

**4. La legislación y
reglamentación ocupacional
y ambiental sobre
el uso del asbesto.**

**Occupational and
environmental legislation
and regulations for
the use of asbestos.**

THE DEVELOPMENT OF ASBESTOS STANDARDS IN THE WORKING ENVIRONMENT IN THE UNITED STATES

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As many of you know, NIOSH has long been involved in the development of criteria for standards and I think for some of the members of the Latin American countries, it would be important to point out some distinctions between the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA).

Both of these organizations were implemented, or came to be, because of the passage of the Occupational Safety and Health Act of 1970. OSHA organizationally was placed in the Department of Labor and was charged with many things to do, of course, but one of those being to develop and promulgate occupational safety and health standards and to also enforce them.

NIOSH, on the other hand, was placed organizationally within the Department of Health and Human Services and among many of our responsibilities, one is to develop criteria or recommended standards for the Occupational Safety and Health Administration. The one distinction that you should know about is that NIOSH, in developing its recommended standards, does not consider the feasibility of complying with the levels that might be recommended, it is only concerned with the lowest level which will protect workers' health. OSHA on the other hand, is required to consider the feasibility in their rule-making.

In my presentation, I want to cover briefly the uses and consumption of asbestos, the recognition of the problem, and trends for development of standards in the United States.

USES IN THE UNITED STATES

The term 'asbestos' is a collective mineralogical term which refers to the unusual crystallization of certain naturally occurring hydrated silicate minerals in the fibrous or asbestiform habit. These fibers have high length to width ratios, are flexible, have higher tensile strengths than non-fibrous habits of the same mineral, and are aggregated in parallel or radiating bundles from which the fibers can be easily separated. Although many minerals occur in a fibrous habit in nature, only 6 are regulated in the United States by the Occupational Safety and Health Administration and by the Mine Safety and Health Administration as asbestos. These minerals fall into two major mineralogical classes: the serpentines, of which chrysotile is the only commercially important member; and the amphiboles, including crocidolite, amosite, asbestiform antophyllite, asbestiform tremolite, and asbestiform actinolite. Only chrysotile, crocidolite and amosite are of economic importance and are exploited for commercial purposes.

In the United States, more than 90% of all the asbestos used is of the chrysotile variety. Total U. S. consumption in 1977 was 610 000 metric tons, down from

peak consumption of 795 000 metric tons in 1973. Of this total only 93 000 were produced in mines and mills in the U. S., with 95% of all imported raw fiber coming from Canada. Consumption of asbestos by end use for 1978 is shown in *Slide 1*.

About 25% of the asbestos consumed in the United States has been incorporated into cement piping for water mains and sewage lines. In the construction industry, asbestos-containing cement products have been widely used in corrugated and flat sheeting, panels, tiles and molded products. In the past, suspensions of asbestos were sprayed onto the structural steel of buildings to provide insulation and fire protection.

Because of its thermal properties, asbestos is used extensively in friction products and is applied to molded brake linings. Although asbestos substitutes are being employed in disc brake products, drum brake linings that do not contain asbestos are not available, to my knowledge.

The asbestos minerals in varying concentrations have been used in the production of textiles and plastics, since they impart fire and corrosion resistance as well as tensile strength without inordinately altering the properties of the product or increasing its weight.

The countless additional uses of asbestos are of concern because they can be overlooked by the manufacturer and unrecognized by the consumer. Although asbestos was known to have industrial uses before the turn of the century, its use in the U. S. increased dramatically during the mobilization that accompanied World War II. Asbestos was employed liberally in the construction and reconditioning of ships and in such diverse war industries as the manufacture of aircraft engines, combat vehicles and gas masks. Although worldwide production has continued to increase since the War, consumption in the United States has dropped substantially during the past decade. This trend can be expected to continue. Since the latency period for the diseases associated with asbestos is usually 20 years or longer, many of the patients seen today were initially exposed in the 1940's, 1950's and 1960's, when control measures were often not as effective or widely employed.

