

The efficiency of systemic solutions for the removal of asbestos in Poland – current status and prospects

Anna Bernaciak
Poznan University of Economics and Business, Poland

Arnold Bernaciak
WSB University in Poznań, Poland

Abstract: The article summarizes the diagnosis of the impact of socio-economic factors on the rate of removal of asbestos in Poland. It presents the basic statistics on the rate of accumulation and removal of asbestos from the territory of the country and an attempt to identify the causes of common patterns in this area. It presents the most important information relating to systemic solutions in the field of asbestos removal. Moreover, the assessment of the effectiveness of functioning of the system has been discussed. Consequently, insufficient progress of implementation of national strategies and the low efficiency of system solutions in this area has been shown.

Keywords: asbestos, asbestos removal, regional dimension, Poland

JEL codes: R10, Q53, Q58

1. Introduction

Current challenges of Polish municipalities in the field of environmental protection differ from those a few years back. Reduction of low emission, reorganization and improvement of waste management systems, the removal and disposal of asbestos and products containing it are the main areas in which governmental units at this level have to intensify their activities. Legal requirements or guidelines of strategic documents at national and regional level impose on municipalities the

Correspondence Address: Anna Bernaciak, Assitant Proffesor/ Department of Investment and Real Estate, Faculty of Management, Poznan University of Economics and Business/ Al. Niepodległości 10, 61-875 Poznań, Poland. Tel.: +48 61 856 90 00 Fax: +48 61 866 89 24 E-mail: anna.bernaciak@ue.poznan.pl

obligation to provide systemic solutions, the formation of the appropriate strategy and monitoring of the effectiveness of the implementation. Despite existing regulations, the effectiveness of the actions undertaken in various regions differ.

It is particularly evident in the case of asbestos removal. The obligation to take action stems from international law, national law and the national sectoral strategy. The first directive on the issue of asbestos was Council Directive (87/217/EEC) of 19 March 1987 concerning the reduction of environmental pollution by asbestos and the prevention of further pollution. The purpose of this directive was the establishment and completion of existing rules to prevent and reduce pollution by asbestos. The control of the pollution of air, soil and water caused by asbestos was employed under this directive. The Directive 1999/77/EC prohibits the use of asbestos in all countries which belong to the European Union from 1 January 2005. Extraction, manufacturing and processing of asbestos products are prohibited under Directive 2003/18/EC of 27 March 2003. In addition, the directive defines the strategies in the field of asbestos removal programmes to be implemented by the member states. Moreover, it commits the European Union to take action to ban the usage of asbestos.

Experience of other countries in this field is not broadly elaborated on in literature. Quite interesting analysis about trends and challenges in asbestos waste management in the Asian-Pacific region were presented by Jinhui Li et al. (2014). In general, many recent studies (Aguilar et al., 2013; Courtice et al., 2012) have focused on banning asbestos production or on eliminating asbestos exposure (Świątkowska et al., 2014; Bianchi and Bianchi, 2012). There are also researchers who have performed studies on results of measurements of airborne asbestos in buildings (Lee and Van Orden, 2008; Camponiano et al. 2004) and on asbestos removal (Fenoglio et al., 2001).

The complete removal of asbestos from the Polish territory is to be completed by the year 2032 (*Asbestos Removal Program in Poland for Years 2009-2032*). The authorities at all levels develop programmes which guide the removal of asbestos. The following is done by posting the data on the amount of asbestos collected in the territory during inventory. The authorities determine the conditions of disposal, predict how much asbestos is going to be removed, decide on funding and supervision of the undertaken actions. Such organization of the system means that most tasks in this area are performed by municipal governments. They are responsible for determining the amount of asbestos located on their premises (usually conducted by physical inventory) updating

the data in this regard, organizing of dismantling, intermediating in the distribution of funds allocated for this purpose, educating and informing. Additionally, in accordance with the *Asbestos Removal Program in Poland for Years 2009-2032*, the process of asbestos removal is to be intensified from 2016, which will require more commitment, higher financing and more partnerships within municipalities (*Asbestos Removal Program...: 21*).

