The Demand for Landfills for Asbestos-Containing Waste in Poland

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http://doi.org/10.29227/IM-2018-02-28

Abstract

In 1998 a broad and long-lasting process of asbestos removal from the territory of the entire country was started in Poland, which at the same time resulted in the generation of group 17 hazardous waste asbestos-containing waste. The asbestos removal in Poland from the area of individual municipalities is carried out based on the Programme of Country Cleaning from Asbestos for the years 2009–2023. The landfilling in places especially designed for this purpose is the basic method for effective disposal of asbestos-containing waste. In the area of Poland there is a number of landfills or sections designed and adapted to landfill asbestos-containing waste (33 facilities). There are also plans to expand such facilities or to build new ones (11 projects). The basis to carry out the analysis consists of the data and information collected in the Asbestos Database of the Ministry of Entrepreneurship and Technology (http://www.bazaazbestowa.gov.pl). At the moment more than 5 million Mg of asbestos-containing products have been registered in the territory of Poland during stocktaking, of which more than one million in the Mazovian Voivodeship only. The registered amount of asbestos-containing products in individual municipalities was considered the amount of potential generation of asbestos-containing waste in the future. On the entire country scale the amount of material registered in the stocktaking is definitely higher than that forecast based on generation indices (Klojzy-Karczmarczyk B. et al. 2016). Voivodeships with high accumulation of asbestos-containing products comprise mainly the area of central Poland. Overall, in the territory of Poland there are 33 landfills, where asbestos-containing products can be subject to disposal. The next 11 projects are planned as expansion of the existing or construction of new facilities. On the entire country scale there is now a deficit of landfilling capacity of approx. 1,750,000 m³ in the case of stocktaking results analysis or of 500,000 m³ in the case of generation analysis based on indices. After the carried out planned expansion of the landfilling base the deficits will decrease to the amount of 600,000 m³ in the case of stocktaking results analysis and even the possible capacity will exceed the demand by 600,000 m³ in the case of generation analysis based on indices. The best conditions for landfilling exist now in the Świętokrzyskie voivodeship after the expansion of the landfilling base, very good possibilities of waste reception will be obtained by the Kuyavian-Pomeranian voivodeship. Taking into account all the performed analysis the necessity to expand the existing base for asbestos-containing waste landfilling should be stated. It is necessary to emphasise that this expansion does not require to take immediate actions and may be distributed over time due to a slow process of asbestos-containing products removal from the area of individual municipalities.

Keywords: waste, asbestos, generation index, landfill, capacity of storage

Submission date: 05-09-2018 | Review date: 14-10-2018

Introduction

The introduction of the Act on Prohibition of Asbestos-Containing Products Use of 19 June 1997 (Dz.U. of 2017, item 2119 with amendments) finished the period of this material use in the territory of Poland. Thereby a broad and long-lasting process of asbestos removal from the territory of the entire country was started, which at the same time resulted in the generation of group 17 hazardous waste asbestos-containing waste (Dz.U. of 2014, item 1923). Asbestos was widely used in Poland in various industrial technologies, construction, power, and transport industries in 1970s. The main elements related to the asbestos-containing products are facilities and areas, where asbestos-containing products of impaired structure are used, in particular when they are removed improperly. The basic asbestos pollution hotbeds related to human activities are buildings and areas, where asbestos-containing waste was generated and stored, unauthorised dumps of asbestos-containing waste, as well as real property, equipment, plants or other places, where such products are used (e.g. Dyczek 2000; Obmiński 2000; Więcek 2004; Jawecki 2008; Pichór 2005; Pyssa and Rokita 2007; Jawecki 2008; Szeszenia-Dąbrowska 2007; Szeszenia-Dąbrowska and Sobala 2010; Szeszenia-Dąbrowska et al. 2015).

