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ZRENJANIN/ECKA AIR QUALITY MONITORING REPORT

TO:

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Results of the Air Quality Monitoring Campaign in Zrenjanin/Ecka

Location: Zrenjanin suburb Ecka

Coordinates of the AQM station:

45°19'19.27" N, 20°26'04.59" E, altitude 75 m

45°19'17.58" N, 20°26'01.63" E, altitude 75 m

Start on: 30/4/11 11:00

End on: 7/5/11 11:00

Experts: dr.ing. Francisc Popescu, dr.ing. Nicolae Lontis

Overview of the monitoring site:



Zrenjanin or *Becicherecu Mare* in Romanian language is a city and municipality located in the eastern part of Serbian province of Vojvodina. It is the administrative centre of the Central Banat District of Serbia. In 2002, the city's population was 79,773, while the Zrenjanin municipality had 132,051 inhabitants. Zrenjanin is the largest city in the Serbian Banat, the third largest city in Vojvodina (after Novi Sad and Subotica) and the sixth largest city of Serbia. Economical, scientific and cultural cooperation between Zrenjanin and Timisoara is at highest level and the two cities are officially recognized as “sister cities”.

Fig. 1. View of the Zrenjanin municipality area.

In 2007, it was declared the City of the Future and, in 2008, the World Bank ranked it first among the cities/towns in Serbia with regard to the overall organization of its business environment. In just two years, Zrenjanin concluded over 20 contracts on Greenfield investments with foreign and domestic companies, to the value of over EUR 400 million. New industrial zones are popping up on the perimeter of the city and, from Zrenjanin, to Europe and the world, products



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are delivered of the textile, machine, foodstuffs, chemical, electrical, pharmaceutical, and other industries. Its development has lasted for almost seven centuries, because, as a settlement under the name of Becskerek, it was first recorded in historical documents way back in 1326. Numerous branches of industry are developed and the most significant ones are the following: Food industry, Textile and leather industry, Metal industry, Chemical industry, Oil and natural gas production, Civil engineering, Traffic / Transport. (source: Zrenjanin Municipality official webpage)

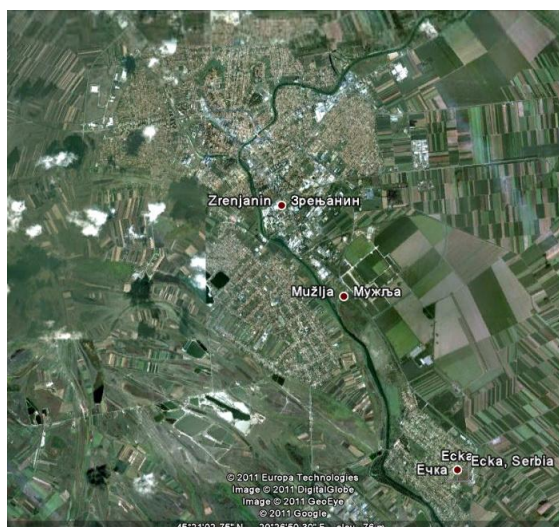


Figure 2. View of the measurement site

Equipment used in the monitoring campaign in Zrenjanin/Ečka

In table 1 the measurement techniques involved, equipments and the measurement uncertainty is presented.

Table.1. Equipments used and relevant informations.

Pollutant	Methods	Standard	Equipment	Measurement uncertainty
CO	NDIR	EN 14626:2005	Environnement CO12M	4 %
NO (NO ₂ , NO _x)	Chemiluminescence	EN 14211:2005	Environnement AC31M	2.06 %
O ₃	UV photometry	EN 14625:2005	Environnement O341M	6.98 %
CH ₄ , NMHC, THC	FID (flame ionization detection)	EN 12619:2002 EN 13526:2002	Horiba APHA 370	0.9 %
SO ₂	UV fluorescence	EN 14212:2005	Environnement AF21M	1.76 %
PM ₁₀	Gravimetric / Light scattering	EN12341	TSI Dusttrack	5 %
Wind speed and direction, air pressure, temperature and humidity	Professional mobile wetter station	-	KRONEIS	-



