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„Joint Risk Monitoring during Emergencies in the Danube Area Border“

New Air Quality Monitoring Network in the Danube Cross-Border Area

Summary

ROMANIA - BULGARIA
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New Air Quality Monitoring Network in the Danube Cross-Border Area
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CHAPTER 1

NEW AIR QUALITY MONITORING STATIONS IN THE DANUBE CROSS-BORDER AREA - LOCATIONS AND MONITORED INDICATORS

1.1. Major sources of emissions

1.1.1. Emission inventory for major sources with significant potential cross-border impact from Romania-Bulgaria cross-border area

A series of economic operators having emission sources have been selected both on Romanian and Bulgarian territory; they meet two criteria:

- Their geographical position is within a territory that extends up to a distance of 35 km, on each side of the Danube, along the Romanian- Bulgarian border
- They are major emission sources for certain pollutants, which are generic or specific for some activity categories

Table 1.1.1 contains for each county the number of inventoried economic operators together with the number of point sources – related chimneys.

Table 1.1.1. *Number of inventoried economic operators and related point sources, from Romania and Bulgaria*

Number of operators					
Romania			Bulgaria		
County	Number of operators	Number of point sources	Region	Number of operators	Number of point sources
Calarasi	14	27	Pleven	4	41
Dolj	1	2	Razgrad	1	26
Giurgiu	14	23	Ruse	14	39
Teleorman	7	74	Silistra	3	5
			Veliko Tarnovo	5	51
			Vidin	1	1
Total	**36**	**126**	**Total**	**28**	**163**

The analysis of the emission distribution from the inventory for the Romanian territory per activity categories, according to NFR classification, emphasizes for each pollutant/group of pollutants the main activity generating atmospheric emissions. So, for the main pollutants:

Table 1.1.2. *The main activity generating atmospheric emissions*

The main pollutants	The main activity generating atmospheric emissions	
	Romania	**Bulgaria**
NO_x, SO_2, CO	- fuel combustion in stationary sources for generating energy - the main source - the chemical sector is the main source of NO_x being represented by the high capacity plant SC Donau Chem SRL, Teleorman county (the major emissions coming from the procedure for getting ammonia by steam reforming of natural gas and from nitric acid production)	-fuel combustion in stationary sources from energy sector - the main source - the large thermal power plants is the main source of SO_2 by using mainly the solid fuels - the minerals industry - units for manufacturing of ceramic products by firing.
PM_{10}	- chemical industry and activities of livestock (surface sources) - minerals industry - combustion sources	- the energy sector and minerals industry is the main sources - the livestock activities (surface sources)
VOC_{nm}	- manufacturing industry and paint application	- manufacturing industry
NH_3	- the livestock and manure management activities (surface sources) - the manufacture of chemical fertilizers (SC Donau Chem SRL)	- the livestock and manure management activities (surface sources) - the municipal solid waste landfill
Metals	- metals industry, especially - the combustion sources	- only emissions from fuel combustion in energy sector and minerals industry could be inventoried

In Figure 1.1.1 it is presented the spatial distribution for the location of emission sources belonging to the selected economic operators on Romanian and Bulgarian territory.

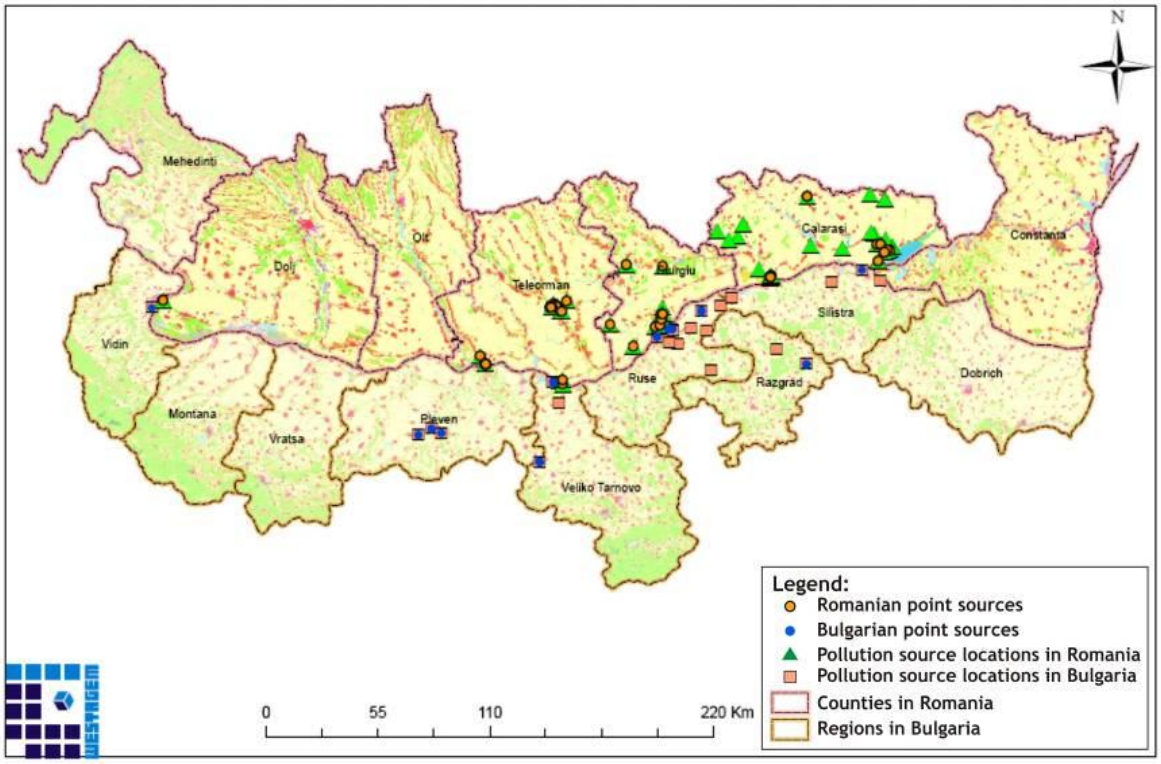


Figure 1.1. *Spatial distribution for the location of emission sources, Romania and Bulgaria*

For assessing the air quality in the Romania-Bulgaria border area by modeling the pollutant dispersion in accordance with the European legislation, two specific fundamental activities have been performed:

- **Achievement of the inventories for pollutant emission** in atmosphere in the Romania-Bulgaria border area, for the major sources with potential cross-border impact
- **Assessment of the impact of these sources on air quality**, by modeling the pollutant dispersion in the area of interest.

1.2.Emission inventories

1.2.1. Methodology of approach

The emission inventories were achieved for the major polluting sources with significant cross-border impact. So, the inventory action was focused on the fixed industrial emission sources, especially on the directed ones.

Ammonia (NH_3) is a pollutant specific to the analysis area for which it was possible to include all the major emission sources on Romanian and Bulgarian territory, both directed sources belonging especially to the operators from chemical industry and also diffuse/fugitive sources associated to the livestock farms or municipal landfills.

So, it was performed the inventory for the emissions generated by the activity of 36 economic operators from Romanian territory and 28 economic operators from Bulgarian territory.

The common pollutants included in the emission inventories achieved both for Romanian and Bulgarian territory are: nitrogen oxides (NO_x), sulphur oxides – expressed as SO_2, particulate matter – fractions PM_{10} and $PM_{2.5}$, carbon monoxide (CO), non-methane volatile organic compounds (VOC_{nm}), ammonia (NH_3), lead (Pb), arsenic (As), cadmium (Cd), mercury (Hg), nickel (Ni).

1.2.2. Emission inventories for major sources with potential cross-border impact from Romania-Bulgaria cross-border area

The emission inventories were extracted from the global inventory achieved for the entire cross-border area. There were choosed 5 analysis areas, each with 60 km x 60 km, around the main urban surfaces from the Romanian-Bulgarian border (containing the main towns on either side of the border) where the major emission sources with cross-border impact in the area of interest are concentrated:

- Calafat– Vidin area
- Giurgiu – Ruse area
- Turnu Măgurele – Nikopol area
- Zimnicea – Svishtov area
- Călăraşi – Silistra area.

Table 1.2.1 contains, for each of the 5 analyzed areas, the number of inventoried economic operators, together with the number of point sources- related chimneys.

Table 1.2.1. *Number of inventoried economic operators and related point sources, for each analyzed area*

Analyzed area	Country	Number of operators	Number of point sources	The main pollutants
0	1	2	3	4
Calafat - Vidin	Bulgaria	1	1	- **NO_x** - highest values - **SO_2** - highest values
	Romania	1	2	
Calarasi - Silistra	Bulgaria	3	3	- **NH_3** - highest values
	Romania	11	17	
Giurgiu - Ruse	Bulgaria	12	25	- **NH_3** - significant values - **VOC_{nm}** - highest values
	Romania	18	30	
Zimnicea – Svishtov	Bulgaria	5	49	
	Romania	9	76	
Turnu Magurele – Nikopol	Bulgaria	8	83	- **NH_3** - highest values - **PM_{10}** - highest values
	Romania	7	74	

Table 1.2.2 presents the total emissions both on Romanian and Bulgarian territory, divided per point sources (chimneys) and per sources with relatively large spatial extension and low heights, which could be defined as surface sources.

Table 1.2.2. *Emission distribution per categories of emission sources: point sources and surface sources on Romanian and Bulgarian territory, respectively*

Pollutant	Unit of measurement for emission	Romania		Bulgaria	
		Point sources	Surface sources	Point sources	Surface sources
NO_x	tons/year	2188.96	1.16	16455.63	6.11
VOC_{nm}	tons/year	257.37	48.97	223.92	4.67
SO_2	tons/year	263.58	8.30×10^{-3}	20476.87	23.00
$PM_{2.5}$	tons/year	379.57	110.43	1519.64	9.56
PM_{10}	tons/year	938.78	812.98	3090.64	58.38
CO	tons/year	1018.78	0.42	1560.92	1.66
NH_3	tons/year	3290.25	3702.55	0.00	1008.13
Pb	kg/ year	31.62	3.32×10^{-3}	4.34	
Cd	kg/ year	5.88	8.30×10^{-3}	0.29	
Hg	kg/ year	20.79	3.32×10^{-3}	0.62	
As	kg/ year	10.44	1.49×10^{-3}	2.55	
Cr	kg/ year	10.02	1.16×10^{-2}	1.32	
Cu	kg/ year	6.48	6.64×10^{-3}	0.04	
Ni	kg/ year	121.29	1.66×10^{-2}	2.18	
Se	kg/ year	1.16	1.66×10^{-4}	6.22	
Zn	kg/ year	171.27	0.23	0.84	
NO	tons/year		16.26	0.00	1.97

Air quality assessment in the Romanian–Bulgarian border area by dispersion modeling has implied a joint approach and unitary results for the territories of the two states as regards the development of the emission inventories used in modeling, also the definition of the geographical areas of analysis.

The dispersion modeling was achieved for all common pollutants included both in the emission inventories made for Romanian territory and for Bulgarian territory, namely: nitrogen oxides (NO_x), sulphur oxides – expressed as SO_2, particulate matter – fractions PM_{10} and $PM_{2.5}$, carbon monoxide (CO), non-methane volatile organic compounds (VOC_{nm}), ammonia (NH_3), lead (Pb), arsenic (As), cadmium (Cd), mercury (Hg), nickel (Ni).

For assessing the impact of the emission sources analyzed in relation to the European norms for air quality, the results of modeling were compared with the limit values, target values or, as the case may be, with the critical levels provided in:

-Directive 2008/50/EC regarding the ambient air quality and a cleaner air for Europe (for sulphur dioxide, nitrogen dioxide and nitrogen oxides, particulate matter (PM_{10} and $PM_{2.5}$), carbon and lead monoxide), and with target values from:

- Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (for arsenic, cadmium and nickel).

In case of ammonia, specific pollutant non-regulated through European directives, the modeling results were reported to the common limit values. These limit values are presented in the Table from below.

Table 1.2.3. *Limit values of Ammonia (NH_3)*

Pollutant	Chemical formula	Limit value per 1 h (µg/m^3)	Limit value per 24 h (µg/m^3)
Ammonia	NH_3	250	100

Pollutant dispersion modeling in order to achieve the purposes of this study implies certain specific aspects that led to the selection of the used model:

- complexity of meteorological conditions from the Romanian-Bulgarian border area, characterized by the presence of some local effects induced by the Danube corridor, also by the "high frequency of temperate-oceanic air advections from west and north-west, especially in the cold semester, and the frequency of temperate-continental air advection from north-east and east, plus the less

frequent penetrations of arctic air from north, of tropical –maritime air from south-west and south, also of continental air from south-east and south" ;

- complexity of the land from the studied area;
- model capability to operate at many spatial scales:
    - regional scale – for including into the dispersion analysis the effects of the transport from emission sources located at long distances from the local areas of interest, by modeling the meteorological phenomena taking place at this scale, which allow performing the calculations for pollutant dispersion in an inhomogeneous and non-stationary wind field;
    - local scale – for including the effects induced by the complex land and for delimitating with sufficiently high accuracy the areas where the concentrations of the analyzed pollutants reach important values in relation to limit values, target values or, as the case may be, critical values.

In order to comply with these technical rigors for modeling the pollutant dispersion, a numeric Euler model developed by CSIRO Australia was used.

Input data

The meteorological data used as input data for the model are supplied by a synoptic scale analysis pattern (LAPS) and consist in data modeled at intervals of six hours in a longitude/latitude geographic network with 0.75 degree resolution (about 75 km) covering the Northern Hemisphere.

The land data are supplied by US Geological Survey, Earth Resources Observation Systems (EROS) Data Centre Distributed Active Archive Centre (EDC DAAC) with a latitude resolution of 30 seconds (about 1 km).

US Geological Survey supplies also, with the same resolution, the data about territory use.

The other categories of input data which have been used include: data related to emission sources – geographical location (geographic coordinates of emission sources), height of sources, top inner diameter for point sources – chimneys; emission data – mass flow rate of pollutants, gas exhaust temperature and speed for point sources, time variation of emissions and data related to the calculation cell grids.

The dispersion calculations have been performed by running the model in "nest" mode, using for each of the 5 studied areas, 4 successive calculation grids with

the following dimensions:

- 400 km x 400 km – resolution of 5000 m;
- 200 km x 200 km – resolution of 2500 m;
- 60 km x 60 km – resolution of 750 m;
- 20 km x 20 km – resolution of 250 m.

Output data

The output data are the concentration fields inside the cells of the defined calculation grids. TAPM generates in all the cells of the calculation grids the hourly average concentrations, averages per 8 hours, daily averages, also yearly averages, percentiles and other important statistical values in air quality assessment.

The concentration fields have been extracted from the calculation grids with the resolution of 750 m and 250 m and interpolated by specific GIS methods.

Each of the Figures from **Annexes A-E** contains three pollution maps, on which the spatial distributions of the pollutant concentrations NH_3 and SO_2 got by modeling are represented, at respiratory level (1.5 m above the ground), at local scale (on the spatial domain occupied by the calculation grid of 30 km x 30 km, with resolution of 250 m) and at regional scale (on the spatial domain occupied by the calculation grid of 60 km x 60 km, with resolution of 750 m).

1.2.3. Result analysis

For each of the 5 areas where the dispersion modeling was performed: Calafat – Vidin, Giurgiu – Ruse, Turnu Măgurele – Nikopol, Zimnicea – Svishtov and Călăraşi – Silistra, separately for the territory of Romanian State and the territory of Bulgarian State, the maximum values of the analyzed pollutant concentrations got by modeling, within the inhabited areas contained in the calculation grid with the dimensions of 20 km x 20 km and resolution of 250 m.

Table 1.2.4. *Analysis of results*

Area	Polu-ttants	Maximum hourly concentration		Maximum daily concentration		Average yearly concentration		Observations
		RO	BG	RO	BG	RO	BG	
Calafat - Vidin	NH_3	-	-	-	-	-	-	-No operators performing activities that imply significant ammonia emissions which should be included in emission inventories have been recorded.
	NO_2	37% of the limit value	<41% of the limit value	-	-	2.31 µg/m^3	1.61 µg/m^3	-Max.values of the concentrations are below the limit values or below the corresponding critical levels for all the averaging periods. -Max.values of NO_2 concentrations are recorded in the area of emission sources located at a distance of 5 km in the south of Vidin locality; the cross-border impact is significant, values of the max.hourly concentrations of up to 37% of the corresponding limit value could be reached.
	NO_x	-	-	-	-	3.47 µg/m^3	2.42 µg/m^3	
	SO_2	44% of the limit value	49% of the limit value	42.48 µg/m^3	39.5 µg/m^3	24% of the limit value	17% of the limit value	-Max.values of concentrations are below the limit values or below the corresponding critical levels for all the averaging periods. -Max.values of concentrations are recorded in the area of emission sources; the cross-border impact is significant, values of the average yearly concentrations of maximum 49% of the corresponding limit value are reached.
	CO	-	-	-	-	-	-	-Max.values of the concentrations are below the corresponding limit values (10,000 µg/m^3) for all the averaging periods. -Max.values of concentrations are recorded in the area of emission sources; the impact is strictly local, concentration values below 0.2% of the corresponding limit value are recorded in the inhabited areas from the closest localities - Calafat and Dunavts.
	PM	-	-	-	-	-	-	-Max.values of the concentrations are below the corresponding limit values for all the averaging periods. -Concentration values – both the max.daily and the average yearly ones recorded represent a percentage of up to 1.5% of the corresponding limit value. -The cross-border impact is insignificant; the concentration values -

Area	Polu-ttants	Maximum hourly concentration		Maximum daily concentration		Average yearly concentration		Observations
		RO	BG	RO	BG	RO	BG	
								both the max.daily and the average yearly ones – recorded within the analyzed localities which are the closest to the emission sources, represent a percentage of up to 1.5% of the corresponding limit values.
	Metals	-	-	-	-	-	-	-Max.values of the concentrations are below the limit values or below the corresponding target values for all the averaging periods. -Max.values of concentrations are recorded in the area of emission sources; the impact is strictly local, concentration values below 7% of the limit value/corresponding target values are recorded in the inhabited areas of the localities from the vicinity of emission sources.
Calarasi - Silistra	NH_3	7105 $\mu g/m^3$	140 $\mu g/m^3$	2759 $\mu g/m^3$	19 $\mu g/m^3$	-	-	-Max. values of the concentrations are below the corresponding limit values for all the averaging periods on Bulgarian territory, while on Romanian territory exceedances of the limit values are recorded both in case of the maximum hourly concentration and maximum daily concentration. -The impact is almost exclusively due to the high capacity livestock farms from Călărași county. Because of the estimation of the emissions from the livestock and manure management activities by using some emission factors of approach level 1, the modeling results may be affected by high uncertainties, which generally are associated to such factors. -The cross-border impact is significant; values of the max.hourly concentrations in the inhabited areas from Silistra locality of up to 56% from the corresponding limit value (on an averaging interval of one hour) may be recorded.
	NO_2	<6.5% of the limit value	4.9% of the limit value	-	-	3.13 $\mu g/m^3$	0.25 $\mu g/m^3$	-Max.values of concentrations from the analyzed area are below the limit values orbelow the corresponding critical levels for all the averaging periods. -Max.values of concentrations are recorded in the area of the main emission sources (thermal power plants of Romanian farms and the veneer mill located near Silistra on Bulgarian territory); -The cross-border impact of these sources in the inhabited areas is insignificant, values of the average yearly concentrations of 7.8% of the corresponding limit value being recorded in the inhabited area of
	NO_x	-	-	-	-	4.7 $\mu g/m^3$	0.38 $\mu g/m^3$	

Area	Polu-ttants	Maximum hourly concentration		Maximum daily concentration		Average yearly concentration		Observations
		RO	BG	RO	BG	RO	BG	
								Călărași and Aydemir.
	SO_2	<1.5% of the limit value	0,3% of the limit value	2 µg/m^3	0.4 µg/m^3	2.56% of the criti-cal level	-	-Max.values of concentrations from the analyzed area are below the limit values or below the corresponding critical levels for all the averaging periods. -Max.values of concentrations are recorded in the area of the main emission sources; the cross-border impact is insignificant, values of the average yearly concentrations of 0.13% of the corresponding limit value being recorded in Silistra locality.
	CO	-	-	-	-	-	-	-Max.values of the concentrations inside the localities are much below the corresponding limit values (10,000 µg/m^3), for all the averaging periods. -Max.values of concentrations are recorded in the area of the main emission sources; the impact is strictly local, concentration values less than 0.6% of the corresponding limit value being recorded in the inhabited areas from Silistra locality.
	PM	-	-	31 µg/m^3 (62%) of the limit value	0.3% of the limit value	20 µg/m^3 (50% of the limit value)	0.1% of the limit value	-Max.values of concentrations are below the corresponding limit values for all the averaging periods. -The highest values of the concentrations are recorded in the areas where the livestock farms from Călăraşi County are located. -The cross-border impact of these sources is an insignificant one; values of the average yearly concentration below 0.12% of the limit values are recorded in the inhabited areas of Silistra locality
	Metals	-	-	-	-	-	-	-Max.values of the concentrations are below 6% of the limit values or below the corresponding target values for all the averaging periods. -Max. values of concentrations are recorded in the area of emission sources (located on the outskirts of Călăraşi town), the cross-border impact being an insignificant one.
Giurgiu - Ruse	NH_3	85.41 µg/m^3	253.63 µg/m^3	15.26 µg/m^3	32.61 µg/m^3	-	-	-Max.values of the concentrations are below the corresponding limit values for all the averaging periods on Romanian territory, while on Bulgarian territory, exceedances of the limit value may be recorded only in the case of maximum hourly concentration, on small areas from Ruse locality

Area	Polu-ttants	Maximum hourly concentration		Maximum daily concentration		Average yearly concentration		Observations
		RO	BG	RO	BG	RO	BG	
								- The impact is almost exclusively due to the livestock farms from Ruse region.
Giurgiu - Ruse	NO_2 NO_x	35.7% of the limit value -	47.65% of limit value -	- -	- -	3.57 µg/m³ 5.36 µg/m³	5.56 µg/m³ 8.34 µg/m³	-Max.values of concentrations are recorded in the area of emission sources (thermal power plant, ceramics factory), in Giurgiu- the closest locality in Romania; the impact is low, the maximum hourly concentration will be at most 30.7% of the limit value and 47.65% of the limit value in Ruse
	SO_2	27.17% of the limit value	46.61% Of the limit value	<9.06 µg/m³	15.34 µg/m³	13.24% of the criti-cal level	10.19% of the criti-cal level	-Max.values of concentrations are below the limit values or below the corresponding critical levels for all the averaging periods. -Max.values of concentrations are recorded in the area of emission sources (thermal power plant from Ruse); the cross-border impact is insignificant, average yearly concentration values of maximum 13.24% of the corresponding limit value are recorded in the inhabited areas from Giurgiu.
	CO	-	-	-	-	-	-	-Max.values of concentrations are below the corresponding limit values for all the averaging periods, representing maximum 0.2% of the corresponding limit value. -Max.values of concentrations are recorded in the area of emission sources; the impact is strictly local, concentration values below 0.2% of the corresponding limit value are recorded in the inhabited areas from the closest localities – Giurgiu and Ruse.
	PM	-	-	<6.79% of the limit value	12.20% of the limit value (6.10 µg/m³)	1.04 (2.06% of the limit value)	1.73 µg/m³	-Max.values of concentrations are below the corresponding limit values for all the averaging periods. -The cross-border impact is insignificant, both the max.daily concentrations and the yearly average recorded in Giurgiu town representing a percentage of up to 6.79% of the corresponding limit values.
	Metals	-	-	-	-	-	-	-Max.values of the concentrations are below the limit values or below the corresponding target values for all the averaging periods. -Max.values of concentrations are recorded in the area of emission sources; the impact is strictly local, concentration values below 5% of

Area	Polu-ttants	Maximum hourly concentration		Maximum daily concentration		Average yearly concentration		Observations
		RO	BG	RO	BG	RO	BG	
								the limit value/corresponding target values are recorded in the inhabited areas of the localities from the vicinity of the emission sources.
Zimnicea – Svishtov	NH_3	37.5 µg/m^3	< 69.3 µg/m^3	6.89 µg/m^3	8.14 µg/m^3	< 1 µg/m^3	< 1 µg/m^3	-Max.values of the concentrations are below the corresponding limit values for all the averaging periods. -Max.values of concentrations are recorded in Zimnicea –the impact is low
	NO_2	6.58% of the limit value	7.24% of the limit value	-	-	< 1 µg/m^3	< 1 µg/m^3	-Max.values of the concentrations are below the corresponding limit values for all the averaging periods. -Max.values of concentrations are recorded in Zimnicea –the impact is not significant
	NO_x	-	-	-	-	1 µg/m^3	1 µg/m^3	
	SO_2	<23% of the limit value	28% of the limit value	21 µg/m^3	26 µg/m^3	3 µg/m^3	3 µg/m^3	-Max.values of the concentrations are below the corresponding limit values for all the averaging periods. -Max.values of concentrations are recorded in Svishtov –the cross-border impact is not significant
	CO	-	-	-	-	-	-	-Max.values of concentrations are much below the corresponding limit values (10,000 µg/m^3) for all the averaging periods. -Max.values of concentrations are recorded in the area of emission sources from the industrial area of Svishtov locality - the cross-border impact is not significant
	PM	-	-	-	-	-	-	Max.values of the concentrations are below the corresponding limit values for all the averaging periods - the cross-border impact is insignificant
	Metals	-	-	-	-	-	-	-Max.values of the concentrations are below the limit values or below the corresponding target values for all the averaging periods. -Max.values of concentrations are recorded in the area of emission sources from the industrial area of Svishtov locality - the impact is strictly local and insignificant
Turnu Magurele -Nikopol	NH_3	531 µg/m^3	412 µg/m^3	78 µg/m^3	87 µg/m^3	-	-	-High values of concentrations are recorded in the Modeling area of Turnu Măgurele – Nikopol, especially due to the nitrogen-based fertilizer plant SC Donau Chem SRL - The cross-border impact is significant, values of the max.hourly

Area	Polu-ttants	Maximum hourly concentration		Maximum daily concentration		Average yearly concentration		Observations
		RO	BG	RO	BG	RO	BG	
								concentrations which are two times higher than the corresponding limit value may be reached in the inhabited areas from Nikopol
	NO_2 and NO_x	58% of the limit value	83% of the limit value	-	-	1.5 µg/m³ 2.2 µg/m³	8.2% of the limit value 4.92 µg/m³	-Max.values of the concentrations are below the limit values or below the corresponding critical levels for all the averaging periods. -Max. values af concentrations are recorded in the area of emission sources associated to the economic operator Donau Chem SRL – the cross border impact is low.
	SO_2	<4% of the limit value	5% of the limit value	4 µg/m³	5.19 µg/m³	2.7% of the criti-cal level	2.7% of the criti-cal level	- Max.values of the concentrations are below the limit values or below the corresponding critical levels for all the averaging periods. -The main emissions sources are associated with coal burning in the thermal power plant from the industrial area of Svishtov locality - The cross-border impact is insignificant
	CO	-	-	-	-	-	-	-Max.values of concentrations reach at most 0.27% of the corresponding limit value for all the averaging periods. -Max.values of concentrations are recorded in the area of emission sources associated to the economic operator SC Donau Chem SRL; the impact is strictly local, concentration values of 0.27% of the corresponding limit value being recorded in the inhabited areas within Turnu Măgurele and Nikopol.
	PM	-	-	<1.12 µg/m³	2.84 µg/m³	1.24% of the limit value	<2.05 % of the limit value	- Max.values of the concentrations are below the corresponding limit values for all the averaging periods. - Max.values of concentrations are recorded in the area of emission sources associated to the economic operator SC Donau Chem SRL - The cross border impact is insignificant
	Metals	-	-	-	-	-	-	-Max.values of the concentrations are below the limit values or below the corresponding target values for all the averaging periods. -Max. values of concentrations are recorded in the area of emission sources associated with the economic operator SC Donau Chem SRL; their impact is strictly local, concentration values of less than 1.5 % of the limit value/corresponding target values being recorded in the inhabited areas within Turnu Măgurele and Nikopol localities.

Area	Polu-ttants	Maximum hourly concentration		Maximum daily concentration		Average yearly concentration		Observations
		RO	BG	RO	BG	RO	BG	
								-A pollutant transport from the area of the thermal power plant from Svishtov, which does not determine a significant cross-border impact,may be noticed.

1.2.4. Conclusions related to the impact on air quality

After analyzing the results of mathematical modeling of pollutant dispersion, presented as pollution maps, and the maximum values of concentrations in ambient air obtained in inhabited areas, the following conclusions may be drawn:

- Within the inhabited areas from the localities near the Romanian-Bulgarian border (which are areas with sensitive receivers to atmospheric pollution), there have been identified and delimited areas where, through the exclusive impact on air quality of the studied emission sources, exceedances of the limit values for NH_3 may have place, both in case of average hourly concentrations and of average daily concentrations.
- The areas where the modeling results emphasized exceeedances for NH_3 contain large zones from Turnu Măgurele – Nikopol area, including Turnu Măgurele town from the Romanian territory and Nikopol, Cherkovitsa, Zhernov and Vabel localities from the Bulgarian territory, also zones from Călăraşi County - more than 20 localities.
- Within Turnu Măgurele – Nikopol modeling area, the emission sources that determine the impact of NH_3 belong to the Plant for chemical fertilizers and nitrogenous compounds - SC Donau Chem SRL, while within the other areas, the determining sources are associated to the livestock and manure management activities within the farms from the Romanian territory.
- According to Directive 2008/50/Ec on ambient air quality and cleaner air for Europe, within the areas with sensitive receivers where exceedances of the limit values are found, the continuous monitoring of ambient air quality must be performed in fixed points.
- So, if there are taken into account the values of background concentrations and also the impact due to some local sources like road traffic for NO_2 and NO_x, fuel combustion for residential heating for NO_2, NO_x, particulate matter – fractions PM_{10} and $PM_{2.5}$, SO_2, and the impact of other important emission sources is also taken into consideration, then exceedances of the limit values or of the corresponding critical levels may take place within the areas identified as areas with significant impact of industrial sources.

1.3.Assessment of the impact of some potential accidents in Romania-Bulgaria cross-border area

1.3.1. Inventory of risk sources from the Romanian-Bulgarian border area

Within the process of selecting the air pollution sources with potential risk of accident the identification criteria specified in Directive 96/82/EC (SEVESO II Directive) related to the industrial accidents that imply dangerous substances, also those ones specified in Helsinki convention related to the transboundary effects of industrial accidents, were taken into account.

The locations with major potential risk and those ones with minor potential risk, placed up to a distance of 35 km from the Romanian-Bulgarian border, were selected.

In Table 1.3.1 it is presented the list of selected operators together with their activity field, also the hazardous substances existing on their locations, covered by the Directive 96/82/EC (SEVESO II Directive).

Table 1.3.1. *Economic operators from Romania-Bulgaria cross-border area, on Romania territory, selected as having industrial accident risk sources with significant potential transboundary impact*

Economic operator	Activity profile	County	MAJOR RISK/ minor risk	Hazardous substance	Maximum amount existing on the location (tons)
0	1	2	3	4	5
SC DONAU CHEM SRL	Manufacture and sale of chemical fertilizers	Teleorman	MR	Ammonia	15000
				Nitric acid	2400
				Granular ammonium nitrate	600
SC CRIMBO Gas 2000 SRL	Wholesale of solid, liquid and gaseous fuels and derivatives	Giurgiu	MR	GPL	1003
SC AZOCHIM SRL Calugareni	Wholesale of chemical products	Giurgiu	MR	Ammonium nitrate	15000
SC DELTA GAS COV SRL	Manufacture of products got from oil processing	Călăraşi	mr	GPL	188.7
SC SIAD Romania SRL	Manufacture of industrial gases	Călăraşi	mr	Oxygen	1934
SC PANEBO GAZ SRL	Gas production	Giurgiu	mr	GPL	159
SC LINZER AGRO TRADE ROMANIA SRL	Wholesale of chemical products	Giurgiu	mr	Ammonium nitrate	4980

0	1	2	3	4	5
SC BIO FUEL ENERGY SRL	Gas production	Teleorman	mr	Bio-ethanol	4858
				Technical ethanol 85%	130
				Concentrate sulfuric acid c=96%	185

The Bulgarian competent authorities did not identify within the Romanian-Bulgarian border area the existence of any hazardous activity covered by the Helsinki Convention (Romanian authorities having no notification in this regard), no potential accident risk sources were inventoried on Bulgarian territory.

In Figure 1.3.1 it is presented the spatial distribution of the locations with potential accident risk belonging to the economic operators selected from Romanian territory.

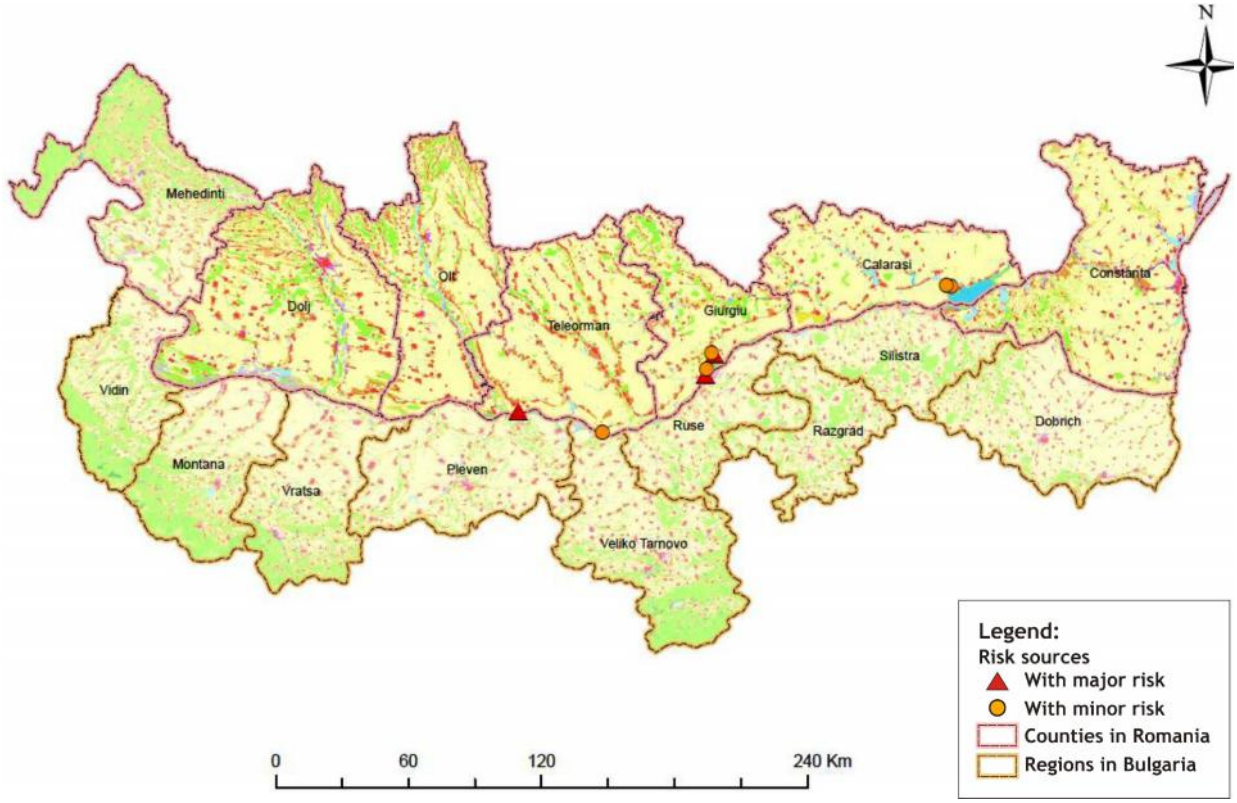


Figure 1.3.1. *Location map for the sources with potential risk of transboundary accident within the Romania-Bulgaria border area*

1.3.2. Assessment of the impact of some potential accidents from Romania territory

1.3.2.1. Approach methodology

Possible scenarios associated to some potential accidents were analyzed for one operator from Romania (the Plant for chemical fertilizers and nitrogenous compounds SC DONAU CHEM SRL) and one operator from Bulgaria (a petroleum product terminal located in the west side of Ruse, belonging to Lukoil Company), in the Danube border area, and the local and transboundary impact was analyzed for each accident scenario.

The economic operator from Romania was selected for the analysis on the basis of the following reasons:

- It is an operator with major risk of producing an industrial accident that implies hazardous substances, according to the identification criteria specified in Directive 96/82/EC (Directive SEVESO II);
- The distance from the operator location up to the Romanian-Bulgarian border is about 0.7 km, in case of an industrial accident being possible to appear significant transboundary effects;
- The unit with potential accident risk is found also in the emission inventory for air pollution sources;
- Analysis of the major pollution source impact on air quality emphasized exceedances of the limit values for NH_3 in Turnu Măgurele, Nikopol, Cherkovitsa, Zhernov and Vabel, due to the emissions coming from the sources belonging to Donau Chem SRL. Because ammonia is also one of the substances for which the operator falls into the category of those ones with major potential risk associated to industrial accidents, the analysis of a risk scenario for this operator which implies NH_3 emissions contributes to defining a common area for monitoring the ambient concentrations of NH_3, representative both for the emissions that are released in current operation and for the accidental ones.

The economic operator from Bulgaria was selected for the analysis on the basis of the following reasons:

- Liquefied petroleum gases are not toxic; they are only an explosion and fire hazard, because they are extremely flammable.

- That is why an explosion scenario of BLEVE-type (Boiling Liquid Expanding and Vapor Explosion - phenomenon is a type of explosion that occurs at a reservoir where liquid under pressure is stored at a temperature much higher than its boiling point under normal conditions) was studied at a cylindrical horizontal reservoir with a capacity of 2000 m^3, where a mixture of liquefied petroleum products (LPG) is stored.
- The phenomenon occurs when a liquid leakage from reservoir appears, particularly when a large breach is produced, leading to sudden depression. The very high temperature of the liquid may determine the instantaneous boiling of the entire mass; this may lead to very fast expanding which determines the reservoir explosion.

1.3.2.2. Analysis of potential effects of the studied chemical accident

A chemical accident with ammonia emission in atmosphere has as main effect the endangerment of people health and life, because of the ammonia feature to be toxic by inhalation.

Ammonia is explosive. But the lower explosion limit is 15% ammonia in air, concentration that may be reached only at the gas-liquid limit. So, the explosion hazard is negligible. Instead, the hazard represented by ammonia toxicity is very high.

For taking into account the most relevant potential effects of the studied scenario of a chemical accident, the impact of the toxic emissions of ammonia on sensitive receivers (human beings) was analyzed by modeling the dispersion of these emissions in atmosphere.

Description of the modeling scenario

The location area of the platform of Donau Chem is characterized by complex meteorological conditions; in the course of a year, air advections both from east or west, with high frequencies, also from north-west, south-east and north-east and east may be recorded. The nearest locality to the location area of the studied risk source (ammonia tank) is Nikopol from the Bulgarian side of the Danube, located at south-south-east to the source, at a distance of about 1.3 km, the yearly frequency of the wind directions that determines the transport of some accidental emissions of NH_3 from Donau Chem towards Nikopol (north-north-west sector) being approximately 4.5%. On the Romanian Danube bank, the nearest locality to the risk source is Turnu

Măgurele, at a distance of about 3.2 km, in opposite direction to Nikopol. The yearly frequency of the wind directions that determines the transport of NH_3 to Turnu Măgurele (south-south-east sector) is much lower, of only 2.5%.

For those reasons, for analyzing the maximum impact of the studied accident scenario occurrence (corresponding to the maximum associated risk) on the inhabited areas, the potential impact on Nikopol was analyzed.

So, for the dispersion modeling, north-north-west was chosen as wind direction, taking into account an average wind speed of 1.95 m/s corresponding to this sector.

Thus, the maximum impact of the chosen accident scenario was analyzed.

Modeling results

For assessing the potential effects of the occurrence of the studied chemical accident, the concentration values got by modeling, at respiratory level (1.5-2 m above the ground) were compared to the threshold values that delineate the classes of effects on human health and the risk of fatalities the toxic substances has. In case of ammonia, the comparison is done with AEGL thresholds.

The values recorded after reaching the stationary flow of the pollutant wedge were considered relevant values of the concentrations got by modeling; at the same time, they are the maximum reached values in any point of the calculation grid, during an hour of simulation. The analysis of these values allows their comparison with AEGL thresholds for any exposure time.

For delineating the impact areas according AEGL classes of effects during the analyzed exposure times, at the level of the areas with sensible receivers where the maximum impact may occur (inhabited area of Nikopol), maps with the spatial distribution of the maximum concentrations got by modeling, on which the area where the maximum modeled concentrations exceed the threshold value is marked by distinct colours for each AEGL relevant value, have been achieved.

The maps are presented in the figures from below, both in top plan view and three dimensionally, from different angles, superimposed on the 3D map of the relief.

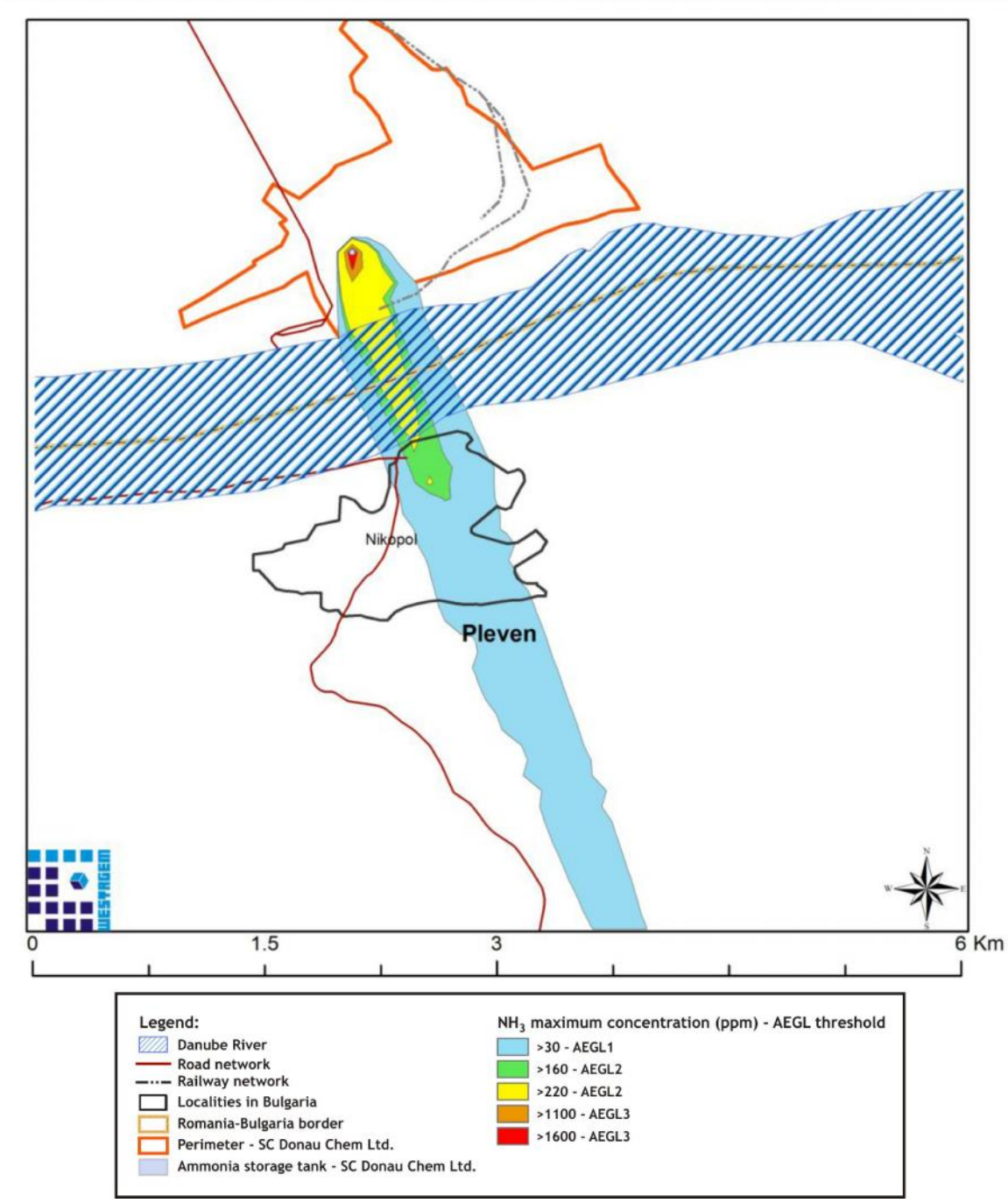


Figure 1.3.2. *Impact of a chemical accident scenario for a NH_3 ammonia storage tank: distribution of NH_3 maximum concentrations got by modeling - SC Donau Chem Ltd.*

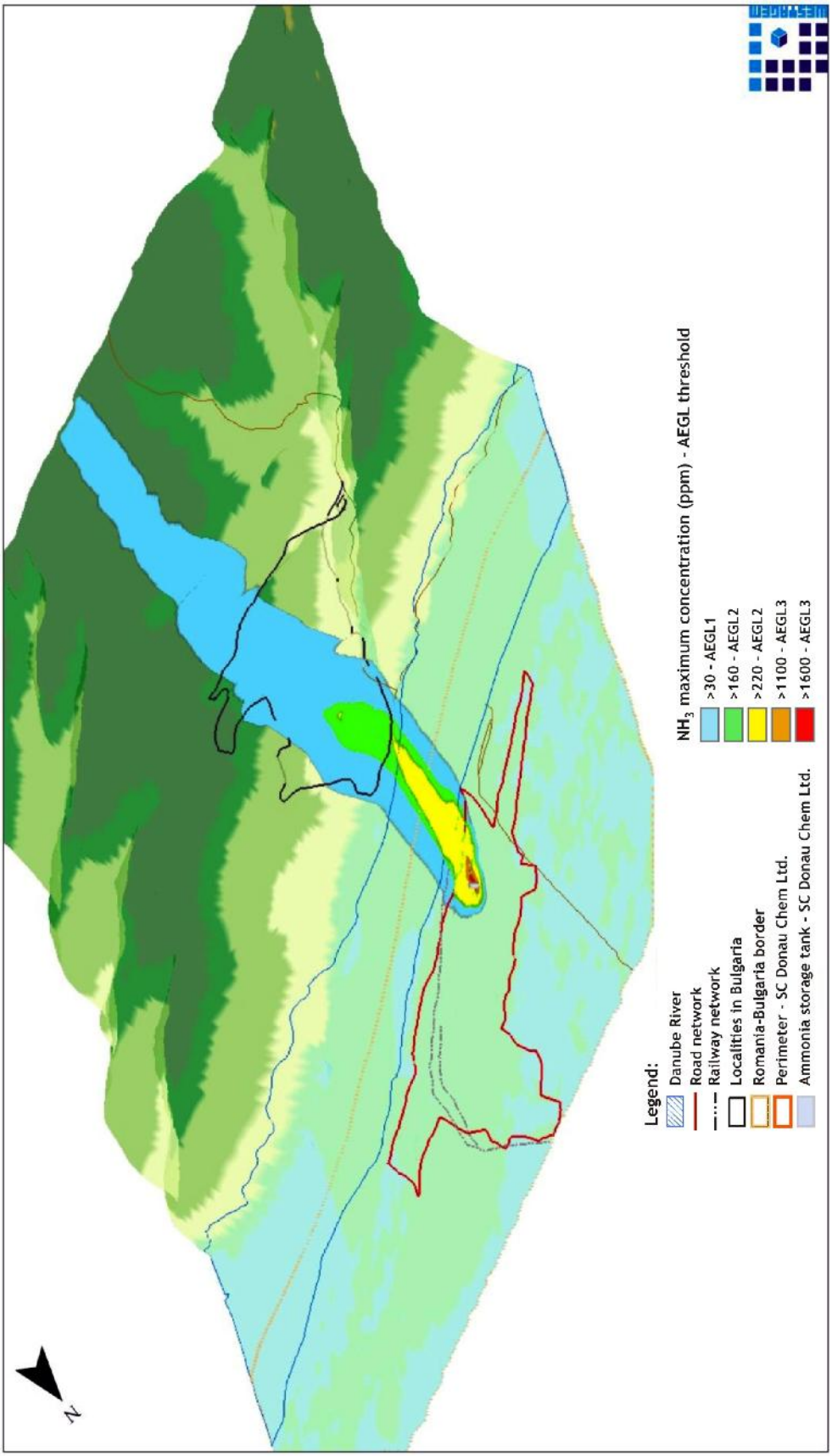


Figure 1.3.3. *Impact of a chemical accident scenario for a NH_3 ammonia storage tank: distribution of NH_3 maximum concentrations got by modeling - SC Donau Chem Ltd.*

1.3.2.3. Conclusions regarding the potential impact of the studied accident scenario on human health

Analysis of the modeling results leads to the following conclusions on the potential effects of a chemical accident with toxic emission of ammonia that may occur at the NH_3 storage tank with a capacity of 15000 t located on the platform of SC Donau Chem SRL:

- Concentrations of more than 160 ppm NH_3 that may cause irreversible effects on human health at an exposure time of more than 60 minutes can be reached up to a distance of 1.73 km from the risk source; the north and the center of Nikopol town may be affected. Maximum distance at which the value of 160 ppm may be recorded is reached after 18 minutes from the accident occurrence;
- Given that in fact, rapid intervention measures for reducing the ammonia emissions in atmosphere (e.g. watering by means of water cannons surrounding the reservoir) may be taken in case of accident, it is estimated that there is a major health hazard (irreversible effects);
- Ammonia concentration values of more than 30 ppm, starting from which effects on health may occur both at a short and an average exposure time, may be reached in large portions of Nikopol; after about 17 minutes from the accident occurrence, the concentration of 30 ppm may cover the southern end of the town;
- Due to the variability of meteorological conditions during one year, other localities (e.g. Turnu Măgurele) may be also affected depending on the moment of accident occurrence, without a major risk of producing irreversible effects on people health.

1.3.3. Analysis of an accident scenario for a risk source from Bulgaria territory

For analyzing the potential effects of a possible accident in the Danube border area, on Bulgarian side, where hazardous substances are involved, a hypothetical scenario was defined at a petroleum product terminal located in the west side of Ruse, belonging to Lukoil Company.

1.3.3.1. Definition of an accident scenario

Liquefied petroleum gases are not toxic; they are only an explosion and fire hazard, because they are extremely flammable.

That is why an explosion scenario of BLEVE-type (Boiling Liquid Expanding and Vapor Explosion) was studied at a cylindrical horizontal reservoir with a capacity of 2000 m^3, where a mixture of liquefied petroleum products (LPG) is stored.

The phenomenon occurs when a liquid leakage from reservoir appears, particularly when a large breach is produced, leading to sudden depression. The very high temperature of the liquid may determine the instantaneous boiling of the entire mass; this may lead to very fast expanding which determines the reservoir explosion.

1.3.3.2. Analysis of the potential effects of the studied accident

For a „BLEVE" type explosion of a LPC reservoir, the relevant negative effects on environment are represented by the mechanical destructions caused by the propagation of the explosion overpressure (shock wave) and by the effect of the thermal radiation of the related fire, which may affect the structures and endanger the human health and life.

The maps with the spatial distribution of the values got by modeling for the thermal radiation of „BLEVE" fire and for the overpressure of the explosion shock wave front have been achieved, on which the areas where the maximum modeled values exceed the threshold value are marked by distinct colours for each relevant threshold value.

The maps are presented in the figures from below, both in top plan view and three dimensionally, from different angles, superimposed on the 3D map of the relief.

The plan views represent the values got by modeling at a height of 2 m above the ground. Although the shock wave and thermal radiation propagation occurs approximately equally in all directions, the threshold values being three dimensionally represented as concentric sphere, in plan, due to topography (modeling was achieved under complex terrain conditions), the relevant impact areas appear restricted.

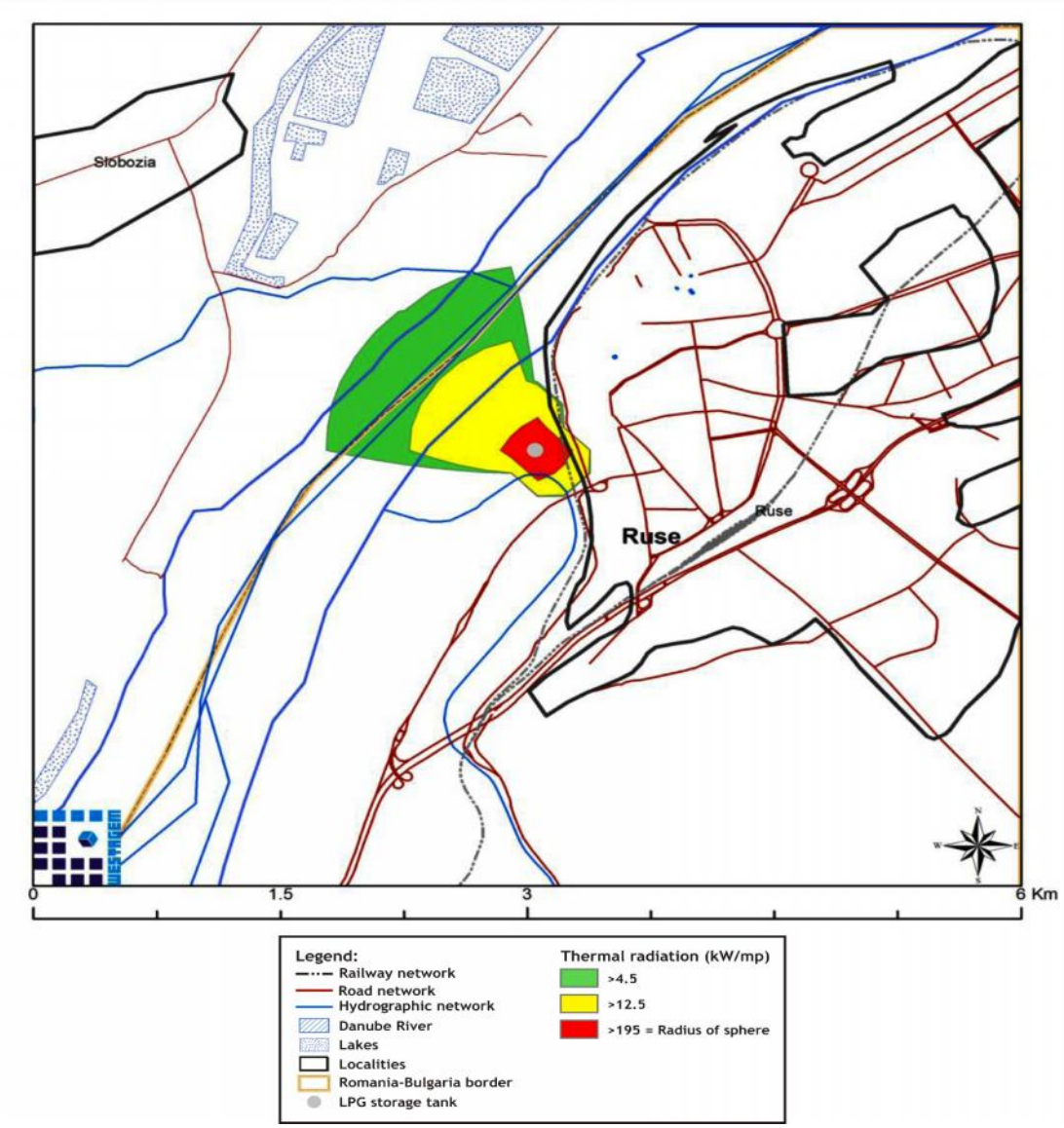


Figure 1.3.4. *Impact of an explosion scenario for a LPG storage tank: distribution of the maximum values of thermal radiation got by modeling*

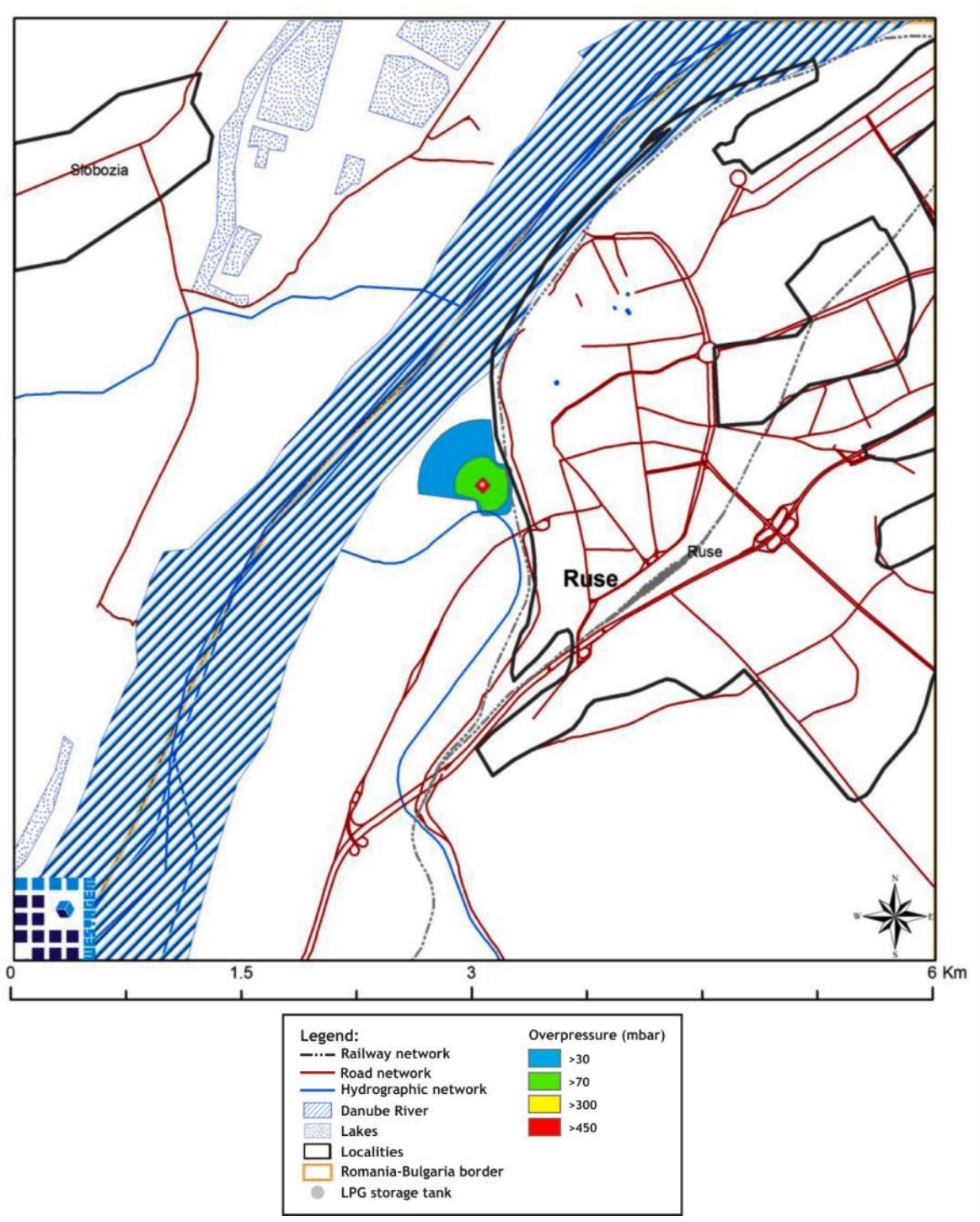


Figure 1.3.5. *Impact of an explosion scenario for a LPG storage tank: distribution of the maximum values of the shockwave overpressure got by modeling*

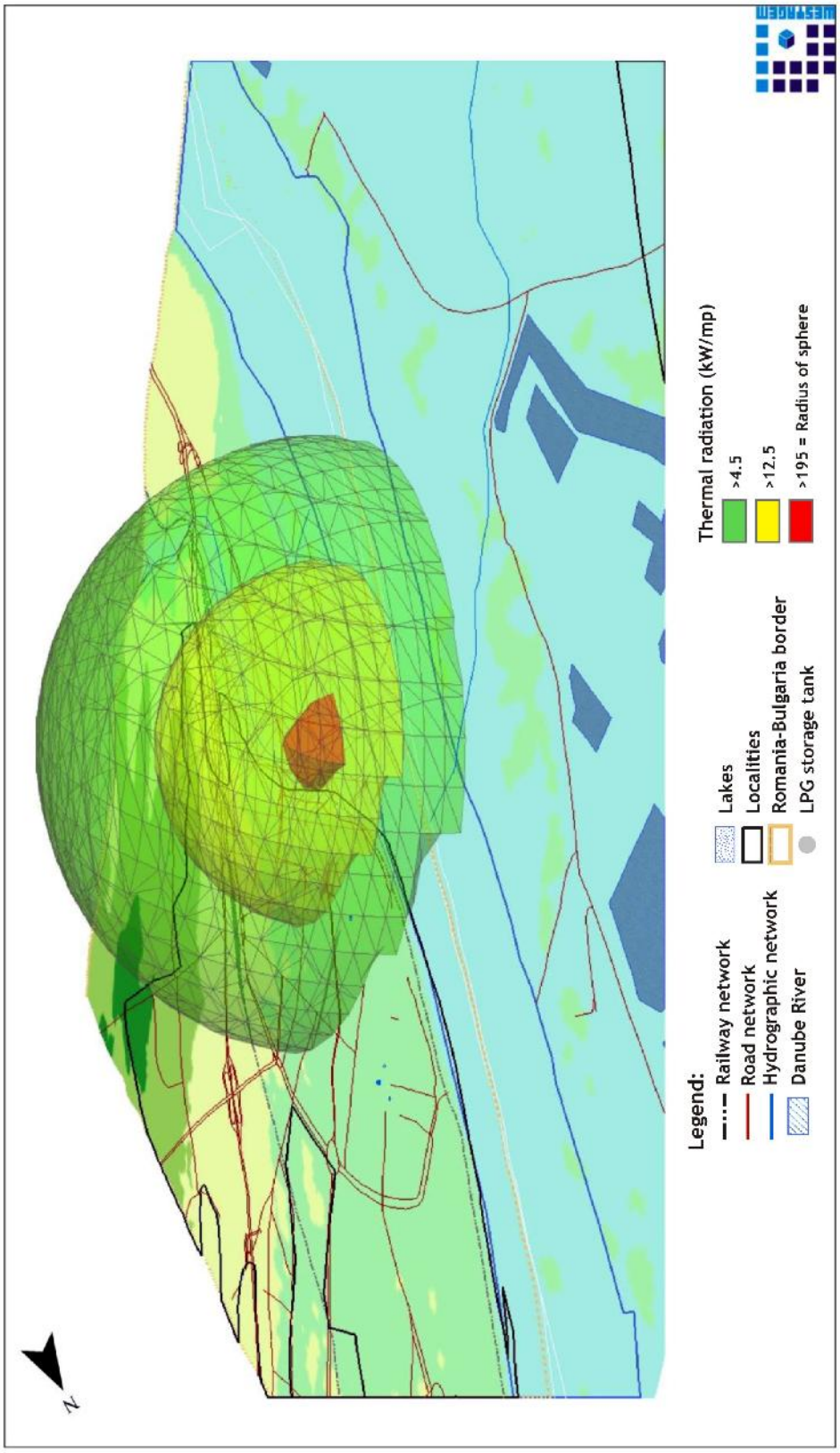


Figure 1.3.6. *Impact of an explosion scenario for a LPG storage tank: distribution of the maximum values of thermal radiation got by modeling*

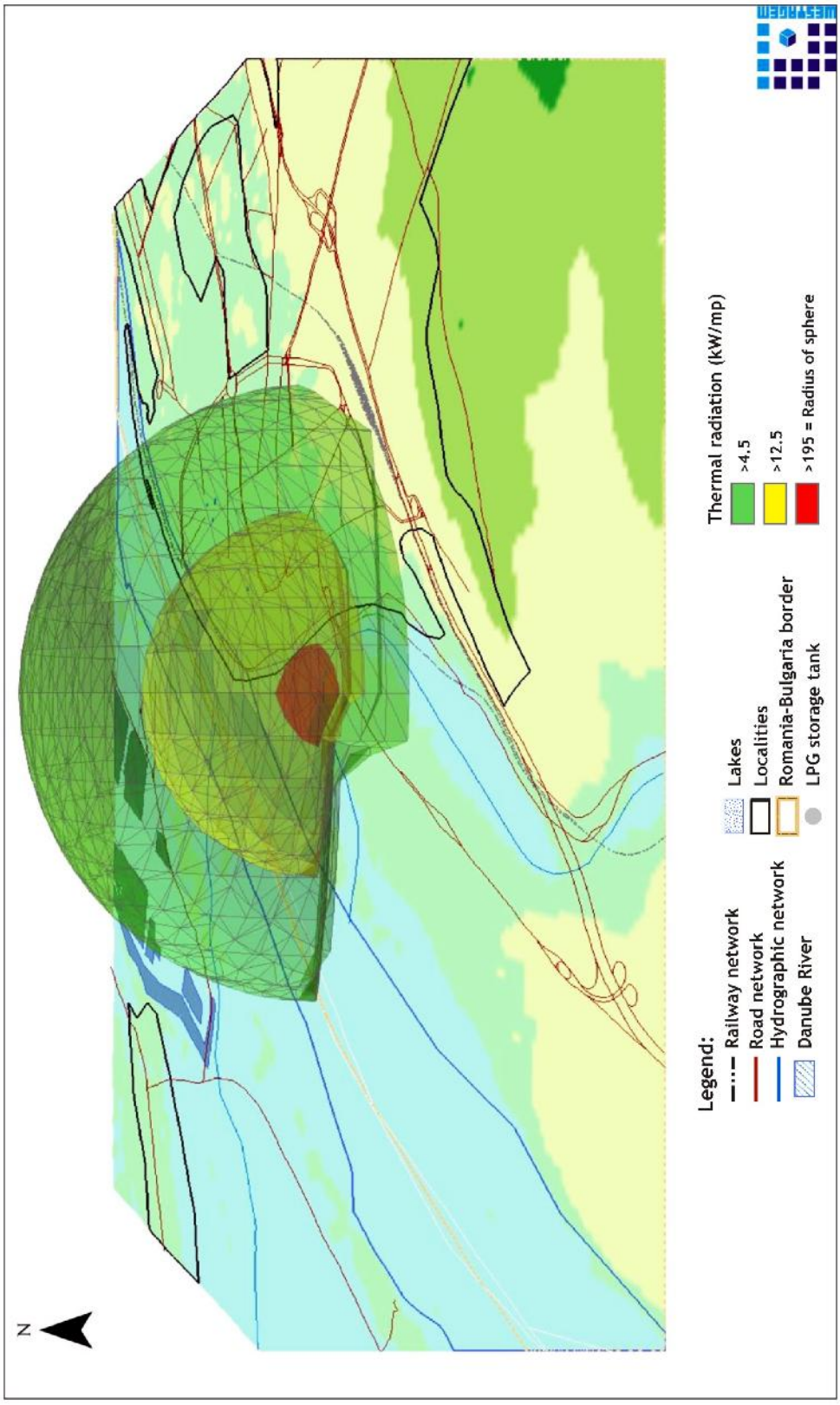


Figure 1.3.7. *Impact of an explosion scenario for a LPG storage tank: distribution of the maximum values of thermal radiation got by modeling*

1.3.3.3. Conclusions regarding the potential impact of the studied accident scenario occurrence on human health and structures

Analysis of the modeling results leads to the following conclusions related to the potential effects of an explosion accident at a LPG reservoir with capacity of 2000 m^3 located on the Bulgarian side of Danube, in the west of Ruse:

- Reservoir location at 250 m distance from the closest inhabited areas leads at most to producing irreversible injuries on the exposed population, due to the mechanical effects of the explosion shock wave; they may occur up to distances of about 350 m from the accident place, so a significant transboundary effect cannot exist;
- The areas where injuries are produced contain portions of Ruse town and the industrial zone from the west of the town;
- Having in view the location of the inhabited areas of the Romanian localities from Giurgiu-Ruse border area at approximately equal distances to the Bulgarian bank of Danube, one can say that even in the case of a similar scenario of an accident at a LPG reservoir located elsewhere on Bulgarian bank, the transboundary impact would be not significant.

