

# 1968 Yant Award

## Occupational and "Non-occupational" Asbestosis in Finland

*By*

LEO NORO, M.D.  
Institute of Occupational Health  
Helsinki, Finland

Preprinted from  
AMERICAN INDUSTRIAL HYGIENE ASSOCIATION JOURNAL  
Volume 29, May-June, 1968

409677 0498

as 2500 B.C. or 4,500 years ago people in Finland knew how to add fine asbestos fiber to raw material for pottery. The technical significance of this discovery is obvious. In the same way that asbestos is now used to improve tensile strength (in the armoring of cement products, for example) so it was once used to strengthen the sides of lightly fired pottery. When the material had been strengthened, the sides of the vessels could be made thinner. In this way cooking utensils were produced which were not only lighter in weight but in which food could also be cooked more quickly. This surprisingly mature technical invention found also a practical adaptation which commands respect for the economic instincts of those forefathers whom we often regard as very primitive people. Asbestos pottery was not limited to being a provincial specialty of eastern Finland; it spread over a wide area of Finland, Scandinavia, and Russia. The asbestos pottery as found in Finland and in neighboring countries is unique—nowhere else have discoveries of that kind been made!

This use of asbestos also illustrates that exposure of man to occupational asbestos in handicrafts has at least a 4,500-year-old history in Finland as well as the non-occupational exposures in asbestos areas. But only since 1918 have we had a modern industrial exposure of workers in quarry, mill, and factories. Our eastern neighbor, Russia, started the production of asbestos as early as 1712 during the reign of Peter the Great. Their production at present is already approximately two million tons per year, half the total of world production per year and twice as much as the United States annually uses.

#### Finnish Asbestos

The present production in Finland is only 11,000 metric tons per year of anthophyllite asbestos. The asbestos dust in the quarry and mill mineralogically contains:

|               |        |
|---------------|--------|
| Anthophyllite | 30-75% |
| Talc          | 20-60% |
| Chlorite      | 3-13%  |

The theoretical chemical composition is  $(\text{Mg}, \text{Fe}^{2+})_7 [(\text{OH})_2 (\text{Si}_4\text{O}_{11})_2]$ . There are small amounts, perhaps smaller than in Canadian

asbestos, of some metals such as Ni, Cr, Co, which might have some cancerogenic interest.

#### Levels of Exposure to Asbestos Dust

Unfortunately the exposure levels at plants have been systematically measured only during recent years. Twenty years, ago, before the management of the quarry and mill changed, the dustiness was, especially in the mill, rather great. One could only see a few meters ahead. The level of dust was surely many times higher than what our threshold limits indicate it should be. This great exposure reflects in the frequency and severity of our asbestosis cases, which will be presented later.

The present situation of dustiness will be reflected in the morbidity of the next ten to twenty years. In the entire asbestos industry approximately 225 different jobs have been examined. In three-fourths of them the level of dust is under the threshold limits, but it is higher in the remaining one-fourth.

We have used: (a) gravimetric samples taken with electrostatic precipitators (MSA) and/or with membrane filter field monitors (Millipore Filter Corp., Type AA), and (b) breathing zone samples taken with an impinger (MSA) for particle counting and sizing under the microscope. X-ray diffraction methods are used also.

In the mill and quarry the total quantity of dust varies from 7.5 to 100  $\text{mg}/\text{m}^3$ . In other working places the level of dust varies from 0.3 to 10.6  $\text{mg}/\text{m}^3$  or 11 to 2,400 particles/ $\text{cm}^3$ . Only 1% to 5.4% of the total dust (impinger-method) has been fibrous particles, i.e., 5  $\mu$  in length, the length being three to four times the width. In this connection I would like to mention that in eastern Europe (the Soviet Union, East Germany) the threshold limits are somewhat lower than the western ones: 2  $\text{mg}/\text{m}^3$  or 100 to 150 particles/ $\text{cm}^3$ .

The level of industrial hygiene in Finland is not yet satisfactory, and unfortunately we must expect still more asbestosis cases.

#### Medical Findings

The first medical survey in our asbestos industry was made in 1946 by C. Wegelius.

tion over fifteen years of age. Under the age of 40 years they were rare, but in persons over 65 years of age the calcifications were observed in almost 30%. In the rural population elsewhere in Finland only seven cases were found in the 265,223 people examined, but in two larger towns they were more frequent, 0.7% of the examined. Kiviluoto has later found 77 cases of calcifications in 35,000 chest x-ray pictures from the population of our second largest city Tampere.

Bilateral thickening of the parietal pleura is, however, a very common finding at autopsies in all of Finland, as Dr. Meurman stated in his study in 1965. He found them in 39.3% of his cases, equally in eastern and western Finland. In 70% of the cases the plaques were bilateral and in 72% the findings were in men. They were more common in the urban population (52.2%) than in the rural areas (31.8%). In the asbestos area the incidence and calcification of plaques were higher. Asbestos bodies were present in 57.6% of the 264 lungs studied, in men 60.1% and women 54.3%. Other findings were:

- The frequency of asbestos bodies in the lungs is higher in urban than rural populations (70%-49%).
- The frequency of asbestos bodies in the lungs of persons in the asbestos area was greater (however in 5 cases of 15 no asbestos bodies could be found).
- In farmers asbestos bodies were found in 47% and in building workers and workers of corresponding trades in 67%.
- Asbestos bodies could not be detected in plaques.
- There was a positive correlation between the occurrence of asbestos bodies in the lungs and of pleural plaques. In cases of bilateral plaques 85.7% exhibited asbestos bodies in the lungs, but, on the other hand, approximately 40% of the cases showing asbestos bodies in the lungs were free from pleural plaques.
- The plaques did not have any correlation with emphysema, heart disease, pulmonary stasis, or pulmonary tuberculosis. Chronic bronchitis was not studied.

