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Handling Asbestos

Chrysotile Asbestos in Plastics

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Asbestos has received a great deal of attention and publicity in recent years, especially after it was designated a "target health hazard" by OSHA and a "hazardous air pollutant" by the EPA. Many of the articles on asbestos by the press have been emotionally oriented or distorted and, in some cases, stories have been sensationalized, based on obvious misinterpretation of facts. The use of half-truths or unsubstantiated statements has led to general confusion and the unfair castigation of asbestos and products containing asbestos. The purpose of this paper is to put the matter of asbestos use and asbestos hazards into a logical and practical perspective. In this paper, the different types of asbestos and their many uses are discussed, along with government regulations controlling the use of asbestos. The health hazards associated with asbestos, both occupational and environmental, and some industrial experience with air sampling and dust control measures are also covered.

KEY WORDS: Asbestos; Plastics; Air pollution; Toxicology.

What is Asbestos?

Asbestos is a commercial or generic term used to describe six naturally occurring "asbestiform" minerals that are fibrous, hydrated metal silicates. The six varieties are divided into two classes—serpentine and amphibole—based on their crystal structure. Chrysotile is the only member of the serpentine class, while the amphiboles include crocidolite, amosite, anthophyllite, tremolite, and actinolite. Chrysotile is by far the most-used variety and accounts for over 95% of U.S. consumption, as noted in *Table* 1.

Crocidolite, also known as blue asbestos, is imported from South Africa. Because of its high mechanical strength and good resistance to acids and alkalis, it is used to reinforce a limited variety of plastics where its pronounced color is not objectionable. Amosite, also imported from South Africa, is used primarily in thermal insulation. Although there are some deposits of anthophyllite in the U.S., most of it is imported from Finland. It is used primarily as a filler for polypropylene and in insulating materials. A comparison of the four varieties of asbestos which are of commercial importance is presented in *Table* 2. It should be noted that there are significant differences between chrysotile and amphiboles with regard to chemical composition and certain physical properties.

Where is Asbestos Used and Why?

Asbestos has served mankind for more than 100 years in a broad variety of applications. The general areas in which asbestos is used in the U.S. are shown in *Table* 3. Based on information from asbestos producers and consumption surveys, it is estimated that the plastics industry uses about 33% of the 800,000 tons consumed annually, which makes it the largest single user of asbestos fiber.

The largest uses of asbestos by the plastics industry are in vinyl-asbestos floor tile and in phenolic molding compounds. It is also used in other plastics such as polypropylene, polyester, nylon, melamine, epoxy, silicone, and vinyl. Asbestos provides a valuable function in such products as brake linings, clutch facings, electrical components, automotive parts, furniture, boats, sealants, coatings, adhesives and mastics. The most important functions of asbestos in plastics are reinforcement, dimensional stability, heat resistance, flow control, and general-purpose filling. Most of the functions are supplied by short-fiber chrysotile asbestos fiber, although longer chrysotile fibers and other asbestos varieties are sometimes required for particular properties.

Why Use Chrysotile?

Among the several advantages of chrysotile, which set it apart from the amphibole minerals and account for its widespread and increasing usage, are world-wide availability, mechanical strength, flexibility, positive surface charge, low iron content, softness, and low refractive index. It is conservatively estimated that chrysotile asbestos is used in over 3,000 applications and, in most of these applications, it is an essential ingredient for which no replacement is readily available.

The information in *Table* 1 shows that the use of chrysotile asbestos and its share of the total market are steadily increasing. This is due partly to technical advances permitting the broader use of chrysotile in plastics and the general decline in the use of asbestos in certain fireproofing and insulating materials. In addition, there is increasing evidence that crocidolite and amosite are more hazardous to

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the following Congressional purpose: "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 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 which are protected under other federal health and safety laws. In a news release issued January 4, 1972, OSHA announced a Target Health Hazards Program aimed at improving health factors associated with working conditions. The following five substances were designated to be the focus of initial and concerted efforts by OSHA and NIOSH: asbestos, cotton dust, silica, lead, and carbon monoxide.