1.4. Proposals on the improvement of the existING air quality monitoring networkS in Romania-Bulgaria cross-border area

1.4.1. General

Considering the situation regarding the existing air quality monitoring network in Romania-Bulgaria cross-border area and the specific nature of the project, the proposals and recommendations regarding the improvement of the air quality measuring network from both sides of the Danube are focused on:

- increase of the present network operability level in terms of assuring the delivery of some air quality data as complete as possible, in accordance with the endowment and equipping level of the stations. It is advisable to measure and report at least the pollutants regulated by the Directive 2008/50/EC, assuring the coverage degree and a proper quality for the data.
- Due to the presence of industrial operators that have pollution sources with major potential impact or risk of accident, it is necessary to extend the present network by installing new monitoring stations serving to capture the impact of industrial sources both at local level and within transboundary context.
- Selection of the new monitoring points will be done by using the results of mathematical modeling supplied within the "Modeling Report". In this report, the maps with the spatial distributions of the pollutant concentrations got after running some advanced dispersion models have been achieved, by using the detailed inventories of the major pollution sources identified at the level of the areas of interest.
- It is well known that the proper operation of the air quality monitoring networks requires considerable technical and financial resources. Therefore, when the network is extended or improved, it is absolutely necessary to take into account the future operation/maintenance costs.

  For reducing the costs, firstly is absolutely ***necessary to optimize the networks in terms of its functionality***, aspect concretized by getting as much information on air quality as possible, by using as few stations / equipment / instruments as possible. This goal may be reached by:

  - assuring an advanced technical level of the personnel responsible

for the network maintenance, in order to achieve the maintenance and to assure an adequate quality of data

- a detailed analysis and rigorous interpretation of the monitoring data based on a deep understanding of the pollution phenomenon at local scale
- development of complete, accurate and transparent emission inventories at local scale for the emission sources (all categories)
- knowledge of local meteorology, especially of predominant circulation of winds, by equipping the monitoring stations with adequately installed meteorological equipment
- possible use of mathematical models of pollutant dispersion, the only relatively inexpensive instruments able to deliver a complete image of the spatial distribution of the pollution at different scales, to solve scenarios focused on the impact generated by certain groups of sources in order to propose some efficient methods for reducing the emissions or to analyze the representativeness of the monitoring stations when the local configuration of emission sources changes.

Taking into account the above mentioned, the extension of the monitoring network should aim as far possible at the delivery of some as complete as possible data, capturing the impact of industrial sources when there is a direct transport from source to station or completing the picture of pollution, especially of the urban/rural background one, when there is no phenomenon of direct transport from the mentioned sources.

1.4.2. Proposals on the improvement of the existing air quality monitoring stations in Romania- Bulgaria cross-border area

The following table presents a synthesis of the proposals referring to the new stationary monitoring stations in order to improve the air quality measuring network from both sides of the Danub

Table 1.4.1. *Proposals on the improvement of the existing air quality monitoring stations in Romania- Bulgaria cross-border area*

Proposals referring to new air quality monitoring stations in Romania and Bulgaria									
ROMANIA					BULGARIA				
S No	**Station type**	**Location**	**Monitored parameters**	**Observations on the operational objectives of the station**	**S No**	**Station type**	**Location**	**Monitored parameters**	**Observations on the operational objectives of the station**
1	Traffic	**Calafat -**	**-Pollutants** NO_x, NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2, CO, benzene, metals (Pb, As, Cd, Hg, Ni) from PM_{10} **-Wet** (including pH, conductivity, anions and cations from wet depositions) and **dry depositions** **-Meteorological parameters** Wind speed and direction, precipitations, temperature, pressure, solar radiation.	▪ monitoring the impact due to TEC Vidahim when there is a predominantly western transport ▪ monitoring the rural pollution background for the other situations of atmospheric circulation.	**1**	Rural back-ground	**Vidin Dunavtsi** village	**Pollutants** NO_x, NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2, CO, metals (As, Cd, Hg, Ni) from PM_{10} **Wet** (including pH, conductivity, anions and cations from wet depositions) *and dry depositions* **Meteorological parameters** wind speed and direction, precipitations, temperature, pressure, solar radiation.	▪ monitoring the impact due to TEC Vidahim when there is a predominantly northern transport ▪ monitoring the rural pollution background for the other situations of atmospheric circulation.
2	Urban back-ground	**Giurgiu** South-east of the city, in a densely populated area	**Pollutants** NO_x, NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2, CO, benzene, metals (Pb, As, Cd, Hg, Ni) from PM_{10} **Wet** (including pH, conductivity, anions and cations from wet depositions) and **dry depositions** **Meteorological**	▪ monitoring the transboundary impact due to TETs "Ruse-Iztok" when there is a predominantly south –east transport ▪ monitoring the urban pollution	**2**	Urban back-ground	**Nikopol** northern area of the city	**Pollutants** NO_x, NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2, CO, metals (As, Cd, Hg, Ni) from PM_{10} **Wet** (including pH, conductivity, anions and cations from wet depositions) *and dry depositions*	▪ monitoring the pollution episodes induced by Donau Chem when there is a favourable transport (from north direction) both in normal operation and

Proposals referring to new air quality monitoring stations in Romania and Bulgaria									
ROMANIA					BULGARIA				
S No	**Station type**	**Location**	**Monitored parameters**	**Observations on the operational objectives of the station**	**S No**	**Station type**	**Location**	**Monitored parameters**	**Observations on the operational objectives of the station**
			parameters Wind speed and direction, precipitations, temperature, pressure, solar radiation	background for the other situations of atmospheric circulation.				**Meteorological parameters** wind speed and direction, precipitations, temperature, pressure, solar radiation.	in case of accidentmonitoring the urban pollution background for the other situations of atmospheric circulation
3	Urban back-ground*)	**Turnu Măgurele** Center of the city, in a densely populated area	**Pollutants** NO_x, NO_2, NH_3, O_3, PM_{10}, $PM_{2.5}$, SO_2, CO, benzene, metals (Pb, As, Cd, Hg, Ni) from PM_{10} **Wet** (including pH, conductivity, anions and cations from wet depositions) and **dry depositions** **Meteorological parameters** Wind speed and direction, precipitations, temperature, pressure, solar radiation.	▪ monitoring the urban pollution background ▪ monitoring the pollution episodes induced by Donau Chem when there is a favourable transport (from south direction) both in case of normal operation and in case of accident.	**3**	Urban back-ground	**Svishtov** north-west area of the city	**Pollutants** NO_x, NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2, CO, metals (As, Cd, Hg, Ni) from PM_{10}, C_S2, H_2S **Wet** (including pH, conductivity, anions and cations from wet depositions) *and dry depositions* **Meteorological parameters** wind speed and direction, precipitations, temperature, pressure, solar radiation	▪ capturing the impact due to the industrial platform from Svishtov in case of a transport from the north-west direction; ▪ capturing the transboundary impact due to the sources from the area of Zimnicea city, when there is a favourable transport from the northern sector or from north-east;

Proposals referring to new air quality monitoring stations in Romania and Bulgaria									
ROMANIA					BULGARIA				
S No	**Station type**	**Location**	**Monitored parameters**	**Observations on the operational objectives of the station**	**S No**	**Station type**	**Location**	**Monitored parameters**	**Observations on the operational objectives of the station**
									▪ allowing monitoring the urban pollution background for the other situations of atmospheric pollution
4	Indus-trial	**Turnu Măgurele** Area of the plant Donau Chem	**Pollutants** NO_x, NO_2, NH_3, O_3, PM_{10}, $PM_{2.5}$, SO_2, CO, metals (Pb, As, Cd, Hg, Ni) from PM_{10} **Meteorological parameters** Wind speed and direction, precipitations, temperature, pressure, solar radiation	▪ monitoring the impact generated by DONAU CHEM, at local level ▪ monitoring the transboundary impact when there is a favourable transport from the northern sector	**4**	Urban back-ground	**Silistra** northern area of the city	**Pollutants** NO_x, NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2, NH_3, CO, metals (As, Cd, Hg, Ni) from PM_{10} **Wet** (including pH, conductivity, anions and cations from wet depositions) *and dry depositions* **Meteorological parameters** wind speed and direction, precipitations, temperature, pressure, solar radiation	▪ capturing the transboundary impact due to the sources from the area of Călărași city, when there is a favourable transport from the northern sector or from north-east; ▪ allowing monitoring the urban pollution background for the other situations of atmospheric pollution

Proposals referring to new air quality monitoring stations in Romania and Bulgaria									
ROMANIA					BULGARIA				
S No	**Station type**	**Location**	**Monitored parameters**	**Observations on the operational objectives of the station**	**S No**	**Station type**	**Location**	**Monitored parameters**	**Observations on the operational objectives of the station**
5	Urban back-ground	**Zimnicea** South-west of the city	**Pollutants** NO_x, NO_2, NH_3, O_3, PM_{10}, $PM_{2.5}$, SO_2, CO, benzene, metals (Pb, As, Cd, Hg, Ni) from PM_{10}, CS_2, H_2S **Wet** (including pH, conductivity, anions and cations from wet depositions) and **dry depositions** **Meteorological parameters** Wind speed and direction, precipitations, temperature, pressure, solar radiation.	▪ monitoring the urban pollution background ▪ monitoring the transboundary impact due to the industrial platform from Svishtov in case of a favourable transport from south west direction.	-	-	-	-	-
6	Rural back-ground	**Călărași** Modelu village	**Pollutants** NO_x, NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2, NH_3, CO, benzene, metals (Pb, As, Cd, Hg, Ni) from PM_{10} **Wet** (including pH, conductivity, anions and cations from wet depositions) and **dry depositions** **Meteorological parameters** Wind speed and	▪ monitoring the ammonia impact due to the livestock and manure management activities when there is a transport predominantly from northern sector ▪ monitoring the rural pollution	-	-	-	-	-

Proposals referring to new air quality monitoring stations in Romania and Bulgaria									
ROMANIA					BULGARIA				
S No	Station type	Location	Monitored parameters	Observations on the operational objectives of the station	S No	Station type	Location	Monitored parameters	Observations on the operational objectives of the station
			direction, precipitations, temperature, pressure, solar radiation.	background for the other situations of atmospheric pollution.					

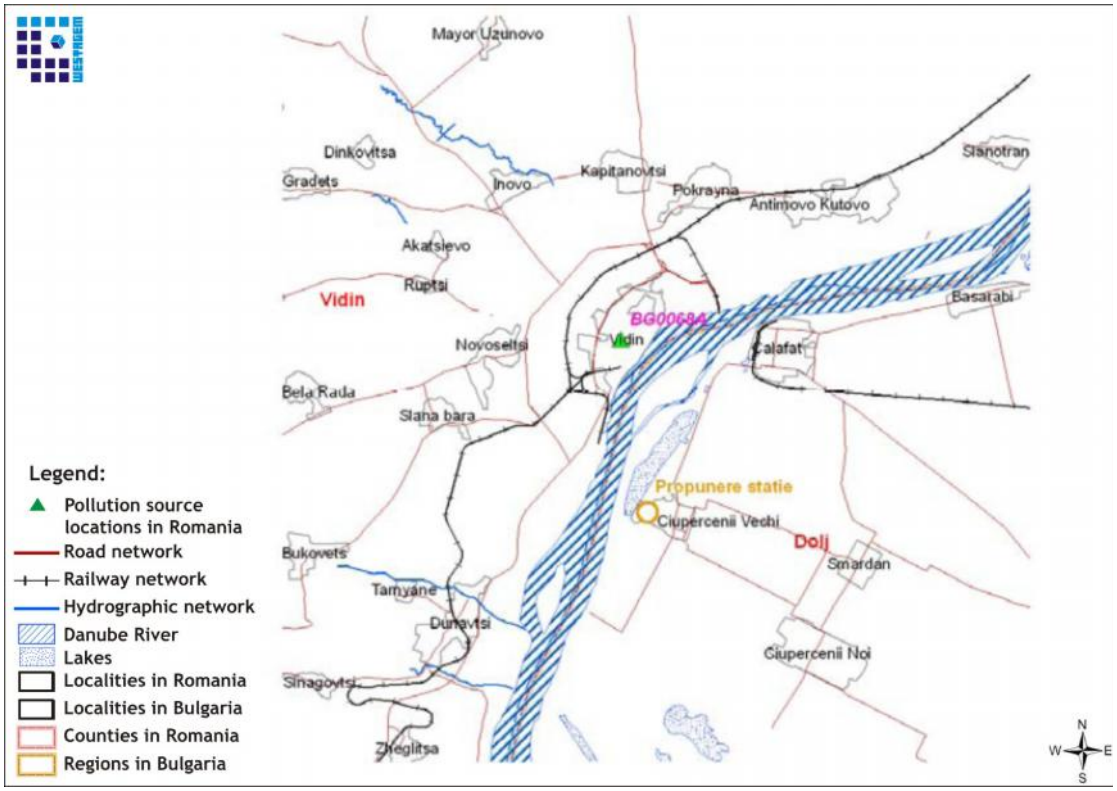


Figure 1.4.1. Proposal regarding the location of a monitoring station in Calafat-Vidin area

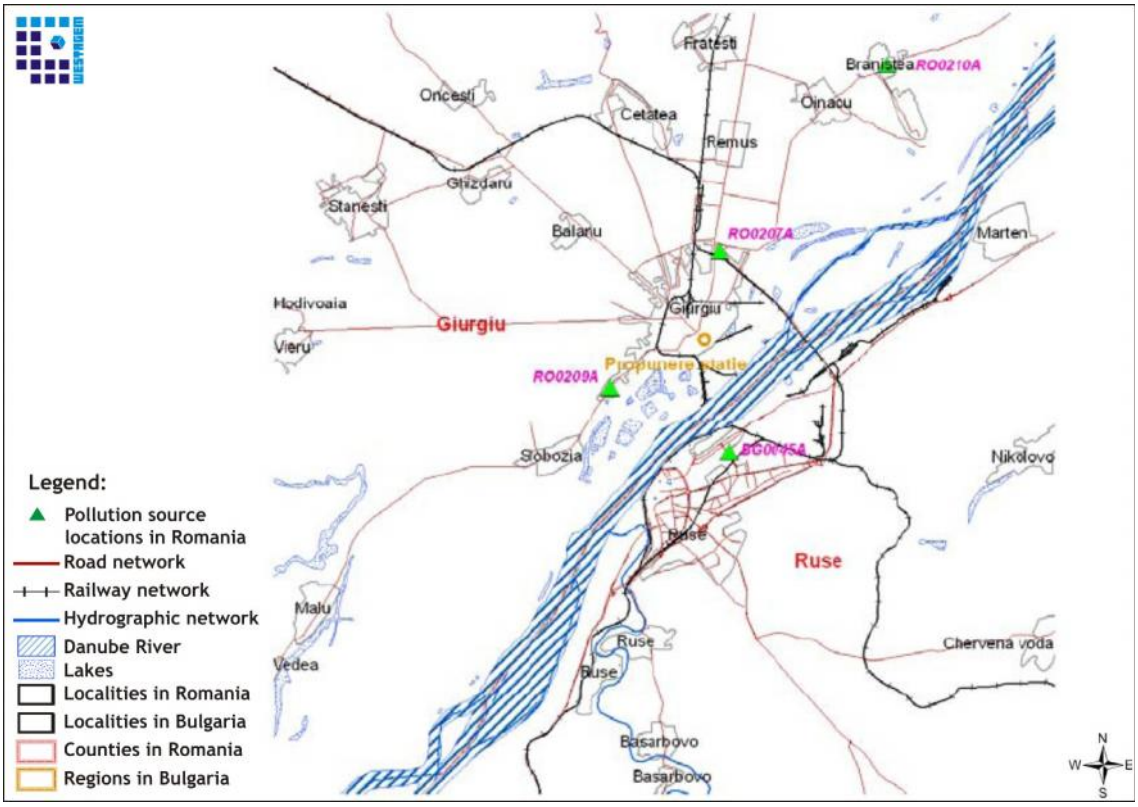


Figure 1.4.2. *Proposal regarding the location of a monitoring station in Giurgiu-Ruse area*

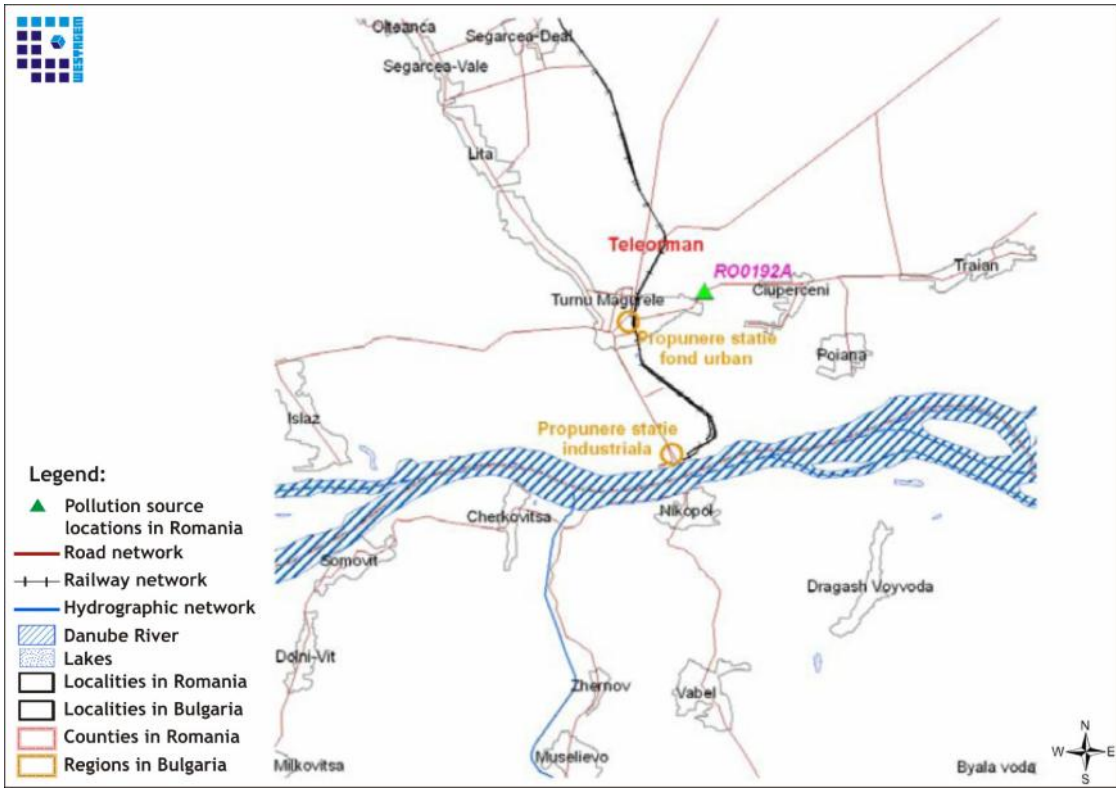


Figure 1.4.3. *Proposal regarding the location of a monitoring station in Turnu Măgurele – Nikopol area*

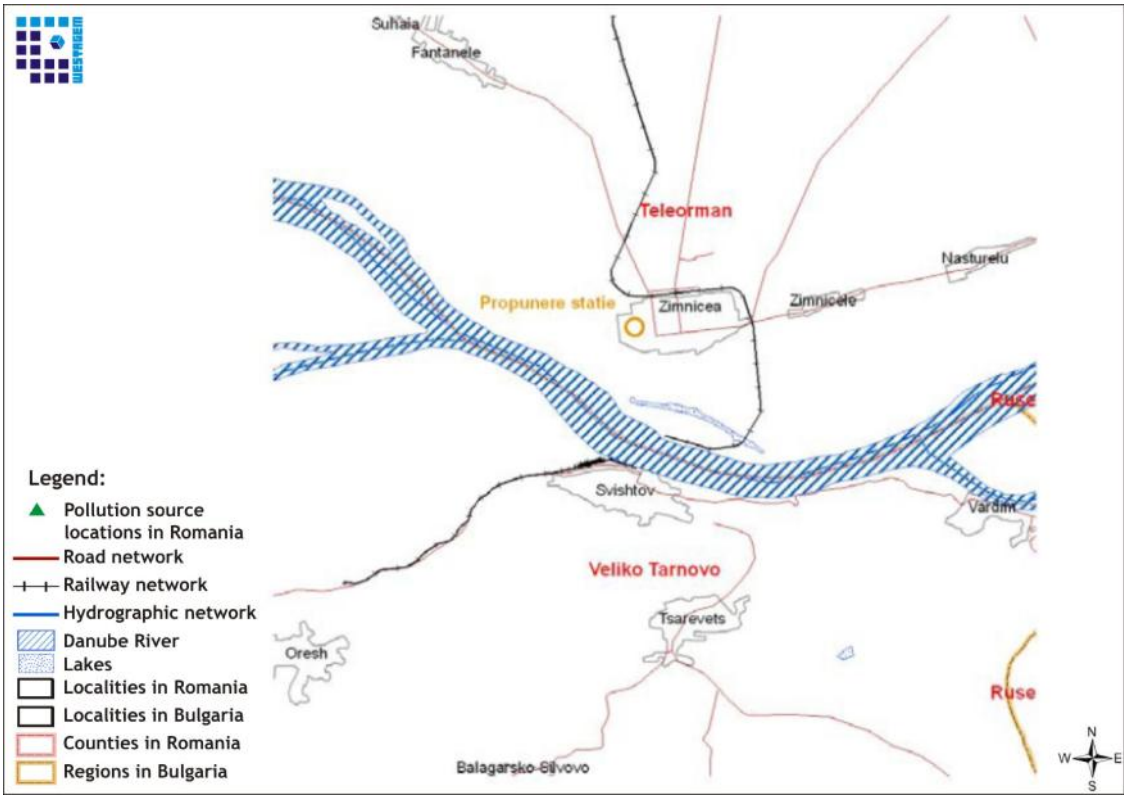


Figure 1.4.4. *Proposal regarding the location of a monitoring station in Turnu Zimnicea-Svishtov area*

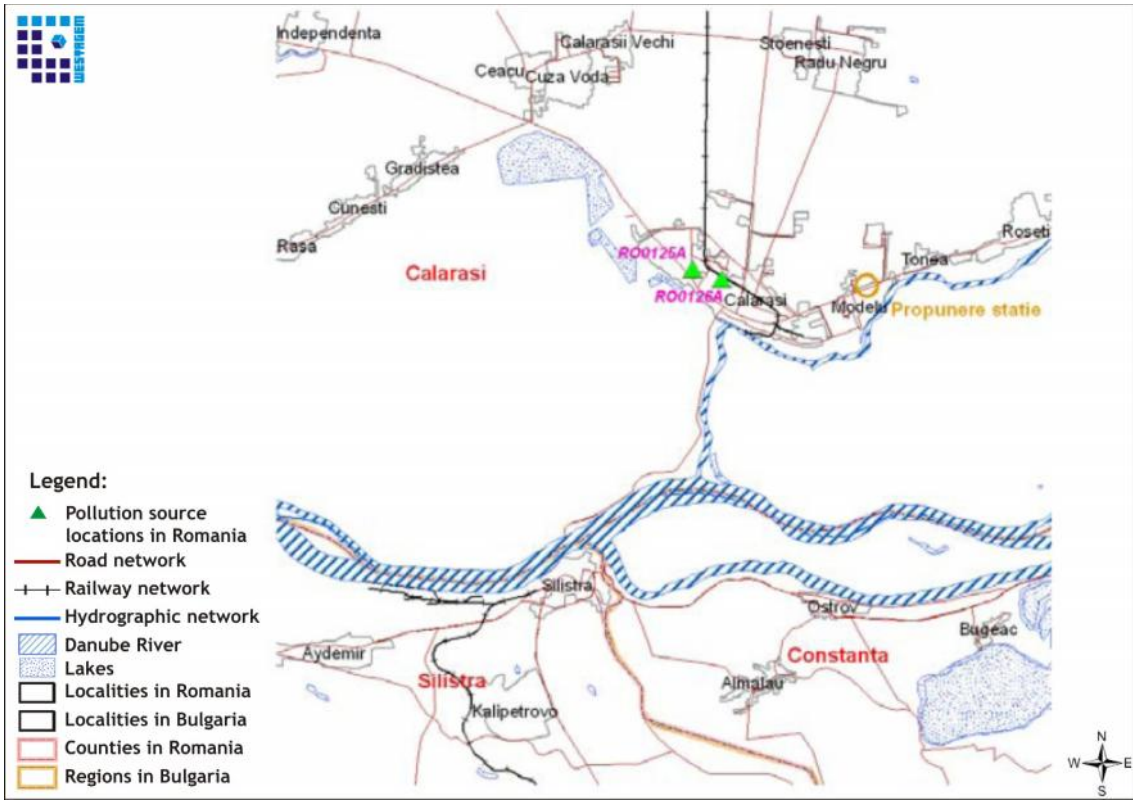


Figure 1.4.5. *Proposal regarding the location of a monitoring station in Călărași-Silistra area*

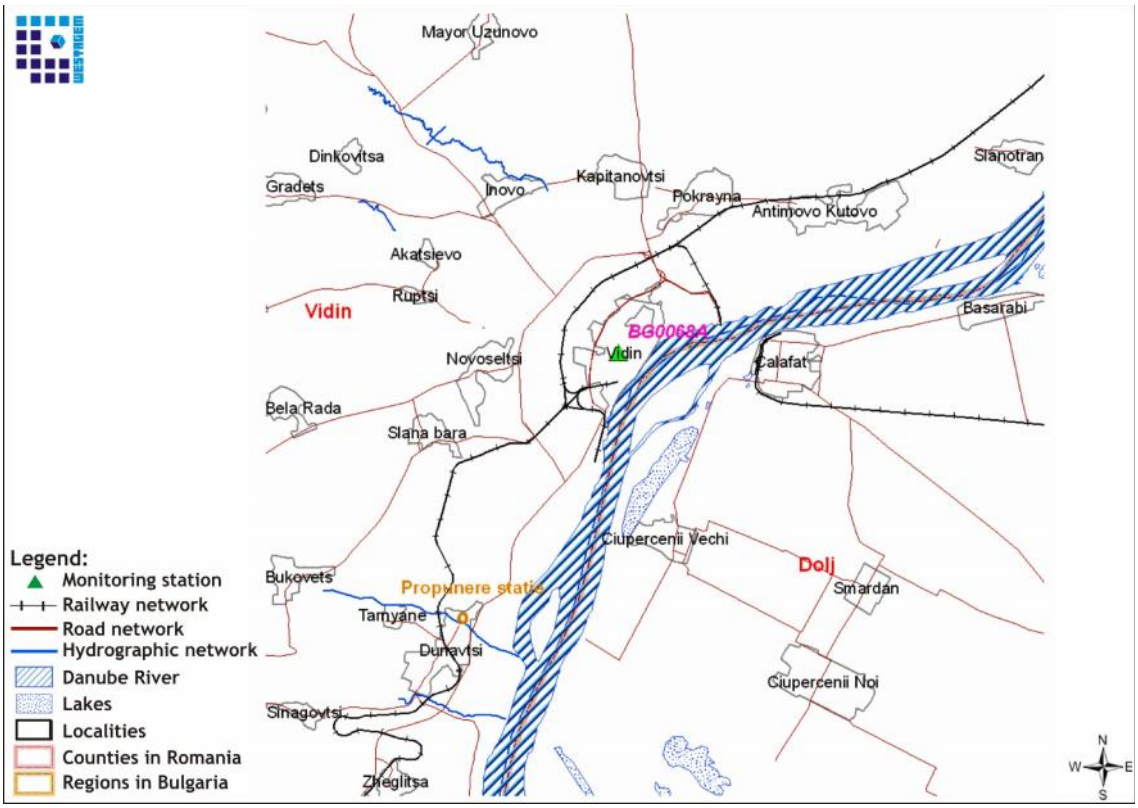


Figure 1.4.6. *Proposal regarding the location of a monitoring station in the Bulgarian side of Calafat-Vidin area*

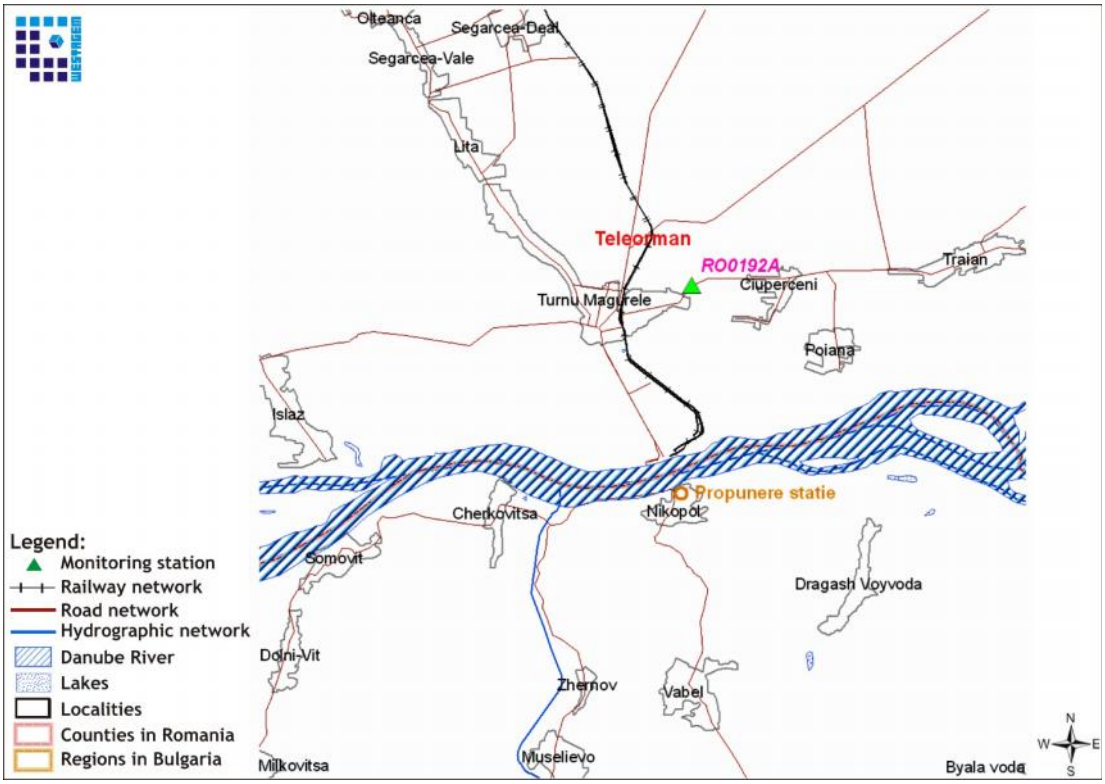


Figure 1.4.7. *Proposal regarding the location of a monitoring station in the Bulgarian side of Turnu Măgurele – Nikopol area*

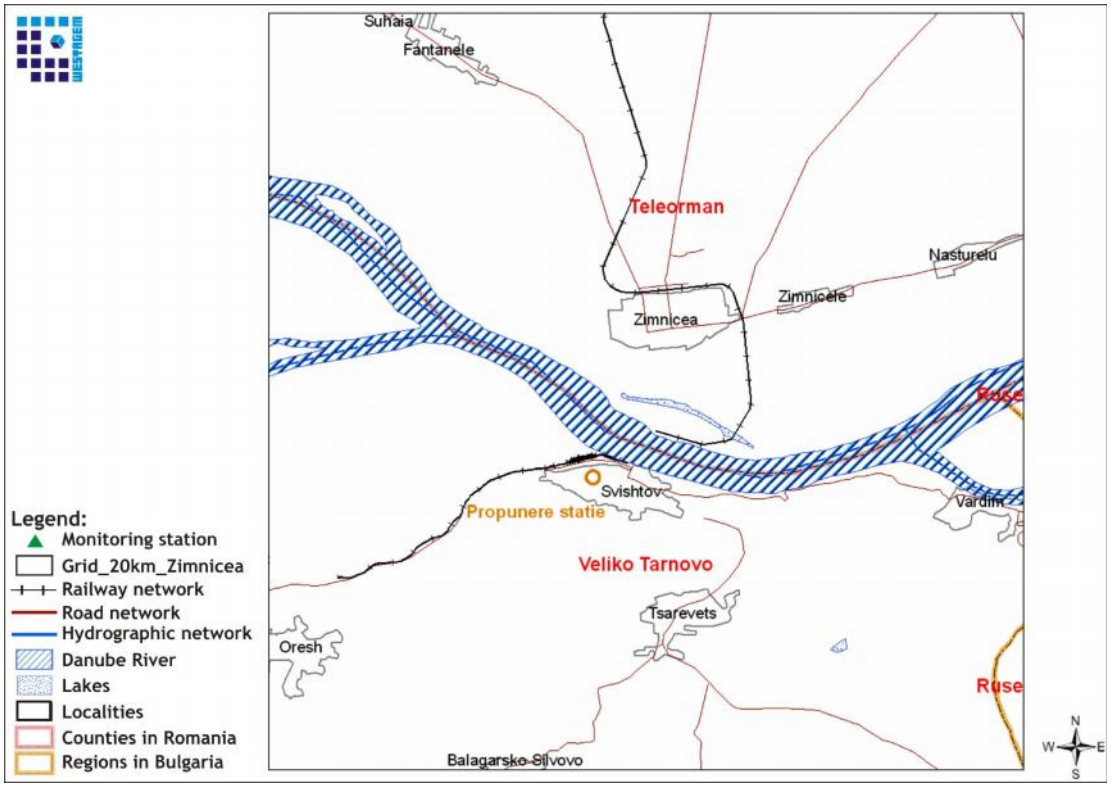


Figure 1.4.8. *Proposal regarding the location of a monitoring station in the Bulgarian side of Zimnicea-Svishtov area*

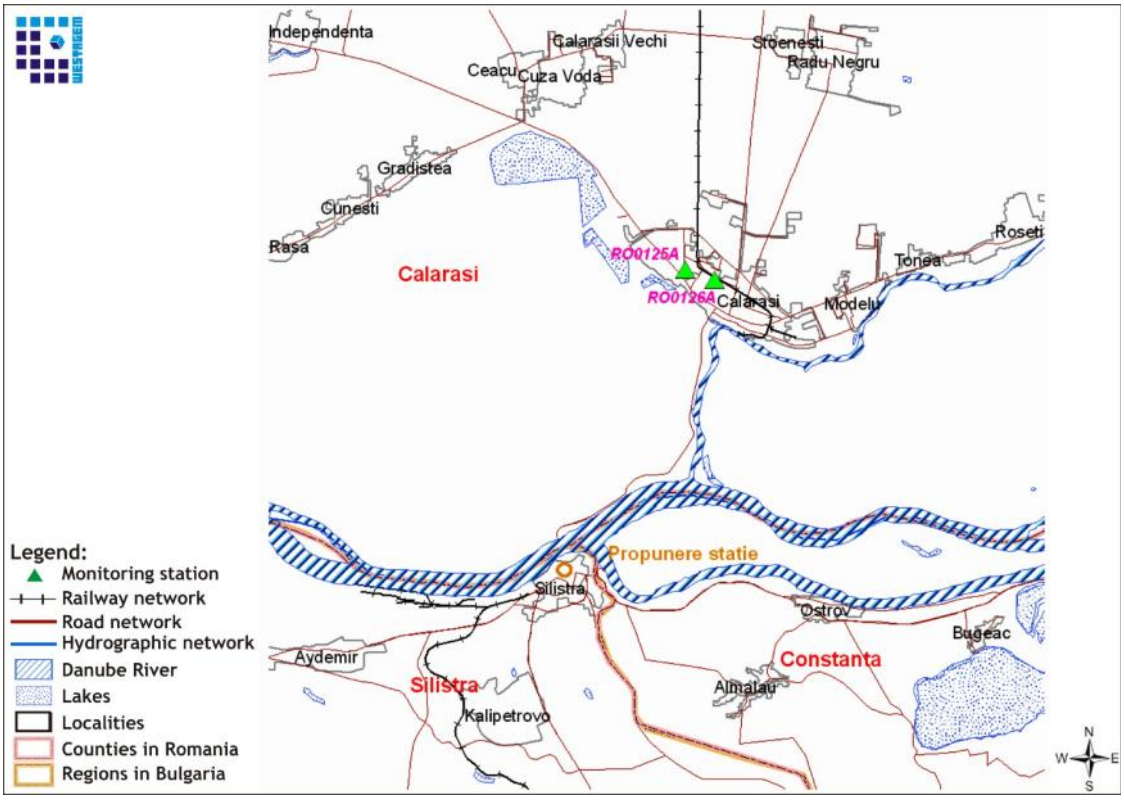


Figure 1.4.9. *Proposal regarding the location of a monitoring station in the Bulgarian side of Călărași-Silistra area*

Regarding the above proposals, the following comments must be made:

- The areas delineated for installing new stations are only approximate, and at their level the locations must be precisely selected
- The accurate choice of the locations must be done in accordance with the criteria for locating them at macro-scale and micro-scale imposed by the Directive and national legislation. Special attention should be paid also to the assurance of location representativeness for meteorological measurements, having in view they have a crucial role in interpreting the data got from the measurements of pollutant concentrations
- It is advisable to carry out measurement campaigns indicating the pollutants of interest for selecting the most affected points in terms of population exposure, before identifying precisely the locations of the future stations.

  The indicative measurements may be carry out with portable equipment (micro-stations) fitted out with sensors for general and specific pollutants, mounted on poles or buildings. For assuring a fast transfer of the information, these micro-stations may be fitted out with wireless

transmission systems.

Besides, this type of measurements may be used each time when the stations in operation are likely to lose their representativeness, being advisable to relocate them.

- All the data coming from the stations will be acquired, validated, centralized and displayed as air quality (both in normal and emergency situations). In this respect, a WEB interface in 3 languages accessible both to Romanian and Bulgarian users may be developed.

CHAPTER 2

NEW AIR QUALITY MONITORING NETWORK IN THE DANUBE CROSS BORDER AREA – STRUCTURE AND TECHNICAL CHARACTERISTICS

2.1. The block diagram "New Air Quality Monitoring Network in the Danube Cross-Border Area"

Following the accession to the European Union, Romania and Bulgaria undertook to comply with the European legislation and with the obligations assumed by the Accession Treaty. Failing in fulfilling any of these obligations has as effect the initiation of the infringement procedure and the application of sanctions in accordance with the EU legislation.

The obligations assumed in the field of air quality result from the implementation and compliance with the requirements of Directive 2008/50/EC of European Parliament and Council on ambient air quality and a cleaner air for Europe, having as main objective the protection of people and environment health, by ensuring the highest possible level of air quality, as regards the management across borders, inclusively.

It is particularly important and urgent to prevent the serious harmful effects of industrial accidents on human beings and environment and to promote all the actions that encourage the rational, economical and efficient measures for prevention, preparation and intervention, in order to allow a sustainable economic development, adequate in terms of the environmental protection. It should be also taken into account the fact that the industrial accident effects could be felt across the borders and need the continuous cooperation between states. In order to monitor the air quality, to prevent, prepare and intervene in case of transboundary effects of industrial accidents, the project "Joint Risk Monitoring during Emergencies in the Danube Border Area" aimed to accomplish the following objectives:

- raising the level of information of the decision makers from the two countries, directly involved in the problem of environmental policies;
- monitoring the air quality for the sustainable protection of the environment in the cross border area of the Danube.

In this respect, all the equipment for monitoring and measuring the air pollution degree, purchased within the project, are intended to form an air quality monitoring network in the cross –border area of the Danube. This network contains 5 monitoring stations and a system of air quality data acquisition, storage and communication, and will be compatible with the National Air Quality Monitoring System, going to be integrated as a part of this system and to provide air quality data, fully complying with the requirements of European and national legislation.

On the basis of the Technical Report "New air quality monitoring stations in the Danube cross-border area", there were established the necessary air quality monitoring stations, also the necessary indicators that should be measured, as follows:

Station 1 Calafat – Dolj County
Station type – Traffic (it monitors the traffic between Romania and Bulgaria on the Calafat-Vidin bridge)

Station 2 Turnu Măgurele - Teleorman County
(downtown area, in a zone with high density of population)
Station type – Urban background

Station 3 Turnu Măgurele - Teleorman County (area of DONAU CHEM chemical plant)
Station type - Industrial

Station 4 Zimnicea – Teleorman County (south-west area of the city)
Station type - Urban background

Station 5 Modelu village- Călăraşi County
Station type - Rural background

The new air quality monitoring network contains also three systems to perform indicative measurements according to Directive 2008/50/EC and to monitor the pollutant level in ambient air, and a portable FTIR analyzer for environmental measurements, specific to emergencies.

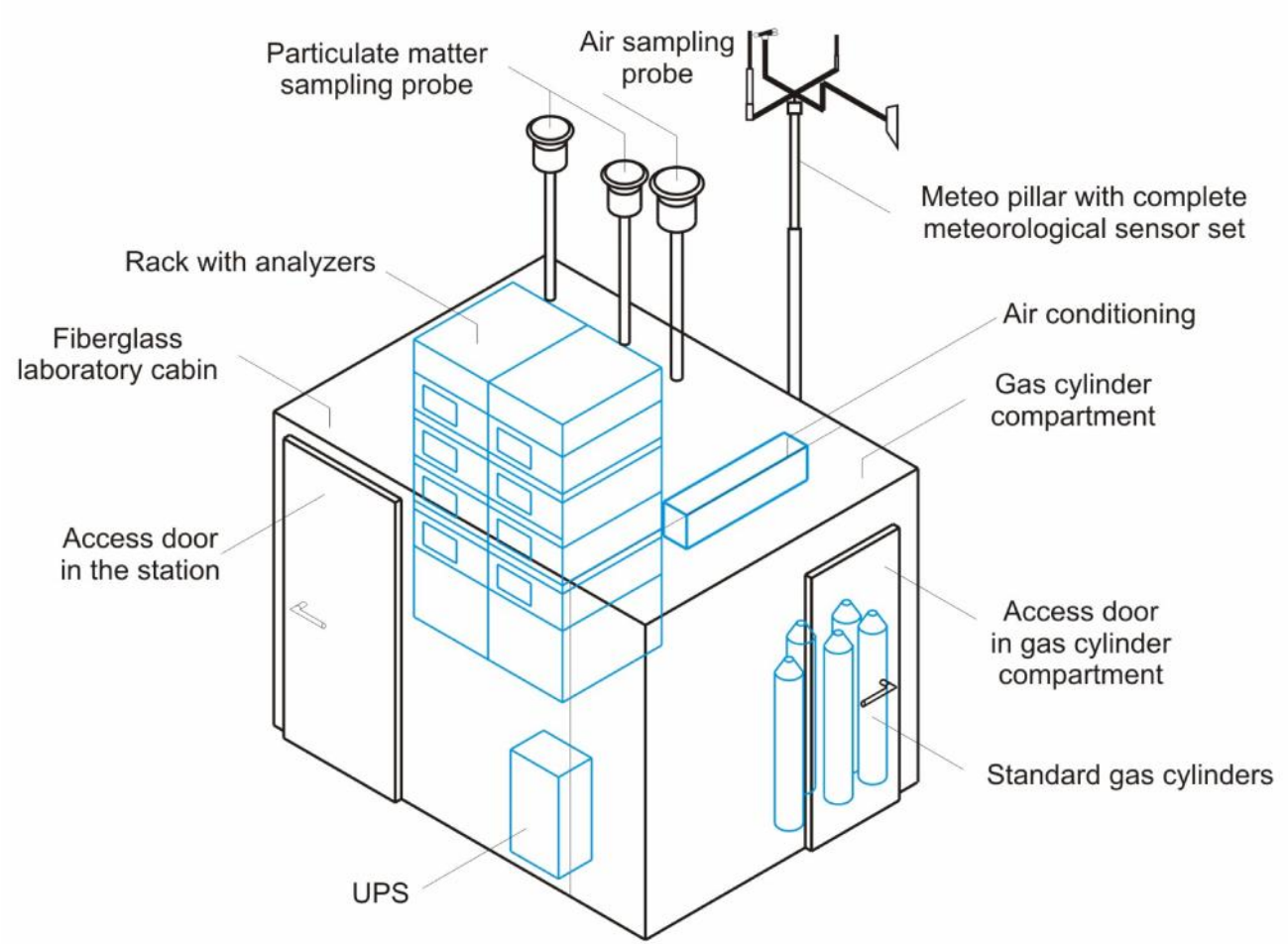
The data on air quality will be transmitted from the five new monitoring stations that form the cross-border monitoring network to the National Network of Air Quality Monitoring (RNMCA) and to ICMET. Data transmission in RNMCA is secured by the Special Telecommunications Service (STS), which is the central body with legal personality that organizes and coordinates the activities in the field of special

telecommunications for the public authorities in Romania and for other users provided by the law. Data transmission from RNMCA to ICMET Craiova is done through a virtual private network, VPN), also secured by STS. The data transmitted to ICMET will be visualized on the www.airqualityrobg.icmet.ro site, functional at the end of the project.

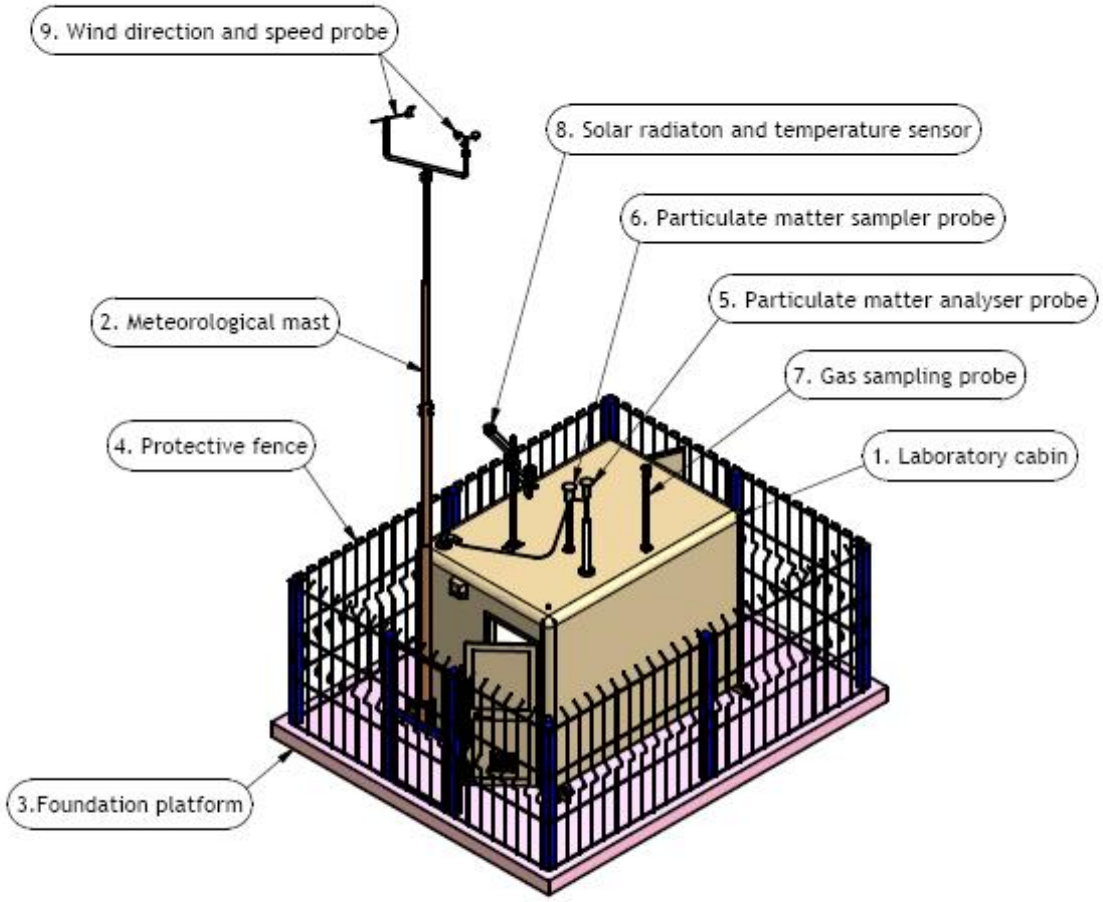
Block diagram: „*New network of air quality monitoring Romania-Bulgaria cross-border area*“

2.2. Air Quality Monitoring Stations

2.2.1. Overview



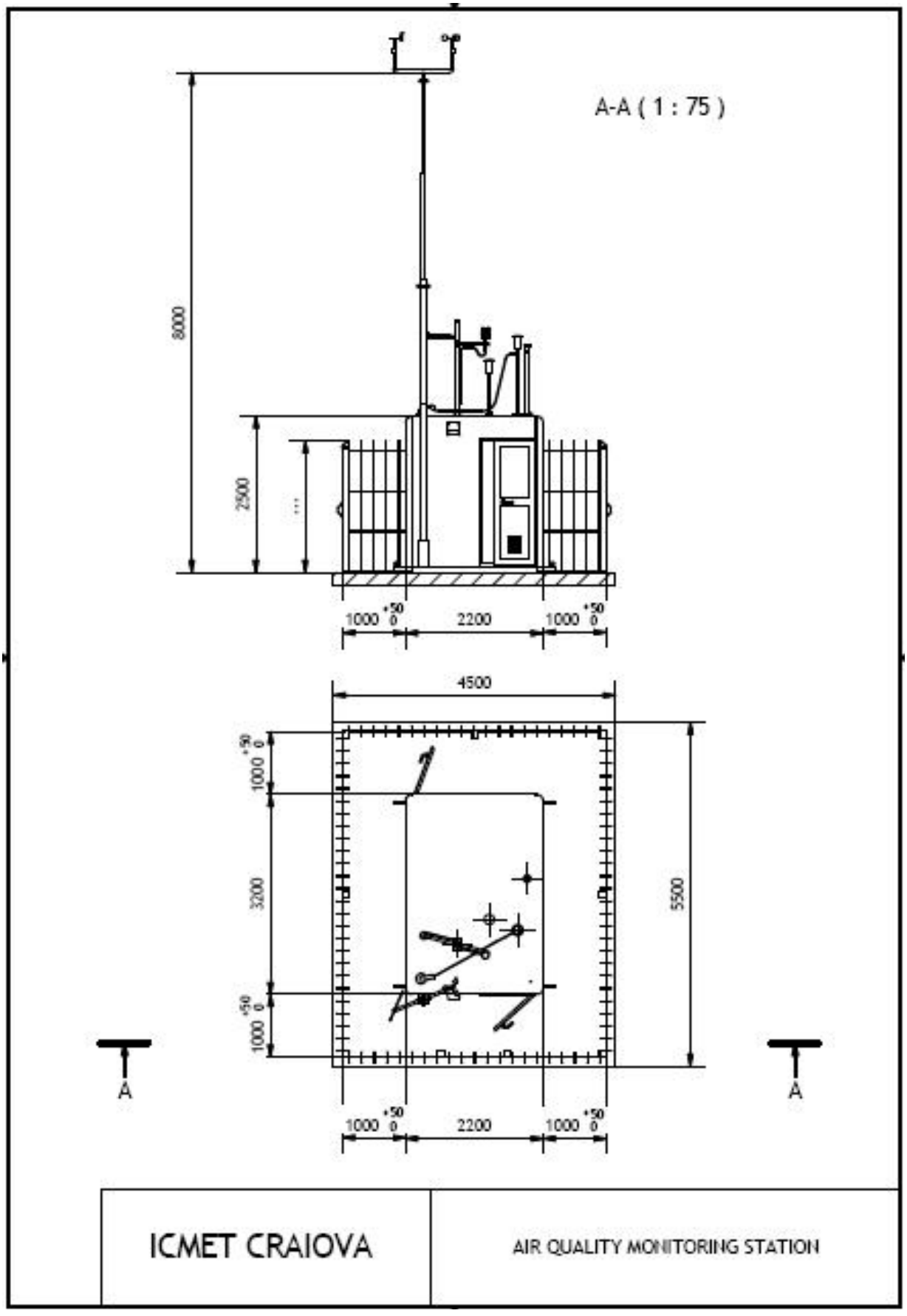
Note :
1. The topmast will be attached to the cabin and will be anchored to the posts of the surrounding fence.
2. The station will be placed on a concrete platform and will be protected by a surrounding fence.
3. The cabin lifting and manipulation will be done by using hoisting rings located on the lifting bars.
4. After handling, the two lifting bars will be removed.



No.	Station placement	1	2	3	4	5	6	7	8	9
1	Calafat - Dolj	x	x	x	x	x	x	x	x	x
2	Turnu Magurele - Teleorman (the central area)	x	-	x	x	x	x	x	-	-
3	Turnu Magurele -Teleorman (the chemical plant area DONAUCHEM)	x	x	x	x	x	x	x	x	x
4	Zimnicea - Teleorman	x	x	x	x	x	x	x	x	x
5	Modelu - Calarasi	x	x	x	x	x	x	x	x	x

ICMET CRAIOVA

AIR QUALITY MONITORING STATION


A-A (1 : 75)
8000
2500
1000 +50 0
2200
1000 +50 0
4500
1000 +50 0
3200
1000 +50 0
5500
A
A
1000 +50 0
2200
1000 +50 0
ICMET CRAIOVA
AIR QUALITY MONITORING STATION

2.2.2. Electric diagram of the air quality monitoring station

2.2.2.1. Electric system

The designed *electric system* contains a unitary assembly made of conductors, circuit breakers, fuses, outlets and devices intended to supply safely a laboratory enclosure for air quality monitoring.

