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ABSTRACT

OSHA STANDARDS AND THE SAFE USE OF ASBESTOS

Asbestos is one of the first target hazards to be handled by the Occupational Safety and Health Agency of the U.S. Department of Labor. The unique properties of asbestos, a fibrous mineral, have resulted in its use in over 3000 applications. There is no reason to prohibit the use of chrysotile asbestos as fiber concentrations in the workplace and in the general environment can be readily and satisfactorily controlled.



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Asbestos has received a great deal of attention and publicity in the last two years, especially after it was designated as a "target health hazard" by OSHA and a "hazardous air pollutant" by the EPA. Most of the media treatment of the subject has been emotionally oriented and distorted and in some cases has bordered on the sensational. Little has been done to place the question of asbestos use and asbestos toxicity in a logical perspective. Many users of asbestos and products containing asbestos have been mislead and confused by distorted reports, federal legislation, and locally-enacted rules and regulations. Some company news releases or advertising have even contained misleading or incomplete information.

It is an accepted fact that asbestos, like many other foreign bodies, can cause disabling lung damage, commonly referred to as asbestosis. It is important to note that asbestosis and statistical excess occurrences of bronchogenic carcinoma, the two most common asbestos-related diseases, have occurred only in workers with massive, long-term exposures to asbestos dust. The risk of this type exposure is normally limited to asbestos mines and mills, manufacturing operations using thousands of tons per year, and construction jobs using sprayed asbestos insulation. The latter operation has been essentially discontinued. Some epidemiological evidence indicates that asbestos fibers must be associated with cigarette smoking and/or the inhalation of other materials to cause a carcinogenic condition.

There is no evidence that the general public is in any danger from the amount of asbestos fiber in community air. The U.S. National Academy of Science states in an October 1971 publication, "Asbestos - The Need for and Feasibility of Air Pollution Controls":

> "at present, there is no evidence that the small numbers of fibers found in most members of the general population affect health or longevity"

This does not, however, preclude the need for definition and control of man-made asbestos emissions into the atmosphere. There are several varieties of asbestos and there is considerable evidence that some are more harmful than others, especially with regard to development of mesothelioma, a very rarely found cancer of the pleura.

Asbestos is a commercial or generic term used to describe six naturally occurring minerals that are hydrated metal silicates. All are fibrous and can be separated into relatively soft, silky fibers. The six varieties are divided into two classes, serpentine and amphibole, based on crystal structure. Chrysotile is the only member of the serpentine class and the amphiboles include crocidolite, amosite, anthophyllite, tremolite and actinolite.

Chrysotile is by far the most used variety of asbestos and accounts for more than 95% of world production. It is the only variety produced in commercial quantities in the U.S. and Canada. Also of commercial importance are crocidolite, amosite and anthophyllite, obtained from Africa and Finland.

In the United States crocidolite is used almost exclusively to reinforce cement pipe. Amosite is used in insulating and packing materials while anthophyllite is used primarily as a chemical resistant filler in plastics. Chrysotile is used in over 3000 applications, the largest and most common include: asbestos-cement products, floor tile, asbestos paper, friction materials and gaskets, textiles, plastics, and insulation.

There is increasing evidence that crocidolite and amosite should be more

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stringently controlled than chrysotile. Some data indicate that even a relatively short exposure to these amphibole minerals can result in the development of mesotheliomas. A panel of experts in Britain concluded that other types of fiber should be substituted for crocidolite wherever possible. The use of crocidolite in Britain has been severely restricted since 1970 and its importation into the United States and Japan has steadily decreased since the middle 1960's.

Where there is a strong statistical relationship between mesothelioma and the inhalation of asbestos, crocidolite and amosite have been involved either alone or in combination. This is the case in crocidolite miners, asbestos-using insulation workers, asbestos textile manufacturing, and in a large asbestos products manufacturing plant. Until recently the insulation trade used much more amosite than chrysotile and large amounts of crocidolite were used in England. The insulation manufacturer is also exposed to silica and other pneumoconiosis producing dusts, as well as additional agents and materials in the particular work environment. These coexisting agents, such as coal tar and aromatic hydrocarbons, have been ignored in the reported studies of insulation and other workers.