The purpose of this paper is to evaluate the effectiveness of the system of asbestos removal which is based on the analysis of organizational solutions, evaluation of regional diversity of accumulation of asbestos and the dynamics of its removal in Poland. As measurements of the efficiency of systemic solutions in that area the percentage of removed asbestos-containing products and the dynamic of asbestos removal compared to its accumulation in particular voivodships were used. At the same time local conditions relating to the diagnosis and strategies for asbestos removal were investigated.

2. The organization of the asbestos removal in Poland

In accordance with the provisions of § 10 of the Regulation of the Minister of Economy of 13 December 2010 *for the use of products containing asbestos and the treatment of installations or products containing asbestos* (Regulation of the Minister of Economy, 2010) articles containing asbestos, installations or devices containing asbestos, hard-paved roads containing asbestos waste, asbestos cement pipes and removed products containing asbestos are equated by physical inventory. The property owner who is a natural person passes the inventory to a municipality head or a mayor annually by 31 January. Legal entities submit the information to a province marshal.

According to the Regulation of the Minister of Economy, Labour and Social Policy of 2 April 2004 *on the methods and conditions for the safe use and disposal of products containing asbestos* (Regulation of the Minister of Economy, Labour and Social Policy, 2004), the owner, perpetual usufructuary or property manager (of construction work, industrial plant or other object) on whose premises asbestos-containing materials are found, checks on the state of these products in terms of the assessment of the status of these articles¹. The person in charge assesses the

¹ The date of next assessment is determined after scoring, according to the form annexed to that regulation. In the case of evaluation, for which the sum of points indicated first degree of the urgency it is necessary to prompt replacement or repair, for the second degree of urgency - a reassessment is required in time of one year, for the third degree of urgency - a reassessment is required within 5 years.

condition and the possibility of safe use of products containing asbestos. Later, the person shall submit the results of this process to the authority in building control.

If the decision to remove the asbestos is made, then the contractor of work who has appropriate licenses, training and eligibility is chosen. He develops a detailed work plan and reports his willingness of implementation to the building control authority, the regional Labour Inspectorate and architecture and construction administration bodies. The work carried out by dismantling and securing asbestos products, transport, storage and disposal are regulated by provisions of the ordinance of the ministers of economy, labour and social policy and the environmental protection and waste management laws.

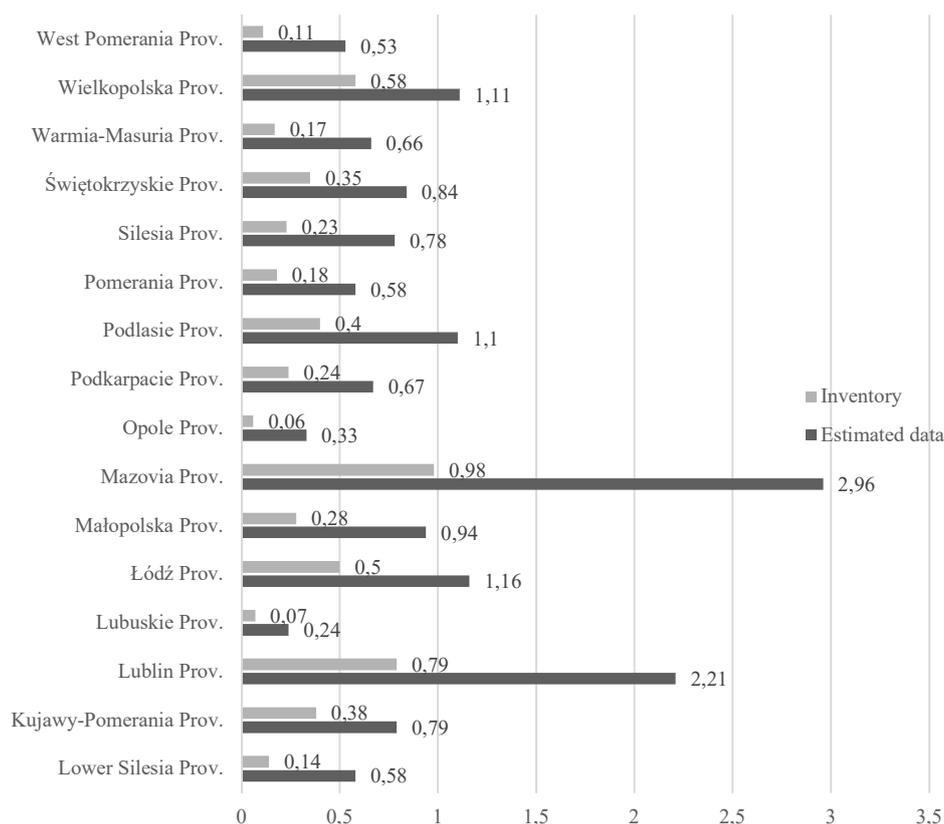
Current regulations give the possibility of financial support for people who want to remove asbestos from the area of a real estate. As far as the priorities are concerned, various provincial funds for environmental protection and water management offer support in funding safe disposal of products containing asbestos. The form and scope of support, as well as eligibility to apply for funding varies depending on the rules in each of the provinces. The most crucial element of the funding process is a fair inventory programme of removing asbestos-containing products conducted by municipalities and counties. Only then can the money for the people to use be obtained from environmental protection funds. It is worth mentioning that only works associated with the removal of asbestos are funded. Financing of new roof covering or elevation is not included.