An electrical distribution panel centralizes the circuit-breakers, fuses, switches and other additional outlets.

For avoiding the accidents and faults in installations, there are separate circuits for the measurement, sampling and calibration equipment, data management system and peripheral equipment system, the air conditioning system inclusively,.

The sizing of the electrical distribution panel is achieved in accordance with the power requirements of the electric apparatus and equipment.

2.2.2.2. The conditioning and uninterruptible power supply (UPS) system

The whole electric circuit is protected against over-voltages and short-circuits by a device for conditioning the power supply with the following characteristics:

Scope

It refers to the protection of the consumers from the calibration units against the dangerous variations of power supply parameters, also to the supply of those consumers in case of accidental interruptions of the power supply from the initial source. To this end, the system is provided both with circuits that filter the current transmitted to the consumer and with switching circuits and batteries that ensure in a very short time the supply of consumers, in the event of a failure of the main current source.

Mode of operation

The system is of on – line type, with double conversion of VFI type (output voltage and frequency independent from the main source): the load is permanently supplied from the inverter that delivers a sinusoidal voltage, with voltage and frequency stabilization.

Input voltage and frequency

400V (3P+N) ± 10%; 50 Hz ± 2%

Output voltage and frequency

230 V AC± 5%, 50 ±1 Hz

Rated power

Minimum 8 KVA, ensuring the consumption of the whole monitoring station and of all the consumers installed in it, for a set time period of minimum 20 minutes, in the event of power supply interruption.

Independence

Minimum 20 minutes.

Management and operation

The system is delivered together with software that ensures the efficient and intuitive management of the system, so as the most important information is visualized by graphics of "bar" type (output voltage, battery capacity, consumed power etc). The system is locally and remotely manageable and operable by means of the software.

Battery

The storage battery is composed of stationary batteries, of sealed type, being placed inside the laboratory enclosure. It has a 2-5 years lifetime and guarantees the supply of a consumer at a connected power of minimum 8 KVA (cos φ = min 0.7), if the supply from the mains is interrupted, with an independence of minimum 20 minutes.

Rectifier

The rectifier is provided with circuits for delaying the reconnection to the network, programmable within the 0 -3 minutes interval, at the resumption of power supply after an interruption. It is also provided with soft start circuits, having the time interval when the current absorbed from the network passes from 0 to the normal duty value, programmable within the interval 0-30 seconds.

Inverter

The inverter manages overload events, as follows:

- for a consumer with power factor cos φ = 0.9 - up to 1 minute for three phase overloads higher by 33% than the rated load and up to 5 seconds for three phase overloads higher by 50% than the rated load;

- for a consumer with power factor cos φ = 0.8 - an infinite period for three phase loads higher by 15% than the rated load, up to 10 minutes for three phase loads higher by 25%, up to 1 minute for three phase loads higher by 50% and up to 5 seconds for three phase loads higher by 66% than the rated load.

The conditioning and uninterruptible power supply system is compact and integrated equipment, manufactured by a prestigious manufacturer in the field.

Automatic restarting after current interruption

After a blackout, all the analyzers, samplers, other systems and equipment have the capability to restart automatically in the moment when power failure is remedied, without losing the data and information measured during the blackout.
This event is transmitted and recorded on the data acquisition system, including the day, month, hour and minute of blackout occurrence and of automatic restart.

2.2.2.3. Alarm systems and other devices

As a safety measure in case of a malfunction or interruption of the operation of the air conditioning system, the laboratory enclosure has an internal temperature sensor which, by means of a control system, interrupts the power supply of the sampling and monitoring equipment if the temperature from inside exceeds the maximum operation temperature of the most sensitive equipment (the temperature can be adjustable).

The laboratory enclosure has an alarm for unauthorized entering (burglary) and a sensor for fires, which are connected to an alarm system with strobe light and audio signal located outside the enclosure.

The associated alarm devices settable by the users trigger and record on the calibration unit from the data acquisition system the following events:

- laboratory supply shortage;
- power supply outside the normal limits;
- failure overtemperature in laboratory;
- low temperature in laboratory;
- burglary open doors;
- fire and burglary alarm system;
- low rate flow of the gas;

2.2.2.4. Air conditioning system

The working compartment is fitted with an adequate air conditioning system (heating and cooling), of split type, that maintains the monitoring, sampling and calibration systems within the optimum operating temperature range, by using a control device. The air conditioning system is configured so as to avoid the humidity condensation inside the equipment and on the sampling lines; for that reason it

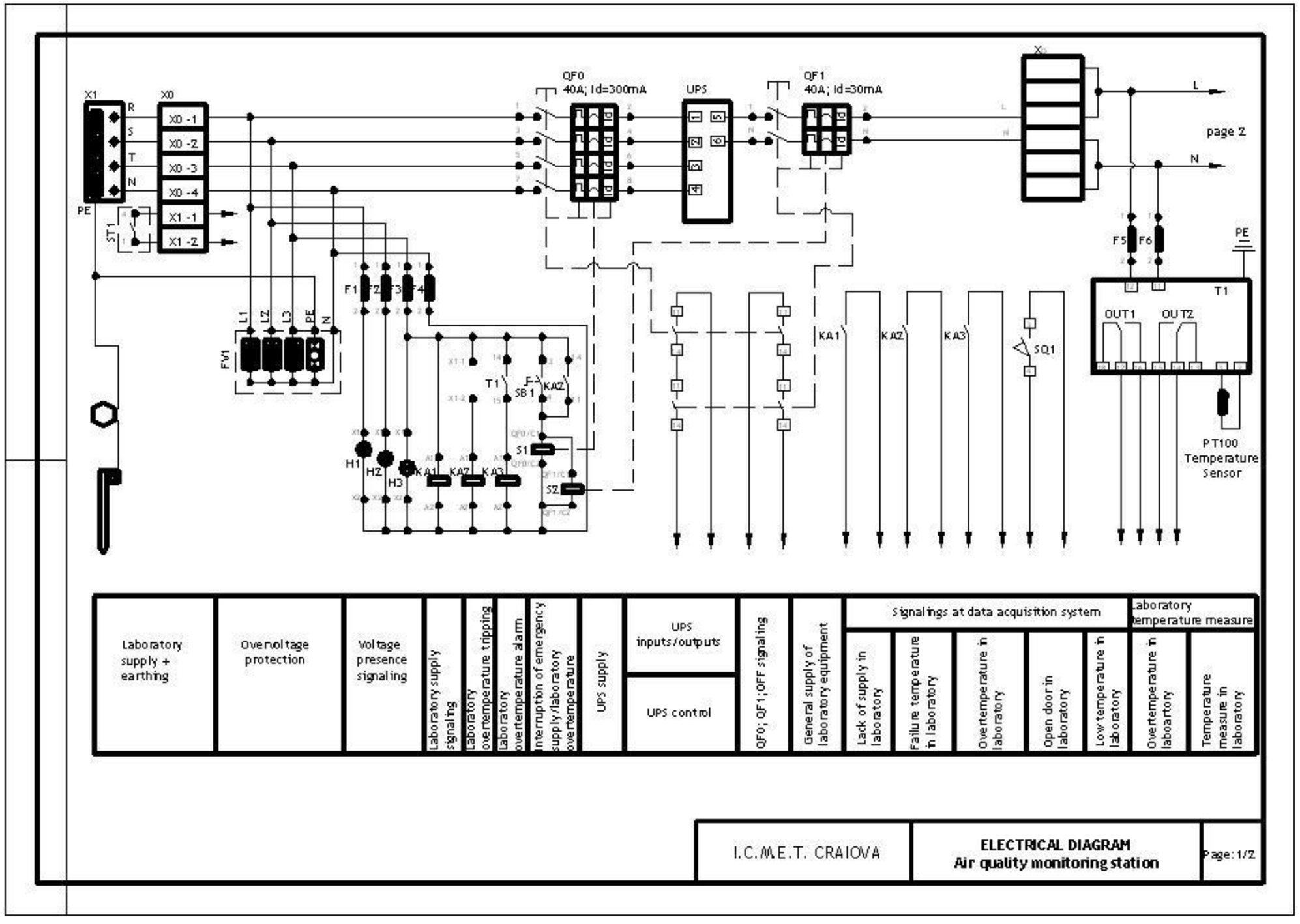
consists in an internal unit, for condensation and an external unit, for evaporation. It has washable filters to reduce to minimum the particulate matter level. The temperature is adjustable between 18°C and 25°C with a tolerance of ± 2°C, so as the system could operate under extreme weather conditions.

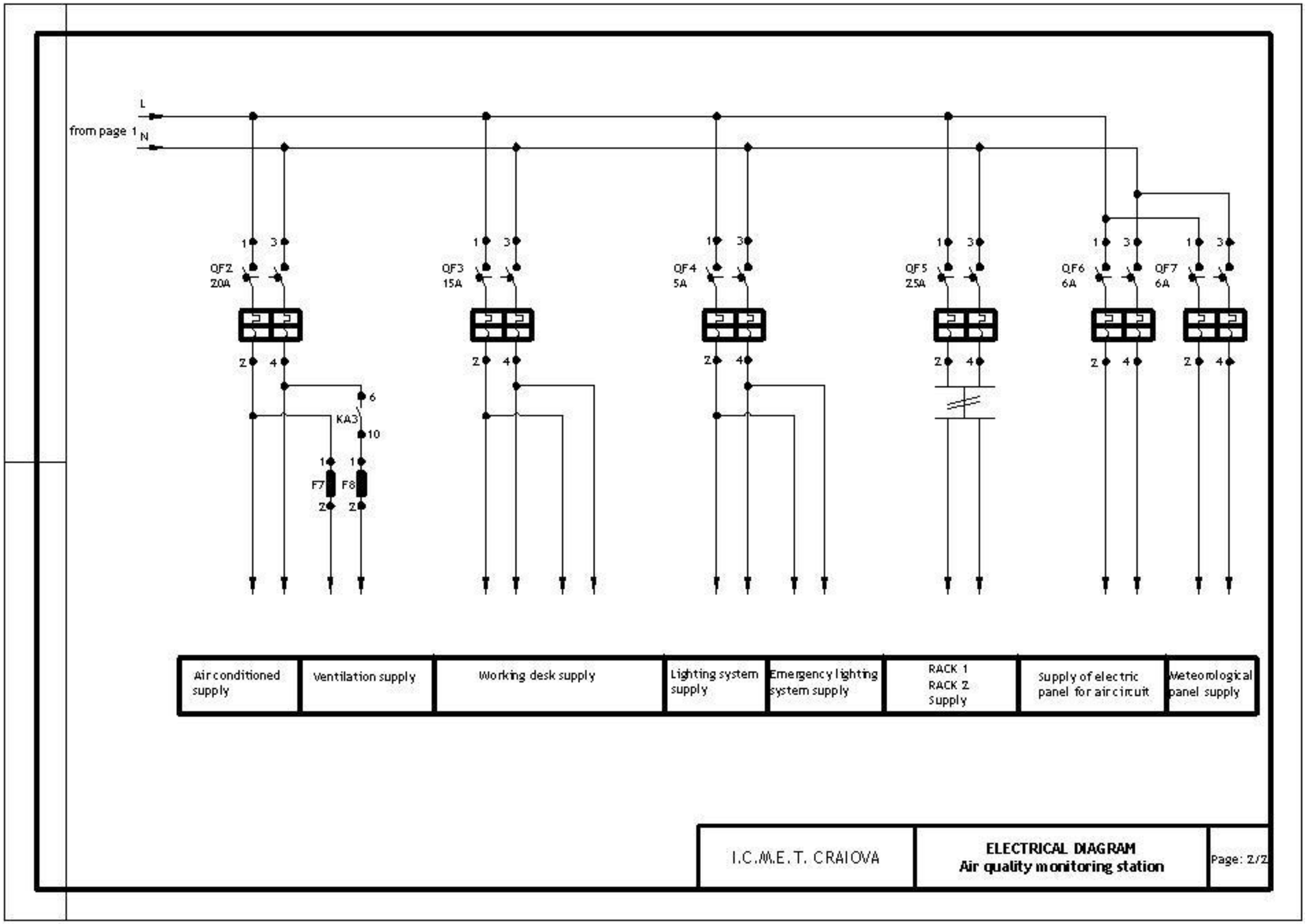
The working compartment is also provided with a fan actuated when the temperature exceeds the threshold of 35ºC, evacuating outwardly the warm air.

2.2.2.5. Lighting

The two compartments (the cylinders and the working one) are provided with fluorescent light sources.

Electric diagram




L
from page 1
N
QF2
20A
QF3
15A
QF4
5A
QF5
25A
QF6
6A
QF7
6A
KA3
F7
F8
Air conditioned supply
Ventilation supply
Working desk supply
Lighting system supply
Emergency lighting system supply
RACK 1
RACK 2
Supply
Supply of electric panel for air circuit
Weteorological panel supply
I.C.M.E.T. CRAIOVA
ELECTRICAL DIAGRAM
Air quality monitoring station
Page: 2/2

2.3. Air quality monitoring stations - Type, monitored indicators and equipment for monitoring and measuring the air pollution degree

2.3.1. Air quality monitoring station located in Dolj county, Calafat city

2.3.1.1. Type, monitored indicators and equipment for monitoring and measuring the air pollution degree

Station type	Indicators	Equipment type	No.	Description
TRAFFIC Cross-border character for assessing the impact due to TEC Vidahim Bulgaria and the impact generated by the road traffic between Romania and Bulgaria on Calafat-Vidin Bridge			1	Industrial type station, laboratory cabin made of 40mm sandwich type glass fiber , pneumatic and electric complete installations, complete accessories for installing the air quality monitoring equipment, conditioned internal atmosphere, pre-location of the extensible meteorological mast, general UPS, alarm etc.
	SO_2	Analyzer	1	**1. Scope**: Measurement of SO_2 concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: UV fluorescence according to EN 14212 "Ambient air – Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence." **4. Measuring range**: 0-100-200-500-1000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤ 1 ppb /day **9. Span deviation**: ≤ 0,5% of scale/day **10. Precision** ≤1 ppb or 1% of reading (whichever is greater) **11.Linearity**≤ 1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤1 ppb (for averaging the values at 1 min.) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *Internal:* oven/permeation tube; *External:* cylinder

Station type	Indicators	Equipment type	No.	Description
				16. Sampling flow rate: 0.5 - 1 l /min; provided by a pump **17. Information storage and display:** Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity**: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19.Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	NO_2, NO_x	Analyzer	1	**1.Scope**: Measurement of NO, NO_2 și NO_X concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: Chemiluminescence according to EN 14211 "Ambient air- Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence." **4. Measuring range**: 0-50-100-200-500-1000-2000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤0.5 ppb **8. Deviation from zero**: ≤0.5 ppb /day **9. Span deviation**: ≤0.5% of scale /day **10. Precision** ≤0.5 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5 ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely.

Station type	Indicators	Equipment type	No.	Description
				Internal: oven/permeation tube; *External:* cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	O_3	Analyzer	1	**1. Scope**: Measurement of O3 concentration from ambient air **2. Overview**: The analyzer will include a zero and span calibration by using an external ozone generator (not delivered within this project). It is installed in a rack of 19". **3. Operating principle**: UV photometry according to EN 14625 „Ambient air-Standard method for the measurement of the concentration of ozone by ultraviolet photometry" **4. Measuring range**: 0-0.05-0.1-0.2-0.5-1-2-5-10-20-50 ppm **5. Unit of measurement** µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤1 ppb /day 9. **Span deviation**: ≤1 % /month **10. Precision**: ≤1 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of

Station type	Indicators	Equipment type	No.	Description
				the time of their initiation, manually or remotely. *External:* with ozone generator **16. Sampling flow rate**: 1 - 2 l/min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	CO	Analyzer	1	**1. Scope**: Measurement of CO concentration from ambient air. **2. Overview**: It is installed in a rack of 19". **3. Operating principle**: NDIR absorption according to EN 14626 "Ambient air– Standard method for the measurement of concentrations of carbon monoxide by non-dispersive infrared spectroscopy." **4. Measuring range**: 0-1-2-5-10-20-50-100-200 - 500 ppm **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤0.05 ppm **8. Deviation from zero**: ≤0.1 ppm /day **9. Span deviation**: ≤1% of scale /day **10. Precision**: ≤0,1ppm or 0.5% pf reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.02 ppm (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *External:* cylinder **16. Sampling flow rate**: 0,5 -2 l /min; provided by a pump

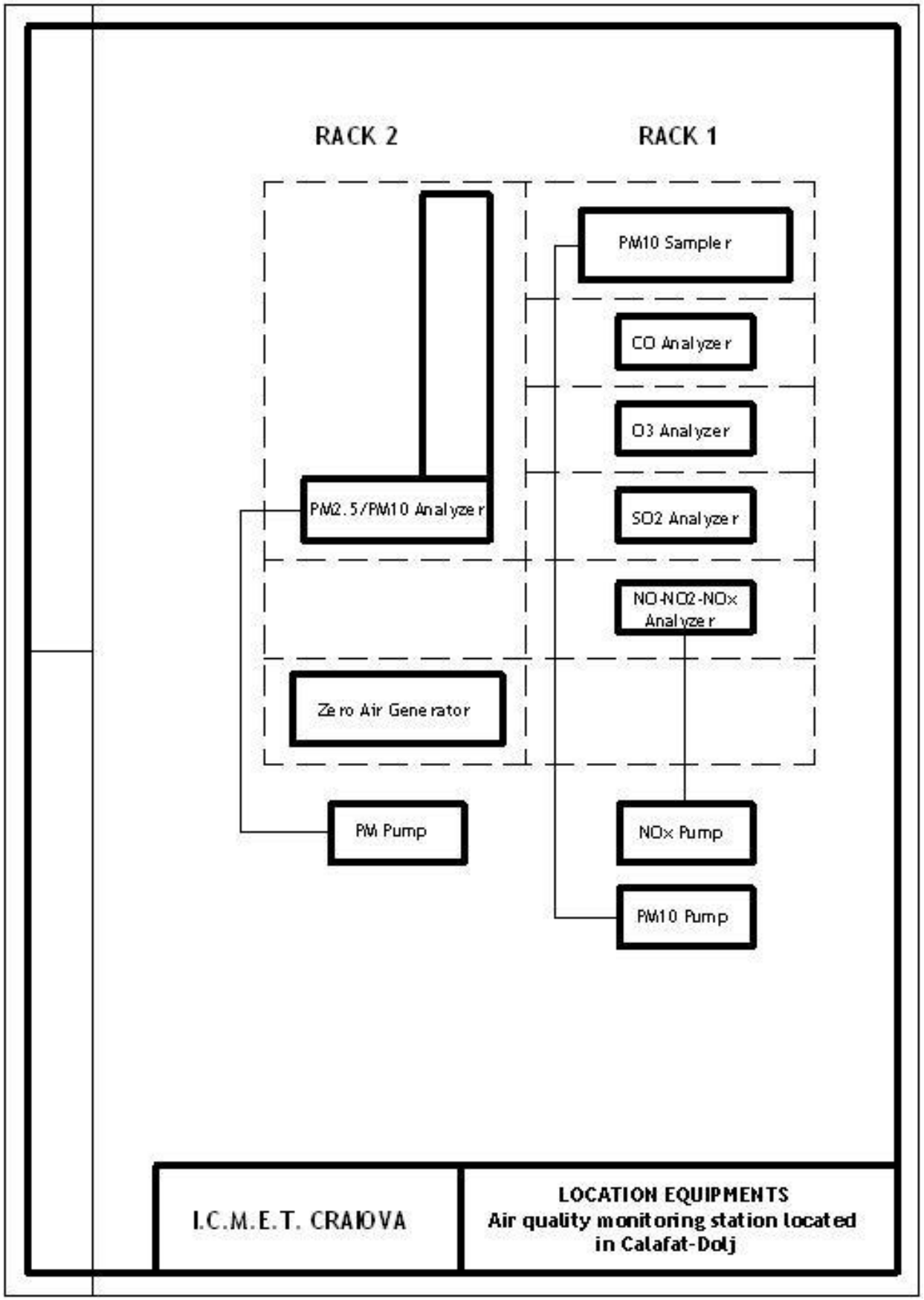
Station type	Indicators	Equipment type	No.	Description
				17. Information storage and display: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity**: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	PM 10	Sampler	1	**1. Scope**: Determination of PM_{10} particulate matter in ambient air **2. Overview**: It is installed in a rack of 19" on support or in console **3. Operating principle**: Gravimetric mass determination according to the requirements of EN 12341: "Air quality – Determination of the PM_{10} fraction of suspended particulate matter – reference method." **4. Sampling system. Sampling head for PM10**: Sampling head for PM_{10} should be according to the requirements of EN 12341. **5. Flow rate**: adjustable between 0.5 – 30 l/min. **6. Stability to flow rate**: Better than ±2% **7. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **8. Not-assisted operating period**: Min. 14 days with automatic, sequential change of the sampling filters **9. Connectivity**: RS 232; **10. Operating temperature**: 5 – 40 °C **11. Power supply**: 230 V, 50 Hz
	Advanced analyzer for particulate matter- simultaneous analysis of	Analyzer	1	**1. Scope**: Simultaneous analysis of PM_{10} and $PM_{2.5}$ fractions of the suspended particulate matter. Determination of PM_{10} and $PM_{2.5}$ particulate matter in ambient air. **2. Overview**: It is installed in a rack of 19" on support or in console **3. Operating principle**: it uses one of the following two methods: absorption of beta radiations or direct measurement of the suspended particulate matter mass,

Station type	Indicators	Equipment type	No.	Description
	PM10, PM2.5			by microbalance. **4. Measuring range**: 0-100.000 μg/m^3 **5. Unit of measurement**: μg/m^3, mg/m^3 **6. Minimal limit of detection**: ≤1 μg/m^3 (1 day average) **7. Precision**: ≤ 1 μg/m^3(1 day average) **8. Resolution**: ≤0,1 μg/m^3 **9. Accuracy**: ±1% **10. Period for averaging the concentration values**: Programmable: 1-24 hours with the possibility to calculate permanently the mobile average for the last hour **11. Sampling and measuring system**: Sampling of PM_{10} and $PM_{2.5}$ particulate matter is done at maximum 1.5 m above the laboratory enclosure. System for avoiding the condensation inside the sampling line. Integrated system for controlling the humidity and temperature of the air sample, so as the interference of water vapors and the losses of volatile and semi-volatile aerosols are eliminated. Capability to measure individually or in a combined way, simultaneously, the particulate matter fractions. It measures/ quantifies and emphasizes separately the volatile and non-volatile particulates, for each particulate matter fraction. **12. Radioactive source** (if applicable): C14 ≤3.7 MBq (100μCi) **13.Filter type** (if applicable):continuous band with automatic change **14. Calibration**: automatic at a pre-set time, or manually by operator **15. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). **16. Connectivity**: RS 232; **17. Operating temperature**: -10 – +25°C – working environment temperature; -30 – +40°C – sampled air temperature **18. Power supply**: 230 V, 50 Hz
	Set of cylinders		1	Includes the delivery of one set of the standard gases mentioned below, in cylinders, for each monitoring stations, as follows: • for each of the 5 stations o $CO+NO+SO_2$ in N_2,: 1500 ppm (CO), 40 ppm (NO), 50 ppm (SO_2) concentrations, minimum 12 months stability, in a cylinder of minimum 40l

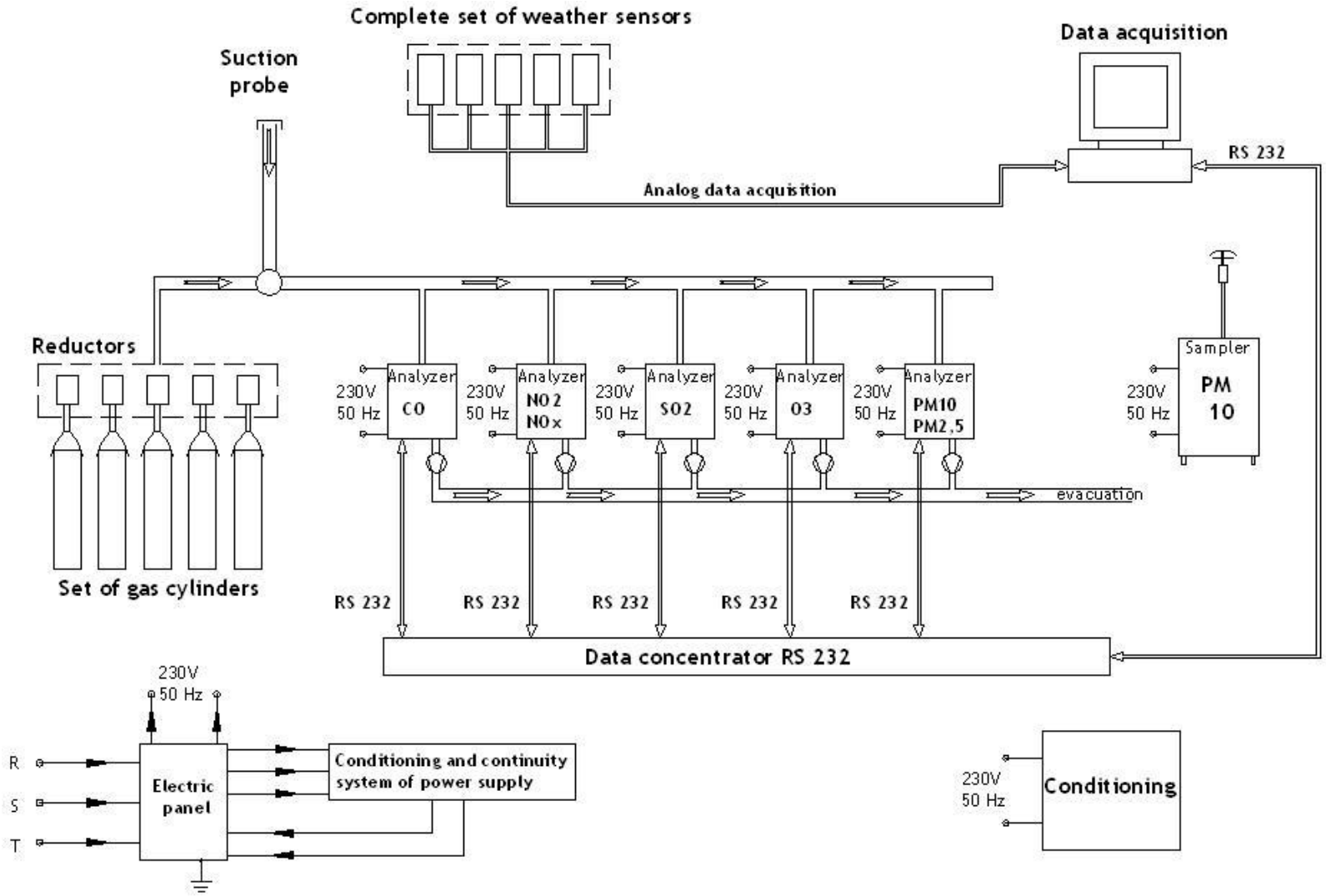
Station type	Indicators	Equipment type	No.	Description
				with stainless steel faucet o NO_2 in air, 50 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet o CO in N_2, 20 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with faucet for alarm • at the stations containing NH_3 analyzer, it is added o NH_3 in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet o NH_3 in air, 600ppb concentration, minimum 3 months stability, in a cylinder of minimum 10l with stainless steel faucet • at the stations containing H_2S analyzer, it is added o H_2S in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 10l with stainless steel faucet For each of the 5 stations, a set of minimum 3 pressure reducers for the standard gas, made of stainless steel, with two pressure steps and a pressure gauge.
	Meteorological parameters	Set of meteorological sensors	1	**1. Overview**: For each monitoring station, where it is foreseen, one set composed of meteorological sensors mounted on telescopic mast. The operating temperature range for all the meteorological sensors is from -30^0C up to $+50^0$C. All meteorological equipment is installed by means of some arms on a telescopic topmast and should be in accordance with the requirements of WMO – World Meteorological Organization. All the sensors are designed and manufactured so as to allow the 24/24 hours, 7/7 days continuous, non-surveyed operation, guaranteeing MTBF and MTTR times so as to ensure, during the estimated lifetime of sensors, a data capture greater than 90%. **2. Telescopic mast//topmast of 8m**: A mast (telescopic topmast), attached to the cabin is installed, reaching a height of at least 8 m above the cabin. The mast is provided with the supports necessary for installing all the meteorological sensors, at suitable heights and taking into account the specific nature and purpose of each one. **3. Wind direction sensor (weathercock)**: Sensor type: weathercock, potentiometer; Measuring range: 0-360°; Sensitivity: 0.3 m/s; Resolution: 1°;

Station type	Indicators	Equipment type	No.	Description
				Power supply: 9…24 V DC; Consumption: <7mA typically, 0.9A with heater; Installed at minimum 8m above the ground. **4. Wind speed sensor (anemometer)**: Sensor type: cup anemometer, impulse reducer; Measuring range: 0 – 50 m/s; Sensitivity: 0.3 m/s; Resolution: 0.1 m/s; Precision ±0.5 m/s for wind speeds < 10m/s and ±1.5 m/s above this speed; Power supply: 9…24 V DC; Consumption: <7mA typically, 0.9A with heater; ; Installed at minimum 8m above the ground. **5. Temperature sensor (thermometer)**: Sensor type: Pt100 or thermistor, protected against solar radiation; Range: -40°C to +70°C; Precision: ±0.1°C; Resolution: 0.1°C; Power supply: 10-24V DC; consumption <10mA. **6. Relative humidity sensor**: Sensor type: Capacitive; Range: 0-100% relative humidity (RH); Precision: ±2% RH; Resolution: 0.1%RH. **7. Atmospheric pressure sensor (barometer)**: Sensor type: piezoelectric transducer with voltage variation; Range: 850-1050 hPa; Precision: ± 0.5 hPa; Resolution: 0.1 hPa; Power supply: 10-24 V DC; Consumption: < 15 mA. **8. Solar radiation sensor (pyranometer**): Sensor type: pyranometer; Range: +/- 2000 W/m^2; Accuracy and resolution: better than 5W/m^2. **9. Precipitation sensor (rain sensor)**: Sensor type: funnel collector and tilting vessel composed of a pair of calibrated recipients and ON/OFF contact. The dimensions and shape of the edge/ mouth of the funnel vessel comply with the WMO indications. It should be electrically heated to prevent freezing and is manufactured from protected, corrosion resistant materials, painted in white for minimizing the solar radiation effect; Resolution: 0.2mm rain or snow equivalent; Measuring range: 0…300mm/h; Precision: ±1%

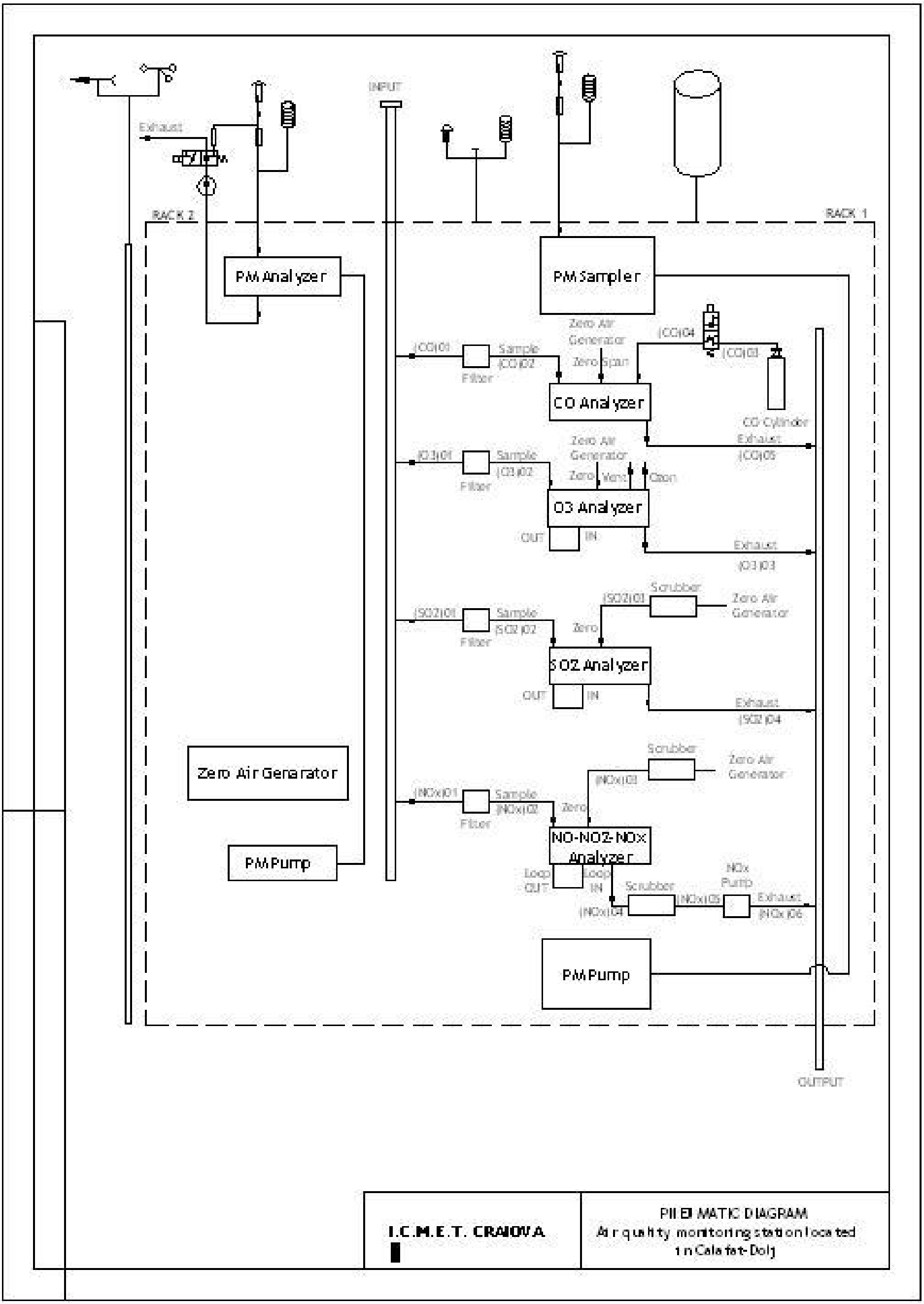
2.3.1.2. Location equipments for monitoring and measuring air pollution degree



2.3.1.3. Functional diagram of the air quality monitoring station located in Calafat city, Dolj County



2.3.1.4. Pneumatic diagram of the air quality monitoring station located in Calafat city, Dolj County



2.3.2. Air quality monitoring station located in Teleorman county, Turnu Măgurele city - The central area (in an area with high population density)

2.3.2.1. Type, monitored indicators and equipment for monitoring and measuring the air pollution degree

Station type	Indicators	Equipment type	No.	Description
Urban background Monitoring the impact of urban activities Monitoring pollution episodes induced by SC DONAU CHEM for a favorable transport from south direction			1	Industrial type station, laboratory cabin made of 40mm sandwich type glass fiber , pneumatic and electric complete installations, complete accessories for installing the air quality monitoring equipment, conditioned internal atmosphere, pre-location of the extensible meteorological mast, general UPS, alarm etc.
	SO_2	Analyzer	1	**1. Scope**: Measurement of SO_2 concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: UV fluorescence according to EN 14212 "Ambient air –Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence." **4. Measuring range**: 0-100-200-500-1000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤ 1 ppb /day **9. Span deviation**: ≤ 0,5% of scale/day **10. Precision** ≤1 ppb or 1% of reading (whichever is greater) **11.Linearity**≤ 1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤1 ppb (for averaging the values at 1 min.) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely.

Station type	Indicators	Equipment type	No.	Description
				Internal: oven/permeation tube; *External:* cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump **17. Information storage and display:** Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity**: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19.Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	NO_2, NO_x	Analyzer	1	**1.Scope**: Measurement of NO, NO_2 şi NO_X concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: Chemiluminescence according to EN 14211 "Ambient air–Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence." **4. Measuring range**: 0-50-100-200-500-1000-2000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤0.5 ppb **8. Deviation from zero**: ≤0.5 ppb /day **9. Span deviation**: ≤0.5% of scale /day **10. Precision** ≤0.5 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5 ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the

Station type	Indicators	Equipment type	No.	Description
				establishment of the time of their initiation, manually or remotely. *Internal:* oven/permeation tube; *External:* cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	O_3	Analyzer	1	**1. Scope**: Measurement of O3 concentration from ambient air **2. Overview**: The analyzer will include a zero and span calibration by using an external ozone generator (not delivered within this project). It is installed in a rack of 19". **3. Operating principle**: UV photometry according to EN 14625 „Ambient air- Standard method for the measurement of the concentration of ozone by ultraviolet photometry" **4. Measuring range**: 0-0.05-0.1-0.2-0.5-1-2-5-10-20-50 ppm **5. Unit of measurement** µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤1 ppb /day 9. **Span deviation**: ≤1 % /month **10. Precision**: ≤1 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756.

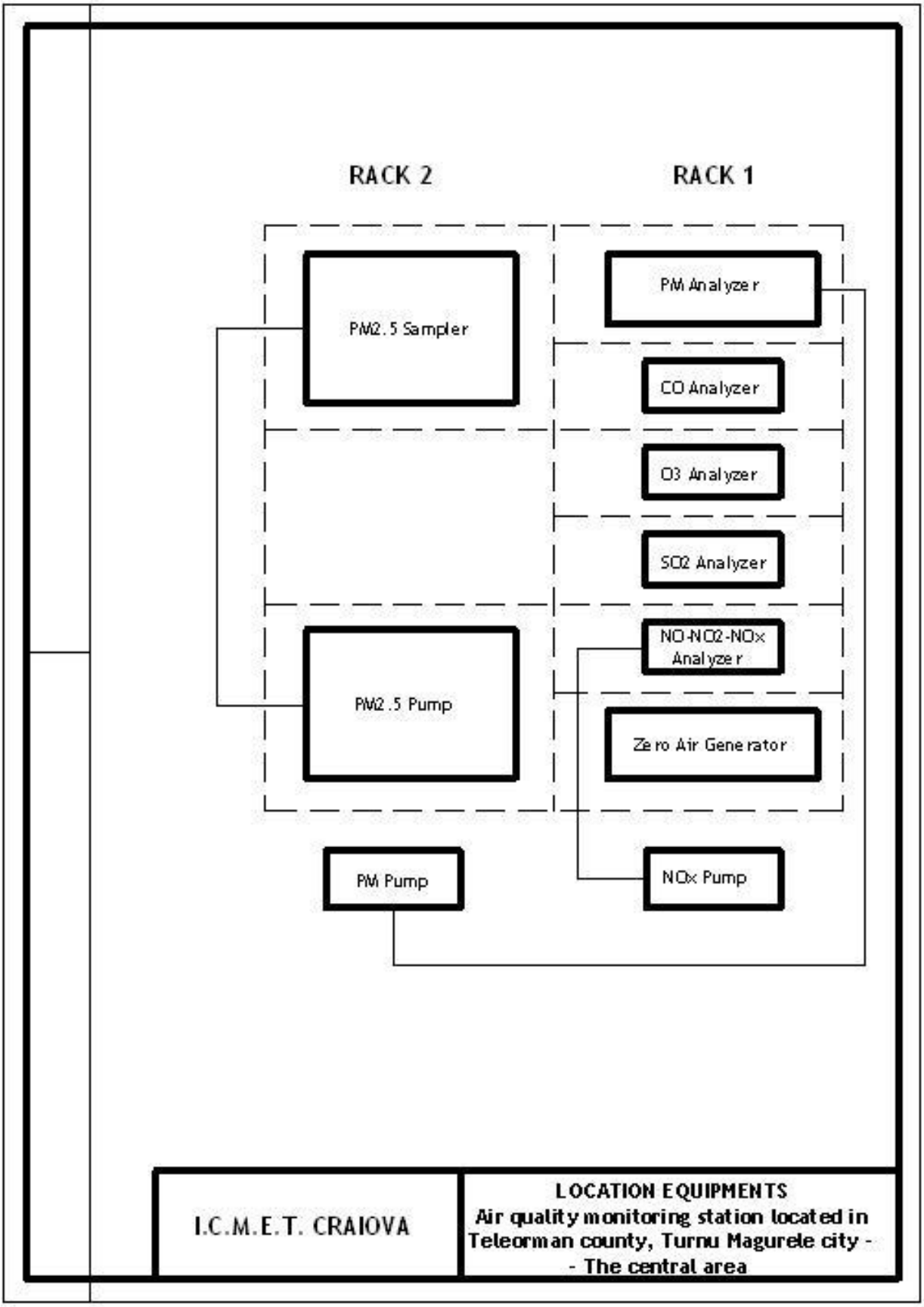
Station type	Indicators	Equipment type	No.	Description
				15. Calibration: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *External*: with ozone generator **16. Sampling flow rate**: 1 - 2 l/min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	CO	Analizor	1	**1. Scope**: Measurement of CO concentration from ambient air. **2. Overview**: It is installed in a rack of 19". **3. Operating principle**: NDIR absorption according to EN 14626 "Ambient air–Standard method for the measurement of concentrations of carbon monoxide by non-dispersive infrared spectroscopy." **4. Measuring range**: 0-1-2-5-10-20-50-100-200 - 500 ppm **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤0.05 ppm **8. Deviation from zero**: ≤0.1 ppm /day **9. Span deviation**: ≤1% of scale /day **10. Precision**: ≤0,1ppm or 0.5% pf reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.02 ppm (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the

Station type	Indicators	Equipment type	No.	Description
				establishment of the time of their initiation, manually or remotely. *External:* cylinder **16. Sampling flow rate**: 0,5 -2 l /min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity**: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	PM 2.5	Sampler	1	**1. Scope**: Determination of $PM_{2.5}$ particulate matter in ambient air. **2.Overview**: It is installed in a rack of 19", on support or in console **3. Operating principle**: The determination of gravimetric mass is according to the requirements of EN 14907. The determination of the PM2.5 mass fraction from suspended particulate matter is in accordance with the requirements of the EU reference method provided in EN 14907. The method is based on the collection of PM2.5 fraction from the ambient air on filters. **4. Sampling system. Sampling head for PM2.5** Sampling head for PM2.5 should be in accordance with the requirements of EN 14907. **5. Flow rate**: Adjustable between 0.5 – 30 l/min. **6. Stability to flow rate**: Better than ±2% **7. Temperature and pressure correction**: : it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756 **8. Not-assisted operating period**: Min. 14 days with automatic, sequential change of the sampling filters. **9. Connectivity**: RS 232; **10. Operating temperature**: 5 – 40 °C **11. Power supply** : 230 V, 50 Hz

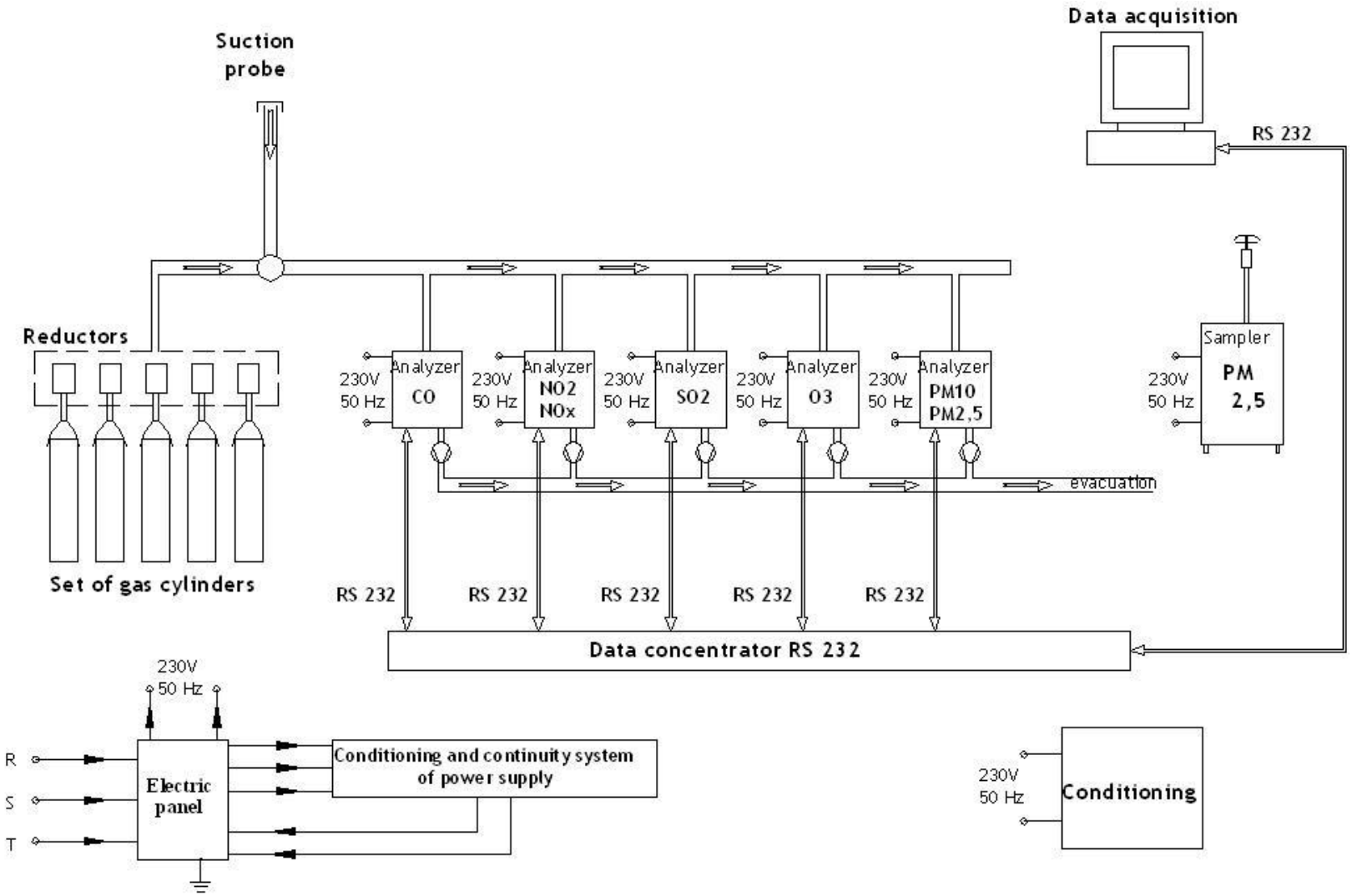
Station type	Indicators	Equipment type	No.	Description
	Analyzer for particulate matter with alternative measurement of PM10, PM2.5	Analyzer	1	**1. Scope**: Alternative analysis of PM_{10} and $PM_{2.5}$ fractions from the suspended particulate matter. Determination of PM_{10} and $PM_{2.5}$ particulate matter in ambient air. **2. Overview**: It is installed in a rack of 19", on support or in console. The selection of the measurement mode (one of the two fractions - PM10 or PM2.5) is done by the operator. **3. Operating principle**: The instrument uses simultaneously and in an integrated mode two of the following three methods, for verifying a method against the other one, and performs the corrections in real time: • Absorption of beta radiation • Nephelometry (light scattering) • Direct measurement of the suspended particulate matter mass, by micro-balance. **4. Measuring range**: 0-100; 0-200; 0-500; 0-1000; 0-5000; 0-10.000 $\mu g/m^3$ **5. Unit of measurement**: $\mu g/m^3$, mg/m^3 **6. Minimal limit of detection**: ≤1 $\mu g/m^3$ (1 day average) **7. Precision**: ≤ 2 $\mu g/m^3$ **8. Period for averaging the concentration values**: Programmable: 1-30 min and 1; 2; 3; 6; 12; 24 hours **9. Sampling and measuring system. Sampling head for PM10/PM2.5**: The sampling head for PM10 should be in accordance with the requirements of EN 12341. The sampling head for PM2.5 should be in accordance with the requirements of EN 14907. **10. Radioactive source (if applicable):** C14≤3.7 MBq (100 μCi) **11. Filter type** (if applicable): for the equipment that uses the absorption of beta radiation: continuous band with automatic change **12. Calibration**: automatically at a pre-set time, or manually by the operator **13. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **14. Connectivity**: Digital ports: RS232/RS485, possibility of accessing

Station type	Indicators	Equipment type	No.	Description
				remotely through Ethernet connection with static or dynamic TCP/IP addressing, with integrated RJ45 port, minimum 10 inputs and 10 digital outputs. **15. Operating temperature**: 5 to 40°C – temperature of the working environment -30 to 40°C – temperature of the sampled air **16. Power supply** : 230 V, 50 Hz
	Set butelii		1	Includes the delivery of one set of the standard gases mentioned below, in cylinders, for each monitoring stations, as follows: • for each of the 5 stations o $CO+NO+SO_2$ in N_2,: 1500 ppm (CO), 40 ppm (NO), 50 ppm (SO_2) concentrations, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet o NO_2 in air, 50 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet o CO in N_2, 20 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with faucet for alarm • at the stations containing NH_3 analyzer, it is added o NH_3 in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet o NH_3 in air, 600ppb concentration, minimum 3 months stability, in a cylinder of minimum 10l with stainless steel faucet • at the stations containing H_2S analyzer, it is added o H_2S in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 10l with stainless steel faucet For each of the 5 stations, a set of minimum 3 pressure reducers for the standard gas, made of stainless steel, with two pressure steps and a pressure gauge.

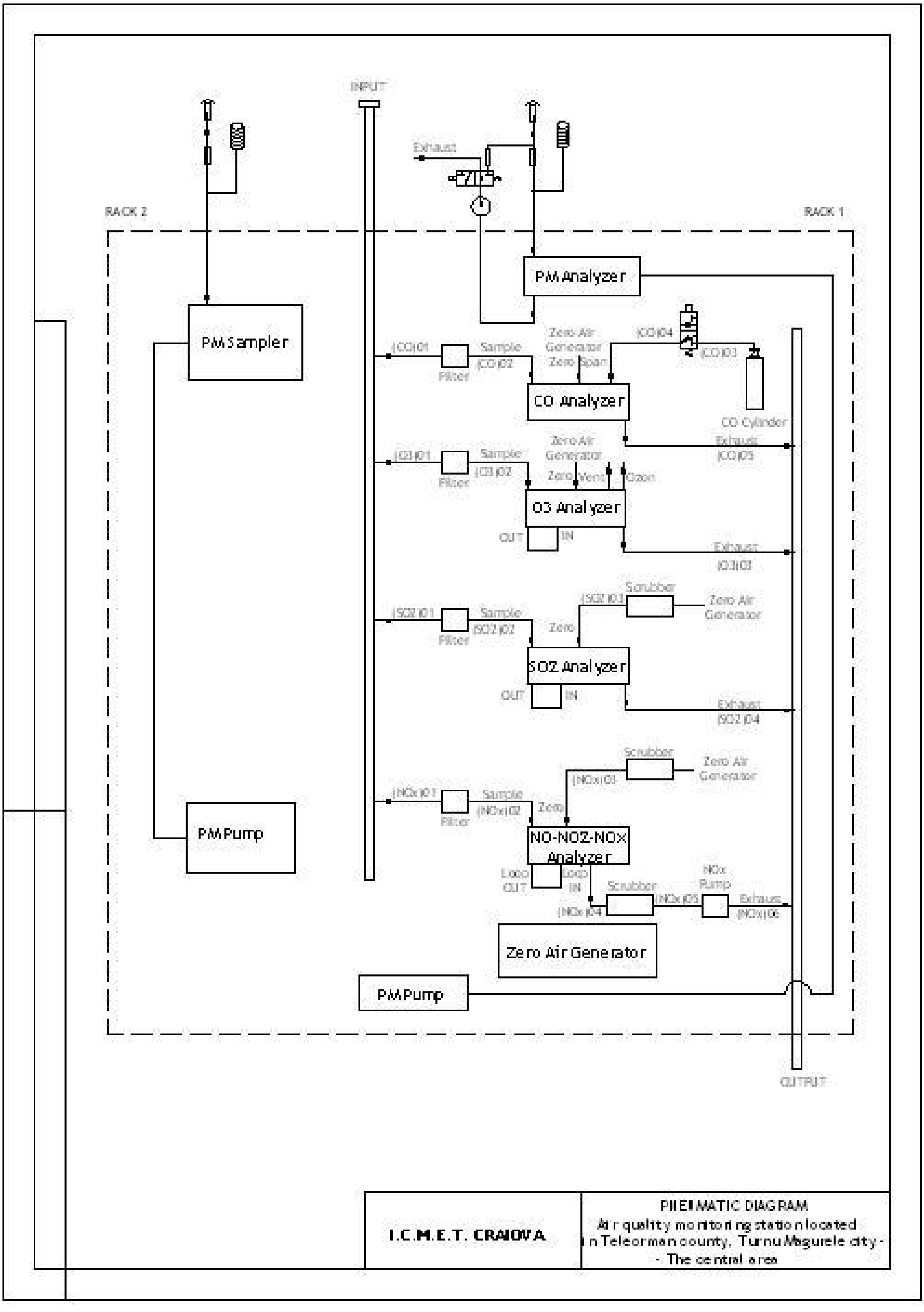
2.3.2.2. Location equipments for monitoring and measuring air pollution degree



2.3.2.3 Functional diagram of the air quality monitoring station located in Teleorman county, Turnu Măgurele city - The central area



2.3.2.4. Pneumatic diagram of the air quality monitoring station located in Teleorman county, Turnu Măgurele city - The central area



2.3.3. Air quality monitoring station located in Teleorman county - the chemical plant area DONAU CHEM of the city Turnu Măgurele

2.3.3.1. Type, monitored indicators and equipment for monitoring and measuring the air pollution degree

Station type	Indicators	Equipment type	No.	Description
Industrial Local monitoring of impacts from DONAU CHEM Monitoring of transboundary character under favorable transport from the northern sector			1	Industrial type station, laboratory cabin made of 40mm sandwich type glass fiber , pneumatic and electric complete installations, complete accessories for installing the air quality monitoring equipment, conditioned internal atmosphere, pre-location of the extensible meteorological mast, general UPS, alarm etc.
	SO_2	Analyzer	1	**1. Scope**: Measurement of SO_2 concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: UV fluorescence according to EN 14212 "Ambient air – Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence." **4. Measuring range**: 0-100-200-500-1000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤ 1 ppb /day **9. Span deviation**: ≤ 0,5% of scale/day **10. Precision** ≤1 ppb or 1% of reading (whichever is greater) **11.Linearity**≤ 1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤1 ppb (for averaging the values at 1 min.) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *Internal*: oven/permeation tube; *External:* cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump

Station type	Indicators	Equipment type	No.	Description
				17. Information storage and display: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **18. Connectivity**: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19.Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	NO_2, NO_x	Analyzer	1	**1.Scope**: Measurement of NO, NO_2 și NO_X concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: Chemiluminescence according to EN 14211 "Ambient air- Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence." **4. Measuring range**: 0-50-100-200-500-1000-2000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤0.5 ppb **8. Deviation from zero**: ≤0.5 ppb /day **9. Span deviation**: ≤0.5% of scale /day **10. Precision** ≤0.5 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5 ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *Internal:* oven/permeation tube; *External:* cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump

Station type	Indicators	Equipment type	No.	Description
				17. Information storage and display: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	O_3	Analyzer	1	**1. Scope**: Measurement of O3 concentration from ambient air **2. Overview**: The analyzer will include a zero and span calibration by using an external ozone generator (not delivered within this project). It is installed in a rack of 19". **3. Operating principle**: UV photometry according to EN 14625 „Ambient air- Standard method for the measurement of the concentration of ozone by ultraviolet photometry" **4. Measuring range**: 0-0.05-0.1-0.2-0.5-1-2-5-10-20-50 ppm **5. Unit of measurement** µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤1 ppb /day 9. **Span deviation**: ≤1 % /month **10. Precision**: ≤1 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *External:* with ozone generator **16. Sampling flow rate**: 1 - 2 l/min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal

Station type	Indicators	Equipment type	No.	Description
				memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	CO	Analyzer	1	**1. Scope**: Measurement of CO concentration from ambient air. **2. Overview**: It is installed in a rack of 19". **3. Operating principle**: NDIR absorption according to EN 14626 "Ambient air- Standard method for the measurement of concentrations of carbon monoxide by non-dispersive infrared spectroscopy." **4. Measuring range**: 0-1-2-5-10-20-50-100-200 - 500 ppm **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤0.05 ppm **8. Deviation from zero**: ≤0.1 ppm /day **9. Span deviation**: ≤1% of scale /day **10. Precision**: ≤0,1ppm or 0.5% pf reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.02 ppm (for 1 min. values averaging) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *External:* cylinder **16. Sampling flow rate**: 0,5 -2 l /min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically.

