

THE CHANGES IN AIR POLLUTION RESULTING FROM THE INSTALLATION OF GAS HEATING IN PRIVATE HOUSES ON THE EXAMPLE OF THE POLISH HEALTH RESORT RABKA

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This paper presents the results of air monitoring (sulphur dioxide and black smoke measurements) carried out in Rabka where gas heating has been installed in private houses. It has been suggested that along with this installation the whole plan of concerted action should be formulated if the air pollution is to be reduced in any significant way. The plan ought to include house insulation against heat loss and low-interest credit for the modernisation of heating in private households.

1. Introduction and Objectives

This paper presents the results of investigations conducted thanks to the grant entitled "A study of effects of decreasing air pollution on children's respiratory diseases" and awarded by Commission of Applied Research, Committee of Health and Environmental Protection KBN in division of Medical and Environmental Engineering. These investigations were undertaken to analyze the changes in air pollution caused by the installment of gas heating in private houses.

Rabka, one of the main Polish resorts, is located in the South of Poland, in the mountaneous region which lies about seventy kilometers from Cracow. Inhabited by fifteen thousand people, the town has been famous for the therapeutic properties of its climate and springs since 1254. It is an excellent object for such an analysis because of some factors: firstly, it is situated in a closed valley; secondly, its pediatric facilities are well developed; thirdly, a considerable number of air pollution measurements had been carried out in Rabka earlier.

The whole town may be divided into three zones in respect of their bioclimatic properties. The first zone which comprises the most part of the resort has the balneoclimatic character only and much attention is paid to the medical treatment of children. In the second zone there are the valleys of two streams: Poniczanka and Słonka. The third zone, the "bad" one, comprises the part of The Raba River valley; fogs and inversion of air temperature are very often observed here, [1].

All measurements of air pollution were performed by means of continuous aspiration method. West-Gaeke method and reflectometric method were used to investigate sulphur dioxide and black smoke respectively. Moreover, the chemical analyzis of the coal conveyed to Rabka was made. At the same time the meteorological factors were recorded: air temperature, air moisture and the speed and direction of winds. Along with that, in the winters of 1994/95 and 1996/97 there was conducted a survey which concerned the practical use of energy sources and the evaluation of the installation of gas heating, particularly in comparison with the period before the installation. The questionnaires were filled in by the

inhabitants of 150 farmhouses.

2. Review of literature and results

A high concentration of air pollution in Rabka resort is getting hazardous to health and balneotherapy. According to the research into air pollution which was carried out in 1977 in selected Polish resorts, in some periods the twenty-four hour mean values of sulphur dioxide concentration were very high, for instance in December 1977 when 97% of gathered data exceeded the limit, [2].

The measurements of standard air pollution as opposed to the level of pollution considered hazardous to health were made by Miczyński in 1977-78. The author found that the concentration of black smoke and sulphur dioxide, observed periodically in Rabka, may cause a higher incidence of respiratory diseases, [3]. These results were confirmed by investigations conducted by other authors and also by observations of pediatricians from National Institute for Tuberculosis and Lung Diseases in Rabka.

Air pollution in Rabka is of local origin and comes from the combustion of different sources of energy. Until 1992 most of the pollutants had been discharged into the atmosphere due to the burning of coal, [4-6]. The chemical analysis of the amount of black smoke and sulphur in coal ash showed that the mean value of the mineral part in coal amounted to 8,5%, while the content of sulphur amounted to about 1,2%. The ash and sulphur contents, although approaching the figures considered as the upper limit for this kind of coal, did not exceed them. However, due to the combustion of large amounts of coal, much sulphur was released into the atmosphere, posing a health hazard, [7, 8].

Since it was the combustion of solid energy sources that brought about such a concentration of pollutants in the air, some steps concerning the reduction of pollution were necessary. Thanks to the great involvement on the part of the local authorities and the financial support from the government, the installation of gas heating in private households began already in 1991. Simultaneously, our Department also expanded the scope of air monitoring in Rabka and its environs.

In 1993, the significant progress could be observed, as almost 50% of boiler houses and the majority of private households had gas piped. Until that time, they had had their own heating systems, based on coal and coke.

In 1995 80 % of houses in Rabka were provided with gas installation; at the end of 1996 the figure was already 95%. [9]. The twenty-four hour mean values of dust suspended in the air measured in selected winter months (January, February and March from 1993 to 1996) indicate that in the period of 1994-95 the level of air pollution fell dramatically. However, in January 1996 the amount of dust increased again, despite the growing number of private houses with gas installations (which was to reduce air pollution in Rabka) and the development of gas infrastructure.

The situation may be accounted for in the following way: air temperature in January 1996 was exceptionally low and it made people use up much more sources of energy than before. Moreover, the high price of gas raised many doubts among individual users: they were uncertain whether it had been reasonable on their part to have the

gas piped to their households. Many of them, along with the gas stove, still had the other stove which would use the traditional and much cheaper sources of energy: coal, wood, coke, briquette, refuse and even rubber or leather scraps.

The evaluation of the energy sources and their use in private households was based on the questionnaires and interviews made in about 150 houses [10]. The respondents were to define the extent to which various energy sources were used before and after the gas installation in Rabka and to express their views on that subject.

Before 1994 coal and coke were used for heating in about 90% of houses. In winter 1994/95 already 39% of households had gas heating, but until 1995/96 that figure rose only by 3%. It is worth observing that it took place at the time when the gas heating was being installed in many houses in Rabka. Although some new houses had the gas piped, the inhabitants of many others gave up heating by gas and returned to traditional energy sources. In some cases people were thinking of cutting off their houses from gas supplies and doing without gas meters. Those facts and statistics are very alarming, because they undermine the importance of gas installation. They are also reflected in the questionnaires where 50% of the respondents stated that gas was definitely too expensive a source of energy, though environmentally friendly (65% of respondents) and efficient one.

4. Conclusion

1. The investigations of air pollution conducted in Rabka indicate that at the very beginning when the gas heating was being installed in private households air pollution decreased considerably.
2. Despite the fact that gas heating was installed in the major part of the town, in the severe winter of 1996 the level of dust suspended in the air increased when compared to the previous period.
3. The survey conducted among the inhabitants of Rabka shows that in winter 1995/96 the actual use of gas as a fuel for heating houses diminished; traditional energy sources such as coal, coke or even refuse were used instead.

5. Practical conclusions

1. In order to maintain the air purity in Polish health resources the system of payments for gas used to heat houses should be altered. For the time being preferential subsidies should be introduced. (Respondents suggested circa 30% for such subsidies).
2. The whole issue ought to be considered in a comprehensive way, including the offer of low-interest credit which would help to implement the following aims:
 - to modernize the old inefficient central heating in private households, replacing them with the modern energy-saving ones;
 - to insulate private houses against heat loss.

Only after these aims have been achieved, will gas be actually an energy source, not only economical, but also environmentally friendly; moreover, the concentration of pollutants in the atmosphere will relatively fall.

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Fig. 1 : Localization of Rabka resort in Poland

