators have associated an unusually high frequency of cases of mesothelioma with exposure to asbestos in certain geographic locations. This was originally reported from certain South African areas where only crocidolite asbestos is produced. However, in another



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crocidolite mining section of South Africa, several hundred miles away, only two mesotheliomas have been found, even though similar techniques for finding these tumors have been used. No mesotheliomas have been found among workers engaged in amosite mining and milling in South Africa. Conversely, cases have been found in employees of a New Jersey factory that in the mid-1940's was making insulation from amosite fiber. These situations have raised the question as to whether factors other than asbestos are involved.[8]

In the United States, mesothelioma is reported so seldom that there are no accurate figures on its occurrence in this country. In Britain, only two cases are currently reported for every thousand cases of lung cancer from all causes.[9]

The search for the cause of this unusual disease is hampered by the fact that its diagnosis and recognition is still considered a problem among medical experts. In several countries mesothelioma registries have been set up to try to collect case histories to learn more about the tumor. It is becoming increasingly obvious that there are circumstances other than exposure to asbestos fiber that can also cause mesothelioma.[10-11] The asbestos industry through research grants is assisting in medical efforts to gain more knowledge about this rare disease.

## INDUSTRIAL HYGIENE AND PREVENTIVE MEDICINE

Today, the asbestos industry has invested millions of dollars in equipment and techniques to prevent the inhalation of asbestos dust by workers in the mining and milling of asbestos and in the manufacture of asbestos-containing products. Johns-Manville continually strives to eliminate dust exposure in the mines and plants which it operates. Processing areas and machinery are equipped with dust suppression and collection devices. Major improvements have been made in fiber shipping methods. For example, Johns-Manville has inaugurated the use of special railroad cars containing pallet loads of interlocked and glue-locked bags. This procedure permits complete unloading by fork truck, eliminating manual handling of bags. Atmospheric dust levels are monitored regularly. Individual respirators are used where indicated. Employees are given physical examinations to OSHA standards. A centralized Department of Environmental Control maintains constant surveillance over conditions in all J-M plants and mines.

Johns-Manville has also conducted a program of consultation with asbestos fabricators, applicators and trade groups such as the *Asbestos Textile Institute, Asbestos Cement Products Association, National Insulation Contractors Association, and Thermal Insulation Manufacturers Association* to provide a thorough understanding of potential risks and to encourage general adherence to sound industrial hygiene practices.

Before asbestos-containing fireproofing sprays were legislated out of existence, Johns-Manville voluntarily stopped selling asbestos fiber for this purpose. The company deemed this an improper use of asbestos because of the relative impossibility of effective dust control in the spraying technique used in the United States.

The company also participated in a major cooperative effort between labor, industry, science and government to conduct a health research program for industrial workers. *The Insulation Industry Hygiene Research Program*, jointly sponsored by a labor union, the International Association of Heat and Frost Insulators and Asbestos Workers, and by Johns-Manville Corporation, was organized in 1968 at the Mount Sinai School of Medicine in New York City to develop improved methods to minimize exposure of insulation workers—men who apply and remove pipe and equipment insulations in buildings, industrial plants and ships—to dust and fumes encountered in their work. The United States Public Health Service provided consultation and technical assistance.

Studies in asbestos-using industries in England and the United States indicate that where effective dust control measures have been taken, the risks of lung diseases have been reduced.[2]

## ASBESTOS HEALTH RESEARCH

Research on the health effects of asbestos has been supported by Johns-Manville since the late 1920's. At the Saranac Lake, N.Y., laboratory of the Trudeau Foundation, then one of the leading research centers for pulmonary disease in the United States, the company sponsored a program of investigations designed to determine safe asbestos dust levels and to eliminate asbestosis among

workers in its mines and plants. For more than 20 years the company supported research in this laboratory, basing its continually improved dust control activities on the research findings.

Today, scientific research to identify and reduce the health risk from asbestos dust exposure is being conducted in many places throughout the world. The asbestos industry both sponsors such research and cooperates in work being done by government agencies and private medical investigators.