Station type	Indicators	Equipment type	No.	Description
				18. Connectivity: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	NH_3	Analyzer		**1. Scope**: Measurement of NH_3 (ammonia) concentrations in ambient air. **2. Overview**: The analyzer is composed of a catalytic converter for NH_3 and an analyzer for $NO/NO_2/NO_X$ oxides measurement. It is installed in a rack of 19". **3. Operating principle**: Catalytic oxidation of ammonia at about 900°C and determination of nitrogen oxides by chemiluminescence, according to EN 14211 "Ambient air – Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence" **4. Measuring range**: 0 – 20 ppm **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤ 1 ppb **8. Deviation from zero**: ≤ 1 ppb /day **9. Span deviation**: ≤ 1 % of scale /day **10. Precision**≤0.5 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤ 1 % of scale **12. Response time**: ≤2 minutes **13. Noise level**: ≤0.5 ppb **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756 **15. Calibration**: External system for zero and span calibration for the ammonia converter. The analyzer is equipped with valves for external zero and span calibration using the standard gas from cylinder. External: cylinder **16. Sampling flow rate** : 0.5 -2 l /min; provided by a pump **17. Catalytic converter for ammonia**: Oven with controlled temperature, configurable within the range 50 - 900°C. Display of oven temperature. **18. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute

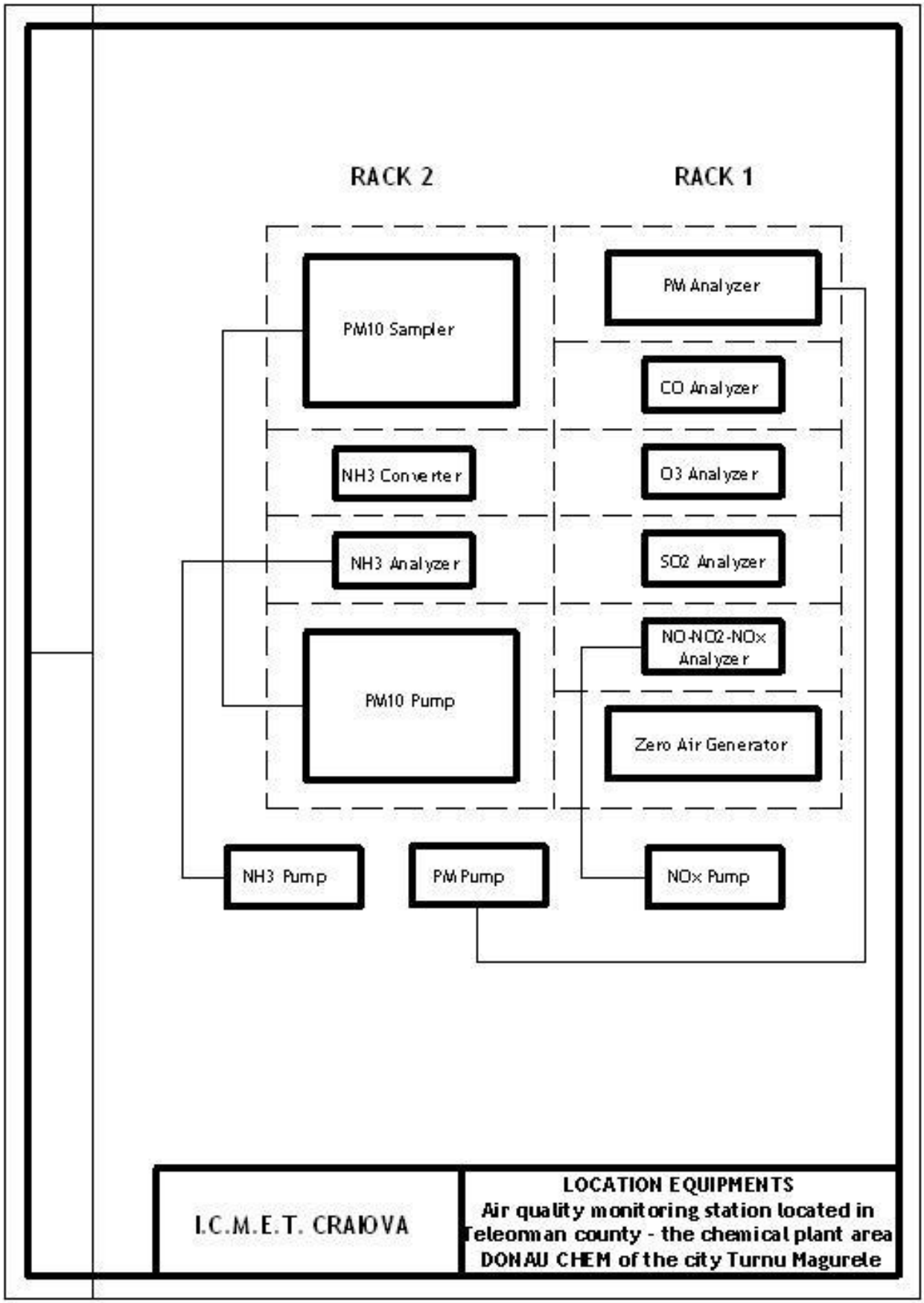
Station type	Indicators	Equipment type	No.	Description
				averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **19. Connectivity**: Digital ports: RS232/RS485, possibility of accessing remotely through Ethernet connection, with static or dynamic TCP/IP addressing, with integrated RJ45 port, minimum 10 inputs and 10 digital outputs **20.Operating temperature**: 5 – 40 °C **21.Power supply**: 230 V, 50 Hz
	PM 10	Sampler	1	**1. Scope**: Determination of PM_{10} particulate matter in ambient air **2. Overview**: It is installed in a rack of 19" on support or in console **3. Operating principle**: Gravimetric mass determination according to the requirements of EN 12341: "Air quality – Determination of the PM_{10} fraction of suspended particulate matter – reference method." **4. Sampling system. Sampling head for PM10**: Sampling head for PM_{10} should be according to the requirements of EN 12341. **5. Flow rate**: adjustable between 0.5 – 30 l/min. **6. Stability to flow rate**: Better than ±2% **7. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756. **8. Not-assisted operating period**: Min. 14 days with automatic, sequential change of the sampling filters **9. Connectivity**: RS 232; **10. Operating temperature**: 5 – 40 °C **11. Power supply**: 230 V, 50 Hz
	Analyzer for particulate matter with alternative measurement of PM10, PM2.5	Analyzer	1	**1. Scope**: Alternative analysis of PM_{10} and $PM_{2.5}$ fractions from the suspended particulate matter. Determination of PM_{10} and $PM_{2.5}$ particulate matter in ambient air. **2. Overview**: It is installed in a rack of 19", on support or in console. The selection of the measurement mode (one of the two fractions - PM10 or PM2.5) is done by the operator. **3. Operating principle**: The instrument uses simultaneously and in an integrated mode two of the following three methods, for verifying a method against the other one, and performs the corrections in real time:

Station type	Indicators	Equipment type	No.	Description
				• Absorption of beta radiation • Nephelometry (light scattering) • Direct measurement of the suspended particulate matter mass, by micro-balance. **4. Measuring range**: 0-100; 0-200; 0-500; 0-1000; 0-5000; 0-10.000 μg/m^3 **5. Unit of measurement**: μg/m^3, mg/m^3 **6. Minimal limit of detection**: ≤1 μg/m^3 (1 day average) **7. Precision**: ≤ 2 μg/m^3 **8. Period for averaging the concentration values**: Programmable: 1-30 min and 1; 2; 3; 6; 12; 24 hours **9. Sampling and measuring system. Sampling head for PM10/PM2.5**: The sampling head for PM10 should be in accordance with the requirements of EN 12341. The sampling head for PM2.5 should be in accordance with the requirements of EN 14907. **10. Radioactive source (**if applicable**):** C14≤3.7 MBq (100μCi) **11. Filter type** (if applicable): for the equipment that uses the absorption of beta radiation: continuous band with automatic change **12. Calibration**: automatically at a pre-set time, or manually by the operator **13. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **14. Connectivity**: Digital ports: RS232/RS485, possibility of accessing remotely through Ethernet connection with static or dynamic TCP/IP addressing, with integrated RJ45 port, minimum 10 inputs and 10 digital outputs. **15. Operating temperature**: 5 to 40°C – temperature of the working environment -30 to 40°C – temperature of the sampled air **16. Power supply** : 230 V, 50 Hz
	Set of cylinders		1	Includes the delivery of one set of the standard gases mentioned below, in cylinders, for each monitoring stations, as follows: • for each of the 5 stations

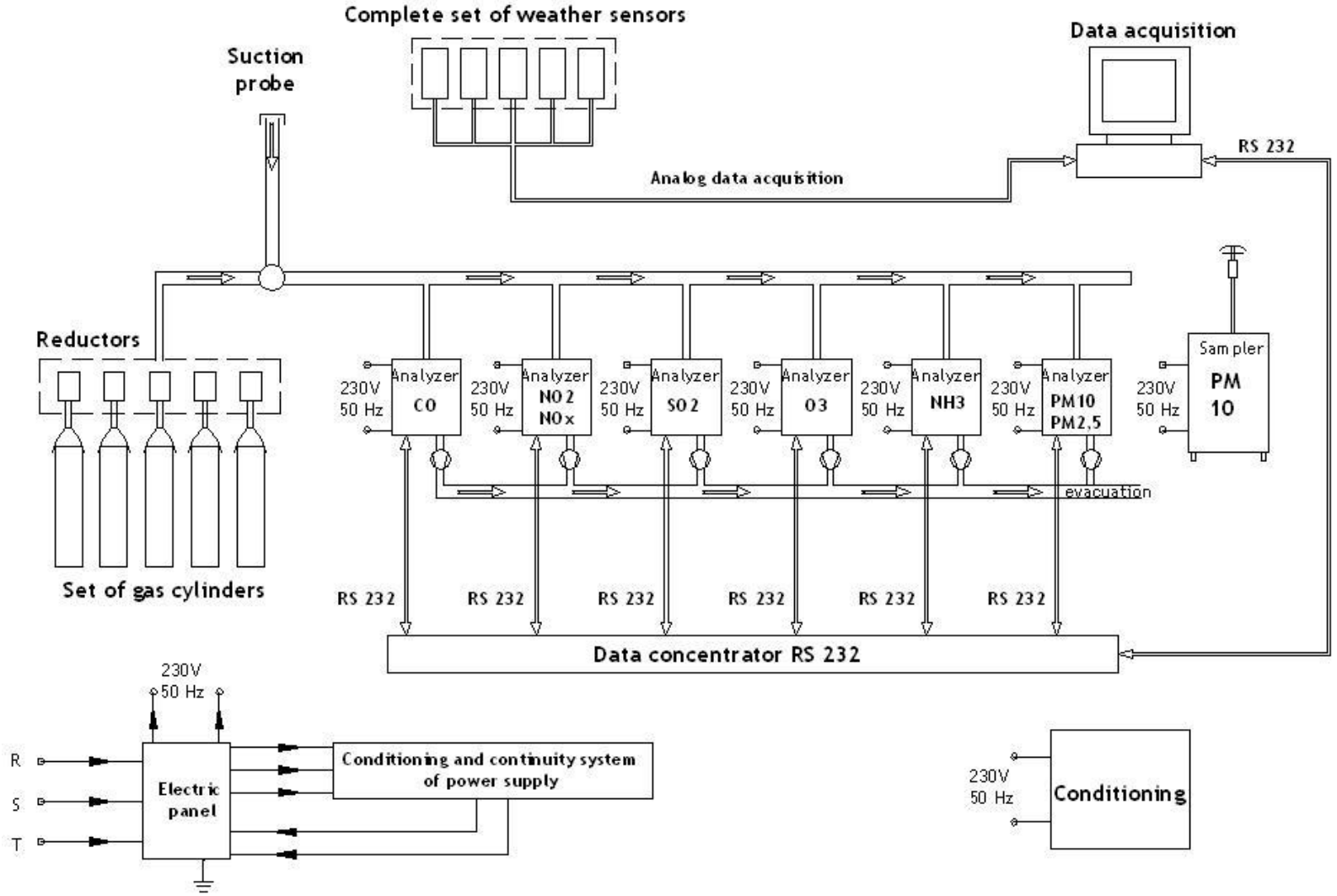
Station type	Indicators	Equipment type	No.	Description
				○ $CO+NO+SO_2$ in N_2,: 1500 ppm (CO), 40 ppm (NO), 50 ppm (SO_2) concentrations, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet ○ NO_2 in air, 50 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet ○ CO in N_2, 20 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with faucet for alarm • at the stations containing NH_3 analyzer, it is added ○ NH_3 in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet ○ NH_3 in air, 600ppb concentration, minimum 3 months stability, in a cylinder of minimum 10l with stainless steel faucet • at the stations containing H_2S analyzer, it is added ○ H_2S in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 10l with stainless steel faucet For each of the 5 stations, a set of minimum 3 pressure reducers for the standard gas, made of stainless steel, with two pressure steps and a pressure gauge.
	Meteorological parameters	Set of meteorological sensors	1	**1. Overview**: For each monitoring station, where it is foreseen, one set composed of meteorological sensors mounted on telescopic mast. The operating temperature range for all the meteorological sensors is from -30^0C up to $+50^0$C. All meteorological equipment is installed by means of some arms on a telescopic topmast and should be in accordance with the requirements of WMO – World Meteorological Organization. All the sensors are designed and manufactured so as to allow the 24/24 hours, 7/7 days continuous, non-surveyed operation, guaranteeing MTBF and MTTR times so as to ensure, during the estimated lifetime of sensors, a data capture greater than 90%. **2. Telescopic mast//topmast of 8m**: A mast (telescopic topmast), attached to the cabin is installed, reaching a height of at least 8 m above the cabin. The mast is provided with the supports necessary for installing all the meteorological sensors, at suitable heights and taking into account the specific nature and purpose of each one. **3. Wind direction sensor (weathercock)**: Sensor type: weathercock,

Station type	Indicators	Equipment type	No.	Description
				potentiometer; Measuring range: 0-360°; Sensitivity: 0.3 m/s; Resolution: 1°; Power supply: 9…24 V DC; Consumption: <7mA typically, 0.9A with heater; Installed at minimum 8m above the ground. **4. Wind speed sensor (anemometer)**: Sensor type: cup anemometer, impulse reducer; Measuring range: 0 – 50 m/s; Sensitivity: 0.3 m/s; Resolution: 0.1 m/s; Precision ±0.5 m/s for wind speeds < 10m/s and ±1.5 m/s above this speed; Power supply: 9…24 V DC; Consumption: <7mA typically, 0.9A with heater; Installed at minimum 8m above the ground. **5. Temperature sensor (thermometer)**: Sensor type: Pt100 or thermistor, protected against solar radiation; Range: -40°C to +70°C; Precision: ±0.1°C; Resolution: 0.1°C; Power supply: 10-24V DC; consumption <10mA. **6. Relative humidity sensor**: Sensor type: Capacitive; Range: 0-100% relative humidity (RH); Precision: ±2% RH; Resolution: 0.1%RH. **7. Atmospheric pressure sensor (barometer)**: Sensor type: piezoelectric transducer with voltage variation; Range: 850-1050 hPa; Precision: ± 0.5 hPa; Resolution: 0.1 hPa; Power supply: 10-24 V DC; Consumption: < 15 mA. **8. Solar radiation sensor (pyranometer**): Sensor type: pyranometer; Range: +/- 2000 W/m^2; Accuracy and resolution: better than $5W/m^2$. **9. Precipitation sensor (rain sensor)**: Sensor type: funnel collector and tilting vessel composed of a pair of calibrated recipients and ON/OFF contact. The dimensions and shape of the edge/ mouth of the funnel vessel comply with the WMO indications. It should be electrically heated to prevent freezing and is manufactured from protected, corrosion resistant materials, painted in white for minimizing the solar radiation effect; Resolution: 0.2mm rain or snow equivalent; Measuring range: 0…300mm/h; Precision: ±1%

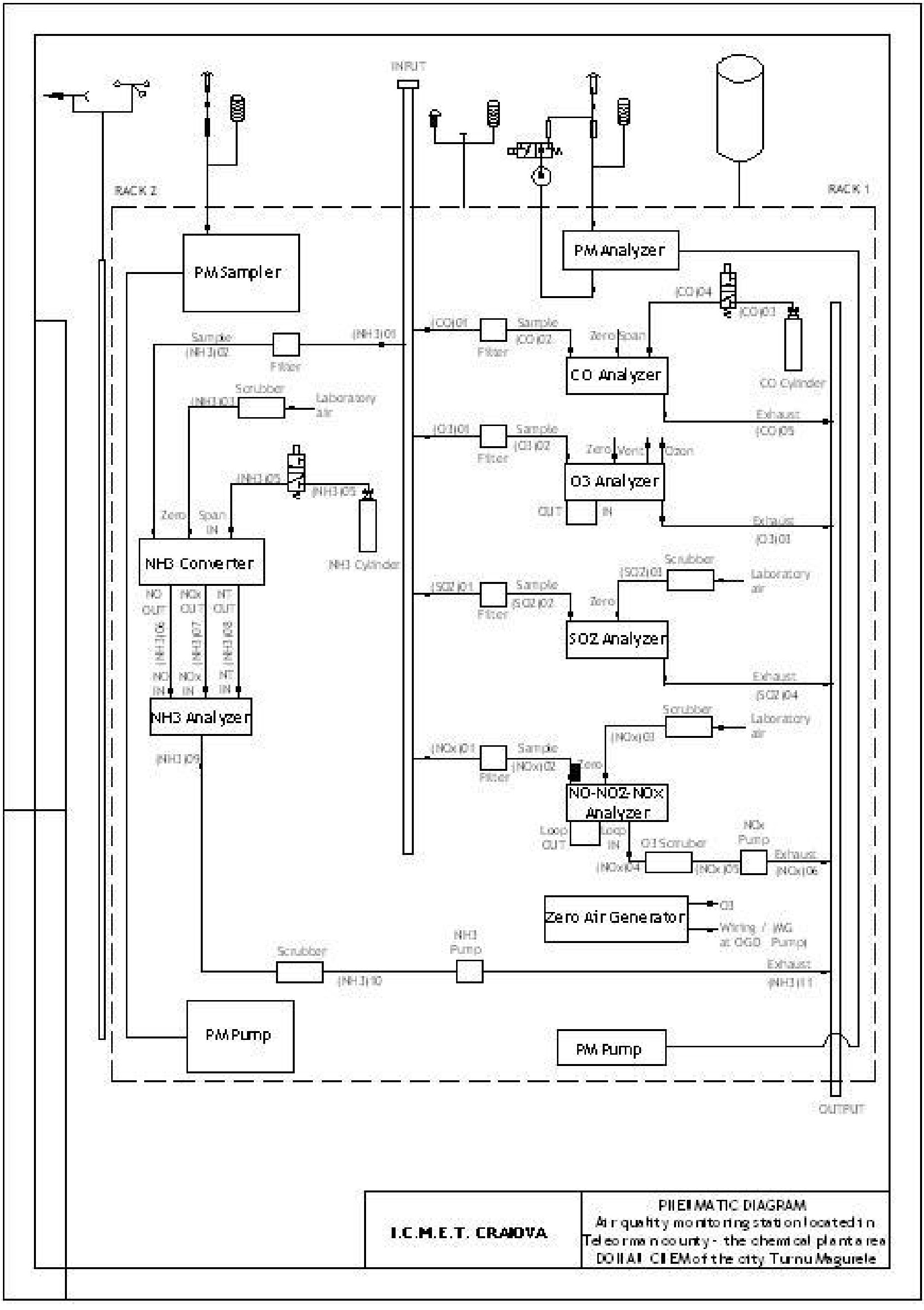
2.3.3.2. Location equipments for monitoring and measuring air pollution degree



2.3.3.3. Functional diagram of the air quality monitoring station located in Teleorman county - the chemical plant area DONAU CHEM of the city Turnu Măgurele



2.3.3.4. Pneumatic diagram of the air quality monitoring station located in Teleorman county - the chemical plant area DONAU CHEM of the city Turnu Măgurele



2.3.4. Air quality monitoring station located in Teleorman county - Area west of the Zimnicea city

2.3.4.1. Type, monitored indicators and equipment for monitoring and measuring the air pollution degree

Station type	Indicators	Equipment type	No.	Description
Urban background Monitoring the impact of urban activities Monitoring of transboundary character due Svishtov industrial platform for a favorable transport south-west			1	Industrial type station, laboratory cabin made of 40mm sandwich type glass fiber, pneumatic and electric complete installations, complete accessories for installing the air quality monitoring equipment, conditioned internal atmosphere, pre-location of the extensible meteorological mast, general UPS, alarm etc.
	SO_2	Analyzer	1	**1. Scope**: Measurement of SO_2 concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: UV fluorescence according to EN 14212 "Ambient air –Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence." **4. Measuring range**: 0-100-200-500-1000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤ 1 ppb /day **9. Span deviation**: ≤ 0,5% of scale/day **10. Precision** ≤1 ppb or 1% of reading (whichever is greater) **11.Linearity**≤ 1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤1 ppb (for averaging the values at 1 min.) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756 **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *Internal:* oven/permeation tube; *External:* cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump **17. Information storage and display:** Graphic display. Storage capacity in internal

Station type	Indicators	Equipment type	No.	Description
				memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity**: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19.Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	NO_2, NO_x	Analyzer	1	**1.Scope**: Measurement of NO, NO_2 și NO_X concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: Chemiluminescence according to EN 14211 "Ambient air-Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence." **4. Measuring range**: 0-50-100-200-500-1000-2000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤0.5 ppb **8. Deviation from zero**: ≤0.5 ppb /day **9. Span deviation**: ≤0.5% of scale /day **10. Precision** ≤0.5 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5 ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756 **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *Internal:* oven/permeation tube; *External:* cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump

Station type	Indicators	Equipment type	No.	Description
				17. Information storage and display: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	O_3	Analyzer	1	**11. Scope**: Measurement of O3 concentration from ambient air **2. Overview**: The analyzer will include a zero and span calibration by using an external ozone generator (not delivered within this project). It is installed in a rack of 19". **3. Operating principle**: UV photometry according to EN 14625 „Ambient air- Standard method for the measurement of the concentration of ozone by ultraviolet photometry" **4. Measuring range**: 0-0.05-0.1-0.2-0.5-1-2-5-10-20-50 ppm **5. Unit of measurement** µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤1 ppb /day 9. **Span deviation**: ≤1 % /month **10. Precision**: ≤1 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *External:* with ozone generator **16. Sampling flow rate**: 1 - 2 l/min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal

Station type	Indicators	Equipment type	No.	Description
				memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	CO	Analyzer	1	**1. Scope**: Measurement of CO concentration from ambient air. **2. Overview**: It is installed in a rack of 19". **3. Operating principle**: NDIR absorption according to EN 14626 "Ambient air–Standard method for the measurement of concentrations of carbon monoxide by non-dispersive infrared spectroscopy." **4. Measuring range**: 0-1-2-5-10-20-50-100-200 - 500 ppm **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤0.05 ppm **8. Deviation from zero**: ≤0.1 ppm /day **9. Span deviation**: ≤1% of scale /day **10. Precision**: ≤0,1ppm or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.02 ppm (for 1 min. values averaging) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *External:* cylinder **16. Sampling flow rate**: 0,5 -2 l /min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both

Station type	Indicators	Equipment type	No.	Description
				numerically and graphically. **18. Connectivity**: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	H_2S	Analyzer		**1. Scope**: Measurement of H_2S (hydrogen sulphide) concentrations from ambient air. **2. Overview**: The analyzer is composed of a catalytic converter for H_2S and an analyzer for SO_2 measurement, fitted out with oven and permeation tube for daily verifications of span. It is installed in a rack of 19". **3. Operating principle**: Catalytic conversion of H_2S and determination of SO_2 by UV fluorescence according to EN 14212 "Ambient air. Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence" **4. Measuring range**: 0 - 10 -100ppm. **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6.Resolution** : ≤1 ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤1 ppb /day **9. Span deviation**: ≤1% of scale /day **10.Precision**: ≤1 ppb or 1% of reading (whichever is greater) **11.Linearity**: ≤ 1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤1 ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756 **15. Calibration**: External system for zero and span calibration for the H2S converter. The analyzer is equipped with valves for external zero and span calibration. Internal system for zero and span calibration for the sulphur oxides analyzer. Capability of automatic zero and span calibrations, with the establishment of their initiation time, manually or remotely. Internal: oven/permeation tube. External: cylinder **16. Sampling flow rate** : 0.5-1 l /min; provided by a pump

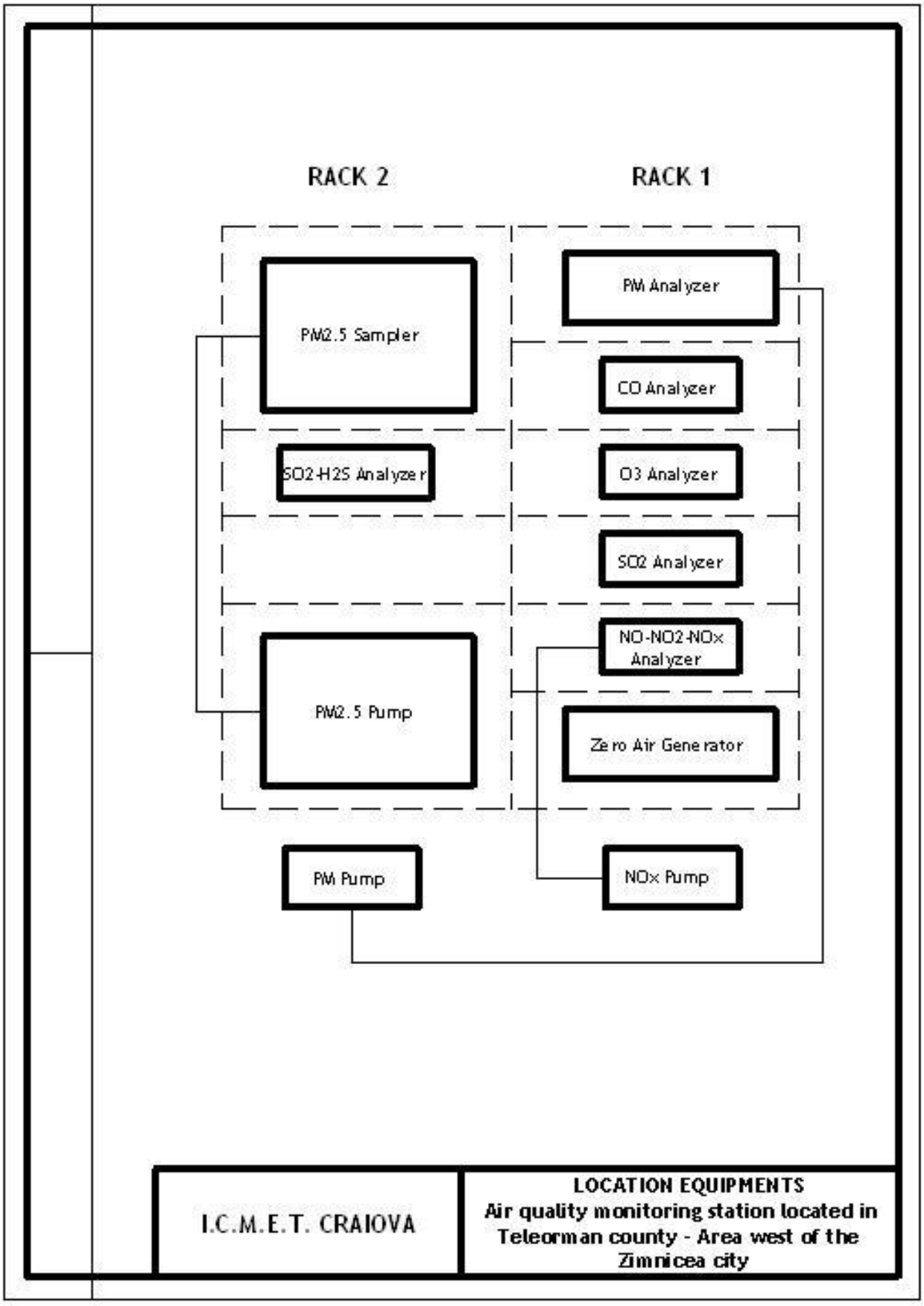
Station type	Indicators	Equipment type	No.	Description
				17. Sample flow: 1 l/min **18. Oven and permeation tube**: The analyzer includes / is equipped with permeation tube and oven for daily verification of span and correction of instrument deviation. Temperature: 30-45 °C (adjustable). **19. Catalytic converter for hydrogen sulphide**: > 80% The efficiency of the catalytic converter for converting H2S to SO_2 should be minimum 80%. **20. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **21. Connectivity**: Digital ports: RS232/RS485, possibility of accessing remotely through Ethernet connection with static or dynamic TCP/IP addressing, with integrated RJ45 port, minimum 10 inputs and 10 digital outputs. **22.Operating temperature**: 25 °C ±5 **23. Power supply**: 230 V, 50 Hz
	PM 2.5	Sampler	1	**1. Scope**: Determination of $PM_{2.5}$ particulate matter in ambient air. **2.Overview**: It is installed in a rack of 19", on support or in console **3. Operating principle**: The determination of gravimetric mass is according to the requirements of EN 14907. The determination of the PM2.5 mass fraction from suspended particulate matter is in accordance with the requirements of the EU reference method provided in EN 14907. The method is based on the collection of PM2.5 fraction from the ambient air on filters. **4. Sampling system. Sampling head for PM2.5** Sampling head for PM2.5 should be in accordance with the requirements of EN 14907. **5. Flow rate**: Adjustable between 0.5 – 30 l/min. **6. Stability to flow rate**: Better than ±2% **7. Temperature and pressure correction**: : it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756 **8. Not-assisted operating period**: Min. 14 days with automatic, sequential change of the sampling filters. **9. Connectivity**: RS 232;

Station type	Indicators	Equipment type	No.	Description
				10. Operating temperature: 5 – 40 °C **11. Power supply** : 230 V, 50 Hz
	Analyzer for particulate matter with alternative measurement of PM10, PM2.5	Analyzer	1	**1. Scope**: Alternative analysis of PM_{10} and $PM_{2.5}$ fractions from the suspended particulate matter. Determination of PM_{10} and $PM_{2.5}$ particulate matter in ambient air. **2. Overview**: It is installed in a rack of 19", on support or in console. The selection of the measurement mode (one of the two fractions - PM10 or PM2.5) is done by the operator. **3. Operating principle**: The instrument uses simultaneously and in an integrated mode two of the following three methods, for verifying a method against the other one, and performs the corrections in real time: • Absorption of beta radiation • Nephelometry (light scattering) • Direct measurement of the suspended particulate matter mass, by micro-balance. **4. Measuring range**: 0-100; 0-200; 0-500; 0-1000; 0-5000; 0-10.000 $\mu g/m^3$ **5. Unit of measurement**: $\mu g/m^3$, mg/m^3 **6. Minimal limit of detection**: ≤1 $\mu g/m^3$ (1 day average) **7. Precision**: ≤ 2 $\mu g/m^3$ **8. Period for averaging the concentration values**: Programmable: 1-30 min and 1; 2; 3; 6; 12; 24 hours **9. Sampling and measuring system. Sampling head for PM10/PM2.5**: The sampling head for PM10 should be in accordance with the requirements of EN 12341. The sampling head for PM2.5 should be in accordance with the requirements of EN 14907. **10. Radioactive source (if applicable):** C14≤3.7 MBq (100μCi) **11. Filter type** (if applicable): for the equipment that uses the absorption of beta radiation: continuous band with automatic change **12. Calibration**: automatically at a pre-set time, or manually by the operator **13. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **14. Connectivity**: Digital ports: RS232/RS485, possibility of accessing remotely through Ethernet connection with static or dynamic TCP/IP addressing, with integrated RJ45

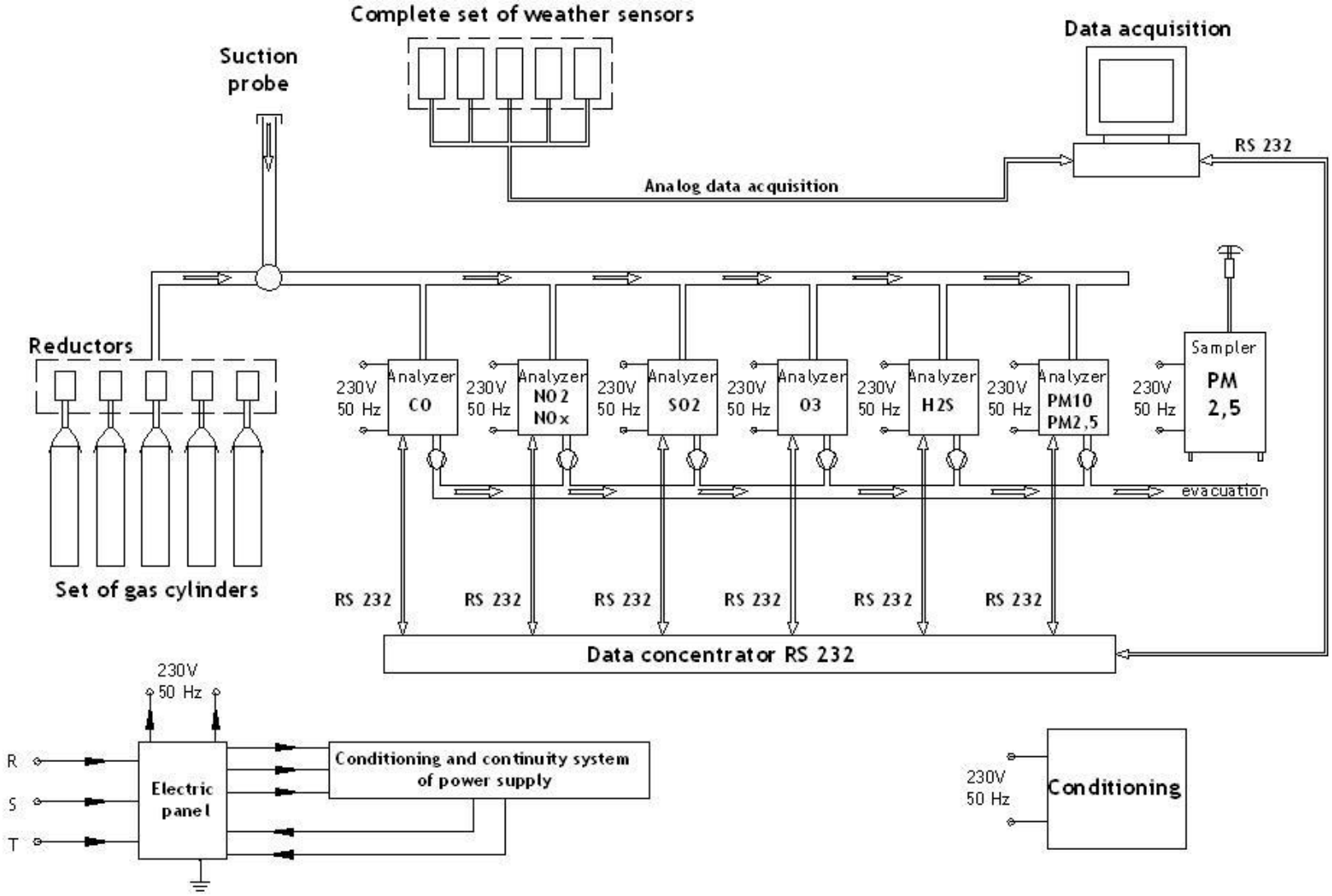
Station type	Indicators	Equipment type	No.	Description
				port, minimum 10 inputs and 10 digital outputs. **15. Operating temperature:** 5 to 40°C – temperature of the working environment -30 to 40°C – temperature of the sampled air **16. Power supply** : 230 V, 50 Hz
	Set of cylinders		1	Includes the delivery of one set of the standard gases mentioned below, in cylinders, for each monitoring stations, as follows: • for each of the 5 stations o $CO+NO+SO_2$ in N_2,: 1500 ppm (CO), 40 ppm (NO), 50 ppm (SO_2) concentrations, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet o NO_2 in air, 50 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet o CO in N_2, 20 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with faucet for alarm • at the stations containing NH_3 analyzer, it is added o NH_3 in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet o NH_3 in air, 600ppb concentration, minimum 3 months stability, in a cylinder of minimum 10l with stainless steel faucet • at the stations containing H_2S analyzer, it is added o H_2S in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 10l with stainless steel faucet For each of the 5 stations, a set of minimum 3 pressure reducers for the standard gas, made of stainless steel, with two pressure steps and a pressure gauge.
	Meteorological parameters	Set of meteorological sensors	1	**1. Overview**: For each monitoring station, where it is foreseen, one set composed of meteorological sensors mounted on telescopic mast. The operating temperature range for all the meteorological sensors is from -30^0C up to $+50^0$C. All meteorological equipment is installed by means of some arms on a telescopic topmast and should be in accordance with the requirements of WMO – World Meteorological Organization. All the sensors are designed and manufactured so as to allow the 24/24 hours, 7/7 days continuous, non-surveyed operation, guaranteeing MTBF and MTTR times so as to

Station type	Indicators	Equipment type	No.	Description
				ensure, during the estimated lifetime of sensors, a data capture greater than 90%. **2. Telescopic mast//topmast of 8m**: A mast (telescopic topmast), attached to the cabin is installed, reaching a height of at least 8 m above the cabin. The mast is provided with the supports necessary for installing all the meteorological sensors, at suitable heights and taking into account the specific nature and purpose of each one. **3. Wind direction sensor (weathercock)**: Sensor type: weathercock, potentiometer; Measuring range: 0-360°; Sensitivity: 0.3 m/s; Resolution: 1°; Power supply: 9…24 V DC; Consumption: <7mA typically, 0.9A with heater; Installed at minimum 8m above the ground. **4. Wind speed sensor (anemometer)**: Sensor type: cup anemometer, impulse reducer; Measuring range: 0 – 50 m/s; Sensitivity: 0.3 m/s; Resolution: 0.1 m/s; Precision ±0.5 m/s for wind speeds < 10m/s and ±1.5 m/s above this speed; Power supply: 9…24 V DC; Consumption: <7mA typically, 0.9A with heater ; Installed at minimum 8m above the ground. **5. Temperature sensor (thermometer)**: Sensor type: Pt100 or thermistor, protected against solar radiation; Range: -40°C to +70°C; Precision: ±0.1°C; Resolution: 0.1°C; Power supply: 10-24V DC; consumption <10mA. **6. Relative humidity sensor**: Sensor type: Capacitive; Range: 0-100% relative humidity (RH); Precision: ±2% RH; Resolution: 0.1%RH. **7. Atmospheric pressure sensor (barometer)**: Sensor type: piezoelectric transducer with voltage variation; Range: 850-1050 hPa; Precision: ± 0.5 hPa; Resolution: 0.1 hPa; Power supply: 10-24 V DC; Consumption: < 15 mA. **8. Solar radiation sensor (pyranometer**): Sensor type: pyranometer; Range: +/-2000 W/m^2; Accuracy and resolution: better than $5W/m^2$. **9. Precipitation sensor (rain sensor)**: Sensor type: funnel collector and tilting vessel composed of a pair of calibrated recipients and ON/OFF contact. The dimensions and shape of the edge/ mouth of the funnel vessel comply with the WMO indications. It should be electrically heated to prevent freezing and is manufactured from protected, corrosion resistant materials, painted in white for minimizing the solar radiation effect; Resolution: 0.2mm rain or snow equivalent; Measuring range: 0…300mm/h; Precision: ±1%

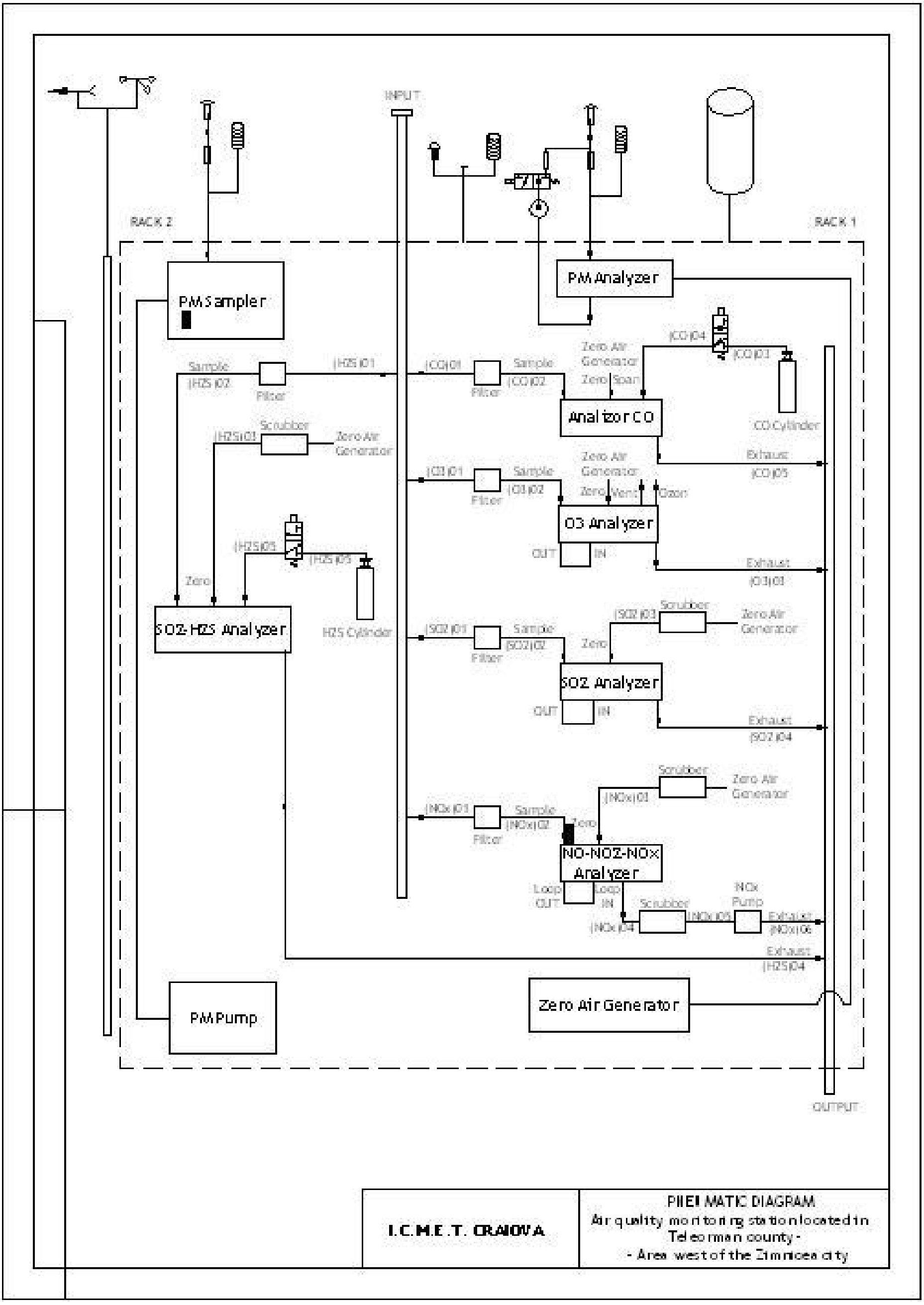
2.3.4.2. Location equipments for monitoring and measuring air pollution degree



2.3.4.3. Functional diagram of the air quality monitoring station located in Teleorman county - Area west of the Zimnicea city



2.3.4.4. Pneumatic diagram of the air quality monitoring station located in Teleorman county - Area west of the Zimnicea city



2.3.5. Air quality monitoring station located in Călăraşi county - Modelu locality

2.3.5.1. Type, monitored indicators and equipment for monitoring and measuring the air pollution degree

Station type	Indicators	Equipment type	No.	Description
Rural background Monitoring the impact of ammonia due to livestock activities and manure management in the context of a predominantly favorable transport from the northern sector			1	Industrial type station, laboratory cabin made of 40mm sandwich type glass fiber , pneumatic and electric complete installations, complete accessories for installing the air quality monitoring equipment, conditioned internal atmosphere, pre-location of the extensible meteorological mast, general UPS, alarm etc.
	SO_2	Analyzer	1	**1. Scope**: Measurement of SO_2 concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: UV fluorescence according to EN 14212 "Ambient air – Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence." **4. Measuring range**: 0-100-200-500-1000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤ 1 ppb /day **9. Span deviation**: ≤ 0,5% of scale/day **10. Precision** ≤1 ppb or 1% of reading (whichever is greater) **11.Linearity**≤ 1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤1 ppb (for averaging the values at 1 min.) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *Internal*: oven/permeation tube; *External*: cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump **17. Information storage and display:** Graphic display. Storage capacity in

Station type	Indicators	Equipment type	No.	Description
				internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity**: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19.Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	NO_2, NO_x	Analyzer	1	**1.Scope**: Measurement of NO, NO_2 și NO_X concentrations from ambient air **2. Overview**: equipped with permeation tube and oven for daily span verifications. It is installed in a rack of 19". The permeation tube should have the concentration of 200-300ppb expressed at a flow rate of 0.5l/min. **3. Operating principle**: Chemiluminescence according to EN 14211 "Ambient air–Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence." **4. Measuring range**: 0-50-100-200-500-1000-2000-5000-10000 ppb **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤0.5 ppb **8. Deviation from zero**: ≤0.5 ppb /day **9. Span deviation**: ≤0.5% of scale /day **10. Precision** ≤0.5 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5 ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *Internal:* oven/permeation tube; *External:* cylinder **16. Sampling flow rate**: 0.5 - 1 l /min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in

Station type	Indicators	Equipment type	No.	Description
				internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	O_3	Analyzer	1	**1. Scope**: Measurement of O3 concentration from ambient air **2. Overview**: The analyzer will include a zero and span calibration by using an external ozone generator (not delivered within this project). It is installed in a rack of 19". **3. Operating principle**: UV photometry according to EN 14625 „Ambient air- Standard method for the measurement of the concentration of ozone by ultraviolet photometry" **4. Measuring range**: 0-0.05-0.1-0.2-0.5-1-2-5-10-20-50 ppm **5. Unit of measurement** µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤1 ppb **8. Deviation from zero**: ≤1 ppb /day 9. **Span deviation**: ≤1 % /month **10. Precision**: ≤1 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.5ppb (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *External:* with ozone generator **16. Sampling flow rate**: 1 - 2 l/min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in

Station type	Indicators	Equipment type	No.	Description
				internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically. **18. Connectivity** Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	CO	Analyzer	1	**1. Scope**: Measurement of CO concentration from ambient air. **2. Overview**: It is installed in a rack of 19". **3. Operating principle**: NDIR absorption according to EN 14626 "Ambient air- Standard method for the measurement of concentrations of carbon monoxide by non-dispersive infrared spectroscopy." **4. Measuring range**: 0-1-2-5-10-20-50-100-200 - 500 ppm **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1ppb **7. Minimal limit of detection**: ≤0.05 ppm **8. Deviation from zero**: ≤0.1 ppm /day **9. Span deviation**: ≤1% of scale /day **10. Precision**: ≤0,1ppm or 0.5% pf reading (whichever is greater) **11. Linearity**: ≤1% of scale **12. Response time**: ≤100 sec. **13. Noise level**: ≤0.02 ppm (for 1 min. values averaging) **14. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **15. Calibration**: zero and span automatically calibration, with the establishment of the time of their initiation, manually or remotely. *External:* cylinder **16. Sampling flow rate**: 0,5 -2 l /min; provided by a pump **17. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured both numerically and graphically.

Station type	Indicators	Equipment type	No.	Description
				18. Connectivity: Digital ports: RS232/RS485, Ethernet connection with static and dynamic TCP/IP addressing, with RJ45 integrated port, minimum 10 inputs and 10 digital outputs **19. Operating temperature**: 5 – 40 °C **20. Power supply**: 230 V, 50 Hz
	NH_3	Analyzer		**1. Scope**: Measurement of NH_3 (ammonia) concentrations in ambient air. **2. Overview**: The analyzer is composed of a catalytic converter for NH_3 and an analyzer for $NO/NO_2/NO_X$ oxides measurement. It is installed in a rack of 19". **3. Operating principle**: Catalytic oxidation of ammonia at about 900°C and determination of nitrogen oxides by chemiluminescence, according to EN 14211 "Ambient air – Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence" **4. Measuring range**: 0 – 20 ppm **5. Unit of measurement**: µg/m^3, ppb, mg/m^3 or ppm. **6. Resolution**: ≤1 ppb **7. Minimal limit of detection**: ≤ 1 ppb **8. Deviation from zero**: ≤ 1 ppb /day **9. Span deviation**: ≤ 1 % of scale /day **10. Precision**≤0.5 ppb or 0.5% of reading (whichever is greater) **11. Linearity**: ≤ 1 % of scale **12. Response time**: ≤2 minutes **13. Noise level**: ≤0.5 ppb **14. Temperature and pressure correction**: it corrects automatically the output signal, in real time, depending on the internal/working environment temperature and pressure variations, according to the requirements from ISO 8756 **15. Calibration**: External system for zero and span calibration for the ammonia converter. The analyzer is equipped with valves for external zero and span calibration using the standard gas from cylinder. External: cylinder **16. Sampling flow rate** : 0.5 -2 l /min; provided by a pump **17. Catalytic converter for ammonia**: Oven with controlled temperature, configurable within the range 50 - 900°C. Display of oven temperature. **18. Information storage and display**: Graphic display. Storage capacity in

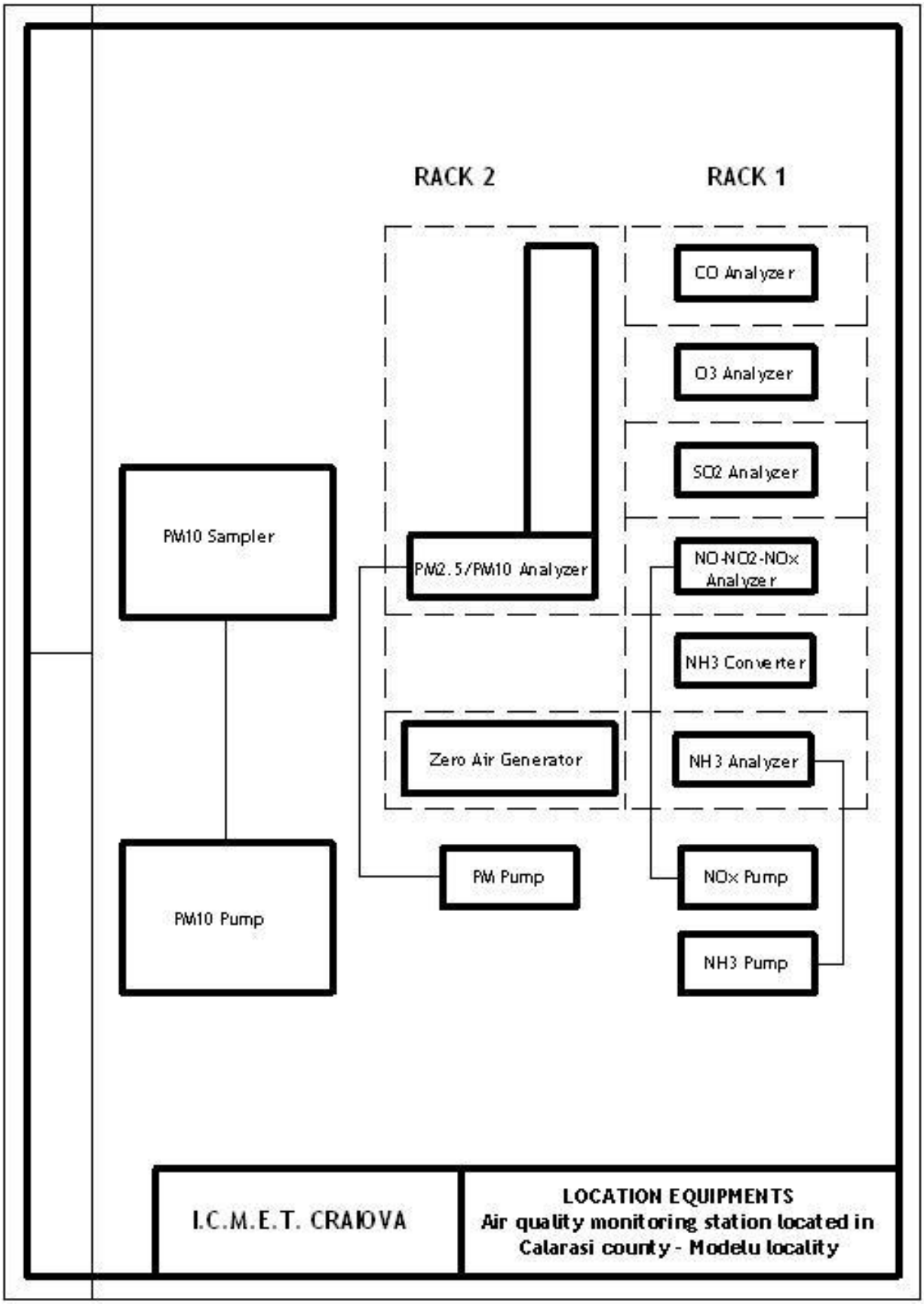
Station type	Indicators	Equipment type	No.	Description
				internal memory: more than 50,000 values of the measured concentrations (1 minute averages). Capacity of displaying the operational parameters and concentrations measured, both numerically and graphically. **19. Connectivity**: Digital ports: RS232/RS485, possibility of accessing remotely through Ethernet connection, with static or dynamic TCP/IP addressing, with integrated RJ45 port, minimum 10 inputs and 10 digital outputs **20.Operating temperature**: 5 – 40 °C **21.Power supply**: 230 V, 50 Hz
	PM 10	Sampler	1	**1. Scope**: Determination of PM_{10} particulate matter in ambient air **2. Overview**: It is installed in a rack of 19" on support or in console **3. Operating principle**: Gravimetric mass determination according to the requirements of EN 12341: "Air quality – Determination of the PM_{10} fraction of suspended particulate matter – reference method." **4. Sampling system. Sampling head for PM10**: Sampling head for PM_{10} should be according to the requirements of EN 12341. **5. Flow rate**: adjustable between 0.5 – 30 l/min. **6. Stability to flow rate**: Better than ±2% **7. Temperature and pressure correction**: corrects automatically the output signal, in real time, depending on the temperature and internal/working environmental pressure variations, according to the requirements from ISO 8756. **8. Not-assisted operating period**: Min. 14 days with automatic, sequential change of the sampling filters **9. Connectivity**: RS 232; **10. Operating temperature**: 5 – 40 °C **11. Power supply**: 230 V, 50 Hz
	Advanced analyzer for particulate matter- simultaneous analysis of PM10, PM2.5	Analyzer	1	**1. Scope**: Simultaneous analysis of PM_{10} and $PM_{2.5}$ fractions of the suspended particulate matter. Determination of PM_{10} and $PM_{2.5}$ particulate matter in ambient air. **2. Overview**: It is installed in a rack of 19" on support or in console **3. Operating principle**: it uses one of the following two methods: absorption of beta radiations or direct measurement of the suspended particulate matter mass, by microbalance. **4. Measuring range**: 0-100.000 $\mu g/m^3$

Station type	Indicators	Equipment type	No.	Description
				5. Unit of measurement: $\mu g/m^3$, mg/m^3 **6. Minimal limit of detection**: ≤1 $\mu g/m^3$ (1 day average) **7. Precision**: ≤ 1 $\mu g/m^3$(1 day average) **8. Resolution**: ≤0,1 $\mu g/m^3$ **9. Accuracy**: ±1% **10. Period for averaging the concentration values**: Programmable: 1-24 hours with the possibility to calculate permanently the mobile average for the last hour **11. Sampling and measuring system**: Sampling of PM_{10} and $PM_{2.5}$ particulate matter is done at maximum 1.5 m above the laboratory enclosure. System for avoiding the condensation inside the sampling line. Integrated system for controlling the humidity and temperature of the air sample, so as the interference of water vapors and the losses of volatile and semi-volatile aerosols are eliminated. Capability to measure individually or in a combined way, simultaneously, the particulate matter fractions. It measures/ quantifies and emphasizes separately the volatile and non-volatile particulates, for each particulate matter fraction. **12. Radioactive source** (if applicable): C14 ≤3.7 MBq (100μCi) **13.Filter type** (if applicable):continuous band with automatic change **14. Calibration**: automatic at a pre-set time, or manually by operator **15. Information storage and display**: Graphic display. Storage capacity in internal memory: more than 50,000 values of the measured concentrations (1 minute averages). **16. Connectivity**: RS 232; **17. Operating temperature**: -10 – +25°C – working environment temperature; -30 – +40°C – sampled air temperature **18. Power supply**: 230 V, 50 Hz
	Set cylinders		1	Includes the delivery of one set of the standard gases mentioned below, in cylinders, for each monitoring stations, as follows: • for each of the 5 stations o $CO+NO+SO_2$ in N_2,: 1500 ppm (CO), 40 ppm (NO), 50 ppm (SO_2) concentrations, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet

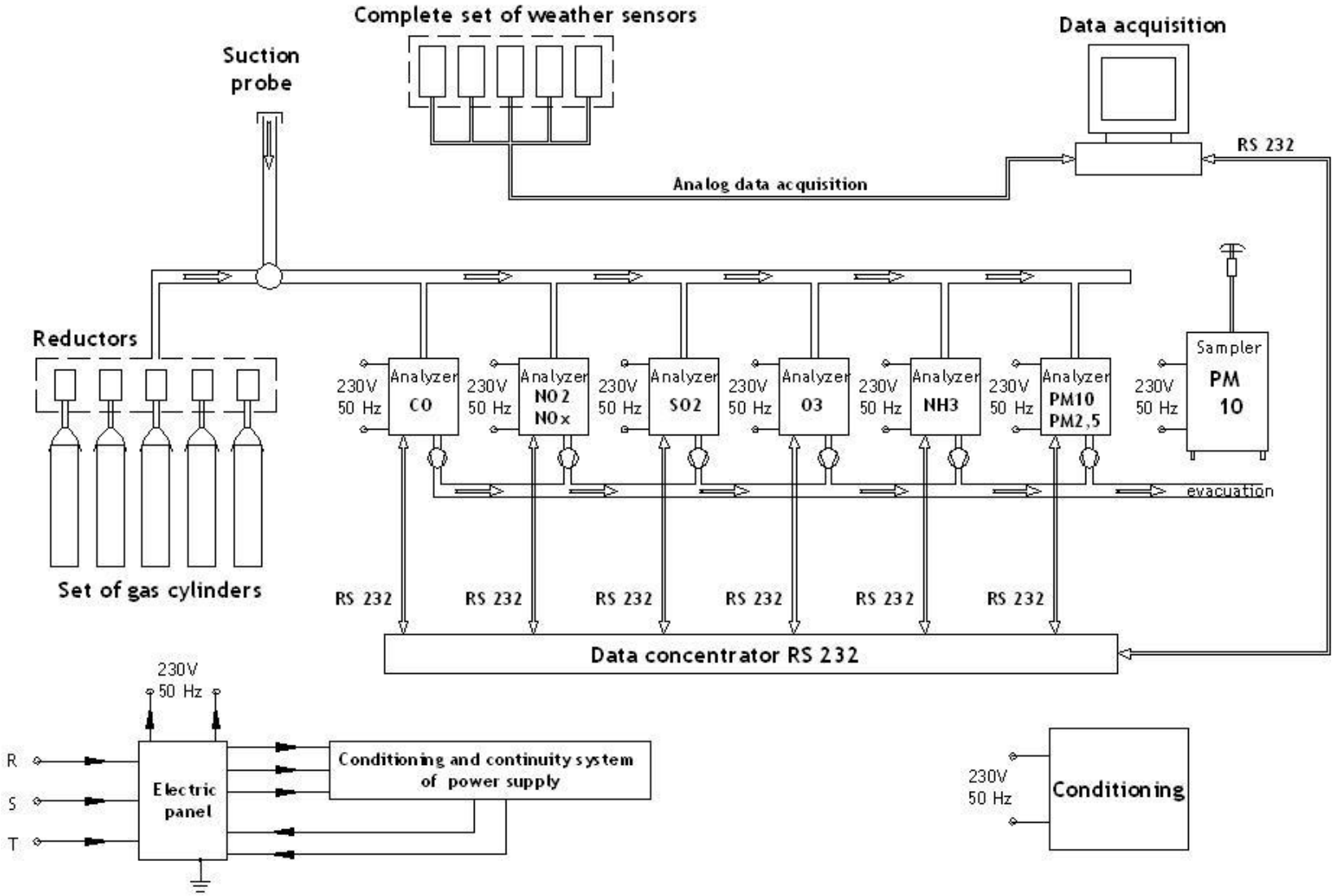
Station type	Indicators	Equipment type	No.	Description
				○ NO_2 in air, 50 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet ○ CO in N_2, 20 ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with faucet for alarm • at the stations containing NH_3 analyzer, it is added ○ NH_3 in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 40l with stainless steel faucet ○ NH_3 in air, 600ppb concentration, minimum 3 months stability, in a cylinder of minimum 10l with stainless steel faucet • at the stations containing H_2S analyzer, it is added ○ H_2S in N_2, 50ppm concentration, minimum 12 months stability, in a cylinder of minimum 10l with stainless steel faucet For each of the 5 stations, a set of minimum 3 pressure reducers for the standard gas, made of stainless steel, with two pressure steps and a pressure gauge.
	Meteorological parameters	Set of meteorological sensors	1	**1. Overview**: For each monitoring station, where it is foreseen, one set composed of meteorological sensors mounted on telescopic mast. The operating temperature range for all the meteorological sensors is from -30^{0}C up to +50^{0}C. All meteorological equipment is installed by means of some arms on a telescopic topmast and should be in accordance with the requirements of WMO – World Meteorological Organization. All the sensors are designed and manufactured so as to allow the 24/24 hours, 7/7 days continuous, non-surveyed operation, guaranteeing MTBF and MTTR times so as to ensure, during the estimated lifetime of sensors, a data capture greater than 90%. **2. Telescopic mast//topmast of 8m**: A mast (telescopic topmast), attached to the cabin is installed, reaching a height of at least 8 m above the cabin. The mast is provided with the supports necessary for installing all the meteorological sensors, at suitable heights and taking into account the specific nature and purpose of each one. **3. Wind direction sensor (weathercock)**: Sensor type: weathercock, potentiometer; Measuring range: 0-360°; Sensitivity: 0.3 m/s; Resolution: 1°; Power supply: 9…24 V DC; Consumption: <7mA typically, 0.9A with heater; Installed at minimum 8m above the ground.

