

# Waste Containing Asbestos in the Community Szczucin

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## Summary

The article describes the problem of the disposal of waste containing asbestos in the municipality of Szczucin, Poland. Due to the shape of its fibres, its poor solubility in body fluids, and its chemical composition, asbestos is a very biologically aggressive and dangerous mineral. From 1959 to 1993, the Department of Asbestos-cement (call) produced corrugated tiles, flat tiles, and pressure pipes. In the production thereof, two varieties of asbestos were used. Scrap construction materials that contained asbestos were commonly used to pave roads, public squares, and playgrounds. This resulted in the community being catastrophically contaminated by respirable asbestos fibres. Since the 1990s, the municipality of Szczucin has initiated and participated in programmes aimed at the removal and disposal of asbestos-containing waste.

Keywords: waste, asbestos, Szczucin, environmental protection

## Introduction

Management of wastes containing asbestos plays an important role in the community of Szczucin and neighboring towns in terms of social and industrial aspects. Disposal of wastes containing asbestos is a difficult task, because this kind of wastes is known as hazardous, and hence, criteria and procedures are strictly regulated by the law. The problem of asbestos is a very serious issue. Now, there are programs for disposal of waste containing asbestos, such as “The National Programme for Asbestos Treatment in years 2009 – 2032”, which has been admitted in 2009 and assumed full clearance of the country from asbestos until 2032.

## Characteristics of asbestos and its use

Asbestos (“unbreakable”, from greek) is the general trade name and refers to six fibrous minerals from the serpentines group (chrysotile) as well as amphiboles (amosite, actinolite, anthophyllite, crocidolite

and tremolite). Asbestos is chemically hydrated metal silicate, that have in its composition magnesium, sodium, calcium, iron. Various types of asbestos are different in terms of chemical composition, physical structure, biological activity and characteristics deciding about asbestos’ industrial application properties. The fibers have a platelike or fibrous structure and white, grey, green or even blue color. Mohs hardness is from 2.5 to 6 [Bolewski et al. 1990; Bolewski, Manecki 1993].

A characteristic feature of the asbestos is crystalline structure. Asbestos fibers belong to the thinnest fiber existing in the nature. For example, cotton fibers have a diameter from 10 000 to 25 000 nm, chrysotile from 15 to 42 nm, and amphibole from 100 to 300 nm [Łuniewski A., Łuniewski S., 2009]. Asbestos fiber length is dependent on the variety, but the chrysotile fibers are longer than amphibole asbestos fibers and reach even 15 cm. The latter have a needle shape and are harder and thicker. Chrysotile asbestos is the most



Fig.1. Crocidolite asbestos

Rys.1. Azbest krokidolitowy

popular and accounts for approximately 95 % of the asbestos. Among the mostly used amphiboles in the industry one can account crocidolite. Due to the shape of fibers, poor solubility in body fluids and the chemical composition, crocidolite is the most aggressive and hazardous asbestos.

If the asbestos is located under the ground and is unable to be relocated to the atmosphere and the to the respiratory tract it is totally harmless for the health of both humans and animals. Its harmfulness results mainly from fibrous structure and external factors re-

sistivity.

Asbestos fibers with a diameter of less than 3  $\mu\text{m}$  and a length greater than 5 microns are called a respirable and they are found to have pathogenic effect.

Asbestos has a characteristics of both chemical and chemical properties that allow its use in many industries, especially in building, textile, machinery and electrochemical. Product that contains asbestos is the one that contains at least 0.1% of asbestos in its composition. On the market there are more than 3000 asbestos products. It is estimated that the production

Table 1. Products containing asbestos [Łuniewski A., Łuniewski S., 2009]  
Tab.1. Wyroby zawierające azbest [za Łuniewski A. Łuniewski S. 2009, zmienione]

<b>Group</b>	<b>Asbestos content [%]</b>	<b>Products</b>
Asbestos-cement products	10-35	Roofing, steel structures covers, ventilation walls covers, façade panels, pressure pipes, electrotechnical fittings
Insulation products	75-100	Wool, fleece, yarn, insulating fabrics, mats, ropes
Sealing products	4,5-85	Cardboards, asbestos-rubber boards, special industrial gaskets
Frictional products	15-75	Friction linings for brakes and clutches, brake bands
Waterproofing products	20-40	Roofing tar, floor tiles, mortar primers, enriched asphalts for road construction

of construction products consumed 80% of acquired asbestos. The most important asbestos-containing products are shown in Table 1.