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The equipments are part of the air quality monitoring mobile laboratory and procedures used are in full compliance with ISO/CEN 17025:2005 standard for quality assurance in analytic laboratories. The laboratory is the property of “Politehnica” University of Timisoara and more details and information’s (including certifications) can be found on www.mediu.ro Linde and DKD (Deutsche Kalibrierdienst) calibrations gases (NO, SO₂, CO, CH₄ in N₂) were used.

Monitoring results.

The mobile laboratory is equipped with reference point instruments for major pollutants (SO₂, O₃, NO_x, CO, CH₄, NMHC, THC and PM₁₀). Meteorological sensors (wind speed and direction, air temperature, pressure and humidity) are mounted around the mobile laboratories. The following pollutants have been continuously measured, with 10 second resolution, over the entire measuring episode with high precision equipment:

- **SO₂** measured with Environnement AF21M instrument, measurement principle is UV fluorescence, reference method: EN 14212:2005. The combined measurement uncertainty is $U = 1.76 \%$ for recorded values;
- **NO**, **NO₂** and **NO_x** measured with Environnement AC31M instrument, measurement principle is chemiluminescences, reference method: EN 14211:2005. The combined measurement uncertainty is $U = 2.06 \%$ for recorded values;
- **O₃** measured with Environnement O341M instrument, measurement principle is UV photometry, reference method: EN 14625:2005. The combined measurement uncertainty is $U = 6.98 \%$ for recorded values;
- **CO** and **CO₂** measured with Environnement CO12M instrument, measurement principle is NDIR (Non Dispersive Infrared), reference method EN 14626:2005. The combined measurement uncertainty is $U = 4 \%$ for recorded values;
- **CH₄**, **NMHC** and **THC** measured with Horiba APHA370 instrument, measurement principle is FID (flame ionization detection), reference method EN 12619:2002. The combined measurement uncertainty is $U = 0.9 \%$ for recorded values;
- **PM₁₀** (suspended particles, fraction PM₁₀), TSI DUSTTRACK, measurement principle is light scattering / laser.

In table 2 the resulted values for daily mean values for all pollutants are presented.



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Table 2. Daily mean values for relevant pollutant concentration in ambient air

Day	O ₃	SO ₂	NO	NO ₂	NO _x	CH ₄	NMHC	THC	CO	CO ₂	Day
	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	ppm	
30/04/11	63.57	11.65	10.08	30.94	41.02	3.84	0.44	4.28	0.59	388.07	Saturday
01/05/11	42.67	11.56	5.20	23.73	28.93	4.00	0.42	4.42	0.64	391.82	Sunday
02/05/11	56.37	8.90	7.08	25.39	32.47	3.92	0.41	4.33	0.74	391.26	Monday
03/05/11	62.61	8.99	9.20	26.14	35.34	3.92	0.37	4.29	0.76	401.47	Tuesday
04/05/11	44.52	8.99	6.68	26.94	33.63	4.06	0.45	4.51	0.73	390.77	Wednesday
05/05/11	36.09	9.15	6.93	26.95	33.88	3.94	0.47	4.41	0.75	386.76	Thursday
06/05/11	46.98	10.65	7.05	28.73	35.78	3.91	0.48	4.39	0.73	390.38	Friday
07/05/11	36.99	10.94	5.34	25.70	31.04	3.86	0.50	4.36	0.72	395.45	Saturday

In figure 3 a print screen of the file report resulted from the TSI DUSTTRACK instrument is given.