Station type	Indicators	Equipment type	No.	Description
				4. Wind speed sensor (anemometer): Sensor type: cup anemometer, impulse reducer; Measuring range: 0 – 50 m/s; Sensitivity: 0.3 m/s; Resolution: 0.1 m/s; Precision ±0.5 m/s for wind speeds < 10m/s and ±1.5 m/s above this speed; Power supply: 9…24 V DC; Consumption: <7mA typically, 0.9A with heater; ; Installed at minimum 8m above the ground. **5. Temperature sensor (thermometer)**: Sensor type: Pt100 or thermistor, protected against solar radiation; Range: -40°C to +70°C; Precision: ±0.1°C; Resolution: 0.1°C; Power supply: 10-24V DC; consumption <10mA. **6. Relative humidity sensor**: Sensor type: Capacitive; Range: 0-100% relative humidity (RH); Precision: ±2% RH; Resolution: 0.1%RH. **7. Atmospheric pressure sensor (barometer)**: Sensor type: piezoelectric transducer with voltage variation; Range: 850-1050 hPa; Precision: ± 0.5 hPa; Resolution: 0.1 hPa; Power supply: 10-24 V DC; Consumption: < 15 mA. **8. Solar radiation sensor (pyranometer)**: Sensor type: pyranometer; Range: +/-2000 W/m^2; Accuracy and resolution: better than 5W/m^2. **9. Precipitation sensor (rain sensor)**: Sensor type: funnel collector and tilting vessel composed of a pair of calibrated recipients and ON/OFF contact. The dimensions and shape of the edge/ mouth of the funnel vessel comply with the WMO indications. It should be electrically heated to prevent freezing and is manufactured from protected, corrosion resistant materials, painted in white for minimizing the solar radiation effect; Resolution: 0.2mm rain or snow equivalent; Measuring range: 0…300mm/h; Precision: ±1%

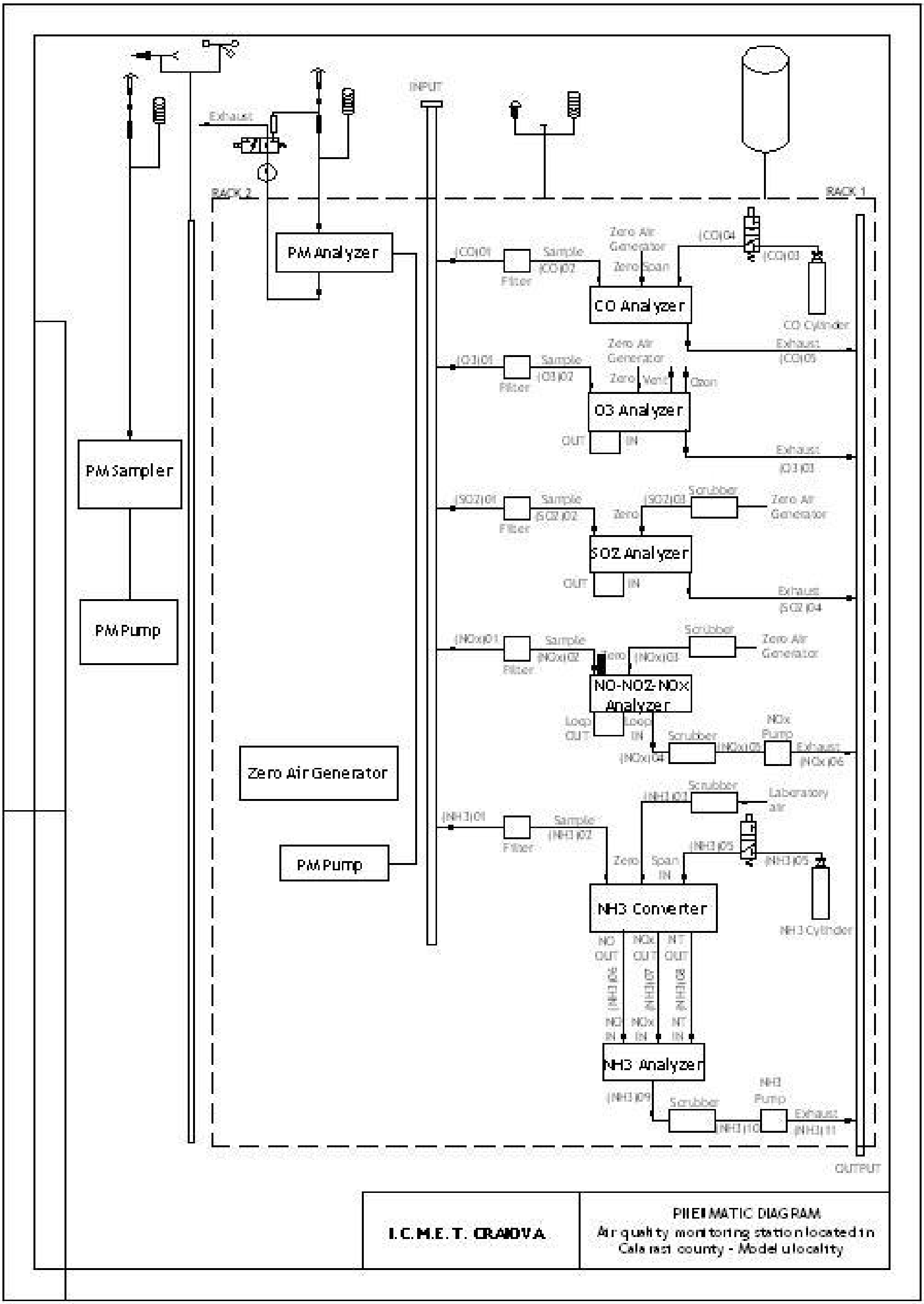
2.3.5.2. Location equipments for monitoring and measuring air pollution degree



2.3.5.3. Functional diagram of the air quality monitoring station located in Călăraşi county - Modelu locality



2.3.5.4. Pneumatic diagram of the air quality monitoring station located in Călăraşi county - Modelu locality



2.4. Air quality measuring and monitoring equipment fitted out with CO, NO_2, O_3, etc. sensors, integrated GPRS data acquisition and transmission

S.N.	Equipment	No. of pieces	Technical characteristics	Destination
1	Air quality measuring and monitoring equipment fitted out with CO, NO_2, O_3,etc. sensors, integrated GPRS data acquisition and transmission	3	**1. Scope:** Carrying out indicative measurements according to Directive 2008/50/EC and monitoring the pollutant levels in ambient air. **2. Overview**: Instrument installable on poles, tripod or on the building ceiling. **3. Operating principle:** The instrument uses sensors with semiconductor layer deposition, electro-chemical sensors or other type of sensors allowing monitoring the pollutants in ambient air (low concentrations). **4. Measurement principle. Configuration:** It provides the ability to be configurable with at least the following types of sensors: CO, NO_2, O_3, SO_2, NH_3, H_2S, C_6H_6 and CH_4 **5. Measuring range, precision:** CO 0.1 - 100 mg/m^3 (precision< 3% of scale) NO_2 0.1 - 500 $\mu g/m^3$ (precision) O_3 20 - 500 $\mu g/m^3$ (precision < 10% of scale) SO_2 0 - 30 mg/m^3 NH_3 0 - 80 mg/m^3 H_2S 0 - 15 mg/m^3 C_6H_6 0 - 100 $\mu g/m^3$ CH_4 0 - 1000mg/m^3 **6. Connectivity:** Digital ports: RS232, ability to be accessed remotely through GSM/UMTS connection and with static or dynamic TCP/IP addressing. Ability to communicate the data towards a specialized application specific to the equipment, or towards the data center. **7. Calibration:** Manually, performed by operator. **8. Information storage:** Storage of minute averages, 15 minute averages or hourly averages, calculated on the basis of elementary second data. **9. Protection degree:** IP55 **10. Weight:** 10 kg **11. Operating temperature:** - 10 to +40 °C **12. Power supply** 230 V, 50 Hz	Environmental Protection Agenies: APM Dolj APM Teleorman APM Călăraşi

2.5. Portable (FT) IR analyzer, for environmental measurements, specific to emergency situations

S.N.	Equipment	No. of pieces	Technical characteristics	Destination
1	Portable (FT)IR analyzer for environmental measurements, specific to emergency situations	1	**1. Scope:** Measurement of pollutant concentrations in ambient air in case of emergencies. **2. Measuring principle:** IR spectrometry **3. Overview**: The instrument is able to: - measure simultaneously many different compounds found in low concentrations in the ambient air, both organic and organic ones, by sampling from gaseous state - measure and display in real time the data; - be insensitive, during the determination cycle, to the position changes/movement; - be portable, so as only one operator to be capable to operate, manipulate and carry (simultaneously) it easily; - be easily utilized in applications involving emergencies (SEVESO activities). **4.Measured compounds:** The instrument is able to: - measure simultaneously 25 gaseous compounds from the same sample, in the same measuring cycle; - re-analyze the sample against other standard matrix of compounds differing from those initially analyzed, without performing a new sampling, by means of the external analysis software, by advanced analysis procedures, against a pre-calibrated matrix of gaseous compounds, determining simultaneously in this way minimum 50 different compounds; - allow optionally the identification of some un-known compounds (from an existent configuration / set of minimum 4000 compounds) possibly present in the sample going to be analyzed, but for which no pre-calibrated matrix was created before performing the measurement. - have the possibility of updating/creating new applications/sets of compounds, by adding or eliminating some compounds from the initial matrix, whose concentrations to be simultaneously determined; **5. Detection limits:** - values between 0.01 and 0.1ppm for the first set and 0.01 – 0.4ppm for the	Environmental Protection Agency APM Teleorman

S.N.	Equipment	No. of pieces	Technical characteristics	Destination
			second set, depending on the determined compound from those presented above in the list from the paragraph "Measured compounds"; - values between 0.01 and 1ppm, depending on the compound determined from another matrix established by the user. **6. Resolution:** 8 cm^{-1} or 4 cm^{-1} **7. Scanning frequency:** 10 scans/ sec. **8. Range for the wave number:** 900 – 4200 cm^{-1} **9. Linearity deviation** ≤ 2% of the measuring range for each compound **10. Deviation from zero:** <2% of the smallest measuring range, on the interval of zero calibration **11. T90 (0-90% of scale) response time:** <120 sec. **12.Connectivity:** RS-232 (by cable) and wireless (ex. Bluetooth) **13. Display/keys/commands:** Analysis parameters, graphics, results and commands should be displayed /entered by means of an integrated or removable handheld device. **14. Operating temperature:** 0 - 40°C, without condensation **15. Weight and dimensions:** Maximum 10-12 kg, with dimensions so as to be easily operable and transportable by only one operator. **16. Power supply:** Battery-powered; chargeable at 230 V, 50 Hz **17. Consumables:** The equipment should perform the analyses and should work without needing the use of reagents or other consumables. **18. Accessories:** Carrying case Battery, charger	

2.6. System for data acquisition and control, centralization and display of air quality data and indexes specific to emergencies

2.6.1. DATA control/ACQUISITION system

General description

The main objective of the data acquisition system consists in processing the data and information from analyzers and making them available to the local Data Center/ central software application described in the next sub-chapter. The data center – acquisition, centralization and display of the air quality data and indexes specific to emergencies - centralizes and displays all the air quality data and indexes specific to emergencies. The data acquisition system dialogues, by means of the telecommunication infrastructure, with the central application. It also communicate the data to the National Network for Air Quality Monitoring (NNAQM).

The format of the data sent by the data acquisition system allow their direct integration into the database nationally managed by the national center of air quality data, for ensuring the compatibility with NNAQM.

System characteristics

In its configuration, the software is able to take over and develop, by parameterizable and configurable scanning, all the data (either analog or digital ones) coming from the instruments present in the station and that will be installed.

The data on air quality measurements will be visualized in numerical format and in real time on dedicated pages, accessible locally or by means of some external connections. The access may be done by portable PCs, smartphones or pads.

Additionally, the measurements will be visualized in real time on graphics with groups of selectable parameters on dedicated pages.

The data acquisition system makes it possible the visualization of instantaneous measurements, both in numerical format and in graphic format, accompanied by exhaustive diagnostic messages related to the quality of the data taken over and to the operations carried out currently by the program.

All the operation and management parameters of the program are configured during its execution, allowing so a real time „tuning“ of the acquisition, both for analog inputs and for digital inputs.

The access to the configuration and visualization operations of the system data are protected by an authentication system.

We list below the main requirements for the data acquisition/station control system:

- to provide a system for displaying (LED or LCD monitor) and entering the data with operator friendly interface, easy to use, for configuring the calibration system, verifying the state parameters of the instruments, including those related to the instantaneous output data of them;
- to take over and record the signals from all the air quality determining instruments and from all the sensors, which it should aggregate as averages per 1 second, many seconds, 1 minute, 5 minutes, 30 minutes or other time periods.
- to require calibrations at time intervals defined by the operator (e.g. 24 hours for any analyzer or for all analyzers);
- to convert automatically and to express the measurement results in different units of measurement (e.g. volume/volumetric concentration in mass/mass concentration);
- to maintain synchronized the time from the station with the time from the Data Center.
- to take over and to record different types of signals: digital signals, current or voltage signals sent on analog and digital ports (including Ethernet) from all the equipment/instruments installed in the station;
- to require calibrations at time intervals defined by the operator (e.g. 24 hours or any other time period for any analyzer or all analyzers);
- to allow the operator to carry out the manual (additionally to the automatic one) calibration of equipment, both locally and remotely through TCP/IP;
- to allow the system operation and reconfiguration (to add or to disable equipment), both locally and remotely;
- to run verification tests for all the instruments operating on line;
- to allow the graphical record on a graphical recorder locally installed and/or printing on a printer
- multitasking real-time operating system. The data acquisition, processing and archiving operations runs in parallel even during data transmission or executing other local procedures.

After the initial installation, there must be a possibility to add new application modules, installable by the user, depending on the requirements of reporting at national level or to EU. The modules are connected to the calculation of certain environments or values, data export of connection to other types of data acquisition systems and/or instruments.

Management of inputs

Management of analog inputs coming from instruments which are not provided with digital outputs:

- Sampling of analog signal of the analyzer performed by means of the interface plate I/O. To the acquired signal, an amplification degree should be applied for optimizing it at the operating range of A/D converter ;
- Conversion of digital value in programmable/configurable engineering units ;
- Verification of the character of verisimilitude of the measurement, on the basis of a set of criteria, configurable by the user. These criteria will be used for building a status associated to each value. The associations between the status values and the verification criteria should be completely configurable by the user. These criteria may be of different types, such as:
  - Setting of the instrument (instrument in scanning, analysis mode, in calibration stage or out of the analysis mode etc.)
  - State of the cabin (lack of power supply, high working temperature etc.)
  - Value location within the pre-defined measurement intervals
  - Value location within the range of values measurable by the instrument etc.
- Memorizing of the measurement and validation status
- Data taking over on a time base configurable for each configured input
- Calibration management, both in real time and by web connecting to the data taking over system
- Calibration verification depending on the analyzer type
- Possible stopping of the reading scanning if certain verifications had not come to an end
- Management of possible times for pre-heating the analyzers, in case or re-putting into operation, after an interruption of the power supply. This function performed, on demand, by configuring a minimum and a maximum pre-heating time for each

analyzer, depending on the duration of the power supply interruption. During this pre-heating stage, the acquisition program should inhibit taking measurements.

Management of digital inputs:

For each acquired digital channel, the software provides the following chain of measurements:

- Archiving/Generation of a logic signal c 0-1
  - Sampling of an electric signal converted into a logic signal by comparing to a <low> threshold for the logic state 0 and to a <high> threshold for the logic state 1
  - Generation of a logical signal directly from the program, depending on the occurrence of some conditions such as the exceedance of the attention limits, verification of incorrect calibration etc.
  - Comparison between the generated logic state and the default logic state associated with the signal from whose response an alarm state is generated or not. The last state is video emphasized, if the visualization has been enabled, by lighting of the graphic LED and of the LED possibly present in hardware.
- Archiving of the state change for the digital channel for which the memory function is enabled.

Management of serial inputs of the instruments fitted out with communication protocol (e.g. the port RS 232)

If the instruments include a port RS 232, the software provides the following aspects:

- Sampling of the analog signal from the analyzer, carried out directly on the port. So, the acquisition system is able to manage the protocol RS 232, which will be delivered by that equipment manufacturer.
- The verification, processing, memorizing of the data acquired from the acquisition system and the calibration procedure should follow the same steps as those described in case of analog inputs.

Management of alarms and information messages

The system provides to the user the possibility of configuring a set of alarms and information messages. Both the alarms and the information are conceptually a significant event. The software contains a procedure for transferring a set of alarms

and information, configurable by the user, to the application installed in the Data Center.

All alarms and information should be recorded and kept in the memory of the data acquisition equipment mounted in the station. Additionally, it is possible configuring a system for generating the text messages, which will be transmitted to a series of mobile phone pre-set numbers (SMS) or mail boxes (e-mail)). The message content should describe the type of the appeared phenomenon.

System configurability

The software allows the complete configuration of all the parameters related to the acquisition and management of measurements, both analog and digital ones. The configuration operations is carried out without interrupting the acquisition. The possible changes made by the user must become operative only after saving the intervention. The access to any configuration operation is done on the basis of a password checking.

Configuration of system parameters

It is provided the possibility to configure the following system parameters:

- network identification code
- station identification code
- station name and description
- station location
- time in the station

Identification codes of analyzers

A list of the identification codes for different analyzers configured and present in the station was created. The creation of such list is mandatory and it is drawn up in order to manage correctly the data and to archive the measurements associated to each analyzer.

Measurement configuration

Configuration of analog measurements

It is provided the possibility to configure, in case of analog measurements, at least the following parameters:

- Measurement name
- Engineering units of measurement
- Monitor code associate to the input

- Electric range of the reading
- Engineering range associated to the electric range
- Position in the analog input terminal block
- Setting of the scanning status (data marking)
- Input acquisition frequency (in seconds)

Parameters needed to process the data:

- Type of the drawing up/calculation applied for calculating the elementary value (raw data)
- Archiving frequency
- Accuracy applied to drawing ups/ calculations

Parameters for validating the data taken over directly from the analyzer:

- Min/max acceptance limits for the interval of reading location (under-low range)
- Min/max acceptance limits for the amplitude of the reading oscillation
- Reference to a set of alarms whose logic state 1 invalidates the reading
- Reference to an instrument whose reading validity is transferred upon the current reading

Validation parameters applied to the calculated averages, using elementary data:

- Minimum percentage of elementary valid data necessary to calculate the average
- Min/max limits for the elementary values that are added to the average calculation
- Min/max limits for the value of the calculated average

Warning thresholds:

- For each average, the possibility to configure a series of warning thresholds exist. These thresholds are used for configuring a set of alarms and information in order to warn in real time the center, if they are exceeded.

Low-pass filter:

- Enables/Disables the low-pass filter on reading
- Filter attenuation

Configuration of digital measurements

- Measurement name
- Type of digital signal (hardware or software)
- Position in the analog input terminal block

- Default logic state
- Signal processing (only visualization or archiving)
- Acquisition setting: enabled/disabled

Configuration of the parameters used in the procedure for calibrating the analyzers

It is provided the management of the stages of verifying the analyzer calibration (where selected).

General parameters:

- Enabling/disabling the automatic calibration of analyzers
- Minutes of inhibiting the acquisition, after ending the calibration verification
- Possibility to stop the instrument data acquisition, if the calibration verification is negative
- Selector for setting, that invalidates the data in case of not fulfilling the verification conditions

Calibration manner:

- To be possible to select the calibration type (e.g.: with permeation tube, gas bottles, dynamic diluter etc.)
- Other parameters necessary to calibration, specific to the selected calibration type (e.g. concentration of the bottle for diluters)

ZERO/SPAN parameters

- Bit-mask of the relay for the stage of ZERO/SPAN
- Minutes of stabilizing the reading
- Minutes of reading

Validation parameters

- Tolerance at the measurement of ZERO point
- Tolerance at the measurement of SPAN point
- Minimum percentage of valid elementary data for determining the measure

Parameters of the operating interval and calibration validation

- Minutes of stabilizing the reading
- Minutes of reading
- Measure tolerance
- Minimum percentage of valid elementary data for determining the measure

- Multipoint calibration (5 points)

Configuration of POWER FAILURE parameters

For the case where there is a period of lack of current supply in the network, it is possible to manage the pre-heating stage of each analyzer. The parameters defining this management are:

- Minimum time for pre-heating
- Maximum time for pre-heating
- Maximum duration of the lack of supply, to which the minimum time of pre-heating is associated
- Minimum duration of the lack of supply, to which the maximum time of pre-heating is associated
- Selector for validating automatically a calibration verification at the end of a pre-heating stage

Marking of the changes made on data

The software traces (memorize in a diary) each operation the data will undergo (validation, change or deletion). The operator that made the change should be also memorized. If validated, the data could not be changed.

Data archiving

The program performs archiving both all the acquired and elaborated measurement data, the calibration results and the events detected in system (alarms and information).

For each elementary measurement datum or for each average calculated in the system, zou can configure:

- Archiving manner: manually, at the operator intervention or automatically.
- Archiving period.

In case of hourly averages, the data for at least the last 90 days of acquisition must be stored.

In case of storing the calibration results, minimum the last 1000 records must be saved.

In case of storing the events, minimum the last 1000 events must be saved.

Characteristics related to communication

The data acquisition system can connect to external <clients> by multiple possibilities of connection.

In case of the stations connected through GPRS or other communication way TCP/IP though GSM, it is provided the possibility of automatic transmission of data at configurable time intervals. It is also provided the possibility that, if necessary, the data acquisition system could be appealed from the center for operations of data configuration or data taking over. For such cases, the remote control system is optimized in terms of the costs, by eliminating/minimizing the use of CSD connections or other ones, of dial-up type.

Data export

The collected data cam be viewed, where they exist, through web pages specifically provided, made available.

The minimum required information is:

- instantaneous analog readings in format of numeric display
- instantaneous analog readings in format of dynamic graphic
- instantaneous digital readings
- averages calculated by software in format of numeric table
- results of calibration verifications as table and graphic

Any graphic page displayed to the user, including the numeric displays and graphics, can export at least in format MS-Excel, PDF or analog one, containing the following information:

- elementary measurements taken over from the analyzer
- averages calculated at diverse intervals (hourly, daily, monthly)
- digital signals
- results of verifications through calibration

The data acquisition system export periodically updates with the elementary measurement data and calculated averages, new or modified since the last data export.

Remote management

The data acquisition system is controlled by the distance by an Ethernet Connection. In both cases, the access is protected by a system of password checking.

The operators responsible for the external maintenance of the stations have the possibility to control the data acquisition system even by means of a notebook and/or PDA.

The data acquisition system is able, by establishing a specific configuration, to interrogate directly the Data Center, for communicating the possible alert, alarm or failure states.

Hardware Characteristics

- to include all the ports necessary to connect the equipment, sensors and communication devices installed in the station, with the possibility of adding subsequently other equipment (serial ports RS-232, ports USB, Ethernet, analog inputs, TTL compatible digital inputs, TTL compatible digital outputs, with relays); possibility of adding subsequently analog and digital inputs/outputs;
- reduced energy consumption, max. 15VA supply;
- operation on wide temperature intervals (-20 ~ 70°C).

2.6.2. System for acquisition, centralization and display of air quality data and indexes specific to emergencies

Scope

Air quality data management and dissemination to the public and environment authorities.

General functions

The system provide the following general functions at the users' disposal:

- Collection, verification, validation, correction, reporting and distribution of air quality data
- Visualization of measured data
- Data export in usual formats
- Data presentation to the public

Data collection, validation and reporting. Detailed functions

The system will is able to manipulate, to process and to report the data in different modes. Further on, the detailed requirements are presented:

- Application have a modern architecture with 3 levels, of client-server type; the user interface could be visualized in the web browser from any device that can access the application server
- Application could run both on desktop/ laptop type computers and on mobile systems such as tablet PC or smartphone
- Application can be implemented in Romanian, Bulgarian and English

- Application allows adding in the future other translations in any other language
- Application allows changing the translation of the texts at any time
- Application allows the users to utilize optionally one of the defined languages
- Application allows adding an unlimited number of user accounts
- Application will allow defining a group of users, to which the accounts will be associated
- Application allows choosing a time zone for each user, depending on which the data reports will be generated
- Application allows defining an agency at which the users could be associated. Information defined in agencies could be used for making uniform the aspect of the reports generated by the users recorded in the same agency.
- **Application allows interconnecting also other data acquisition systems (data could be exported to NNAQM)**
- Application allows dividing the stations in hierarchical ranges, that could be managed by different users with different roles
- Application allows sharing information between different defined ranges
- Application allows allocating rights on different elements of the application and grouping them in roles
- Application allows anytime the authorized users to define or edit roles
- Application allows allocating different roles to the users for the defined ranges
- Application allows changing the users' rights for any range at any time in interface
- Application have an automatic system for data collection. There can import in the system at least data series with minute values, hourly series and hourly maximum/minimum, alarms and results of the calibrations of measuring instruments
- Application allows connecting the stations by GPRS type connections
- Application can collect the measured values from the air monitoring stations, both for pollutants and for meteorological parameters
- Data collection system allows the subsequent connection of other air monitoring stations, by using an efficient and flexible data communication protocol. By efficiency, one understands the system capacity to transmit information by communication channels with reduced transfer rate (e.g. GPRS) and to minimize

the total volume of data transferred for increasing the cost efficiency. By flexible, one understands the system capacity to adjust new types of stations and data acquisition systems in the future.

- System allows configuring the data loggers from the stations from the main interface of the application
- Application allows the users to define schedules for receiving or requesting data from the stations, at fixed intervals of the day or repetitively, or a combination of these ones
- Application can resume the data transmission if problems appeared at the previous transmission
- Application allows receiving synchronously the data from stations (e.g. alarms)
- Application allows visualizing the history of data transmission, for each station separately, and warning the users if the data transmission has not been correctly performed
- Application allows adding measurement stations in the future
- Application allows visualizing the coordinates of a station in a GIS-type interface, the user having the possibility to observe the region where this is positioned, at many zoom levels
- User will be able to change the station coordinates directly from that interface
- Application allows the management of the mobile measurement stations, in a transparent manner, for the users that utilize the reporting function
- Application allows recording the information related to the configuration of stations and measuring devices (analyzers) existent in them
- Application allows defining many types of analyzers, which subsequently will be associated to the analyzers
- Application allows transferring the measuring devices between stations, in order to store and visualize a history of their use
- Application allows taking over and aggregating the data as averages or sums of the following types:
  - Minute averages
  - Hourly averages
  - Mobile hourly averages

  - Hourly minimum
  - Hourly maximum
  - Daily averages
  - Daily maximum of the mobile hourly average
  - Annual averages
  - Annual maximum of the mobile hourly averages
- Application allows the users to choose the data series on the basis of which the high order averages will be calculated. As basic series, at least the series of minute average and hourly average types may be chosen. Moreover, a high order average can be calculated on the basis of some heterogeneous basis data series (e.g., an annual average can be calculated on the basis of some hourly and minute series, if in the course of the year the regulations for measuring the pollutants have been changed).
- Application allows calculating statistical parameters and exceedances of the threshold values in a way compatible with the standard format for reporting the data to EU.
- User can choose the following methods for activating the thresholds, in relation to a given value:
  - Lower
  - Higher
  - Lower or equal
  - Higher or equal
  - Equal
  - Different
- User can choose the following methods for activating the thresholds, in relation to a value interval:
  - Inside the interval
  - Outside the interval
- User can configure the threshold activation for only one exceeded value, and for a configurable number of successive exceeded values
- User can configure a multi-annual tolerance with linear variation from year to year for the defined thresholds

- Application allows defining an arbitrary number of thresholds for exceeding the values, for any type of calculated average
- Application allows defining multiple series of values of the same type or of different types, for a parameter measured in a station
- Application allows defining multiple intervals for validating the data measurements, for different time intervals
- User can define the way in which the errors related to the exceedance of minimum and maximum values admitted for measurements, having the following possibilities:
  - to invalidate the values and to not include them in the calculations
  - to use pre-defined values (ends of the measurement interval)
  - to leave unchanged the measured values
- Application offers the possibility of treating the situations when the measured values are below the device detection limit, by displaying some warnings and offering the possibility to use pre-set values instead of original values
- Application will put modules of data analysis and presentation at the users' disposal, with the following characteristics:
  - Possibility to display the data under graphic, tabular and report form that can be saved on the users' computer
  - Possibility to report simultaneously different types of data series (e.g. hourly and daily series), from different parameters with different units of measurements and from different stations, in an intuitive manner
  - Possibility to display concomitantly at least 15 data series
  - Possibility to choose the exceedance thresholds that will be calculated
  - Possibility to emphasize the values that exceeded the configured threshold values, for each series separately, both under graphic form and under tabular form
  - Possibility to emphasize the data that do not comply with all the validation criteria
  - Possibility to visualize simultaneously, in the status of a value, all the validation criteria that have not been fulfilled

- Possibility to display data in an interactive graphic, allowing the enlargement of some data areas, the real time display or removal of certain data series, also the display of information on certain measurement directly from the graphic
- Possibility to export data as images
- Possibility to group the data in different intervals: hours, days, weeks, months and years (e.g.: 4 hours, 8 hours, 2 days, 1 week, 2 weeks, 2 months, 2 years, etc)
- Possibility to calculate different statistic parameters for the chosen groups:
  - Minimum
  - Maximum
  - Sum
  - Average
  - Percentage of validated data
  - Variation
  - Percentile (configurable by the user)
- Possibility to save in the database the configurations of the most often used data reports, for allowing the easy access to the most often visualized data

- Application allows exporting reports at least in pdf and xls formats, with the possibility of adding supplementary formats
- Exported reports can be personalized for each user, depending on the agency to which it is associated
- Application allows calculating the pollution indexes, which represents the conversion of the measured values for one or many data series at one index.
  - Indexes can be calculated for individual series (specific indexes) or for many series (general indexes), in which case the highest index from the set of constituent indexes will be chosen
  - Hourly and daily indexes can be calculated. The daily indexes represent the value of the highest hourly index from certain day.
  - For validation, in the calculation of general indexes the minimum number of valid indexes can be specified.
- Application allows displaying on the map, in a suggestive manner, the index values, both for the application users and for the public
- Application can offer a module for validating the data, allowing:

  - Linear transformation of data, also their validation or invalidation
  - Manual entering of the missing values, both randomly and as an interpolation of two values
  - Simultaneous display of data, under graphic and tabular form
  - Possibility to record the validation comments of the users
  - Possibility to come back on the data changes during the validation operations, or to give up to a set of operations
  - Possibility to perform simultaneously operations on the data coming from many data series
  - Storage of all the value changes in the database
  - Subsequent visualization of the history of value changes
- Application allows displaying the history of alarms from many stations, simultaneously
- Alarms received from the stations should contain at least the information regarding the fact that the alarm is active, inactive or reactivated
- Application makes the distinction between the alarms related to the measurements and the alarms related to the general operation of the station
- Application allows configuring the following parameters for the alarm reports
  - Set of selected stations
  - Time interval, with the possibility to display all the alarms
  - Event source (station or measurement)
  - Event type
  - Event states
  - Affected measurements, in case of the alarms related to measurements
- Application allows filtering the alarms after generating the report, depending on:
  - Station
  - Event type
  - Event state
- Application allows displaying the history of the operations performed on the data
- Application allows configuring the following parameters for the operation reports:
  - Set of selected stations
  - Time interval when the operations are performed
  - Time interval of changed values

  - User which performed the operation
  - Data series for which the operations have been performed
- Application allows filtering the operations after the report generation, depending on:
  - Station
  - Parameter
  - User which performed the operations
  - Data interval
  - Operation type
- Application allows displaying the history of the calibrations performed in stations
- Application offers the users at least the following information related to the calibrations:
  - Calibration date and time
  - Calibration type (automatic or manual)
  - Measurements for which the calibrations have been performed
  - Calibration points:
    - Operation result
    - Reference value
    - Got value
    - Error value
    - Deviation value
- Application allows configuring the following parameters for the calibration reports:
  - Set of selected stations
  - Time interval when the calibrations have been performed
  - Calibration type
  - Calibration results
  - Affected measurements
- Application allows filtering the operations after the report generation, depending on:
  - Station
  - Calibration type
  - Affected measurement

- Type of the calibration points (at least zero and span)
- Calibration result

- Application allows adding new parameters
- Application allows adding new units of measurement for any parameter, also equations of conversion between these units of measurement, for each parameter separately
- Application allows adding an unlimited number of parameters for each station
- Application allows making backups of the entire data base
- Application allows the users to download the backups of the data base
- Application allows the users to recover any time the current configuration with one of the backups

The data base structure, also the mode of connection and extracting from the data base, necessary for carrying out subsequently a web site, is in accordance with that one delivered by NNAQM.

Hardware characteristics

The system is of server type, with non stop operation

Processor

Processor frequency (MHz): minimum 3100

Processor core: 4

Motherboard

Memory slots: 4

Memory

Memory capacity (GB): minimum 8 (2 x 4 GB)

Memory type: DDR3

Storage units

Number of hard disks: 1

HDD capacity (GB): minimum 1 TB

Speed (rpm): 7200

HDD technology: SATA

Maximum number of HDDs: 4 x 3.5 inch SAS/SATA

Optical unit: SATA DVD-RW

Network

Gigabit: 10/100/1000 Mbps

Network ports: 2

Monitor 22"

Keyboard

Mouse

Operating system

License for Server Operating System - 5 users

The operating system is able to host web pages developed in Asp.Net technology

The overall architecture of the monitoring system is presented in Figure 2.1. There are 5 monitoring stations, and their location will be in: Calafat, Zimnicea, Turnu Măgurele (2) and Modelu. The involved environment agencies are those ones from the counties: Dolj, Teleorman, Călăraşi.

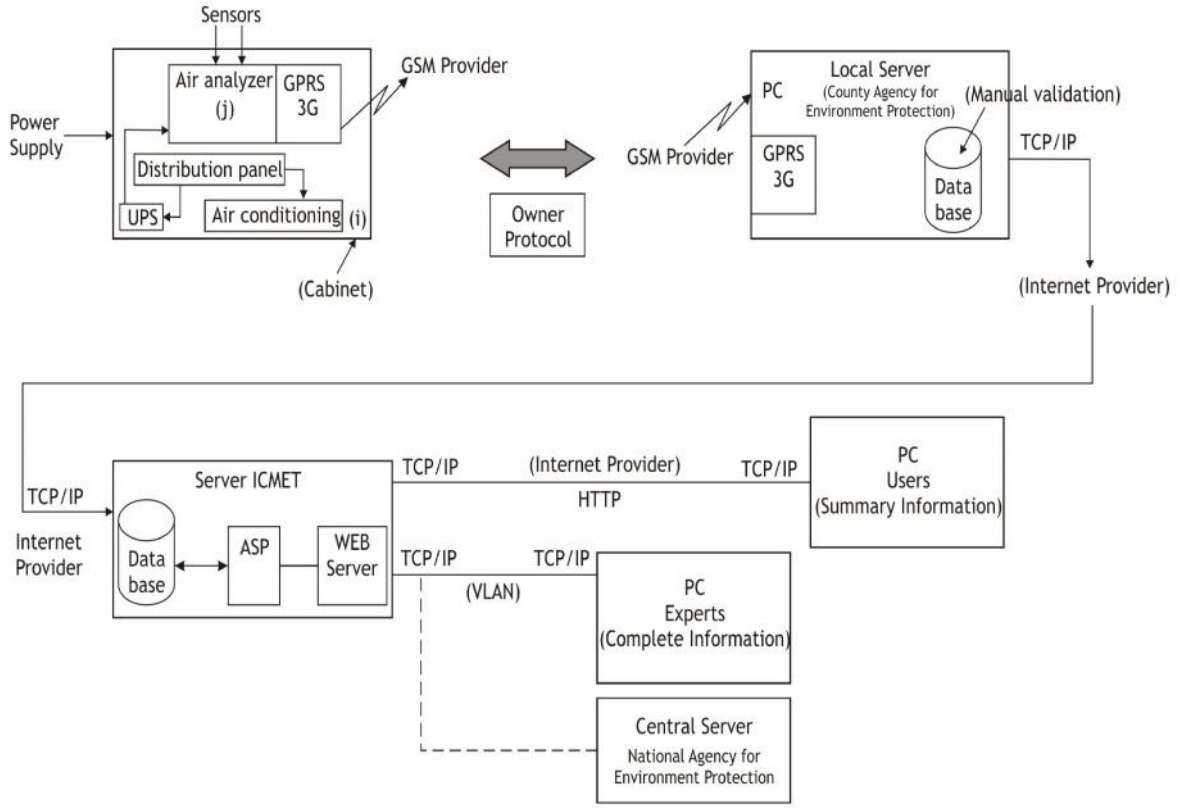


Figure 2.6.1. *The overall architecture of the air quality index monitoring system, specific to emergencies*

CHAPTER 3

INTERACTIVE MAP ON AIR POLLUTION SOURCES AND AIR QUALITY MONITORING STATIONS WITHIN ROMANIA – BULGARIA CROSS-BORDER AREA

SOFTWARE RESOURCES FOR ACHIEVING THE INTERACTIVE WEBSITE

Windows Server 2008 Standard

Windows Server 2008 is the most advanced Windows Server operating system, designed for supporting the next generation of Web services, applications and networks. By Windows Server 2008, special experiences and applications can be developed and offered for users. This solution offers also an extremely safe network infrastructure and improved technological efficiency.

Windows Server 2008 develops the success and power of Windows Server predecessors, providing valuable new functionalities, and brings considerable improvements to the basic operating system. The new instruments for Web, virtualization technologies, safety improvements and management utilities help in saving time, reduce the cost and offer a solid foundation for the IT infrastructure.

Windows Server 2008 integrates Internet Information Services 7.0 (IIS 7.0), a Web server and a manageable platform with improved security, for developing and hosting the Web applications and services. A major improvement brought to Windows Web platform, IIS 7.0, includes an architecture having components for more flexibility and control. IIS 7.0 also provides simplified management, powerful diagnostic and debugging capabilities that save time and a complete capacity for expansion.

Internet Information Server IIS 7.0, together with .NET Framework 3.0, provides a complex platform for developing applications that connect data and users, allowing the latter to visualize, share and use information. Moreover, IIS 7.0 plays a central role in unifying the technologies for Web Microsoft—ASP.NET platform, Windows Communication Foundation Web Services and Windows SharePoint Services.

ASP.NET

ASP.NET is a Microsoft technology for creating web applications and web services. ASP.NET is the successor of ASP (Active Server Pages) and benefit from the

power of the .NET development platform and from the set of instruments offered by the development environment of the application „Visual Studio .NET". The ASP technology became in time an integral part of the numerous Web-oriented Windows techniques, becoming for those conducting Web applications one of the most natural and normal modes of building dynamic Internet pages, even Internet applications on these platform.

Some of ASP .NET advantages are:

- ASP .NET has a large set of components, XML-based, offering thus an object-oriented programming (OOP) model.

- ASP .NET runs a compiled code, increasing in this way the performances of web applications. The source code can be separated in two files, one for the executable code and the other for the page content (HTML code and text from the page).

- .NET is compatible with more than 20 different languages; the most used are C# and Visual Basic.

JavaScript language

JavaScript language was created by Netscape Company. Unlike Java, which is a compiled language (the programs are compiled on server then locally executed on the client computer), JavaScript is an interpreted language (language interpretation is done by browsers, which incorporate an interpreter analyzing the JavaScript instructions and executing them on the client computer). The interpreted languages are simpler than the compiled ones and easier to learn. The modification and debugging is also much easier to achieve, because the compilation is no more needed every time. Unlike CGI scripts, which are executed on the host computer (server), JavaScript scripts are loaded from the server on the local computer. The interpreter will decode the instructions of the scripts and will execute them at the right time: when loading the page on the server, when pushing a button, when moving the mouse etc. JavaScript scripts are a part of the HTML source code of Web pages, giving them a dynamic, interactive and much more attractive aspect. However, this has a big disadvantage - the scripts can be copied, modified and reused. In case of Java applets, this problem does not arise, because their source code is not transferred from the server to the client computer. Both languages create applications that are independent from the platform on which they are executed.

JavaScript characteristics

- is a language for creating scenarios both the client side and for the server side;

- has a C language-like syntax;

- was implemented starting with the version 2.0 of Netscape Navigator program;

- has the advantage that it needs no compiler;

- JavaScript scenarios are executed by the browser;

- JavaScript instructions are included within a HTML document;

- with JavaScript, the pages become "smart", because they respond to user actions (mouse, keyboard).

SQL database

SQL (Structured Query Language) is a programming language specific to relational database systems (RDBMS), and originally is a language based on relational algebra. Its purpose is the insertion, queries, update and deletion of data, the modification and creation of schemes, also the control of data accessing. It became a standard in the field (ANSI-ISO standardized), being the most popular language used for data creation, modification, retrieval and management by the relational Database Management Systems (DBMS). Besides the standardized versions of the language, there are a lot of dialects and variants, some of them proprietary, specific to certain DBMSs, and also containing extensions for supporting the object (object-relational DBSs (Database Systems).

OpenStreetMap

Web mapping is the process of developing, implementing, generating and supplying maps on web. The use of geographical data in the digital environment is related by some researchers to the term of neogeography (Udell, 2005).

The usual classifications of web maps shows us the existence of a special category, namely that of collaborative maps.

OpenStreetMap (OSM) is a project that attempts to create a free editable world map. The idea behind OSM was to encourage the distribution of free geo-spatial data, so as they could be used by anyone, anytime. In brief, any user of a GPS device can use the points of interest or routes traveled, loading them the as a usual format in the OSM database for being available (or not, being possible that the routes are not

made public) to the users, as support for the future streets, footpaths, alleys etc. Digitizations from satellite images or maps are added to these, where different institutions or companies made them available. In other words, the updates are very prompt and facile, and the access to the data from behind the map is free.

But the free power behind the OpenStreetMap project consists in the possibility to access any data from behind the map and to use them in GIS software or for loading them in GPS receivers. The data updated daily, per states, are found at http://download.geofabrik.de/osm/, in *.osm or *.shp format.

The advantages of using OpenStreetMap over other similar solutions (Google Maps, Yahoo! Maps, Bing Maps):

- Information is free and may be used for commercial purposes;

- Updates are fast and the resulted maps may be topical and very precise;

- Is a collaborative project, where the experience can be transmitted between users;

- Is relatively easy to use and does not imply any special initial training.

INTERACTIVE MAP

In the stages of the process of achieving the interactive maps, the pollution sources, the existent air quality monitoring stations, the new stations with on-line transmission from the cross border network, the environmental protection agencies also the regional inspectorates of environment and water from Romania and Bulgaria were positioned.

 - Marker for pollution sources;

 - Marker for the existent air quality monitoring stations;

 - Marker for the stations with on-line transmission from the cross border network;

 - Marker for the environmental protection agencies also for the regional inspectorates of environment and water from Romania and Bulgaria.

For visualizing the pollution sources:

- select the country from the dropdown menu “country” (Romania or Bulgaria), select the check box corresponding to the menu;

- select the county or district from the dropdown menu, select the check box “Pollution sources”;

- finally push the button “display”;

- the polluters in the selected county or district will be displayed.

The visualization of the pollution sources from Romania and Bulgaria may be done only after authentication with username and password, these data being available just for the environmental authorities.

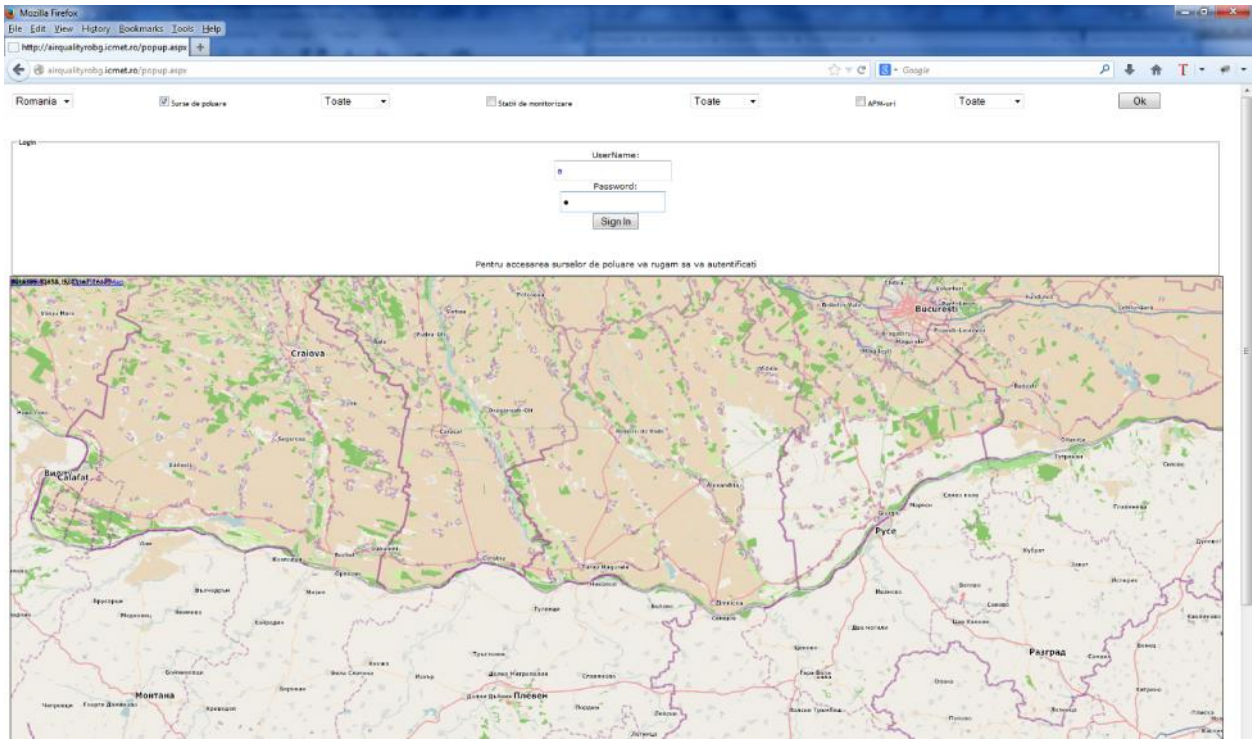


Figure 3.1. *Authentication for visualizing the pollution sources*

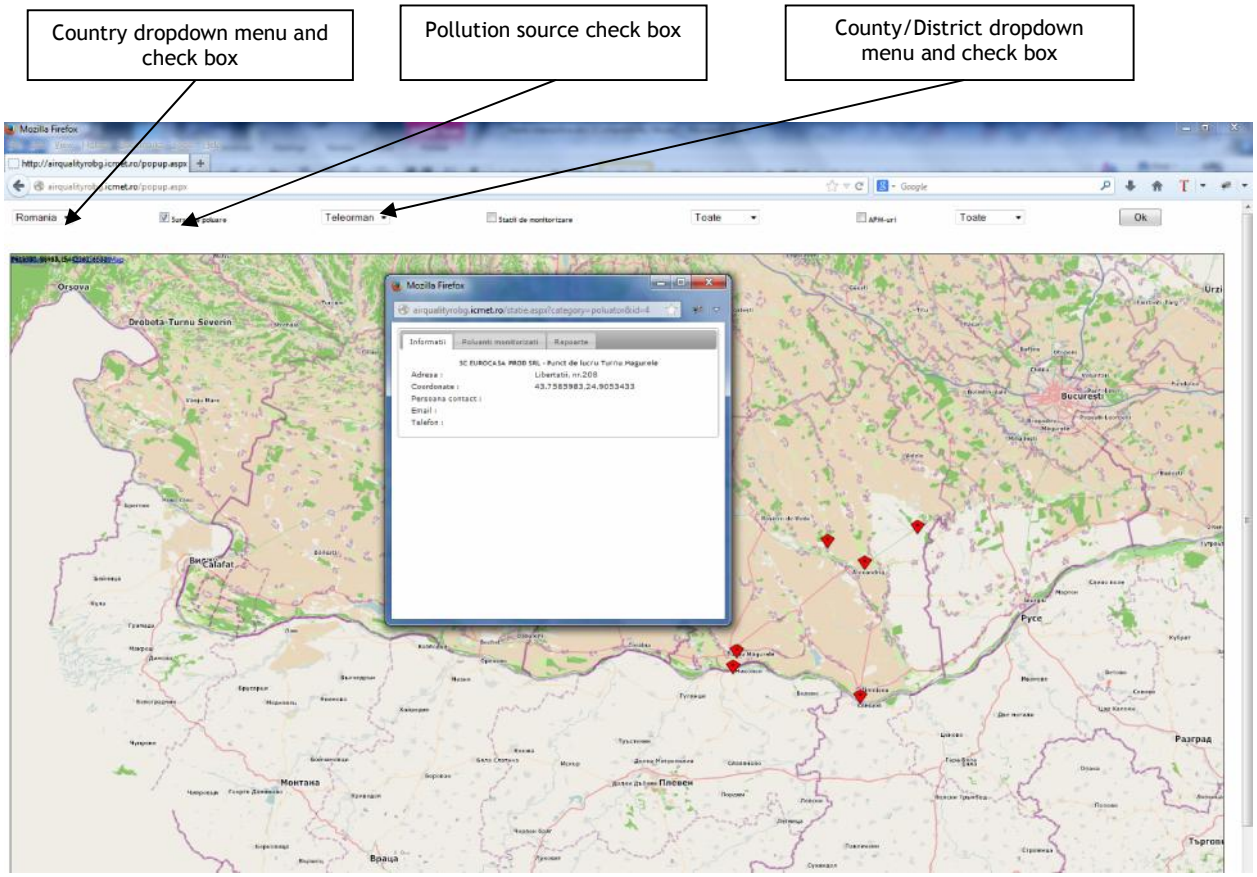


Figure 3.2. *Pollution source in Teleorman county, Romania*

For visualizing the air quality monitoring stations:

- select the country from the dropdown menu “country” (Romania or Bulgaria), select the check box corresponding to the menu;

- select the county or district from the drop down menu, select the check box “Monitoring stations”;

- finally push the button “display”;

- the monitoring stations in the selected county or district will be displayed

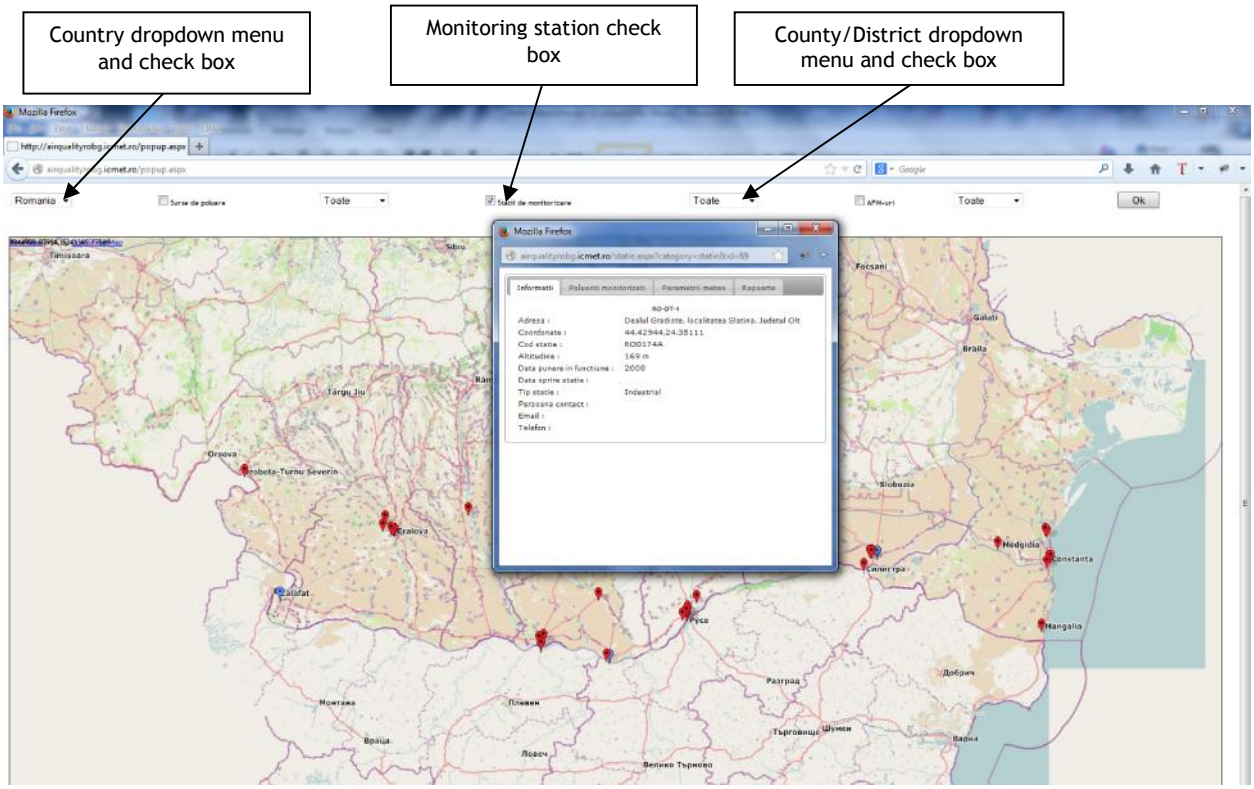


Figure 3.3. *Monitoring station in Olt county, Romania*

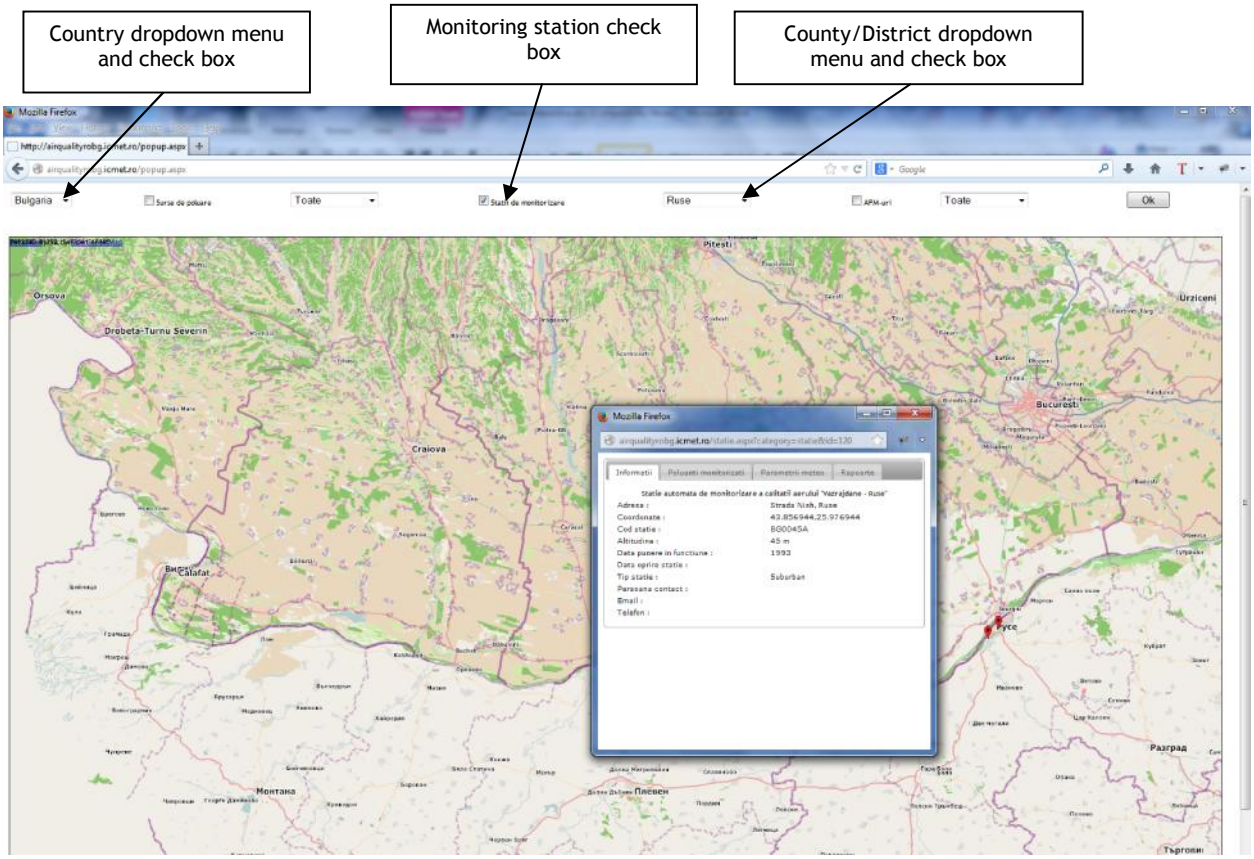


Figure 3.4. *Monitoring station in Ruse district, Bulgaria*

For visualizing the on-line transmission stations from the Romania-Bulgaria cross-border network:

- select the country from the dropdown menu “country” (Romania or Bulgaria), select the check box corresponding to the menu;

- select the county or district from the drop down menu, select the check box “Monitoring stations”;

- finally push the button “display”;

- the monitoring stations in the selected county or district will be displayed.

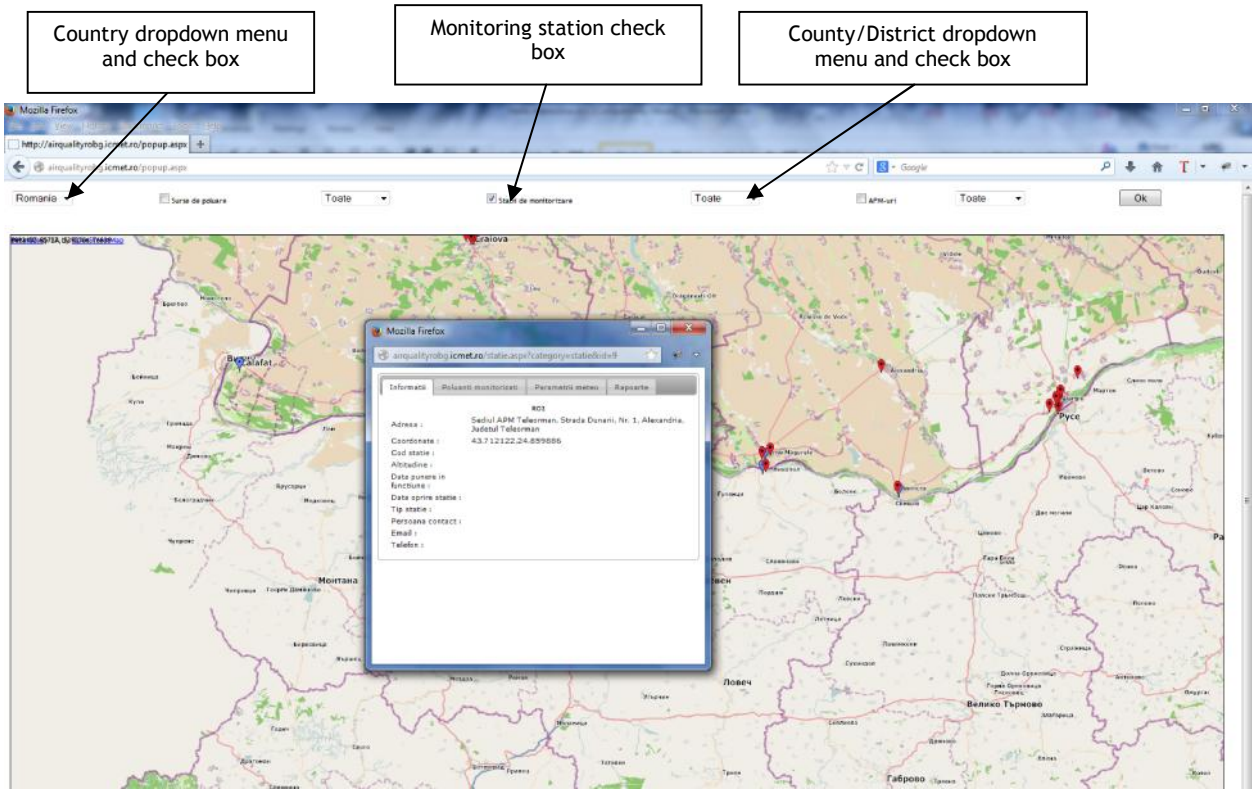


Figure 3.5. *Station with online transmission from the Romania-Bulgaria cross border network*

For visualizing the environmental protection agencies from Romania and Regional Inspectorates of Environment and Water from Bulgaria:

- select the country from the dropdown menu “country” (Romania or Bulgaria), select the check box corresponding to the menu;

- select the environmental protection agency or regional inspectorate of environment and water from the dropdown menu, select the “” check box;

- finally push the button “display”;

- the monitoring stations in the selected county or district will be displayed.

