

The Swedish Experience with Asbestos: History of Use, Diseases, Legislation, and Compensation

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After World War II, large quantities of asbestos were imported to Sweden and used in construction and ship building. In 1976, the use of asbestos was for practical purposes prohibited. Today, the only exposures are environmental, from asbestos in place and when buildings are demolished or rebuilt, and there are very strict rules for such work. Consequently, it is assumed that the asbestos-related diseases will gradually disappear from society, but due to the long latency time, about 100 mesotheliomas still occur every year in Sweden, and so far there is no certain sign of a decrease in incidence. Compensation is from the state via general insurance and consists basically of compensation for lost income and medical costs. *Key words:* asbestos; Sweden; pleural lesions; lung cancer; mesothelioma; history.

INT J OCCUP ENVIRON HEALTH 2004;10:154-158

Asbestos is a fairly common component of the earth crust in many areas of the world, including Scandinavia. In Sweden there are no large lodes of asbestos, and no asbestos mining has taken place. However, different types of asbestos are present in many places. The deposits are small and local and have not been mined or used in historical times. Archaeology has shown, however, that local asbestos was once used and had economic importance.

The most troublesome of the “native” types of asbestos have been those that are present in the various mines, as described below.

Asbestos Use in Prehistory

The oldest archeologic evidences of human use of asbestos materials have been found in northern Europe, including Sweden. From about 4000 BC asbestos was used in pottery in the Paakila district in Eastern Finland, where there are extensive lodes of anthophyllite. The use of asbestos from Paakila spread to all Finland and neighboring parts of what is now Russia. The Paakila asbestos was also mined in modern times, resulting in a local “epidemic” of calcified plaques. By about 1500 BC asbestos use was also

common in northern Sweden and Norway. It is now assumed that most of the asbestos used in northern Scandinavia was obtained locally, even if imports from Finland did occur. That such imports should have been sufficient for people’s needs seems unlikely, based on the many asbestos-containing artifacts that have surfaced. In fact, in practically all settlements from this time, pieces of asbestos pottery can be found (Fig. 1). The origins of the asbestos cannot be determined.

The people living in these prehistoric villages were fishers and hunters. Asbestos was used in their large cooking vessels (Fig. 2). The addition of asbestos served to strengthen the vessels—trials have shown that the asbestos-fortified vessels can be dropped from three to four times as high a level before breaking as compared with vessels without asbestos.¹ Thus, asbestos had an important early economic impact.

The asbestos in the pottery is anthophyllite. Holes were drilled in many pots, presumably to make it possible to hang the vessels above fires, and the threads in these consist of chrysotile.² The different properties of various forms of asbestos were thus known thousands of years ago.

In Finland, the use of asbestos was abandoned at about the time of the birth of Christ, after almost 4,000 years. In Sweden, the last asbestos pottery is from the 5th century AD, but in Norway the substance remained in use in pottery for another century.

Serious health effects of the asbestos use in prehistoric Scandinavia seem unlikely. The collection and mixing of asbestos must have caused some dust, but



Figure 1—Archaeological asbestos, found in a stone-age village in northern Sweden.

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according to archaeologists these activities occurred in fresh air, and of course there was no smoking. Among those few who lived long enough, one would assume that pleural plaques were common, and probably some odd cases of mesothelioma occurred as well.

Exposures in Mines

In Sweden mining of various ores, mainly metal (iron, copper, silver, gold, etc.) has been and continues to be an important industry. In some of these mines the ores or other minerals that have to be crushed in the mining process contain asbestos fibers or fibers that are not officially classified as asbestos (since asbestos is in fact a commercial term) but nevertheless are in all aspects asbestiform. Examples are so-called “dannemorite” in the now no-longer-used iron mine in Dannemora and “porcellophite” in the old silver mine of Sala. More usually, variants of tremolite and anthophyllite can occur.

Many mines have now been closed for economic reasons. The closing of many smaller mines occurred mainly in the 1980s. The awareness of the asbestos in the mines and the discussion thereof was about to start in earnest at the same time as the threat of closing mines loomed higher, and as a consequence the labor unions were concentrating on the latter problem and asbestos hazards were not high on the agenda—it was felt that this could be used as a further argument for closure. However, some cases of mesothelioma were diagnosed in miners and correlated with the asbestiform fibers found in the mines.

