CONFERENCE PROCEEDINGS
HUNGARIAN JOURNAL
OF INDUSTRIAL CHEMISTRY
VESZPRÉM
Vol. 2. pp. 65 - 70 (2000)

NEW WASTE MANAGEMENT SYSTEM IN ZIRC AREA

A. VONYÓ, L. TAMASKA and Á. RÉDEY

(Department of Environmental Engineering and Chemical Technology, University of Veszprém)

This paper was presented at the Second International Conference on Environmental Engineering, University of Veszprém, Veszprém, Hungary, May 29 – June 5, 1999

The amount of generated solid wastes increases from year to year in the whole world. One of the causes of this fact is the increasing population, but the change of the standard of living plays an extremely important role, too. The enterprise dealing with municipal solid waste (they are also responsible for the waste collection in some of the surrounding villages) is collecting about 95-105 m^3 of compacted waste every week from the area of the town. As far as waste management is concerned, Zirc - as smaller Hungarian settlements - can be characterised with disposal in a landfill site. However, the necessity of a new waste management system is connected with the drinking water supply of the town. The different possible waste disposal methods were evaluated mostly from environmental and social acceptance viewpoints, a brief waste reduction plan was recommended. The digitised map of the surrounding area was created, as far as land usage, contour lines, surface waters, topsoil types, geological formations, artificial facilities are concerned. With the help of the electronic processing of these data, two possibly suitable areas were found for a new municipal waste landfill site.

Keywords: waste; management; environment

Introduction

The contribution of packaging materials and goods having short life cycle to the increasing amount of solid waste is very significant.

During the last two decades, the amount of annually produced municipal solid wastes (MSW) in Hungary has doubled from roughly 10 million m^3 to about 20 million m^3. Its composition has also changed to a great extent. In case of industrial waste generation a continuous growth could be observed that ended with the political and consequently, economical changes in the late 1980's and early 1990's [1-6].

While in the large majority of Western European countries significant achievements can be observed as far as prevention of waste generation, reuse, and recycling of solid wastes are concerned, the case in Hungary is quite different. The country's waste management policy and practice is characterised mostly by different disposal methods, i.e. disposal in landfills and incineration. However, most of our existing and operating landfill sites are not meeting the national standards and in the large majority of our settlements there are no financial possibilities to build a new landfill and remedy the outmoded old one.

Almost every Hungarian settlement has its own problem connected with solid wastes. These problems are ranging from the relatively harmless uncontrolled disposal of MSW and littering to very serious cases causing extremely bad consequences like large areas polluted with chlorinated hydrocarbons.

In the first part of the complete version of this report the general state of municipal and industrial waste management in Hungary is discussed. Then the problem of Zirc is specified, the data collection techniques and progress and the calculations are described. Finally, conclusions are drawn in the form of presenting suggestion. In the shortened version only the detailed Zirc case is discussed, followed by the conclusions and suggestions and where necessary, some calculated data are mentioned [7,11,12].

The Zirc Case

General Description of the Town

Zirc is a small town in the mountains of Bakony that can be found in Transdanubia, north from the Lake Balaton and about 20 km from the capital of Veszprém county, Veszprém. The citizens of the town often refers to their settlement as the capital of mountains Bakony.

Zirc has a population of about 8500 citizens. Though the town is in the so called northwest-southeast industrial centreline established mainly at the beginning

of the 1950s, it has no remarkable industrial activity. There are only three small industrial plants. One of them is the sawmill belonging to the Forestry of Zirc, the second one is a newly established company dealing with treatment of painting tools contaminated with paint residues. The third company deals with the construction of agricultural machinery. The main activities connected to the area are agriculture and forestry. The tourism is not significant and it has a transit character, nevertheless the representatives of the local government would like to develop this financial source in the future.

The only green movement in the town is a small group of civilian activists forming the "Sziget" (Island) organisation. The organisation has 18 members and was formed at the end of 1995. Their main goal is to prohibit the operation of the paint-waste incineration plant mentioned above. As they are arguing, the wastes treated by the plant are qualified as hazardous wastes and during the location of the plant the laws having reference to construction of hazardous waste treating facilities were not taken into consideration. To achieve their main goal they have gathered about 2500 autographs from the population of the town among the citizens having the right to vote. Nevertheless, the plant's test operation has taken place already and emission measurements proved that the plant met the current emission standards described by the law [29].