The asbestos removal in Poland from the area of individual municipalities is carried out based on the Programme of Country Cleaning from Asbestos for the years 2009–2023 (Programme of Asbestos Removal... 2002, Programme of Country Cleaning... 2009). The basic tasks analysed and suggested in that planning document comprise removal and disposal of asbestos-containing products, minimisation of negative health effects caused by the asbestos existence within the country, and liquidation of harmful asbestos environmental impact. The programme determines tasks necessary to clean the country from asbestos by 2032, resulting from economic and social changes, which occurred inter alia due to Poland's accession to the European Union. The set targets should be accomplished by mutually complementing tasks on three tiers of admin-

Tab. 1. Amount of asbestos-containing products acc. to the results of stocktaking carried in the area of Poland (http://www.bazaazbestowa.gov.pl)
Tab. 1. Ilość wyrobów zawierających azbest zgodnie z wynikami inwentaryzacji przeprowadzonej na obszarze Polski (http://www.bazaazbestowa.gov.pl)

No	Voivodship	Registered stock of asbestos-containing products [Mg] based on the Asbestos Database *
1	Lower Silesian	110,999.557
2	Kuyavian-Pomeranian	373,998.944
3	Lublin	823,038.051
4	Lubuskie	56,566.569
5	Łódź	554,998.834
6	Lesser Poland	249,003.793
7	Mazovian	1,024,778.557
8	Opole	56,845.741
9	Podkarpackie	220,650.268
10	Podlaskie	398,848.534
11	Pomeranian	171,939.874
12	Silesian	192,828.088
13	Świętokrzyskie	348,485.545
14	Warmian-Masurian	154,291.079
15	Greater Poland	534,605.684
16	West Pomeranian	110,839.690
total	**POLAND**	**5,392,718.809**

* – The registered stock of asbestos-containing products based on the Asbestos Database of the Ministry of Entrepreneurship and Technology, as on 21 August 2018. (http://www.bazaazbestowa.gov.pl)

istration: central, regional and local (district and municipal), financed from private and public funds.

There is a number of methods for effective and safe disposal of asbestos-containing waste (e.g. Makoudi 2007; Pawluk 2010). Their landilling in places especially designed for this purpose is one of the basic methods. The Regulation of the Minister of Environment on waste landfills (Dz.U. of 2013, item 523) defines the basic rules for such facilities construction, operation, and monitoring. Landfills constructed for such hazardous waste should be constructed in pits especially made in the ground with side walls protected against sliding. An extremely important requirement consists in the prevention against asbestos fibres release to the air, e.g. through covering by an appropriate layer of earth or by carrying out building works in such a way as to not damage the asbestos structure. In the area of Poland there is a number of landfills or landfill sections designed and adapted to landfill asbestos-containing waste. There are also plans to expand such facilities or to build new ones. The paper is aimed at checking, whether the current capacity of landfills intended for asbestos-containing products disposal is sufficient to secure the needs on the national scale or is it necessary to expand the landfilling base. The basis to carry out the analysis and to determine the demand for the next landfills or sections consists of the data and information collected in the Asbestos Data of the Ministry of Entrepreneurship and Technology and of the data acquired during the own work of the authors.

The stocktaking and generation of asbestos-containing waste

The basic task performed in the process of country cleaning from asbestos is a detailed stocktaking together with the assessment of the situation and the results of stocktaking carried out in the area of municipalities are placed on a current basis in the Asbestos Database maintained by the Ministry of Entrepreneurship and Technology (formerly Ministry of Development, and earlier Ministry of Economy) (http://www.bazaazbestowa.gov.pl). The Asbestos Database is one of tools for monitoring the performance of tasks resulting from the programme of country cleaning from asbestos. In addition, on the Asbestos Database website it is possible to obtain information on the performance of tasks in the field of safe decommissioning of asbestos products, including: database of companies removing asbestos-containing products, list of landfillsdesigned to store removed asbestos-containing products, list of local and regional asbestos removal programmesfrom individual municipalities as well as statistics related to municipalities' activities (http://www.bazaazbestowa.gov.pl).

The data gathered in the Asbestos Database allow to obtain a real and not estimated amount of materials accumulated in the area of Poland. At the moment more than 5,392,718 Mg of asbestos-containing products have been registered during the stocktaking, of which more than one million in the Mazovian Voivodeship only (Table 1). This stocktaking is still incomplete and requires continuation. It should be emphasised, that the total number of municipalities covered by full or only partial stocktaking is estimated at 90%. So the figures given in Table 1 will be increased once full stocktaking is completed throughout the country.

