

Air Pollution: Concern, Monitoring and Interpretation

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Abstract: Air pollution is today a global concern for all nations, due to the rapid growth of the industrial sector and urban development, road and air traffic. A significant proportion of Europe's population live in areas, especially cities, where exceeding of air quality standards occurs. In order to create a coherent framework for ongoing air quality monitoring activities and ensure full comparability of data at European level, both in Romania and Bulgaria was transposed Directive 2008/50/CE on ambient air quality and cleaner air for Europe. During 21.03.2012 - 23.03.2012, a measurement campaign of air pollutants was performed in two locations from Romania-Bulgaria trans-border area, in order to assess air quality. The paper presents the experimental monitoring work and final conclusions are drawn for future work.

Key words: Air pollution, Air Quality, Environment, Monitoring, Legislation and interpretation

INTRODUCTION

Air pollution is a global environmental problem that represents a measure of the potential of the climate change rate influenced by local pollution sources, although its scale has a strong regional or local orientation. Improvements in technology supported by policy measures have lead to reduced pollution levels, but still, especially in new member states, more activity is needed. In developed countries advanced low pollution technique is applied in order to reduce the pollution levels. However, in developing countries the relatively high economic growth rates increase the incomes but also the global (regional or local) pollution level, and hence contribute as long range transported pollution to air quality problems in regions far away. Reaching the stringent AQ levels remains to be the challenge for all countries and especially for urban areas. This calls for an intensive cooperation between all cities, in developed or developing countries, in terms of research collaboration, technology transfer, knowledge exchange and dissemination [1].

In order to create a coherent framework for ongoing air quality monitoring activities and ensure full comparability of data at European level, both in Romania and Bulgaria was transposed Directive 2008/50/CE on ambient air quality and cleaner air for Europe [2], into Romanian Law no.104/15.06.2011 on environmental air quality (published in MO 452/28.06.2011)[3] and Clean Air Act and Ordinance No.12 of 15 July 2010 in Bulgaria[4]. During 21.03.2012 - 23.03.2012, a measurement campaign of air pollutants was performed on Romanian side of Danube, in order to assess air quality in cross border area.

EXPERIMENTAL WORK

The measurements were performed in two locations, 24 hours continuously in each of the measuring points, by NRDGT COMOTI with the mobile laboratory. This device is equipped with automatic analyzers for measuring concentrations of NO, NO₂, NO_x, CH₄, NMHC, THC, CO, SO₂ and O₃ in ambient air and meteorological parameters of interest: wind direction, wind speed, air temperature, relative humidity and atmospheric pressure.

Furthermore, measurements were performed for concentrations of particulate matter fraction PM 10, with a particle sampler designed according to the reference method.



Fig. 1: Monitoring locations

For monitoring of air pollutants and meteorological data, the mobile laboratory was placed in an industrial area (location 1) and in a non-industrial area (location 2).

Mobile laboratory belonging to INCDT COMOTI is equipped with analyzers for determination of air pollutants (NO , NO_2 , NO_x , SO_2 , CO , hydrocarbons, O_3), a device to determine the concentration of particulate matter - PM10 fraction, and equipment to determine meteorological parameters (wind speed and direction, atmospheric pressure, temperature and humidity) [5].

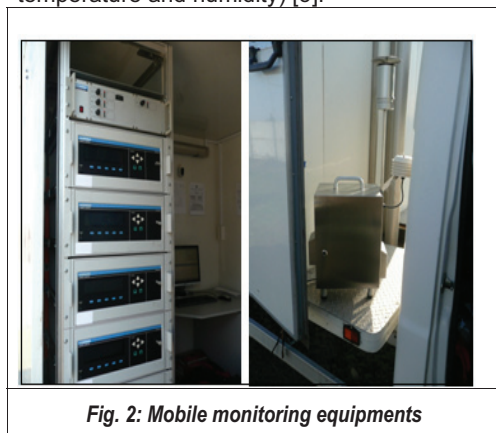


Fig. 2: Mobile monitoring equipments

The signals provided by analyzers and weather devices are stored and handled by a data acquisition and processing system which includes: calculation unit, interface, data logger and a modem that allows real time access from distance to system as well as the storage of data obtained from measurements.

