

## PARTICULATE MATTER (PM) AIR POLLUTION IN THE TRANSBOUNDARY REGION RUSE-GIURGIU

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### **Abstract:**

This report analyses the problems with air pollution in the transborder region Ruse - Giurgiu. During the summer season fires occur on both sides of the Danube river, causing air pollution and release of foul-smelling gases in the two regions (from Bulgarian and Romanian side). There is a problem with air pollution during the autumn-winter season as well. The reason for this is domestic wood and coal heating, which leads to emitting of soot and ash. The report discusses the problems that arise in cases of accidents and fires. The following measures could be proposed as part of the solution for this problem - joint teams to work on preventing of accidents with fires, taking prompt and adequate measures in case of their occurrence, creating a better communication between the teams for exchange of information in the event of fire.

**Key words:** *transborder region, air pollution*

### **Introduction**

The report analyses problems related to air pollution as a result of fires and burning of stubble fields (which is permitted in Romania, but not on the territory of Bulgaria). Another problem included in the report is the spontaneous landfill combustion in the town of Ruse, resulting in air pollution over the Bulgarian and Romanian areas in the transborder region. The report proposes specific measures that could be useful in solving the problems related with air pollution in the region.

Ruse and Giurgiu are located in an area that features a climate with a hot and dry summer. Dry spells and high temperatures wither up the grass and this is a precondition for increased risk of fires. Combustion emits smoke, soot, fine dust particles (FDP) and foul-smelling substances to the atmosphere.

### **Statement**

Fires have negative impact on other environmental factors such as harmful emissions released into the air from - CO<sub>2</sub>, CO, CH<sub>4</sub>, and NO<sub>2</sub>. Moreover, stubble combustion emits highly toxic substances - dioxins and furans, especially harmful to the health of humans and animals [7,6].

Depending on the wind direction, air pollution could be observed both over the city of Ruse and the city of Giurgiu. All of this leads to air pollution and deterioration of the ecological conditions, albeit not exceeding the limit concentrations. To some extent these incidents increase health risks for the local population on both sides. It is also related with unpleasant organoleptic sensations for the local population, leads to deterioration of ecological conditions in the region and reduces the visibility in the affected areas.

In outbreaks of combustion on the territory of Bulgaria and in the presence of south or southeast wind, the smoke and pollutants are carried towards settlements on the territory of Romania. When the wind direction is from north or northwest, and the fire or ignition source is on

the territory of Romania, pollution is observed over the town of Ruse. There are different possibilities for transmission of air pollutants from Romania to Bulgaria and in the opposite direction.

A source of air pollution could be outbreaks of fire (as a consequence of an accident) or as a result of controlled burning (such as stubble combustion). On the territory of Romania there is no definitive prohibition on stubble burning, while in Bulgaria it is prohibited by law [1]. In Romania burning of stubble is only allowed in areas with diseased plants. When the wind is northwest, the burning of stubble creates conditions for air pollution above the city of Ruse with ash and soot, fine dust particles and foul-smelling substances. All too often it is not related with exceeding the concentration limit values (CLM), but leads to deterioration of visibility and unpleasant organoleptic sensations for the local population.

The latest instance of air pollution above the town of Ruse as a result of stubble combustion on the territory of Romania is from 17<sup>th</sup> July 2016.

Air quality measurement has been carried out around 11:00 o'clock on 17<sup>th</sup> July. A slight increase in the permissible levels for fine dust particles (FDP) and carbon monoxide has been reported. Such increases however do not affect human health. Sometimes they are reported on weekdays and heavy transport traffic as well, which is confirmed by the Regional Inspectorate of Environment and Water (RIEW). At the end of the same month, however, the recorded levels of FDP have exceeded the limit values [2,3,5].

This problem could be solved if stubble combustion is conducted under enhanced supervision and only in appropriate weather conditions - during calm days or if the wind direction does not cause pollution over inhabited areas.

The problem with air pollution in cases of fire is not unilateral.

An example of air pollutants transmission from Bulgaria to Romania is the spontaneous combustion of the landfill near the town of Ruse on 27<sup>th</sup> August 2012. The reason for this combustion was the extremely hot and dry summer in 2012. During the fire and the following days teams of RIEW Ruse have conducted the necessary measurements and have not found exceeding limit concentrations of any of the tested indicators [4].

The fire, however, became a source of mists and foul-smelling substances, which led to deterioration of the ecological situation in the region. After the incident additional control measures have been taken and this has not happened again ever since. Such incidents should not be allowed because the burning of waste in landfills creates a great risk of release of dioxins and furans, which are extremely dangerous to human health even in low concentrations.

