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MONITORING AIR QUALITY NETWORKS IN ROMANIA AND BULGARIA

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Abstract:

Air pollution has many and significant adverse effects on people health and may cause damages to flora and fauna, in general. That is why a special attention is paid to the activity of air quality surveillance and improvement. In Romania, the National Agency for Environment Protection (NAEP) is the specialized institution of the central public administration, found under the subordination of the Ministry of Environment and Forest, with competences in implementing the policies and legislation in the field of environment protection. In Bulgaria, under the direct coordination of the Ministry of Environment and Water from Bulgaria, the Executive Agency for Environment from Sofia operates, agency which has as main functions the management, coordination and information on the environmental protection. In the paper, the structure of the National Network for Monitoring the Air Quality in Romania and the structure of the National Network for Real Time Transmission of the Information on Air Quality from Bulgaria are presented. The monitoring stations located in the Romania-Bulgaria cross-border area, which transmit data on air quality the environment authorities from the two countries, are also presented.

Key words: air quality, network, monitoring, stations.

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1. INTRODUCTION

Air is the environmental factor which represents the fastest support favoring the pollutant transportation in environment. Air pollution has many and significant adverse effects on people health and may cause damages to flora and fauna, in general. For these reasons, a special attention is given to the activities of surveying and improving the air quality.

Air pollution has often cross-border effects - "suffering" is no more the characteristics of only one country, but also of the neighboring ones. So the neighboring countries need joint action plans for assuring the environment protection.

2. MONITORING AIR QUALITY NETWORK IN ROMANIA

The responsibility for monitoring the ambient air quality in Romania belongs to the authorities for environment protection, according to the provisions of the Law no.104/2011 related to ambient air quality.

National Agency for Environment Protection (NAEP) is the specialized institution of the central public administration, under the subordination of the Ministry of Environment and Forests, with competences in implementing the policies and legislation in the field of environment protection assigned on the basis of the Government Decision no. 918/30.08.2010 regarding the re-organization and operation of the National Agency for Environment Protection and of the public institutions which under its subordination.

NAEP is designed to act for assuring a healthy environment to the population, harmonized with the economic development and social progress of Romania. The mission of the national agency, like that of the 8 regional agencies and the 34 county agencies which are under its direct subordination, is to assure a better environment in Romania for the present and future generations, and the achievement of some major and continuous improvements of air, soil and water quality.

The National System for Assessment and Integrated Management of Air Quality (NSAIMAQ) under the NAEP coordination, provides the organizational, institutional and legal framework of cooperation between the public authorities and institutions, with competences in the field, for unitarily assessing and managing the ambient air quality on the whole territory of Romania, also for informing the population and European and international bodies on the ambient air quality.

The National System for Assessment and Integrated Management of Air Quality includes:

- National System for Monitoring the Air Quality (NSMAQ)
- National System for the Inventory of Atmospheric Pollutant Emissions (NSIAPE).

The information supplied by the two subsystems NSMAQ and NSIAPE are integrated by the Center for Assessing the Air Quality) (CAAQ) in accordance with the national and international requirements in the field of assessing and managing the air quality.

NSMAQ assures the monitoring of the ambient air quality by the National Network for Monitoring the Air Quality (NNMAQ), objective of national public interest, under the administration of the Central Public Authority for Environment Protection.

The monitored pollutants, measurement methods, limit values, alert and informing thresholds and criteria for locating the monitoring points are set by the national legislation on atmosphere protection and are in accordance with the requirements provided the European regulations.

The monitoring system allows the local authorities for environment protection to:

- assess, know and inform permanently the public, other interested authorities and institutions on the air quality level;
- take in time prompt measures for mitigating and/or removing the pollution episodes, or measures in case of emergencies;
- prevent accidental pollutions;
- warn and protect population in case of emergencies.

At present there are 142 stations for monitoring continuously the air quality in Romania, fitted with automatic equipment for measuring the concentrations of the main atmospheric pollutants:

- 24 stations of traffic type;
- 57 stations of industrial type;
- 37 stations of urban background type;
- 15 stations of suburban background type;
- 6 stations of regional type;
- 3 stations of EMEP type.