POPULATION AT RISK

Because of the mineral's many industrial uses and its resistance to thermal and chemical degradation, exposure may take place starting from initial mining of the fibers through manufacture, use, and eventual burial of asbestos-containing waste. Mining and milling of asbestos in the U. S. is a small industry, employing fewer than a thousand workers.

Estimates of the number of workers exposed to asbestos in primary manufacture of asbestos products is shown in *Slide 2*. In the primary manufacturing sector, approximately 18 000 workers are estimated to be potentially exposed; however, this number has been estimated in another report to be as high as 37 000. A large variety of asbestos products and materials produced in primary manufacturing are fabricated and processed with other materials in secondary industries to produce some more than 3 000 products containing asbestos.

Secondary fabrication and processing industries are very large and it has been estimated, in a report prepared for the Occupational Safety and Health Administration, to employ more than 300 000 workers.

By far, the largest number of workers with potential asbestos exposure may be

found in industries which utilize asbestos products such as the construction industry, the automobile servicing industry and the shipbuilding and repair industry. In the construction industry, including those doing demolition and repair, an estimated 180 000 to 408 000 workers are potentially exposed to asbestos. The automobile servicing industry includes brake and clutch servicing, garages, rebuilding and refacing of friction parts, and the repackaging of friction products. It has been estimated that 2 000 000 workers are potentially exposed to asbestos in this sector of the industry, and I will stress potentially exposed. Approximately 3 800 workers are potentially exposed to asbestos in shipbuilding and repair.

A total of 2,3 to 2,5 million workers are estimated to be potentially exposed to asbestos in the United States. However, because of the long latency required before asbestos-related disease becomes clinically manifest, past asbestos workers must also be considered to be at risk. These estimates are especially difficult to develop and are subject to controversy. Nonetheless, large numbers of previous asbestos workers are now completing their latency period and are at risk of asbestos related disease.

RECOGNITION OF THE PROBLEM

Asbestosis

The first record of a well documented case of asbestosis was reported in England by H. Montague Murray in 1906, although there were several anecdotal reports prior to this time. Murray's report documented a case of pulmonary fibrosis at autopsy in a worker engaged in the production of asbestos textiles. The first report of asbestosis in the United States was by Pancoast in 1917, when he reported 17 cases of pulmonary fibrosis in a Pennsylvania plant. The first complete description of asbestosis and of the "*curious bodies*" seen in a lung tissue appeared in 1927, when Cooke reported a case of asbestosis, and McDonald reported on the same in another case. Each author gave reasons for believing that these "*curious bodies*" originate from asbestos fibers that reach the lungs.

Early case reports stimulated concern and in 1928, the first detailed epidemiological study of asbestos workers was undertaken by the Ministry of Labor in Great Britain. Results were published by Merewether and Price in 1930. As has been noted already, this was a cross-sectional chest X-ray study of 363 workers engaged in the production of asbestos textiles. Of this group 95 (or 22,6%) were found to have pulmonary fibrosis, and the prevalence of fibrosis after 20 or more years employment was over 80%.

In the United States, Donnelly in 1936 reported a cross-sectional chest X-ray study of 151 asbestos workers which found a pulmonary fibrosis prevalence of 59% among workers employed 4 years or more. In that same year, Schull reported chest X-ray studies of 100 workers dismissed from North Carolina asbestos plants due to disability and found a 55% prevalence of moderate or advanced asbestosis.

The United States Public Health Service began active research in the health effects of asbestos in the mid-1930's and in 1938, published the first detailed epidemiologic study of asbestos workers in that country, being the work of Dressen and his colleagues. A total of 511 employees were studied in this cross-sectional study and worker exposures were estimated by the impinger method. A relationship was found between extensive asbestos exposure and clinical symptoms of asbestosis, although many workers had short periods of exposure at the

time of the study (I will mention more about the study during the development of standards in our country).

Lung cancer and mesothelioma

With regard to lung cancer and mesothelioma, the first report that asbestos might be a human carcinogen came in 1935. In the United States, Lynch and Smith, and in England, Gloyne independently reported three cases of lung cancer in autopsied asbestos workers. All three workers had died of asbestosis. Other case reports followed and in 1947, the Annual Report of the Chief Inspector of Factories in England stated that of 365 asbestosis deaths, 65 (or 17,8%) also had cancer of the lung at autopsy.

