STUDY ON INFLUENCE OF NOISE DISPERSION ON AIR QUALITY IN THE AREA OF ROVINARI THERMAL POWER PLANT

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ABSTRACT. This paper presents a case study on the impact of emissions from the Rovinari thermal power plant on air quality. There are presented the results of the measurements made with specialized equipment for emissions and immissions of exhaust in this paper. There are presented the maps of the dispersion of pollutants generated by ISC 3 software.

KEY WORDS: SO_2 NOx ,CO, CO_2 , powders, gas analyzer TESTO 350 XL, laser opacimeter.

1. INTRODUCTION

The Rovinari Thermal Power Plant is a core of the National Energy System. The power plant is part of the Oltenia Power Complex. The power plant consists of 4 energy groups of 330 MW. The 330 MW energy groups are provided with:

- a steam boiler of 1035 t/h, with steam parameters: 192 bar, 540^o C
- a steam turbine with the power of 330MW with steam parameters: 180 bar, 535^o C
- an electric generator of 330 MW
- a 400MVA electric transformer

The basic fuel of the boilers is lignite, with the following chemical composition:

- C = 20,4 – 23,7 %
- H_2 = 2,1 – 2,5 %
- $O_2 + N_2$ = 10,3 – 10,8 %
- S = 0,7 – 1,5 %
- A = 21 – 23 %
- W = 38,5 - 45,5 %

In order to ensure flame suppression during combustion, natural gases are used with the following chemical composition:

- CO_2 = 0,7%
- O_2=0,08 %
- N_2 = 0,24 %
- $C_2 H_6$ = 0,52 %
- $C_3 H_8$ = 0,5 %
- CH_4 = 97,6 %

Boilers are also designed to function fully with fuel oil, with the following chemical composition:

- C = 80 – 85 %
- H_2 = 10,2 – 11 %
- $O_2 + N_2$ = 1,4 – 1,6 %
- S = 0,8 – 1,2 %
- A = 0,1%
- W = 1,1 %

When operating lignite boilers, the fuel is used as a flame support.

Boilers of energy groups are upgraded to meet environmental standards. Each boiler is equipped with a SO_2 emission reduction facility.

Electro-filters of energy groups have been upgraded. Evacuation of slag and ash is done through the clean technology of dense slurry evacuation.

In order to reduce NOx emissions, the boilers will be equipped with a combustion denoxing system.

2. EXPERIMENTAL RESULTS

Figure 1 shows the schematic diagram of the 330 MW energy group.

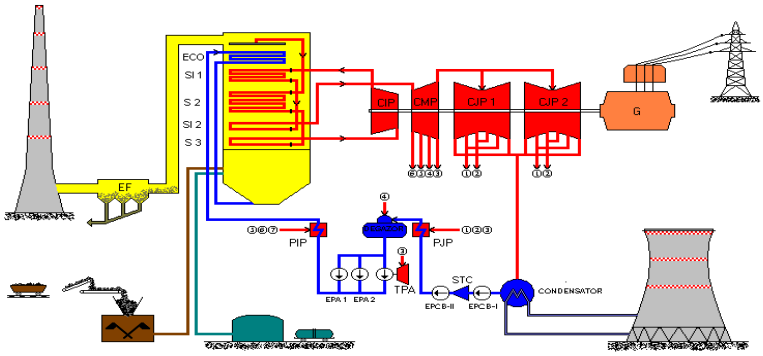

Fig. 1. Schematic diagram of the 330 MW energy group

Combustion gases are discharged into the atmosphere through a chimney of 120 m height and a diameter of 7.5 m.

For the boiler of the energy group no. 4, the results of the experimental emissions measurements are presented in Table 1.

The pollutant concentrations in the flue gases (SO_2, NO, NO_2, NO_x; O_2 ;CO , CO_2) were determined with the TESTO 350 XL gas analyzer. The concentration of dust in the combustion gases was determined with the laser opacimeter.

The amount of pollutants discharged into the atmosphere:

- Dusts 4.272 ton/year
- SO_2 115.004 ton/ year
- NOx 13.657 ton/ year
- CO_2 5.720.753 ton/ year
- CO 806 ton/year

Table 2 shows the maximum / average concentrations of PM10 dusts in the Rovinari area for various periods. In Table 3 and Figures 2,3,4, there are presented the results of the mathematical modeling for dispersion of pollutants emitted on the boiler chimney.

Table 1

Month	CO (mg/Nm^3)	CO_2 (%)	O_2 (%)	NOx (mg/Nm^3)	SO_2 (mg/Nm^3)	λ	Burning gas temperature. (°C)
January	69,3	10,5	10,9	324,6	188,3	2,4	146
February	78,5	9,5	11,2	338,1	192,2	2,2	142
March	60,4	10,3	10,2	341,5	187,3	2,5	148
April	68,8	10,6	12,3	339,8	179,8	2,4	144
May	77,2	9,7	14,2	351,2	177,2	2,2	149
June	65,3	8,6	13,8	366,6	186,4	2,3	147
July	69,5	8,5	14,5	328,3	182,8	2,6	145
August	73,7	9,3	12,9	337,8	180,5	2,1	141
September	71,2	9,8	15,4	350,2	190,9	2,9	140
Octomber	66,1	8,8	11,3	344,1	192,1	2,7	149
November	59,3	9,9	11,9	346,8	176,5	2,5	142
December	74,7	9,3	12,3	352,2	188,9	2,3	144

Table 2

Zone	Pollutants	Mediation times	C_{max} [µg/m^3]	C_{medie} [µg/m^3]	Alert threshold (PA) [µg/m^3]	Limit values (V.L.) [µg/m^3]	Observations
Rovinari	PM10	an	19,4	9,9	-	40	C_{max} < V.L. C_{med} < V.L.
		24h	30,6	21,2	-	50	C_{max} < V.L. C_{med} < V.L.
		1h	411,2	236,4	500	350	C_{max} > V.L. C_{med} < V.L.