3. Accumulation and dynamics of asbestos removal in Poland

About 90% of asbestos in Poland was used to manufacture asbestos cement products. The largest amount was used in the 70s (it was about 60 thousand tonnes a year). In the following decades, consumption of asbestos decreased to 50 thousand tonnes a year in the 80s. In the early 90s approx. 30 thousand tonnes a year (Pyssa and Rokita, 2007) were used. In the Programme for removing asbestos and products containing asbestos implemented on Polish territory in 2002, it was estimated that there were around The same number defined on the basis of inventory reflected a much lower

amount of products. It estimated 5.5 million tonnes from which 4.9 million tonnes were located on the premises of natural persons². (Fig. 1).

Figure 1. The accumulation of products containing asbestos in Polish provinces by estimated data and inventory [mln tonnes]



Source: Author's own elaboration.

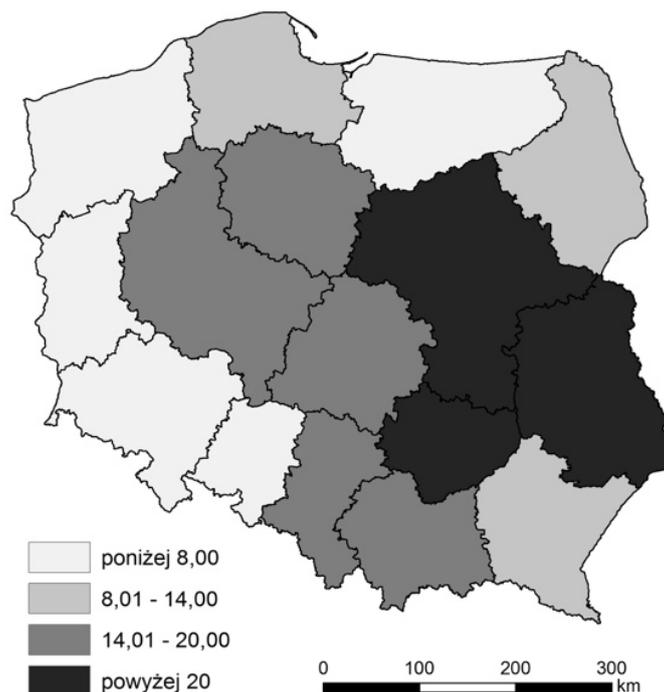
The highest number of products containing asbestos in buildings (by estimates of *Asbestos Removal Program in Poland for Years 2009-2032*) were in: Mazovia (2.9 million tonnes), Lublin (2.2 million tonnes), Wielkopolska, Łódź and Podkarpackie Provinces (approx. 1,1 million tonnes). The result of conducted inventory determined that the greatest accumulation of asbestos occurred in the Mazovia (0.98 million tonnes), Lubuskie (0.79 million tonnes), Wielkopolska and Łódź Provinces (0.58 and 0.50 million tonnes respectively).

² Inventory data include 93% (2,308) of municipalities for inventory conducted in natural persons and 86% (2,137) of municipalities for inventory conducted in legal persons (bazaazbestowa.gov.pl).