At the present time, new standards have been established only for asbestos, although, of the 8,000 toxic substances on the NIOSH list, only 500 are covered by standards and many of those need updating. The new Standard for Exposure to Asbestos Dust was published in the *Federal Register*, Vol. 37, No. 110, on June 7, 1972. The basic exposure standard is an 8-hr time weighted average (TWA) of five fibers, longer than 5 micrometers, per cubic centimeter of air. The TWA limit is to be reduced to two fibers per cubic centimeter on July 1, 1976. A peak concentration of 10 fibers per cubic centimeter is not to be exceeded at any time. All of the fiber concentrations are those to which an employee may be exposed without protective clothing and 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. Some asbestos suppliers provide a monitoring service to customers, and a similar service may be obtained from state health department officials, insurance carriers, or private consultants. The law requires that monitoring be repeated as necessary to ensure that employees are not exposed to levels in excess of the exposure limits.

Improper interpretation of the regulations has created many misconceptions about equipment and procedures needed to properly use asbestos. If exposure limits are not exceeded, there are no further compliance requirements except for medical examinations. Medical examinations are required for all employees in any occupation exposed to airborne concentrations of asbestos fibers. The examinations are relatively simple and should cost no more than $50 per year, per employee.

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, change rooms, clothes laundering, and waste disposal. Respirators are not a substitute for engineering controls, but the law allows their use while controls are being implemented, in special situations where controls are not feasible or adequate, in emergencies, and for infrequent short-term, job assignments. 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 could include: dry acoustical spray products and joint cements, unsaturated roofing felt and textiles, and some insulating products made without adequate binders. The labeling of a product does not prohibit its use. It should be noted here that in at least 90% of the products containing asbestos, the fibers are solidly locked into the product thereby presenting little danger of dust generation during normal use and handling of the product."

EPA Standards

Whereas OSHA is responsible for the protection of the worker, the Environmental Protection Agency (EPA) is charged with improving 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 the Administrator of the EPA. National Emission Standards for asbestos were then published by EPA in the *Federal Register*, Vol. 38, No. 66, April 6, 1973. Although no numerical emission standards were established, operating criteria are prescribed to prevent or limit asbestos emissions to the outside air from asbestos mills, roadways, certain manufacturing operations, building demolition, and the spray-on application of materials used to insulate or fireproof equipment and machinery. The law further requires that spray-on materials used to insulate or fireproof buildings, structures, pipes, and conduits shall contain less than 1% asbestos on a dry-weight basis. This should significantly reduce emissions to which the general public may be exposed, especially in large urban areas.

". . . the Administrator (of EPA) has determined that, in order to provide an ample margin of safety to protect the public health from asbestos, it is necessary to control emissions from major man-made sources of asbestos emissions into the atmosphere, but that it is not necessary to prohibit all emissions.

"In this determination, the Administrator has relied on the National Academy of Sciences' report on asbestos, which concludes: "Asbestos is too important in our technology and economy for its essential use to be stopped. But, because of the known serious effects of uncontrolled inhalation of asbestos minerals in industry, and uncertainty as to the shape and character of the dose-response curve in man, it would be highly im-

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ly, the plastics industry uses primarily chrysotile asbestos and, in most products, the fibers are locked-in to prevent airborne contamination. Although asbestos dust levels are generally lower than expected, industry continues to expend large amounts of time and money to further improve the quality of the workplace. Although the general public is not currently in danger, occupational controls are required to prevent future environmental contamination.

Chrysotile asbestos is an important and necessary raw material, vital to the nation's safety and economy; and, with proper control, it can be used safely and in compliance with government regulations. Medical, scientific, government, and industrial personnel must continue to work closely together to establish reasonable exposure limits, provide safe work areas, and eliminate any possibility of public endangerment. □

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