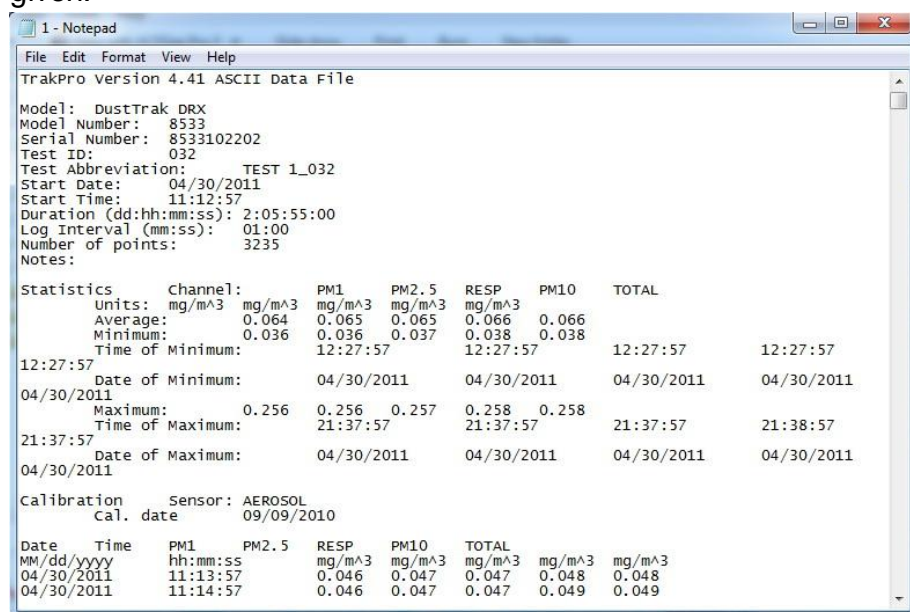


Figure 3. TSI DUSTTRACK typical report for PM10 continuous measurement



One hour mean values recorded for CO₂, CO, CH₄, NMHC, THC concentration in ambient air.
Location: Zrenjanin/Ecka - Serbia

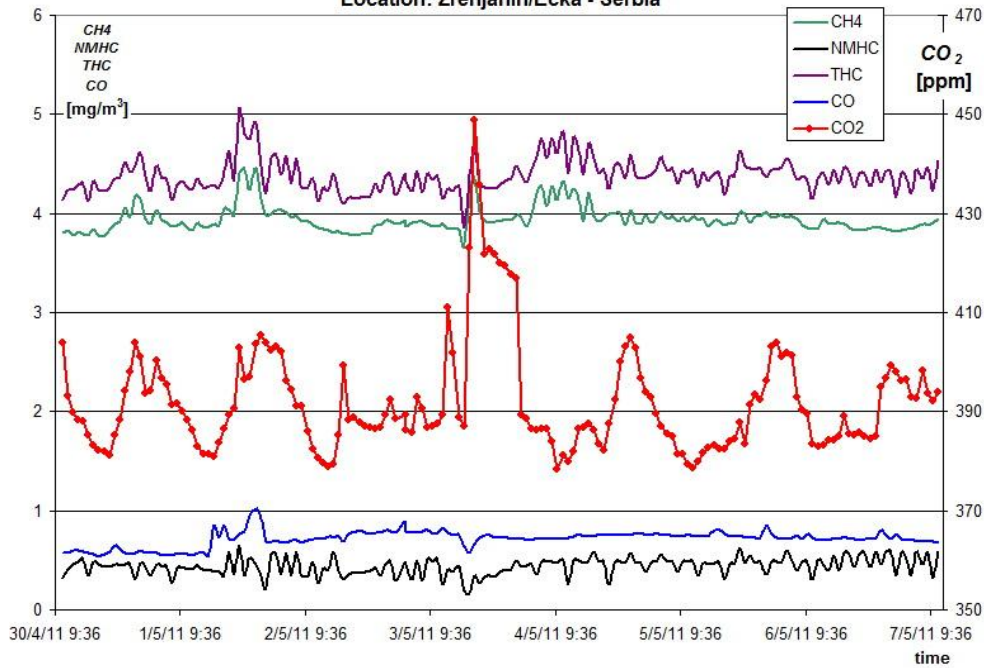


Figure 4. Hourly mean values recorded for CO₂, CH₄, NMHC, THC and CO in Zrenjanin/Ecka location

One hour mean values recorded for O₃, SO₂, NO, NO₂, NO_x concentration in ambient air.