The electric power supply of the mobile laboratory is achieved using the electrical existing network from the vicinity of location or using the electric generator Honda EP6500CXS.

Sampling of air is done through an sampling outlet with a height of 3.5 m, equipped with teflon sampling pipe.

The mobile laboratory is equipped with a pneumatically telescopic mast activated from inside, with a height of 10 m, mast on which are installed devices for meteorological parameters measuring.

In the mobile laboratory for air pollution control, are fitted all the analyzers, equipped with independent internal devices of sampling in dry condition that allows to reach high levels of sensitivity and accuracy of measurements:

- ✚ Analyzer for determination of nitrogen oxides concentration from atmosphere, APNA-360, is a detector of NO and NO_x by chemiluminescence;

- ✚ The analyzer for determination of sulfur dioxide concentration from atmosphere, APSA-360 measuring principle is the fluorescence, UV reference method;

- ✚ Analyzer for determination of carbon monoxide concentration from the APMA – 360 atmospheres, is measuring IR radiation absorbed by the polyatomic gases with asymmetric molecule;

- ✚ Analyzer for determination of the total hydrocarbons concentration (HCT), non-methane hydrocarbons (NMHC) and methane (CH_4) uses a combination of two principles: selective combustion and detection through ionization in flame to determine the

hydrocarbons concentrations;

✚ Analyzer for determination of ozone concentration from atmosphere works on base of UV radiation absorption principle, according to Beer-Lambert Law. The absorption of UV radiation with the wavelength of 254 nm which crosses the sample, is directly proportional to the ozone content in the sample;

✚ Sampler for determination of suspended particles concentration – PM10 fraction type LVS3 - Kleinfiltergerät (Sven Leckel)- is equipped with an impactor for sampling the fractions. The impactor is composed of 8 separate tubes designed for a flow of 2,3 m³/h, according to the reference method;

✚ Meteorological station automatically measures and records the evolution of meteorological parameters in the location area of mobile laboratory. The measured parameters are: wind direction, wind speed, temperature, atmospheric pressure and relative air humidity. The data are collected via a data logger device and transmitted to the computer of mobile laboratory.

RESULTS AND INTERPRETATION

The values continuous measured by analyzers, are averaged at 3 minutes and recorded in the computer.

The measurement results from the two locations were compared with the limit values set by Law 104/2011, to evaluate the pollution level.

In table 1 are presented the daily and hourly average concentrations variations from the two locations of cross border area.

Table 1: Measured data

Location	Averaging interval	NO	NOx	NO ₂	O ₃	CO	SO ₂	THC	CH ₄	NMHC
		µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	mg/m ³	mg/m ³	mg/m ³
Location 1	Hourly average	1.833-22.99	7.2-57.51	5.676-39.43	21.64-91.54	0.2476-0.6456	0.63-4.422	2.603-4.422	2.148-3.979	0.138-0.5417
	Daily average	10.172	32.949	85.511	56.219	0.385	1.81	3.009	2.651	0.357
Location 2	Hourly average	0.7997-5.528	6.051-22.5	4.523-19.02	11.64-97.26	0.261-0.6201	0.6612-6.496	2.682-9.849	2.019-2.738	0.2456-7.83
	Daily average	1.985	11.684	8.649	44.401	0.351	2.159	3.189	2.512	0.676

The diagrams below show hourly average concentrations variations from the two locations.

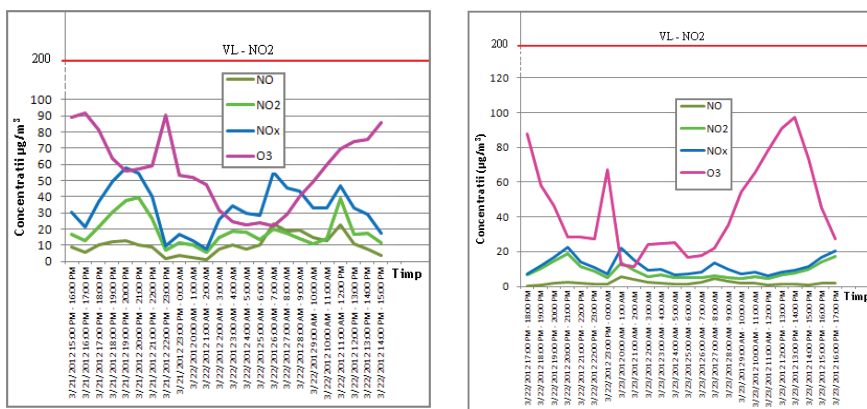


Fig. 3: Hourly average concentration variations of NO₂ and O₃ in Locations 1 and 2

