DIFFERENTIATION IN AIR POLLUTION

RESULTING FROM THE GASIFICATION OF THE CITY OF RABKA

AGAINST SELECTED WEATHER FACTORS

Janusz Miczyński, Janusz Leszek Kozak, Tadeusz Wach

AGRICULTURAL ACADEMY

Chair of Meteorology and Climatology

Faculty of Environmental Engineering and Surveying

Krakow, Al. Mickiewicza 24-28

SUMMARY

Continuous monitoring of the basic index air pollution elements was conducted at the premises of the Rabka Health Resort. These include suspended dust and sulphur dioxide. Both of these pollutants were measured on the 24-hour basis with samples taken with the aspiration method. The results show that significant reduction of pollution was noted before 1995, especially in winter months, which is to be presumed as a result of the city gasification.

The 1995/1996 winter, colder than the previous ones, forced return to cheap traditional fuels, in consequence of combustion of which air pollution increased again in winter months.

It is suggested that the problem is considered on many levels, with low-interest credits for the realisation of the two following goals taken into consideration as well:

– The first goal shall include a concept of the universal reconstruction of outdated ineffective heating systems of central heating in individual households into modern, high-efficient and energy-saving solutions;

– The second goal shall refer to universal provision of additional heat insulation in the existing buildings.

Under such circumstances, using gas as an energy vehicle shall be only ecological as well as justified from the economic point of view and, what is most important, shall be realised in practise. Air pollution concentration level in Rabka and in other health resorts in the south of Poland shall then relatively decrease.

1. INTRODUCTION

The city of Rabka, one of the oldest Polish health resorts, is located about 70 km away from Krakow, at the point of contact of two mountain massifs: Gorce and Beskid Wyspowy. Thus, it constitutes a splendid starting point for tourism and winter sports for people from Krakow, especially for weekend rest and for spending holidays and winter school breaks here.

The Rabka studies have been a relatively long-standing examination process, with special advancements made in 1993-1995 within the No. 613/C.S4-4/93 Purpose Grant financed by KBN. At that time, all the characteristic Rabka centre areas were covered by air pollution examinations, both in the health resort part and in the suburbs of the city.

This work is an attempt at presenting the dynamics of pollution over the years 1973-1997, with special emphasis placed on the period of 1993-1995. Due to the fact that pollution level was low in hot months (non-heating period), the work is restricted to the air pollution analysis in winter months.

2. RESULTS OF EXAMINATIONS AND THEIR ANALYSIS

The data given below come from the archive materials for the 1970s and 1980s [Plate 1] as average month values and from recent studies, i.e. for the period of 1993-1997.

Very high concentration (harmful to health) of sulphur dioxide was characteristic in the 1970s and 1980s. [1-3]. The resolution to proceed with gasification of Rabka and its neighbourhood was made in 1990s and executed. The analysis of Plate 1 shows a decreasing tendency over the years, which was attributed to the city gasification process.

Back in the early 1990s (the beginning of gasification) concentrations were relatively high, to stabilise at a later time at the low level of 20-30 mg/m3 (Plate 1, Table 1) as the investment was proceeding. The decrease of sulphur dioxide concentration observed in the early 1990s may have resulted from the commonly noted tendency of warm winters which occurred at that time in Poland as well as from using other energy vehicles (gas, electricity, wood).

Statistical analysis of the relationship between sulphur dioxide and air temperature in winter months in 1994/1995 is presented in Plate 2 (this analysis has not shown significant relationships with other weather elements).

High correlation index at the level of almost 60% proves that the examined weather element had significant impact upon sulphur dioxide concentration in Rabka.

Suspended dust in the years 1970s and 1980s showed alike levels and (similarly to sulphur dioxide) since the beginning of 1990s concentration level threshold decrease had been noted which has showed slight increasing tendency since 1995 (Plate 3). Causes of such concentration changes shall be sought (as in the SO2 case) in the general tendency that results from warm winters and proceeding gasification of the city of Rabka (Plate 3).

Changes in suspended dust concentration levels have also been determined as average daily data in winter periods, as shown in Plate 4.

The plate shows an increasing tendency, characteristic of 1995/1996 winter. This phenomenon may be influenced by the tourist activity reviving after the early 1990s stagnation, as well as by a long 1995/1996 winter characterised with low temperatures, which presumably disturbed the earlier decreasing pollution tendency. Low air temperatures resulted in referring to cheap traditional energy vehicles (i.e. coal, coke and any type of waste products) in place of expensive gas in individual Rabka households. As a result of this process, air pollution increased significantly in the 1995/1996 winter.

