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Asbestos is still a health problem

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This year it is 50 years since a scientific consensus was achieved that asbestos can cause asbestosis, lung cancer and mesothelioma. It happened at a big and later very famous international conference in New York.

Yet two decades went by before effective prevention was adopted in the western world. In Denmark a ban against the use of asbestos was first introduced in 1986. But globally about 150 million people daily continue to be exposed to asbestos in their work. Approximately 107,000 workers die every year from asbestos-related diseases.

In Denmark, about 250 people each year get lung cancer or mesothelioma as a result of previous work with asbestos. Deaths from asbestos-related diseases are 4-5 times higher than the number of those who die in accidents in the work place, and despite the ban on the use of asbestos in 1986, asbestos continues to be the working environment factor that causes the highest number of deaths in Denmark.

The incidence of asbestos-related cancer is expected to rise until around 2025 before the curve turns. Asbestos is removed or encapsulated, but exposure may still occur. Asbestos still exists in significant quantities in buildings, ships, trains etc.

The history of asbestos, both internationally and in Denmark, is a working environment scandal. Economic interests have over-ruled the prevention of serious and fatal diseases. It is an important lesson of history that the research and assessment of risks in the working environment must be publicly available, transparent and independent of industry. The same applies to the decisions of the authorities.

What is asbestos?

Asbestos is a generic term for a variety of fibrous minerals found in rocks. In the mining and use of asbestos, small, long and thin asbestos fibers are dispersed in the air, from where they are inhaled and deposited in the lungs. The fibers are fibrogenic and carcinogenic - the more, the longer and thinner the fibers are. Alveolar macrophages are damaged by attempts to phagocytize them and release reactive oxygen radicals and various cytokines that cause inflammation and possibly subsequent fibrosis and cancer (1) (see Fig. 1).

The main asbestos related diseases are lung asbestosis, lung cancer and mesothelioma but asbestos can also cause laryngeal cancer, exudative pleuritis and pleural plaques

WHO estimates that approximately 150 million people are daily exposed to asbestos in their work, and that about 107,000 workers die each year from asbestos-related diseases (2).

Asbestos production and consumption is still increasing in Russia, China, Brazil and other third world countries. This means that the incidence of asbestos-related diseases will continue to increase in the years ahead.

Asbestos is now banned in 55 countries and therefore allowed in the other 135 countries in the world. Asbestos is used especially in many developing countries. WHO recommends that all use of asbestos should stop, and many occupational medicine societies, including the Collegium Ramazzini, the International Joint Policy Committee of Societies of Epidemiology and the World Federation of Public Health Associations, are advocating for a worldwide ban.

Lobbyists from the asbestos industry are trying to avoid a ban. In particular they are active in the developing countries. Independent researchers, doctors and public health experts have recently warned against these lobby activities (3).

The history of asbestos

From about the beginning of the 1900s, there has been suspicion that asbestos dust can cause fibrosis of the lung tissue (lung asbestosis), and this was generally recognized from the 1930s. During World War 2 it was suspected that asbestos can cause lung cancer, and this was confirmed in population studies from mid 1950s (4). In 1960, studies also showed an increased incidence of mesothelioma among those exposed to asbestos (5). But even if the results were published in scientific journals, and doctors and other experts warned against the harmful effects, the warnings did not reach the public and were concealed from the workers so as not to create "unnecessary" unrest and to avoid adverse economic effects on the asbestos industry.

This policy of silence ceased only gradually after 1964, when the New York Academy of Sciences held the first International Congress on the biological effects of asbestos (6). This congress was the breakthrough for broad recognition that working with asbestos involved a high risk of disabling and fatal lung disease.

Nevertheless, the road to effective prevention was long and is still very deficient worldwide. This is mainly due to the fact that the asbestos industry in the UK, USA and Canada from the early 1960s went massively into a campaign to block preventive measures, which would result in less use of asbestos. The campaign was inspired by the campaign of the tobacco industry to avoid restrictions on smoking. The methods were disinformation and lobbying. The industry created, funded and controlled "independent" research institutes which were intended to create continuously and

systematically doubt regarding the results of independent scientific studies that showed health damage from exposure to asbestos. The asbestos industry employed highly estimated medical professors, researchers and doctors who used their authority to reassure the public, cast doubt on the evidence of asbestos hazard and influence the authorities not to impose measures that could reduce the use of asbestos.