Crocidolite asbestos is also used in the brewing industry, where is applied for filters production. It also found application in production of gas masks.

Another division of asbestos distinguishes two classes, taking into account the content of asbestos, binder and a bulk density:

- I class (“soft” products) – includes products having a bulk density less than  $1000 \text{ kg/m}^3$ , having low concentration of binder and high content of asbestos (more than 20%). These include textiles used for protection purposes, fire blankets, boards and soft paper boards, PVC tiles. These products can be eas-

ily damaged mechanically simultaneously emitting asbestos fibers to the environment.

- II class (“hard” products) – includes products having a bulk density greater than  $1000 \text{ kg/m}^3$ , high binder content and low asbestos content (less than 20%). This group includes: asbestos-cement panels, sandwich slabs, asbestos-cement pipes, fittings, moldings, pipe insulation. These products have a very high consistency and the emission of asbestos dust occurs while being mechanically treated.

Currently in Poland there is a legal ban on the production and marketing of products containing asbestos: “In order to eliminate the production, use and marketing of products containing asbestos, the following shall be prohibited: introducing to the territory

of Republic of Poland the products containing asbestos, asbestos, asbestos production, asbestos trading as well as products containing asbestos” [Regulation 1997].

### ***Production of asbestos in the municipality of Szczucin.***

Szczucin municipality lies on the north – eastern edge of Lesser Poland voivodship, in the Sandomierz Basin. The natural border with the Świętokrzyskie Voivodship from the north side and on the length of 21 km is made by Vistula river. Municipality of Szczucin neighbors with Podkarpackie Voivodship from the

east. Trunk road no 73 of relation Warsaw – Krynica goes through Szczucin.

Szczucin municipality is flat area with low forest coverage (about 8 %) and an area of 12 thousand ha. The population equals 13.5 thousand of citizens.

In 1959 Szczucin run an Asbestos-Cement Production Facility (Zakład Wyrobów Azbestowo-Cementowych, ZWAC). In 1960 this facility was hiring about 300 workers and in 80s around 500. The facility produced corrugated and flat boards, and as the only one in Poland, the pressure pipes. Two varieties of asbestos were used for production purposes: chrysotile and crocidolite.



Fig..2. Szczucin municipality location  
Rys.2. Lokalizacja gminy Szczucin



Fig.3. Derelict asbestos-cement boards on private property (Szczucin 2013) [fot. M. Glica]  
Rys. 3. Niszczące płyty azbestowo-cementowe na prywatnej posesji (Szczucin, 2013 r.) [fot. M. Glica]

Asbestos was transported by rail in paper bags, which were often damaged due to the conditions. After the intervention this kind of bags were replaced by jute bags. Until 1970 the dry method of fiberisation of asbestos was used. After 1970 the wet method was implemented which involved milling of asbestos with water addition. Asbestos-cement boards when being produced, generated wastes in the shape of wet cuttings, which found their application in the middle 70s. Another type of waste was created in the process of machining and grinding of pressure pipes, when it has been carried out in dry conditions. "The dust generated during pipe grinding were discharged by use of ventilation to special shelter, from where workers manually loaded it on trucks. These works were also carries out by people who were arriving to the facility in order to use the wastes in yards and roads paving as well as in private construction sites." [Material Safety Data Sheet 2014].

In ZWAC, from 1959 to 1993, around 350 thousand tons of asbestos were processed, including 65 thousand tons of crocidolite – blue asbestos, the most biologically aggressive. This represented 70 % of its general amount processed in Poland.

Construction materials scrap, which contained asbestos (e.g. pipes, sludge, eternit), has been used until July 1992 for purposes such as paving of roads, public squares and playgrounds. Strong demand for its use meant that all types of waste from the facility found an application in economic context (Fig.3.).

### **Effects of activity of Asbestos-Cement Production Facility in Szczucin**

Since the mid- 90s of the twentieth century, the Szczucin municipal authorities sought institutions that could help to diagnose threats. In 1996 – 1998, Committee for Scientific Research developed the project called "Development and implementation of the program in the field of health protection of the residents of the city and municipality of Szczucin, taking into account the size of the health risks resulting from environmental pollution by asbestos. The results of the research, which was published by the Institute of Occupational Medicine in Łódź, demonstrated catastrophic picture of the contamination of the area of municipality with the wastes containing asbestos: limits of respirable asbestos fibres concentration were exceeded up to 50 times. On the road of 100 km length there were 330 thousand m<sup>3</sup> of asbestos wastes, while private properties reached volume of 250 thousand m<sup>3</sup>. Total volume of asbestos wastes and masses of contaminated soil reached nearly 1 million m<sup>3</sup>. Dispersion of asbestos wastes throughout the municipality resulted in environmental exposure of

all its inhabitants [2006].

