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## **Uncontrolled Combustion of Household Wastes and Vegetation Remains in a Rural Community – Questionnaire Results\*\*\***

### **1. Introduction**

Uncontrolled combustion of household wastes and vegetation remains makes a serious problem referring to the emission of many substances polluting atmosphere, including polychlorinated dibenzo-*p*-dioxins and dibenzofurans [8, 12]. As shown by the United States Environmental Protection Agency and National Academy of Sciences, the emission of dioxins and furans from this source, in USA, in 2002–2004 exceeded 600 g TEQ/year, which made above 60 per cent of the total emission to the atmosphere in USA [1, 5]. It has been estimated that through open combustion (in steel barrels or on an open fire) about 25–50 per cent of rural wastes are neutralized there. This way people burn not only pieces of wood, paper or cardboard, but also inflammable gardening wastes, building wastes, containers and other products of plastic, foam, organic wastes etc. [12, 13].

This problem has been noticed in the European Union, which was expressed in the EU strategy on dioxins, furans and polychlorinated biphenyls [2], pointing, among others, at the combustion of solid household wastes, main non-industrial source of dioxin emission. The issues related to the inventory and limitation of the emission of dioxins and other persistent organic pollutants (POPs), taking place e.g. during uncontrolled combustion of wastes, were also mentioned in the Stockholm Contention, Aarhus Protocol to the convention of transboundary transport of toxic substances on large distances and the enactment of the European Community no. 850/2004 referring to POPs [3, 4, 10, 11]. Emissions from such sources are counted into the combustion processes in the municipal and household sector. Thus it is not surprising that this sector plays a dominant role in the total quantity

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of dioxins and furans emitted to the atmosphere or poly-cyclic aromatic hydrocarbons. For example, the participation of this sector in the emission of these two groups of persistent organic pollutants in 2005 in Poland was estimated on the level of 49 and 87 per cent, respectively [6].

Combustion of post-use wastes or garbage and burning grasses are also seen as one of the causes of air pollution in larger and larger number of communities in Poland [7]. The awareness of the Polish society referring to this problem and related appearance of different air pollutants, including dioxins and furans, has still been low. It was studied in one of Polish rural communities, based on the results of the questionnaires. In the questionnaire studies both combustion of wastes in household stoves was included as well as on the open space.

## 2. The Characteristic of the Study Area

The questionnaire was carried out among 100 persons living in one-family houses in the community of Krościenko Wyżne. The persons who obtained the questionnaire represented respective groups of people of different age, education level, financial status and occupation, so that the obtained results are the closest to the truth and reflect the consciousness of the whole community. The questionnaire mainly referred to the problem of burning of wastes of different kind, formed in the area of the household. The didactic information was enclosed with the questionnaire. It was called: "Dangerous Combustion", where the sources of dioxins and furans were presented, as well as their harmfulness, as toxic substances and their negative influence on the environment and human health [9].

The commune of Krościenko Wyżne is situated in south-eastern region of Poland (the Podkarpacie province), within the Doły Jasielsko-Sanockie, near Krosno (Fig. 1). It covers the area of 1633 ha, including two localities: Krościenko Wyżne and Pustyny with about 1500 family houses.

In the northern part of the community mountainous areas of low soil classification are predominant, while in the southern part – flat areas are predominant. In the areas of the arable land fields, meadows, orchards and one-family detached houses dominate as well as auxiliary buildings. Arable grounds make as much as 83.5 per cent of the community, while forests only 5 per cent. In the southern part of the community there is now a not very much used airport, covering 106 ha, i.e. ca. 6.5 per cent of the community. Most owners of agricultural land are additionally employed in public or private enterprises, or carry out their own businesses. In the area of the community there are different enterprises, specialized in production, commerce and/or services (production of bitumen masses, metal, furniture, plastics, cakes, commerce, transport services, etc.).

