IMPACT ASSESSMENT OF THE POLLUTANT NO_2 EMITTED INTO THE ATMOSPHERE BY THE ROVINARI THERMAL POWER PLANT

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ABSTRACT: The purpose of this paper is an analysis of the NO_2 pollution from Rovinari Thermal Power Station Plant considering to undesirable effects on the environment and human health. Impact assessment of pollutants discharged into the atmosphere by the Power Station Rovinari is done in two ways: as emissions and the dispersion (immission) of pollutants in the surrounding area of pollution source, the obtained values being reported in permissible limit values from effectual regulations. Modelling the dispersion of the pollutants for the neighbouring areas of the Rovinari Power Station Plant has been carried out by using the Austal View specialized software within INSEMEX Petroşani.

KEY WORDS: impact of pollutants, nitrogen oxides, emission

1. GENERAL CONSIDERATIONS

Rovinari Thermal Power Plant (C.T.E. Rovinari) is located near Rovinari city, on the right side of Jiu river, nearby the national road which connects Targu Jiu city to Filiasi town, about 16 kilometres away to west of Tg-Jiu, in a hilly area, at an altitude of 150 m above sea level. It was built during 1972-1979, in order to provide electricity for covering the required consumption at the level of the National Power System. Nowadays, there are four power blocks (blocks 1 and 2 are currently disassembled), that generating a total available power of 1320 MW (4x330MW).

The four power blocks are connected to two smoke funnels (two blocks for each funnel), having 220 m in height and an exhaust diameter of 8.8 m.

Fig. 1. *Rovinari Thermal Power Plant*

The assessment of the impact of pollutants released into to atmosphere by Rovinari Thermal Power Plant is carried out from two points of view: as emissions, quantities of polluting substances from burning gases are compared to the stipulated values by effectual regulations (GD, 2010), (Law, 2011), (Order, 2005). And as dispersions (imission) of polluting substances into the area surrounding of the pollution source, the obtained values being reported to the allowable limit values from effectual regulations (GD, 2010), (Law, 2011), (Order, 2005). The most important releases in air resulting from the burning of fossil fuels are the following: sulphur dioxide, nitrogen oxides, carbon monoxide, powders, but also greenhouse gases and heavy metals, halogenated compounds and dioxins, released in small amounts but having significant effects upon the environment due to their toxicity and persistence.

2. THE IMPACT OF NITROGEN DIOXIDE DISCHARGED INTO THE ATMOSPHERE BY THERMAL POWER PLANT ROVINARI

2.1. Monitoring of the emissions of nitrogen oxides

The content of sulphur dioxide in burning gases depends on the sulphur content of the used fossil fuels. In Rovinari thermal-power plant, the main fuel is the lignite having a calorific power ranging between P_{ci} = 1664÷2456 kcal/kg, a sulphur content ranging between 0.5÷1.35% and an ash content between 1.8÷25.4%. There is added the sulphur content from the additional flame support fuel (~8%), which may be naphtha with a sulphur content between 0.97÷3.3%.

Emission limit value for nitrogen oxides (NOx), measured as nitrogen dioxide applicable to large combustion installations with a rated thermal input greater than 500 MW, in the case of using of solid fuel (HG 440/2010) is 500 mg/Nm^3. In 2011, the concentration of oxides of nitrogen, as measured by nitrogen dioxide in the exhaust gas were all located below the emission limit. Thus, in the boiler no. 3, except May month when it was closed for the commissioning of the plant desulfurization, NOx emission values ranged from 76%, the lowest recorded in January month, from the emission limit value. The highest concentration of nitrogen oxides in the exhaust gas boiler there were in no. 4 boiler and presented values ranged between 84% and 98% of the emission limit. In boiler no. 5 the concentration of nitrogen oxides in the flue burning ranged from 82% to 97% of the emission limit.