The main monitored atmospheric pollutants for which continuous measurements are performed are: sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O₃), suspended particulate matters (PM 10 and PM 2.5), benzene (C₆H₆) and lead (Pb). Air quality in each station is represented by suggestive quality indicators, set on the basis of the concentrations of the main measured atmospheric pollutants.

A monitoring station supplies air quality data which are representative for certain area around the station. The area within which the concentration does not differ from the concentration measured in station by more than a “specific amount” (+/- 20%) is called “representativeness area”.

Station of traffic type

- assesses the traffic influence on air quality;
- radius of the representativeness area is 10-100m;
- monitored pollutants are sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O₃), volatile organic compounds (VOC) and suspended particulate matter (PM 10 and PM 2.5).

Station of industrial type

- assesses the industrial activities influence on air quality;
- radius of the representativeness area is 100m-1km;
- monitored pollutants are sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O₃), volatile organic compounds (VOC) and suspended particulate matter (PM 10 and PM 2.5) and meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

Station of urban type

- assesses the influence of “settlements” on air quality;
- radius of the representativeness area is 1-5 km;
- monitored pollutants are sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O₃), volatile organic compounds (VOC) and suspended particulate matter (PM 10 and PM 2.5) and meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

Station of suburban type

- assesses the influence of “settlements” on air quality;
- radius of the representativeness area is 1-5 km;
- monitored pollutants are sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O₃), volatile organic compounds (VOC) and suspended particulate matter (PM 10 and PM 2.5) and meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

Station of regional type

- is the reference station for assessing the air quality;
- radius of the representativeness area is 200-500km;
- monitored pollutants are sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O₃), volatile organic compounds (VOC) and suspended particulate matter (PM 10 and PM 2.5) and meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

Station of EMEP type

- monitors and assesses the pollution air within the cross-border context on long distances;
- the stations are located in mountain zones, at average altitude: Fundata, Semenice and Poiana Stampei;
- monitored pollutants are sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O₃), volatile organic compounds (VOC) and suspended particulate matter (PM 10

and PM 2.5) and meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

2.1 DATA CIRCUIT

Information on air quality coming from the 142 monitoring stations and the meteorological data received from the 119 monitoring stations are transmitted to the Local Centers of the 41 Agencies for Environment Protection.

The national network for monitoring the air quality centralizes at present the data from the 142 stations spread on the whole Romanian territory. The stations are ascribed to the 41 Local Centers, located in the County Agencies for Environment Protection.

The values measured on-line by the sensors of the analyzers installed within the stations are transmitted through GPRS to the local centers. These are interconnected, forming a network which contains also the central servers, where all the data arrive and from where they are made known in real time to the public, by means of the site www.calitateaer.ro, public displaying panels located in big cities and also by the informing points placed in city halls. After the primary validation within the Local Centers, data are transmitted for certification to the National Reference Laboratory for Air Quality (NRLAQ) within the framework of the national Agency for Environment Protection.

For informing as promptly as possible the public, the presented data are those ones transmitted on-line by the sensors of the analyzers from stations (raw data). So, the values must be considered provided that they are in fact only automatically validated (by software), following to be manually validated by the specialists at local centers, and subsequently to be centrally certified.

The central database stores and archives both raw data and the valid and certified ones. The specialists access these data both for different studies and for transmitting the Romania reports to the European forums.

Data on air quality coming from stations are presented to the public by means of some outdoor panel (conventionally located in the densely populated zones of the cities) and by means of some indoor panels (located in city halls).

At national level, there are 107 points for informing the public (48 outdoor panel and 59 indoor panels).