Johns-Manville has extended full cooperation to the U.S. Public Health Service in its 7 to 10 year study of workers employed in asbestos processing plants. This epidemiological study will assess the varying environmental factors affecting the health of more than 10,000 asbestos factory workers. In addition, the company provides funds, asbestos materials, equipment and information, as the individual situation may require, for research of such institutes as: The Industrial Health Foundation of America, The Institute of Occupational & Environmental Health, Mount Sinai School of Medicine, Tulane University, University of Pittsburgh, McGill University, St. Luke's Hospital, Cleveland, Ohio. Johns-Manville also conducts studies on technical aspects of asbestos in its own Research and Development Center in Denver, Colorado.*

In cooperation and in conjunction with other agencies, the asbestos industry will continue to seek new information about the biological effects of asbestos fiber and to develop ways of assuring maximum possible protection from occupational hazards for its employees in asbestos mines, mills and plants and among fabricators and applicators of this essential material.

## EXPLANATORY NOTES

**1.** Because the major types of asbestos differ chemically and physically, they also differ in their biological effect on humans and in experimental animals. Current knowledge indicates that crocidolite, the type least used in the United States, is most clearly associated with health hazards for people. This is the consensus of a panel of nine medical experts appointed by the British Ministry of Labour—Christy, R. K. and members of the panel, "Problems Arising from the Use of Asbestos," *Her Majesty's Stationery Office*, 1967.

Wagner published experimental evidence that, compared with other asbestos fibers, crocidolite produces the most severe asbestosis in laboratory animals. —Wagner, J. C., "Asbestosis in Experimental Animals," *British Journal of Industrial Medicine*, 1963, 20, 1.

Wagner et al., reported a high number of mesothelioma cases among crocidolite miners and millers in one area of South Africa, but no cases among amosite miners and millers—Wagner, J. C., Sleggs, C. and Marchand, P., "Diffuse Pleural Mesothelioma and Asbestos Exposure in the North Western Cape Province," *British Journal of Industrial Medicine*, 1960, 22, 261. By contrast, chrysotile mining areas in other parts of the world have exhibited either no excess or a barely perceptible excess incidence of mesothelioma.

Evidence for an important difference in risk in different occupations and with the type of asbestos has increased. The risk is greatest with crocidolite, less with amosite and still less with chrysotile.—*Report of the Advisory Committee on Asbestos Cancers to the Director of the International Agency for Research on Cancer of the World Health Organization*, meeting at Lyon, France, October 5 and 6, 1972.

**2.** Only in occupational exposures do asbestos dust levels appear great enough to become possible health hazards. This fact is related to dosage levels, as pointed out by Enterline and Kendrick: "Asbestos dust at levels to which general populations are exposed probably is of little importance in the etiology (causation) of disease."—Enterline, P. E. and Kendrick, M. A., "Asbestos Dust Exposures at Various Levels and Mortality," *Archives of Environmental Health*, August 1967.

In addition investigators who report so-called "asbestos bodies" in human lungs, note that these findings are not related to cause of death, or indeed to any disease. The comment of Thomson and Graves is representative of those in other studies: "But to convert the scanty or very scanty bodies which have demonstrated to be present in so many urban dwellers to the frequency present in a minimal basal asbestosis would require an increase by hundredfolds and to get a more diffuse classical asbestosis with pulmonary disability the multiplying factor might well be in many millions." Thomson, J. G. and Graves, W. M., "Asbestos as Urban Air Contaminant," *Archives of Pathology*, May 1966.

"...excess lung carcinoma risk is not detectable when the occupational exposure has been low. These low occupational exposures have almost certainly been much greater than that to the public from general air pollution. There is no evidence of excess risk of mesothelioma from asbestos air pollution which has existed in the neighborhood of chrysotile and amosite mines. There is no evidence of risk to the general public at present."—*Report of the Advisory Committee on As-*

*Refer to "History of Johns-Manville Health Research." (Copies available from Johns-Manville)



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*bestos Cancers to the Director of the International Agency for Research on Cancer of the World Health Organization,* meeting at Lyon, France, October 5 and 6, 1972.