In the autumn-winter period transboundary air pollution in the region is a topical issue as well. The reason for this is that most people use solid fuel stoves for heating. According to the Executive Environment Agency (EEA) domestic heating is a major source for FDP emissions in the atmosphere. Fine dust particles are microscopic solid or liquid substances which are suspended in the atmosphere. The most common FDP are as large as 10 micrometres (FDP10). They are released during combustion, in road traffic and in various industrial processes. Smaller particles - 2.5 micrometres in size (FDP2.5) - are toxic organic compounds, suspended mostly on heavy metals, and they constitute a greater threat to public health. [8]

In a comparison of the days with exceeded levels of FDP10 it is established that during cold months the number of days with exceeded levels are more than those in the spring-summer season. The number of days with air pollution depends on whether the summer is hot and dry, whether there are rainfalls or long periods of draught.

Table 1 shows data of measured concentrations of FDP10 at a monitoring station on the territory of RIEW Ruse - AMS “Vazrazhdane” Ruse for the period June 2015 – July 2016 [9].

**Table 1. DATA FOR MEASURED CONCENTRATIONS OF FDP10 IN MONITORING STATIONS ON THE TERRITORY OF RIEW –RUSE, MEASURED IN AMS ‘VAZRAZHDANE’ RUSE FOR THE PERIOD JUNE 2015 – JULY 2016.**

Date/month	Measured	Exceeding of	Number of registered exceedings for the month	Number of registered data for the month	Average monthly concentration	Time range
	concentration	LV for ADR				
	[µg/m <sup>3</sup> ]	(50 µg/m <sup>3</sup> )				
1	2	3	4	5	6	7
June			0	27	25,841	98,34254144
July			0	31	33,045	98,58490566
04/9/2015	55,8	1,116	3	30	33,593	98,9010989
05/9/2015	50,9	1,018	3	30	33,593	98,9010989
18/9/2015	53,5	1,070	3	30	33,593	98,9010989
25/10/2015	67,7	1,354	3	31	35,255	99,01315789
26/10/2015	58,9	1,178	3	31	35,255	99,01315789
27/10/2015	55,3	1,106	3	31	35,255	99,01315789
01/11/2015	83,5	1,670	12	30	53,997	99,10179641
02/11/2015	63,4	1,268	12	30	53,997	99,10179641
03/11/2015	98,7	1,974	12	30	53,997	99,10179641
04/11/2015	186,7	3,734	12	30	53,997	99,10179641
05/11/2015	116,1	2,322	12	30	53,997	99,10179641
06/11/2015	133,2	2,664	12	30	53,997	99,10179641
07/11/2015 г	87,4	1,748	12	30	53,997	99,10179641
08/11/2015 г	79,8	1,596	12	30	53,997	99,10179641
09/11/2015 г	66,2	1,324	12	30	53,997	99,10179641
18/11/2015 г	53,4	1,068	12	30	53,997	99,10179641
19/11/2015 г	59	1,180	12	30	53,997	99,10179641
20/11/2015 г	54,9	1,098	12	30	53,997	99,10179641
03/12/2015 г.	71,3	1,426	19	31	56,687	99,17808219
04/12/2015 г.	50,4	1,008	19	31	56,687	99,17808219
05/12/2015 г.	55,2	1,104	19	31	56,687	99,17808219
09/12/2015 г.	62,7	1,254	19	31	56,687	99,17808219
10/12/2015 г.	57,5	1,150	19	31	56,687	99,17808219
11/12/2015 г.	51	1,020	19	31	56,687	99,17808219
12/12/2015 г.	61,4	1,228	19	31	56,687	99,17808219
13/12/2015 г.	90,9	1,818	19	31	56,687	99,17808219
15/12/2015 г.	51,2	1,024	19	31	56,687	99,17808219
18/12/2015 г.	65,7	1,314	19	31	56,687	99,17808219
19/12/2015 г.	78,2	1,564	19	31	56,687	99,17808219
20/12/2015 г.	79,8	1,596	19	31	56,687	99,17808219
21/12/2015 г.	66,8	1,336	19	31	56,687	99,17808219
23/12/2015 г.	80,8	1,616	19	31	56,687	99,17808219
24/12/2015 г.	71,5	1,430	19	31	56,687	99,17808219
25/12/2015 г.	91,1	1,822	19	31	56,687	99,17808219
26/12/2015 г.	69,1	1,382	19	31	56,687	99,17808219