According to the estimates the largest quantities of building materials containing asbestos per inhabitant (ie approx. 1 tonne per person) were in Podlasie and Lublin Provinces. Slightly lower values were recorded in Mazovia, Świętokrzyskie and Warmia-Masuria Provinces where was about 0.5 tonnes per person. According to the data inventory, most asbestos products per person were in Lublin and Podlasie (approx. 0.35 tonnes) and Świętokrzyskie, Mazovia, Łódź, Kujawy-Pomerania and Wielkopolska Provinces (approx. 0.2 tonnes per person) (Fig. 2)³.

Summarizing, regularity in the distribution of the accumulation of asbestos in various regions in Poland can be proven. The highest total accumulation of asbestos occurred in the provinces of eastern and central Poland and in Wielkopolska Province. The lowest values were recorded in the provinces located along the western border and in the provinces of Opole, Silesia, Warmia-Masuria and Pomerania Provinces.

Figure 2. The amount of asbestos products used as building materials by provinces [in thousands of tonnes per person]



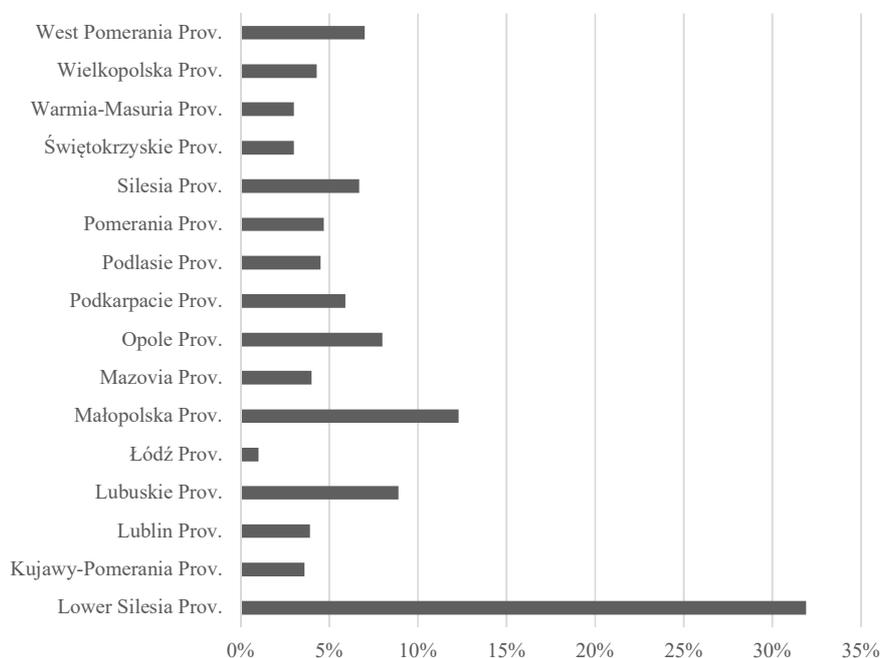
Source: Author's own elaboration.

³ Due to the fact that the estimates contained in the Programme of Removing Asbestos and Products Containing Asbestos Used on Polish Territory was given as of the year 2000, for calculation of the accumulation of asbestos per capita were used the population figures from 2000. The data of inventory is difficult to point a year the base, because some municipalities still have not performed this task. Consequently, the population figures also were used from the year 2000.

In most regions asbestos is primarily accumulated on properties belonging to natural persons. Only in Silesia, Opole, Lower Silesia and Wielkopolska Provinces between 40 and 23% of asbestos is located on properties belonging to legal entities. The lowest percentage, between 2 to 5%, is in Świętokrzyskie, Podlasie, Podkarpacie, Lublin and Mazovia Provinces⁴. In terms of financial incentives and organizational support, local government units do not have possibility to influence the activities carried out by legal entities. Thus, most of the data on the removed asbestos applies to the property belonging to natural persons.

The largest proportion of the asbestos disposed of in relation to inventory results occurs in Lower Silesia Province (32% of asbestos has been already neutralized). More than 10% of accumulated asbestos neutralized in Małopolska Province (12.3%). In the following provinces the proportions are lower and constitute less than 10%. In Lubuskie, Opole, West Pomerania, Silesia and Podkarpacie Provinces they fluctuated between 5.9 and 8.9%. In other provinces the proportions averaged between 1 and 4.7%. By the end of 2014 the smallest amount of removed asbestos was recorded in Łódź Province with only 1% (Fig. 3).