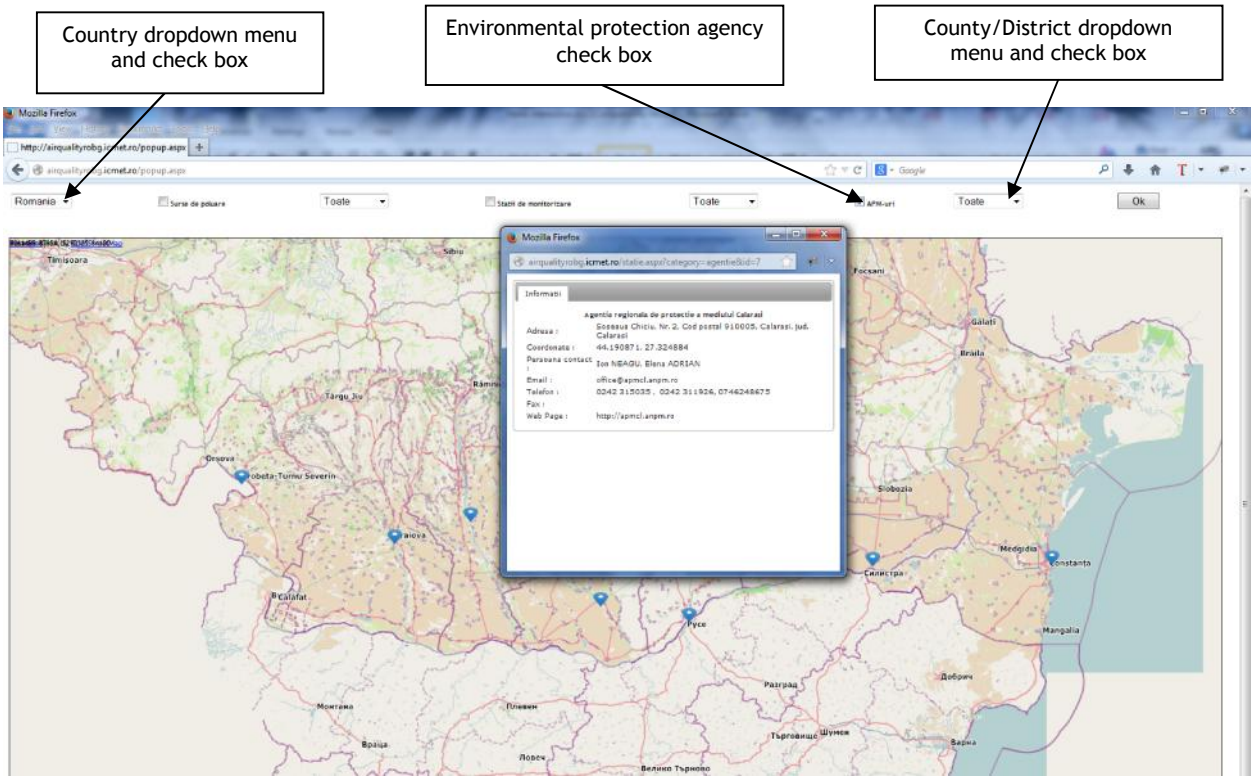


Figure 3.6. *Environmental protection agency from Călăraşi, Romania*

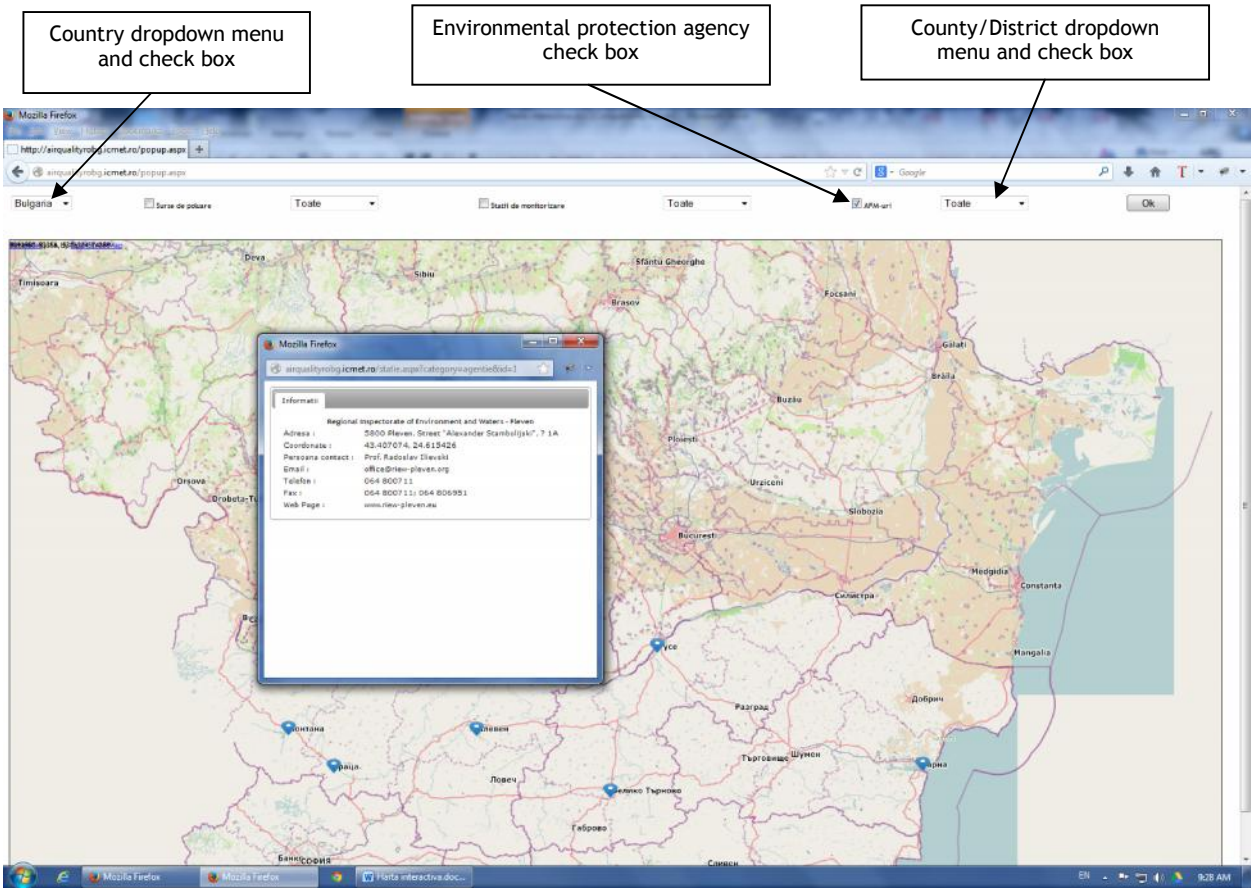


Figure 3.7. *Regional Inspectorate of Environment and Water from Pleven, Bulgaria*

CHAPTER 4

4.1. Public Information in Real Time on Air Quality in Bulgaria

Executive Environment Agency prepares and publishes nationally representative information about the environment and natural resources. For this purpose, a wide range of specialized Internet bulletins are developed – daily, three-month and annual. The website also publishes the National State of the Environment Report and other specialized reports. Part of the bulletins and reports are available as printed publications.

Figure 4.1.1. *Executive Environment Agency (ExEA)*

4.1.1. National Report on the State of Environment in Bulgaria

The National State of the Environment (SoE) Report is developed by experts teams of the Ministry of Environment and Water (MOEW) and Executive Environmental Agency (ExEA) together with other institutions - Ministry of Economy, Energy and Tourism, Ministry of Agriculture and Food and National Statistical Institute. The data for the report is provided by the National System for Environmental Monitoring, administered by ExEA, Regional Environmental Inspectorates, National Statistical Institute and the National Institute of Meteorology and Hydrology. This is a publication

announcing the policy and activities of the MOEW and its bodies for improving the environment.

The report includes information on the following economic sectors: energy, industry, transport and agriculture, and related development of emissions of harmful substances in air, water, soil pollution, waste generated, energy and natural resources, disturbed land plots, noise and ionizing effects.

The report describes the Quality status of the components of the environment and outlines trends are, using key indicators used in publications of the European Environment Agency. Included is information on fulfilling the commitments of the country to the Framework Convention of the United Nations on Climate Change (UNFCCC) and the Vienna Convention for the Protection of the Ozone. Trends in the status of individual species for ten years are followed and the process for approval and announcement of protected areas NATURA 2000 network is described. Examined are the main directions of environmental policy and government regulation of the use and protection of the environment. Presented is information about unsolved problems and unfulfilled commitments of the country in implementation of the National and European legislation in Environment.

4.1.2. National Report on Greenhouse Gas Inventory for Bulgaria

The Annual national reports on the inventory of greenhouse gases are issued in connection with the commitments of Bulgaria to the UN Framework Convention of Climate Change (UNFCCC) and include greenhouse gas emissions by sources and the country sinks under the UNFCCC approved methodology.

Framework Convention of Climate Change is the first major international legal instrument affecting climate change globally. The main objective of the Convention is **"to stabilize concentrations of greenhouse gases (GG) in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"**. In 1995 Bulgaria ratified the UNFCCC.

At the third Conference of the parties to the UNFCCC held in 1997 in the city of Kyoto, Japan, signed "Kyoto Protocol". Its main objective is **"To reduce GG emissions worldwide, a total of 5%"**. By ratifying the Kyoto Protocol in July 2002, Bulgaria undertook the duty to reduce greenhouse gas emissions by 8% compared to emission levels in 1988, chosen as the base. Bulgaria fulfills its obligations under the UNFCCC to prepare and periodically update inventories of greenhouse gases in the country by

sources and sinking by sinks. In accordance with these obligations Bulgaria presents these annual inventories, starting with the base 1988.

Inventories include direct emissions of greenhouse gases: carbon dioxide (CO2), methane (CH_4), nitrous oxide (NO_2); precursors of greenhouse gases (NOx, CO and NMVOCs) and sulfur dioxide (SO_2). Hidrofluorcarbon emissions (HFCs), perfluorcarbons (PFCs) and sulfur hexafluoride (SF_6) are being studied in Bulgaria since 1995.

Figure 4.1.2. *National Report on the State of Environment in Bulgaria and National Report on Greenhouse Gas Inventory for Bulgaria*

4.1.3. Daily Bulletin for Air Quality

Daily bulletins for exceedance of the 30 min. and 1 h limit values, and the 24 h average limit values of the following pollutants: dust, TSP, sulphur dioxide, nitrogen dioxide, carbon dioxide, hydrogen sulfide, ozone, ammonia, methane and NMVOC.

Figure 4.1.3. *Daily Bulletin for Air Quality*

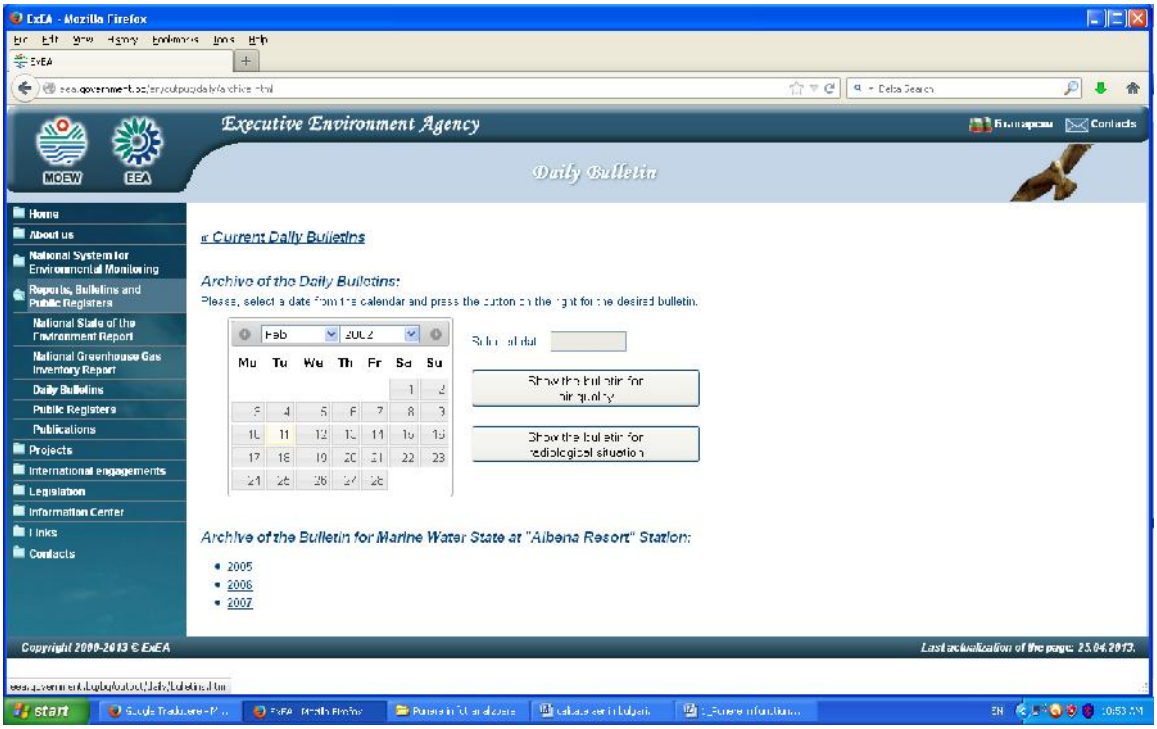


Figure 4.1.4. *Current Daily Bulletins and Archive of the Daily Bulletin*

Figure 4.1.5. *Reports, Bulletins*

Settlement / Station	SO_2 1h LV 350.0 µg/m³	SO_2 24h LV 125.0 µg/m³	NO_2 1h LV 200.0 µg/m³	PM_{10} 24h LV 50.0 µg/m³	CO LV (8h) 10.0 mg/m³	O_3 Information threshold 180.0 µg/m³
Burgas - ky Dolno Ezerovo				1.06		
Dimitrovgrad - Rusovski				1.69		
Vidin				2.74		
Pleven				1.79		
Pavlik - Banya Starinka				1.73		
Ruse - Vazrazhdane				0.20		
Smolyan				1.3		
Stara Zagora - Zelen Klin				1.19		
Usmiya - Izvorite				1.04		
Varna - AMS Buluk				1.12		

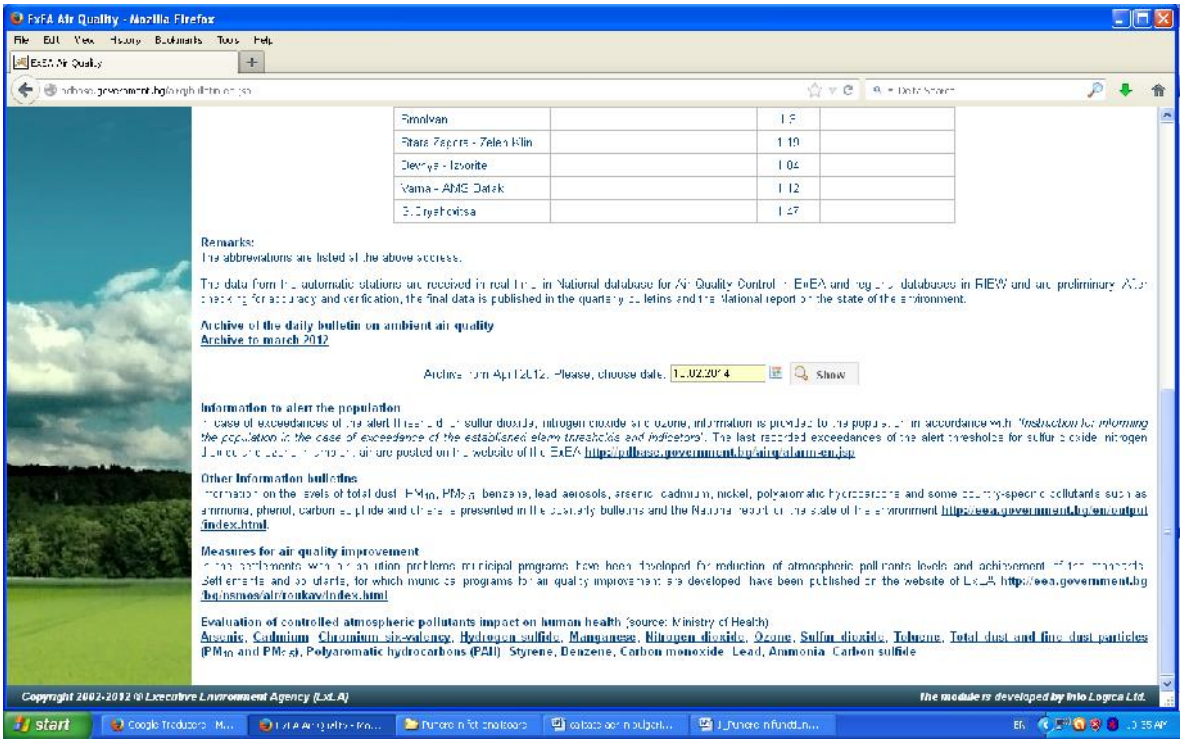


Figure 4.1.6. *DAILY BULLETIN*
for air quality in the country within the period from 00:00 to 24:00, 10.02.2014

The daily bulletin contains information about the levels of certain key parameters, characterizing air quality, in accordance with the national and European legislation: fine particulates (PM10), sulfur dioxide, nitrogen dioxide, carbon monoxide and ozone. Information on norms for the content of pollutants in the ambient air, according to the national and European legislation, and information on the health effects of air pollution, is published on the website of the ExEA
http://eea.government.bg/bg/output/daily/norms-air.doc.

Table 4.1.1. *Exceedances of AQ limit values (LV) for sulphur dioxide, nitrogen dioxide, particulate matter (PM10), ozone and carbon monoxide in ambient air within the period from 00:00 to 24:00, 09.02.2014*

Station	SO_2		NO_2	PM_{10}	CO	O_3
	1h LV 350.0 µg/m^3	24h LV 125.0 µg/m^3	1h LV 200.0 µg/m^3	24h LV 50.0 µg/m^3	LV (8h) 10.0 mg/m^3	Information threshold 180.0 µg/m^3
Burgas - kv. Dolno Ezerovo				1.37		
Burgas - kv. Meden Rudnik				1.3		
Dimitrovgrad - Rakovski				1.94		
Vidin				6.56		
Pleven				5.45		
Lovech				2.06		
Plovdiv - Banya Starinna				2.86		
Ruse - Vazrazhdane				2.43		
Sofia - Druzhba				1.09		
Sofia - Orlov most				1.33		
Sofia - Nadezhda				1.31		
Sofia - Hipodruma				1.06		
Stara Zagora - Zelen Klin				1.47		
Sliven				1.1		
Devnya - Izvorite				1.38		
Varna - AMS Batak				1.87		
Varna - SOU Angel Kanchev				1.11		
G.Oryahovitsa				1.99		
Vratsa - ZHP Gara				3.18		

Remarks:

The abbreviations are listed at the above address.

The data from the automatic stations are received in real time in National database for Air Quality Control in ExEA and regional databases in RIEW and are preliminary. After checking for accuracy and verification, the final data is published in the quarterly bulletins and the National report on the state of the environment.

4.1.4. Information to alert the population

In case of exceedances of the alert threshold for sulfur dioxide, nitrogen dioxide and ozone, information is provided to the population in accordance with

"Instruction for informing the population in the case of exceedance of the established alarm thresholds and indicators". The last recorded exceedances of the alert thresholds for sulfur dioxide, nitrogen dioxide and ozone in ambient air are posted on the website of the ExEA.

http://pdbase.government.bg/airq/alarm-en.jsp.

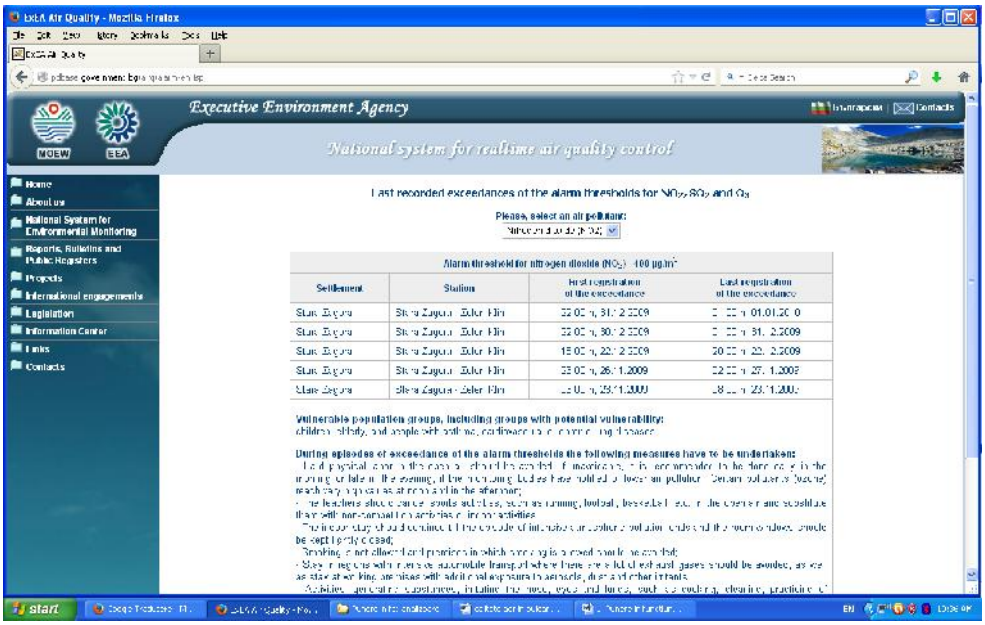
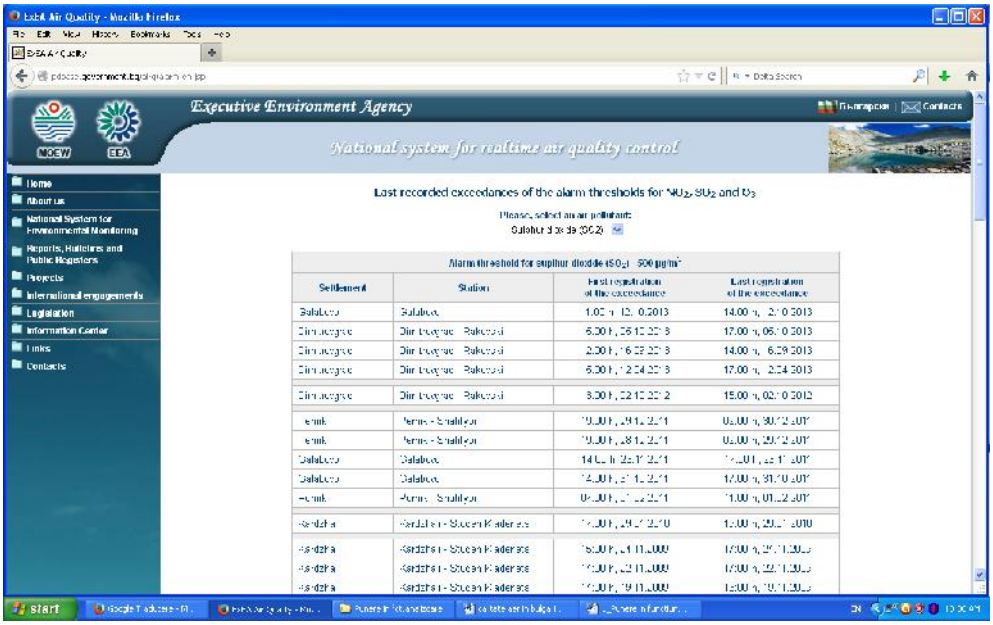


Figure 4.1.7. *Information to alert the population for NO_2*



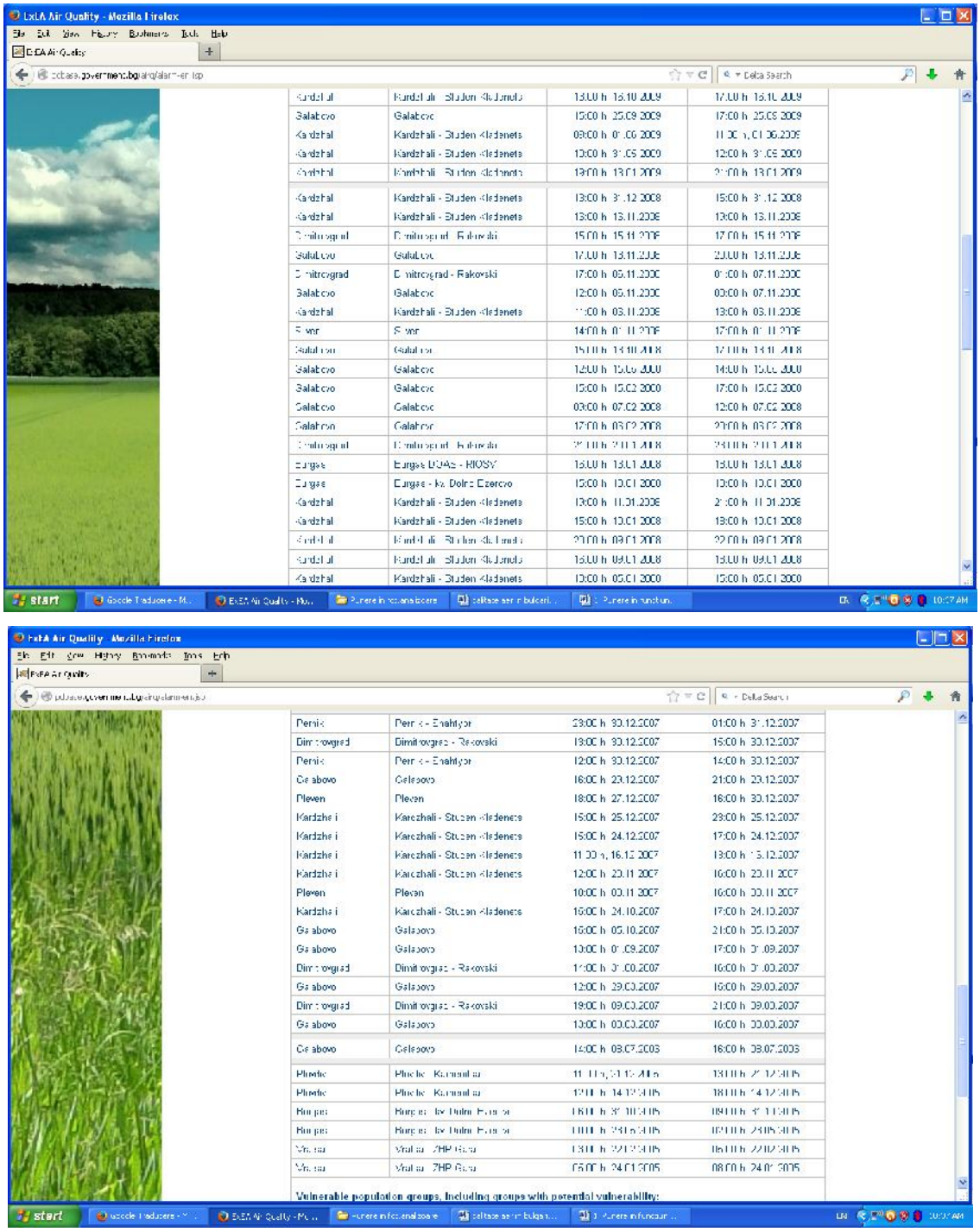
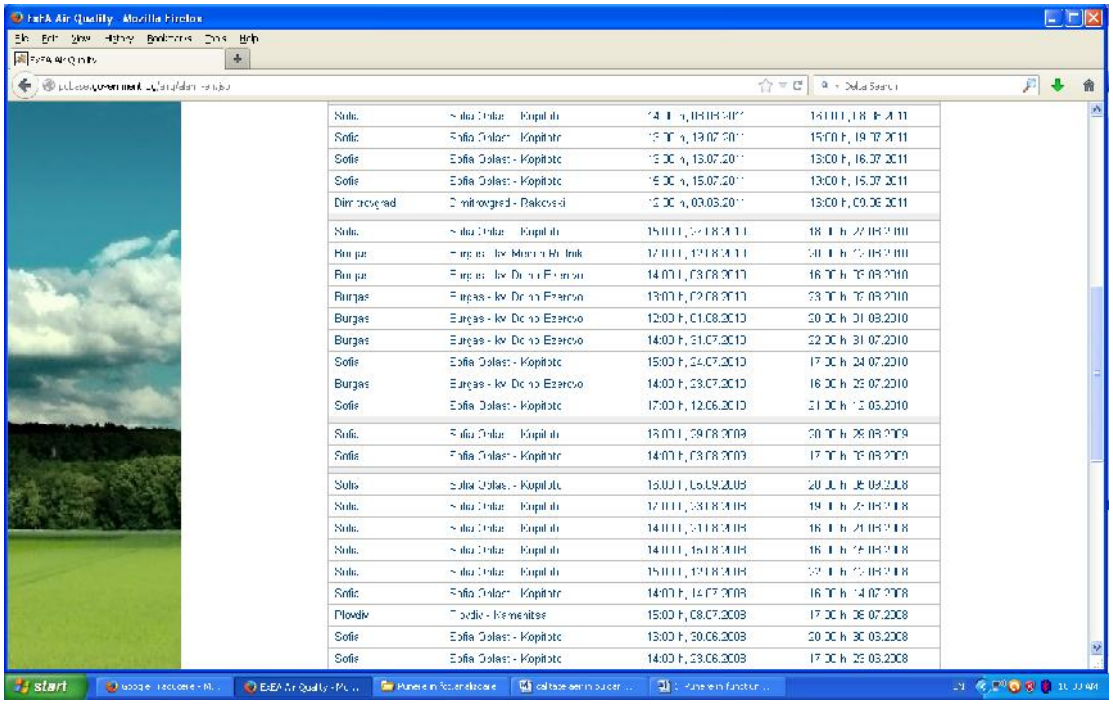


Figure 4.1.8. *Information to alert the population for SO_2*


Executive Environment Agency
National system for realtime air quality control
Last recorded exceedances of the alarm thresholds for NO2, SO2 and O3
Please, select an air pollutant:
Ozone (O3)
Alarm threshold for ozone (O3) 240 µg/m3
Information threshold for ozone (O3) 180 µg/m3
Settlement
Station
First registration of the exceedance
Last registration of the exceedance
Home
About us
National System for Environmental Monitoring
Reports, Bulletins and Public Registers
Projects
International engagements
Legislation
Information Center
Links
Contacts



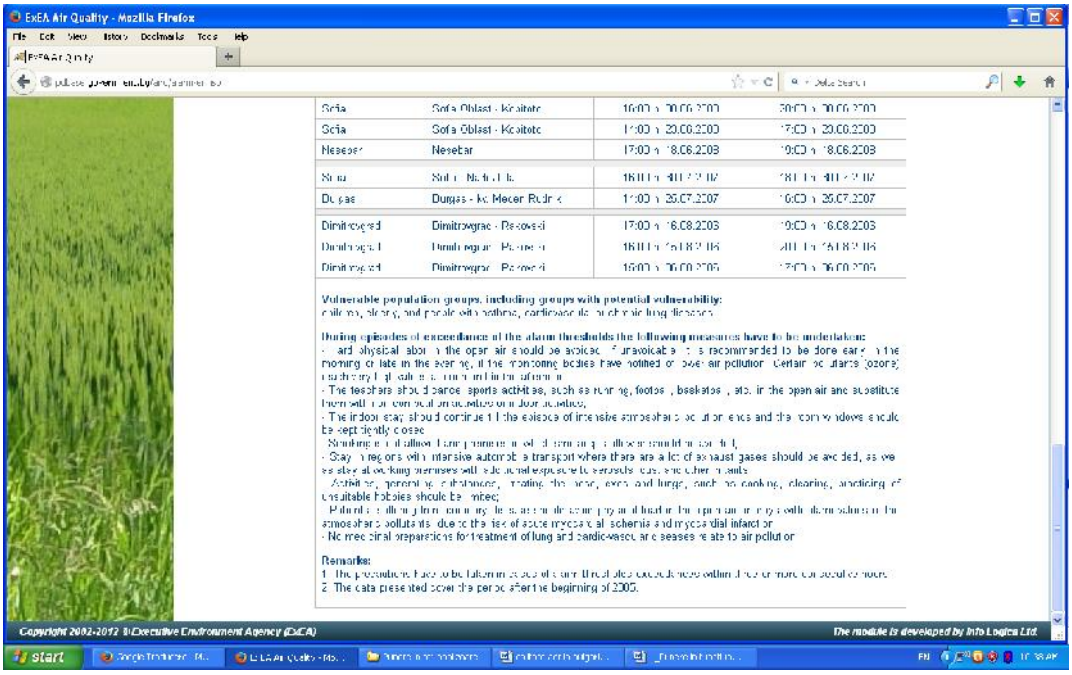


Figure 4.1.9. *Information to alert the population for O_3*

4.1.5. Other information bulletins

Information on the levels of total dust, PM_{10}, $PM_{2.5}$, benzene, lead aerosols, arsenic, cadmium, nickel, polyaromatic hydrocarbons and some country-specific pollutants such as ammonia, phenol, carbon sulphide and others is presented in the quarterly bulletins and the National report on the state of the environment: http://eea.government.bg/en/output/index.html.

4.1.6. Measures for air quality improvement

In the settlements with air pollution problems municipal programs have been developed for reduction of atmospheric pollutants levels and achievement of the standards. Settlements and pollutants, for which municipal programs for air quality improvement are developed, have been published on the website of ExEA: http://eea.government.bg/bg/nsmos/air/roukav/index.html.

Национален каталог на източниците на екологична информация (National Catalogue of Environmental Data Sources)

Райони за оценка и управление на КАВ, съгласно Наредба № 7 от 1999 год. (Areas for assessment and management of air quality under Ordinance № 7 1999)

Areas where it is necessary to establish community programs to reduce the levels of pollutants.


ИАОС Mozilla Firefox
Изпълнителна агенция по околна среда
English
Контакти
Района за оценка и управление на КАВ, съгласно Наредба № 7 от 1999 г.
Начална страница
Новини
За агенцията
Национална система за мониторинг на околната среда
Лаборатории на ИАОС
Разрешителни режими
Докладни, бюлетини, публични регистри и информационни системи
Международни проекти
Международни ангажименти
Законодателство
Информационен център
Обяви
Интернет връзки
Контакти
Райони, за които е необходимо да се изготвят общински програми за намаляване нивата на замърсителите
Район
Територпален обхват
Класификация по чл. 30 ЗЧ
Замърсител по точки 1 и 2
Общинска програма
1
2
3
4
5
Столичен София
Столична голяма общ... с изключение на районите Банкя, Г. сви Искър и Панчарево
т 1
Програма 2011-2014 г.
Средногорие
Община Стара Загора
Община Гълъбово
Община Чирпан
т 1
Програма
Перник
Община Перник
т 1
Програма 2012-2016 г.
Пазарджик
Община Пазарджик
т 1
Програма 2011-2014 г.
Пещера
Община Пещера
т 2
Програма за управление
Велинград
Община Велинград
т 2
Програма
Панагюрище
Община Панагюрище
т 2
Програма и план за действие
Пловдив
Община Пловдив
Община Асеновград
Община Родопи
т 1
Програма 2011-2013 г.
Програма 2011-2015 г.
Кърджали
Община Кърджали
т 1
Програма 2011-2013 г.
Димитровград
Община Димитровград
т 1
Програма 2012-2014 г.
Стара Загора
Община Стара Загора
т 1
Програма 2011-2015 г.
start

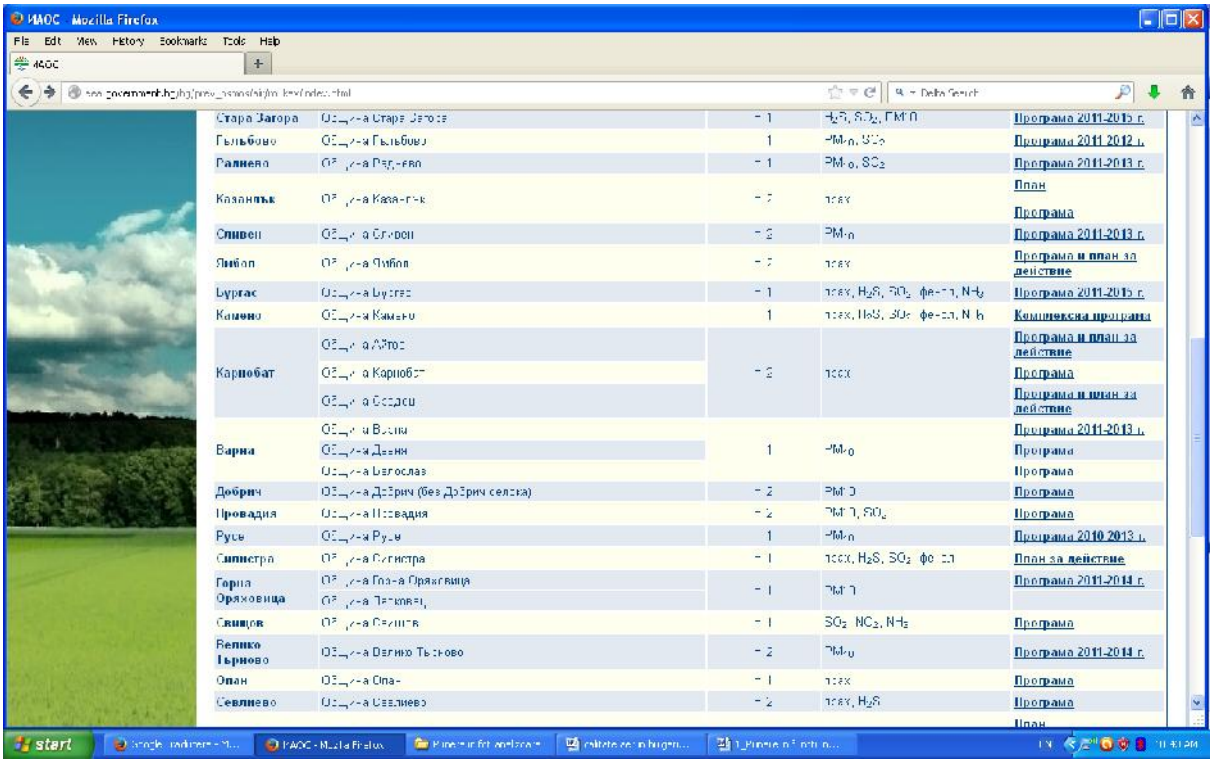

ИАОС Mozilla Firefox
Стара Загора
Гълъбово
Раднево
Казанлък
Сливен
Ямбол
Бургас
Камено
Карнобат
Варна
Добрич
Провадия
Русе
Силистра
Горна Оряховица
Свищов
Велико Търново
Опан
Севлиево
start

Figure 4.1.10. *Areas for assessment and management of air quality under Ordinance № 7 1999*

4.1.7. Urban population exposure to selected air pollutants

Urban population exposure

The percentage of urban population exposed to the pollutant concentrations according to the objectives of air quality in EU (2009-2011)

Bulgaria	EU reference value	Exposure estimate (%) (minimum and maximum over the period)
PM_{10}	day (50 μg/m³)	100
O_3	8-hour (120 μg/m³)	0 – 3
NO_2	year (40 μg/m³)	0

Color coding of exposure estimates refers to the fraction of urban population exposed to concentrations above the reference level:

< 5 %	5-50 %	50-75 %	> 75 %

4.1.8. Air quality status – Examples

4.1.8.1. NO_2 monitoring stations in the database for air quality of AEM - (2011)

Table 4.1.2. *NO_2 monitoring stations*

Station classification	Number of stations	Percentage
Others	0	0.8
Rural	2	8.0
Traffic	6	24.0
Urban	17	68.0
Total	**25**	**100.0**

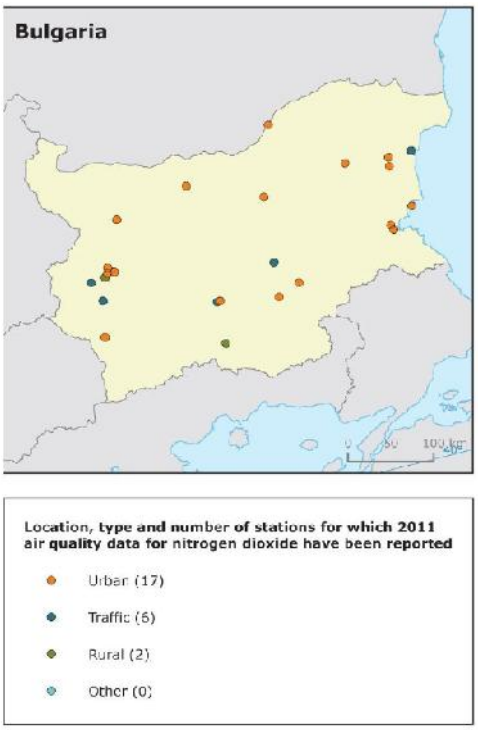


Figure 4.1.11. *Location, type and number of the stations for which the air quality data related to NO_2 have been reported*

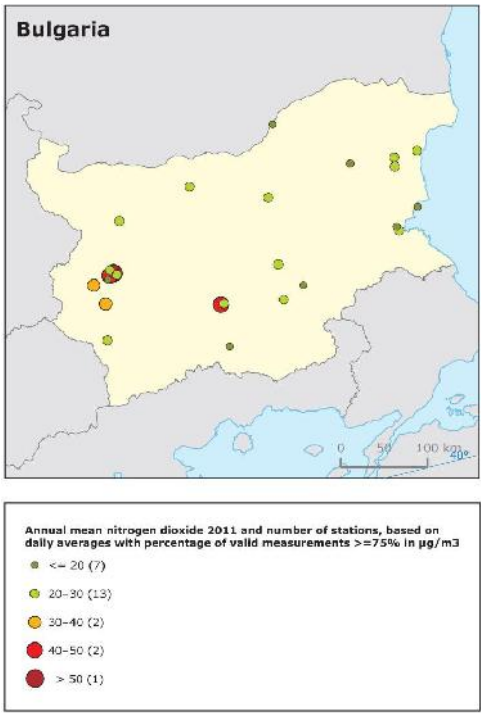


Figura 4.1.12. *Annual mean nitrogen dioxide (2011) and number of stations based on daily averages with percentage of valid measurements ≥ 75% in µg/m^3*

4.1.8.2. PM10 monitoring stations in the database for air quality of AEM - (2011)

Table 4.1.3. *PM10 monitoring stations*

Station classification	Number of stations	Percentage
Others	0	0.0
Rural	2	5.0
Traffic	9	22.5
Urban	29	72.5
Total	**40**	**100.0**

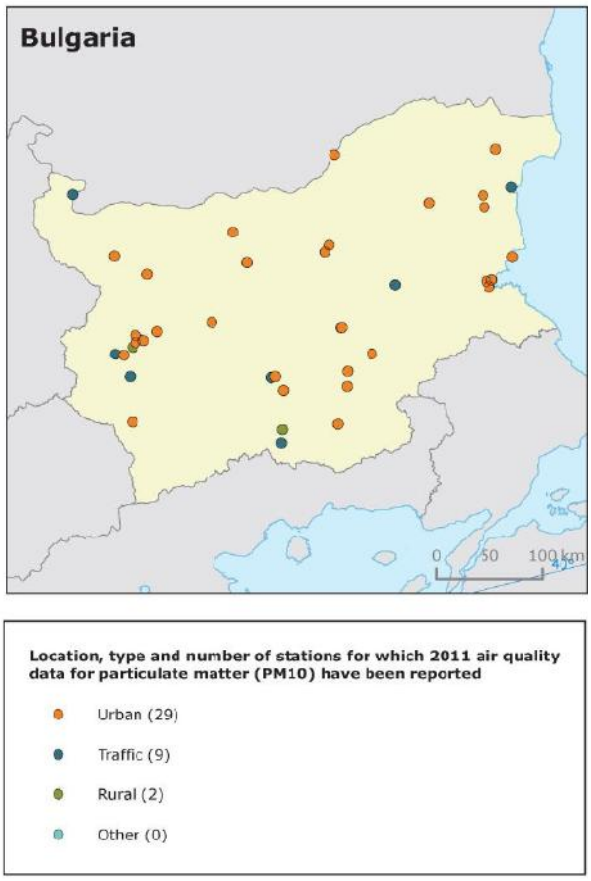


Figure 4.1.13. *Location, type and number of the stations for which the air quality data related to PM10 have been reported*

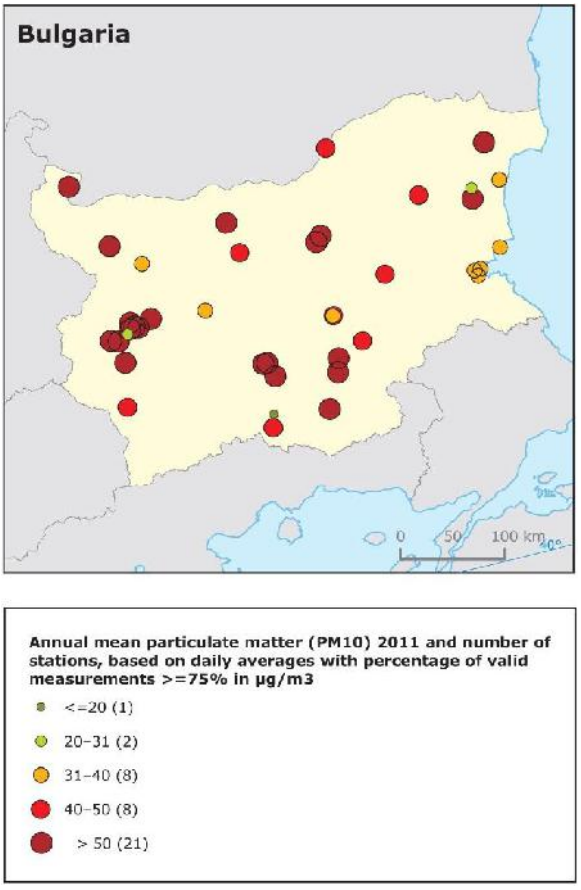


Figure 4.1.14. *Annual mean PM10 (2011) and number of stations based on daily averages with percentage of valid measurements ≥ 75% in µg/m³*

4.1.8.3. O_3 monitoring stations in the database for air quality of AEM - (2011)

Table 4.1.3. *O_3 monitoring stations*

Station classification	Number of stations	Percentage
Others	0	0.0
Rural	2	10.5
Traffic	3	15.8
Urban	14	73.7
Total	**19**	**100.0**

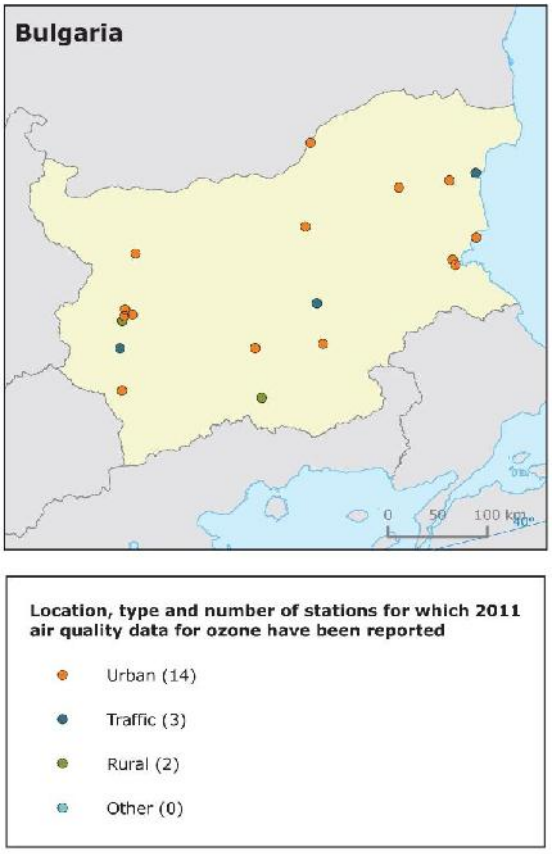


Figura 4.1.15. *Location, type and number of the stations for which the air quality data related to O_3 have been reported*

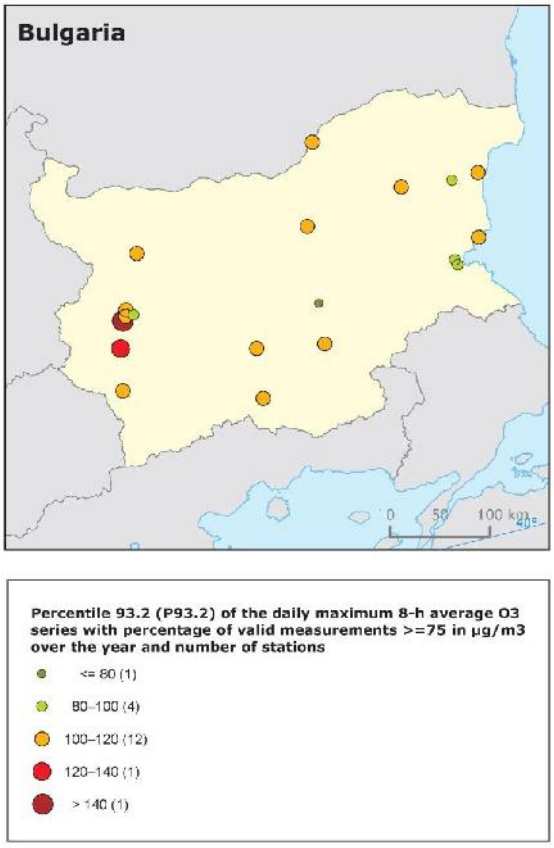


Figura 4.1.16. *Percentile 93.2 of the daily maximum 8h - average O_3 series with percentage of valid measurements ≥ 75% in µg/m^3 over the year and number of stations*

4.2. Public Information in Real Time on Air Quality in Romania

4.2.1. CALITATEAER.RO

This site is intended to inform in real time the public on the air quality parameters monitored in more than 100 station on the whole surface of Romania, which form the National Network for Air Quality Monitoring (NNAQM).

Figure 4.2.1. The site *calitateaer.ro*

For making available the existent data in the shortest time, the site displays the quality indexes and the measured values, hourly updated, which are in course of validation and certification.

According to the provisions of the Law no.104/2011 on ambient air quality, the responsibility for monitoring the ambient air quality in Romania belongs to the authorities for environmental protection.

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

At present, NNAQM performs continuous measurements of sulfur dioxide, nitrogen oxides (NOx), carbon monoxide (CO), ozone (O3), particulate matter (PM10

and PM2.5), benzene (C6H6), lead (Pb). Air quality in each station is represented by suggestive quality indexes, established on the basis of the concentrations of the main air pollutants measured.

At present, in Romania there are located 142 stations for the continuous monitoring of air quality, equipped with automatic equipment for measuring the concentrations of the main air pollutants. NNAQM contains 41 local centers, which collect and transmit the data supplied by the stations to the panels for informing the public; after the primary validation, they send them for certification to the National Reference Laboratory for Air Quality (NRLAQ) within the framework of the National Agency for Environmental Protection.

In this site, the data supplied by the 41 local centers for data collection are displayed.

Network structure

Monitoring stations

The National Network for Air Quality Monitoring (NNAQM) contains 142 automatic stations for air quality monitoring and 17 mobile stations:

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

Figure 4.2.2 *Monitoring stations in Dolj county*

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

Traffic station:

– assesses the traffic influence on air quality;

- the radius of the area of representativeness is 10-100m;

- monitored pollutants are sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O_3), volatile organic compounds (VOC) and particulate matter (PM10 and PM2.5).

Example of traffic station

Figure 4.2.3. *Station DJ-1 of traffic type, Craiova, Dolj county located at the address: Calea Bucuresti*

Industrial station

- assesses the influence of industrial activities on air quality;

- the radius of the area of representativeness is 100m-1km;

- monitored pollutants are sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O_3), volatile organic compounds (VOC) and particulate matter (PM10 and PM2.5) and also meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

Urban station

- assesses the influence of "human settlements" on air quality;

- the radius of the area of representativeness is 1-5 km;

- monitored pollutants are sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O_3), volatile organic compounds (VOC) and particulate matter (PM10 and PM2.5) and also meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

Suburban station

- assesses the influence of "human settlements" on air quality;

- the radius of the area of representativeness 1-5 km;

- monitored pollutants are sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O_3), volatile organic compounds (VOC) and particulate matter (PM10 and PM2.5) and also meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

Regional station

- is the reference station for assessing the air quality;

- the radius of the area of representativeness 200-500km;

- monitored pollutants are sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O_3), volatile organic compounds (VOC) and particulate matter (PM10 and PM2.5) and also meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

EMEP station

- monitors and assesses air pollution within long-distance transboundary context;

- is located in the mountains, at medium altitude: Fundata, Semenic and Poiana Stampei;

- monitored pollutants are sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O_3), volatile organic compounds (VOC) and particulate matter (PM10 and PM2.5) and also meteorological parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitations).

Data circuit

The monitoring system enables the local authorities for environmental protection to:

- assess, know and inform permanently the public, other interested authorities and institutions, on the air quality level;

- take timely, prompt action for diminishing and/or eliminating the pollution episodes or in case of some emergency situations;

- prevent accidental pollutions;

- warn and protect the population in case of emergency.

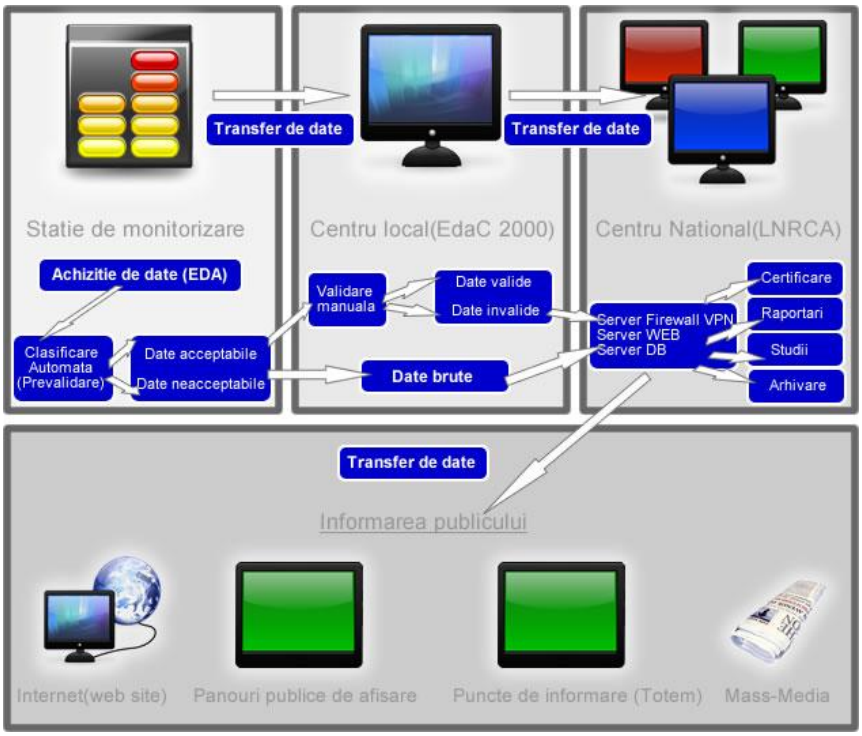


Figure 4.2.4 *Data circuit*

Information on air quality, coming from the 142 monitoring stations and meteorological data received from the 119 monitoring stations will be transmitted to the Local centers from the 41 Agencies for Environmental Protection.

Data on air quality, coming from the stations, will be presented to the public by means of some outer panels (conventionally placed in the densely populated areas of the cities).

Quality indexes

In the sub-menu *Quality indexes*, information of specific index for air quality and general index is presented.

For being possible to calculate the general index, at least 3 specific indexes corresponding to the monitored pollutants should be available. The general index and the specific indexes are represented by integers between 1 and 6, each number corresponding to one color (both the colors and the numbers associated to them will be represented on the figure).

Figure 4.2.5 *Quality indexes*

The specific index for air quality, in brief "specific index", is a system for coding the concentrations recorded for each of the following monitored pollutants:

1. sulfur dioxide (SO_2)
2. nitrogen dioxide (NO_2)
3. ozone (O_3)
4. carbon monoxide (CO)
5. particulate matter (PM10)

The general index is established for each of the automatic stations in the National Network for Air Quality Monitoring, as the highest one from the specific indexes corresponding to the monitored pollutants.

The specific indexes and the general index of the station are displayed every hour.

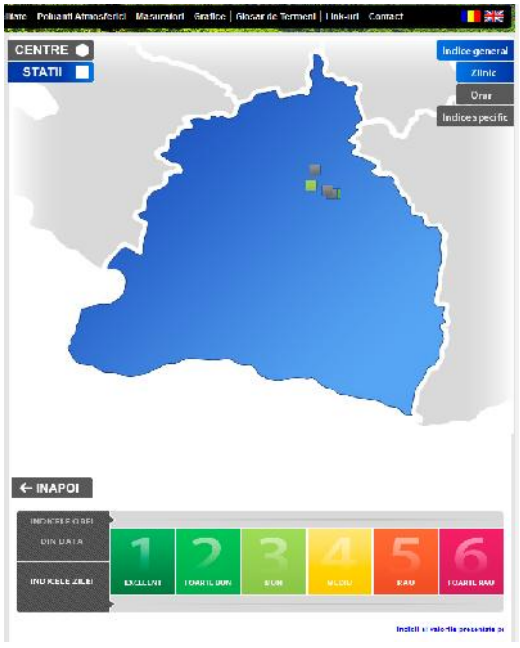


Figure 4.2.6. *Daily general index in Dolj county*

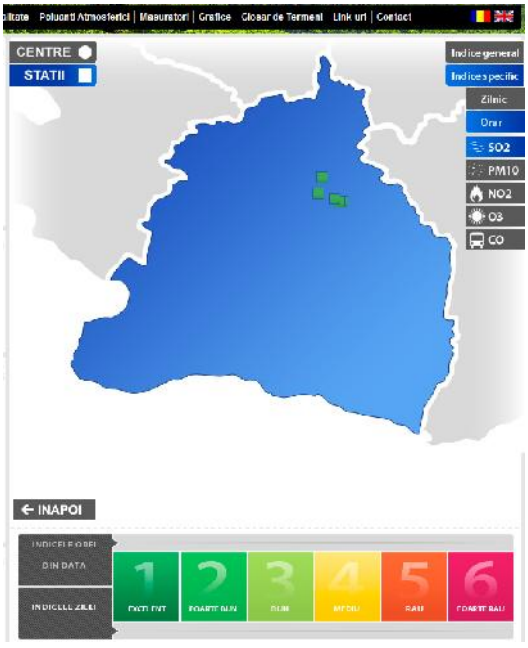


Figure 4.2.7 *Hourly specific index for sulfur dioxide in Dolj county*

The specific index corresponding to sulfur dioxide is established by placing the average hourly concentrations in one of the concentration ranges written in the following table:

Table 4.2.1. *Specific indexes corresponding to sulfur dioxide*

Concentration range for sulfur dioxide (µg/m^3)	Specific index
0-49,(9)	1
50-74,(9)	2
75-124,(9)	3
125-349,(9)	4
350-499,(9)	5
>500	6

The specific index corresponding to nitrogen dioxide is established by placing the average hourly concentrations in one of the concentration ranges written in the following table:

Table 4.2.2. *Specific indexes corresponding to nitrogen dioxide*

Concentration range for nitrogen dioxide (µg/m^3)	Specific index
0-49,(9)	1
50-99,(9)	2
100-139,(9)	3
140-199,(9)	4
200-399,(9)	5
>400	6

The specific index corresponding to ozone is established by placing the average hourly concentrations in one of the concentration ranges written in the following table:

Table 4.2.3. *Specific indexes corresponding to ozone*

Concentration range for ozone (µg/m^3)	Specific index
0-39,(9)	1
40-79,(9)	2
80-119,(9)	3
120-179,(9)	4
180-239,(9)	5
>240	6

The specific index corresponding to carbon monoxide is established by placing the arithmetic mean of hourly values, recorded in the last 8 hours, in one of the concentration ranges written in the following table:

Table 4.2.4. *Specific indexes corresponding to carbon monoxide*

Concentration range for carbon monoxide (µg/m^3)	Specific index
0-2,(9)	1
3-4,(9)	2
5-6,(9)	3
7-9,(9)	4
10-14,(9)	5
>15	6

The specific index corresponding to particulate matter is established by placing the arithmetic mean of hourly values, recorded in the last 24 hours, in one of the concentration ranges written in the following table:

Table 4.2.5. *Specific indexes corresponding to particulate matter*

Concentration range for particulate matter (ug/m3)	Specific index
0-9,(9)	1
10-19,(9)	2
20-29,(9)	3
30-49,(9)	4
50-99,(9)	5
>100	6

Air pollutants

In the sub-menu Air pollutants we may select each pollutant and we get information on it:

Figure 4.2.8 *Air pollutants*

Example of selecting an air pollutant – Sulfur dioxide SO_2

1. General

Sulfur dioxide is a colorless, bitter, non-flammable gas, with a pungent odor, that irritates eyes and respiratory tracks.

Natural sources: volcanic eruptions, marine phytoplankton, bacterial fermentation in wetlands, oxidation of sulfur-containing gas resulted from biomass decomposition.

Anthropogenic sources (due to human activities): systems for heating the population that do not use marsh gas, thermal power plants, industrial processes (siderurgy, refinery, sulfuric acid production), pulp and paper industry and, to a lesser extent, the emissions coming from diesel motors.

Effects on human health:

Depending on concentration and exposure time, the sulfur dioxide has different effects on human health.

Exposure to a high concentration of sulfur dioxide, for a short time, may generate severe respiratory difficulties. There are especially affected people suffering from asthma, children, elderly and people with chronic diseases of respiratory tracts.

Exposure to a reduced concentration of sulfur dioxide for a long time may cause infections of respiratory tracts.

Sulfur dioxide may intensify the harmful effects of ozone.

Effects on plants:

Sulfur dioxide affects visibly many species of plants, the negative effect on their structures and tissues being noticeable to the naked eye.