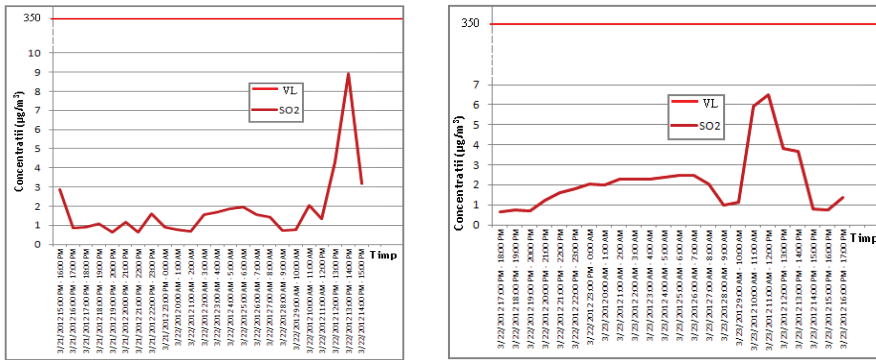


Fig. 4: Hourly average concentration variations of SO₂ in Locations 1 and 2

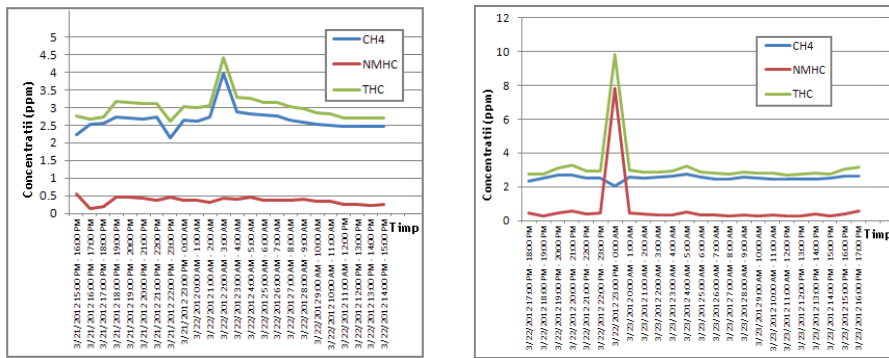


Fig. 5: The hourly average concentration variations of THC in Locations 1 and 2

Analyzing the hourly average concentration values obtained from measurements we can see that even the values from Location 1 are significantly higher, being an industrial area, these are below the limit specified by Law 104/2011[5], for all pollutants, in both locations.

For the particulate matter, fraction PM 10 samplings were performed in both locations. The measurements results are presented in Table 2 and in Figure 6, where we can notice the PM 10 values from both locations are below the limit imposed by Law 104/2011.

Table 2: PM 10 measured data

Location	Sampling period	PM10 (µg/ m ³)
Location 1	21.03.2012- 22.03.2012	38
Location 2	22.03.2012- 23.03.2012	31
VL 24h, according Law 104/2011		50 µg/ m ³ , do not exceed more than 35 times/year

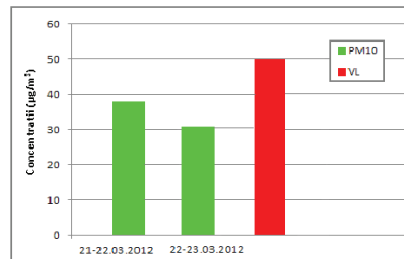


Fig. 6 The daily average concentration variations for fraction

CONCLUSIONS AND FUTURE WORK

Air pollution is and continues to be a global concern. Therefore, the governments around the world are involved in managing air quality in their countries for the welfare of their citizens. The management of air pollution involves understanding air pollution sources, monitoring of contaminants, modelling air quality, performing laboratory experiments, the use of satellite images for quantifying air quality levels, indoor air pollution, and elimination of contaminants through control. Research activities are being performed on every aspect of air pollution throughout the world in order to respond to public concerns.

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The paper is reviewed.