Due to the specifics of the analysed area (including the lack of any environmentally harmful industry), the main wastes are municipal wastes. The only wastes of any other type are: sawdust, wood scraps and scrap metal. Municipal wastes come first of all from households, objects of public use and public services. These wastes can include dangerous wastes, containing toxic substances (including: fluorescent lamps, thermometers, emptied packages of paints, solvents and varnishes, greases, used oils, old (with expired validity term) medicines, chemicals, pesticides and emptied packages of these products). It has been estimated that they contain ca. 0.5% of total waste mass.

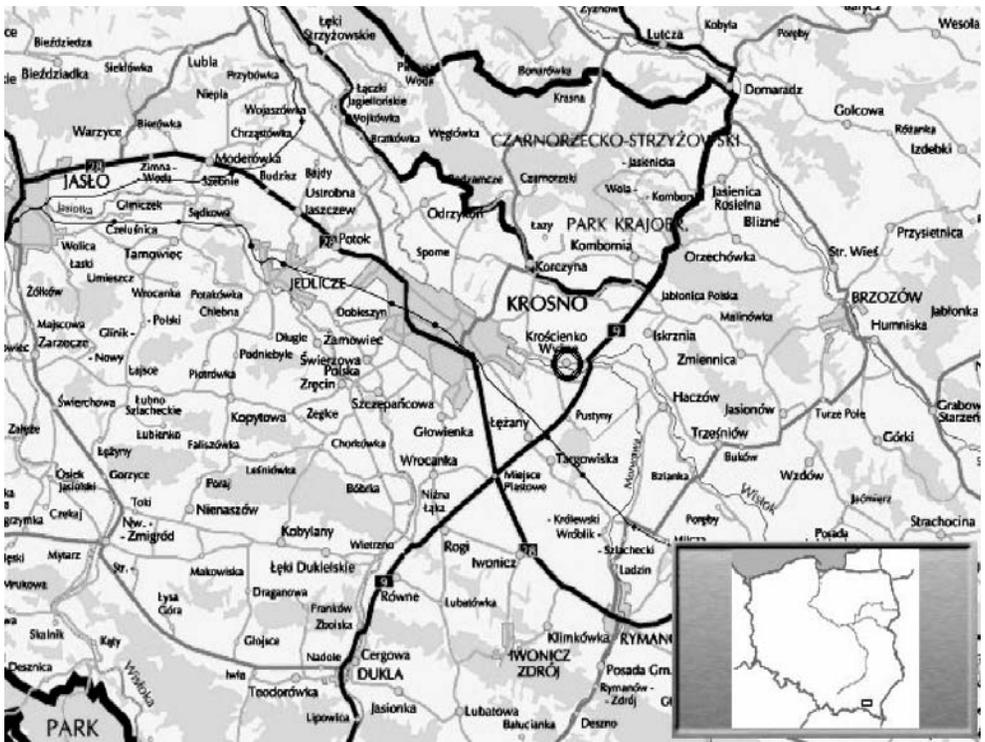


Fig. 1. The situation of the community of Krościenko Wyżne

In the commune of Krościenko Wyżne, in the terms of the waste collection, there is a system of direct waste removal, based on the regular service of collecting wastes with the use of the normalized equipment for collecting and removal of wastes. The carried out analysis of wastes showed that not all municipal wastes are collected from the residents. Not always the producers of wastes, despite

the contracted agreement with the transport services use these services. It partially causes uncontrolled release of wastes into the environment (illegal landfills), moreover, due to a typically agricultural character of the community, most organic wastes and paper products are used in households [14].

### 3. Questionnaire Results

Among the carried out 100 questionnaires, 14 were regarded irrelevant, because the obtained answers were in some points contradictory, thus it was suspected that those questionnaires were not filled in accurately, thus were not reliable. Based on the remaining questionnaires, it was possible to draw conclusions on the state of public awareness, among others, in the issues of environmental threats, caused by uncontrolled combustion. Combustion of wastes in coal stoves or on an open fire put in front of houses is largely connected with the lack of knowledge on the possibilities of producing toxic substances, including dioxins and furans, during such thermal treatment of wastes.