Waste Management in Zirc

The Cause of Demand for a New Waste Management System

As far as waste management is concerned, Zirc - as most of the smaller Hungarian settlements - can be characterised with disposal in a landfill site. However, the necessity of a new waste management system is connected with the drinking water supply of the town.

The drinking water supply of Zirc was based on consuming the water content of a nearby aquifer. However, a new housing estate without sewage system was built above the aquifer used as the main water source. The houses were provided with cesspools which (with proper insulation and operation) could prevent the pollution of the aquifer. Nevertheless, part of the citizens in a rather inadmissible way have followed the very characteristic Hungarian practice, namely they have ruined or have not installed the insulation system of the cesspools in order to let the liquid fraction of their domestic liquid wastes infiltrate to the soil. In this way they could reduce the fee to be paid for transport and disposal of these wastes. The pollution derived from the cesspools has reached the aquifer already, causing a nitrate concentration in the water supply higher than the allowable threshold limit in the Hungarian national standards [13-17].

After that the pollution has become obvious the local firm providing the drinking water supply service decided to use the karstic water to mix with the water deriving from the aquifer, thus diluting its nitrate content below the threshold limit. However, the old landfill site of the town was located in an abandoned sand pit in the border of the town. This landfill site does not have any insulation system, fencing, leachate or landfill gas control, etc. A small intermittent water flow connects the landfill site with the rivulet Cuha flowing near the town. In this way the leachate can get to the rivulet. According to some estimations about one-third part of the water flowing in the watercourse of Cuha gets to the karstic system under the town. So, it is very possible that sooner or later the pollution will appear in the karstic water used to provide healthy drinking water for the city. Because of these facts, there is no possibility of disposing any wastes in the old landfill site of Zirc from May 1, 1996. From that time the large majority of municipal solid wastes is disposed in a nearby village's landfill site at Dudar.

The Amount, Composition, and Collection of Waste in Zirc

The two most important non-domestic waste generation facilities of the town Zirc are the waste water treatment plant operated by the local government and the sawmill belonging to the Forestry of Zirc.

The largest proportion of the technological wastes produced in the sawmill is sawdust. A significant part of it is burned in-site and the produced heat is used up in the dryers of the mill. The remains are sold to different companies (brick works, caloric centres, etc.). Besides the sawdust, the metal wastes are sold to the scrap yard. Moreover, a large container (5 m^3 volume) is filled with municipal-like wastes in every two weeks that is hauled by the firm responsible for the collection and transportation of municipal solid wastes in the town.

The waste water treatment plant produces roughly 500 kg sludge every day. This sludge is delivered to the local farmers' co-operative and after chemical analysis proved its suitability, it is used as a fertiliser.

Besides these, the "Általános Fogyasztási és Értékesítési Szövetkezet" i.e. ÁFÉSZ (General Co-operative Society) produces a large amount of paper and cardboard wastes that is gathered selectively and carried to the landfill. The rest of waste generated in the town is municipal solid waste.

The enterprise dealing with municipal solid waste (they are also responsible for the waste collection in some of the surrounding villages) is collecting about 95-105 m^3 of compacted waste every week from the area of the town. They are using a collection-transporting vehicle having 7 m^3 volume and a compaction ratio of about 4.5. This vehicle is collecting the municipal solid waste generated in households and the publicly owned areas of the town and is capable of loading from standardised 110 l volume containers. Besides this, there are 17 large (5 m^3) containers for construction and demolition wastes, and every winter the local government is providing 30 containers (also 5 m^3) for the collection of slag and ash generated during the heating period (15th Nov. - 15th Apr.). However, due to

the installation of natural gas pipeline system into the town, the amount of these materials will decrease drastically in the future and their generation should not be taken into consideration from the next year. The fee for collecting and transporting of solid waste is 300 HUF/month/household, regardless the amount of waste generated during one month in the household in question [25,7,8,10].

The overall amount of waste disposed in landfill is 23 500 m^3/year (uncompacted) The seasonal variation in the amount of municipal solid waste is not significant, mostly because of the transit character of the tourism. Nevertheless, if the projects aiming to develop the tourism in the region will start, the increase of waste generation rate during the summer season is very likely.