A particularly glaring example is the activities that were carried out by "The Chrysotile Institute" associated with McGill University in Canada, supported by the Canadian government. Canada was the world's largest asbestos exporter of white asbestos (chrysotile). The strategy was to blame the adverse effects on other types of asbestos (crocidolite and amosite) than white asbestos and claim it was possible to work safely with white asbestos ("safe use of chrysotile asbestos"). The Institute was closed in 2012. There has subsequently been hearings on the role and responsibilities of McGill University. There have also been raised accusations of scientific fraud with the Institute's research. These accusations have not been met by the presentation of original data (8). After the closure of the institute high-ranking members of the Institute have been employed by industry lobbying to oppose ban on asbestos, for example, recently in Pakistan. (3) The asbestos Industry has unfortunately succeeded in preventing or delaying action against the use of asbestos. Worldwide consumption rose sharply until 1980, after which it gradually decreased mainly due to a decrease in consumption in the western world, while consumption, particularly in Asia, has increased dramatically. Worldwide consumption in recent years has stayed at around 2 million metric tons a year.

Asbestos history in Denmark

In Denmark, the local asbestos story is as dramatic as the international one.

To put it nicely, the attitude of companies, authorities and the established occupational medicine authorities was to drag their feet, although it was understood that working with asbestos led to invalidating and fatal diseases among the employees. The lung clinic in Aalborg took x-rays of the lungs of the workers at the Danish Eternit factory. But the results were largely kept confidential within a narrow group of doctors at the clinic and the Labour Inspectors.

They apparently wished to avoid what they considered unnecessary anxiety among the workers or unnecessary unrest in the workplace.

No action was really taken until insulation workers threatened to refuse to work with asbestos. This and demands from the Transport and General Workers' Union in Denmark (the current 3F) ensured that in 1972 asbestos was banned for insulation purposes. In 1980 came a partial ban, which, however, exempted the Danish Eternit factory, in 1986 a ban with exceptions, and in 2004 a total ban on the use of asbestos.

In Denmark consumption peaked in the mid-1970s with an annual import to Denmark of 30,000 tons of asbestos (see Fig. 2) (7). Subsequently, imports decreased to an insignificant level in 1986,

Asbestos-related mesothelioma

Approximately 90% of all cases of malignant mesothelioma of the pleura is believed to be caused by asbestos exposure. The number of new cases continues to rise (Fig. 3 and 4). Because of greater exposure to asbestos, men have a much higher incidence of mesothelioma than women and subjects with known asbestos exposure have a higher risk than subjects without exposure. For example, the incidence of mesothelioma in the period 1961-2005 was 22 times higher for plumbers than for farmers.

Other building workers, sailors and mechanics also had a higher risk (Table 1) (12).

Following a change in workers' compensation law in 2007 all cases of mesothelioma recorded in the National Board of Health are passed over to the Industrial Injury Board to be examined for workers' compensation.

In 2011, 106 men and 17 women were diagnosed with cancer in the pleura.

Of these cases, 83 (67%) were recognized for compensation as an occupational disease.

A short-term exposure to low concentrations of asbestos fibers in the air is enough to increase the risk of mesothelioma. The latency period is about 30 years or more.

Asbestos-related lung cancer

In a reference document on asbestos exposure and lung cancer it was estimated that 4-8% of new lung cancer cases are caused by asbestos exposure (13), ie 100-150 new cases annually.

Each year, about 75 cases of asbestos-related lung cancer are reported to the Industrial Injury Board and just below half of those are recognized to be compensated as an occupational disease.

Unlike mesothelioma, which can occur after even low exposure to asbestos, the exposure to asbestos needed to cause lung cancer is bigger. Dose-response relationship at low exposures is uncertain. Internationally, it is generally accepted that asbestos exposure equivalent to approximately 25 fibers x year per ml doubles the risk of lung cancer (14).

In a study from Sweden a doubling of risk of lung cancer was found in persons exposed to 4 fibers x year per ml (15). The latency is about 10 to 30 years. Asbestos exposure increases the risk of lung cancer equally in smokers and non-smokers. Lung cancer in asbestos-exposed smokers should be recognized in the same way as in non-smokers, i.e. without prejudice for smoking. It is unfortunately not the case today, but will hopefully be changed in connection with a pending lawsuit (16).

The significance of the remaining asbestos

The use of asbestos was banned in Denmark in 1986. At the same time the safety rules were

reinforced for workers dealing with the remaining asbestos.

