



Material partly was presented on:

**European Asbestos Conference:
Policy, Status & Human Rights
European Parliament, Brussels,
22-23 September 2005**

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Environmental Asbestos Exposure in Poland

Import, production and trading of asbestos and asbestos-containing products has been banned in Poland since 1997 (1). The parliamentary act prohibiting the use of asbestos products has solved the problem of the occupational exposure of the workers employed in the materials processing industry and prevented use and storage of the products. But the problem of enormous quantities of asbestos and asbestos-cement products in the communal environment remains to be solved yet.

In discussing the problems of the environmental exposure to asbestos, attention should be paid to asbestos characteristics that contribute to the specificity of asbestos as the environmental contamination, and also to the specificity of the biological activity of asbestos fibres, as both affect the procedures used to reduce health hazard and the methods of handling materials containing asbestos. The specific characteristics of the environmental pollution with the asbestos may be listed as follows:

- unlimited life (asbestos fibres are practically indestructible)
- elementary fibres are released from asbestos-containing materials in the course of degradation of the latter (asbestos-cement, various insulation products)
- a considerable scatter of sources of asbestos dust released to air from products containing asbestos
- variable concentration of asbestos fibres in the ambient air, depending on many factors.

Environmental exposure to asbestos dust increases the risk of lung cancer; it may also cause mesothelioma and non-malignant lesions in the pleura. The specificity of the biological activity of the asbestos, very essential for the determination of the health hazard to the population comprises the following aspects:

- 1) accumulation of respirable asbestos fibres inhaled from the ambient air in the lungs during the whole individual's lifetime
- 2) very long latency period of the disease (20-40 years)
- 3) the disease may develop after cessation of the exposure
- 4) the development of mesotheliomas associated with the environmental exposure after short-term exposures to high concentration or prolonged contact with low concentrations of asbestos fibres.

The specificity of the biological activity of the asbestos on the human organism, along with characteristic of asbestos environmental pollution cause that it is very difficult to assess the risk of asbestos-related cancer development in the population. Health risk assessment is based on the determination of the health hazard from the level of the concentration and the duration of the exposure, i.e. determination of the cumulated dose of the fibres. Due to the considerable variability of the concentrations of asbestos fibres in the atmosphere, „indirect” measures of the environmental asbestos pollution are employed:

- quantity of imported asbestos and materials containing asbestos
- the use of raw asbestos in asbestos-processing plants
- yearly the use of raw asbestos per inhabitant
- quantity and the condition of asbestos-containing products in the country
- quantity of asbestos and asbestos-contaminated wastes.

Since 1945, a total of 2 million tons of asbestos have been imported into Poland: 90% was chrysotile brought mostly from the former Soviet Union and 10% was crocidolite obtained from the Republic of South of Africa. The overall quantity of asbestos-containing materials included in Polish buildings is estimated to be as high as 15.5 million metric tonnes (2).

The use of asbestos in plants manufacturing products asbestos-cement in 1946-1993 was in total ca. 1.4 million of tons, in this ca. 86 thousand tons of crocidolite.

In the 70's, those works processed ca. 100 thousand tons, while in 80's the corresponding value was 60 thousand, and in 90's it was ca. 30 thousand tons. Since 1985, crocidolite has no longer been used. In 1998, Poland ceased manufacture of products containing asbestos (3).

The areas of particularly high hazard of asbestos exposure are:

- areas affected by the asbestos plants, and asbestos-cement plants in particular

- areas where large quantities of asbestos-cement was used for building construction
- areas where asbestos products were used for farmstead applications
- illegal asbestos-cement waste dumping sites.

The Fig. 1 above shows location of asbestos-processing plants in Poland. Plants manufacturing asbestos-cement products were sources of considerable atmospheric pollution; air in the vicinity of those plants contained considerable concentrations of asbestos fibres. The storage of asbestos waste and reckless attempts by the local populations to re-use asbestos-contaminated items “for the sake of economy” constitute a serious health problem.