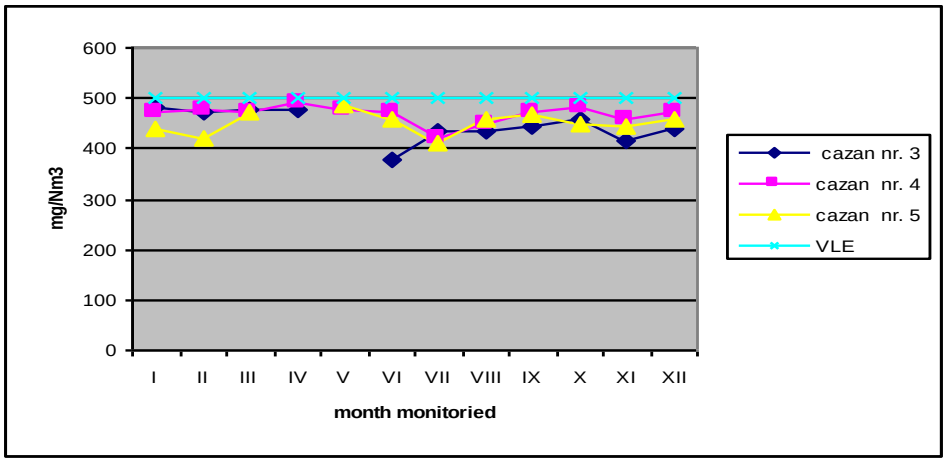

Fig.2. The evolution of NO_2 concentration in the flue gases in 2011

2.2. Research regarding of emitted pollutant dispersion by Rovinari Thermal Power Plant in november 2010

Pollutant dispersion modeling for surrounding areas of Thermal Power Plant was performed by using a specialized program within INSEMEX Austal View (2010), which allows modeling the dispersion of pollutants emitted by one or several sources and also made a chart and a forecast situation of entic scenarios proposed by the operator.

Weather date, necessary for plotting pollutant emissions by Austal View Program were obtained from GJ Station 2 – industrial located in city Rovinari, and refers to: temperature, precipitation, direction and speed wind, relative humidity, pressure, Solar radiation.

According to data from APM Gorj, the average wind speed in November 2010 is 0.675 m / s (maximum wind speed is 2m/s), and the prevailing wind direction is from the N - NE. Corresponding compass zone is shown in Figure 3.