Nowadays, the Swedish mines are strictly regulated. The mines have good air conditioning, mainly because of the risk of silicosis, but this of course also diminishes the risk of asbestos exposure.

Asbestos Use in the Industrial Age: before and during World War II

After the 5th century, there was no known use of asbestos in Sweden until the industrial age. Before WWII, its use was limited mainly to insulation and fire protective products such as protection curtains in theaters, but was slowly increasing, and during a five-year period just before WWII, a total of 17,600 metric tons was imported.³ During the war, no import to the country was possible, but with the economic boom after the war the volume imported increased considerably (Fig. 3). During the war, the scarcity of oil and petroleum products precluded the use of private cars. Buses and other necessary motor vehicles were powered by special wood or coal burners (Fig. 4) which had to be well insulated, and here asbestos was used in most cases.

Development after World War II

Once the war was over, Sweden participated in the rapid economic development that occurred all over the



Figure 2—Pottery containing asbestos. From the Finnish National Museum, Helsinki.

Western world. The risks of asbestos use had been largely neglected and forgotten during the war, and asbestos was freely used in construction, ship building, and all kinds of industry. Imports increased very rapidly (Fig. 3). The vast majority of the imported asbestos was chrysotile from Canada, but crocidolite and amosite from South Africa and anthophyllite from Finland was also imported. The import and use continued until the mid-1970s, when awareness of the risks and new laws made the import decrease rapidly until it was practically nonexistent.

The First Reported Cases of Asbestos-related Diseases in Sweden

The first case of asbestosis was described in 1953 and with investigation of the various work forces, eight more cases were found.⁴ Seven patients were insulators and had mild asbestosis; in addition, there were two sprayers of asbestos who had severe disease, in one of whom it was rapidly fatal. Two of the patients had had less than five years of exposure, illustrating the heavy exposures that must have occurred. Up to 1960, the total of known cases of asbestosis in Sweden was only 15.³

ASBESTOS-RELATED DISEASES AND FINDINGS IN SWEDEN TODAY

As mentioned, asbestos is for all practical purposes banned in Sweden today. That does not mean that exposure no longer occurs: as in most other countries, there are many tons of the substance built into our buildings, machines, etc., and even if according to the law very strict regulations are to be enforced when these are rebuilt or demolished, this is far from always done in practice, from lack of knowledge (or to save money). In addition, we have the problem of deterioration of roofs, plumbing, etc., resulting in exposures—sometimes considerable—of persons who are

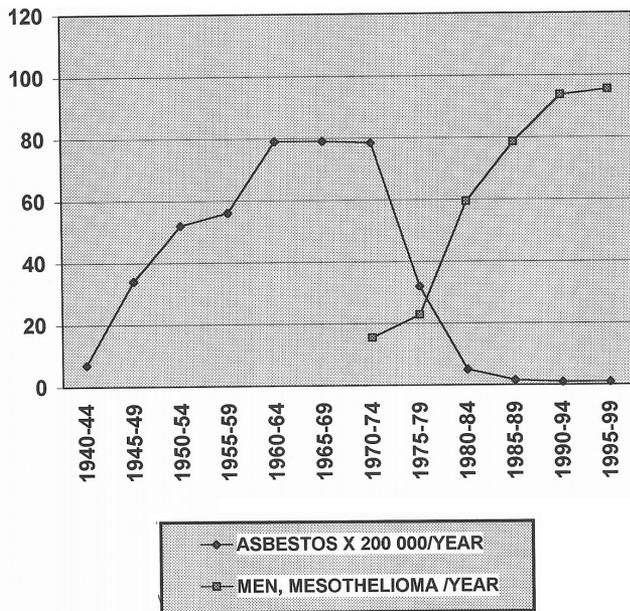


Figure 3—Import curve of asbestos to Sweden and incidence of mesothelioma.

unaware of the risks and have no idea that they have been exposed.

Pleural plaques are a very common finding on chest roentgenograms, and in fact after the age of 40, 3–4% of the male population are carriers of plaques. In more than 80% of these, asbestos exposure—usually occupational—can be ascertained, but sometimes this is very difficult. Plaques are a sign of exposure to asbestos and mean that the carrier is at risk for asbestos-related diseases, but in themselves they are likely to be harmless.⁵

Asbestosis is a rare disease today in Sweden. Mild cases in elderly men do occur. For asbestosis to occur, quite a heavy exposure is necessary, and such exposures are now nonexistent in our country. However, less severe restrictive lung disease does occur. Diffuse pleural thickening is much more serious than are simple plaques, and affected patients can have an important reduction in pulmonary function. Even this, however, is not commonly seen.