Perhaps the most important finding is that pleural plaques are a very common disease in

the entire population. Already in 1884 Curschmann described them as "sugar icing"—"Zuckerguss"—at the time when the asbestos industry was only starting in some countries. Asbestos bodies—if they are all asbestos (?)—are rather frequent in lungs: in Finnish material in 57.6%, in some other material between 5 and 50%. (It depends on what kind of method is used and in what detail the lungs are studied.) This does not mean, however, that they are "asbestos's cases," as *Chemical Week* (Sept. 10, 1956) seemed to think when it stated, "Forty per cent of all Americans have mild, chronic cases of asbestosis." We do not even know yet what materials are a part of the needles, fibers, bodies, etc. which have been found in the human body.

In the Finnish asbestos area, however, calcifications, visible in x-ray pictures, are much more common than in other parts of the country. Air pollution is not the only cause of exposure. We have made some investigations and noticed that calcifications are found outside of the area where asbestos dust spreads. Of course, the local exposure to dust (asbestos ovens, asbestos stones in the sauna, agricultural exposure from dust in fields, etc.) could be a cause. But also the entire geo-micrological composition of the soil is different. In our preliminary studies in this area we have noticed great differences, for example, in the Mg-content of the drinking water, which might influence the calcification processes. The study, however, is not yet finished. It, nevertheless, seems that asbestos in the air or soil has something to do with calcification of plaques, because also in occupational asbestosis cases pleural calcifications are rather frequent symptoms (in our material of advanced cases in 100% of them).

What then is the prognosis of plaques and calcifications? Does one part of them develop into mesotheliomas and why? This is an interesting question. Our Finnish experience does not as yet prove it to be so.

You might ask, "If you find this kind of peculiar pleural changes in even 9% of the population, then what is the situation in regard to pleural malignancies and mesotheliomas in this area which already has a 4,500-year history of endemic exposure." The Fin-

## Finnish Bibliography on Asbestosis

- Ahlman, Kaj: Asbestosis among Insulator Workers in Finland. *Proc. XV Int. Congr. Occup. Health*, Vienna (1966).
- Aurola, E., and A. Vesasalo: Über die Asbestverkommen Finnlands und ihre technische Verwertung. *Geologische Untersuchungsanstalt, Geotechnische Veröffentlichungen Nr 54* (1954).
- Finnish Mineral (Carlsson): *The World's First Asbestos Merchants*.
- Kiviluoto, R.: Pleural Calcification as a Roentgenologic Sign of Nonoccupational Endemic Anthophyllite-Asbestosis. *Acta Radiol.* (Stockholm) Suppl. 1960:194 (1960).
- Kiviluoto, R.: Pleural Plaques and Asbestos; Further observations on endemic and other non occupational asbestosis. *Annals N. Y. Acad. Sci.* 132: 235 (1965).
- Kiviluoto, R.: Pleural Calcifications and Asbestosis. *Brit. J. Radiology* (1967).
- Laamanen, A., and V. Raunio: Observations on Atmospheric Air Pollution Caused by Asbestos. *Annual Report of the Institute of Occupational Health 1964*, Helsinki (1964).
- Laamanen, A., Leo Noro, and V. Raunio: Observations on Atmospheric Air Pollution Caused by Asbestos. *Ann. Acad. Sci.* 132: 240 (1965).
- Meurman, L.: Asbestos Bodies and Pleural Plaques in a Finnish Series of Autopsy Cases. *Acta Path. Scand.* Suppl. 182 (1966).
- Noro, Leo: On the Histology of Asbestosis. *Acta Path. Microbiol. Scand.* 23: 53 (1946).
- Noro, Leo, K. Ahlman, A. Laamanen, and M. Viikari: Asbestose als Berufskrankheit in Finnland. *Int. Arch. Gewerbepath.* 22: 179 (1966).
- Noro, Leo, K. Ahlman, A. O. Heinonen, T. Partanen, E. Rintala, E. Siltanen, and M. Viikari: Occupational Anthophyllite-Asbestosis in Finland (A preliminary report): Second International Conference on the Biological Effects of Asbestos. Dresden 1968.
- Raunio, V.: Occurrence of Unusual Pleural Calcification in Finland in *Studies on Atmospheric Pollution Caused by Asbestos*. Helsinki (1966).
- Siltanen, E.: *Industrial Hygiene Aspects on Studies of Asbestos Dust at Working Places*. IVA. Stockholm (1967).
- Siltanen, E.: Observations on the Asbestos Dust Measurements. Czechoslovak-Swedish-Finnish Symposium on Pneumoconioses. Prague, June 12-17, 1967.
- Wegelius, C.: Changes in the Lungs in 126 Cases of Asbestosis Observed in Finland. *Acta Radiol.* (Stockholm) 28: 139 (1947).
- Viikari, M., and K. Ahlman: Radiological Classification of Cases with Pneumoconiosis in the Light of a Group Study. *SLL* 19: 2211 (Finnish) (1964).
- Viikari, M., et al.: Ultrashall Examinations in Asbestosis. To be published.

PRINTED  
IN  
U.S.A.

① Hypoxia

409677 0506