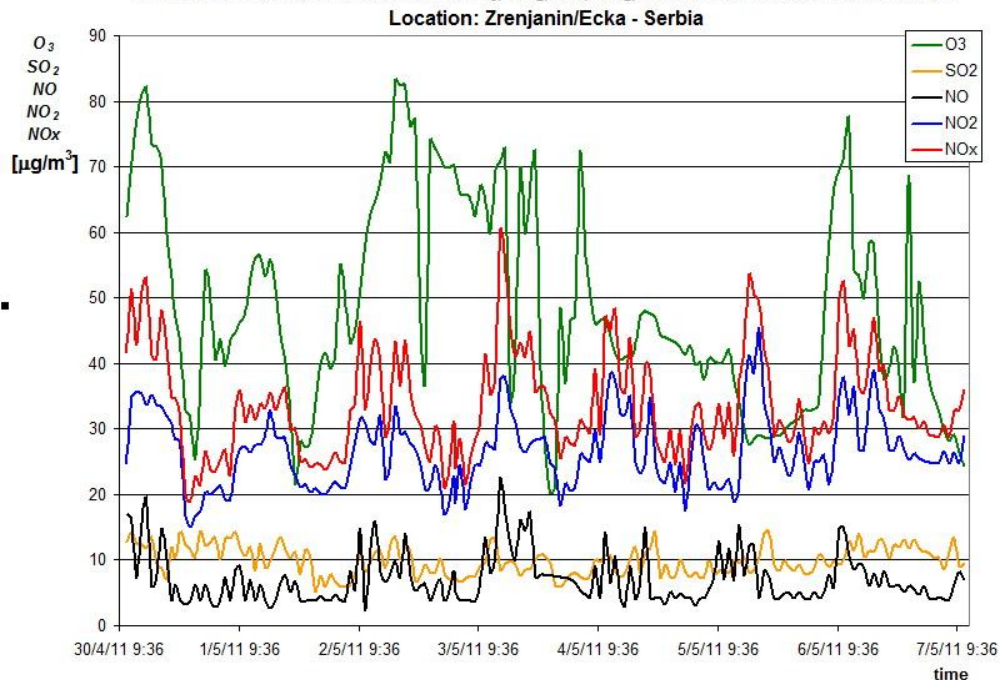


Figure 5. Hourly mean values recorded for O₃, SO₂, NO, NO₂ and NO_x in Zrenjanin/Ecka location



Daily mean values recorded for O₃, SO₂, NO, NO₂, NO_x concentration in ambient air.
Location: Zrenjanin/Ecka - Serbia