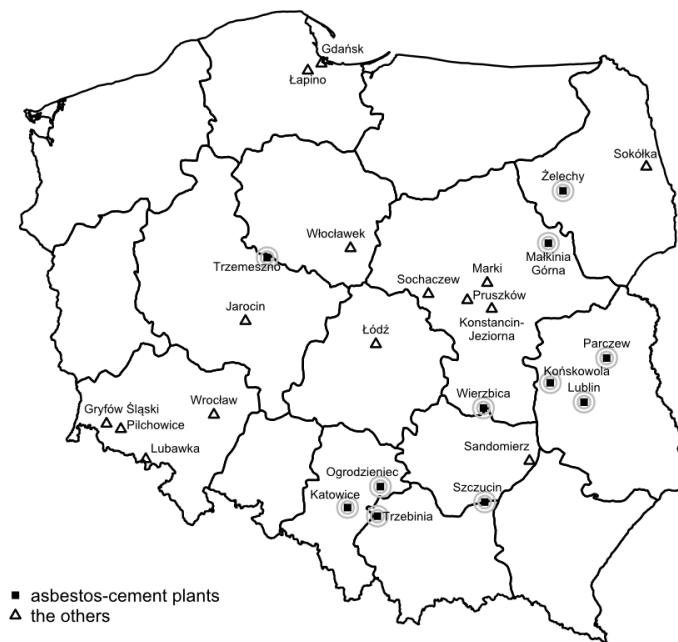


Fig. 1. Location of asbestos-processing plants



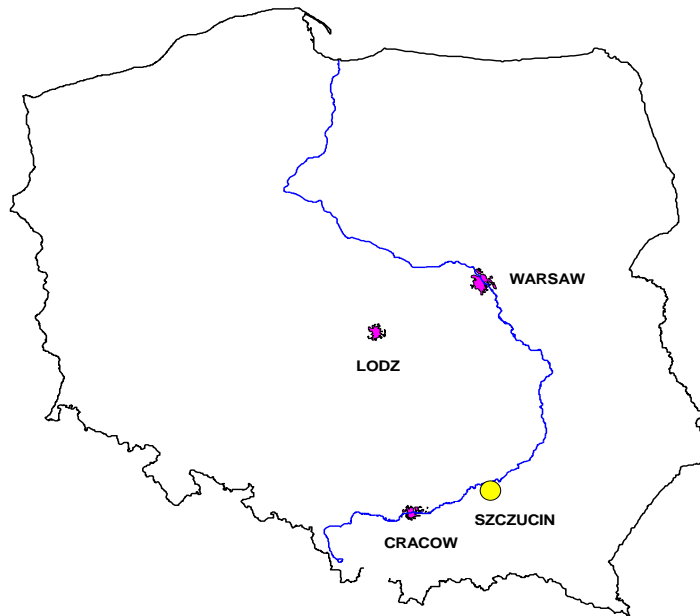
Fig. 2. Consumption of asbestos in terms of kg per capita, by provinces

The Fig. 2 above showing the quantity of asbestos products used for construction of buildings in the individual provinces of Poland, expressed in terms of 1 kg asbestos per 1 inhabitant, reflects the health hazard from emission of asbestos dust to the atmospheric air as a result of degradation of those products, including mainly roof tile and wall panels. Three zones are clearly visible. The greatest quantity of asbestos-cement products had been used for construction purposes in the provinces forming so-called the Eastern Wall: Podlaskie, Lubelskie, Mazowieckie and Świętokrzyskie.

Asbestos production during the 80's in Poland is estimated at 1.7 kg per 1 inhabitant. In the same period the corresponding values for other countries were: GDR 3.3, Czechoslovakia 2.8, Japan 2.6, Austria 2.0, Belgium and Luxembourg 1.9 kg asbestos per inhabitant (4). Results of analyses show that the use of 2.8 kg of the asbestos a year per 1 inhabitant results in a mesothelioma incidence rate of 18 cases of mesothelioma per 1 million of inhabitants (5).

The example of the Szczucin Community

The Szczucin Community is an example of an area whose inhabitants are subject to a considerable exposure to asbestos dust. Szczucin is a small town (about 14 thous. inhabitants) in the South-East part of Poland. In 1959, an asbestos cement plant was started in Szczucin. It operated up to 1997 (6,7).



From 1959 till 1993 about 370,000 tonnes asbestos were processed including 65,000 tonnes crocidolite (blue asbestos). Over the period 1959-1985, the plant processed about 70% of the total crocidolite used at that time in the Polish asbestos-cement industry.

Assuming dust emission from the plant ventilation system of 50g per 1 tonne asbestos processed, the total emission for the period of 1959-1996 was estimated to be ca. 17.5 tonnes asbestos, including 3.2 tonnes blue asbestos.