Tab. 2. Forecast generation of asbestos-containing waste in the area of Poland based on indices estimated by authors
Tab. 2. Prognozowane wytwarzanie odpadów zawierających azbest na obszarze Polski na podstawie wskaźników szacowanych przez autorów

No	Voivodship	Population *			Forecast generation of asbestos-containing waste [Mg] **		
		towns	villages	total	towns	villages	total
1	Lower Silesian	1,996,356	906,191	2,902,547	39,528	210,055	249,583
2	Kuyavian-Pomeranian	1,234,999	847,945	2,082,944	24,453	196,554	221,007
3	Lublin	988,365	1,137,952	2,126,317	19,570	263,777	283,347
4	Lubuskie	659,689	357,143	1,016,832	13,062	82,786	95,848
5	Łódź	1,553,425	922,890	2,476,315	30,758	213,926	244,684
6	Lesser Poland	1,637,850	1,753,530	3,391,380	32,429	406,468	438,898
7	Mazovian	3,463,514	1,921,103	5,384,617	68,578	445,312	513,889
8	Opole	522,594	467,475	990,069	10,347	108,361	118,708
9	Podkarpackie	876,243	1252875	2,129,138	17,350	290,416	307,766
10	Podlaskie	719,151	465,397	1,184,548	14,239	107,879	122,118
11	Pomeranian	1,484,837	839,414	2,324,251	29,400	194,576	223,976
12	Silesian	3,496,038	1,052,142	4,548,180	69,222	243,887	313,108
13	Świętokrzyskie	556,176	691,556	1,247,732	11,012	160,303	171,315
14	Warmian-Masurian	846,422	587,523	1,433,945	16,759	136,188	152,947
15	Greater Poland	1,903,380	1,585,830	3,489,210	37,687	367,595	405,282
16	West Pomeranian	1,170,214	535,319	1,705,533	23,170	124,087	147,257
total	**POLAND**	**23,109,253**	**15,324,305**	**38,433,558**	**457,563**	**3,552,174**	**4,009,737**

* – Population based on the Local Data Bank (BDL), Central Statistical Office (GUS) (https://bdl.stat.gov.pl)
** – Forecast generation of asbestos-containing waste estimated based on indices presented in the paper by B. Klojzy-Karczmarczyk et al. (2016)

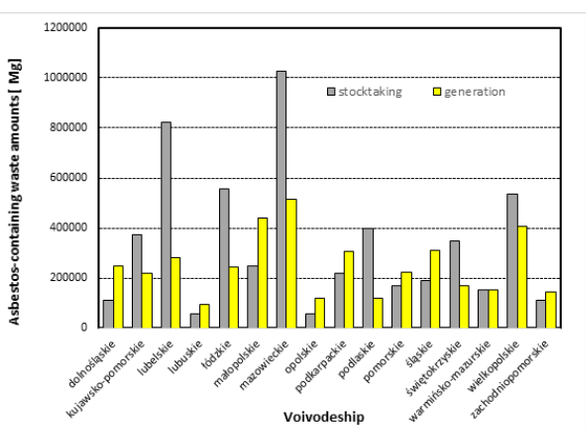

Fig. 1. Comparison of asbestos-containing waste amounts registered during the stocktaking and forecast based on indices in individual voivodeships
Rys. 1. Porównanie wielkości zinwentaryzowanych odpadów zawierających azbest oraz wielkości prognozowanej na podstawie wskaźników w poszczególnych województwach

The estimation of possible generation of asbestos-containing waste based on indices of generation by residents is a separate issue. The authors of the paper participated in many stocktaking activities, which results were also entered to the Asbestos Database (Klojzy-Karczmarczyk and Makoudi 2011, 2012; Klojzy-Karczmarczyk, Makoudi and Staszczak 2015). In a previous paper with the authors involvement the index of asbestos-containing waste generation was estimated based on 10-year long work in the area of 63 municipalities (Klojzy-Karczmarczyk et al. 2016). Because of conditions in the urban and rural areas it is necessary to estimate separately waste generation indices for those areas. The registered amount of asbestos-containing products in individual municipalities was considered the amount of potential generation of asbestos-containing waste in the future. The smallest amounts of asbestos-containing products accumulation per one residents were recorded in urban municipalities, and the highest in rural municipalities. This results from a frequent application of asbestos-containing products as the roofing of single-family houses and of outbuildings. Definitely the highest amount of asbestos-containing products per resident was shown for rural municipalities, where the estimated index is 21 m2/per capita (0.2318 Mg/per capita). Instead, the estimated index for such waste generation in urban areas is 1.8 m2/per capita (0.0198 Mg/per capita). Indices obtained in real conditions for urban areas are definitely lower than those provided in the planning documents of the national level (Pro-