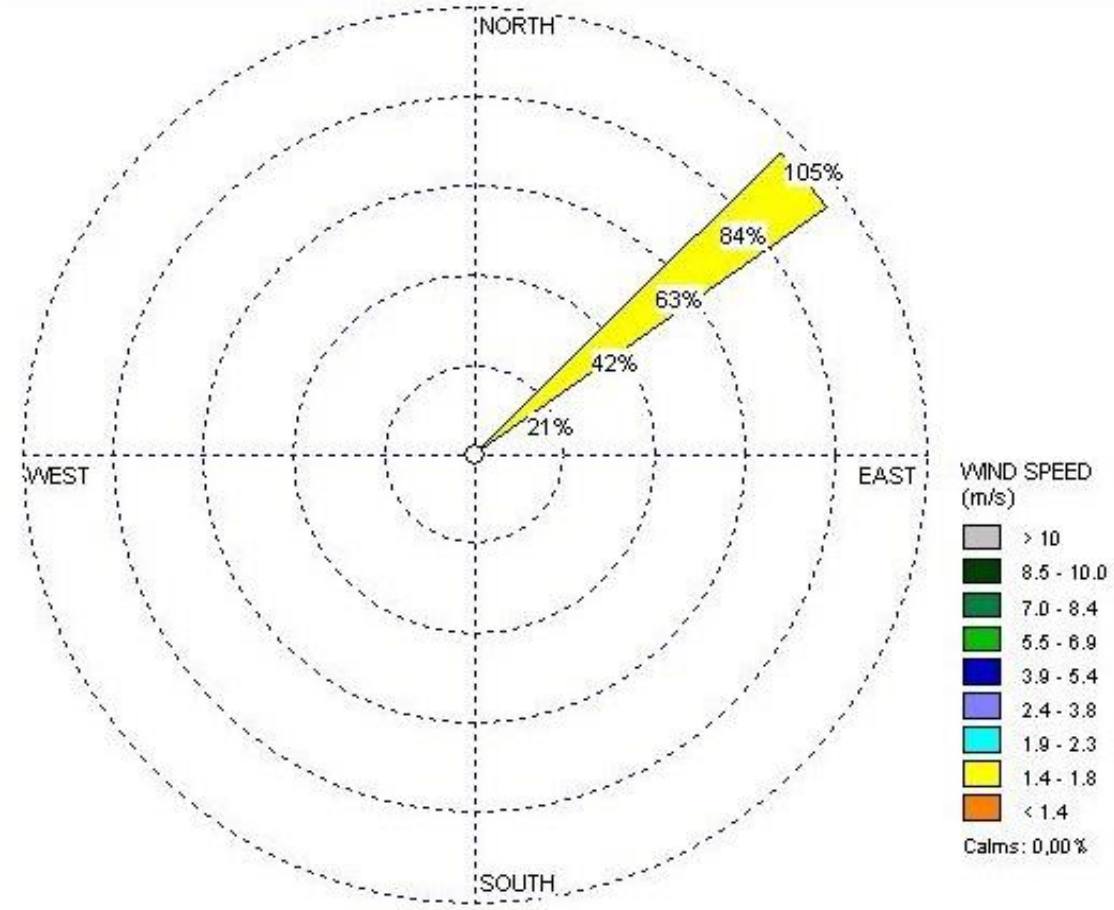

Fig.3. Wind rose related to Rovinari area

In November month 2010, in the period when the survey was carried out of the impact on air, three power units worked (3, 4, 5), the Energy Block No.6 being under repairing.

Graphical representation of the results of mathematical modeling of the dispersion of pollutants SO_2, NO_2, CO and TSP was made georeferenced topographic maps scale 1:90.000.

Calculations were carried out in a grid with dimensions 20 km x 20 km, with up to 400 m for main characteristics pollutants emitted by stationary burning sources conducted within CTE Rovinari.

The dispersion modeling software

allows these averaging intervals.

Dispersion maps were made and the average values were determined daily, hourly and hourly maximum concentrations of pollutants in ambient air. Given the wind compass, wind speed and prevailing wind direction, the dispersion is in S - SV and appropriate location of a point on the downwind MNT3 monitoring (pollutant cloud).

The maximum concentration is placed on axis wind, the direction of pollutant cloud. Overlapping the izocinetism areas over targets it can determine the most affected region by pollutants from power blocks of Thermal Station Plant Rovinari. It is noted that for the pollutant SO_2, pollutant has a bell shape with maximum concentrations distributed inside, outwards concentration decreasing and pollutant cloud covers direct - SV.

2.3. NO_2 pollution

In November 2010, the concentrations of NO_2 from the three blocks of Rovinari Thermal Power Plant not exceed the emission limit value set by GD 541/2003.

Medium value of concentrations of NO_2, for each boiler of power plant emissions, are: 89.26% (boiler no. 3), 93% (boiler no. 4), 92.1% (boiler no.5) from limit value emission. Continuous Monitoring Station of Air Quality GJ-2, recorded in November 2010, values that do not exceed the maximum permissible concentration for the pollutant NO_2, a daily average of 14.5 g/m^3.

It is noted that until direct pollutant - SV. From the dispersion map analysis shows that the average daily maximum concentration value obtained by modeling is 87 g/m^3, the distance between (2000-2500) m from the source, over an area of 1600 m^2 (Peak Linden). For this period of consultation, Order no. 592/2002 does not provide values.