Soon after the plant had been started, the production wastes were made available for use by the population, which was in agreement with legal regulations on asbestos cement waste then in force. For longer than 30 years, all types of the asbestos cement wastes were used by the inhabitants to pave local roads, farmyards, sports fields, and also as an additive to construction materials in the individual farmsteads. During the period when Portland cement was available only with utmost difficulty, the asbestos cement wastes were highly valued by the district's population as the material for building construction. Estimated total volume of asbestos wastes and asbestos-contaminated soil is 0.8-1.0 million m³, of which 330,000 m³ on roads.

Approximately the surface of 65.5 km roads, 8.6 ha farmyards, 28.6 ha driveways is contaminated with asbestos wastes.

Sources of asbestos dust emission in the Szczucin District are as follows:

- road, farmyard, plaza paving built of, or hardened with, asbestos wastes
- dwelling houses, farm buildings and tool sheds in which asbestos products or wastes were used as construction and finish materials
- clothing, carpeting, blankets, mats and covers made of cloth contaminated with asbestos fibres
- heaps of asbestos wastes in residential areas
- farmland on which fine-grain asbestos wastes were used

The asbestos cement wastes widely used by the inhabitants of the district contain considerable amounts of easily visible crocidolite asbestos. The widespread use of the asbestos waste in the roads, farms, houses, to improve soil and manufacture clothes caused that the inhabitants of the district of Szczucin are exposed to asbestos dust released from a huge collective source.

The number of respirable fibres per unit volume of air present in the atmosphere of the district has been found to be considerably high – from 5 to 50 fibres/l. The analysis of the measurements shows that over half (55%) of the district's inhabitants are environmentally exposed to high asbestos fibre concentrations, that is above 10f/l.

In the late 1980's, first cases of pleural mesothelioma, the cancer specific to asbestos dust exposure, were noted both among workers of the asbestos-cement plant and in the district inhabitants not employed in the plant.

Over the period 1987-2006, 85 cases of pleural mesothelioma were recorded, including 44 among Szczucin plant workers (occupational and environmental exposure) and 41 among Szczucin inhabitants (environmental exposure).

Table 1. Characteristics of pleural mesothelioma cases in the Szczucin population

	Workers of Szczucin asbestos-cement plants	Szczucin inhabitants not employed in the plant
Number of cases	44	41
Males	39	16
Females	5	25
Age at first exposure	29.9±8.5	12.6±11.8
Latency period	32.0±8.7	40.3±5.2
Age at death	62.7±13.5	55.2±13.3
Exposure duration	13.8±9.8	-

**Pleural mesothelioma among Szczucin inhabitants
(occupational or environmental exposure) in 2000-2006**

Year	Number of cases
2000	5
2001	11
2002	4
2003	7
2004	7
2005	8
2006	5
	47

Mean number of cases yearly: ≈ 6.7 per 14,000 inhabitants

i.e. ≈ 500 cases per 1 million inhabitants

The incidence risk: 125 times as high as for the general population of Poland

The risk of asbestos-related diseases, and of malignant tumours in particular, was assessed by observing the deaths among the inhabitants of the Szczucin district and comparing them with the mortality recorded for the same period of time among the inhabitants of the reference (asbestos-free) district.

Results of observation revealed that in Szczucin:

- the rate of deaths from asbestos-related cancers (i.e. respiratory and gastrointestinal) is more than twice as high
- non-cancerous respiratory diseases in males are four times more frequent
- respiratory cancers appear in younger age groups and the mean age at death from those cancers is by 3 years less.

The identification of the health hazards and the epidemiological analysis of the health effects have been used as the basis for taking steps in the commune intended to eliminate the sources of asbestos dust and reduce the hazard. Education projects were prepared and implemented to inform the inhabitants of the commune about the harmful effects of asbestos and teach them safe handling of asbestos-containing materials. Particular attention was paid to teaching asbestos safety to children and juvenile people at schools. The elimination of asbestos dust emission sources has been started by removing the asbestos-containing paving from the school and municipal playgrounds. The dumping site belonging to the former asbestos-processing plant has been suitably protected. The process of asphalt-paving the roads formerly covered with asbestos-containing material has been started.