Tab. 3. Available capacity of landfills for asbestos-containing products disposal by voivodeships
Tab. 3. Dostępna pojemność składowisk do unieszkodliwiania wyrobów zawierających azbest z podziałem na województwa

No	Voivodship	Number of generally accessible landfills*	Free capacity of generally accessible landfills [m^3]*
1	Lower Silesian	2	3,800
2	Kuyavian-Pomeranian	2	65,250
3	Lublin	3	171,198
4	Lubuskie	1	38,806
5	Łódź	2	8,957
6	Lesser Poland	3	47,921
7	Mazovian	1	43,500
8	Opole	-	-
9	Podkarpackie	4	9,101
10	Podlaskie	2	144,233
11	Pomeranian	4	202,939
12	Silesian	4	323,186
13	Świętokrzyskie	1	1,460,000
14	Warmian-Masurian	1	12,193
15	Greater Poland	1	53,000
16	West Pomeranian	2	95,325
total	**POLAND**	**33**	**2,679,409**

* – Based on the Asbestos Database of the Ministry of Entrepreneurship and Technology, as on 21 August 2018. (http://www.bazaazbestowa.gov.pl)

gramme of Asbestos Removal ...2002, Programme of Country Cleaning ...2009). It is possible to conclude that indices provided in the programme referred to reflect the problem scale only for rural areas.

Table 2 presents the forecast generation of asbestos-containing waste in the area of Poland, estimated based on indices arranged by voivodeships (Klojzy-Karczmarczyk, Staszczak 2016). On the entire country scale the amount of material registered in the stocktaking is definitely higher than that forecast based on indices. The situation differs in individual voivodeships (Fig. 1). Only in the Warmian-Masurian and Greater Poland voivodeships the amount registered in the stocktaking corresponds to the forecast one. In 8 voivodeships (Lower Silesian, Lubuskie, Lesser Poland, Opole, Podkarpackie, Pomeranian, Silesian, West Pomeranian) the forecast amount is higher than the registered one. In the other voivodeships the forecast amounts are lower than those registered in stocktaking. Voivodeships with high accumulation of asbestos-containing products comprise mainly the area of central Poland. In the process of index estimation this area, due to the sequence of tasks performance, was represented only by single municipalities.

Landfills for asbestos-containing waste

Almost in every voivodeships there is a landfill for asbestos-containing waste or another landfill with a separate section for asbestos-containing waste landfilling. The Opole voivodeship is an exception, where there is no such landfill at all. Perhaps this results from the fact that the Opole voivodeship belongs to those with the smallest amounts of asbestos-containing products, which ultimately will become waste. Moreover, in the neighbouring Silesian voivodeship there are as many as 4 plants for this hazardous waste landfilling.

Overall, in the territory of Poland there are 33 landfills, where asbestos-containing products can be subject to disposal. The biggest number, 4 facilities, are situated in Podkarpackie, Pomeranian, and Silesian voivodeships, while 3 facilities in each of Lublin and Lesser Poland voivodeships. The specification of remaining free capacity for asbestos-containing products (Table 3) shows that in many voivodeships the available capacity becomes scarce. In the Lower Silesia voivodeship only 3,800 m³ are left to be filled, in the Łódź voivodeship 8,957 m³ are left, while in the Podkarpackie voivodeship only 9,101 m³ are left (despite 4 operating landfills). So a necessity exists to build new landfills or to transport asbestos-containing waste to other voivodeships.

Fig. 2 presents the location of existing landfills for asbestos-containing waste in the territory of Poland. Also investment projects, referred to as planned for construction or expansion, have been marked (https://www.bazaazbestowa.pl).

Estimation of sufficient landfilling capacity

Landfills specified in Table 3 are in general ready to receive asbestos-containing waste. However, only a small part of those 33 facilities is already filled and now they do not receive asbestos-containing waste. Such landfills include the non-hazardous and neutral waste landfill in Trzebcz as well as the non-hazardous and neutral waste landfill in the city of Jastrzębie Zdrój.