Despite these early suggestions, the first detailed epidemiologic study to conclusively demonstrate an association between asbestos exposure and lung cancer was not published until 1955 by Doll. Doll studied the mortality experience of a cohort of 113 asbestos textile workers employed more than 20 years. Among this group, 11 lung cancer deaths were observed compared to only 0,8 expected, based on the mortality experience of England and Wales.

Asbestos exposure is associated with mesothelial tumors of pleural and peritoneal tissues. Lee and Selikoff have reviewed early reports associating asbestos exposures and mesothelioma. The first cases were reported in 1946 by Wyers. However, conclusive evidence of an association between asbestos exposure and mesothelioma was not presented until 1960 when Wagner reported 33 pleural mesotheliomas in the chrysotile mining area of South Africa.

Development of Standards in the United States

As mentioned, the U.S. Public Health Service began active research into the health effects of asbestos in the mid-1930's. The first recommended guideline for controlling the exposure to asbestos dust was recommended by Dressen and his colleagues in Public Health Service Bulletin No. 241, published in 1938. This recommendation was made following a study of 541 employees in four asbestos textile plants where massive exposures occurred. A tentative limit for asbestos dust in the textile industry of 5 million particles per cubic foot (mppcf), determined by the impinger technique, was recommended. They found numerous well-marked cases of pneumoconiosis where concentrations exceeded 5 mppcf, but only 3 doubtful cases where concentrations were under 5 mppcf. However, only 3 persons had been exposed for more than 10 years to concentrations below 5 mppcf. Of the 39 persons exposed to concentrations below 4,5 mppcf, none showed evidence of asbestosis; but only 6 of these had been employed more than 5 years. Other limitations of the study, most of which were pointed out by the authors, include the fact that 333 of the 541 employees studied had worked less than 5 years in these textile mills; only 66 were employed as long as ten years, and only 2 of these for more than 20 years. Furthermore, the average age of these asbestos textile workers was 32,1 years and only 1 of the 4 plants studied had been in operation for more than 15 years. Thus, the first accepted (or what came to be accepted) exposure limit established in the United States was based upon limited data. The authors recognized the limitations and stated in the report that "*5 mppcf may be regarded tentatively as the threshold value for asbestos dust exposure until better data are available*". As you will see, it was 30 years later before this level was changed in our country.

The guidance of the Public Health Service Bulletin No. 241 and the recommended 5 mppcf level was later adopted and published as a Threshold Limit Value (TLV) by the American Conference of Governmental Industrial Hygienists (ACGIH), an independent consensus standard-setting agency, in 1946. The Threshold Limit Values, as issued by the ACGIH, are guidelines for good occupational health or industrial hygiene practice and have no legal effect. More recently the TLV's have been used or included by reference in Federal and/or State statutes or registers, and when such is the case, the TLV's do have the force and effect of law.

In 1960, the first official U. S. Government Standard was set for some workers exposed to asbestos. The standard was contained in the Longshoremen's and Harbour Workers' Compensation Act of 1960 which provided compensation for injuries suffered by employees when they were working for private employers within the Federal Maritime Jurisdiction on Navigable Waters of the United States, including dry docks. The environmental concentration stated in this Act for asbestos was 5 mppcf and was adopted from the ACGIH and the Public Health Service recommendation.

In addition to the Longshoremen's Act, the Walsh-Healey Public Contracts Act of 1960 required contractors, entering into contracts of \$10 000 or more with the United States Government, to assure that materials or goods manufactured or supplied to the government would be manufactured in factories that are free from conditions that are hazardous or dangerous to the health and safety of the employees. This Act adopted a standard of 5 mppcm of air for asbestos. It is not clear why the Walsh-Healey Act used 5 mppcm of air when the guideline of the U. S. Public Health Service, the American Conference of Governmental Industrial Hygiene Guidance, and the Standard under the Longshoremen's Act all had a much more restrictive concentration of 5 mppcf of air. However, in 1969, under the same Walsh-Healey Act, a new set of standards was adopted using the threshold limit value of airborne contaminants for 1968, of the American Conference of Governmental Industrial Hygienists which set the level for asbestos at 2 mppcf of air or 12 f/cc of air.