When asbestos exposure has been limited to the serpentine class (chrysotile), as in Quebec asbestos workers, there is strong evidence that no excess mesotheliomas will occur. Additional data, as reported by Dr. J. C. McDonald, show that the Quebec miners have no excess of lung cancer unless they were very heavily exposed (probably to greater than 10 fibers per cc for forty years). Dr. McDonald is Professor of Epidemiology at McGill University in Montreal and has specialized in epidemiology for 25 years.

The Williams-Steiger Occupational Safety and Health Act of 1970 became effective on April 28, 1971. Based on congressional mail this law has stirred up more confusion and controversy than any other recent legislation. In spite of the interest it is estimated that 30% of the nation's employers are not aware of the law's existence and many others have no real idea of what it is all about.

The Congressional purpose of the Act is:

> "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources."

The Act established the Occupational Safety and Health Administration (OSHA) within the Department of Labor, which has responsibility for administration and enforcement. Research and related functions are handled by the Department of Health, Education and Welfare (HEW) through the newly created National Institute of Occupational Safety and Health (NIOSH).

Five million employers and 60 million of the nation's 80 million workers are covered by OSHA. Specifically excluded from coverage are government employees and operations, such as mining, which are protected under other Federal health and safety laws.

Most of the controversy originally surrounding OSHA was related to safety rules and the safety-oriented target industries program. Early efforts were aimed at eliminating hazards in the five industries whose safety record was especially bad:

Longshoring
Meat and Meat Products
Lumber and Wood Products

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Roofing and Sheet Metal
Mobile Homes and Other Transportation Equipment

In a news release issued January 4, 1972, OSHA announced a Target Health Hazards Program to parallel the Target Industries Program. The new program is aimed at improving health factors associated with working conditions. It was initiated by naming five substances to be the focus of initial and concerted efforts by OSHA and NIOSH:

Asbestos
Cotton Dust
Silica
Lead
Carbon Monoxide

Prior to this announcement, on December 7, 1971, an asbestos emergency standard was set at 5 fibers per ml. This replaced a prior threshold limit value (TLV) of 12 fibers per ml. originally established by the American Conference of Governmental Industrial Hygienists (ACGIH). This "emergency" action was prompted by an AFL-CIO request based on studies of insulation workers. The Act empowers the Secretary of Labor to establish emergency temporary standards, effective immediately upon publication in the Federal Register, where it is found that employees are exposed to "grave danger".

Continuing from the OSHA news release, following is a summary of the specifics on the five target substances:

Substance	Can Produce	No. Employees At Risk	Industries
Asbestos	Asbestosis, Cancer	200,000	Insulation, Ship building, construction, etc.
Cotton Dust	Byssinosis	800,000	Cotton Processing-all types
Silica	Silicosis	1,100,000	Abrasives, mineral processing, sandblasting, etc.
Lead	Severe nervous system disabilities	1,600,000	Ammunition, paint, battery, auto, etc.
Carbon Monoxide	Brain damage, death	Uncountable. Thousands	Metal processing, users of gasoline-powered equipment

At the present time, new standards have been established only for asbestos. Of the 8000 toxic substances on the NIOSH list, only 500 are covered by standards and many of them need updating. By some estimates, a new chemical goes into industrial use every 20 minutes; and the toxic effects of many of these chemicals are unknown.

A new Standard for Exposure to Asbestos Dust was published in the Federal Register, Volume 37, No. 110 on Wednesday, June 7, 1972. The basic exposure standard is an 8-hour time-weighted average (TWA) of 5 fibers, longer than 5 micrometers, per cubic centimeter of air. The fiber limit is to be reduced to 2 on July 1, 1976. A peak concentration of 10 fibers per cc is not to be ex-

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ceeded at any time. All of the fiber concentrations are those to which an employee may be exposed without protective clothing or equipment.

The first basic requirement of the new standard is monitoring to determine whether or not fiber concentrations are in excess of the exposure limits. This was to have been completed within six months at "every place of employment where asbestos fibers are released". Obviously there are not enough industrial hygienists to enable compliance with this provision. Some asbestos suppliers provide a monitoring service to customers and several insurance companies have personnel trained in fiber counting. Many service companies have been formed and inexperience has resulted in several instances of inaccurate and misleading results. NIOSH sponsors training schools and each session is filled to capacity.