The verification, whether the asbestos-containing waste landfills operated now have a sufficient capacity to receive asbestos-containing waste both on the scale of individual voivodeships and of the entire Poland, is a

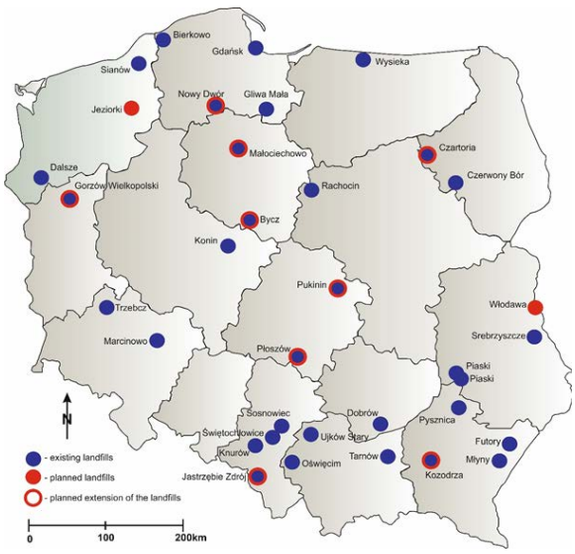

Fig. 2. Location of landfills for asbestos-containing waste in the territory of Poland (existing ones and planned for construction or expansion), based on the Asbestos Database of the Ministry of Entrepreneurship and Technology, as on 21 August 2018. (http://www.bazaazbestowa.gov.pl)
Rys 2. Lokalizacja składowisk do przyjmowania odpadów zawierających azbest na terytorium Polski (istniejące oraz planowane do budowy i rozbudowy)

significant issue in this analysis. The available capacity of landfills, which enable disposal of asbestos-containing waste, was compared with the amount of products registered during the stocktaking (Table 1). To estimate the volume of asbestos-containing materials an assumption was made that 1 Mg of asbestos-cement panels has a volume of 0.82 m³ (https://bazaazbestowa.pl). Figures 3, 4, 5, and 6 present in a graphical form the demand for landfilling capacity for asbestos-containing waste in individual voivodeships in Poland. The existing landfilling capacity as well as that planned after expansion was analysed. The demand for landfills consists of the total landfilling capacity in a specific area less the amounts registered during stocktaking and the forecast amounts of generation estimated based on indices. Negative values mean the lack of possibility to landfill in individual voivodeships, while positive values are landfilling surpluses, which can indicate a possibility to landfill waste from other voivodeships.

The amount of available space in landfills, which enable the neutralization of asbestos-containing products along with the number of stockating (Table 1), was compared. The results show clearly that there is a great deficit of capacity for disposal of asbestos-containing products (Fig. 2). Only 4 voivodeships (Pomeranian, Silesian, Świętokrzyskie, and West Pomeranian) are prepared to receive all the products recorded during the stocktaking. However, in the case of that last voivodeship the availability of landfilling capacity is doubtful due to a possible actual increase in the asbestos-containing waste after the performance of detailed repeated stocktaking. On the entire country scale the deficit of landfilling capacity is approx. 1,742,620 m³ (Fig. 3).

In a few voivodeships the expansion of existing landfills was planned as well as the construction of new facilities (Table 4, Fig. 1). During a few years the capacity of landfills containing asbestos should grow by nearly 1,300,000 m³, however, this does not change the fact that some deficit of landfilling capacity will remain. Having considered the planned increase in the landfilling capacity, the deficits in terms of landfilling sites will definitely decrease. In addition, in the next voivodeship – Kuyavian-Pomeranian – the capacity grows beyond the demand. On the entire country scale, after the landfilling base expansion, the capacity deficit will be on a more than 3 times lower level of 497,650 m³ (Fig. 4).

Further on the amount of available landfill capacity for asbestos-containing waste has been compared with the potential generation of asbestos-containing waste forecast based on indices adopted in the paper B. Klojzy-Karczmarczyk et al. (2016) (Table 2). To estimate the necessary capacity a similar assumption was made that 1 Mg of asbestos-cement panels has a volume of 0.82 m³ (https://bazaazbestowa.pl). Because of much lower forecast amounts of asbestos-containing waste generation in voivodeships of central Poland, the deficit of landfilling capacity throughout the country is estimated at 600,000 m³ (Fig. 4). Results show clearly that also in this case there is a deficit of capacity for asbestos-containing waste disposal. Only Pomeranian, Silesian, Świętokrzyskie, and additionally Podlaskie voivodeships are prepared to receive all the generated asbestos-containing waste. Having considered the planned increase in the landfilling capacity and the estimated generation taking into account indices, the landfilling capacity deficits get cancelled. On the entire country scale, after the landfilling base expansion, its capacity will be higher than demand and the surplus can reach a level of 600,000 m³ (Fig. 5). In addition,