With the passage of the Occupational Safety and Health Act of 1970, the Department of Labor's new Occupational Safety and Health Administration adopted for all general industries under their jurisdiction, the 1968 ACGIH TLV's; thus the recommendation of 12 f/cc or 2 mppcf became the first asbestos standard under OSHA in April of 1971. As I mentioned, the OSHA Act was passed in 1970, but in 1971 they established a regulation and they did not have time to promulgate a standard, so they adopted consensus standards, and this 1968 TLV was one of the consensus standards. In that same year 1971, the ACGIH further reduced their level to 5 f/cc. So you can see that from this period of 1968 on, things changed quite rapidly, but until that time, from 1938 till 1968 there was very little change.

Then in November 1971, OSHA was requested by the American Federation of Labor -Congress of Industrial Organizations (AFL-CIO) to issue an emergency standard covering the industrial use of asbestos, and an emergency temporary standard was promulgated on December 7, 1971. The emergency temporary standard stated a concentration of 5 f/cc, but not to exceed 10 f/cc, may be permitted up to a total of 15 minutes in an hour for up to 5 hours in an 8-hour workday. In

addition, this emergency temporary standard outlined engineering controls such as vacuum sweeping and local exhaust ventilation as well as respiratory protection. In the meantime, NIOSH prepared and transmitted to OSHA a criteria document for a recommended standard for exposure to asbestos, and this was the first criteria document on asbestos. It recommended an 8-hour time-weighted average of 2 f/cc longer than 5 micrometers, with a 15 minute ceiling value of 10 fibers. The NIOSH criteria document relied heavily on the Committee on Hygienic Standards of the British Occupational Hygiene Society for their asbestos recommendations, and indicated that control of worker exposures to these limits would prevent asbestosis and more adequately guard against asbestos-induced neoplasms. But as has been pointed out in some of the comments, it was actually developed to control asbestosis. The document also contained recommendations designed to limit and control exposures of workers through engineering methods and respirator protection and to provide medical surveillance for exposed workers.

In July of 1972, OSHA promulgated a definitive standard for asbestos. This was the first health standard for a contaminant promulgated to undergo formal rulemaking by OSHA under the provisions of the 1970 Act. The standard adopted a time-weighted average of 2 f/cc longer than 5 micrometers, with a 15 minute ceiling of 10 fibers, and that 2 f/cc would be effective July 1, 1976; all other provisions of the standard were effective July 7, 1972.

In addition to permissible exposure levels to airborne concentrations of dust, the standard included methods of compliance including both engineering methods and work practices, methods of measurement and monitoring, caution signs and labelling, as well as housekeeping, recordkeeping, medical examinations, and limited use of respirators. Until July 1, 1976, the emergency temporary standard of 5 f/cc would remain in effect.

As a result of a court case, the Occupational Safety and Health Administration decided that, to achieve the most feasible occupational health protection, a re-examination of the standard's general premises and general structure was necessary. To this end, on October 9, 1975, OSHA announced a proposed rulemaking to lower the exposure limit to an 8-hour time-weighted average concentration of 0,5 asbestos f/cc of air determined by a sampling period of up to 15 minutes. In December 1975, OSHA requested NIOSH to re-evaluate the information available on the health effects of occupational exposure to asbestos fibers, and to advise OSHA on the results of this study.

In December 1976, NIOSH submitted a revised recommended asbestos standard to OSHA, advising that the current 2,0 f/cc standard was inadequate to protect against asbestos-related disease and that the standard should be set at the lowest reliable concentration detectable by available analytical techniques. Since phase contrast microscopy was the only generally available and practical analytical technique at that time, the concentration recommended by NIOSH was 0,1 f/cc longer than 5 micrometers as an 8-hour TWA with a peak concentration not exceeding 0,5 f/cc as determined in a 15 minute sampling period. This new recommendation was intended to protect against the non-carcinogenic effects of asbestos and to lower the carcinogenic risk since cancer risks had been demonstrated at all fiber concentrations studied to that date. The available data at that time provided no evidence for a threshold of response or for a "safe" level of asbestos exposure.

