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RESEARCH CONCERNING DEVELOPMENT OF NEW TECHNOLOGIES FOR AIR QUALITY MONITORING AND NOXES IMPACTS ON HUMAN HEALTH AND ENVIRONMENT

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Abstract: *Indoors and outdoors air pollution represent a factor with great impact on human health, also being responsible for a series of environmental related diseases. In Europe, especially in Romania, urban areas traffic emissions are a major source of airborne pollutants. Consequently, traffic-related pollution abatement is a critical component of air quality management.*

This paper shows some actions in implementation of new air quality monitoring technologies in Europe and in Romania and proposes to assess the effects of the main airborne pollutants on human health. There are also presented the results of a national project for air quality monitoring – Traffic Noxes Monitoring Station – which offers results concerning some traffic pollutants level (CO, NO_2, SO_2, O_3).

The main targets for air quality monitoring and health impacts are the followings:
designing and producing effective-cost monitoring units for CO and other air pollutants; assessment of traffic monitoring necessity by using video systems and standard procedures in order to elaborate guidelines of good practice in the field of urban traffic management and of the public health; evaluating the reliability of monitoring sensor equipments in order to be accurate, precise and specific; designing and producing on-line data transmission and data processing systems; analysis regarding health impact assessment focusing on the main air pollutants with evaluation of their effects on target population categories: children, seniors and people suffering from chronic cardiopulmonary diseases.

Modeling and simulation software of a sustainable traffic are concerned as important tools to help local authorities to adopt appropriate measures and to promote such a policy as to provide efficient transport, access to services and a clean and safe environment.

Key words*: air pollution monitoring, traffic noxes, health impact*

1. Background

Human health is intimately connected to the surrounding environment, but is usually very difficult to identify cause-and effect relationship between a certain pollutant and a certain disease. Identifying these relationships and linking human health to environmental pollution helps redefine priorities and unlock resources.
People are exposed to a mixture of different environmental stressors, often in combination from different sources and this should be taken into account in environment and health risk management. Environmental exposure occur during the whole lifecycle from the moment of conception, through germ cell differentiation and development, pre-and post-natal development, growth into adulthood and adult life, to aging and senescence. This is the reason why air pollution has been an European major political concern in the latest

decades.

Links between exposure to certain pollutants and their health consequences depend on the environmental pollutants and disease being considered, but are also influenced by factors such as genetic constitution, age, nutrition, lifestyle and socioeconomic factors such as income, education.

The child-focused EU SCALE process (science, children, awareness-raising, legal instruments, evaluation) has initially identified 4 priority groups of disease: childhood cancer, childhood respiratory health/asthma, neurodevelopment and endocrine disorders, but the list of potential pollution-induced diseases is much longer and includes diseases of adults.

The societal costs of air pollution related diseases for EU Member States in 2000 were evaluated within the CAFE programme to EUR 305-875 billion/year. Recent estimates indicate that 20 million Europeans suffer from respiratory problems every day.

Asthma is increasing all over Europe, although there is a significant variation between EU countries. The societal cost of asthma has been estimated at EUR 3 billion/year. Clearly, asthmatic persons and particularly asthmatic children are sensitive to air quality and several studies show a strong association between exposure to air pollution and the aggravation of asthma.

In addition, the increased ozone level have severe health implication, such as bringing forward the deaths of more than 20000 people per year. Ozone concentrations generally exceed the long-term objective to protect human health, 120 $\mu g/m^3$ during 8 hours, in most EU Member States.

The highest concentrations of nitrogen oxides are observed at street level due to traffic emissions, especially in larger cities throughout Europe.

The public informations about the environment are guaranteed by the law, but the main information source is the mass-media which does not represent a real time information source and this is why could not involve any real action or decision at the personal-level.

2. Experimental results

In accordance with European Union framework on air quality, Romania aims to develop and implement appropriate instruments to improve air quality. The transposure of EU environmental normative was done by implementation of national specific regulations. Within the framework of AMTRANS program, a large group of specialists from SC ICPE SA, SC ECOPROIECT SRL, SC Caloris Group SA, the Pollution Preventing Centre, UAUIM Bucharest and the municipality of Constanta as beneficiary, materialized a prototype for an air quality monitoring station which will be running in Constanta.

In the national context regarding the European legislation implementation, based on some other EU research results, we believe of the viability of the proposed solution in this project, in connection with the prospect of founding a national network for air quality monitoring and with the world wide research.

In Constanta there is now only one mobile laboratory for monitoring the ambient air quality, which belongs to Environmental Protection Agency, and in the next two years will be installed a network of air monitoring stations, EU compatible, for the Seaside of Romanian Black See towns. The sensors based systems we design assure the monitoring of the following parameters: CO, SO_2, NO_2, ozone, temperature, relative humidity, wind rate, wind direction. The system is fit for an efficient monitoring showing the exceeded admissible maximum level for any of the indicators. This will allow the traffic detour from the concerned crossroad, until the situation comes back to normal.