Some of the most sensitive plants are: pine, vegetables, red and black acorns, white ash, alfalfa, blackberries

Effects on the environment

In atmosphere, it contributes to the acidification of precipitations, with toxic effects on vegetation and soil.

Increase of sulfur dioxide accelerates the metal corrosion, due to the formation of acids.

Sulfur oxides may erode: stone, masonry, paints, fibers, leather and electric components.

2. Measurement methods

The reference method for measuring the sulfur dioxide is that one provided in the standard SR EN 14212 - Ambient air quality — Standard method for the measurement of sulfur dioxide concentration by ultraviolet fluorescence.

Measurements

In the sub-menu *Measurements* we may visualize the data measured in the following three possibilities:

- Complete data of only one parameter at only one station (1P-1S);
- Data of only one parameter at many stations (1P-nS);
- Data of many parameters at only one station (nP-1S).

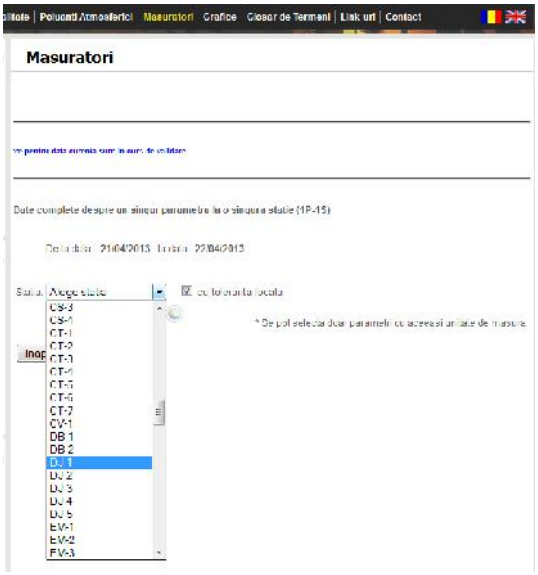


Figure 4.2.9 *Selection - Complete data of only one parameter at only one station (1P-1S);*

After selecting the monitoring station from which we want to get information, we have the possibility to check off the desired air pollutant, also the desired interval, as it can be seen in the next figure:

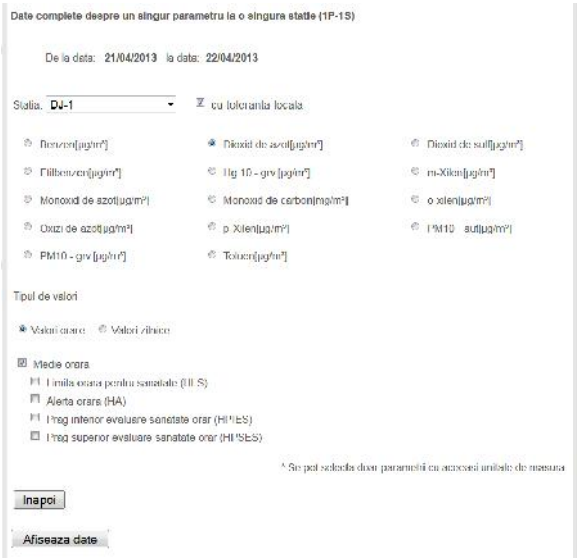


Figure 4.2.10 *Selection of air pollutant and interval for visualization*

We will get the data from the next figure:

21/04/2013	Valori standard (µg/m³)	Procentaj	Brut	Valid	Certificat	Val. min.	Timp min.	Val. max.	Timp max.	Praguri standard
Statia DJ-1 Dioxid de azot	Medie orara									
01:00	91.31	99	✓	✓	✗	56.21	00:59:00	114.14	00:01:00	
02:00	30.72	98	✓	✓	✗	12.71	01:59:00	70.78	01:01:00	
03:00	19.87	99	✓	✓	✗	8.92	02:43:00	42.45	02:25:00	
04:00	17.57	99	✓	✓	✗	9.48	03:57:00	28.84	03:15:00	
05:00	15.39	99	✓	✓	✗	6.24	04:19:00	24.38	04:09:00	
06:00	15.67	99	✓	✓	✗	5.59	05:36:00	31.27	05:41:00	
07:00	18.82	98	✓	✓	✗	8.80	06:13:00	28.33	06:46:00	
08:00	19.72	99	✓	✓	✗	7.77	07:14:00	29.05	07:28:00	
09:00	24.73	99	✓	✓	✗	9.63	08:09:00	42.54	08:30:00	
10:00	43.47	99	✓	✓	✗	18.31	09:21:00	85.89	09:42:00	
11:00	56.38	99	✓	✓	✗	36.55	10:47:00	101.76	10:17:00	
12:00	40.06	99	✓	✓	✗	10.66	11:54:00	96.97	11:20:00	
13:00	27.40	98	✓	✓	✗	8.08	12:27:00	99.00	12:20:00	
14:00	26.16	99	✓	✓	✗	5.95	13:06:00	59.97	13:47:00	
15:00	20.02	99	✓	✓	✗	0.43	14:46:00	62.21	14:41:00	
16:00	23.64	99	✓	✓	✗	3.29	15:05:00	50.10	15:55:00	
17:00	26.77	99	✓	✓	✗	6.89	16:44:00	59.71	16:17:00	
18:00	32.34	99	✓	✓	✗	6.78	17:09:00	101.15	17:58:00	
19:00	40.94	98	✓	✓	✗	21.27	18:52:00	70.05	18:10:00	
20:00	30.27	99	✓	✓	✗	15.36	19:49:00	66.86	19:38:00	
21:00	30.64	99	✓	✓	✗	10.19	20:42:00	56.51	20:22:00	
22:00	26.72	99	✓	✓	✗	12.42	21:07:00	51.48	21:02:00	
23:00	19.00	99	✓	✓	✗	3.70	22:48:00	31.09	22:54:00	
24:00	15.06	99	✓	✓	✗	2.09	23:36:00	37.08	23:24:00	

Grafic [Afiseaza grafic] ◉ linie ○ bara ☐ Afiseaza praguri limita

[sus]

Figure 4.2.11 *Measured data - nitrogen dioxide at the station DJ-1 , on 21.04.2013*

We have the possibility to get the diagram of the measured data by clicking on the button *Display data*.

Figure 4.2.12 *Diagram corresponding to the measured data of nitrogen dioxide at the station DJ-1 on 21.04.2013*

Graphics

In the sub-menu *Graphics* we have the possibility to choose the type of graphic as follows:

- Effective values of one parameter at different stations;
- Comparison of many parameters between stations.

Time interval:

- Averages on hourly intervals;
- Averages on daily intervals;
- Averages on monthly intervals.

By selecting the variant *Averages on daily intervals*, a new page with all the monitoring stations from the network will be opened.

Example:

By choosing the variant *Comparison of many parameters between stations* by checking off the corresponding box and the variant *Averages on daily intervals* we have the possibility to select many monitoring stations and many air pollutants for comparing the data and displaying the graphic.

For exemplification, three monitoring stations: OT1, DJ-1 and MH-1, and the atmospheric pollutants: Nitrogen monoxide, PM10 and sulfur dioxide are checked off, as is shown in the following Figure:

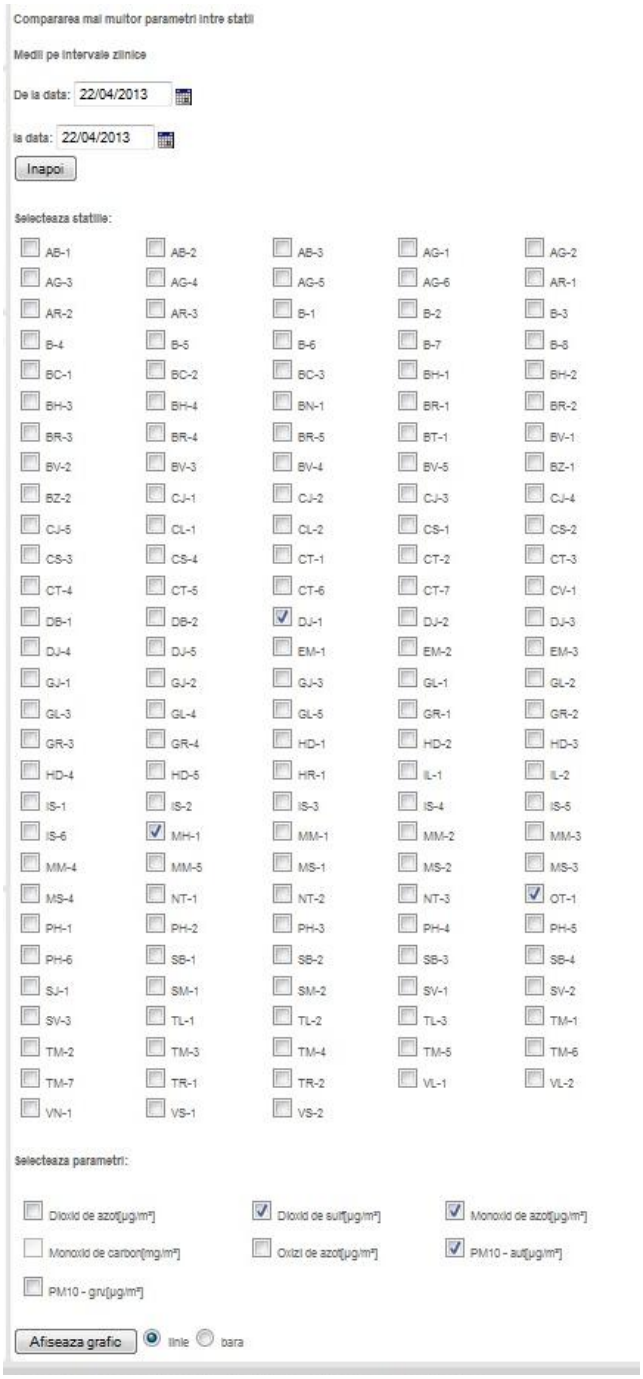


Figure 4.2.13 *Selection of stations and pollutants for comparison*

By clicking the button *Display the graphic*, we will get the comparison graphic:

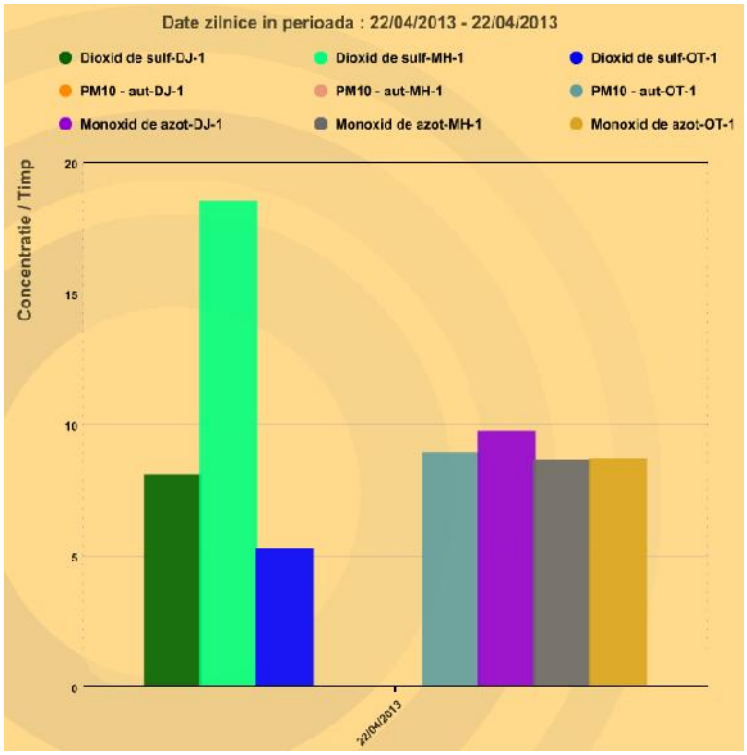


Figure 4.2.14 *Comparison graphic*

Glossary of terms

In the sub-menu *Glossary of terms* we could find information on the terms regarding the ambient air quality, such as:

- Ambient air – air from troposphere, excepting that one from the working places, as they are defined by the Government decision no. 1.091/2006 related to the minimal requirements of safety and health for the working place, where usually the public has no access and for which the dispositions referring to the health and safety at the working place are applied;

- Pollutant – any substance existing in the ambient air, which may have harmful effects on human health and/or environment as a whole;

- Level – concentration of a pollutant from the ambient air or its deposition on surfaces within a given time period;

- Limit value – level established on the basis on scientific knowledge, for avoiding and preventing the occurrence of some harmful events and for reducing their effects on human health and environment as a whole, which is reached within a given time period and which, once reached, must not be exceeded ;

- Critical level - level established on the basis on scientific knowledge, which if exceeded, leads to possible direct adverse effects on certain receivers, such as trees, plants or natural ecosystems, but not on human beings;

- Margin of tolerance – percentage of the limit value by which that value may be exceeded, according to the conditions established in the present law;

- Air quality plans – plans by which measures for reaching the limit values or the target values are established;

- Target-value – level established to avoid and prevent the occurrence of some harmful events and to reduce their effects on human health and on environment as a whole, which should be reached, as far as possible, within a certain period;

- Alert threshold – level which, if exceeded, leads to a risk for human health at short time exposure of population, in general, and requires acting immediately;

- Information threshold - level which, if exceeded, leads to a risk for human health at a short time exposure for particularly sensitive population groups and requires informing immediately and adequately;

- Area – part of the country territory delimited for assessing and managing the ambient air quality;

- Agglomeration – area representing a conurbation with a population of more than 250,000 inhabitants or, where the population is smaller or equal to 250,000 inhabitants, has a density per square kilometer higher than 3,000 inhabitants;

- Fixed measurements – measurements performed in fixed points, either continuously or by random sampling, for determining the levels in accordance with the relevant quality objectives of data;

- Indicative measurements – measurements that respect data quality objectives less stringent than those required for measurements in points;

- Fugitive emissions – undirected emissions, released in ambient air through windows, doors and other orifices, ventilation or opening systems, which usually do not belong to the category of directed pollution sources;

- Emissions from fixed sources – emissions released in ambient air by equipment, facilities, including the ventilation ones, from the building activities or from other fixed works which produce pollutants or by means of which pollutants are discharged ;

- Emissions from mobile pollution sources - emissions released in ambient air by road, railway, naval and air means of transportation, mobile non-road equipment fitted out with internal combustion engines;

- Emissions from diffuse pollution sources - emissions released in ambient air by undirected emission sources of air pollutants, such as fugitive emissions sources, natural emission sources and other sources that have been not specifically defined.

Links

In the sub-menu *Links,* by checking off the selection box, we get information about the following:

- Useful links;
- Information on regions;
- Information on centers;
- Information on stations.

Example of useful links:

- Link to the Ministry of Environment and Forests - www.mmediu.ro;
- Link to the site of National Agency for Environment Protection - www.anpm.ro;
- Link to the Environment Legislation/Air Quality http://www.mmediu.ro/protectia_mediului/calitate_aer.htm;
- Link to the Normative Documents on Environment / Air Quality http://www.mmediu.ro/legislatie/calitate_aer.htm;
- Link to the European Environment Agency - www.eea.europa.eu.

Information on stations

Examples of information from the table with the monitoring stations forming the National Network for Air Quality Monitoring:

Table 4.2.6 *Information stations*

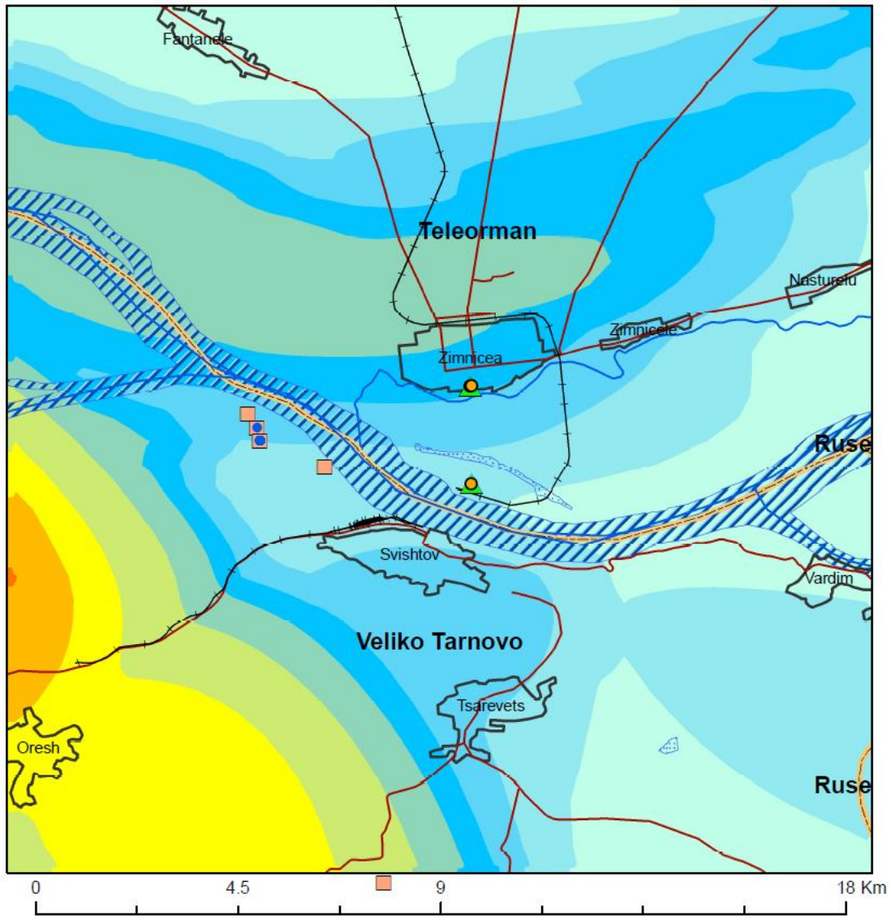
Station name	Extended name	Abbreviation	National code	International code
DJ-1	DJ-1, Craiova, Dolj county	DJ-1, Craiova	040101	RO0078A
MH-1	MH-1, Drobeta Turnu Severin, Mehedinţi county	MH-1, Drobeta Turnu Severin	040301	RO0166A
CL-1	CL-1, Calarasi, Calarasi county	CL-1, Calarasi	030301	RO0125A
GR-1	GR-1, Giurgiu, Giurgiu county	GR-1, Giurgiu	030501	RO030501
OT-1	OT-1, Slatina, Olt county	OT-1, Slatina	040401	RO0174A
CT-1	CT-1, Constanţa, Constanţa county	CT-1, Constanţa	020201	RO0131A
TR-1	TR-1, Alexandria, Teleorman county	TR-1, Alexandria	030701	RO0191A

ANNEX A

Impact assessment in the Zimnicea-Svishtov area

Spatial distribution of maximum hourly concentration for NH3

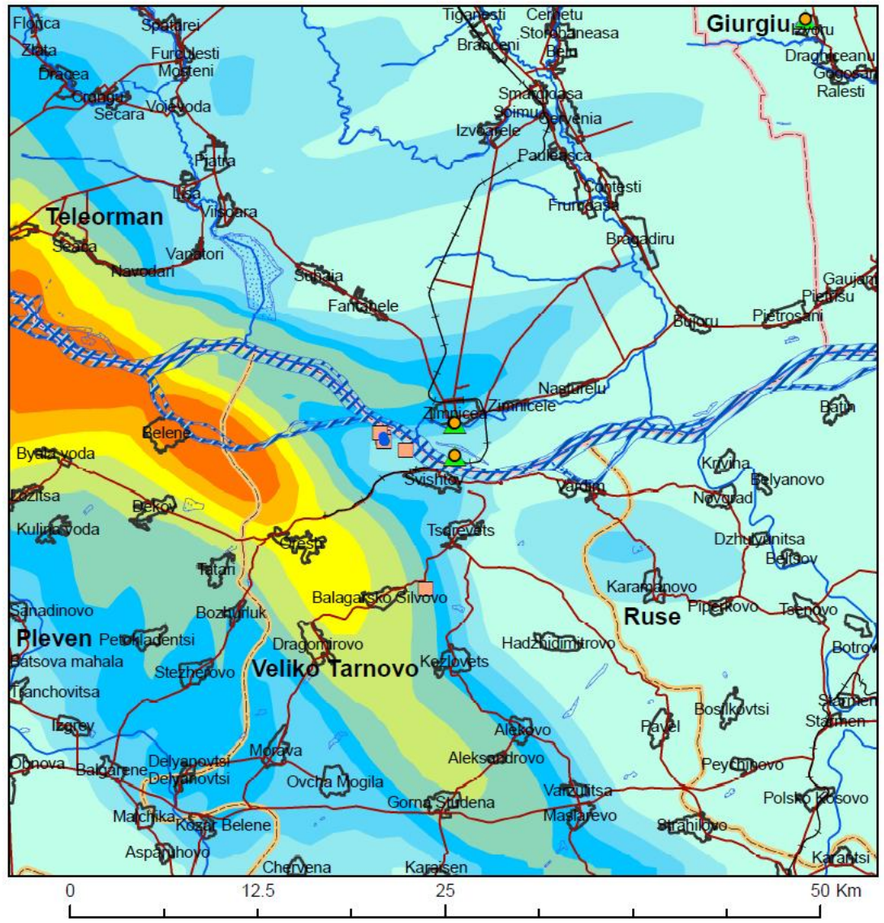
Impact at local level



Legend:

- Romanian point sources
- Bulgarian point sources
- Pollution source locations in Romania
- Pollution source locations in Bulgaria
- Road network
- Railway network
- Hydrographic network
- Danube River
- Lakes
- Localities in Romania
- Localities in Bulgaria
- Counties in Romania
- Regions in Bulgaria

Impact at regional level



Legend:

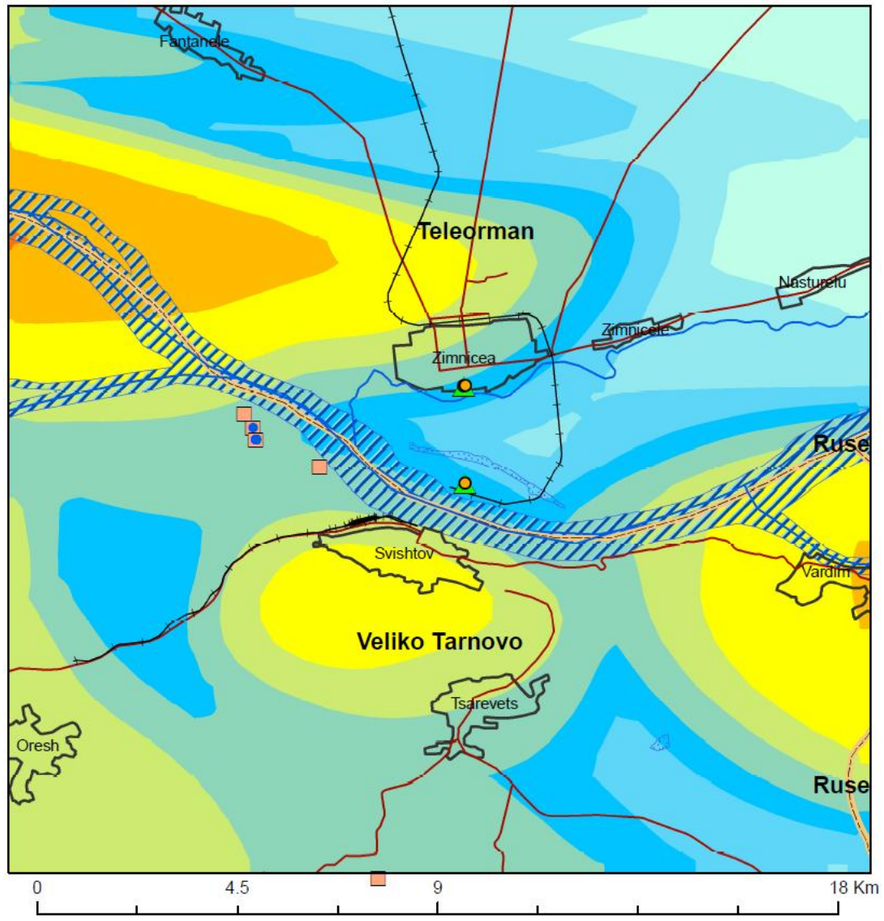
NH3 [µg/mc]	
12.1 - 19.4	36.1 - 45.1
19.5 - 24.8	45.2 - 59.2
24.9 - 30.5	59.3 - 68.9
30.6 - 36	69 - 78.2
	78.3 - 300
	>300 - LV

„Modeling study" - Impact assessment in Zimnicea-Svishtov area

Figure No.1

Spatial distribution of maximum daily concentration for NH3

Impact at local level



Legend:

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- Railway network
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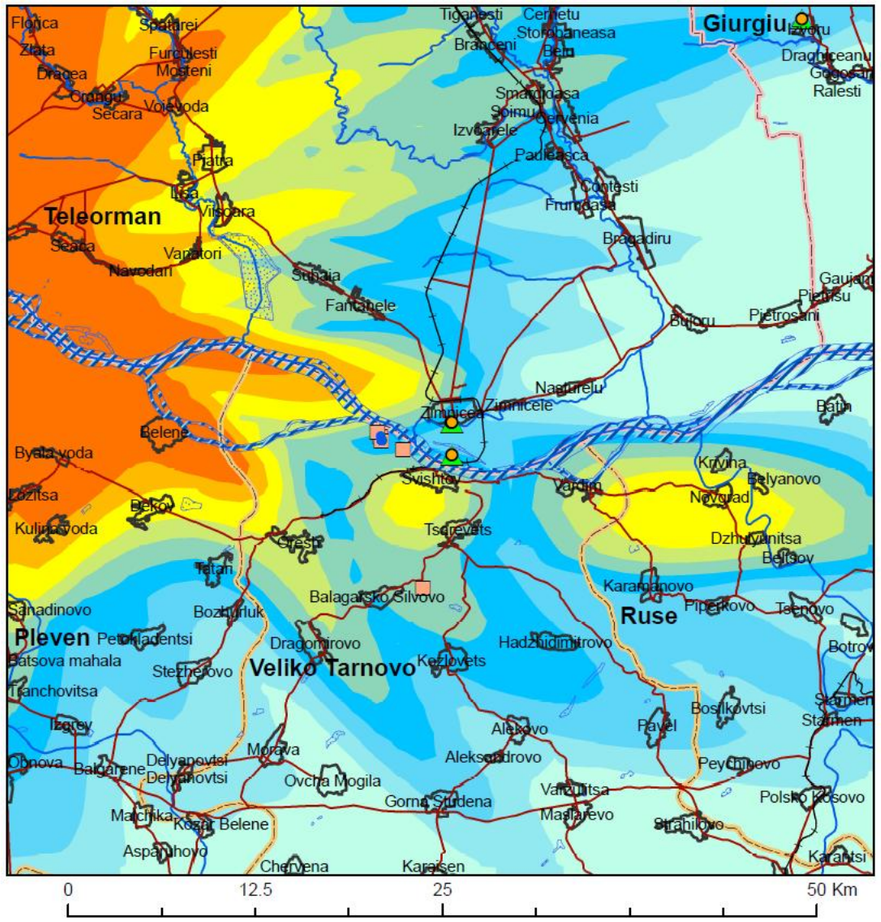
- Danube River
- Lakes
- Localities in Romania
- Localities in Bulgaria
- Counties in Romania
- Regions in Bulgaria

Impact at regional level



Legend:

NH3 [µg/mc]

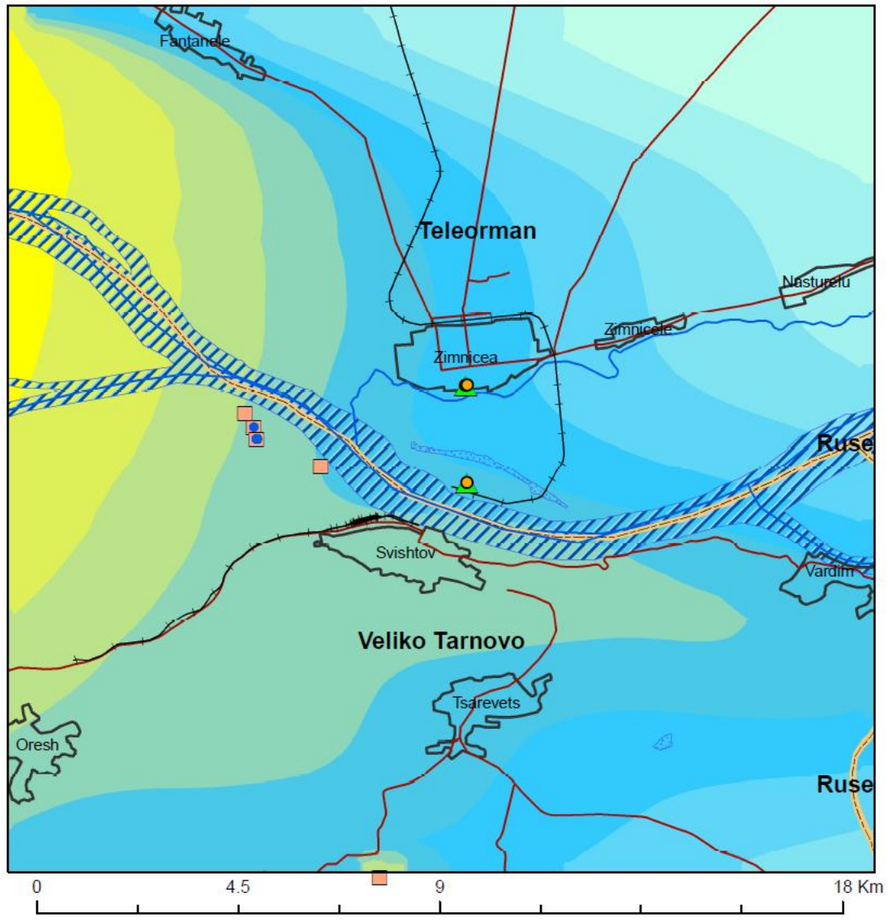
3.4 - 4	5.9 - 6.4
4.1 - 4.6	6.5 - 7
4.7 - 5.2	7.1 - 8.1
5.3 - 5.8	8.2 - 9.2
	9.3 - 100
	>100 - LV

„Modeling study" - Impact assessment in Zimnicea-Svishtov area

Figure No.2

Spatial distribution of average yearly concentration for NH3

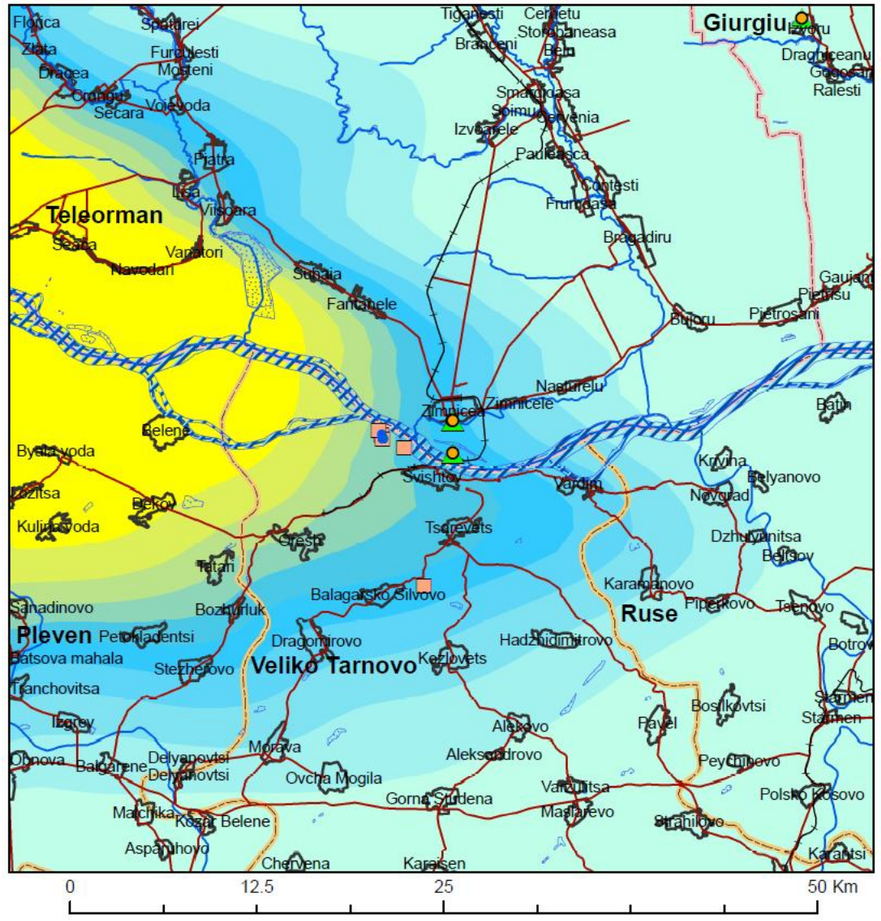
Impact at local level



Legend:

- Romanian point sources
- Bulgarian point sources
- Pollution source locations in Romania
- Pollution source locations in Bulgaria
- Road network
- Railway network
- Hydrographic network
- Danube River
- Lakes
- Localities in Romania
- Localities in Bulgaria
- Counties in Romania
- Regions in Bulgaria

Impact at regional level



Legend:

NH3
[µg/mc]

0.22 - 0.26	0.38 - 0.39
0.27 - 0.3	0.4 - 0.42
0.31 - 0.34	0.43 - 0.45
0.35 - 0.37	0.46 - 0.48
	0.49 - 0.54
	0.55 - 0.57

„Modeling study" - Impact assessment in Zimnicea-Svishtov area

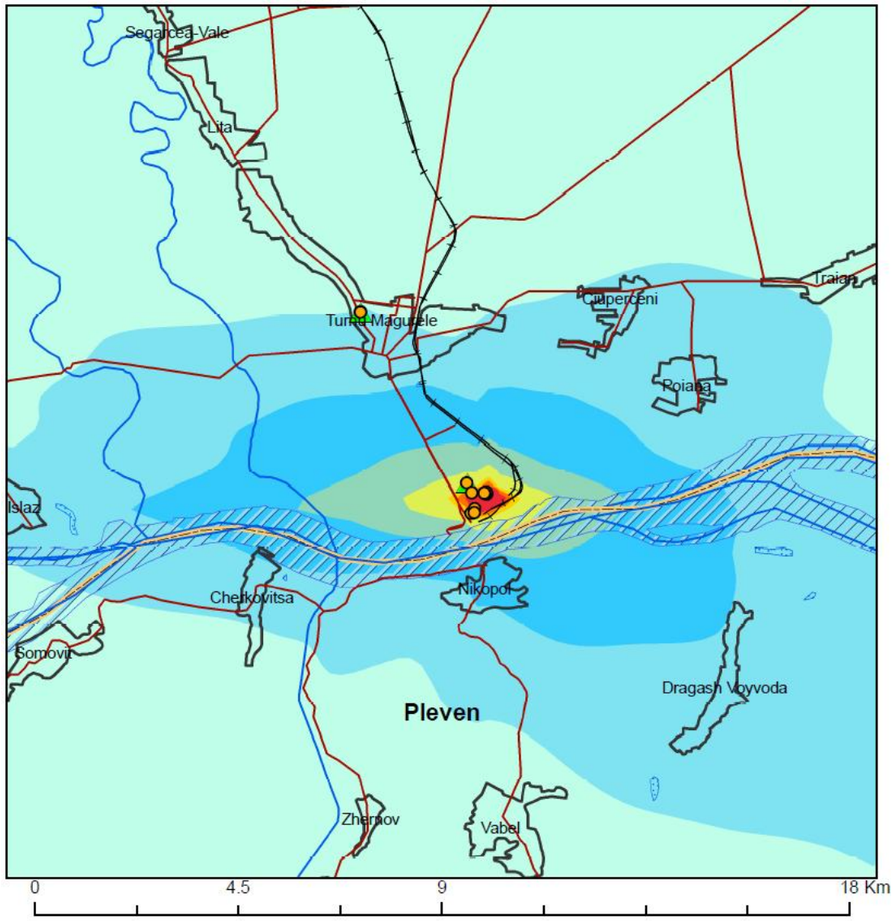
Figure No.3

ANNEX B

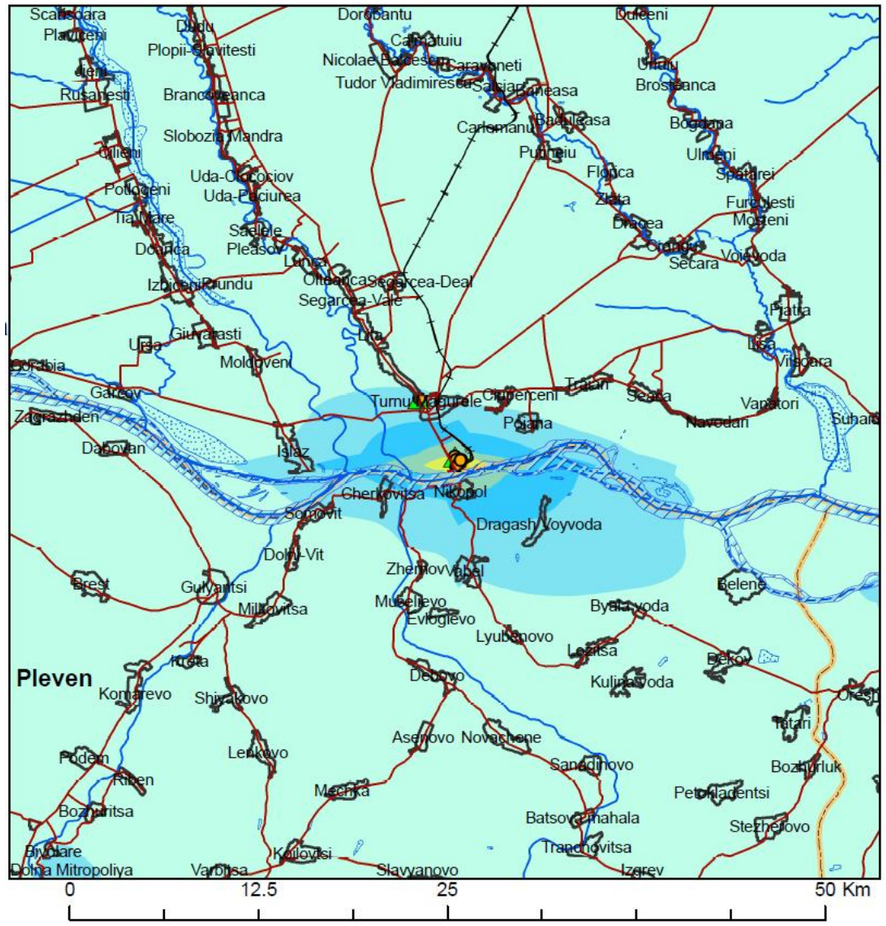
Impact assessment in the Turnu Magurele Nicopole area

Spatial distribution of average yearly concentration for NOx

Impact at local level



Impact at regional level



Legend:

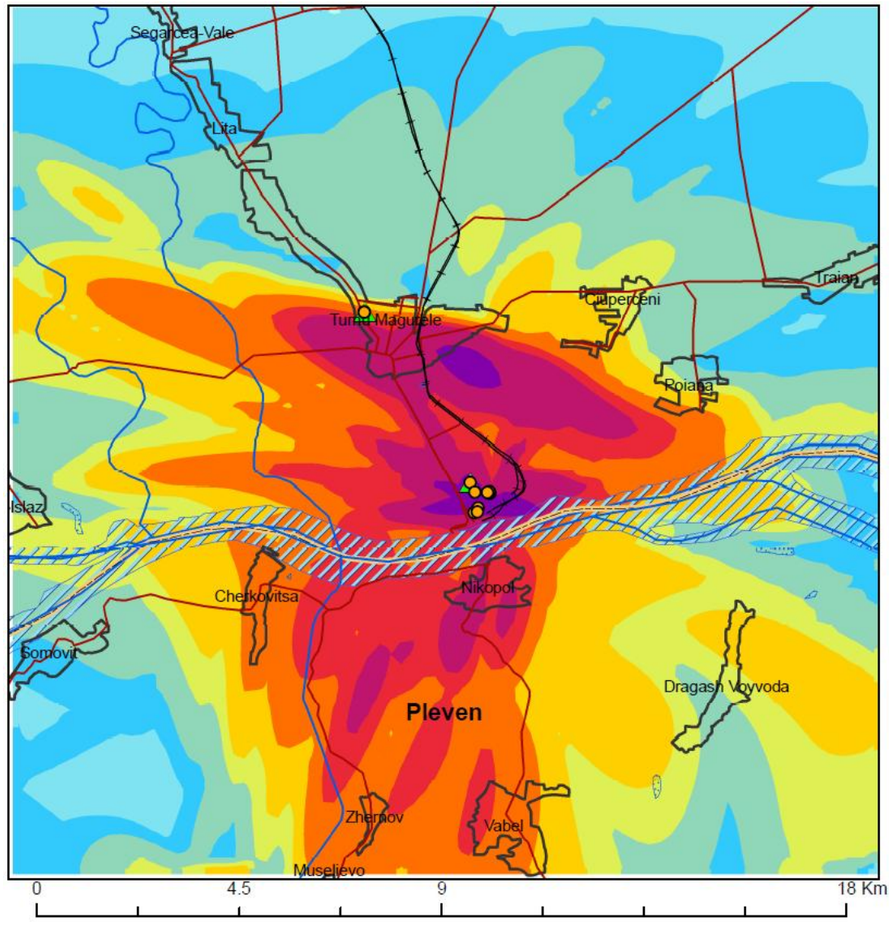
NOx [ug/mc]	
0.5 - 1.5	10 - 19.5
1.5 - 2.5	19.5 - 24 - LAT
2.5 - 5	24 - 30 - VAT
5 - 10	30 - 90 (30=CL)
	90 - 110.6

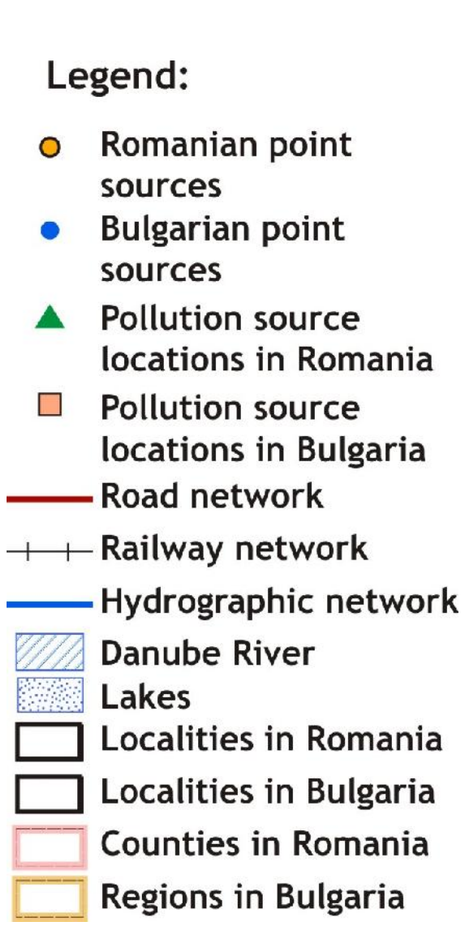
„Modeling study" - Impact assessment in Turnu Măgurele-Nikopol area

Figure No.1

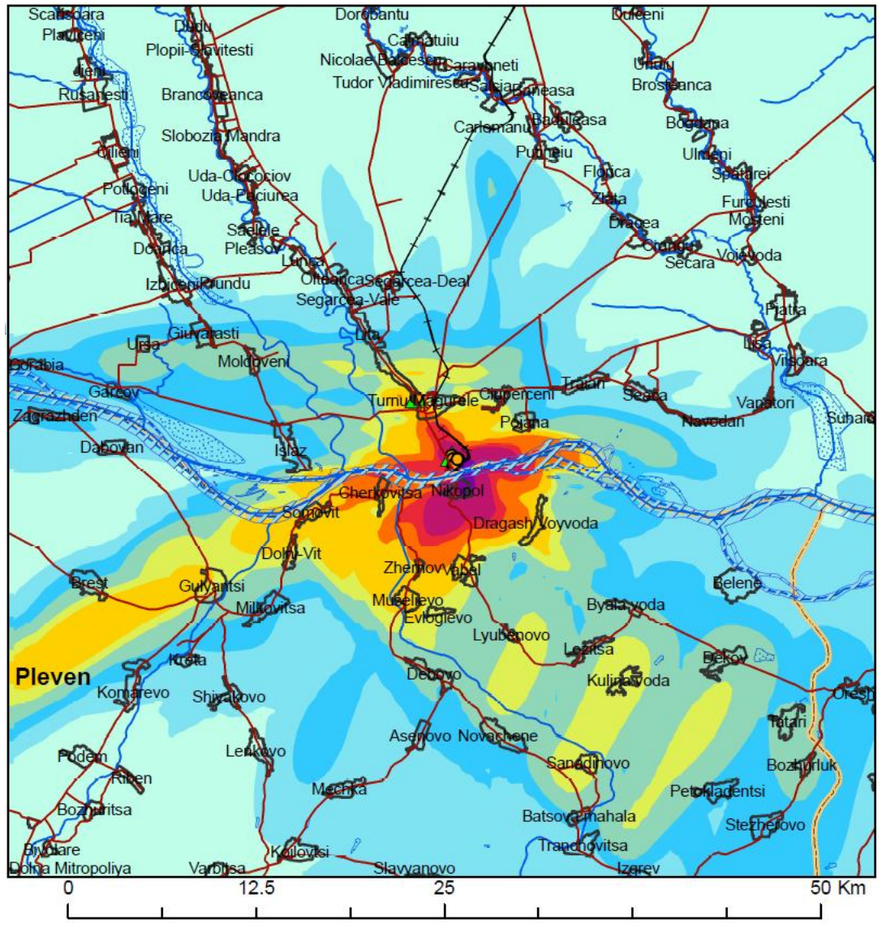
Spatial distribution of maximum hourly concentration for NH3

Impact at local level





Impact at regional level



Legend:

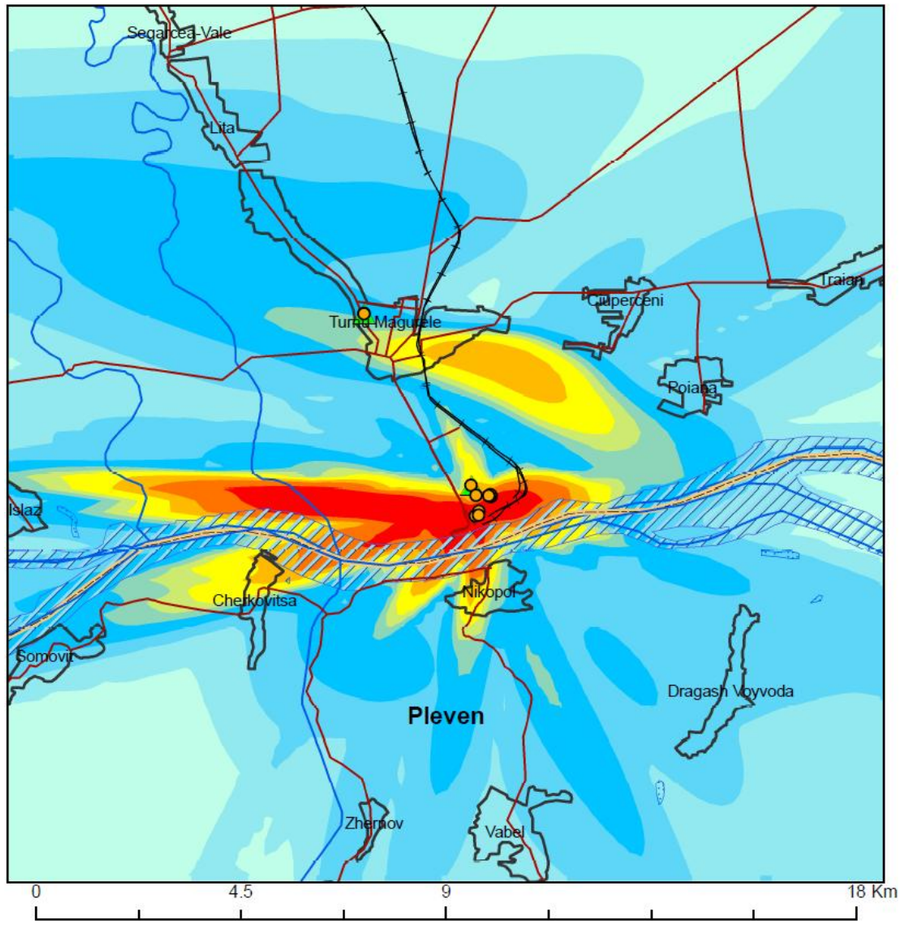
NH3 [µg/mc]	
60 - 65	160 - 190
65 - 95	190 - 230
95 - 125	230 - 300
125 - 160	300 - 350 (300=LV)
	350 - 500
	500 - 738.73

„Modeling study" - Impact assessment in Turnu Măgurele-Nikopol area

Figure No.2

Spatial distribution of maximum daily concentration for NH3

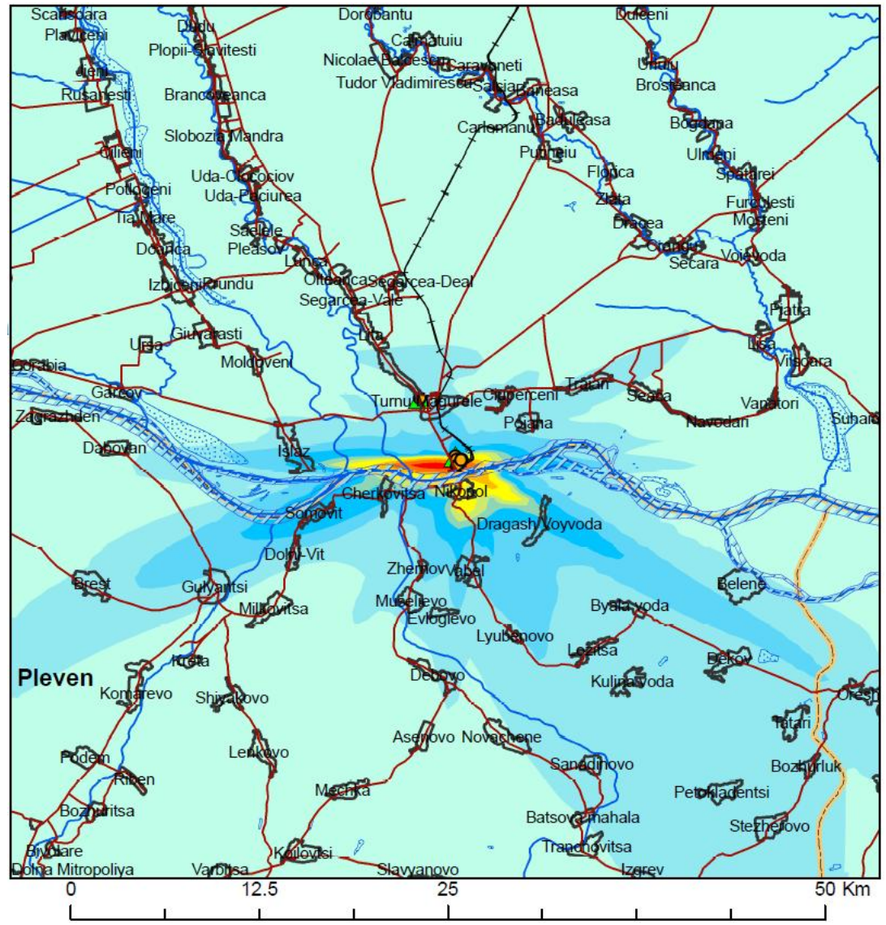
Impact at local level



Legend:

- Romanian point sources
- Bulgarian point sources
- Pollution source locations in Romania
- Pollution source locations in Bulgaria
- Road network
- Railway network
- Hydrographic network
- Danube River
- Lakes
- Localities in Romania
- Localities in Bulgaria
- Counties in Romania
- Regions in Bulgaria

Impact at regional level



Legend:

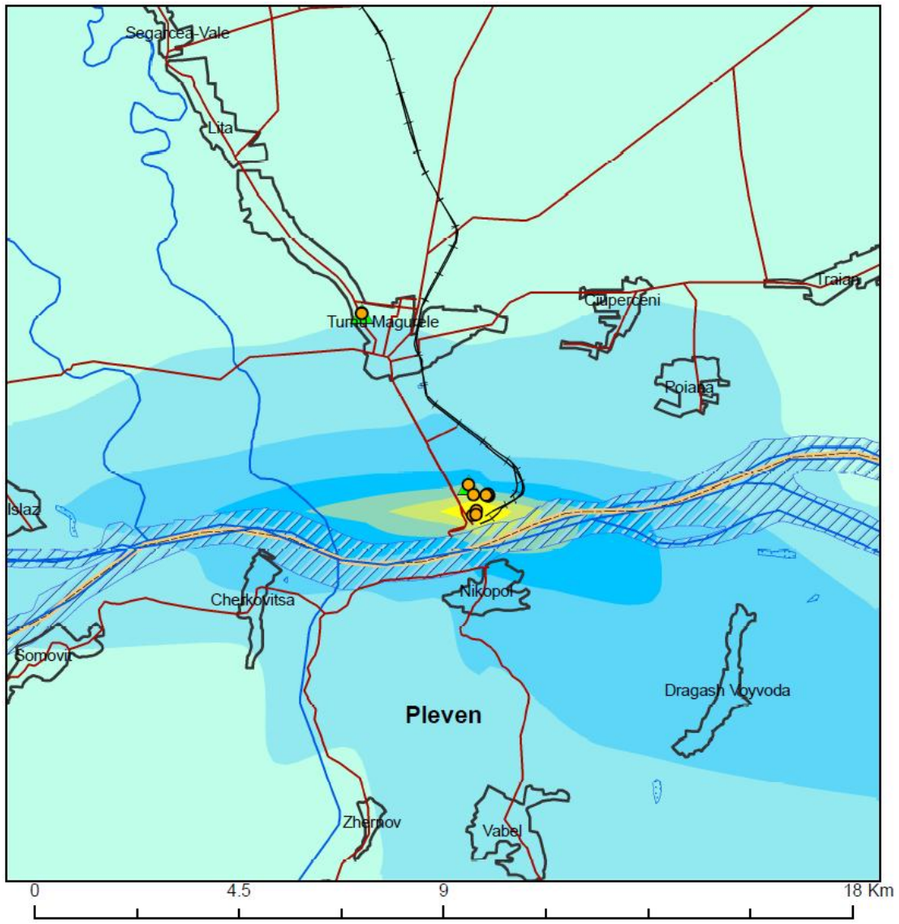
NH3 [µg/mc]	
9.6 - 20	50 - 55
20. - 30	55 - 60
30 - 40	60 - 70
40 - 50	70 - 80
	80 - 100
	100 - 170.3 (100=LV)

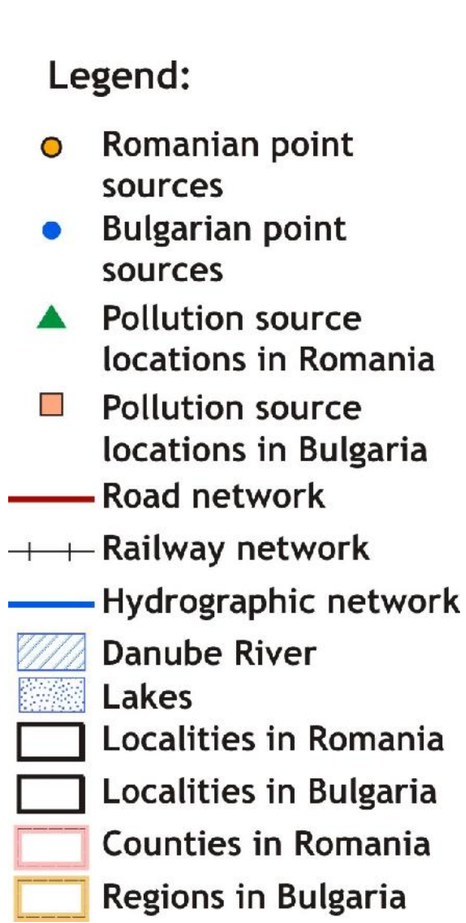
„Modeling study" - Impact assessment in Turnu Măgurele-Nikopol area

Figure No.3

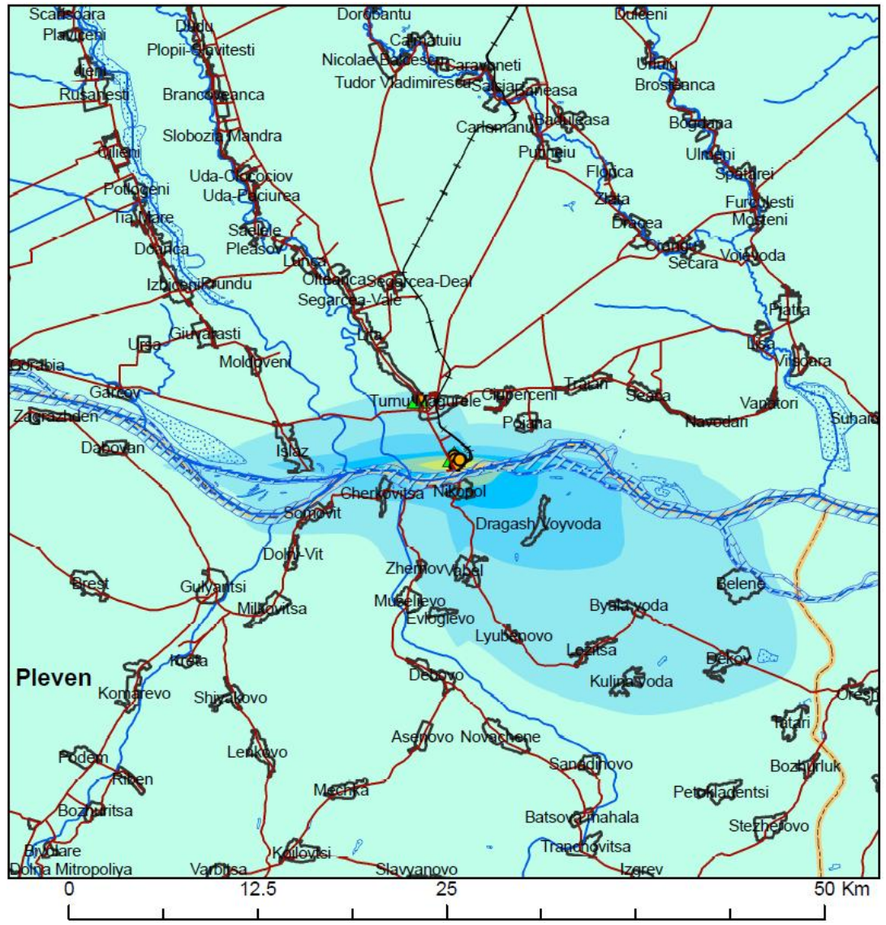
Spatial distribution of average yearly concentration for NH3