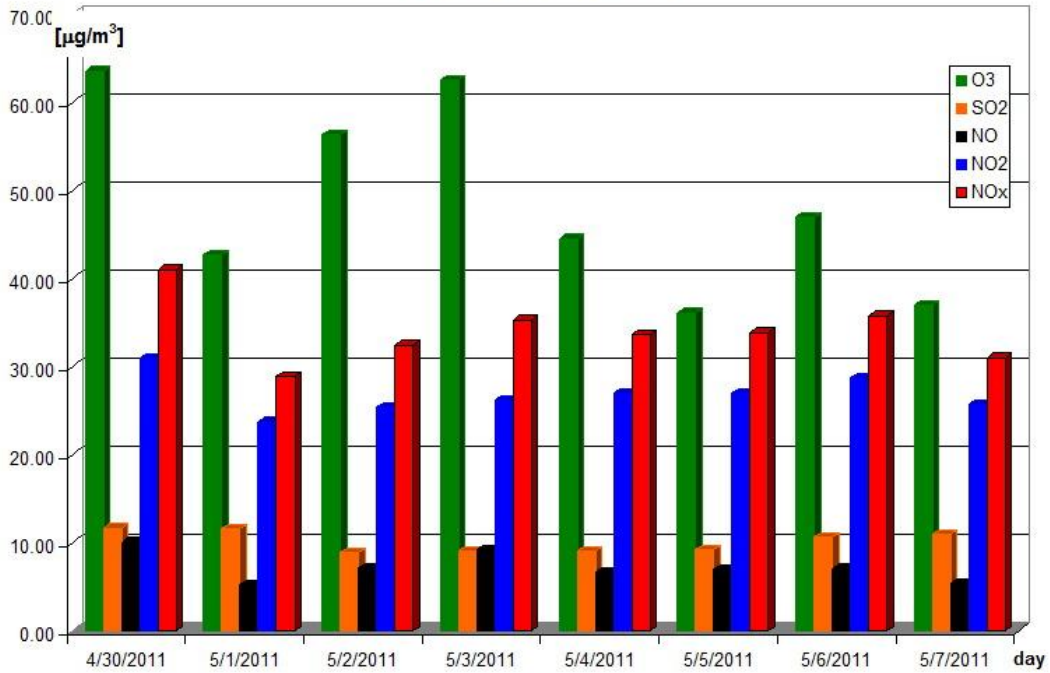


Figure 6. Daily mean values recorded for O₃, SO₂, NO, NO₂ and NO_x in Zrenjanin/Ecka location

One hour mean values recorded for CO, CH₄, NMHC, THC concentration in ambient air.
Location: Zrenjanin/Ecka - Serbia

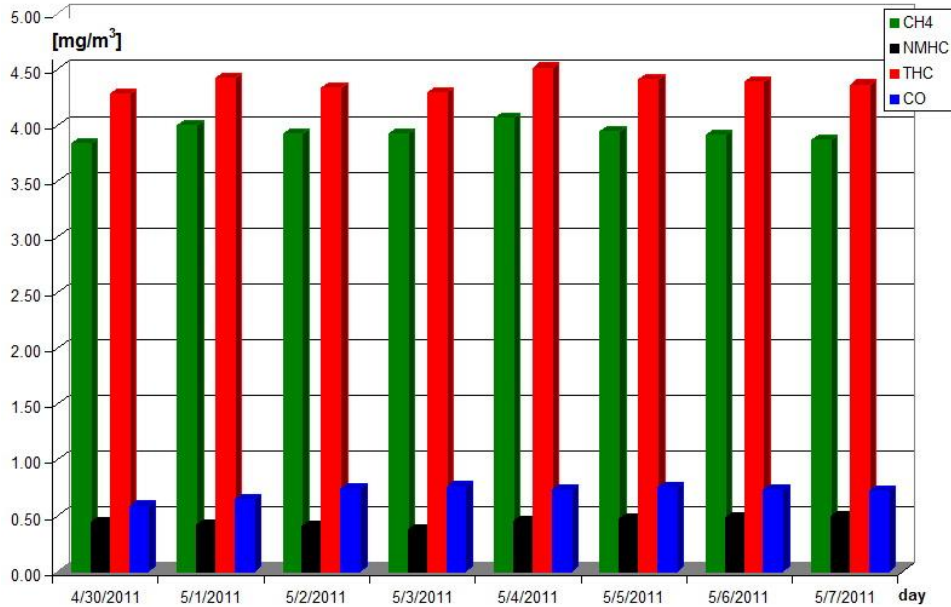


Figure 7. Hourly mean values recorded for CH₄, NMHC, THC and CO in Zrenjanin/Ecka location



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Instantaneous PM10 concentration in ambient air from 30.04.2011 - 02.05.2011