The remaining asbestos is found in Eternit (asbestos cement), insulation and brake linings. Whether release of asbestos fibers takes place depends on the condition of the material. Damaged materials will release the most asbestos fibers.

The highest incidence is found in buildings, but how big it exactly is, is not known. A total of 73% of the buildings in Denmark were built before 1980 and therefore potentially contain asbestos (17). In these buildings asbestos can be found as insulation around pipes, in floor coverings, in sheets for walls and ceilings, in glues, in paints and as fire insulation in e.g. stairwells. Outside of buildings, asbestos can be found in the roof and facade panels (Eternit) e.g. on farms. It is particularly buildings constructed between 1920 and 1990 which contain asbestos.

Exposure to asbestos fibers can occur during renovation or demolition of buildings containing asbestos materials, if workers are not aware of it or if the rules deliberately are bypassed to save time and money. The Labour Inspection authorities unfortunately have experience of the latter from time to time (18).

What can we learn from the history of asbestos

The history of asbestos is the story of how companies, physicians, regulators and politicians let things happen year after year, regardless of scientifically based knowledge about asbestos hazard. Economic interests were given precedence over the workers' health. The human victims have been - and will remain – considerable in number and suffering. Not undeservedly, the asbestos story today, both in Denmark and internationally, is called the largest safety scandal ever.

But we can learn from history. First of all, there should be openness and transparency in all matters relating to the investigation and assessment of risks associated with the working environment. You cannot count on data, if it is the industry itself that is responsible for investigations and risk assessment.

It is therefore important that the public sector ensure a good framework for independent research and risk assessment. To the extent that industry contributes to public research through research funding, from the date of authorization there should be a clear separation between any influence from the grant donor and the grant-recipient conducting the research task and data should then be publicly available. Transparency and the requirement to operate at arm's length is generally a good protection against misuse of power. It is worth remembering this at a time when there is much talk of cooperation between public research institutions and private industry.

Authorities and other decision makers must in the same way secede from corporate interests and implement the measures necessary to prevent workers from becoming ill from their work.

Economic conflicts of interest: none declared.

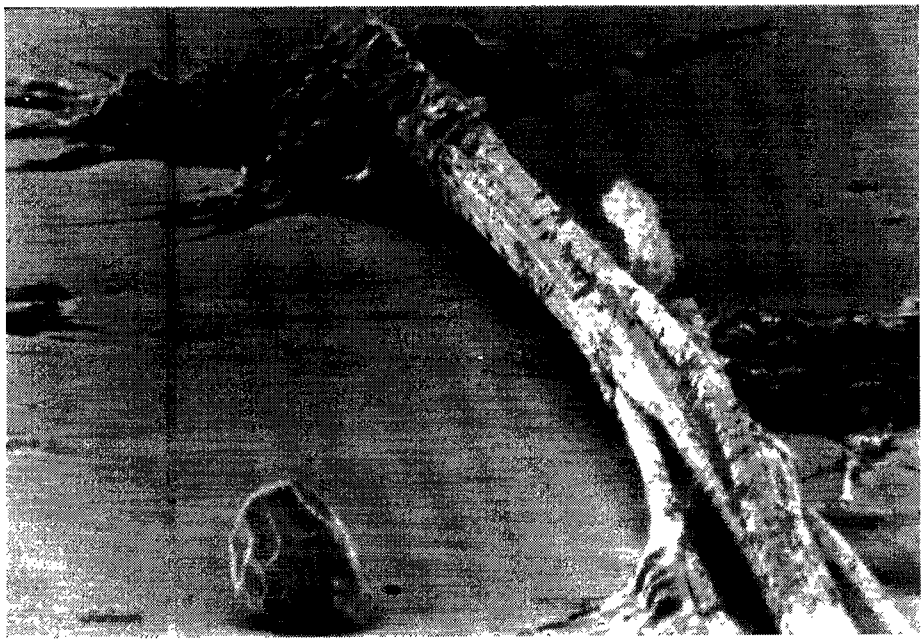


Figure 1. Electron microscope image of macrophage in alveoli trying to phagocyte an asbestos fiber. (Foto: Lennart Nilsson/TT)