The determination of the composition of municipal solid waste transported to the landfill site of Dudar has been fulfilled personally. The measured data, however, are valid only in the vegetational period (June-August). The composition of the solid waste produced during the winter is unknown. It is likely, however, that the amount of compostable constituents are much lower than in summertime. Taking into consideration other facts and data, the composition of Zirc's waste (by weight) was estimated as follows: paper and cardboard = 3 %; inorganic matter (without metals) = 20 %; plastics = 8 %; metals = 4 %; textile and rubber = 2.5 %; compostable organics = 62.5 %.

Present Waste Disposal Practice in Zirc

Waste disposal methods other than the disposal in landfill sites (i.e. composting, controlled incineration, reuse and recycling) are not typical in the region. The high amount of compostable organic materials reveals that composting is not a widespread practice. The open burning of combustible waste components can not be regarded as an environmentally friendly method. The only recycling facility in the town is a scrap yard that is accepting only metal wastes. The annual amount of metal wastes delivered over there is about 500 T, 30 % of it is delivered by individuals, the rest is transported by different companies. The wastes are cut up, sorted, and then transported to the Danube Ironworks for reprocessing.

After the closure of the Zirc's own landfill, the municipal solid wastes of the town is transported to a nearby village (Dudar) for landfilling. That landfill site is one of the few acceptable examples in the country, however, some imperfections have been found during the visit [24].

Conclusions and Suggestions

In order to create a complete waste management strategy, all of the techniques evaluated fully in the complete version of this report have to be examined from environmental, economic, and social viewpoints.

New Landfill Site

Establishing of a new landfill site is included in the long-range plans of the local government. The map of preferred areas (see at the end of this document) that was created electronically, is a good help for them to select an appropriate area for a new landfill site in the proximity of the town.

The red spots in the southern edge of that map are too far from Zirc, the distance on road between the town and the area is only slightly shorter than that of between Zirc and the landfill site of Dudar. The same is true for the smaller areas signed with red in the eastern edge of the examined quadrangle. The red specks very close to Zirc are too small for constructing a landfill site, though the combination of green and red areas (positioned at about 1.5 km northwest from Zirc) is worth being investigated because of its medium-poor water conductivity, size and closeness.

The most promising site, however, can be found on the mid-western margin of the "Preferred areas" map. This area is near the Pálinkaházpuszta Farmer's Co-operative, and its preferability is supported by the following facts:

- its characterising geological formation is Tés clay marl formation;
- the water conductivity of geological formations of the adjacent areas is middling;
- roughly half of it is under cultivation, the other half is grassland;
- the size of it is about 0.126 km^2, and the combined area of poor and medium water conductivity is 0.306 km^2;
- the gradient of the area is about 6%; and
- the distance on road from Zirc is about 3 km.

However, there are large areas southeast from Zirc within twenty kilometres (out of the borders of the digitised area), where the characteristic geological formation is the so called Gyulafirátót formation. The main constituents of this formation are clay, bentonite, gravel, and some calcareous clay, lignite, lime silt and tuff. If further studies and measurements prove the suitability of these areas, it would be worth taking into the consideration the construction of a regional municipal solid waste landfill site there - possibly together with the government of Veszprém, since this large city's landfill was located above very sensitive karstic systems and limestone formations [26-28].

Incineration

The building of a waste incinerator is not advisable. Though the volume and weight reduction of that method is very good (94 and 81 %, respectively) and according the enthalpy balance calculations, Zirc's waste could be incinerated without auxiliary fuel, it has several disadvantages, namely:

- High investment cost. This investment cost will be even higher if the generated amount of waste increases due to the growth of tourism in the

area. This is, because the amount of waste to be burned is quite close to the 1000 kg/hour limit (the present amount to be burned is about 800 kg/h), above which the continuous monitoring of flue gas constituents is ordered by law.
- The presumption of the necessity of the implementation of an exhaust gas scrubber system is very high and this also increases the investment costs of the incinerator (the sulphur-dioxide content of the exhaust gases under almost every but extreme operational conditions exceeds the allowable threshold limit of 200 mg/Nm^3).
- The solid residues of incineration have to be regarded as II class hazardous wastes and their disposal is possible only in landfill site belonging to the third building category, their usage as a covered material is allowed only in landfills provided with artificial insulation system.
- The acceptance of deployment of an incinerator by the citizens is uncertain. The public opposition against such facilities can be observed world-wide.
- With incineration, the valuable secondary raw materials (recyclables and compostables) in the waste perish forever. Though the energy content of the waste can be recovered in the form of heat, this fact is not a good argument for the sake of building an incinerator if one considers the implementation of the relatively cheap and environmentally friendly natural gas to the town proceeding in our days [18-22].