Figure 3. The percentage of removed asbestos-containing products in the provinces [%]

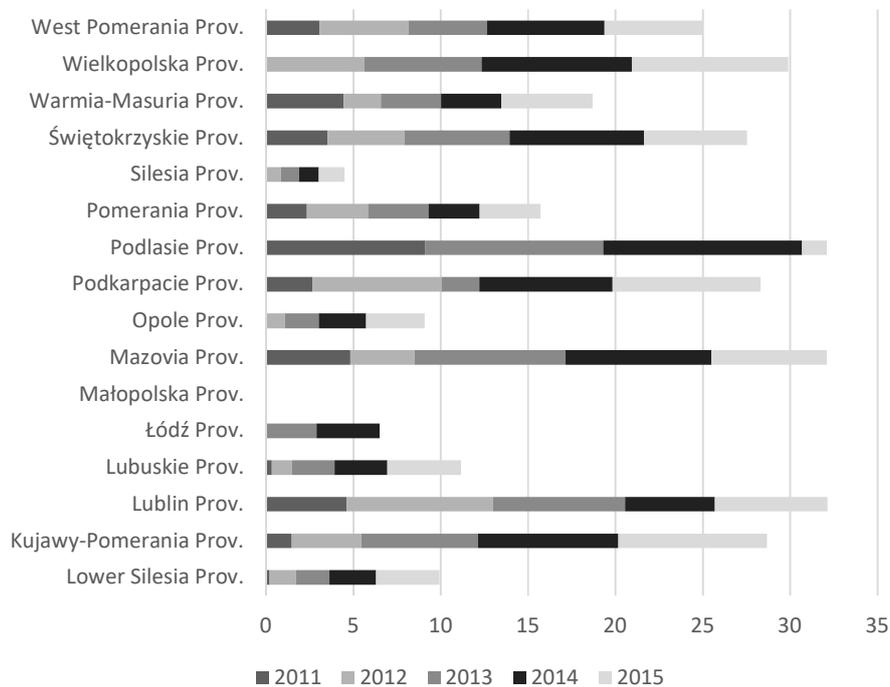


Source: Author's own elaboration.

⁴ These figures are not final, because in some regions the inventory is not fully conducted.

The analysis of the dynamics of asbestos removal in different regions can be also based on the data from the National Fund for Environmental Protection and Water Management. Since 2011 this institution grants funds to remove asbestos from municipalities. Over the last five years the program has helped in removing a total of over 300 thousand tonnes of asbestos. More than 56 million PLN was designated for that purpose. The funding has risen from 8 million PLN in 2011 to more than 17 million PLN in 2013 and 2014. Most asbestos products removed from the area of Podlasie, Mazovia and Lublin Provinces (more than 30 thousand tonnes), while the least from the area of Silesia, Łódź and Lower Silesia (5 to 10 thousand tonnes) (Fig. 4). Provinces which systematically increased the amount of disposal of asbestos in 2011-2014 are: Lower Silesia, Lubuskie, Opole, Silesia, Wielkopolska and Kujawy-Pomerania as well as Warmia-Masuria where, in the case of the last two, annual dynamics of growth was the greatest. The lowest funds are obtained by Łódź and Mazovia Provinces. As a result, they remove asbestos the least effectively and during the period of 2011-2015 they had not requested any national funds for that purpose.

Figure 4. The amount of asbestos disposed of in 2011-2015 in particular provinces



Source: Author's own elaboration.

4. Factors differentiating the dynamics of asbestos removal in Poland and assessment of organizational solutions in this area

So far, there is no broader diagnosis of the influence of socio-economic factors on the rate of removal of asbestos in Poland and there have not been made any attempts to assess any organizational solutions in this regard. However, the rate of removal of asbestos in each province certainly derives from historical factors which result in differentiations in the accumulation of asbestos. Close dependencies in this area occur between: the amount of accumulated asbestos and the percentage of agricultural land in the region, the number of people employed in agriculture, average wage levels and the location of factories using asbestos, which are primarily plants producing asbestos products for the building industry.