In many cases, despite full awareness of residents, referring to the harmfulness and the ban of domestic combustion, such practices have been performed due to the low level of life standard, the applied way of heating or the will of quick waste disposal. For some people wastes make a value as additional energy resource used in obtaining thermal energy in their installations heating flats and water. As it can be concluded from the responses in questionnaires, the kind of produced wastes and the choice of their neutralization are much influenced by the system of heating houses and the way of the management of the land around the houses. Above 53 per cent of the respondents admitted common or sporadic burning of municipal wastes (Tab. 1). Among them elderly people were predominant (above 50 years old) and people of low education level (elementary, basic vocational).

Among the wastes burnt in households, first of all empty food packages were mentioned: plastic bags, milk bags and plastic packages and empty bottles (PET), as well newspapers, magazines, tissues etc. There were also people using other plastic waste products for heating (insulation materials), clothes, shoes and wood-imitating materials. As shown in table 2, as much as 95% of people burning wastes showed in the questionnaire that they burn newspapers, magazines and cardboard. Majority of these people use such wastes as burning-initiating material. Almost half of them also burn empty food packages. Wood-imitating materials, such as floor panels, used furniture, particle boards and fibreboards, are also used as fuel for heating flats. This was admitted by ca. 37 per cent of respondents. Among burned wastes sporadically appeared: tyres, styrofoam, shoes, clothes and pampers.

**Table 1.** The number of people burning municipal wastes

Residents taking part in the questionnaire	Number of all the questionnaires	Number of correctly filled in questionnaires (c.q.)	Number of people burning wastes	The percentage of people burning wastes,% of total c.q.	The percentage of people burning wastes in a given group, %
Total	100	86	46	53.5	53.5
Women	53	44	19	22.1	43.2
Men	47	42	27	31.4	64.3
Age:					
<20	3	2	1	1.2	50.0
20-30	29	26	12	14.0	46.1
30-50	30	27	11	12.8	40.7
50-60	20	16	10	11.6	62.5
>60	18	15	12	14.0	80.0
Education:					
University	27	22	7	8.1	31.8
Middle	37	31	15	17.4	48.4
Basic Vocational	29	26	17	19.8	65.4
Elementary	7	7	7	8.1	100.0

**Table 2.** The number of people burning respective kinds of wastes

Kind of wastes	Number of people burning respective kinds of wastes	Number of people burning respective kinds of wastes,% of total number applying combustion
Newspapers, cardboard, magazines	44	95.6
Emptied packages of milk, juices, yoghurt etc.	22	47.8
Empty packages of detergents	5	10.9
Wood-like materials	17	36.9
Plastic films	7	15.2
Styrofoam	3	6.5
Shoes	4	8.7
Clothes	3	6.5
Plastic	4	8.7
Tyres	3	6.5
Pampers	2	4.3

In households, depending on the season of the year, also vegetation remains are burned as well as other garbage. As shown in table 3, ca. 45 per cent of respondents apply open combustion of this kind of organic wastes. Some inhabitants explain this indicating small harmfulness for the environment, lack of space for waste deposition or too long time of their biological decomposition.

**Table 3.** The number of people burning vegetation remains

Residents taking part in the questionnaire	Total number of questionnaires	Number of correctly filled in questionnaires (c.q.)	Total number of people burning wastes	Percentage of people burning wastes, % of total c.q.	Percentage of people burning wastes in a given group, %
Total	100	86	39	45.3	45.3
Women	53	44	17	19.8	38.6
Men	47	42	22	25.6	52.4
Age:					
<20	3	2	1	1.2	50.0
20-30	29	26	7	8.1	26.9
30-50	30	27	13	15.1	48.1
50-60	20	16	10	11.6	62.5
>60	18	15	8	9.3	53.3
Education:					
University	27	22	4	4.6	18.2
Middle	37	31	14	16.3	45.2
Basic Vocational	29	26	16	18.6	61.5
Elementary	7	7	5	5.8	71.4