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27/12/2015 г.	97,6	1,952	19	31	56,687	99,17808219
28/12/2015 г.	68,4	1,368	19	31	56,687	99,17808219
05/1/2016 г.	95,1	1,902	17	31	73,752	100
06/1/2016 г.	89,5	1,790	17	31	73,752	100
09/1/2016 г.	72,4	1,448	17	31	73,752	100
10/1/2016 г.	107,3	2,146	17	31	73,752	100
11/1/2016 г.	131,9	2,638	17	31	73,752	100
19/1/2016 г.	87,3	1,746	17	31	73,752	100
20/1/2016 г.	109,4	2,188	17	31	73,752	100
21/1/2016 г.	108,4	2,168	17	31	73,752	100
22/1/2016 г.	136,7	2,734	17	31	73,752	100
23/1/2016 г.	118,2	2,364	17	31	73,752	100
24/1/2016 г.	141,4	2,828	17	31	73,752	100
25/1/2016 г.	148,4	2,968	17	31	73,752	100
26/1/2016 г.	156,3	3,126	17	31	73,752	100
27/1/2016 г.	80,7	1,614	17	31	73,752	100
29/1/2016 г.	53,5	1,070	17	31	73,752	100
30/1/2016 г.	85	1,700	17	31	73,752	100
31/1/2016 г.	60,4	1,208	17	31	73,752	100
02/2/2016 г.	85,9	1,718	9	28	48,793	100
03/2/2016 г.	63,4	1,268	9	28	48,793	100
06/2/2016 г.	68	1,360	9	28	48,793	100
07/2/2016 г.	57,8	1,156	9	28	48,793	100
08/2/2016 г.	79,9	1,598	9	28	48,793	100
09/2/2016 г.	94,3	1,886	9	28	48,793	100
16/2/2016 г.	101,9	2,038	9	28	48,793	100
23/2/2016 г.	86	1,720	9	28	48,793	100
26/2/2016 г.	63,6	1,272	9	28	48,793	100
01/3/2016 г.	54,7	1,094	4	31	37,155	100
16/3/2016 г.	50,9	1,018	4	31	37,155	100
21/3/2016 г.	54,6	1,092	4	31	37,155	100
28/3/2016 г.	56,3	1,126	4	31	37,155	100
05/4/2016 г.	58,6	1,173	4	30	35,087	100
06/4/2016 г.	69,6	1,393	4	30	35,087	100
07/4/2016 г.	63,6	1,272	4	30	35,087	100
08/4/2016 г.	50,5	1,010	4	30	35,087	100
16/5/2016 г.	50,6	1,012	1	31	27,457	100
22/6/2016 г.	61,9	1,239	3	30	31,99	100
23/6/2016 г.	65,3	1,306	3	30	31,99	100
24/6/2016 г.	52,2	1,045	3	30	31,99	100
15/7/2016 г.	56,0	1,120	6	31	37,995	100
27/7/2016 г.	56,5	1,130	6	31	37,995	100
28/7/2016 г.	55,1	1,103	6	31	37,995	100
29/7/2016 г.	65,7	1,314	6	31	37,995	100
30/7/2016 г.	56,2	1,125	6	31	37,995	100
31/7/2016 г.	56,9	1,139	6	31	37,995	100

The highest number of days with exceeded LV for FDP10 is observed during November, December, January and February. The highest rates of average monthly concentrations of PM10

have been measured during this period. The main reason for this is the common use of household stoves for heating and the characteristic features of the climate in the region. During these months there are long periods with low temperatures, fog and no wind. All these factors advantage the retention of fine particulate matter near the earth's surface and prevent their scattering in the atmosphere.

Measurements recorded during the summer season over the years show large index differences. In hot summers with high temperatures and long drought periods (as in 2016) fires occur more frequently and this is a reason for air pollution. During the summer months with lower temperatures and more rainfalls fires occur more rarely and the pollutants released in the atmosphere are less in concentration.

### **Conclusion**

It's impossible to prevent completely the cases of fire during summer, but the risk of them could be substantially minimized. A joint group of teams could be gathered to act together in both regions for fire extinguishing. Each team could monitor and control the fire hazardous areas located on their local territory. In case of fire or other incident the two groups could work together to reduce the damage and to inform the local population in due time in cases of emergency or evacuation. Moreover, teams could create a joint system for control, prevention and action in times of disasters, accidents and catastrophes. A plan could be elaborated for prompt, adequate and timely informing of the local population if necessary, to print leaflets with instructions for prevention of potential fires and for adequate action when they occur. The level of air pollution during the autumn-winter season can be reduced by gasification of the region, especially in the Bulgarian section, and by improving the central heating systems. Solving this problem will significantly improve the environmental situation in the region.

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