In the case of the first three factors, Pearson correlation coefficient between a variable and the amount of accumulated asbestos in the provinces is at a level of 0.55 to 0.71. This indicates strong relationship. With regard to the plants that used asbestos in production, the manufacturing of products for the building industry mainly corrugated sheets, flat and ridge tiles, showed a strong correlation between the number in the region, the type and scale of the business, and the amount of accumulated asbestos in the region (Tab. 1).

Table 1. Location of plants that used asbestos in production, including the manufacture of products for the construction industry and the accumulation of asbestos in thousands tonnes

No.	Province	City*	Amount of accumulated asbestos in region (inventory)[thousands tonnes]
1.	Mazovia	Marki, Malkinia , Konstancin-Jeziorna, Wierzbica , Sochaczew **	983,94
2.	Lower Silesia	Gryfów Śląski, Pilchowice, Wrocław, Lubawka	140,46
3.	Lubelskie	Lublin , Końskowola , Parczew	791,41
4.	Pomerania	Gdańsk, Łapino	175,77
5.	Silesia	Ogrodzieniec , Trzebinia	233,49
6.	Wielkopolska	Jarocin, Trzemeszno	580,94
7.	Małopolska	Szczucin	280,89
8.	Kujawy-Pomerania	Włocławek	375,58
9.	Łódź	Łódź	502,42
10.	Podlaskie	Żelechy	400,97

* Additionally in annexes mentioned plants in Pruszków, Włocławek, Sokółka, Sandomierz and Katowice indicating that in these plants were not manufactured products containing asbestos.

** Bold names indicate locations in which were manufactured asbestos products used in construction

Source: Authors' own elaboration.

An interesting dependence exists for the characteristics based on the level of social development. For example, for education measured by the participation of students in universities and civil society measured by turnout in elections. For most regions they show the inverse relationship: the higher the value of these variables, the slower dynamics of asbestos removal. The following data allows to conclude statements that both the nature of the region's economy and the level of welfare of the residents are closely related to the amount and rate of removal of asbestos, whereas citizenship and education do not show dependence in this instance⁵.

It is also important to attempt to assess the effectiveness of the system of asbestos removal. The current level of implementation of the objectives of the National Programme of Asbestos Removal is insufficient. The average degree of advancement, measured by the percentage of asbestos removed, is approx. 7% (end of 2014). If the assumed deadlines are about to be kept, the advancement should be at the level of approx. 30%. Hereinafter, not all municipalities in the country have made the expected inventory. Only four provinces: Lubuskie, West Pomerania,

⁵ Although voter turnout in Poland, however strongly linked to the social structure, is characterized by high instability, so it is quite labile factor, whose impact is difficult to conclude (Cześniak, 2009).

Warmia-Masuria and Lublin conducted an inventory in all municipalities. In comparison, Świętokrzyskie, Lower Silesia and Łódź it was less than 95% (Tab. 2).

Table 2. Percentage of municipalities that have made an inventory of asbestos and asbestos-containing products in the area of particular province [%]

No.	Province	Percentage of municipalities that have made an inventory [%]
1.	Lublin	100
2.	Lubuskie	100
3.	Warmia-Masuria	100
4.	West Pomerania	100
5.	Mazovia	99,4
6.	Podlasie	99,2
7.	Wielkopolska	99,1
8.	Kujawy-Pomerania	98,6
9.	Opole	98,6
10.	Silesia	98,2
11.	Pomerania	97,6
12.	Małopolska	96,7
13.	Podkarpacie	95,6
14.	Świętokrzyskie	94,1
15.	Lower Silesia	92,9
16.	Łódź	92,1

Source: Authors' own elaboration.

The inventory does not equate to an effective implementation of tasks related to asbestos removal from the municipalities. On the basis of its findings a communal program of removing asbestos must be made. What is more, municipalities have to systematically perform an update. Each municipality is required to upgrade the current information on removed asbestos from its land in the national database bazaazbestowa.gov.pl. Due to complicated procedures for the preparation of information on asbestos-containing products such as: different types of documents, different legal forms of the property owner as well as various different entities the documents should be submitted. The lack of specific guidelines on how to carry out an inventory and financial barriers act as a restraint to finding solutions to the issue of asbestos and its removal. Ownerships such as natural persons often have no awareness of the responsibility they have due to the presence of asbestos on

their property. Inefficiency of asbestos removal processes exists because of the need to incur large capital expenditures associated with the building of new roofing.