The project also conducted a study that aimed to estimate the size of the health risks associated with occupational exposure to asbestos among people employed in the facility for asbestos-cement production. In the group of former employees hundreds of deaths have been reported, including the mortality caused by large intestine cancer, mesothelioma and pancreas cancer. Mesothelioma is considered as specific for exposure to asbestos dust, particularly crocidolite. The researchers found that the area of Szczucin bears the hallmarks of ecological disaster.

### **Programs for asbestos combat in Szczucin municipality**

Discussed development became the basis for further action to eradicate the sources of asbestos dust emission into the environment. In 2001-2002, the "Regional Program for Asbestos Disposal in Szczucin Municipality" was created. This program inventoried places of occurrence of asbestos wastes in the municipality and indicated the safety measures. A large part of roads contained asbestos waste and had to be subjected to sanitation. More than 50 % of the surveyed road sections revealed dust-creating asbestos component.

According to the final draft, the main method of sanitation of asbested roads was improvement of existing and development of new pavement on existing foundations. Only in the case of ineffective or costly ways of sustainable elimination of asbestos dust emitting, pavements had to be removed.

Modernization and sanitation works were carried out by securing the road surface against dusting during works, stabilizing the surfaces, which existed under the new pavement and construction of new roads. All municipal and dirt roads do not pose a risk, because all the planned works have been done.

In the 2002 – 2007 was conducted intensive disposal of asbestos by asphaltting the roads, protection of the school yards and pitches and private properties' yards. Concentration measurements, carried out in 2007 within the roads covered with asphalt, showed a very low concentration of asbestos fibers in the air. By 2013 municipality preserved 177 km of the public roads. Only 3 km of private roads are left.

Szczucin municipality, after many years of work related to asbestos removal, has become a pioneer in the region and has not stopped the efforts for further improvements. In 2012 the municipality has signed the agreement with Swiss Federal Council on the implementation of Swiss – Polish Cooperation Programme. The mechanism of this agreement is oriented on the activities of environment protection and

reduction of economic and social disparities within European Union enlarged in 2004. Szczucin municipality, as the initiator of this project, is the implementing institution. In a 4-year project it is assumed to carry out dismantling of the roofs made of elements containing asbestos (Fig.4.), collection, transport and storage of dismantled roofing derelict on private prop-

erties, financing for the poorest citizens in the form of purchasing the new roofEng. The results will be deactivation of more than 20 thousand tons of wastes containing asbestos [Project 2012].

#### Facility landfill for production wastes

Szczucin municipality coped very well with the



Fig.4. Eternit roofing (Szczucin, 2013) [M. Glica]

Rys.4. Pokrycie dachowe z eternitu (Szczucin, 2013 r.) [for. M. Glica]

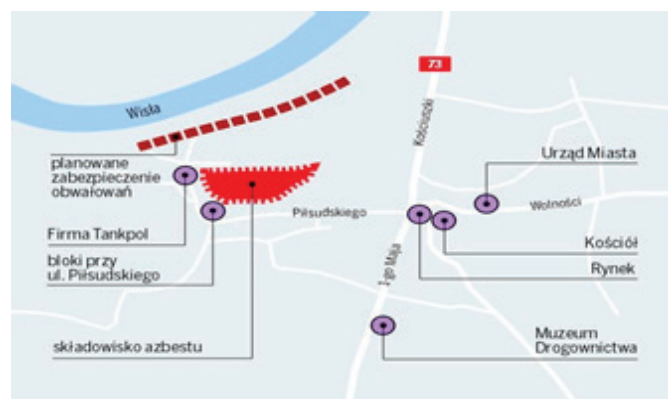


Fig.5. Localization of the landfill for production wastes. [[http://d.naszemiasto.pl/k/r/d5/08/528b4a5511e8b\\_g1.jpg](http://d.naszemiasto.pl/k/r/d5/08/528b4a5511e8b_g1.jpg)]

Rys.5. Lokalizacja składowiska odpadów poprodukcyjnych



Fig.6. Fragment of fencing at facility heap. Szczucin 2013 [M. Glica]

Rys. 6. Fragment ogrodzenia przyzakładowej hałdy. Szczucin 2013 r. [fot. M. Glica]



Fig.7. Asbestos-cement boards left next to fencing of the heap [M. Glica].