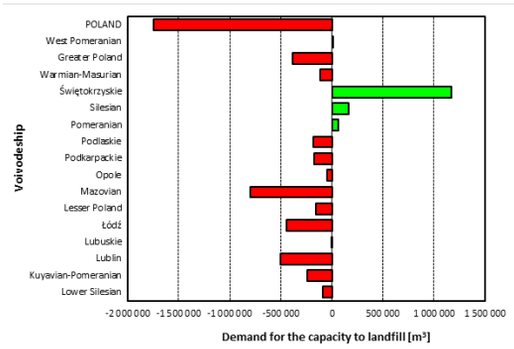

Fig. 3. Demand for the capacity to landfill asbestos-containing waste in individual voivodeships in Poland, taking into account the actual stocktaking results
Rys. 3. Zapotrzebowanie na pojemność składowania dla odpadów zawierających azbest w poszczególnych województwach w Polsce z uwzględnieniem rzeczywistych wyników inwentaryzacji

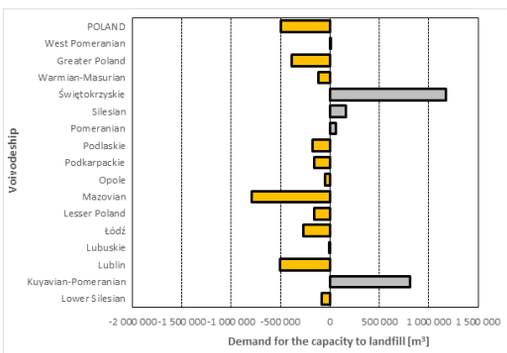

Fig. 4. Demand for the capacity to landfill asbestos-containing waste in individual voivodeships in Poland, after the planned expansion and construction of new facilities, taking into account the actual stocktaking results
Rys. 4. Zapotrzebowanie na pojemność składowania dla odpadów zawierających azbest w poszczególnych województwach w Polsce po planowanej rozbudowie i budowie nowych obiektów z uwzględnieniem rzeczywistych wyników inwentaryzacji

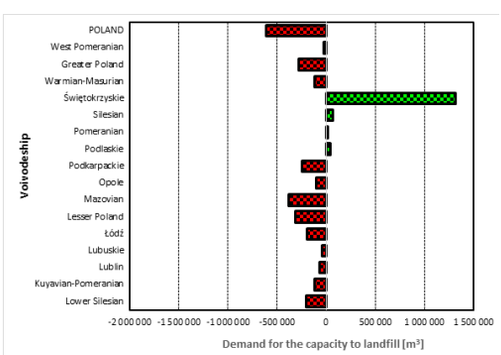

Fig. 5. Demand for the capacity to landfill asbestos-containing waste in individual voivodeships in Poland, taking into account the generation indices
Rys. 5. Zapotrzebowanie na pojemność składowania dla odpadów zawierających azbest w poszczególnych województwach w Polsce z uwzględnieniem wskaźników wytwarzania

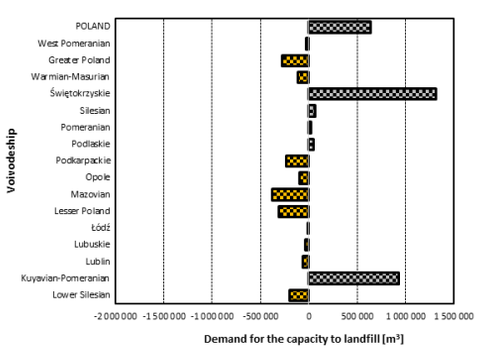

Fig. 6. Demand for the capacity to landfill asbestos-containing waste in individual voivodeships in Poland, after the planned expansion and construction of new facilities, taking into account the generation indices
Rys. 6. Zapotrzebowanie na pojemność składowania dla odpadów zawierających azbest w poszczególnych województwach w Polsce po planowanej rozbudowie i budowie nowych obiektów z uwzględnieniem wskaźników wytwarzania

Tab. 4. Planned construction and expansion of existing landfills, receiving asbestos-containing waste
Tab. 4. Planowana budowa oraz rozbudowa składowisk istniejących a przyjmujących odpady zawierające azbest