In terms of systemic solutions, there are no effective tools for monitoring and control of the programmes advancement (such as national and local levels). Adjusting aid does not operate as well. Although the government document from 2009 states that from 2016 the activities related to the removal of asbestos from the area of property should be reinforced, but there's been neither an additional formal and legal framework for these regulation, nor a significant modernization of the system of financial support made. It appears that, apart from the ambiguity of systemic solutions, the main barrier is the limited financial capabilities of natural persons.

Funding the dismantling of the roofing is an insufficient incentive to remove asbestos from the area of the property, even when 100% of the investment is funded. The necessity of installing a new roof exceeds the cost of dismantling of the old roof therefore it is a big expense for individual households in rural areas, where asbestos roofing is used not only for residential houses but also for the farm buildings where the surface of the roof is large.

The organization of the system of financial support may give rise to doubts. It can take the form of grants, loans and credits. The following institutions are indicated as sources of financing the removal of asbestos: state budget funds at the disposal of the Minister of Economy, own funds of the owners of buildings, own funds of private investors, funds of environmental protection institutions (The National Fund for Environmental Protection and Water Management and the provincial environmental protection funds), own funds of governmental units', loans (mainly provided by the Bank of Environmental Protection – BOŚ).

Apart from investments, the total expenditure from institutional budgets, also includes: support for preparatory activities (preparation of documentation of asbestos removal), support for the development of municipality, district and provincial programmes of asbestos removal, support of local training, monitoring the implementation of programmes, assessment of exposure to the asbestos, health care as well as education and information activities. As a result, funds allocated for the implementation of activities are dedicated for various purposes and are transferred in different forms. Individual institutions should remain in close co-operation in the implementation of projects, the distribution of financial resources, training, information and promotional campaigns (Pietrzak 2014).

Potential beneficiaries do not, however, have full information about the possibility of obtaining funds for the planned activities. Choosing the correct recipient of the application for asbestos removal can be problematic, whether it is right to enquire to the commune office, district governor's office, or perhaps the provincial environmental protection fund. In fact, the money circulates among the institutions and problematically, the holder of the funds is not always the entity which receives or deals with requests. The support is also not constant over time – some regions did not take part in all editions of the funding programme. As a result, planning of investment by potential beneficiaries may be subject to a high degree of uncertainty regarding the ability to obtain financing in the future, its terms of conditions and amounts.

4. Conclusion

Both the accumulation of asbestos and the dynamics of its removal in the regions are varied. In this instance, the issue of full identification of the factors influencing the rate of removal of asbestos by individuals seems to be particularly important. The asbestos should be completely removed from Polish territory by 2032. The process of its removal and the management of waste should be done in accordance with legal guidelines.

Therefore, in addition to further systematic funding of the activities undertaken i.e. education and organizational support for natural persons, better organization and coordination of system processes on a regional and national level should be obtained. Available inventory tools and the database maintained to supervise the actions taken are not fully effective. The data collected through them is significantly different from the estimates established in strategies. Data generated on the basis of the statistics are also not consistent. In addition, the possibility of support for individual recipients is inherently uncertain and involves their own participation, which is the biggest obstacle in the process of cleansing the country from asbestos.