Composting in a Central Facility

Composting is a very effective way to reduce the overall volume and weight of waste to be disposed in landfills (the estimated annual percentage of compostables in Zirc's waste is about 60 % by weight). It has several advantages.
- A valuable product is produced that can be used to improve topsoil structure and prevent soil destruction by erosion, for land reclamation, and for daily cover in landfill sites;
- Removing the compostable materials from the municipal solid waste decreases the generated amount of landfill gas and leachate, the possibility of mobilisation of heavy metal ions in the landfilled waste will also decrease.
- The composting process is natural and very simple, special equipment is not needed unless in-vessel technique is applied.

Among the disadvantages, the high land requirement (800 - 3150 m^2 depending on the applied technique) and the possible odour generation can be mentioned. Also, there is a chance of ground water pollution, if the infiltration of the produced leachate is not prevented with some kind of insulation system.

The two potential organisations that may be interested in composting in the town are the forestry and the local farmers' co-operative. The local government should make contact with them in order to determine their willingness to start an experimental project. For the selective collection of compostable materials from households, the 5 m^3 containers could be used that were applied to collect the slag and ash generated in the heating period. The containers could be positioned in the same points where they used to be, and the citizens should transport their compostables to them. In this case, a hauled container system could be used.

On the other hand, since almost every households have two 110 l containers, one of them also could be used to collect the organic materials selectively. In this case, containers of organic matter have to be distinguished clearly for example with a colour code, and one of the collector-compactor vehicles should be appointed exclusively to fulfil the collection of compostable materials. Since its amount varies during the year, and the biological reactions taking place in the organic materials are much quicker in summer than in wintertime, a varying collection frequency should be applied. Also, because of taking away one collection-compaction vehicle from the fleet, the whole collection route system should be redesigned, even in the nearby villages. Thus, the favourable reception of the fixed container system is questionable [25].

Source Reduction

Source reduction would be the most favourable way to resolve most of the town's problems connected to waste management. This technique requires a combination of composting, recycling, a new waste fee system with arousing public interest towards the waste related problems, and very broad social co-operation. Source reduction has multitude advantages:
- Backyard composting has the same advantages as were enumerated in the previous chapter.
- This option has the lowest investment costs.
- Due to the reduced amount of landfilled waste, the life-span of a landfill site can be expanded, the necessity of constructing a new one may arise later.
- Citizens may become more environmentally conscious behaving more environmentally friendly every day.
- Due to the labour-intensiveness of the activities, new jobs can be created.

However, the timing of the different steps to be accomplished is crucial, otherwise the program can come to a halt, fail or even can worsen the situation [12-13].

Meeting of Interested Parties

The very first step is to summon a meeting of the representatives of parties interested in the issue, namely the local government, the potential receivers of the recyclable materials (forestry, farmers' co-operative,

scrap yard, the by-product and waste trading company of Veszprém, companies dealing with hazardous waste treatment from Dorog and Budapest, etc.) and the representatives of citizens. It is extremely important to invite the members of Island organisation since they have a very strong influence and public opinion forming ability - as it has been proved in the past already. The whole problem should be discussed and the receiving willingness and capacity of the potential recyclable material processing companies have to be determined. The acceptability of the different waste treatment options (incineration, composting at central facilities, inspiring of backyard composting amongst the citizens, locating containers for recyclable materials at frequently visited facilities i.e. at shopping centres for glass and plastics, at kiosks for newsprints, in schools for dry cells and small batteries, etc.) and a combination of these possibilities should be got across to every parties [13-15].

New Waste Fee System

The implementation of a new waste fee system also has to be discussed in this meeting, mainly with the owner of the company responsible for the collection and transport of solid waste. The reason of this is that if the project aiming to reduce the amount of wastes to be disposed in landfills has a great success, the profit of this firm will decrease - unless the owner is willing to take part in the collection and transport of recyclable materials. Instead of the present flat rate, a per container fee system should be suggested. In order to implement this system, the record of the number of monthly emptied containers per every single households is inevitable. This can be fulfilled with simple forms containing the date, the addresses of household served on that day and the number of containers emptied in reality. The forms can be printed in advance, and only the number of containers should be written by hand. At the end of each months, the waste fee has to be calculated individually for every household. The amount of per container waste fee is crucial. If it is too low, there is no economic incentive that forces the citizens to exploit the waste reducing possibilities. If it is too high, the illegal waste disposal affairs will be more frequent and the cost of eliminating the results of uncontrolled littering will be quite high. Perhaps a fee between 200 and 300 HUF/container is reasonable and can help the program to a success [9].