It has been carried out at Polytechnic University Timisoara (UPT) some experimental testing for calibration of Air quality monitoring station, as following:

- **Calibration testing**

Calibration equipment scheme for UPT systems is shown in figure 1. Calibration equipment scheme for CALORIS station is shown in figure 2.

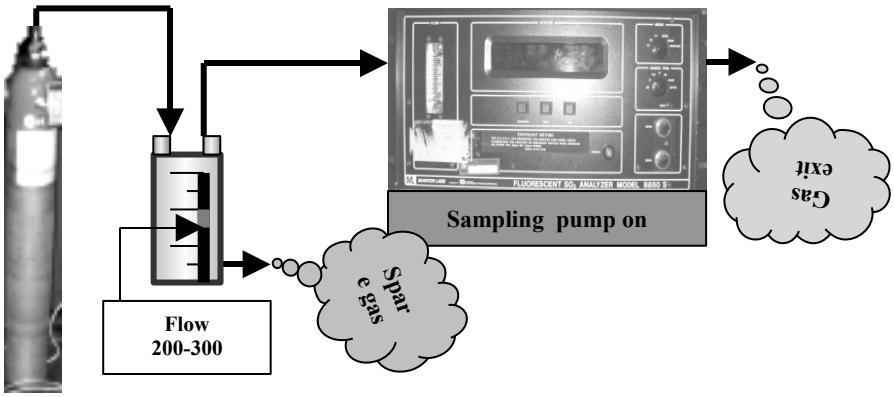

Fig. 1 Calibration equipment scheme for reference systems

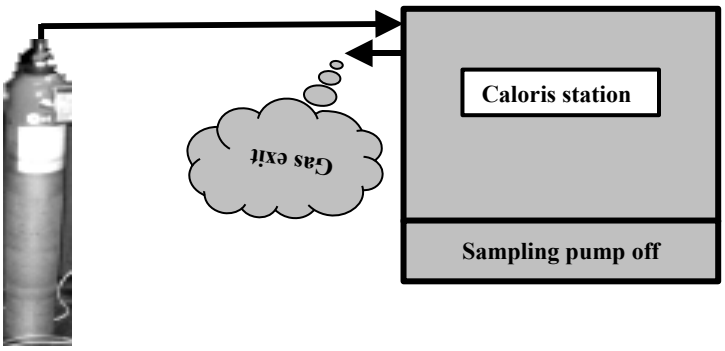

Fig. 2 Calibration equipment scheme for CALORIS station

It has been used for calibration the following gases:

- No HC synthetic air (a calibration specifically gas, type Linde);
- NO_2, 3.18 [ppm], (a calibration specifically gas, type Messer);
- CO, 30 [ppm], (a calibration specifically gas, type Linde);
- CO, 2 [ppm], (a calibration specifically gas, type Messer);
- SO2, 2.04 [ppm], a calibration specifically gas, type Linde);

The calibration testing results are shown in the table below:

Table 1. Equipments calibration

CO			
Hour	**Equipment / Experimental values**		**Standard gas level [ppm]**
	CALORIS station	**Horiba APMA-350E**	
10^{56}	30.4	30.0	30
10^{58}	30.3	30.1	
11^{00}	30.4	30.0	
11^{06}	2.1	2.0	2
11^{08}	2.1	2.1	
11^{10}	2.1	2.0	
NO_2			
Hour	**Equipment / Experimental values**		**Standard gas level [ppm]**
	CALORIS station	**ML 8840**	
12^{24}	3.1	3.17	3.18
12^{26}	3.3	3.18	
12^{28}	3.2	3.18	
SO_2			
hour	**Equipment / Experimental values**		**Standard gas level [ppm]**
	CALORIS station	**ML 8850S**	
15^{24}	1.9	2.03	2.04
15^{26}	1.9	2.04	
15^{30}	2.0	2.04	

- **Comparative measurements with standard gases**

Comparative measurements with standard gases have been carried out in the figure 3.

- **Comparative measurements with traffic noxes**

The comparative measurements with traffic noxes have been carried out in two stages.

In simultaneously testing, CALORIS station shown two-three times high level for CO.

These results are supposed to be from the different sampling procedures. From this reason, it was necessary to go to the serial testing, with serial link of apparatus.

