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## A COMPARISON OF THE LANDFILLS IN SZADÓŁKI AND ŁĘŻYCE – A CASE STUDY OF TWO COMPETING LANDFILLS

### 1. General information about the landfills

Tricity (Gdańsk, Sopot, Gdynia) is the biggest agglomeration in the north of Poland with more than one million inhabitants. Among others, there are an oil refinery, three shipyards and car component factories. Such a big agglomeration exploits two landfills. One of them is Łężyce, located in the northern part of the area, and the second one is Szadółki, located in the south.

The Szadółki landfill is located 8 km outside the City of Gdańsk. Its area is equal to about 57 ha and it is bigger than the Łężyce landfill, as it receives waste from a large area of the City of Gdańsk and surrounding communities: Żukowo, Kolbudy and Pruszcz. Its total capacity is 12,000,000 m<sup>3</sup>.

The Łężyce landfill is half as big as Szadółki. It receives waste from a less populated area of Sopot, Gdynia, Rumia, Reda, Wejherowo and the surrounding communes: Luzino, Kosakowo, Szemudy. The capacity of this landfill is 5,500,000 m<sup>3</sup> and this size is quite large, keeping in mind the fact that it is located inside the Tricity Landscape Park and above a groundwater reservoir. However, according to an environmental impact assessment, it does no harm to the surrounding areas.

256,000 Mg of solid waste is delivered annually to Szadółki. Łężyce takes 180,000 Mg of refuse each year. Szadółki will be exploited until 2020. Łężyce will be closed this year (2002).

## 2. Structure of the landfills

The area is not the only element that differs in these two landfills. They also differ in structure. While the smaller landfill consists only of a deposit area, composting facility, junkyard and a weighing bridge, the bigger one has also dumping grounds, steel containers for selected waste (electronic elements, fridges, medicines, batteries etc.), a system for the extraction of landfill gas and an electricity generating plant fuelled by this gas. There is also a drained liquids treatment plant being built, which will be in use in June 2002.

Numerous vehicles work simultaneously on both landfills including excavators, dozers, compactors, graders, squeezers, scraper loaders, vibrating rolls and other trucks.

There are several types of waste separately collected and recycled at both landfills. Among them are: "green" waste, rubble, scrap paper, plastics, glass, paper, aluminium, and tyres. The table 1 shows which kinds of waste are collected separately at both landfills.

**'Green' waste.** Composting is a process in which mesophilic and thermophilic microorganisms and bacteria take part. In this process, an intensive cycle of biochemical changes results in the partial mineralization and humification of organic compounds.

Leaves and cut grass from the area of the Tricity are collected and used on both landfills to produce compost for the recultivation of the area. A special machine for the grinding of branches is used and then everything goes to the composting facility. As it is difficult to produce compost of high quality (without the presence of heavy metals and bacteria), the compost produced by the landfills is only used by them. In the future, if it appears that the compost is of good quality, it might be sold to other users.

**Rubble.** Donating and/or buying used and reusable-building materials is an important way of keeping valuable resources out of landfills. Patronage of such businesses and services conserves resources and sustains trades and skills. However, in Poland this is not always practised. That is why there are special containers for rubble at both landfills. Rubble (bricks, stones, concrete) has the same use at both sites, that is for improving internal roads for trucks and other vehicles working in the area.

**Scrap metal.** It takes 74% less energy to make new steel from recycled steel. However, scrap metal is not segregated from the stream of waste before depositing on the landfill. At the Łężyce landfill, there is