Those steps have been undertaken in mid 90's and continue until now. But the problem of the health effects in the affected population has remained unsolved. Current regulations provide for medical aid to the former workers of asbestos-processing plants and compensations to occupationally exposed people. However, there are no regulations concerning medical care and/or compensations to the inhabitants of asbestos-polluted areas.

Legal acts and other materials

1. Act on the Ban of Use of Asbestos-Containing Products of June 19th, 1997. Law Gazette 04.3.20, 05.10.72
2. Elimination of Asbestos and Asbestos-Containing Products Used in Poland. Government Program of 14 May 2002. www.mgjp.gov.pl Programy gospodarcze.
3. J.Indulski, N.Szeszenia-Dabrowska: Asbestos in Poland in "Proceedings of the Asbestos Symposium for the Countries of Central and Eastern Europe" 4-6 December 1997, Budapest, Hungary: People and Work. Research Reports, Finnish Institute of Occupational Health, 1997.
4. Swedish Working Environment Association. Asbestos in Working Environment. Working Environment 1992, Stockholm.
5. A.Tossavainen: Global use of asbestos and the incidence of mesothelioma. Int J Occup Environ Health 2004; 10: 22-25.
6. N.Szeszenia-Dąbrowska, J.Siuta (ed.): Asbestos in Environment. Health effects and prevention. NIOM, Lodz, 1998.
7. N.Szeszenia-Dabrowska, J.Siuta, A..Gniazdowski, Z.Jasak: Asbestos in Szczucin Area. Risk and sanitation. Krakow-Lodz-Warszawa 2003.

8. Environment Protection Law of 27 April 2001, Law Gazette 2001, 62, 627 with subsequent amendments.
9. Act of Waste Management of 27 April 2001, Law Gazette 2001, 62, 628 with subsequent amendments.
10. Regulation of the Minister of Economy of 14 August 1998, Law Gazette 1998, 138, 895 later amended 2004, 71, 649.
11. Regulation of the Minister of Labour and Social Policy of 2 April 1998, Law Gazette of 1998, 45, 280.

ENVIRONMENTAL ASBESTOS POLLUTION – SITUATION IN POLAND

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Key words: Asbestos consumption, Airborne asbestos fibre concentrations, Ambient air asbestos pollution, Non-occupational asbestos exposure

ABSTRACT

Objectives: Environmental exposure of the general population to asbestos in Poland is mainly due to degradation of very popular asbestos-cement products and the resultant release of the elementary asbestos fibres into the ambient air. Fibre concentrations inside the buildings are insignificant, because the technique of coating the walls with asbestos spray was not used in the construction industry and use of soft asbestos products was limited. Assessments of environmental pollution by asbestos were based on the volume of the raw material used, amount of manufactured asbestos products, and measuring the concentration of fibres in the air. **Material and Methods:** Under the governmental program intended to remove asbestos, measurements of the concentration of asbestos fibres were performed in 2004-2010 in all provinces of Poland. Considering that potential sources of asbestos dust emissions were present in residential areas, 1634 sampling sites were designated. From 2 to 4 air samples were collected at each sampling site. A total of 5962 samples were collected during seven years. A single dose of air collected by 25 mm 0.8 µm pore Sartorius filter was 1,300 litres. The fibres were counted using optical microscopy with phase contrast (PCM) on a polarizing microscope (PLM) at a total magnification of 600x. The detection limit of the method was obtained at 180 f/m³ by counting fibres on 500 to 800 cells on a Walton-Beckett graticule. **Results:** Mean concentration of asbestos fibres based 492 f/m³ (95% CI:467-518). In 82% of the sampling sites, the mean concentrations did not exceed 800 f/m³. As much as 25.8% of the samples were found to be below the detection limit of the method. Estimated mean concentrations of fibres in different provinces ranged from 146 (95% CI:106-203) to 709 f/m³ (95% CI:591-851). In the areas affected by former asbestos-processing plants, mean concentration was 732 f/m³ (95% CI:527-1016) and was significantly higher than levels recorded in other areas of Poland. **Conclusion:** Asbestos consumption per capita and the recorded moderate levels of asbestos fibre concentration in atmospheric air point to a relatively low level of environmental asbestos pollution in Poland.

The described situation, may be made considerably worse after the statutory implementation of a new, unproven in terms of health, method of "disposal" of asbestos-cement products through crushing them and subjecting to microwave treatment in a mobile device.