In the fall of 1979, at the request of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of NIOSH, a joint NIOSH/OSHA

working group on asbestos was established. In November 1980 the committee's report was released. The working group was requested to review the existing scientific information concerning asbestos-related disease and assess the adequacy of the current OSHA standard of 2,0 f/cc greater than 5 micrometers. This NIOSH/OSHA committee reviewed previous NIOSH criteria documents, the report of the British Advisory Committee on Asbestos (completed in 1979) and the 1977 International Agency for Research on Cancer (IARC) monograph on the carcinogenic hazards of asbestos.

Among the recommendations made by the joint committee was a recommended definition of asbestos for regulatory purposes.

Asbestos is defined to be chrysotile, crocidolite and fibrous cummingtonite-grunerite including amosite, fibrous tremolite, fibrous actinolite, and fibrous anthophyllite. The fibrosity of the above minerals is ascertained on a microscopic level with fibers defined to be particles with an aspect ratio of 3 to 1 or longer.

The working group concluded that given the inadequacy of the current 2 f/cc standard, the committee urged that a new occupational standard be promulgated, designed to eliminate non-essential asbestos exposure, and which required the substitution by less hazardous and suitable alternatives where they exist. Where asbestos exposures cannot be eliminated, they must be controlled to the lowest possible level. A significant consideration in establishing a permissible exposure limit should be the lowest level of exposure detectable using currently available analytical techniques. At present this level would be 0,1 f/cc greater than 5 micrometers in length averaged over an 8-hour workday. Regardless of the choice of a permissible exposure limit, the best engineering controls and work practices should be instituted, and protective clothing and hygiene facilities should be provided and their use required of all workers exposed to asbestos. Respirators are not a suitable substitute for these control measures. The committee also reiterates its judgment that even where exposure is controlled to levels below 0,1 fiber, there is no scientific basis for concluding that all asbestos-related cancers would be prevented.

As was already mentioned, OSHA issued in 1983 an Emergency Temporary Standard, but it was invalidated by the court.

The latest, but not likely to be the last chapter in occupational asbestos standards, occurred in 1984 with the publication by the OSHA of a proposed rule and notice of a hearing. The proposed standard was issued because the OSHA determined that employees exposed to asbestos, at the current 2 f/cc exposure limit, face a significant risk to their health and that the proposed standard would substantially reduce that risk. The proposed standard is a new approach in which alternative levels of 0,2 f/cc or 0,5 f/cc are proposed, and this was done after exploring the feasibility of meeting three possible exposure limits of 0,5, 0,2 and 0,1 f/cc.

The administration went on to state that a significant risk remains at the proposed exposure limits. However, it was felt that recent available evidence indicates that either 0,2 or 0,5 f/cc were an appropriate limit to propose when considering the available information regarding feasibility limitations, particularly asbestos measurement accuracy at low levels. OSHA convened hearings in June of 1984 and intends to issue a final rule before the end of 1985, but as Mr. Pigg commented it will probably be more like mid-1986 before that rule comes out.

This completes a chronology of the development of occupational asbestos standards in the United States. In closing, I would say that the position of NIOSH is that we urge that a new occupational standard be promulgated which is designed to eliminate non-essential asbestos exposures and which requires substitution by suitable and less hazardous alternatives where they exist. Where asbestos exposures cannot be eliminated, they must be controlled to the lowest level possible. A significant consideration in establishing a permissible exposure limit should be the lowest level of exposure which can be accurately measured using currently available analytical techniques. At present this level would be 0,1 fibers greater than 5 micrometers in length per cubic centimeter, as determined in a sample collected over any 100 minute period at a flow rate of 4 L/min using the NIOSH analytical method 7400.