No	Voivodship	Number of constructed and expanded landfills	Planned additional landfills' capacity after expansion [m^3]*
1	Lower Silesian	-	-
2	Kuyavian-Pomeranian	2	1,050,000
3	Lublin	1	No data**
4	Lubuskie	1	No data
5	Łódź	2	177,100
6	Lesser Poland	-	-
7	Mazovian	-	-
8	Opole	-	-
9	Podkarpackie	1	8,870
10	Podlaskie	1	9,000
11	Pomeranian	1	No data
12	Silesian	1	No data
13	Świętokrzyskie	-	-
14	Warmian-Masurian	-	-
15	Greater Poland	-	-
16	West Pomeranian	1	No data **
total	**POLAND**	**11**	**1,244,970**

* – Based on the Asbestos Database of the Ministry of Entrepreneurship and Technology, as on 21 August 2018. (http://www.bazaazbestowa.gov.pl)
** – In municipalities of Włodawa (Lublin) and of Barwice (West Pomeranian) the construction of new landfills is planned, designed for asbestos-containing waste.

also in the Kuyavian-Pomeranian voivodeship the capacity grows beyond the demand.

The Świętokrzyskie voivodeship features now the best conditions for landfilling. In this case the basis consists of a landfill designed only to receive asbestos-cement building waste with codes 170601 and 170605. It is situated in the land degraded after the sulphur extraction in Doborów, Tuczepy municipality. The free landfilling capacity is 1,460,000 m³. After the planned expansion of the landfilling base, the Kuyavian-Pomeranian voivodeship will obtain very good possibilities for the waste reception. Two expansion projects of existing landfills are planned there. The first of them is the asbestos-containing hazardous waste landfill in Małociechowo, municipality of Pruszcz (the landfill is planned to expand by 900,000 m³). The second case is the hazardous waste landfill Bycz in Piotrków Kujawski municipality (the landfill is planned to expand by 150,000 m³).

Conclusions

The landilling in places especially designed for this purpose is one of basic methods for effective and safe disposal of asbestos-containing waste. In the area of Poland there is a number of landfills or landfill sections designed and adapted to landfill asbestos-containing waste. There are also plans to expand such facilities or to build new ones. The paper was aimed at checking, whether the current capacity of landfills intended for asbestos-containing products disposal is sufficient to secure the needs on the scale of individual voivodeships and of the entire country or is it necessary to expand the landfilling base. The basis to carry out the analysis and to determine the demand for the next landfills or sections consisted of the data and information collected in the Asbestos Database of the Ministry of Entrepreneurship and Technology (http://www.bazaazbestowa.gov.pl) and the data acquired during the own work of the authors.

At the moment more than 5 million Mg of asbestos-containing products have been registered in the territory of Poland during stocktaking, of which more than one million in the Mazovian Voivodeship only. This stocktaking is still incomplete and requires continuation. However, it should be emphasised that the share of municipalities covered by full or partial stocktaking is definitely of majority nature. The estimation of possible generation of asbestos-containing waste based on indices of generation by residents is a separate issue. Because of conditions in the urban and rural areas it is necessary to estimate separately waste generation indices for those areas.

On the entire country scale the amount of material registered in the stocktaking is definitely higher than that forecast based on indices. In 8 voivodeships (Lower Silesian, Lubuskie, Lesser Poland, Opole, Podkarpackie, Pomeranian, Silesian, West Pomeranian) the forecast amount is higher than the registered one. In the other voivodeships the forecast amounts are lower. Voivodeships with high accumulation of asbestos-containing products comprise mainly the area of central Poland. So it is not possible to generalize the generation index for the entire country area. Individual voivodeships feature specific natures and each of them should be considered on an individual basis. Taking into account the analysis of current stocktaking results and the forecast for waste generation based on indices it is necessary to consider that the amount of accumulated asbestos-containing products throughout the entire country is higher than that registered now during the stocktaking.