On the border with Bulgaria there are located 29 stations for monitoring the air quality:

Table 1. Stations for monitoring the air quality located in Romania, in the counties situated in the Romania- Bulgaria cross-border area

Name of the Environment Agency	Number of stations for monitoring the air quality
County Agency for Environment Protection Mehedinti	1
County Agency for Environment Protection Dolj	5
County Agency for Environment Protection Ilt	1
County Agency for Environment Protection Teleorman	5 (3 type DOAS)
County Agency for Environment Protection Giurgiu	6 (2 type DOAS)
County Agency for Environment Protection Calarasi	4 (2 type DOAS)
County Agency for Environment Protection Constanta	7

Within the project “Joint Risk Monitoring during Emergency in the Danube Area Border” during 2012, there were drawn up data centralizers regarding the equipments from the endowment of all the above stations.

3. MONITORING AIR QUALITY NETWORK IN BULGARIA

Under the direct coordination of the Ministry of Environment and Water from Bulgaria the Executive Agency for Environment from Sofia operates, agency which has as main functions the management, coordination and information on the environment protection in Bulgaria.

The agency is the National Reference Center within the European Environment Agency and at the same time it is a member of the European Network of the Heads of Environment Protection Agencies (EPA Network). The European Network of the Heads of Environment Protection Agencies brings together the leaders of the environment protection agencies and of the similar bodies from Europe and, essentially, represents a working group which exchanges information regarding the points of view and experiences in problems of common interest related to implementing the environmental policies in the everyday life.

The Executive Agency for Environment establishes the architecture and coordinates the National System for Environmental Monitoring, with a view to getting information and monitoring all the factors which influence the environment throughout Bulgaria.

The National System for Environment Monitoring from Bulgaria is founded and operates in accordance with Article 1, point 7 of the Law regarding Environment Protection. The system offers reliable and in time information regarding the quality of air and influence factors. On the basis of this information, analyses, evaluations and prognoses are achieved; these are the starting point for the activities of preserving and protecting the environment against harmful factors.

The Ministry of Environment and Water in Bulgaria manages the National System for Environment Monitoring, by mean of the Executive Agency for Environment. Everything that means assurance and management of material and technical resources, methodologies and software, necessary to the operation and development of the national system for environment monitoring are responsibilities of the Executive Agency for Environment. All the measurements on environment quality, also the findings got after the measurements analysis, are performed by the structures of the Executive Agency for Environment. The unitary methods used for preparing, sampling and analyzing the samples are in accordance with the procedures, assuring the quality of data and measurements. All the laboratories within the Agency are accredited according to EN ISO/IEC 17025:2005- General requirements for the competences of the testing and calibration laboratories.

The databases at regional and national level are structured per components depending on the field they are referring to, using a common terminology.

The assessments of the environment components and the data reporting at national level are the Agency's responsibilities, while the assessments at regional level are achieved by the Regional Inspectorates for Environment and Water Management.

A distinct field is the assessment and reporting of the data referring to the water resources at the level of the hydrographic basins, field which is under the jurisdiction of the 4 Directorates for hydrographic basins.

The Regional Inspectorates for Environment and Water Management and the Directorates for hydrographic basins are structures subordinated to the Ministry of Environment and Water.

The Regional Inspectorates for Environment and Water Management have been established as authorities that represent the Ministry of Environment and Water at regional level and they are the role to lead the policy for environment protection in the districts found under their jurisdiction. At the same time, they cooperate with the municipalities in developing the action plans for implementing the environment policies.

The National system for Environment Monitoring is organized in accordance with chapter 8 from the Law on Environment Protection and includes the national monitoring networks for:

- air;
- water;
- lands and soil;
- forests and protected areas;
- biodiversity;
- noise and radioactivity

The information and control systems related to the emissions of hazardous substances in air, water contamination, waste and protection of natural deposits are also included in the National System for Environment Monitoring.

An important part of the National System for Environment Monitoring from Bulgaria is the National System for Monitoring the Air Quality which, at present, is composed of a network of 53 fixed stations. The 53 fixed stations are as follows:

- 14 unconventional automatic stations;
- 9 automatic stations - method DOAS;
- 26 manual stations - manual sampling and chemical analyzes;
- 4 automatic background stations.