Informing the Population

Before starting the program, informing the citizens is very important. A short leaflet is the best way that contains the problems of the town connected to its solid waste, the harmful effects (dioxin, solid particles, halogen emissions) of uncontrolled burning of waste components, the possibilities of the decision-makers, the planned arrangements to be made, and the possible actions that each citizen can do to reduce the amount of waste produced in his or her household (description of composting, using the recycling opportunities, location of recyclable collection containers, buying products that have recyclable packaging, etc.), consequently, the amount of money he or she has to pay for waste disposal. It is very important that all the participants of the first meeting should sign the document, preferably with a few lines in which they are stressing the advantages and importance of the agreement and the action plan. A simple questionnaire also should be attached to the leaflet, inquiring information about the citizens' opinion. The result of the survey - with the possible modifications of the preliminary program plan concerning the public opinion - should also be published together with the agreement of all the interested parties. An informational phone line - preferably free of charge - should also be provided for answering the questions in connection with the program [12-15].

Starting and Maintenance of the Source Reduction Program

The best time to start a program is in the spring, when the percentage of compostable materials in municipal solid waste starts to grow due to the beginning of vegetational period. It is very important that at first the waste reducing facilities (containers for recyclables, information leaflet about composting, 5 m^3 containers for compostable materials, small containers for dry cells and batteries, etc. depending on the accepted action plan) have to be located in publicly accessible areas. A brief article about the action plan and the positive effects expected can be placed into a local or regional newspaper at the same time. It has to be emphasised that only those special containers may be placed into public areas, whose content really will be reused and recycled (in case of recyclables) or treated properly (for example in case of household hazardous wastes). If the selectively collected waste components are transported to the landfill site, people may lose their trust toward the program.

A few weeks after that, the implementation of the new waste fee system can be started. If the time interval between the two action is too short, the citizens can not discover and get used to the new waste reducing possibilities, consequently, their waste fee will grow, so there is a very high possibility that uncontrolled disposal and littering can spread in the area of the town. If the time is too long, however, those who follow the program and act properly, will pay the same amount of money for waste disposal that the other part of the population whose response time is longer. This can cause disappointment amongst the citizens with stronger willingness to follow the program and can defeat the success of the action plan. If the timing is good, the economic advances connected to waste reducing activities become obvious and there will be a greater chance for the success of the program to proceed.

Starting the program is not enough. The method of its maintenance has an equal importance. The necessary modifications of the program - regardless whether they were decided by the policy-makers or were born with the help of the citizens' suggestions - have to be implemented. The success and problems of the program have to be published regularly, for example decline of actually landfilled amount of waste in the past few months, impairment of the special containers, realisable ideas of public origin (preferably with mentioning their author), impurities in the selectively collected materials, etc. [12.29].

Results

Within the confines of the complete version of this report, the following results were obtained: the amount, composition, physical and chemical properties of Zirc's municipal solid waste were estimated, the present waste disposal practices were identified. The different possible waste disposal methods were evaluated mostly from environmental and social acceptance viewpoints, a brief waste reduction plan was recommended. The digitised map of the surrounding area was created, as far as land usage, contour lines, surface waters, topsoil types, geological formations, artificial facilities are concerned. With the help of the electronic processing of these data, two possibly suitable areas were found for a new municipal waste landfill site. A database was created containing the data of Hungarian companies dealing with waste recycling, treatment and disposal, this database was made available on the internet.