Literature

- Aguilar, M.; Beaudry, M.; Bell, W.; Bowes, D.; Brophy, J.; Burdorf, A. (2013). Statement in response to asbestos industry efforts to prevent a ban on asbestos in Pakistan: chrysotile asbestos use is not safe and must be banned. *International Archives of Occupational and Environmental Health* 68(4): 243-249.
- Asbestos Removal Program in Poland for Years 2009-2032 adopted by virtue of Resolution by the Council of Ministers on 14 July 2009, amended by Resolution dated 15 March 2010. Available at: <https://www.mr.gov.pl/strony/zadania/bezpieczenstwo-gospodarcze/usuwanie-azbestu/program-oczyszczania-kraju-z-azbestu/>. Accessed 10 March 2016.
- Bianchi, C.; Bianchi, T. (2012). Malignant mesothelioma in Eastern Asia. *Asian Pacific journal of cancer prevention* 13(10): 4849-4853.
- Camponiano, A.; Casciardi, S.; Fiovavanti, F.; Ramires, D. (2004). Airborne asbestos levels in school buildings in Italy. *Journal of Occupational and Environmental Hygiene* 1: 256-261.
- Commission Directive 1999/77/EC of 26 July 1999 adapting to technical progress for the sixth time Annex I to Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (asbestos) (Official Journal of the European Communities L 207/18, 6.8.1999).
- Council Directive 87/217/EEC of 19 March 1987 on the prevention and reduction of environmental pollution by asbestos as amended by Council Directive 91/692/EEC (further amended by Council Regulation 1882/2003/EC), and Council Regulation 807.2003/EC (Official Journal of the European Communities L02017, 5.6.2003).
- Courtice, M.N.; Lin, S.; Wang, X. (2012). An updated review on asbestos and related diseases in China. *International Journal Occupational and Environmental Health* 18(3): 247-253.
- Cześniak, M. (2009). *Partycypacja wyborcza Polaków*. Warszawa: Instytut Spraw Publicznych.
- Directive 2003/18/EC of the European Parliament and of the Council of 27 March 2003 amending Council Directive 83/477/EEC on the protection of workers from the risks related to exposure to asbestos at work. (Official Journal of the European Union L 097, 15.04.2003).
- Fenoglio, I.; Tomatis, M.; Fubini, B. (2001). Spontaneous polymerisation on amphibole asbestos: relevance to asbestos removal. *Chemical Communications* 7(21): 2182-2183.
- Jinhiu Li; Qingyin Dong; Keli Yu; Lili Liu (2014). Asbestos and asbestos waste management in the Asian-Pacific region: trends, challenges and solutions. *Journal of Cleaner Production* 81: 218-226.
- Lee, R.J.; Van Orden D.R. (2008) Airborne asbestos in buildings. *Regulatory Toxicology and Pharmacology* 50(2): 218-225.
- Pietrzak, K., 2014, *Finansowanie usuwania wyrobów zawierających azbest. Poradnik dla gmin oraz osób fizycznych*. Warszawa: Meritum Competence.
- Pyssa, J.; Rokita, G.M. (2007). Azbest – występowanie, wykorzystanie i sposób postępowania odpadami azbestowymi. *Gospodarka Surowcami Mineralnymi* 23(1): 49-61.
- Regulation of the Minister of Economy of 13 December 2010 for the use of products containing asbestos and the treatment of installations or products containing asbestos (Journal of Laws of 2011. No. 8 item 31)
- Regulation of the Minister of Economy, Labour and Social Policy of 2 April 2004 on the methods and conditions for the safe use and disposal of products containing asbestos (Journal of Laws of 2004, No. 71 item 649 and 2010, No. 162, item 1089)
- Świątkowska, B.; Wojciech, S.; Szubert, Z.; Szeszenia-Dąbrowska, N. (2014). Continued spirometry changes after cessation of exposure in asbestos-cement workers. *Journal of Occupational and Environmental Medicine* 56(4): 403-408.

*Efektywność rozwiązań systemowych w zakresie usuwania azbestu w Polsce
– stan i perspektywy*

Streszczenie

W artykule dokonano skróconej diagnozy w zakresie wpływu czynników społeczno-gospodarczych i organizacyjnych na tempo usuwania azbestu w Polsce. Zaprezentowano podstawowe dane statystyczne dotyczące nagromadzenia i tempa usuwania azbestu z terytorium kraju oraz podjęto próbę wskazania przyczyn występujących prawidłowości w tym zakresie. Dodatkowo zaprezentowano najważniejsze informacje dotyczące rozwiązań systemowych w zakresie usuwania azbestu i dokonano oceny efektywności funkcjonującego systemu. Wykazano niewystraszające zaawansowanie realizacji strategii krajowych w tym obszarze oraz niską efektywność rozwiązań systemowych w tym zakresie.

Słowa kluczowe: azbest, usuwanie azbestu, efektywność, rozwiązania systemowe, Polska, regiony