Table 1. Waste collected at the landfills in Szadólki and Łężyce

Szadólki Landfill	Łężyce Landfill
<p><b>Rubble</b> is used for the purposes of the landfill, such as building roads on the landfill area.</p> <p><b>Leaves, branches and grass</b> are composted.</p> <p><b>Scrap metal</b> is partially collected by local people and sold to the „Złomowiec” cooperative.</p> <p>There is no segregation at the landfill and waste like paper or glass is not bought by Zakład Utylizacyjny (the owner of the Szadólki landfill).</p>	<p><b>Rubble</b> is used for improving truck roads on the landfill.</p> <p><b>Leaves, branches and grass</b> are composted.</p> <p><b>Scrap metal.</b> There is a junkyard within the area of the landfill. Local people collect metal dumped with other garbage. Unfortunately, there is no segregating system before dumping.</p> <p>In some of the districts selective collection has been introduced. <b>PET, HDPE and PE</b> are segregated and delivered to the companies Elana PET in Toruń and Triumwirat in Koszalin respectively.</p> <p><b>Glass</b> is delivered to Olsztyn and a glass works in Jarosław. <b>Paper</b> is taken away by the „Złomowiec” cooperation and the regional recycling company (Okręgowe Przedsiębiorstwo Surowców Wtórnych).</p>
Hazardous waste	
<p>Hazardous wastes like <b>batteries, paints, varnishes, oils, fluorescent lamps, and out of date medicines</b> are collected. Paints, varnishes, medicines and other organic waste undergo pyrolysis; oils are biodegraded.</p>	<p><b>Hazardous wastes</b> are collected every three months. Local press and media give information about the place of collection and several trucks take the waste to a company responsible for disposal of such waste. <b>Batteries, paints, varnishes, oils, mercury, and fluorescent lamps</b> are welcome. <b>Out of date medicines</b> are collected in drugstores. In several schools containers for batteries are placed.</p>
Power station plant fuelled by gas	
<p>The gas extraction system in the municipal landfill in Gdańsk is the first electricity generating plant fuelled by landfill gas existing in the province. The system consists of 39 perforated wells, a 5200m long gas grid, control stations, dewatering wells and a current generator. From the system in Szadólki it is possible to obtain about 120 Nm<sup>3</sup> of biogas annually, which gives about 2,3mln kWh of electricity.</p>	<p>There is no such system at this landfill.</p>

a junkyard within the area of the landfill. "Scavengers" collect metal deposited with other garbage. They work there illegally and their presence is a real problem to the board of the landfill, but it is almost impossible to stop them collecting scrap metal. They are usually homeless and collecting waste at the landfill is their only source of income. The situation is similar at the Szadółki landfill. Scrap metal is partially segregated by scavengers and sold to the „Złomowiec” cooperative. Despite the fact that these 'inconvenient collectors' are quite a problem for the board of the landfill, they help not to waste scrap metal. In this aspect, their work is advantageous. At the same time, their work only proves that waste segregation is necessary and profitable.

**Plastics.** Plastic comprises a continually growing proportion of the packaging and products we use in our daily life. If you lined up all the polystyrene cups made in just one day, they would more than circle the entire planet. Plastics in our oceans kill around 1 million seabirds and over 100,000 marine mammals each year. The plastic from 5 soda bottles can completely insulate a ski jacket. This, the need for the recycling of plastic seems to be obvious.

Plastics are collected at the Łężyce landfill and delivered to the companies Elana PET in Toruń and Triumwirat in Koszalin. The following kinds of plastics are collected: PET, HDPE and PE.

In the case of the Szadółki landfill, there is no segregation at the landfill and selected wastes like paper or glass are not bought by Zakład Utylizacyjny (the owner of Szadółki landfill).

**Glass.** When glass is recycled, water consumption is reduced by 50%, mining waste by 79%, and air pollution by 14%. Glass can be recycled indefinitely. Glass is collected and stored at the Łężyce landfill. It is delivered to Olsztyn and a glass works in Jarosław.

**Paper.** If all the morning newspapers read around the USA were recycled, over 41,000 trees would be saved daily. Americans throw away enough wood and paper every year to heat 5 million homes for 200 years. Paper is collected by the Łężyce landfill and taken away by the „Złomowiec” cooperation and the regional recycling company (Okręgowe Przedsiębiorstwo Surowców Wtórnych).

**Aluminium.** It takes 90% less energy to recycle an aluminium can than to make a new one. On average, an aluminium can contains by content more than 50% percent post-consumption recycled material. Aluminium is collected by Zakład Utylizacyjny (the landfill owner), but it is

not segregated from the stream of waste. Scavengers collect and sell aluminium cans and the rest remains at the landfill.

**Tyres.** Half a barrel of crude oil is used to produce one tire. There is a problem of what to do with old tyres. A very interesting application of used tyres was implemented at the Szadółki landfill, where a low fence was made of tires along the inside roads.