Table 3

No	Name	Symbol	The unit of measure	Stock measured
1.	Combustion gas temperature at the chimney	t_{gc}	^oC	144
2	Speed of combustion gases at the chimney exit	W_g	m/s	15,2
3	CO mass flow rate	m_{CO}	mg/s	11260
4	Mass NO_x flow rate	m_{NOX}	mg/s	131860
5	Mass ash flow rate	m_{cen}	mg/s	65480
6	The height of the chimney	H_c	m	120
7	Diameter at the top of the chimney	D_c	m	7,5
8.	Mass SO_2 flow rate	m_{SO2}	mg/s	310764

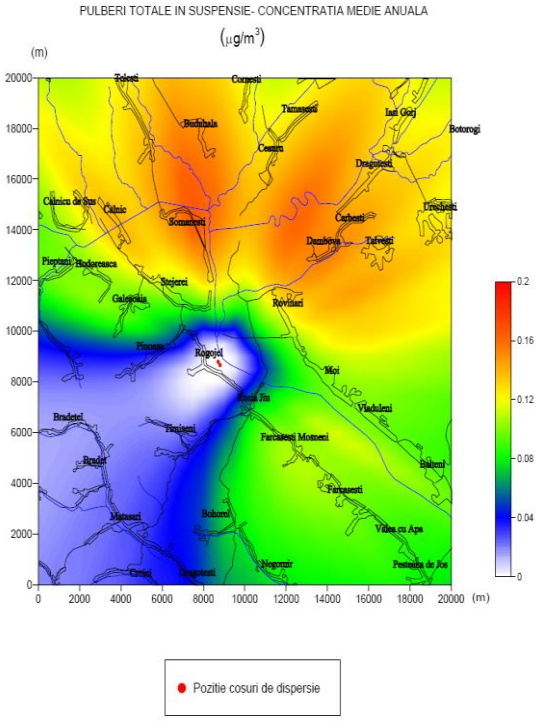

Figure 2. Dusts in suspension

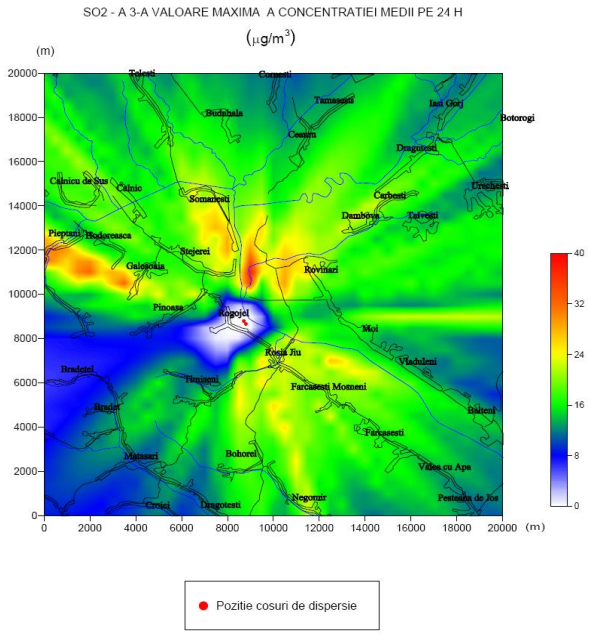

Figure 3. Maximum SO_2 Concentration

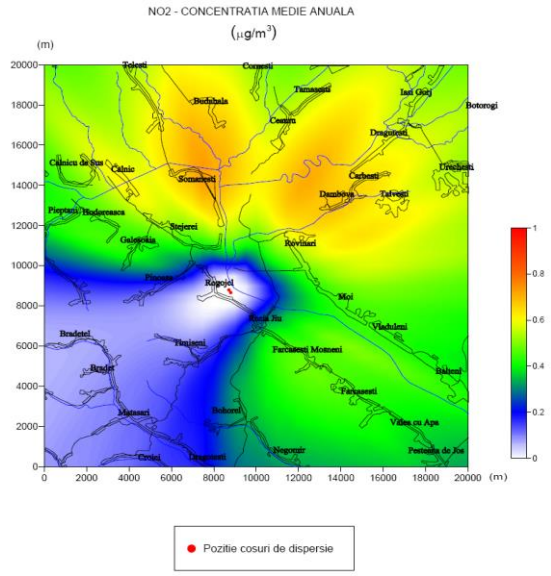

Figure 4. NO_2 Concentration

3. CONCLUSIONS

By applying the measures to reduce pollutant emissions to the Rovinari thermal power plant, it was found that the pollutant emissions and pollutants are included in the environmental legislation for:

- SO_2
- Dusts

For the NOx pollutant the exhaust emission values exceed the maximum limit of 200 mg/Nm^3.

Reduction of NOx emissions will be achieved by the denoxing of combustion fired gases by urea injection.

The dispersion maps generated by the ISC3 Mathematical Modeling Program demonstrate that at a distance of 5 km from the emission source of the pollutants, the concentrations of the pollutant immissions fall within the limits allowed by environmental legislation.

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