Zrenjanin/Ecka - Serbia

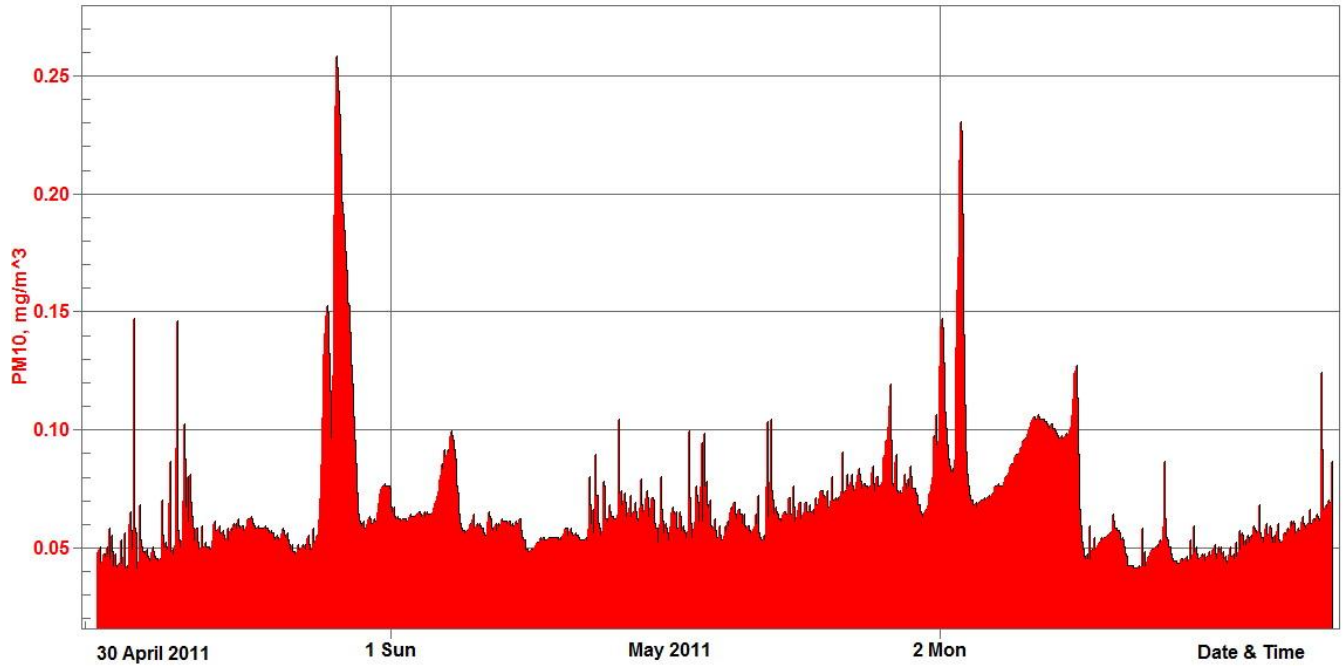


Figure 8. Instantaneous PM10 recorded values in Zrenjanin/Ecka location

Instantaneous PM10 concentrations in ambient air from 04.05.2011 - 08.05.2011

Zrenjanin/Ecka - Serbia

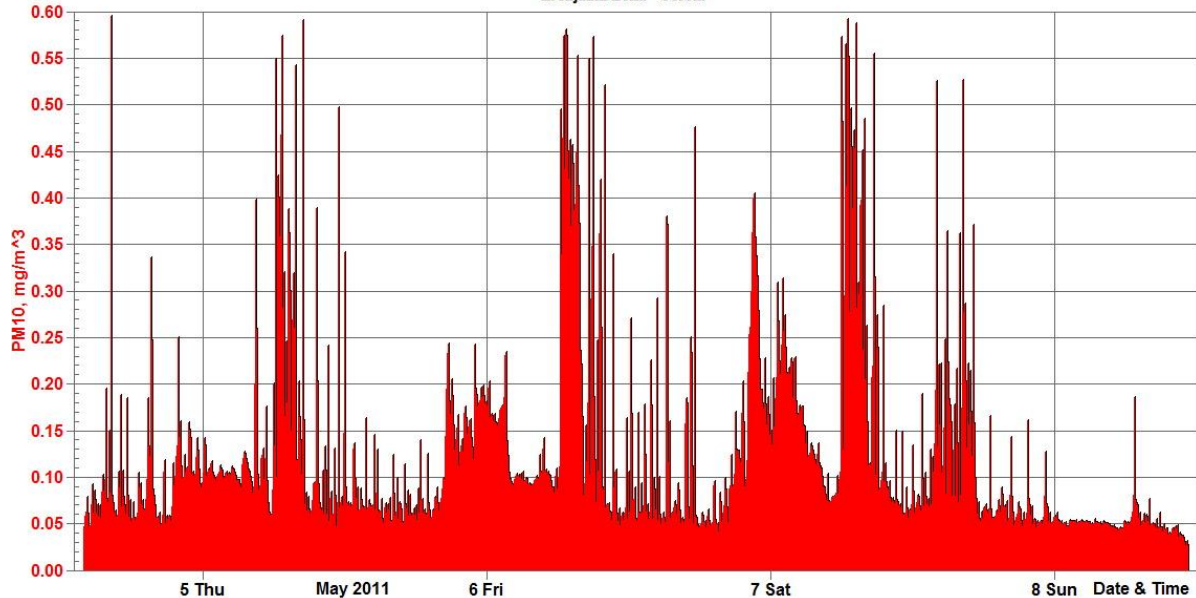


Figure 9. Instantaneous PM10 recorded values in Zrenjanin/Ecka location



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Some topics are of particular concern to many European citizens. One of these is air quality. This is also one of the areas in which Europe has been most active in recent years. The European Commission has aimed to develop an overall strategy. Member States are required to transpose and implement new directives on air quality which set long-term quality objectives. But it is also our direct responsibility to cope with this problem, changing our day by day behavior. Like the availability of capital, manpower, or transport infrastructure, the quality of air is likely to become a determining factor in the location of investment and therefore economic growth of a region. The way in which not only cities, but also companies, organize their transport systems will become, without any doubt, one of the major priorities of years to come.

Table 3. EU air quality standards

Pollutant	Concentration	Averaging period	Permitted exceedences each year
Sulphur dioxide (SO ₂)	350 µg/m ³	1 hour	24
	125 µg/m ³	24 hours	3
Nitrogen dioxide (NO ₂)	200 µg/m ³	1 hour	18
	40 µg/m ³	1 year	n/a
PM ₁₀	50 µg/m ³	24 hours	35