Improper interpretation of the regulations has created many misconceptions about the equipment and procedures needed to use asbestos. If exposure limits are not exceeded, there are no further compliance requirements except for medical examinations. Interpreted literally, medical examinations are required for all employees in any "occupation exposed to airborne concentrations of asbestos fibers". Some definition of "exposed" is necessary since evidence indicates that small amounts of asbestos fiber have existed in the atmosphere for millions of years. The source of these fibers would be from the weathering of naturally occurring surface outcrops. In its criteria document on asbestos, NIOSH recommended that "exposed to asbestos" be defined as "average exposures above one fiber per cc or peak exposures above five fibers per cc".

Respirators and special clothing are required in the construction trade for the spray application of insulation and fireproofing materials, and for the removal of such materials. This special protection is not required for any other use of asbestos unless exposure limits are exceeded. This is also true for other items such as specially equipped tools, product limitations, change rooms, clothes laundering and waste disposal.

Caution labels are required on products containing asbestos except where the fibers have been modified by a bonding agent or other material to prevent dusting during any normal subsequent use or handling. Besides raw asbestos fiber, products which require package labeling would include: dry acoustical spray products and joint cements, unsaturated roofing felt and textiles, various insulating products made without adequate binders. The labeling of a product does not prohibit its use.

Although the list could be endless, products containing up to 40% asbestos and not requiring a label could include: reinforced plastics (phenolic, nylon, polypropylene, polyester, etc.), roofing compounds, floor tile, reinforced rubber, ready-mix joint cements, flooring, coating and adhesives (polyester, epoxy, urethane, casein, etc.), paint (PVC, alkyd, acrylic latex), mineral board, lubricants and greases.

Soon after the asbestos standards were published, industry and OSHA representatives met to clarify a number of points with regard to interpretation and enforcement. Since these are the first set of standards it is expected that they will become guidelines for the other substances listed as target health hazards. There are several areas where literal interpretation is obviously not feasible. It was the consensus of the industry group after the meeting with OSHA that enforcement and citations would be reasonable provided that there was no attempt by industry to circumvent the spirit and intent of the

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regulations or to compromise the safety of the worker.

In addition to the OSHA standards, there are other regulations concerning asbestos which are being considered or which have been promulgated. Although expected six months earlier, as of the end of 1972 the Environmental Protection Agency (EPA) had not issued asbestos standards.

The EPA was founded by the Clean Air Act of 1970 to improve the environment to which the general public is exposed. On March 31, 1971, asbestos, along with beryllium and mercury, was identified as a "hazardous air pollutant" by Mr. William Ruckelshaus, Administrator of the EPA. Whereas OSHA is responsible for the protection of workers, the EPA regulations will be designed to protect the general public from harmful emissions which may be generated by plants and other industrial operations. In addition to requiring filters on certain plant ventilation equipment, it is expected that the spraying of certain materials will be prohibited. At this writing it is understood that the spraying on structures of fireproofing compounds containing more than 1% asbestos will be prohibited. This prohibition will not apply to insulating materials, roof coatings, auto undercoating, decorative paints and coatings, and similar products containing asbestos held with a suitable binder.

At least two states and local authorities have enacted "asbestos" regulations. Quoting from the New York State regulations: "No person shall engage in or allow surface coating by the spraying of asbestos or asbestos - containing materials". The intent was probably to restrict the spraying of insulation and fireproofing materials on structures, similar to the EPA provision, but a literal interpretation would eliminate many safe and necessary uses of asbestos.

Apparently much more thought and expert advice went into regulations enacted by the State of Illinois as they are feasible and workable without compromising public safety. However, the law enacted by the City of Chicago is similar to that of the State of New York which leaves much to be desired with regard to industry compliance and public safety. It is assumed that the EPA regulations will eventually be adopted or used as a pattern by state and local governments. Some proposed regulations are obviously based on misleading articles about asbestos.

Within the past year articles have been published about the hazard from asbestos in friction materials and to mechanics who blow dust from brake assemblies. The U.S. Public Health Service conducted a study which showed that less than 1% of the 40-50% asbestos in brake linings remains as free fiber after wear. The asbestos is converted by the high heat of friction to a non-fibrous, non-toxic material called forsterite. A study in England found that mechanics engaged in this activity had TWA exposures of 0.68 fibers per cc of air, much less than OSHA's 1976 standard. There is no known study which indicates any hazard to men employed in this occupation.