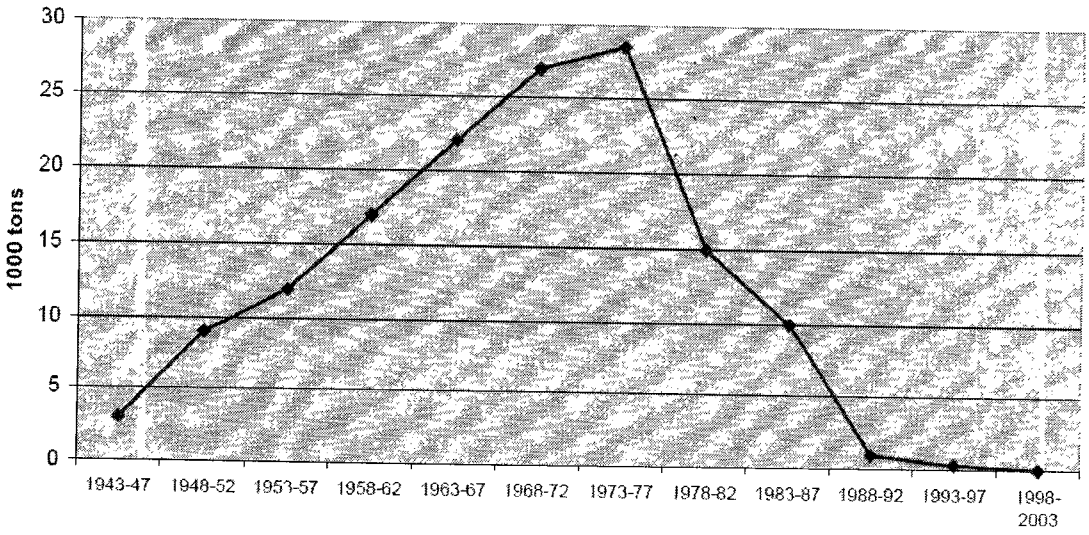


Figure 2. Annual asbestos imports in Denmark 1943-2003 (7).

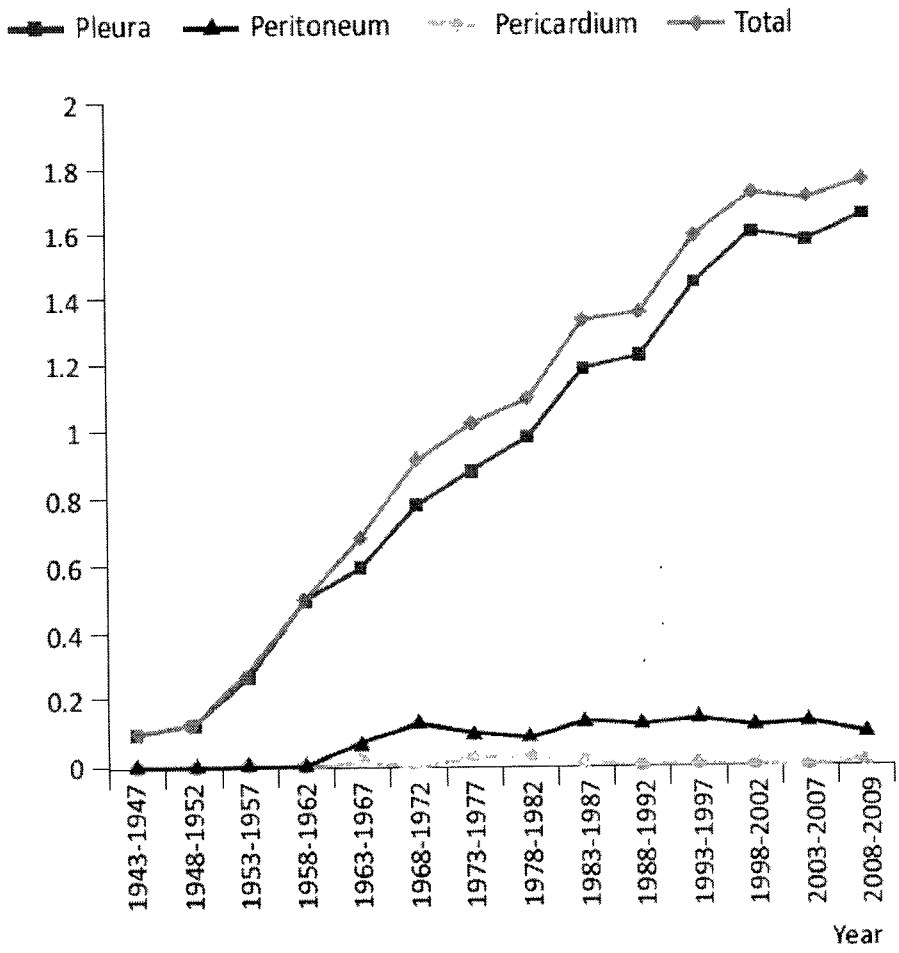


Figure 3. Age-adjusted annual incidence of mesothelioma per. 100,000 men in Denmark 1943-2009 (9). (The figure was previously published in the Danish Medical Journal and placed with the authors' permission).