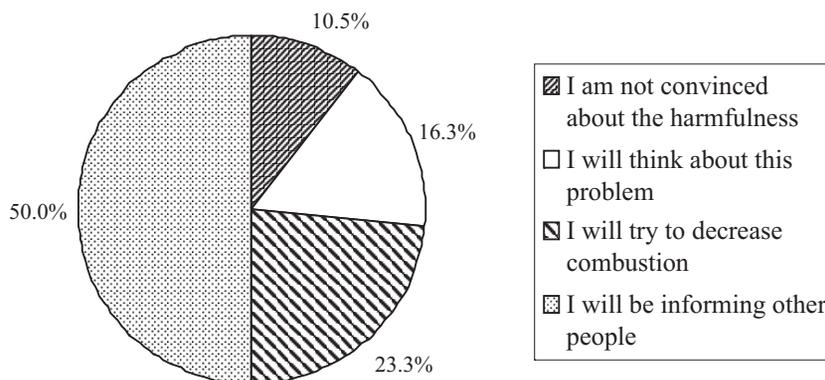
As shown in table 4, the community residents' awareness of the problem of dioxins is very low. More than 40 per cent of people have never in their lives heard about dioxins. This name was totally strange to them. This was much related to the education level.

One of the questions in the questionnaire was aimed at checking how many people would treat the problem of wastes combustion seriously and would undertake proper steps limiting such a way of their neutralization.

**Table 4.** The number of people showing the lack of knowledge on dioxins

Residents taking part in the questionnaire	Total number of questionnaires	Number of correctly filled in questionnaires (c.q.)	Number of respondents not hearing about dioxins	Percentage of people not hearing about dioxins, % of total c.q.	Percentage of people not hearing about dioxins in a given group, % in a group
Total	100	86	36	41.9	41.9
Education:					
University	27	22	6	6.9	27.3
Middle	37	31	10	11.6	32.3
Basic Vocational	29	26	15	17.4	57.7
Elementary	7	7	5	5.8	71.4

As shown in figure 2, after reading the educational instructions, some residents decided to limit uncontrolled combustion of wastes (about 23 per cent), as well as inform the others on the results of such practices (about 50 per cent).

**Fig. 2.** Answers referring to the declared actions after taking the questionnaire

#### 4. Conclusions

The results of the carried out questionnaire provided the information to what extent and why, in a typical Polish rural community the combustion of wastes in

households takes place, despite the organized collection of municipal wastes. The combustion of municipal wastes was admitted in more than a half of correctly filled in questionnaires and burning vegetation remains – in ca. 45% questionnaires.

The main cause of this situation can be first of all identified as the lack of the awareness among the residents, referring to the effects of uncontrolled waste combustion. People have no sufficient knowledge on toxic effects of the produced substances, thus the wastes made during cleaning and redecoration of their households are eliminated by combustion. The carried out questionnaires allow conclusions that young and highly educated people are more aware of the harmfulness of uncontrolled waste combustion than elderly people. Elderly people turn out to be much less responsible for the surrounding environment.

Among the important reasons of burning wastes in households, there is also an economic aspect. The possibility of using one's own wastes as "free" fuel is a very tempting alternative for fossil fuels (including hard coal and natural gas). And the growth of prices of the latter makes these alternatives even more encouraging.

A chance to diminish uncontrolled waste combustion and the quantity of emitted air pollutants, including particularly dangerous chlorinated dioxins and furans, can be continuous education of the residents in the area of correct waste management and potential effects of their uncontrolled burning, especially in terms of the threat to their own health.

Another proper criterion can be lowering the fees for garbage collection with the growth of the amount of wasted provided for neutralization, as well as their segregation in the place of their production, including the promotion of collecting scrap paper and other wastes applicable for reuse and recycling.

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