Pollutant cloud which has average daily concentration value in the range (50-87) g/m^3 covers an area of 1600 m^2, near the site immediately to the E and the distance of 1200 m, to S, an area of 8800 m^2 (C. Rosii D. Bogdan, D. Curăturile, sat Bohorel, Timişeni, Jidovia).

The largest expanse has pollutant cloud which has average daily concentration value below 10 g/m3 and stretches to SV: Mătăsari, V. Borelui, V. Boncea, Ştiucani, V. Gros, Brădet village. In other areas, the medium daily concentration has the following values: Rogojel, Pd. Timişeni, Pd. Dragoteşti, Jilt, Negomir, V. Scoarta, V. Lupilor (20-50) g/m^3;Rovinari, V. Rogojel, Jidovia D. Maiag (10-20) g/m^3.

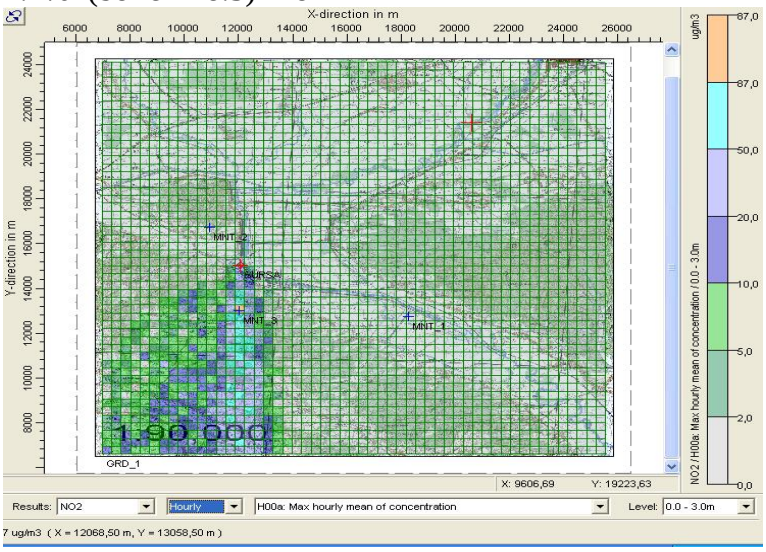

Fig. 4. Dispersion of NO_2 – medium daily concentration

3. CONCLUSIONS

Air quality is influenced by the presence of major air pollution sources: Thermal funnels from Rovinari, slag and ashes store Cicani - Beterega, lignite pits, waste dumps and tailings storage traffic. By putting sequenced according desulphurisation installations it is found to be the limit imposed for SO_2. As a result of the modernization and efffected repairs,

In May month 2011, it was stopped the boiler No. 3 and from June month it has put into operation the desulphurisation instalation, the concentrations of sulfur dioxide from flue gases being below to the limit prescribed by the regulations.

From the point of view of environmental protection, two of oxides of nitrogen, nitric oxide and nitrogen dioxide have a special importance. Nitric oxide is formed under conditions of high temperature combustion of fossil fuels, gas, oil, coal, air.

At high temperature formed oxid dissociates quickly.

However, if the cooling rate exceeds the rate of decomposition (the powder emissions into the atmosphere decreased, concentration in the combustion gases (according to the results of self-monitoring) for all boilers hovering below the project.

Rovinari Energy Thermal Complex obtained the transition of 2013, and respectively 2017, in order to comply with the emission limit values according to GD 541/2003, as amended and supplemented, for SO_2, NOx, powders.

temperature must be lowered sharply to about 7000C) nitrogen monoxide becomes stable.

As a result, the high combustion temperatures, rapid cooling and diluting the gas favors the instant of emission of high concentrations of nitric oxide and nitrogen dioxide, small concentrations.

Most of the oxides of nitrogen present in the atmosphere is the nitric oxide produced by in a biologically way.

Natural sources produced about 10 times more than the nitrogen oxides derived from human activities. In artificial sources, combustion technology is the main cause of emissions of nitrogen oxides.

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