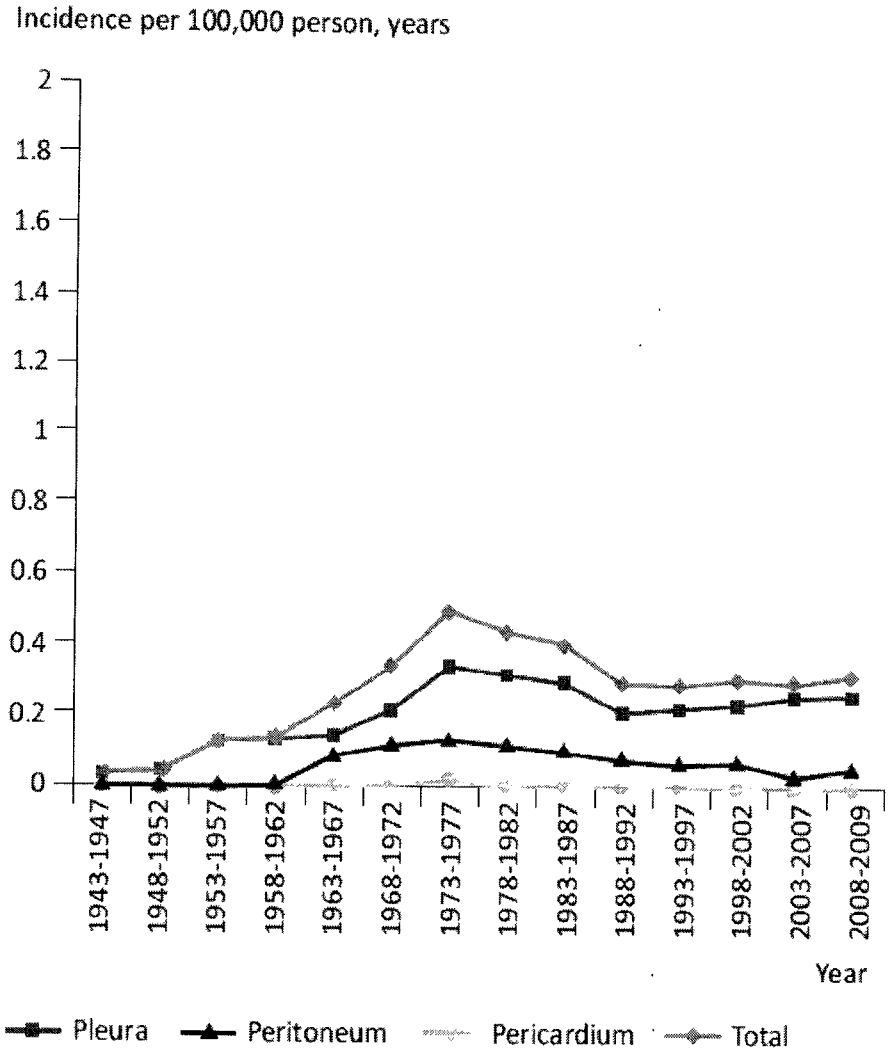


Figure 4. Age-adjusted annual incidence of mesothelioma per. 100,000 women in Denmark 1943-2009 (9). (The figure was previously published in the Danish Medical Journal and placed with the authors' permission).

Figure 5. Number of mesothelioma cases among men in Denmark and standardized incidence ratio (SIR) for the period 1961-2005 in selected trades with a statistically significant SIR (12).

Trade (isco 1958)	Obs	SIR
Technical skills	136	1.53
Teachers	14	0.36
Farmers	32	0.18
Sailers	26	2.53
Welders	101	3.53
Mechanics	187	2.46
Plummers	27	3.92
Electricians	31	1.69
Wood workers	109	2.13
Machine operators	34	1.78



Figure 6. There are still many thousands of square meters of asbestos cement sheets on roofs in Denmark as a potential source of exposure to asbestos fibers *(Private photo Jonathan Aavang Petersen)*

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