Sampling has made using UPT apparatus pump. In this configuration, the devices shown the same results (CO ~ 2ppm)

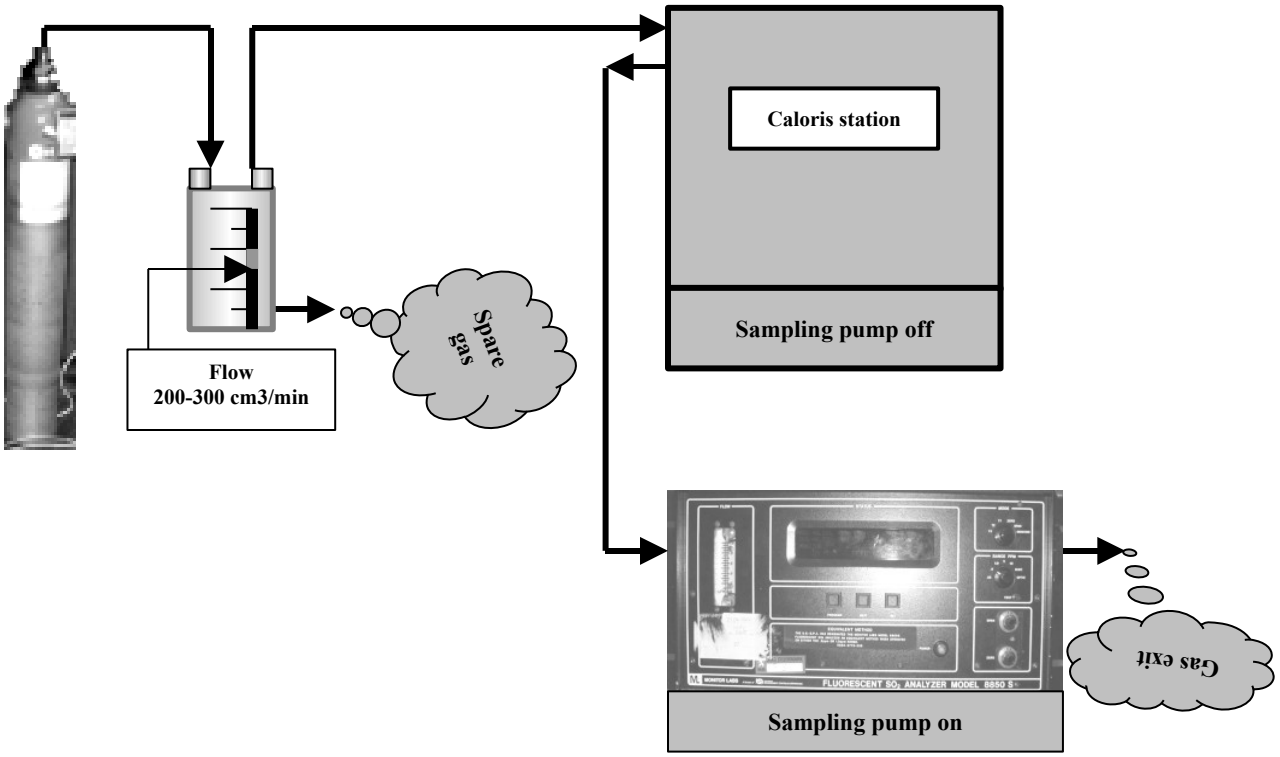

Fig. 3 Equipments scheme for comparative measurements

Conclusions:

Implementing this project will help decrease the local traffic-related pollution by deturning the traffic to other roads and though reducing both pedestrian exposure to vehicular pollution and the urban background pollution, in that area. Reducing the pollution level will lead to an improvement of air quality.

From this project will benefit all citizens through improving their quality of life and the sanitary authorities through decrease of societal costs of pollution-related diseases. Municipalities will also benefit from this project which will be a useful tool in the environmental and public health management and in developing short- and long-term environmental policy. The real users of this project are the civil society which can control the activities of the local authority for preventing environmental quality degradation and the peoples whose life quality will be increased.

References:

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User manuals for Monitor Labs NO and SO_2 analyzers and for Horiba CO analyzer.

Rezumatul lucrarii *"Cercetari privind dezvoltarea de noi tehnologii de monitorizare a calitatii aerului si impactul noxelor asupra sanatatii populatiei si mediului"*

Poluarea aerului de interior sau exterior reprezinta un factor de mediu cu impact semnificativ asupra sanatatii populatiei. In Romania, emisiile de noxe din trafic in zonele urbane reprezinta o sursa importanta de poluare a aerului si, prin urmare, o componenta de baza in activitatile de management privind imbunatatirea calitatii aerului.

Lucrarea de fata prezinta succint cateva activitati de implementare in Romania a noilor tehnologii de monitorizare a calitatii aerului, precum si evaluarea efectelor principalilor poluanti asupra sanatatii populatiei. Sunt prezentate, de asemenea rezultatele experimentale obtinute prin derularea unui proiect national de monitorizare a calitatii aerului – Statie de Monitorizare a Noxelor din Trafic – care furnizeaza date privind nivelul urmatorilor poluanti din trafic: CO, NO_2, SO_2 si O_3.

Tehnicile de modelare si simulare privind nivelul poluantilor din trafic, reprezinta o unealta de baza in sprijinul autoritatilor locale pentru adoptarea masurilor ce se impun si promovarea politicilor in asigurarea unui transport durabil si a unui mediu curat.