**Hazardous waste.** Waste paints, pesticides, household cleaners, automotive fluids and products, household and rechargeable batteries, fluorescent lamps and other common items we have or use in our homes or at work can be harmful and hazardous. Many of these products contain chemicals that are poisonous, toxic, corrosive or flammable. These products may contaminate the environment when deposited on soil, down a household or municipal drain, or dumped in the garbage. It is harmful to our environment and, in most cases, illegal to put such materials into the trash or down the drain.

**Oil utilization.** One quart of improperly disposed oil can pollute over 250,000 gallons of drinking water. Oil poured into the ground can seep into the ground-water table and contaminate drinking water supplies.

At the Szadółki landfill, there is a special system of oil waste utilization – biodegradation. Such waste is piled up in special compost heaps together with the appropriate amount of wet sawdust, straw or tree bark. Bacteria are introduced to such heaps, which helps in the process of biodegradation. Taking into account the risk of pollution, it is very wise to utilize oil and oil-contaminated waste in spite of the dangers placing them at the deposit area.

**Dumping grounds.** At the Szadółki landfill hazardous wastes, which cannot be utilized or deposited on the landfill, are stored in dumping grounds (open top ground containers where bottom and sides are covered with impermeable silicon composites).

**Pyrolysis.** Pyrolysis is the process of thermal destruction of organic materials at temperatures from 150–450°C. Products of thermal decomposition and flue gases are oxidized to nontoxic carbon dioxide and water. Household chemicals, paints, varnishes, medicines and other organic waste can undergo pyrolysis. The Szadółki landfill disposes of hazardous organic wastes using pyrolytic degradation.

In the area serviced by the Łężyce landfill, wastes causing health hazards are collected every three months. Batteries, paints, varnishes, oils are welcome. Local press and media give information about the place of

collection and several trucks take the waste to a company responsible for the disposal of such waste. Out of date medicines are collected in drug-stores and utilized.

**'White goods'.** Large household appliances are often called "white goods" and include stoves, refrigerators, freezers, washing machines, dryers, and water heaters. Refrigerators, freezers, air conditioners and water coolers contain refrigerants, such as ozone-depleting Freon, which must be isolated. In addition, these and other appliances contain compressor and transmission oils and components that may contain mercury and PCBs. On both landfills, there are special places for such equipment.

**Batteries.** Motor vehicle batteries contain about 18 pounds of lead and about one gallon of corrosive lead-contaminated sulphuric acid. Batteries of all types contain harmful and caustic materials. Nickel-Cadmium (Ni-Cad) rechargeable batteries cannot be thrown into the trash and must be collected separately. On both landfills, there are places where people can bring auto batteries and household batteries.

### **3. The power station plant fuelled by gas on the Szadółki landfill**

Landfill gas (biogas) is a product of the anaerobic decomposition of organic matter, which is the main component of municipal waste. The main component of the biogas is methane. Its content usually oscillates between 40 and 60%. Having such a composition, the biogas can be used for energy generation. As methane is one of the gases responsible for the greenhouse effect, it is important to capture it before it enters the atmosphere. That was one of the aims of the installation of a gas extracting system. The gas extraction system in the municipal landfill in Gdańsk is the first electricity generating plant fuelled by landfill gas to exist in the province.

The system consists of 39 perforated wells, a 5200 m long gas grid, control stations, dewatering wells and a current generator. From the system in Szadółki it is possible to obtain about 120 Nm<sup>3</sup> of biogas annually, which gives about 2,3 mln kWh of electricity. There is no such system in Łężyce.

### **4. Conclusions**

As one may notice, there are many environmental initiatives being introduced by the landfills of Tricity. What is Certain is that prices for the

depositing of waste at the landfill are getting higher and higher. That is one reason why people are starting to segregate waste at source. However, a lot of time is needed to introduce the western model of segregation in Poland and until then, landfills like Szadółki or Łężyce can set a good example of sustainable waste management.

## Literature

[www.zut.com.pl](http://www.zut.com.pl)

[www.stopwaste.org](http://www.stopwaste.org)

<http://www.kzgdricz.polbox.pl>

Data from Zakład Utylizacyjny Sp. z o.o. w Gdańsku

Data from Łężyce landfill