REFERENCES

1. BARÓTFI I.: Environmental Technical Handbook, Környezet-Technika Szolgáltató Kft., Budapest, 1991 (in Hungarian)
2. ÁRVAI J.: Waste Management Handbook, Műszaki Könyvkiadó, Budapest, 1993 (in Hungarian)
3. Indexes of the State of Hungary's Environment, Ministry of Environment and Regional Policy, Budapest, 1994
4. SÁNTHA A.: Environmental Management, Nemzeti Tankönyvkiadó, Budapest, 1993 (in Hungarian)
5. State of Hazardous Wastes in Hungary, Ministry of Environment and Regional Policy, Budapest, 1994
6. GULYÁS F., SZILI KOVÁCS T. and ANTON A.: Agrochemical and Biological Evaluation of Compost Gained by Processing Garden Wastes from the Public Areas in the Capital, 2nd Environmental Protection Conference, Veszprém, 30 May - 1 June 1995
7. Hungary's National Report to United Nations Conference on Environment and Development, Budapest, 1997
8. State of the Environment in Hungary, Ministry of Environment and Regional Policy, Budapest, January 1997
9. Waste Fee in Budapest, Heti Világgazdaság, 4 November 1995 (in Hungarian)
10. VONYÓ A.: Waste collection and Disposal in Hungary, Warmer Bulletin 49, May 1996
11. VONYÓ A. and MAGOSÁNYI Zs.: Hungarian Waste Management Related Laws, under publication, Warmer Bulletin 51, October 1996
12. VONYÓ A. and FÖLDÉNYI R.: The waste in Hungary - Solid waste management in Hungary, Environmental Excellence Magazine, September, 1996
13. TCHOBANOGLOUS G., THEISEN H. and VIGIL S.: Integrated Solid Waste Management, McGrow-Hill Book Company, New York,1993
14. Environmental and Building Affairs Bulletin Official Paper of Ministry of Environment and Regional Policy, Budapest, July 21, 1995
15. ERDEY GY.: Full Collection of Environmental Related Laws Napra-forgó Joginformatika és Kiadó Kft., Budapest, 1994
16. Scavenger Quarterly Press of the Waste Work Association, Győr, Spring 1996
17. SZENES E.: Environmental Protection in the Small and Middle-sized Food Processing Plants, Integra-Project Kft., Budapest, Appendix 7. pp 215-218, 1995
18. Hungarian Statistic Annual, 1994, Central Statistical Office, Budapest, 1995
19. 11/1991. (V.16) KTM enactment about the determination of technological emission threshold limits of waste incineration and about the rules concerning their application, Comprehensive Collection of Environmental Laws, Napra-forgó Joginformatika és Kiadó Kft., Budapest, p 124, 1994(in Hungarian)
20. CHEREMISINOFF P.N.: Waste Incineration Handbook, Butterworth-Heinemann Ltd., Oxford, p 15, 1992
21. RAZNJEVIC K.: Calorific Tables, Műszaki Könyvkiadó, Budapest, pp 286-288, 1964 (in Hungarian)
22. PUNGOR E.: Handbook of Analysts, Műszaki Könyvkiadó, Budapest, p 31, 1987 (in Hungarian)
23. 102/1996. (VII.12.) Korm. r. Law about Hazardous Wastes, Hungarian Bulletin 57., Official paper of the Hungarian government, Budapest, pp 3578 – 3653 (in Hungarian)
24. STEFANOVITS P.: Soil Research, Mezőgazdasági Kiadó, Budapest, p 253, 1975 (in Hungarian)
25. O'LEARY P., WALS P. and RZVI A.: Solid Waste Composting, study-aid, University of Wisconsin-Madison, p 7, 1990
26. FÜLE L. and MAGYAR I.:Geo-informatic Evaluation of the Surroundings of Balatonfüzfő with Environmental Aspects, Institut für Technische Ökosystemanalyse Montanuniversität Leoben, 1994
27. MÁLDNÉ SZŐNYI J.:Vulnerability Survey of Water Holding Systems, Theory and Practice, Eötvös Lóránd Technical University, Department of Applied and Environmental Geology, Budapest, 1995
28. Geology of Bakony Mountains, Explanation of the uncovered geological maps of the Bakony Mountains, Hungarian NationalGeological Institute, Budapest, 1990
29. Personal communication with BÉLA KASZÁS, representative of the local government of Zirc with VILMOS MÁR, owner of X-ion Ltd, the firm collecting and transporting municipal solid waste of Zirc with LÁSZLÓ HEGEDŰS, operator of landfill site of the village Dudar with ZOLTÁN HORVÁTH, owner of the scrap yard of Zirc with ISTVÁN GALAMBOS, member of the local non-governmental green organisation Sziget of Zirc with GYÖRGY POLGÁR, manager of the sawmill of Zirc Forestry with LÁSZLÓ FÜLE, professor's assistant at Department of Environmental Engineering and Chemical Technology, University of Veszprém