Overall, in the territory of Poland there are 33 landfills, where asbestos-containing products can be subject to disposal. The next 11 projects are planned as expansion of the existing or construction of new facilities. On the entire country scale there is now a deficit of landfilling capacity of approx. 1,750,000 m³ (in the case of stocktaking results analysis) or of 500,000 m³ (in the case of generation analysis based on indices). After the carried out planned expansion of the landfilling base the deficits will decrease to the amount of 600,000 m³ (in the case of stocktaking results analysis) and even the possible capacity will exceed the demand by 600,000 m³ (in the case of generation analysis based on indices). The best conditions for landfilling exist now in the Świętokrzyskie voivodeships after the expansion of the landfilling base, very good possibilities of waste reception will be obtained by the Kuyavian-Pomeranian voivodeship.

Taking into account all the performed analysis the necessity to expand the existing base for asbestos-containing waste landfilling should be stated. It is necessary to emphasise that this expansion does not require to take immediate actions and may be distributed over time due to a slow process of asbestos-containing products removal from the area of individual municipalities. However, considering the requirements set in the programme of asbestos-containing products removal on the national level the expansion of the landfilling base should be completed definitely before 2032.

The research was performed within the framework of the statutory work of the Mineral and Energy Economy Research Institute of the Polish Academy of Sciences.

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Zapotrzebowanie na składowiska odpadów zawierających azbest w Polsce

W roku 1998 rozpoczęto w Polsce szeroki i długotrwały proces usuwania azbestu z terytorium całego kraju, co równocześnie prowadzi do wytwarzania odpadów niebezpiecznych z grupy 17 – odpadów zawierających azbest. Usuwanie azbestu w Polsce z terenu poszczególnych gmin realizowane jest na podstawie Programu oczyszczania kraju z azbestu na lata 2009–2032. Podstawową metodą bezpiecznego unieszkodliwiania odpadów zawierających azbest jest ich składowanie na składowiskach specjalnie przeznaczonych do tego celu. Na terenie Polski istnieje szereg składowisk lub kwater przeznaczonych i przystosowanych do składowania odpadów zawierających azbest (33 obiekty). Istnieją też plany rozbudowy tych obiektów lub budowy nowych (11 przedsięwzięć). Podstawą do przeprowadzenia analizy są dane i informacje zgromadzone w Bazie Azbestowej Ministerstwa Przedsiębiorczości i Technologii (http://www.bazaazbestowa.gov.pl). Na chwilę obecną zinwentaryzowanych zostało ponad 5 milionów Mg wyrobów zawierających azbest na terytorium Polski z czego przeszło milion w samym województwie mazowieckim. Zinwentaryzowaną ilość wyrobów zawierających azbest w poszczególnych gminach uznano za ilość potencjalnego wytwarzania odpadów zawierających azbest w przyszłości. W skali całego kraju ilość materiału zinwentaryzowana jest zdecydowanie wyższa niż prognozowana na podstawie wskaźników wytwarzania (Klojzy-Karczmarczyk B. et al. 2016). Województwa o wysokim nagromadzeniu wyrobów zawierających azbest to głównie obszar centralnej Polski. Łącznie, na terytorium Polski zlokalizowane są 33 składowiska, gdzie można poddawać unieszkodliwianiu wyroby zawierające azbest. Planowanych jest kolejnych 11 przedsięwzięć jako rozbudowa istniejących lub budowa nowych obiektów. W skali całego kraju istnieje obecnie niedobór miejsca do składowania na poziomie 1 750 000 m³, w przypadku analizy wyników inwentaryzacji lub 500 000 m³, w przypadku analizy wytwarzania na podstawie wskaźników. Po przeprowadzonej planowanej rozbudowie bazy składowania niedobory ulegną zmniejszeniu do wartości 600 000 m³, w przypadku analizy wyników inwentaryzacji a nawet możliwa pojemność składowania przekroczy zapotrzebowanie o 600 000 m³, w przypadku analizy wytwarzania na podstawie wskaźników. Najlepszymi warunkami do składowania charakteryzuje się obecnie województwo świętokrzyskie a po rozbudowie bazy składowania, bardzo dobre możliwości przyjmowania odpadów zyska województwo kujawsko-pomorskie. Biorąc pod uwagę całość przeprowadzonej analizy stwierdza się konieczność rozbudowy istniejącej bazy do składowania odpadów zawierających azbest. Należy zaznaczyć, że rozbudowa ta nie wymaga podejmowania natychmiastowych działań i może być rozłożona w czasie ze względu na powolny proces usuwania wyrobów zawierających azbest z terenu poszczególnych gmin.

Słowa kluczowe: odpady, azbest, wskaźnik wytwarzania, składowiska, pojemność składowisk