Carbon monoxide (CO)	10 mg/m ³	Maximum daily 8 hour mean	n/a
Ozone (O ₃)	120 µg/m ³	Maximum daily 8 hour mean	25 days averaged over 3 years

*Under the new Directive the member State can apply for an extension of up to five years (i.e. maximum up to 2015) in a specific zone. Request is subject to assessment by the Commission. . In such cases within the time extension period the limit value applies at the level of the limit value + maximum margin of tolerance (48 µg/m³ for annual NO₂ limit value).

**Under the new Directive the Member State was able to apply for an extension until three years after the date of entry into force of the new Directive (i.e. May 2011) in a specific zone. Request was subject to assessment by the Commission. In such cases within the time extension period the limit value applies at the level of the limit value + maximum margin of tolerance (35 days at 75µg/m³ for daily PM₁₀ limit value, 48 µg/m³ for annual Pm₁₀ limit value).

From the data presented in this report we can observe that, with the exception of PM₁₀, for the Zrenjanin/Ecka location the concentrations of all relevant pollutants is fitted under the EU air quality standards.

In the next pictures a visual overview of the campaign is presented. The location was chosen in order to obtain an overview of the background pollution in the Zrenjanin municipality area. The data will be compared with the future Zrenjanin inner-city air quality monitoring campaign.



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