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WASTE MANAGEMENT IN GDAŃSK[1]

Whenever the subject of waste management is touched upon, the area, to which management is applied, should be considered and studied. Thus, following the idea, some essential information about Gdańsk is presented below (according to the data obtained from the City Development Bureau):

Total number of inhabitants:	456,574
Total number of legal entities:	56,478
employing:	
at least 250 people	125
50–249 people	511
10–49 people	1,896
up to 9 people	53,946
Total number of public service units:	140
Total number of health and social care centres:	133
Total number of education institutions:	260

It should not been forgotten that the units mentioned above together with the inhabitants of the city are all "waste producers".

Waste management described and analysed by OBREM [2001] refers to both municipal and industrial waste. However, this article refers to the most important waste group, especially from the inhabitants' point of view, which is domestic waste – i.e. the waste produced by households.

[1]The general principles on waste management in the city of Gdańsk by Dr. Monika Piotrowska-Szypryt and M.Sc. Eng. Jadwiga Kopeć were defined in the report titled: *„Program gospodarki odpadami w gminie Gdańsk"* ("Waste management programme in the city of Gdańsk") prepared by *Ośrodek Badawczo-Rozwojowy Ekologii Miast* – OBREM (The Research and Development Centre of Urban Ecology) from Łódź [OBREM, 2001].

It is crucial to realise that unlike other waste groups, domestic waste is composed of a few different types of waste. Table 1 illustrates the percentage of these individual types in a domestic waste sample.

Table 1. The composition of domestic waste

Waste fractions	The amount of waste produced in 2000 [in thousands of tonnes]	Content [%]
Glass	24.24	12.12
Metals	7.44	3.72
Paper	40.72	20.36
Textiles	6.36	3.18
Plastics	26.28	13.14
Organic waste of vegetable origin	36.10	18.05
Organic waste of animal origin	5.38	2.69
Other organic waste	17.92	8.96
Other non-organic waste	9.48	4.74
0–10 mm fraction	26.08	13.04
Total	200.00	100.00

Source: Badania właściwości technologicznych..., 1999

Table 1. illustrates that secondary materials (such as: glass, metals, plastics and paper) account for almost 50% of wastes whereas organic waste accounts for an additional 30%. Thus, segregating secondary materials and organic waste from the remainder of the mixed waste could decrease the amount of disposed waste by c. 80%. What is more, these segregated secondary materials can then be reused in the production of new goods. Restricting the amount of organic waste disposed would considerably decrease the emission of flammable and explosive gases. Furthermore, the organic material collected could be turned into good quality compost during composting processes.

Currently, almost the entire amount of produced domestic waste is disposed at the landfill in Gdańsk – Szadółki. Therefore, on the basis of the amount of waste deposited, we can estimate the level of municipal waste and the average waste per inhabitant per year. The amount of waste that was accepted at the landfill in Gdańsk – Szadółki in 2000 is presented in Table 2.

Although, the results of waste segregation „at source" carried out in the city are rather poor, they cannot be omitted. Currently, waste segregation is carried out in two ways. One is the segregation „at source" – by

Table 2. Amount of municipal waste (in thousands of tonnes) accepted at the landfill in Gdańsk – Szadółki in 2000

Municipal (domestic and commercial waste)	220,000
From Gdańsk (domestic, municipal and commercial waste generated by institutions and legal entities)	200,000
From outside the city of Gdańsk,	20,000
Of which hazardous waste	1,850
Other waste, in particular	
Green waste (intended for composting)	3,600
Bulky waste (including debris)	58,700
Soil	12,200
Industrial – different kinds	17,300
Oil-derivative waste (intended for biodegradation)	50
Accepted for pyrolysis	230
Accepted for tombs	100
Total	312,000

Source: data obtained from the Utilisation Company – administrator of the landfill.

inhabitants at home. Furthermore, the waste segregated at home are disposed of in special containers distributed around the city. The second means is the collection of secondary materials at return stations both from inhabitants and from companies. The results of both these segregation systems are presented in Table 3.

Except for inventory analysis of the present state of waste management in Gdańsk, the report [OBREM, 2001] also includes a scenario for waste management till 2020. This prognosis also refers to both municipal and industrial waste. However, as mentioned at the beginning, this presentation refers only to the first group – domestic waste in particular. The changes in the level of domestic waste were estimated on the assumption that the amount of waste can rise annually by about 6%. The exit data for these calculations account for 390kg/inhabitant/year – the level observed in 2000 [Ocena..., 2000]. The data presented below describe the changes in the accumulation index (the amount of waste generated per inhabitant per year) and in the total amount of waste (generated by the entire city) up till 2020. The number of inhabitants was estimated by the City Development Bureau, which assumes that the population of Gdańsk will slowly decrease until 2010 and then stay at the same level of about 450,000 people. The estimated values of the

Table 3. The results of the segregation of waste of secondary use properties achieved in 2000 [tonnes]

Waste group	Waste collected due to waste segregation organised in the city	Waste collected by secondary materials return units
Paper	150	6,000
Glass	400	400
Plastics	170	22
Aluminium cans	0.1	10
Overdue medicines	2.51	
Mercury lamps	2.40	
Scrap metals		16,900
Accumulators		260
Bottles		0.8
Sum:	725.01	23,592.8
Total:	24,317.81 tonnes	

Source: data obtained from the City Infrastructure Department at the Municipality of Gdańsk and to data from obligatory annual reports prepared by the companies.

changes in the accumulation index and of the amount of waste are presented below:

Accumulation index by weight

- 2000 – 394 kg/inh./ar (including 3.24 kg of hazardous waste/inh./an),
- 2005 – 417 kg/inh./ar (including 3.43 kg of hazardous waste/inh./an),
- 2010 – 442 kg/inh./ar (including 3.63 kg of hazardous waste/inh./an),
- 2015 – 468 kg/inh./ar (including 3.84 kg of hazardous waste/inh./an),
- 2020 – 496 kg/inh./ar (including 4.07 kg of hazardous waste/inh./an).