The course of winter air temperature in Rabka in the years 1993-1997 [Plate 5], which shows significant decreasing tendency, supports this hypothesis.

Relationship between average daily air temperature and average daily suspended dust concentration at the correlation index of 50% was also examined at the example of the 1994/1995-winter period, which proves significant impact of temperature upon the concentration level of this pollutant. (Plate 6).

3. SUMMARY

The existing situation provokes fear that the process of the area gasification in itself, i.e. without other multi-plane activities like central heating systems modernisation and housing supplementary heat insulation, shall not result in expected air-sanitary effects, ultimately not enhancing the Rabka health resort advantages.

In the winter period, boiler rooms in households, holiday resorts, etc. emit huge amounts of air pollution into the atmosphere, thus being a threat to the health resort in the form of the so-called low-altitude emission. This low-altitude emission is the most important threat in winter periods not only for Rabka but also for many other mountain locations. Low-altitude emission, when combined with unfavourable topographic configuration and unfavourable climatic conditions resulting from topography may lead to increase in pollution concentrations up to the levels noted in large city complexes.

Economic changes in recent years caused decrease in tourist activity, but owners of rest and sanatorium resorts approach the issues of heating in an „economic" way at the same time. They purchase fuel of unknown origin, burn waste products, etc.

Many local government agencies seek to provide economic policy, mostly consisting in complex city gasification. The Rabka case shows that the effect of transfer into gas-based heating is radically different from the expected one. [4,5] After the gasification, inhabitants mostly use gas for preparing food, then for water heating and finally only for heating their household. Gas is an expensive energy vehicle; therefore it is often used only to sustain temperature in central heating systems. Many household boiler-room owners keep their old installation and install „multi-fuel" heating stoves that serve as a means for „economic" waste removal. When crossing southern Poland in winter, one can

easily see mountain locations enveloped with smoke; high pollution concentration at night is most easily visible when the daily temperature drop occurs.

4. CONCLUSIONS

a. Air pollution examinations conducted in Rabka before 1995 showed significant concentration reduction, especially in winter months.

b. The reduction tendency in air pollution noted before 1995 suggests that it resulted from the Rabka gasification process.

c. The winter of 1995/1996, colder than earlier winters, resulted in returning to cheap traditional fuels, as a result of burning of which increase in air pollution in winter months was noted.

d. The problem shall be approached on many levels, with low-interest credits for the realisation of the two following goals taken into consideration:

– The first goal shall include a concept of the universal reconstruction of outdated ineffective heating systems of central heating in individual households into modern, high-efficient and energy-saving solutions;

– The second goal shall refer to universal provision of additional heat insulation in the existing buildings.

Under such circumstances, using gas as an energy vehicle shall be only ecological as well as justified from the economic point of view and, what is most important, shall be realised in practise. Air pollution concentration level shall then relatively decrease.

In order for the gasification process in Polish health resorts to result in expected estimated significant reductions in air pollution and in areas under special protection, multi-plane activities shall be undertaken such as: temporary preference price indexing for gas and widely-available low-interest credits for housing supplementary insulation and for modernisation of outdated household heating systems.

LITERATURE

[1]. Hałuszka J., Pisiewicz K., Miczyński J: Monitoring the state of atmospheric air in the Rabka health resort in order to improve effects of respiratory tract chronic diseases treatment, the final report for the No. 613/C.S4-4/93 Target Project realisation. 1995.

[2]. Miczyński J., Kozak J. L : Changes in air pollution in Rabka related to the city gasification, materials of the 1st symposium on „Estimation of air pollution immission," POL-IMIS Symposium „95 and 97," Oficyna Wydawnicza Politechniki Wrocławskiej. 1995.

[3]. Miczyński J : Changes in the air pollution resulting from the gasification on the example of the Polish Rabka resort, ENVIRO NITRA '97 International Seminar. 1997.

[4]. Miczyński J : Analiza zmian zanieczyszczenia powietrza w Rabce w aspekcie prowadzonej gazyfikacji, I Forum Inżynierii Ekologicznej, Technika i technologia w ochronie środowiska. 1996.

[5]. Wach T : Changes in air pollution in Rabka as a result of its gasification, Master's thesis prepared in the Chair of Meteorology and Climatology, Agricultural Academy, Krakow. 1996.