As for the malignant diseases, there are about 100 mesotheliomas every year in the country. It has long been thought that the incidence should decrease, but this has not been seen yet.⁶ The latency time of usually three decades or more is the probable reason that the epidemic continues (Fig. 3). We can foresee that the curve should start to go down some years from now, when the occupational cases become fewer. Against this trend we will probably see more cases in people who have not been occupationally exposed but have been the victims of background exposures; hopefully, however, these cases will also be fewer in the future.

As for lung cancer, most of these cases are never reported as due to asbestos. Since practically all

patients with lung cancers are or have been smokers, the doctors rarely go further than to establish the smoking habits. Thus, there is an underestimation of the importance of asbestos in causing this type of cancer. Most likely, as in other countries, there are two to three lung cancers for each mesothelioma, and thus we should have about 250 cases of lung cancer each year that are at least partially due to asbestos exposure.

OCCUPATIONAL GROUPS SUBJECT TO ASBESTOS EXPOSURE

The spectrum of occupational exposures in Sweden is no different from that in other countries. The main findings from some of the studies of Swedish exposures are shown here.

Construction Workers

Workers in the building and construction industry who were active in the 1950s and 60s were all more or less exposed to asbestos. They form the largest group of asbestos-exposed people in Sweden. Some subgroups, such as insulators and plumbers, could have had fairly high levels of exposure. The “Bygghälsan” in Sweden—the Construction Workers Health—is very well organized and has for many years had a health program for construction workers of all kinds. As many as 180,000 workers are monitored. Much important research has also been done. Asbestos has been on the agenda since the 1970s, and, for example, a handbook for construction workers describing what was typical for different buildings as well as rapid and exact analyses of suspect materials have been organized.⁷

Asbestos-cement Plants

Maria Albin investigated a plant situated in the south of Sweden, which had operated from 1907 to 1977.⁸ Mainly chrysotile was used, but in the 1950s small amounts of amosite and up to 1966 also crocidolite had also been added. The exposure levels were not high. The fiber concentration in the lungs of asbestos-cement workers was found to be higher than that in controls, but as in other studies this was less pronounced for chrysotile than for the amphiboles. Mortality from all causes, non-malignant respiratory disease, and all respiratory cancers including mesothelioma was significantly increased. The diseases occurred mainly 20 to 40 years after exposure.

Shipyard Workers

Workers in shipyards used extensive amounts of asbestos when constructing ships until the 70s, and were also exposed when repairing or demolishing older ships. Ship construction was in Sweden in the 1950s and

60s a very important industry, and the country was in fact the world's second largest producer of ships. During World War II, very few ships were produced, and no asbestos was used due to import difficulties. Due to various health reports, asbestos was no longer used after a decision in 1972. In the next few decades, competition from Korea and other low-salary countries became too heavy, and all large shipyards in Sweden are now closed. The most important shipyard cities were Gothenburg and Malmö in southern Sweden. As a legacy, the incidence of malignant mesothelioma is now the highest in the country in this area.

The Swedish shipyard workers in Gothenburg were studied in a thesis from 1993 by Åke Sandén.⁹ A greatly increased risk of mesothelioma, but no significant excess of lung cancer was found for workers who had stopped working with asbestos some years earlier. An intriguing finding was that persons with impaired lung function had an increased risk of death from ischemic heart disease, even when corrected for smoking.

COMPENSATION RULES IN SWEDEN

In Sweden, every employer has to pay a certain amount for each worker every year to the Labour Insurance, which is managed between the Unions and the Employers Association according to the law. If there is an occupational disease, the victim will be awarded compensation that covers his medical costs, the loss of income (or predicted income for the next few years) and some extra compensation for pain, disability, etc. It is all regulated by the law and makes it very difficult for the individual to sue outside the system. The amounts awarded are therefore very modest compared with, for instance those in the United States or Australia. The main asbestos-related diseases for which compensation will be paid are mesothelioma and asbestosis, which is now rare in Sweden, and some cases of lung cancer.