The amount of waste[2]

- 2000 – 220 th. tonnes (including 1,850 tonnes of hazardous waste),
- 2005 – 215 th. tonnes (including 2,022 tonnes of hazardous waste),
- 2010 – 227 th. tonnes (including 2,156 tonnes of hazardous waste),
- 2015 – 255 th. tonnes (including 2,267 tonnes of hazardous waste),
- 2020 – 270 th. tonnes (including 2,400 tonnes of hazardous waste).

[2]Amounts of waste presented include 10% of the waste generated by different institutions (not by inhabitants) and 10% of the waste produced by surrounding communities and accepted at the landfill in Gdańsk – Szadółki.

Nevertheless, the prognosis for the future cannot only include scenarios of the level of waste generation. In the region, the possibility of prolonging the exploitation period of the landfill in Gdańsk – Szadółki, as long as possible, seems to be of a higher importance. The authors of the report [OBREM, 2001] proposed six possible variants, which could help to solve the problem of waste management in general and of the landfill in Gdańsk – Szadółki, in particular, such as:

1. **Variant I**: Utilisation Company in Gdańsk – Szadółki, minimum disposal range, maximum processing range, no incineration plant.

2. **Variant II**: Utilisation Company in Gdańsk – Szadółki, minimum disposal range, maximum processing range, incineration plant at the municipal landfill in Gdańsk – Szadółki.

3. **Variant III**: construction of utilisation company and landfill outside the city of Gdańsk, progressing remediation of the landfill in Gdańsk – Szadółki.

4. **Variant IV**: Utilisation Company in Gdańsk – Szadółki, landfill outside the city of Gdańsk.

5. **Variant V**: construction of incineration plant at the municipal landfill in Gdańsk – Szadółki, elimination of segregation system.

6. **Variant VI**: Utilisation Company in Gdańsk – Szadółki, minimum disposal range, maximum waste processing range, waste segregation system type „2 + 1 + SW"[3], no incineration plant.

The proposed variants are also presented in Table 4.

The authors determined the first proposed variant to be the best given the existing realities and conditions in the community. The variants assuming the construction of an incineration plant cannot be accepted because of high investment and exploitation costs (the waste generated in Poland is of a very low calorific value). Additionally, Polish society is not yet ready to accept incineration plants without any complaints and protests. The variants assuming the organisation of a landfill outside the city of Gdańsk cannot be accepted either, as they could increase the costs of waste removal – to be paid for by inhabitants (higher transportation costs).

Therefore, apart form the first variant only the sixth one can be accepted, although it contains a different segregation system compared to the system already applied in the city.

[3] 2 stands for: one container for packaging waste collection (dry fraction) and one – for organic waste collection (wet fraction); 1 stands for: container for mixed waste collection; SW stands for: group of containers for waste collection of secondary material properties, to be placed at so called collection centres.

Table 4. Possible variants to solve the problem of waste management in Gdańsk

Variant	Location of landfill	Range of disposal	Incineration plant	Processing range	Waste segregation	Investment costs [mln zł]	Exploitation costs [mln zł]
I	Gdańsk – Szadółki	min.	—	Maximum	system of nests(a)	54.0	8.9
II	Gdańsk – Szadółki	min.	yes	max. + incineration	system of nests	283.0	21.5
III	outside Gdańsk	min.	—	maximum	system of nests	94.1	11.7
IV	outside Gdańsk	min.	—	maximum	system of nests	89.0	11.6
V	Gdańsk – Szadółki	no disposal	yes	incineration plant	—	392.5	25.8
VI	Gdańsk – Szadółki	min.	—	maximum	„2 + 1+ SW" system	58.1	10.3

(a) System of nests stands for: a group of containers intended for separate collection of different waste streams, such as paper, glass, plastics (as applied recently).

To summarise, it should be mentioned that the waste management programme elaborated by OBREM constituted the basis for the preparation of the City Board Resolution No 74/1084/01 of 12th of December 2001 on the project of the waste management plan for the period 2001–2006. After that Resolution had been approved by the Board, it was passed for approval to the Pomeranian Provincial Board, according to the Act of 27th of April 2001 on Waste [Dziennik Ustaw no. 62, pos. 628]. Consequently, this project of the waste management plan was approved by the Resolution of the Pomeranian Provincial Board No 29/02 of 25th of January 2002. Following the implementation of regulations – the Act of 27th of April 2001 – "Environmental Protection Law" [Dziennik Ustaw, No. 62, Item 627], the City Council Resolution No XLVII/1416/2002 of 26th of March 2002 on the waste management plan for the period 2002–2006 was passed. Besides other aspects of waste management, the plan accepts the first variant prolonging the exploitation period of the landfill in Gdańsk – Szadółki, as proposed by OBREM.

Recently, the resolution has formed the basis for the process of the development and implementation of waste management in the community and also the basis for application for financial support to either national or external funds. It is assumed that without additional finance from outside the city budget resources, e.g. support from The World Bank, National Fund for Environmental Protection and Water Management or any EU Funds (ISPA or Cohesion Fund), this idea is considered to be unattainable until 2010. The implementation costs were calculated as being 70,000,000 PLN. Additional support could shorten the implementation period, however, that period cannot last less than 4 years.

Literature

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