In another article, Dr. Irving Selikoff of Mount Sinai Hospital was quoted as predicting 95,000 deaths from asbestos - related cancer among 250,000 men currently employed in the U.S. asbestos industry. The two studies on which this dire prediction was based were of men employed in the industry for a minimum of 20 years during the 1930's and 1940's when dust levels were unfortunately many times higher than they are today. It is illogical to apply death rates resulting from long term exposure to dust levels existing some 30 years ago to today's working population.

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Quoting from an article in the June 7, 1972 issue of the Wall Street Journal: "bits of asbestos used in filters for beverage making have been found in wine and beer, for instance, and could be dangerous if swallowed". A study in Great Britain showed that the total amount of asbestos fiber found in British beer added up to only 0.002 ounces in the total annual production of over one billion gallons. This is equivalent to about five parts per million-million by weight. There is not one shred of evidence that ingesting such small amounts of asbestos is hazardous.

Many stories refer to Dr. Selikoff and his studies at Mount Sinai Hospital. It should be noted that when Dr. Selikoff uses the term "asbestos workers" he is not referring to the men engaged in the general asbestos mining, milling or manufacturing industries. His studies have been on men employed only in the asbestos insulation trade who belong to a union called the "Heat, Frost, Insulation and Asbestos Workers", commonly referred to as the asbestos workers union. It was reported in one Mount Sinai survey that there was only one dust count taken for every 20,000 man-days worked by 9400 "asbestos workers". They have reported on similar dust count frequencies for years, but always in reference to the construction industry, never to asbestos milling and manufacturing plants.

Dust counts have been taken on a regular basis in most asbestos operations for years. With new and better counting techniques, pelletized asbestos, wet processing, and improved operating conditions, many industries are finding that OSHA compliance presents no major problem. In many cases dusty conditions are being caused by other raw materials. The new membrane filter technique for counting asbestos fibers precludes the inclusion of many dust particles as asbestos. The problem becomes one of nuisance dust control not a lengthy and usually unnecessary program to "get rid of asbestos". One large chrysotile asbestos user is now receiving pelletized asbestos in bulk hopper cars containing about 95 tons of product. With appropriate storage, transfer, and ventilation equipment, there is no asbestos dust released to the work or public atmosphere. The asbestos pellets flow freely from the car and there is no residual material. Plastic bags and repulpable paper bags are other means used to preclude container opening by personnel.

More is probably known about the potential health hazards of asbestos and the proper means for controlling or eliminating them than would be the case with possible substitute materials. It would be imprudent to use unproven materials, whose health effects are unknown, to replace asbestos which has proven its usefulness for the past 100 years.

Asbestos is used by the plastics industry for reinforcement, heat resistance and flow control. About 93% of the 250,000 tons used annually is chrysotile, normally chosen for most applications because of its plentiful supply and product uniformity. Sometimes the special advantages of another fiber are required.

Polypropylene has been reinforced with anthophyllite asbestos because it permits more effective heat stabilization. Recent work may overcome this shortcoming of chrysotile and permit its use in this large application. Chrysotile also has poor resistance to acids and an amphibole is usually chosen for this type application.

Chrysotile is set apart from the amphibole minerals by its positive surface charge, softness, flexibility, and low refractive index. Its fibril diameter is

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less than 0.03 micron, the smallest among commonly known fibers, and it has exceptional mechanical strength. Wet processing of chrysotile has permitted chemically modified products with surface properties similar to pyrogenic silica for use in antisag and thixotropic applications. Compared to chrysotile, amphibole fibers are larger in cross-section, harsh, and hard. They are anionic in surface charge and more resistant to acids.

The unit chrysotile fibril is now recognized as a naturally occurring reinforcing whisker. Because of its high strength, stiffness and aspect ratio it provides excellent whisker reinforcement; assuming that it has a high degree of fiber liberation and has been specially processed to remove extraneous gangue material.

The largest uses for asbestos in plastics are in vinyl asbestos floor tile and in phenolic molding compounds. It is also used in numerous other compounds of polypropylene, polyester, nylon, melamine, epoxy, silicone, etc. It is used in many product types such as friction materials, heat resistant and electrical components, sealants, adhesives, coatings, mastics, etc.

Asbestos has been, is, and can be used safely in the plastics industry as well as most other areas of application. It is an important and necessary raw material and its use cannot and should not be prohibited. Medical, industrial and governmental personnel must continue to work together to establish reasonable exposure limits while, at the same time, providing safe work areas for employees.

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