Since 1985, compensation for pleural plaques has been given only when there is also impaired lung function, more specifically FEV₁ less than 80% of predicted. In such cases a small sum can be awarded each year, depending on how bad the lung function is. This has also been very much discussed, since mainly smokers with chronic bronchitis will be rewarded in this way. It is rare that a non-smoking person with pleural plaques only will have a lung function result that is less than 80% of predicted.

ASBESTOS REGULATIONS

In 1964, the first regulation on the use of asbestos was passed. Means to reduce the dust were recommended and also that wherever possible asbestos should be replaced by other substances. In 1975, the first threshold limit value for asbestos dust was set at 2 fibers/mL. Before this, measurement had been in particles per cc



Figure 4—Bus from World War II. The special equipment for making gas from wood is visible at the back. This was often insulated with asbestos.

only, and exposures are therefore difficult to ascertain. In 1976, because of a number of articles in the lay press resulting from a dissertation describing mesotheliomas in Swedish asbestos workers, the limit was lowered to 1 fiber/mL and crocidolite was banned completely. As can be seen from Figure 3, there was a very rapid fall in import of asbestos to the country. There was some opposition from the industry, claiming that asbestos could not be replaced—but in fact, other substances were found very rapidly, and even asbestos brake linings were soon replaced (at least in those cars that were sold in Sweden—for export cars it took longer).

In 1984, the limit was further lowered to 0.5 fibers/mL for all handling of asbestos—which was mainly the “asbestos in place” in buildings, old machinery, etc. Very strict rules have since been implemented for such handling—all the asbestos-contaminated area has to be closed off with plastics, there should be a negative pressure in the area, the workers should be dressed in “space suits” with external air, and there are special rules for what to do with the contaminated waste—it has to be deposited in certain areas, covered with soil, etc. (Fig. 5). These rules will of course increase the cost of any rebuilding, and there is now a clear risk of neglecting asbestos, with small private firms doing the job in their own way. How big this problem is is not known. Another problem is that due to the large costs, many private owners will renovate their houses themselves, and for such work there are no regulations; most often the persons are probably not even aware of the risks.

During the early 1980 there was much discussion of pleural plaques, and whether people who had them should be compensated. A special committee (including the present author) was appointed, and its conclusions were published first in Swedish and then a year later in English.¹⁰ No special recommendations were given regarding health surveys or compensation for



Figure 5—Warning sign in Swedish put up during reconstruction work in a building.

pleural plaques; however, such decisions were later taken by the authorities. As for compensation, it was decided that anyone with pleural plaques should be compensated with 10,000 Swedish Crowns, which at that time was a considerable sum. For practical reasons, the plaques had to be diagnosed after the end of January 1974 (when the special insurance was agreed upon). Probably, the involved parties did not read the conclusions of the committee, which had estimated there to be at least 300,000 persons in Sweden with pleural plaques, and the number of claims for compensations was soon so large that from June 1985, the agreement was no longer in force—it had proven too expensive. There were many problems: If a person had had an x-ray taken before 1974 and this was found in retrospect to show plaques, no compensation was given, while if no such x-ray had been made (or could be found) he or she would be compensated (provided that the plaques were visible before June 1985).

Due to continuous unrest in the press and in the Labour Unions, the government in 1986 decided to organize health surveys of persons who had had earlier occupational exposures to asbestos. A certain sum was provided mainly to general practitioners for the investigation, which was to be clinical and include a case history; if chest roentgenograms and/or spirometry were considered necessary, that should also be done, costs paid by the state. The period of the investigation was 1986–88. Thousands of persons were investigated; the only requirement being that each person knew or

believed that he or she had been exposed to asbestos. The findings were not many—mainly pleural plaques—but due to the various criteria for diagnosis of plaques and the selection of patients the scientific value of this exercise was low.

If the findings were normal, no further controls were planned. Thus, a potentially very interesting material to follow was lost. The psychological effect of the control was sometimes great, and in my own experience many persons needed much reassurance. After all, with a modest exposure, the chances are greater that you die from a non-asbestos-related disease than from an asbestos-related one.

THE FUTURE

The large number of occupationally exposed persons will gradually diminish with time, and with them also the asbestos-related diseases, such as mesothelioma. However, this will take a few more decades. We can already see how asbestos-related diseases in people exposed to environmental “background levels” of asbestos are increasing, but the risk is much less for these people than for those with heavier exposures. Since the asbestos “in place” is likely to stay with us for many generations to come, it is important to stay vigilant and be aware of this risk.

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