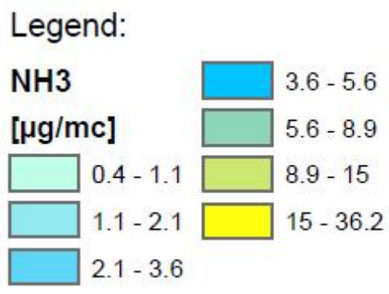
Impact at local level





Impact at regional level





„Modeling study" - Impact assessment in Turnu Măgurele-Nikopol area

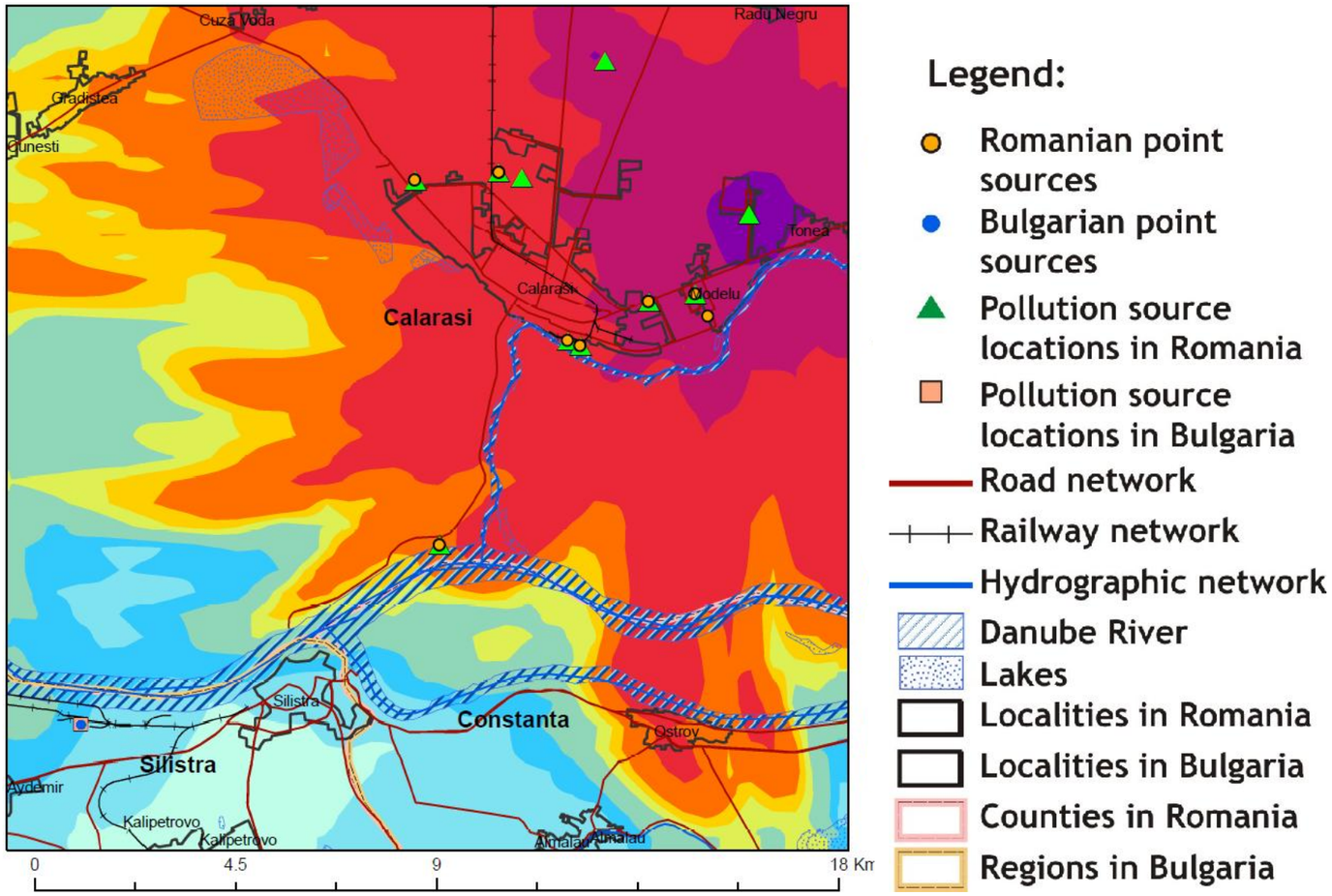
Figure No.4

ANNEX C

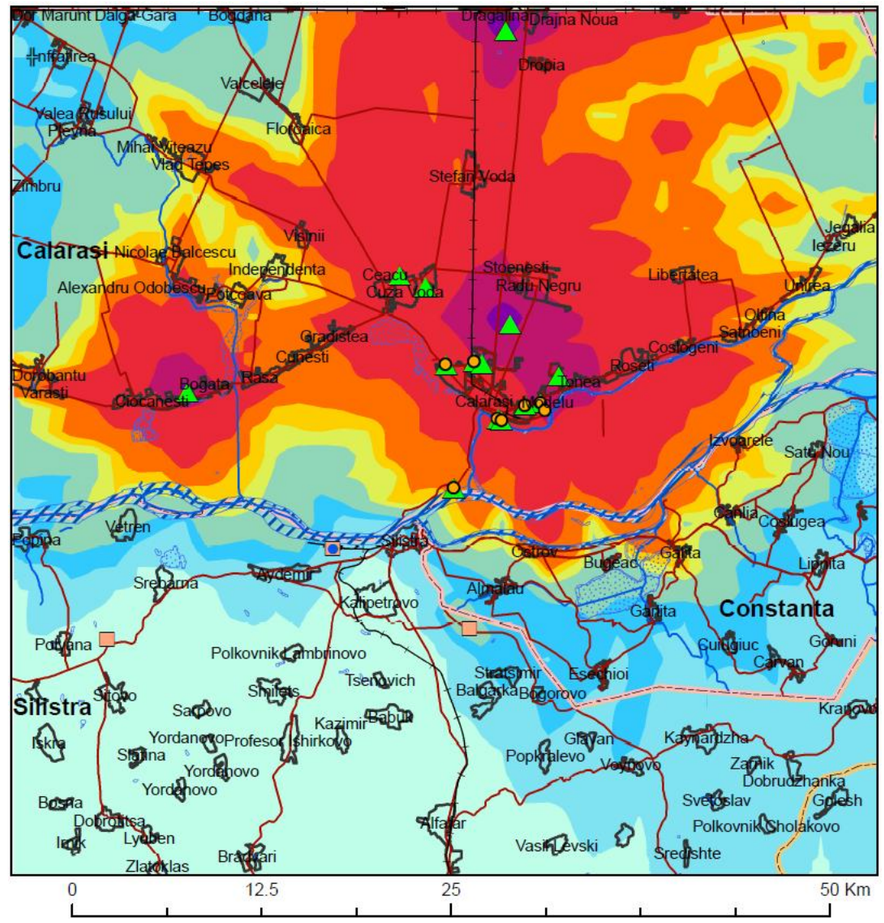
Impact assessment in the Calarasi-Silistra area

Spatial distribution of maximum hourly concentration for NH3

Impact at local level



Impact at regional level



Legend:

- Romanian point sources
- Bulgarian point sources
- Pollution source locations in Romania
- Pollution source locations in Bulgaria
- Road network
- Railway network
- Hydrographic network
- Danube River
- Lakes
- Localities in Romania
- Localities in Bulgaria
- Counties in Romania
- Regions in Bulgaria

Legend:

NH3
[µg/mc]

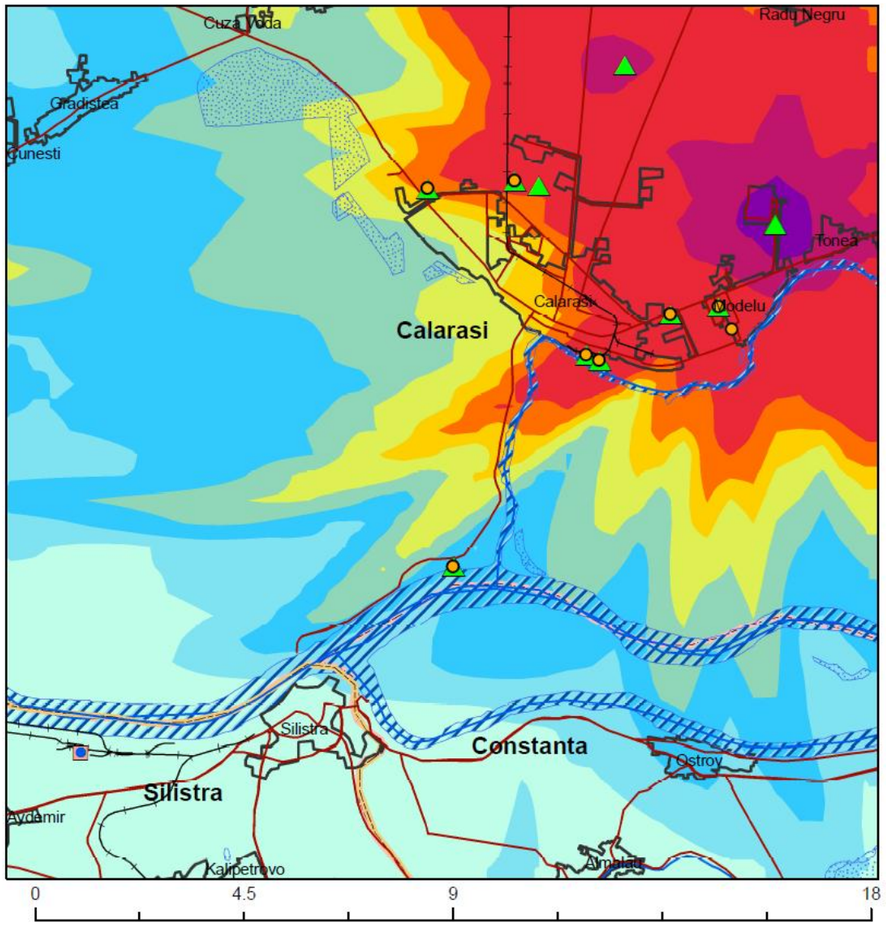
47.4 - 64.7	175.1 - 200
64.8 - 100	200.1 - 225
100.1 - 125	225.1 - 300
125.1 - 175	300.1 - 761 (300 = LV)
	761.1 - 2,377.9
	2,378 - 7,105.6

„Modeling study” - Impact assessment in Călăraşi-Silistra area

Figure No.1

Spatial distribution of maximum daily concentration for NH3

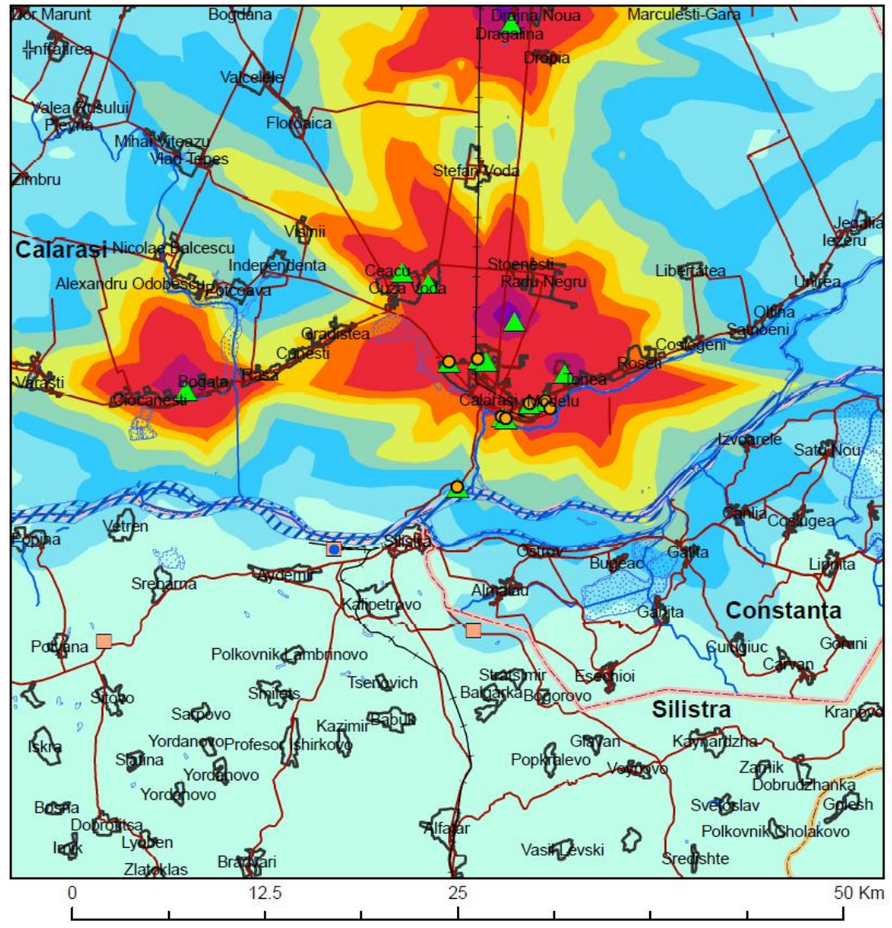
Impact at local level



Legend:

- Romanian point sources
- Bulgarian point sources
- Pollution source locations in Romania
- Pollution source locations in Bulgaria
- Road network
- Railway network
- Hydrographic network
- Danube River
- Lakes
- Localities in Romania
- Localities in Bulgaria
- Counties in Romania
- Regions in Bulgaria

Impact at regional level



Legend:

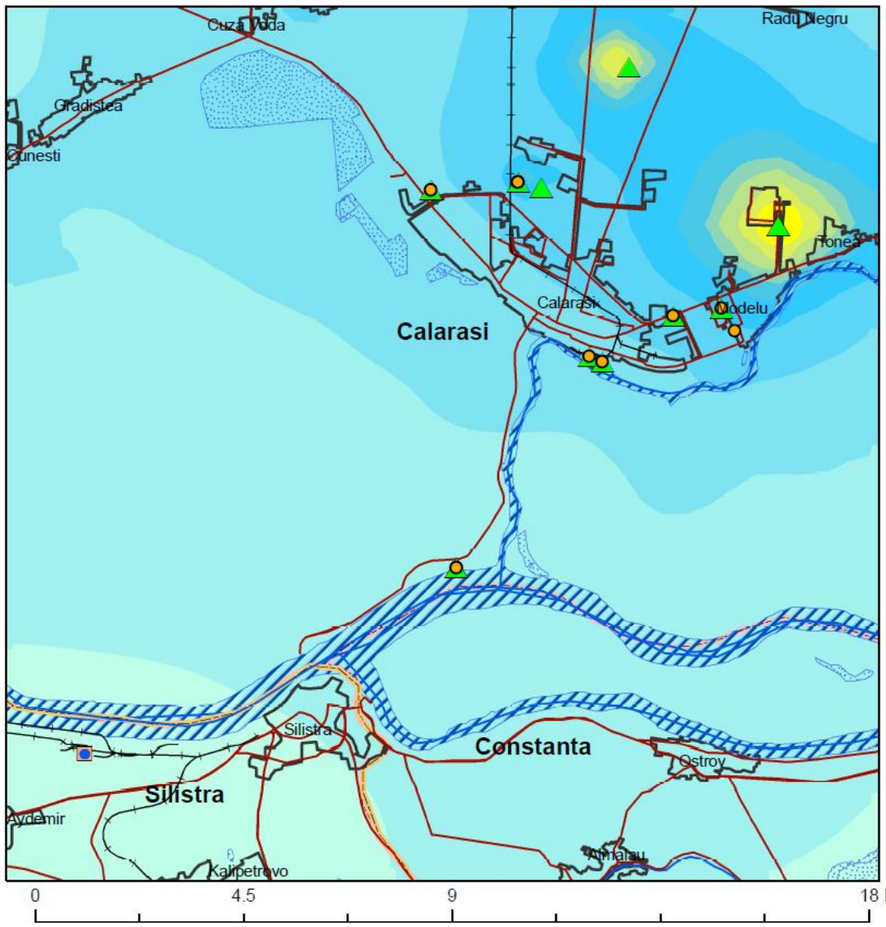
NH3 [µg/mc]	
9.2 - 18.1	54 - 69.6
18.2 - 28.3	69.7 - 82.2
28.4 - 41.3	82.3 - 100
41.4 - 53.9	100.1 - 294.1 (100 = LV)
	294.2 - 756
	756.1 - 2,759.1

„Modeling study" - Impact assessment in Călăraşi-Silistra area

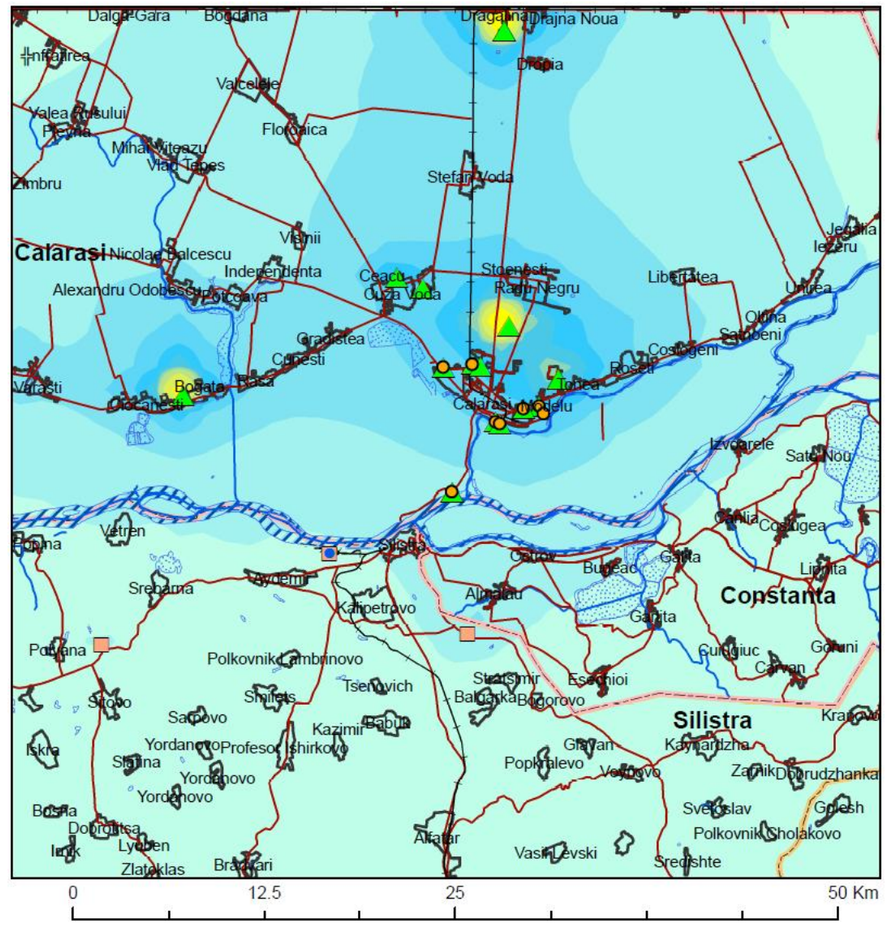
Figure No.2

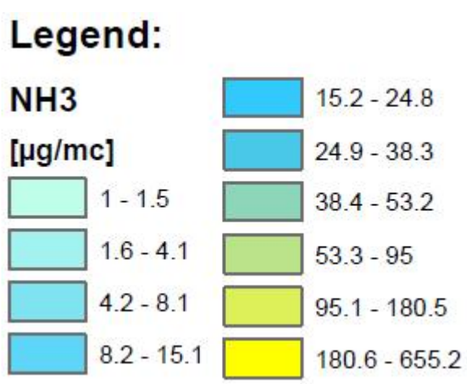
Spatial distribution of average yearly concentration for NH3

Impact at local level



Impact at regional level





„Modeling study" – Impact assessment in Călăraşi-Silistra area

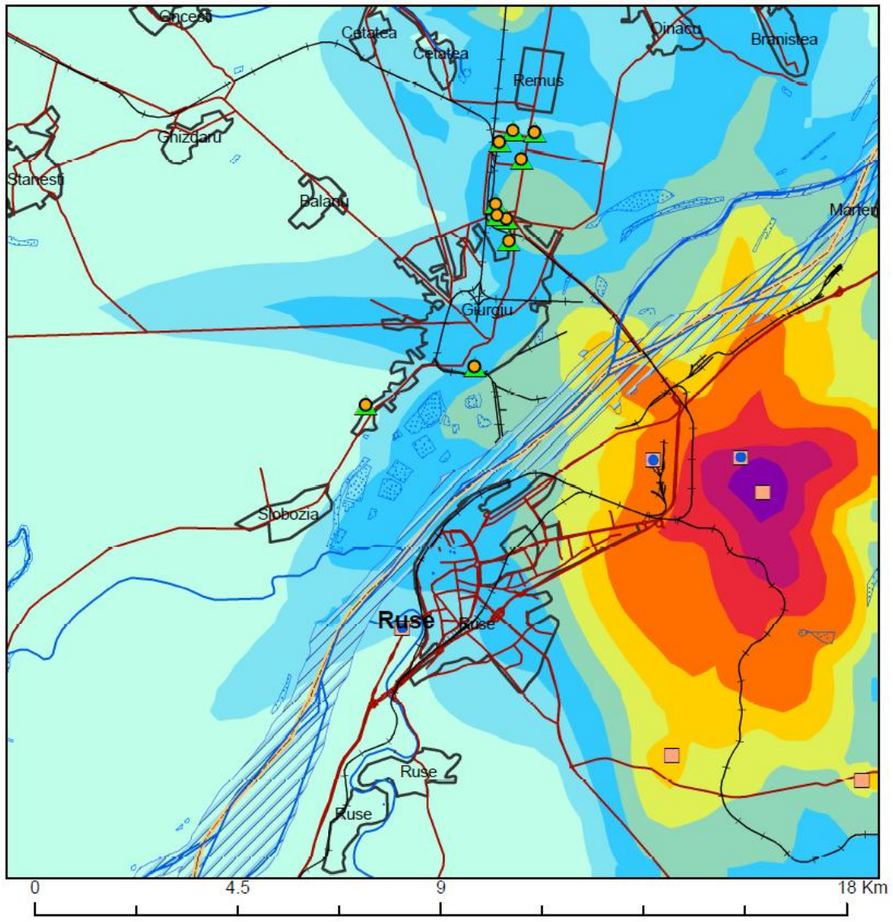
Figure No.3

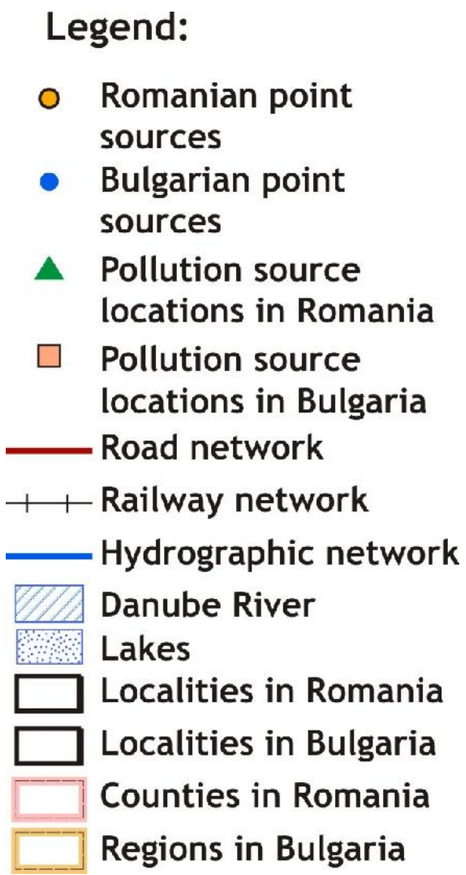
ANNEX D

Impact assessment in the Giurgiu-Ruse area

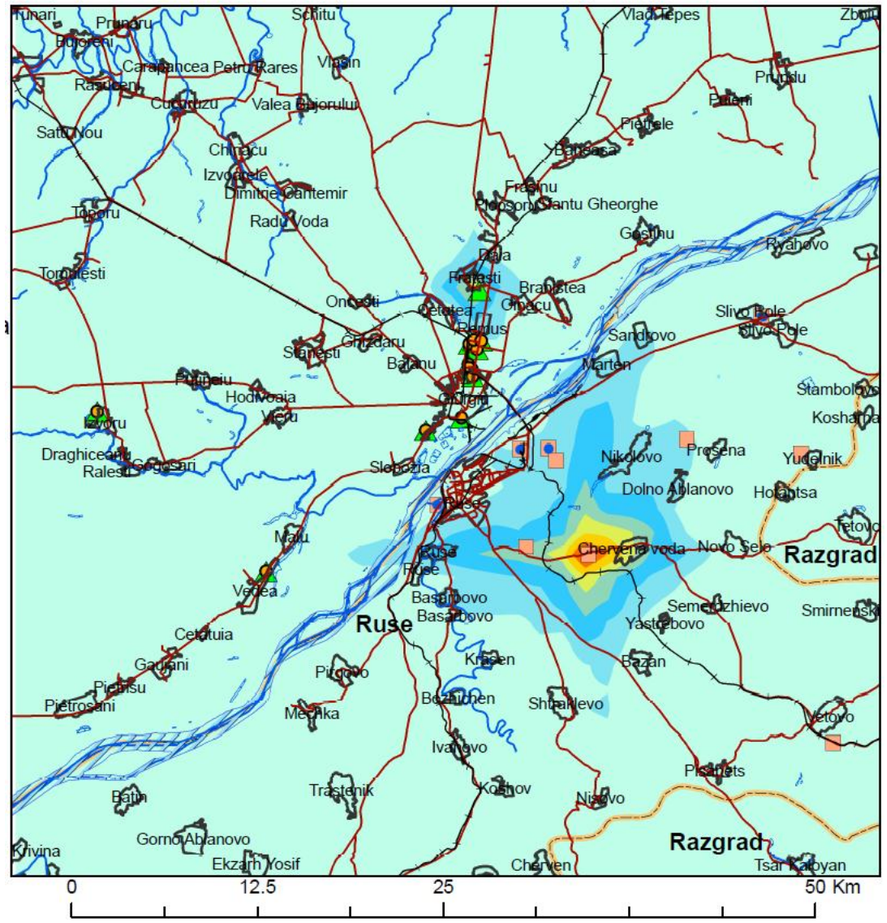
Spatial distribution of maximum hourly concentration for NH3

Impact at local level





Impact at regional level



Legend:

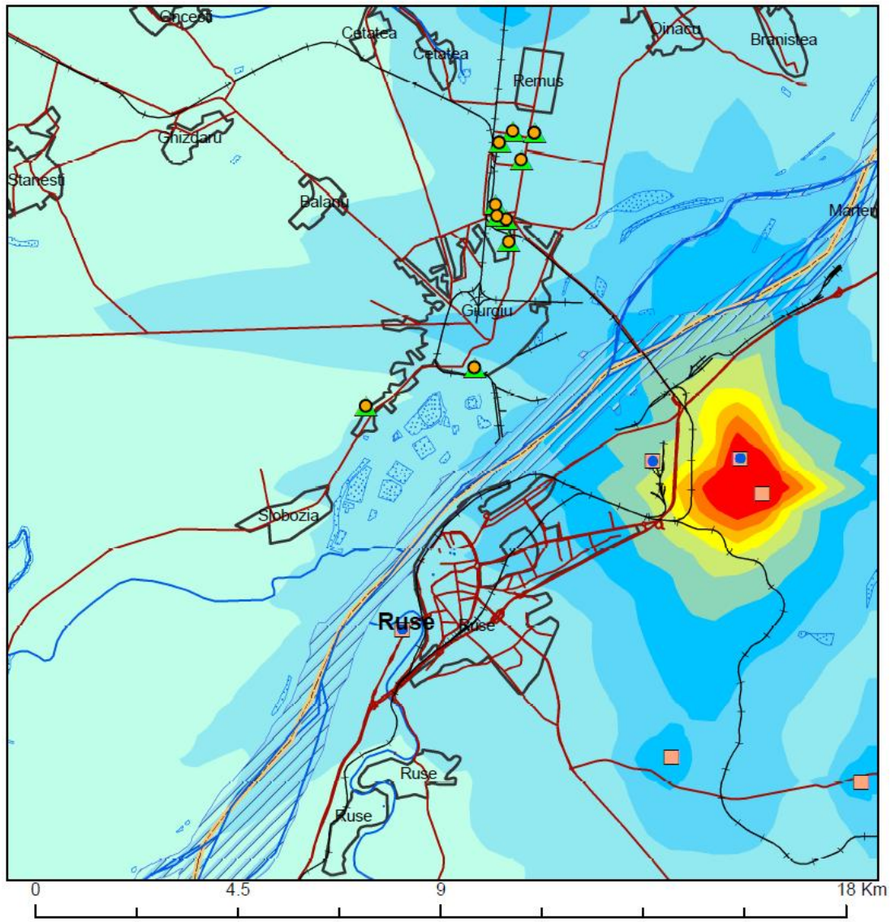
NH3 [µg/mc]	
5.9 - 29	101 - 133
29 - 45	133 - 177
45 - 71	177 - 300
71 - 101	300 - 430 (300=LV)
	430 - 600
	600 - 1,192.63

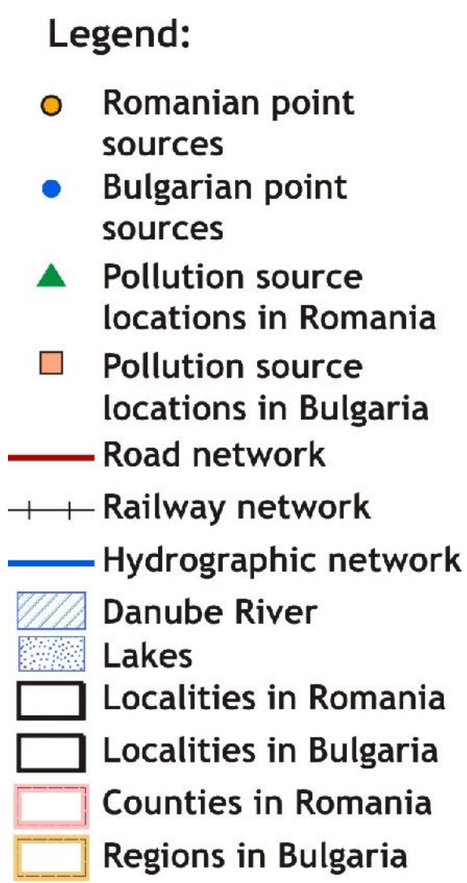
„Modeling study" - Impact assessment in Giurgiu-Ruse area

Figure No.1

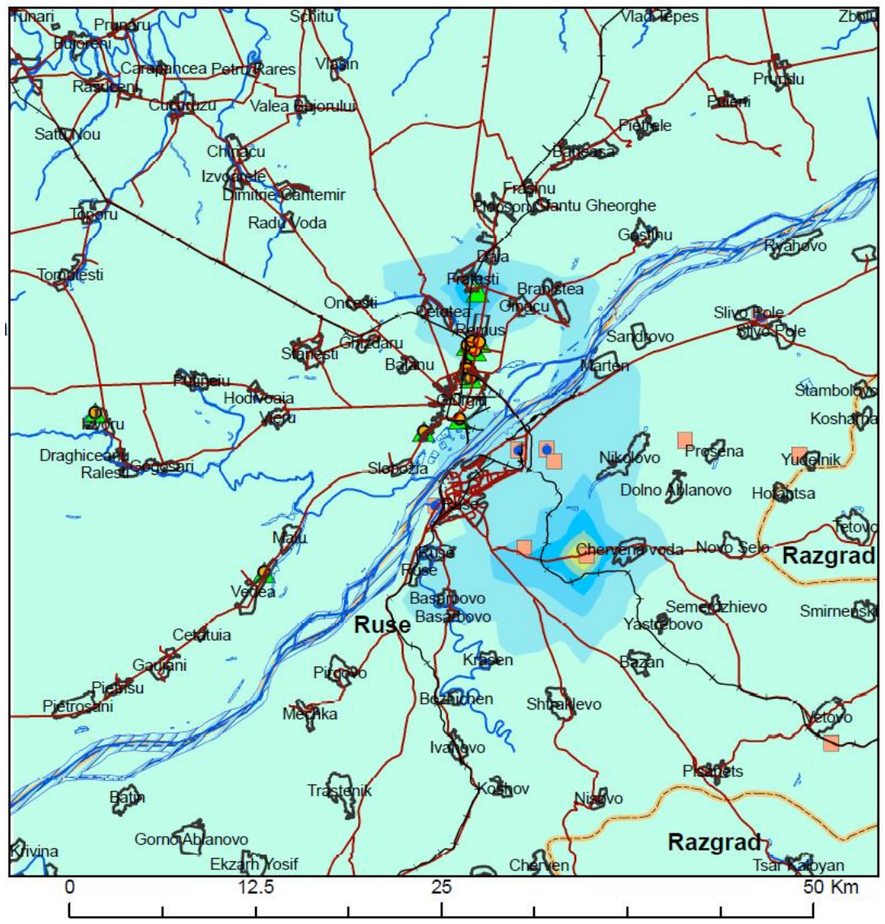
Spatial distribution of maximum daily concentration for NH3

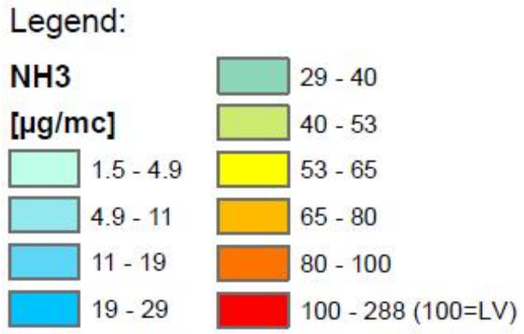
Impact at local level





Impact at regional level



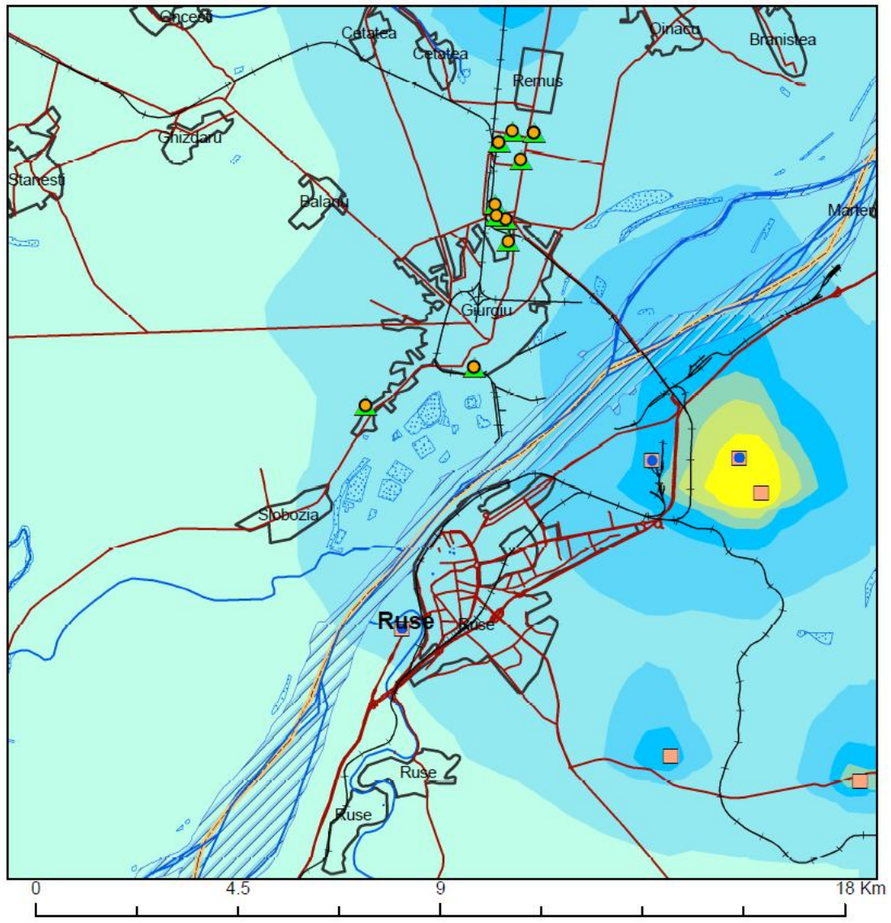


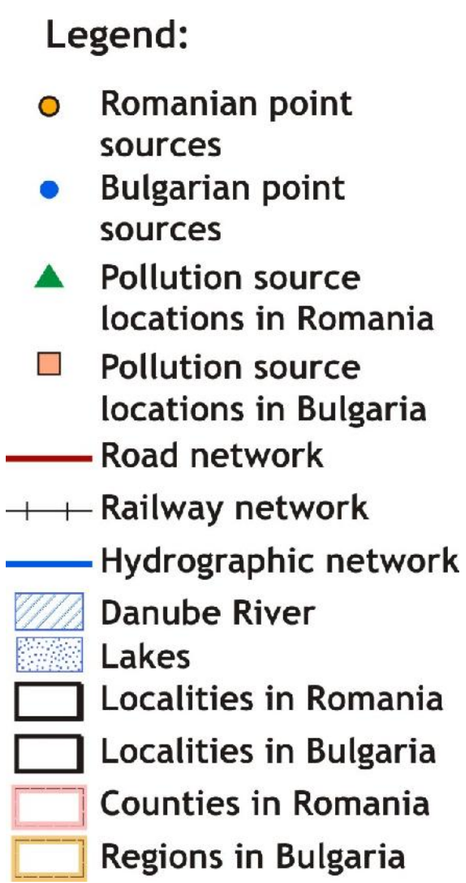
„Modeling study" - Impact assessment in Giurgiu-Ruse area

Figure No.2

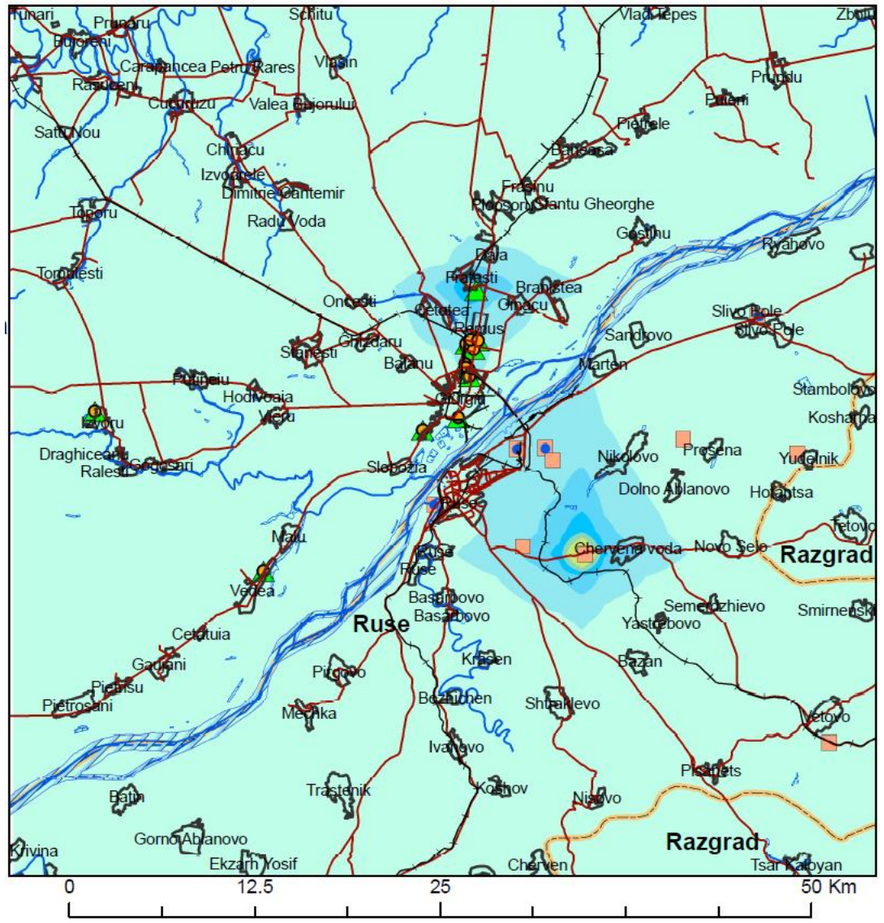
Spatial distribution of average yearly concentration for NH3

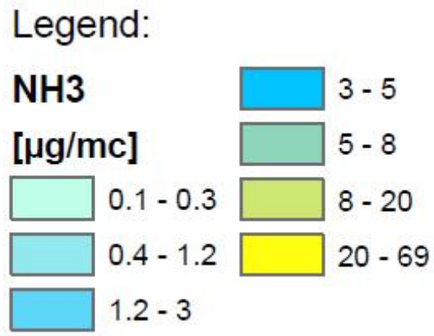
Impact at local level





Impact at regional level





„Modeling study" - Impact assessment in Giurgiu-Ruse area

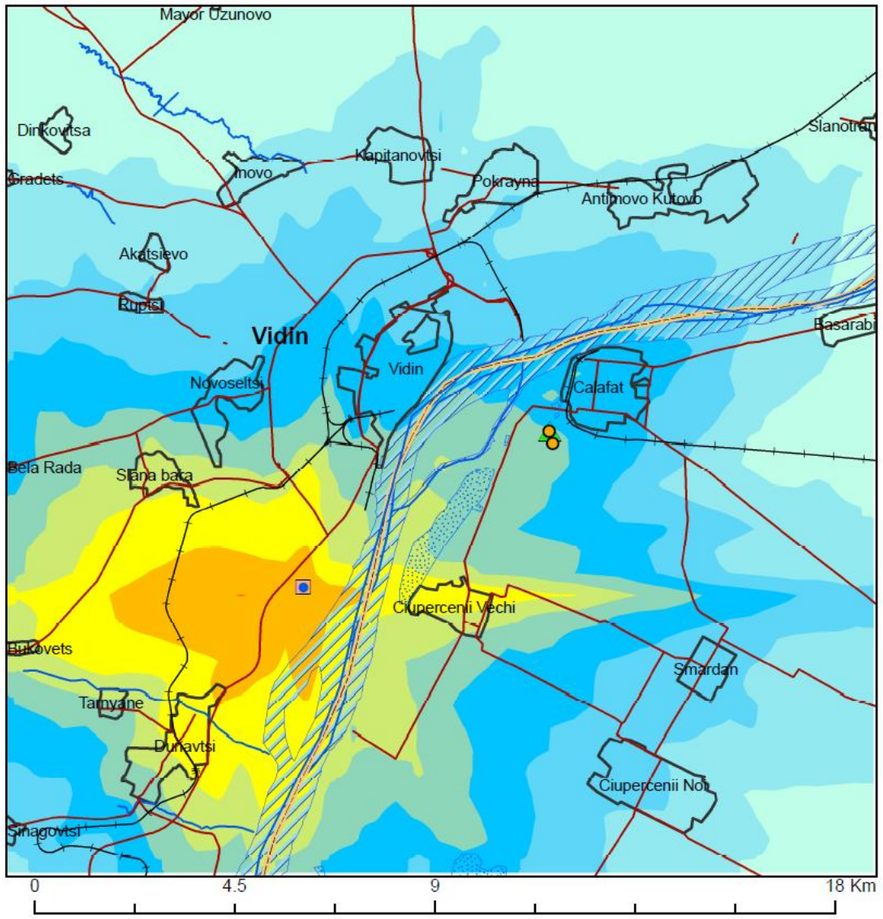
Figure No.3

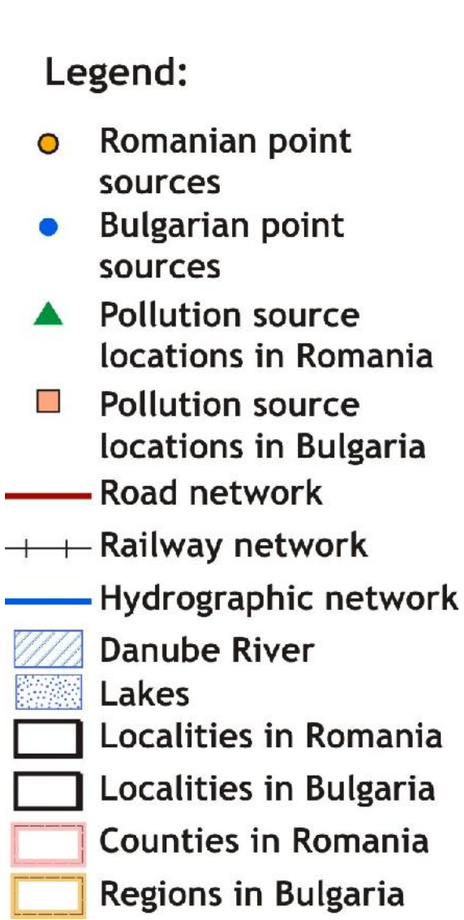
ANNEX E

Impact assessment in the Calafat-Vidin area

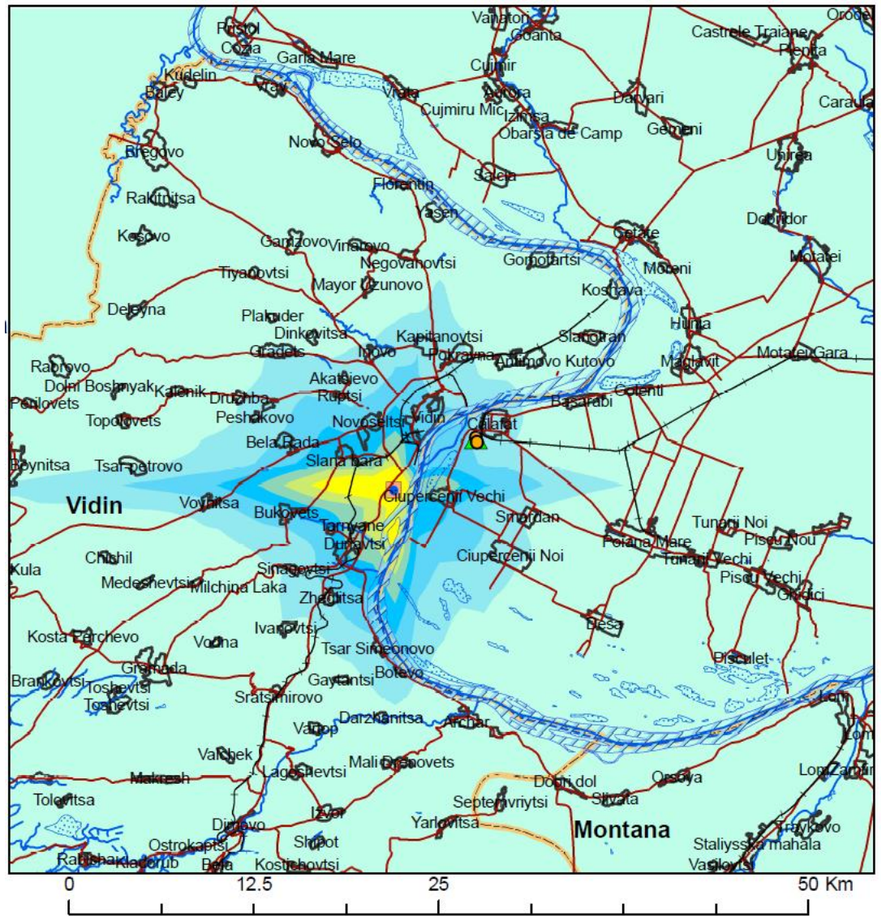
Spatial distribution of maximum hourly concentration for SO2

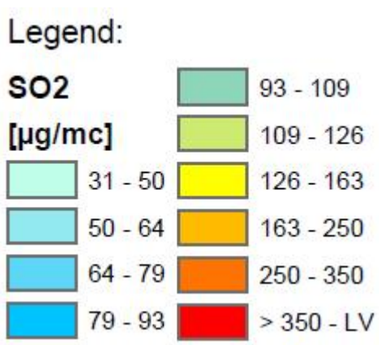
Impact at local level





Impact at regional level



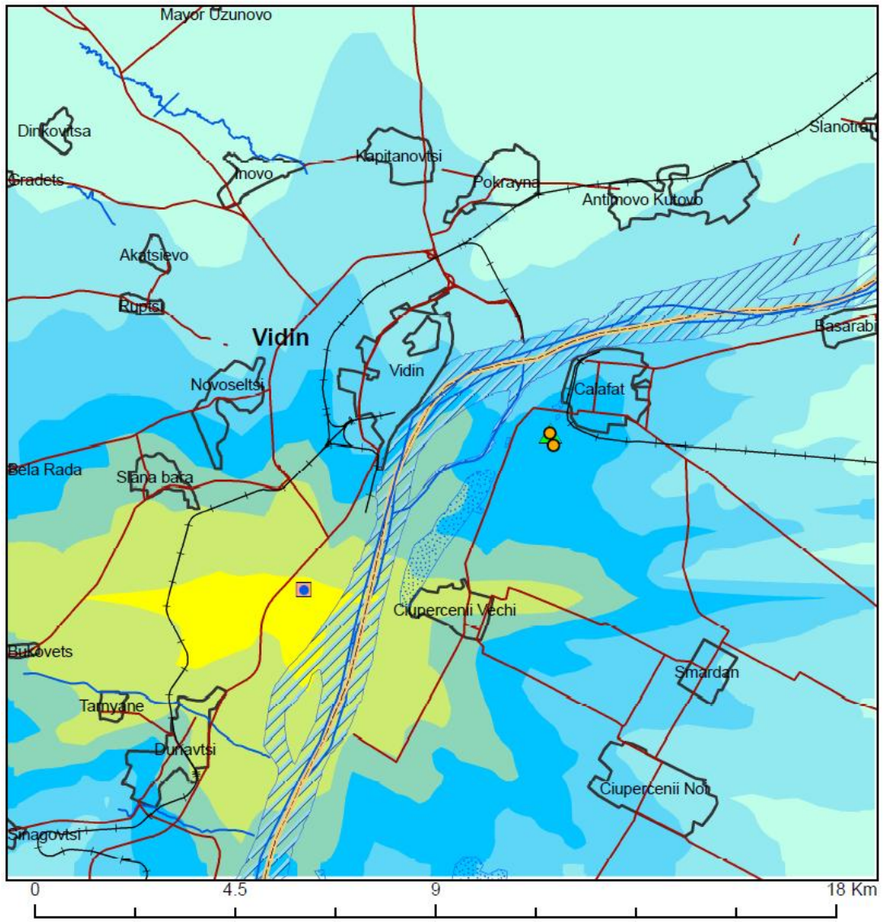


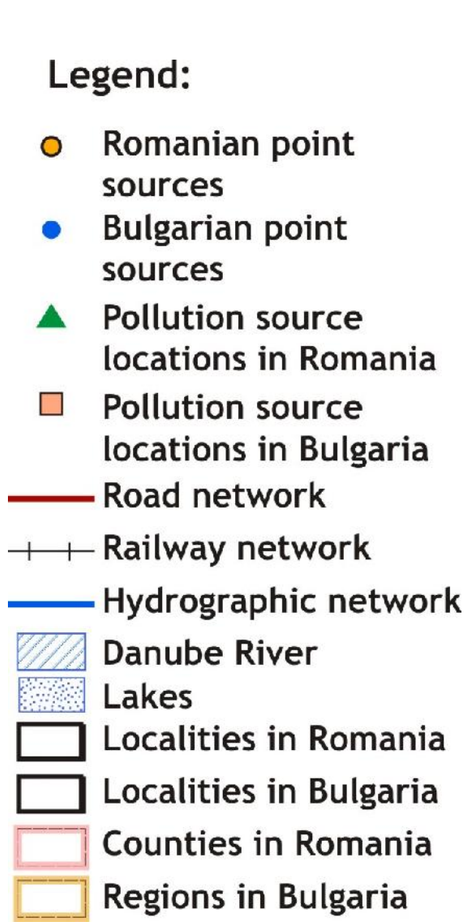
„Modeling study" - Impact assessment in Calafat-Vidin area

Figure No.1

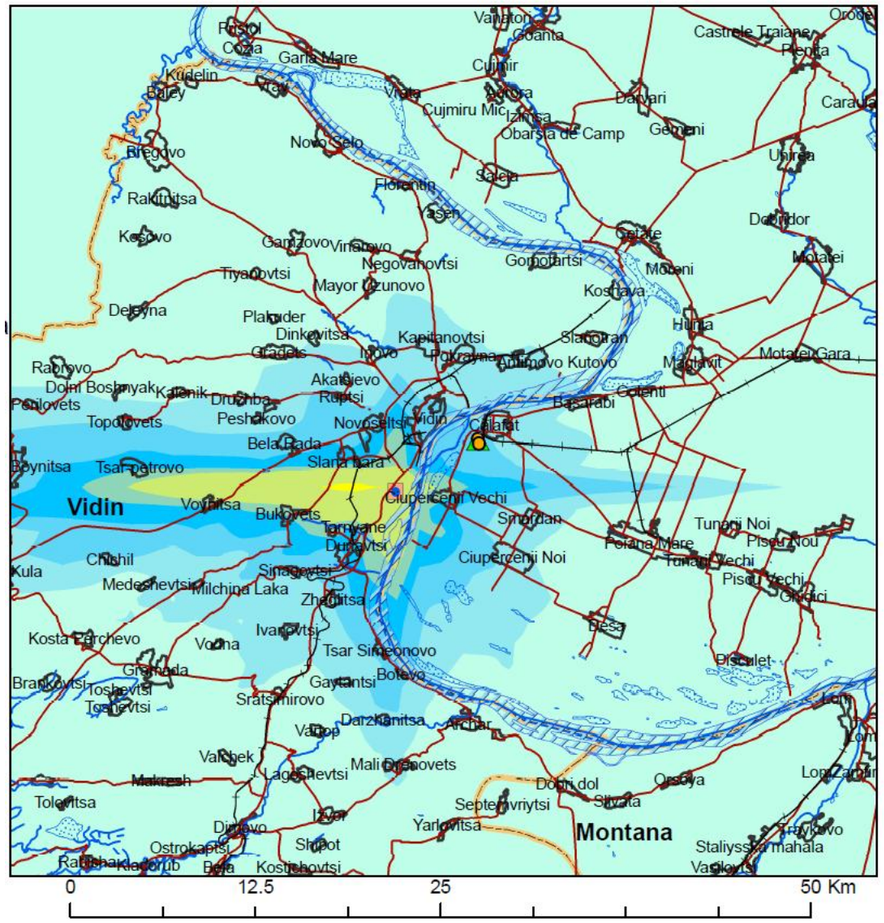
Spatial distribution of maximum daily concentration for SO2

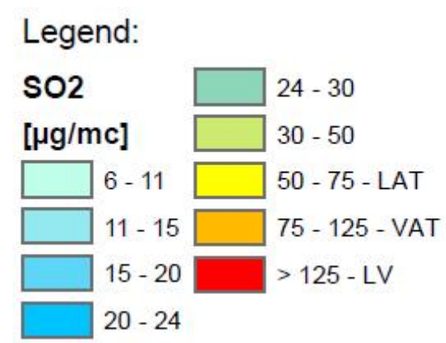
Impact at local level





Impact at regional level



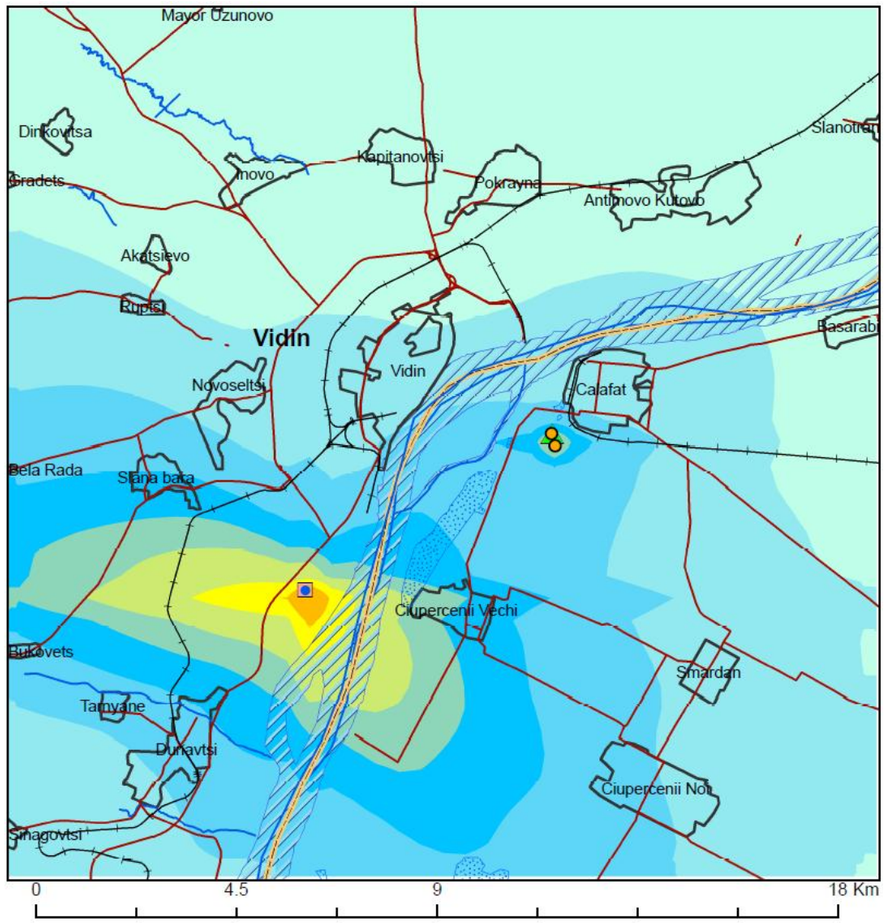


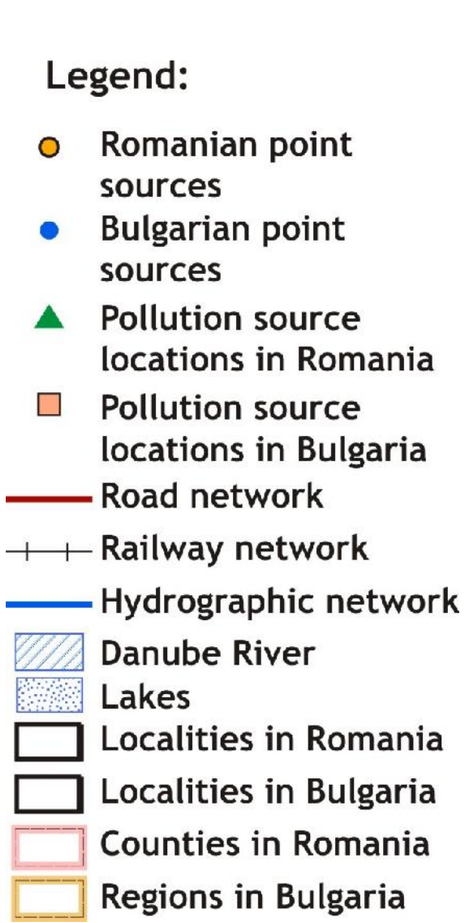
„Modeling study" - Impact assessment in Calafat-Vidin area

Figure No.2

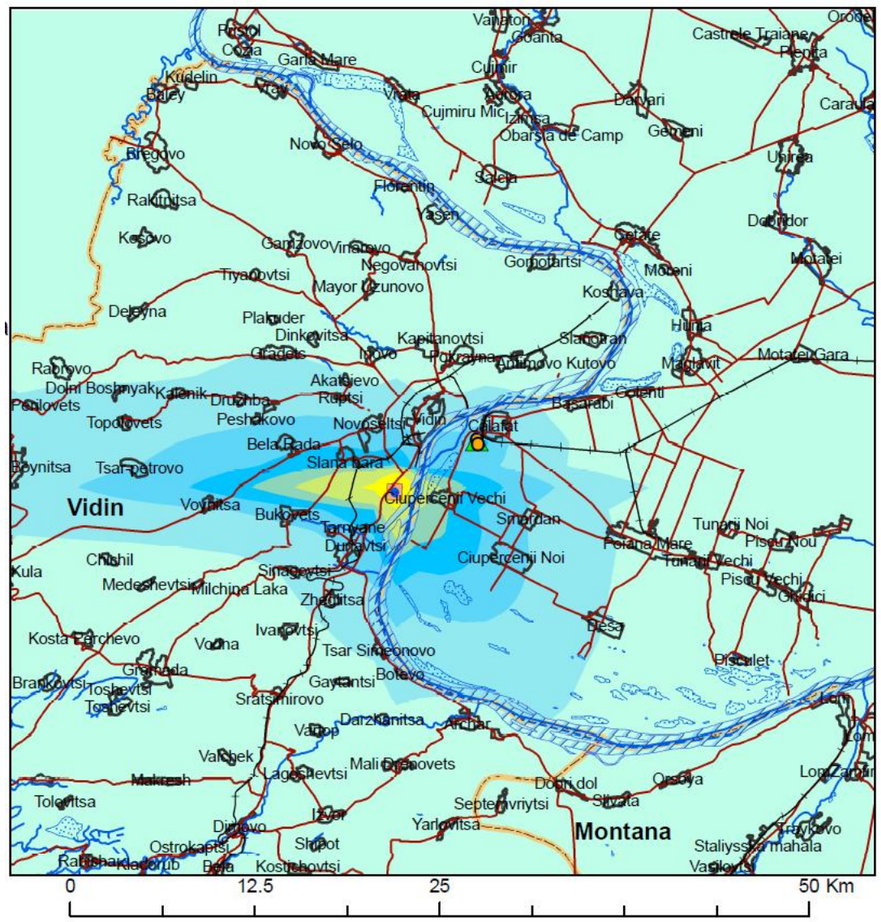
Spatial distribution of average yearly concentration for SO2

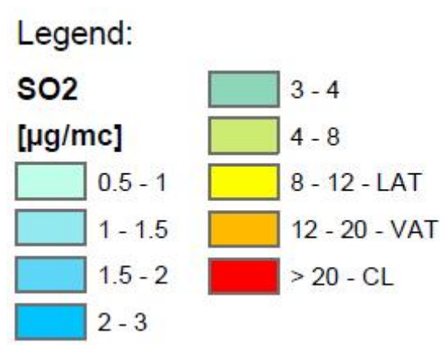
Impact at local level





Impact at regional level





„Modeling study" - Impact assessment in Calafat-Vidin area

Figure No.3

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