Rys.7. Płyty azbestowo-cementowe pozostawione obok ogrodzenia hałdy [fot. M. Glica]

problem of asbestos. However, this is not the end of the fight against this harmful material, because there are still roofing materials consisted of eternit. The biggest problem that remained is a facility landfill for production wastes: “How much effort on our part was, that after closing the eternit facility Szczucin could have been not been linked with asbestos municipality. How many programs have been implemented and how much money were spent to remove the remnants from roofs, roads, playgrounds and ditches. A lot of us did it, we overcame many difficulties but the heap, that is a huge burden for all of us.” [Ziobro, 2013].

The heap is located in outer part of the facility and belongs to elusive investor from Spain, who acquired the right to perpetual usufruct of the property, on which the heap resides. This means, that the heap, in

formal term, is beyond the reach of any programs for asbestos removal. Nonetheless, the efforts for changing the ownership are still carried out. There is even a plan for what to do once the owner is changed. It will be necessary to perform a protection harboring the landfill (Fig.3.), and in the context of reclamation and land development – creation of the hill, which will be a place of recreation for citizens.

The landfill collecting about 1.5 million tons of hazardous wastes is temporarily protected (replenish the soil and trees planting). In many places unburied asbestos-cement wastes can be noticed. Heap in the current state poses no immediate threat, but in case of flood there is a risk of washing out the wastes and contamination of surrounding areas as well as the Vistula river. The threat is very serious and, additionally,

the heap is located almost in the center of Szczucin, near multi-family buildings (Fig.6., Fig.7.). Whenever there is a risk of flood in the municipality, the desperate defense of the levee takes place. In 2009 the heap was placed by Chief Inspector of Environmental Protection on the list of ecological bombs.

## Conclusions

Asbestos, which once seemed to be an ideal mineral due to its physical and chemical properties, today is considered as one of the most dangerous substances. Asbestos-Cement Production Facility in Szczucin, once the largest plant in the region, which guaranteed the work for many people, caused a lot of damage both to residents and the environment. The widespread and prolonged use of materials containing asbestos in the construction industry polluted the municipality area so badly, that it has been recognized as an area of ecological disaster. However, the determination of the city and the municipality and involvement of residents have led to significant clearance from asbestos

[Pawul, Sobczyk 2011; Sobczyk, Biedrawa 2011].

Szczucin municipality, since 90s of twentieth century, has been an initiator and participated in programs aiming at disposal and removal of asbestos-containing waste. It has actively created and still creates new support projects. Szczucin municipality has gained an extensive experience, so that all the aims and objectives contained in the programs so far, have been realized. Asbestos wastes that were located within the municipality, have been disposed. The only problem are wastes stored on private properties, but Swiss Project takes such situations into consideration and co-finances their removal.

Szczucin municipality, by the year 2032, should be completely cleared of asbestos, which is an assumption of "The National Programme for Asbestos Treatment in years 2009 – 2032". So far, the effective implementation of programs provides a basis for thinking, that this project will also be performed successfully.

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### Streszczenie

*W artykule opisano problem zagospodarowania odpadów zawierających azbest w gminie Szczucin. Ze względu na kształt włókien, słabą rozpuszczalność w płynach ustrojowych i skład chemiczny azbest jest bardzo agresywnym biologicznie i niebezpiecznym minerałem.*

*Od 1959 r. do 1993 r. Zakład Wyrobów Azbestowo-Cementowych (ZWAC) produkował płyty faliste i płaskie oraz rury ciśnieniowe. Przy produkcji stosowano dwie odmiany azbestu. Złom materiałów budowlanych, który zawierał azbest, stosowano powszechnie do utwardzania dróg, placów użyteczności publicznej i boisk. Spowodowało to katastrofalne skażenie terenu gminy respirabilnymi włóknami azbestu. Gmina Szczucin od lat 90. XX wieku jest inicjatorem oraz uczestniczy w programach mających na celu unieszkodliwienie i usuwanie odpadów zawierających azbest.*

*Słowa kluczowe: odpady, azbest, Szczucin, ochrona środowiska*