**3.** So-called "asbestos bodies" in the lung may be produced by other substances. Gross et al., have offered experimental proof: "So-called 'asbestos' bodies were produced in the lungs of hamsters injected intratracheally with respirable filamentous particles composed of aluminum silicate... Instead of the term 'asbestos' body, the designation of ferruginous body is suggested." – Gross, P., Cralley, L. J. and deTreville, R. T. P., "'Asbestos' Bodies: Their Nonspecificity," *American Industrial Hygiene Association Journal,* November-December 1967.

Similar results have been reported by Davis, working at Cambridge University, England. Davis said that hamsters were injected in the trachea and the pleura with dust from aluminum silicate, glass fiber, carborundum and man-made textile fiber. "In both injection sites all these foreign materials produced bodies which with the light microscope appeared very similar to asbestos bodies. The basic assumption that asbestos-like bodies can only be produced from asbestos has proved incorrect." – Davis, J. M. G., Gross, P. and deTreville, R. T. P., "Asbestos Bodies and Bioeffects – A Detective Story," *Annual Meeting, Industrial Hygiene Foundation,* Pittsburgh, October 1967.

**4.** An uninformed speculation, frequently stated as if it were a fact, is that the wearing of automobile brakes releases dangerous quantities of asbestos fiber into the air. A study by Lynch of the U.S. Public Health Service, has demonstrated that this statement is erroneous. Lynch performed laboratory tests of automotive brake linings and found that normal wear releases insignificant amounts of asbestos fiber into the air. He concluded that "the free fibers from brake lining wear appear to be an inconsequential health factor in urban air pollution." – Lynch, J. R., "Brake Lining Decomposition Products," *Journal of the Air Pollution Control Association.*

**5.** A time factor in asbestosis cases is demonstrated by the study of McVittie showing that clinical asbestosis takes on the average about 17 years to develop. – McVittie, J. C., "Asbestosis in Great Britain," *Annals New York Academy of Sciences,* December 31, 1965.

**6.** Selikoff et al., reported a much higher rate of lung cancer among asbestos workers who smoked cigarettes than among cigarette smokers generally. However, they reported not one case of lung cancer among non-smoking asbestos workers. The authors concluded that their evidence "suggests that exposure to asbestos does not lead to an extremely high risk of lung cancer among nonsmokers." – Selikoff, I. J., Hammond, E. C. and Churg, J., "Asbestos Exposure, Smoking and Neoplasia," *Journal of the American Medical Association,* April 8, 1968.

A 1969 update of this study reported one case of lung cancer among nonsmokers – Selikoff, I. J., Hammond, E. C. and Churg, J., "Mortality Experience of Asbestos Insulation Workers 1943-1968," presented at the International Conference on Pneumoconiosis, Johannesburg, South Africa, April-May 1969.

**7.** Kannerstein and Churg reported in their recent study that lung cancer will not develop in asbestos workers unless they are also cigarette smokers. – Kannerstein, M. and Churg, J. "Pathology of Carcinoma of the Lung Associated with Asbestos Exposure," *Cancer,* American Cancer Society, July 1972.

**8.** The varying prevalence of mesothelioma in the two crocidolite mining areas of South Africa has prompted comment by Wright: "That something other than, or in addition to, asbestos plays a role in mesothelioma formation seems inescapable." Wright, G. W., "Asbestos and Health in 1969," *American Review of Respiratory Disease,* October 1969.

**9.** About 50 cases of mesothelioma are reported annually in Great Britain. – Gunter, R., Minister of Labour. *Official Report to the House of Commons,* April 17, 1967.

**10.** In a study of 76 mesothelioma patients in a London hospital, 25 had no known contact or exposure to asbestos. – Newhouse and Thompsen, "Mesothelioma in a London Hospital."

**11.** In a study of 232 mesothelioma cases in the South African Register, 32 had no asbestos exposure. – National Research Institute for Occupational Diseases of the South African Medical Research Council, *Annual Report,* 1971.

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