The automatic stations operate continuously, and data are collected in the databases at local and national level through the National Network for Real Time Transmission of the Information on Air Quality. Data received from stations are under a preliminary form, and the validated final form is published in the Yearly Report on Environment.

Among the 53 fixed stations with form the National System for Monitoring the Air Quality, 10 stations are in the districts from the Romanian border.

Table 2. *Stations for monitoring the air quality located in Bulgaria, in the districts from the Bulgaria Romania cross-border area*

Name of the Regional Inspectorate for Environment and Water	Number of stations for monitoring the air quality	Number of measurement points
Regional Inspectorate for Environment and Water Montana	1	1
Regional Inspectorate for Environment and Water Vratsa	1	1
Regional Inspectorate for Environment and Water Pleven	2 (1 type DOAS)	-
Regional Inspectorate for Environment and Water Veliko Turnovo	2 (1 type DOAS)	1
Regional Inspectorate for Environment and Water Ruse	3 (2 type DOAS)	-
Regional Inspectorate for Environment and Water Varna	1	-

Information related to a number of 6 stations, listed in the following, are updated at the level of 2011, as a result of the travels of the team members of the project “Joint Risk Monitoring during Emergency in the Danube Area Border”, at the site of each stations:

- Automatic Station “ZHP Gara” - Vratsa District - Regional Inspectorate for Environment and Water Vratsa;
- Automatic Station “Pleven” - Pleven District - Regional Inspectorate for Environment and Water Pleven;
- Automatic Station “Gorna Oreahovitsa” - Veliko Tarnovo District - Regional Inspectorate for Environment and Water Veliko Tarnovo;
- Automatic Station “Vazrazhdane” - Ruse District - Regional Inspectorate for Environment and Water Ruse;
- Automatic Station “Jiti” - Ruse District - Regional Inspectorate for Environment and Water Ruse;
- Automatic Station “Dobrich” - Dobrich District - Regional Inspectorate for Environment and Water Varna;

The data on the location of the above mentioned stations, the operating state also the equipment from the endowment or any other technical information are widely presented in the study “Assessment of the situation existing within the Romania - Bulgaria cross border region in the field of air quality monitoring” achieved within the project.

4. MONITORING AIR QUALITY NETWORK IN ROMANIA-BULGARIA CROSS BORDER AREA

In November 2002, the project “Joint system for monitoring the air quality in the cities from the Romanian - Bulgarian Lower Danube border”, funded through the programme PHARE CBC RO/BG 1999. Within this project, automatic stations for monitoring the air quality in 4 cross-border areas have been located. Each area has in its structure a city from Romania and a corresponding city from Bulgaria. The stations have been located as follows:

Table 3. Stations for monitoring the air quality located in Bulgaria - Romania cross-border area within the PHARE CBC RO/BG Programme

Romania		Bulgaria	
City name	Number of stations for monitoring the air quality	City name	Number of stations for monitoring the air quality
Calarasi	2	Silistra	2
Zimnicea	1	Svistov	1
Turnu Magurele	2	Nikopol	1
Giurgiu	2	Ruse	3

The network for monitoring the air quality at the Romania Bulgaria border has acquired the values of the concentrations of pollutants from the 14 measurement stations located along both banks of Danube.

The pollutant concentrations and the measured meteorological data have been transmitted to the local servers from the headquarters of the Environmental Agencies from the cross-border area and then they have been processed and reached the national monitoring system of each country. Subsequently, all the data acquired from the measurement stations are concentrated in a Regional Data Center. The Executive Agency for Environment from Sofia is the Regional Data Center for Bulgaria, and APM Giurgiu is the Regional Data Center for Romania. The Regional Data Centers (RDC) transmit regularly the monitored data to the Environment Ministries from Bulgaria and Romania.

At present, only the following stations from the Romania-Bulgaria cross-border network are still operating:

- In Romania: 2 stations - Calarasi County
2 stations - Giurgiu County
- In Bulgaria: 2 stations - Ruse District
1 station - Veliko Turnovo District
1 station - Pleven District

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