ANALYSIS RESULTS POLLUTANTS DISPERSION FROM COAL IN POWER INSTALLATIONS

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ABSTRACT: Electricity generation by combustion in thermal power plants leads to evacuation of the atmosphere pollutants:, SO2, NO2, C02, dust ash. These pollutants have a negative impact of environmental factors air, water, soil. This paper presents an analysis of variance model pollutants using mathematical modeling using a computer program
Keywords: emissions, pollutant immission, pollutant dispersion, thermal power stations

АНАЛИЗ НА РЕЗУЛТАТИТЕ ОТ РАЗПРОСТРАНЕНИЕТО НА ВЪГЛИЩНИ ЗАМЪРСИТЕЛИ ОТ ТЕЦ

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РЕЗЮМЕ: Производството на електрическа енергия от ТЕЦ води до отделянето на много замърсители в атмосферата: SO_2, NO_2, CO_2 , прах , сажди и други. Последните имат отрицателно въздействие върху околната среда: въздух, вода, почва. Статията представя анализ на различни модели на замърсители с помощта на компютърно математическо моделиране.
Ключови думи: емисии, емисии на замърсители, разпространение на замърсяване, ТЕЦ.

1.INTRODUCTION

Thermal power Rovinari subject of this study is composed of four power units of 330 MW. Basic fuel boilers is coal energy. The boilers are designed and operate entirely on oil.

Thermal power plant currently operating in three energy groups, an energy group is being modernized.

2. COMPUTER SYSTEM SIMULATION OF THE DISPERSION OF POLLUTANTS

Dispersion of pollutants in the atmosphere is a complex process that can be described mathematically by the general statistical models, or mathematical models and is influenced by

- Meteorological conditions;

Pollution-source characteristics (speed of combustion gases, flue gas temperature, flue gas flow, chimney height);

- Topographical features of land areas analyzed.

Software used to make numerical simulations used these assumptions simplifying

- Used in geometry and Physical Properties real simulation model to solve temporary dependence dispersion process in a complex three-dimensional domain;
- Codes are based on the concept of finite volume in Cartesian coordinate system. Treaty area is complex depending on surface roughness.
- Increased complexity and scope of study does not involve a complication in treating the problem;
- The system is in thermodynamic equilibrium (gaseous components have the same pressure and temperature at all points in the domain).

To obtain meteorological data necessary numerical simulations, we used the automatic weather station in Targu-Jiu, who provided data: temperature, wind speed, wind direction, atmospheric pressure, humidity and light intensity.

Meteorological data processing was done using Version 3.5 software product WRPLOT View Lakes Environmental Software. WRPLOT View is a program for Windows, a program that generates wind rose, and statistics on the direction, intensity and stability class for weather data input. The program sorts the data by wind direction in 16 sectors, each of 22.5 degrees and intensity depending on the speed in six classes.

Figure 1 shows the wind rose, ie the distribution of velocities for a set of data in the range 01/02/2009 to 12/31/2009.

ISC4 program is the most common assessment program dispersions, so the determination of immission. The program is internationally certified, proof that one of the most famous environmental protection agency (U.S. EPA) protocols it uses its analysis of the dispersion, the solid or wet deposition, even in the complex field (eg. When receiver is superior share of the issuer and vice versa).

ISC4 is an improved version and the latest variant ISC3 (Sources Industrial Complex), which until now has seen several versions.

Models have been evolving, to improve the user interference (experienced or not) and ease of preparation of input files for spatial location, quantity and quality of sources and meteorological data.

Requirements related to unit of account are not special. Demonstration applications or a reasonable number of sources conditions offered by the IBM-PC computers and FORTRAN compiler min. 640 kRAM enough.

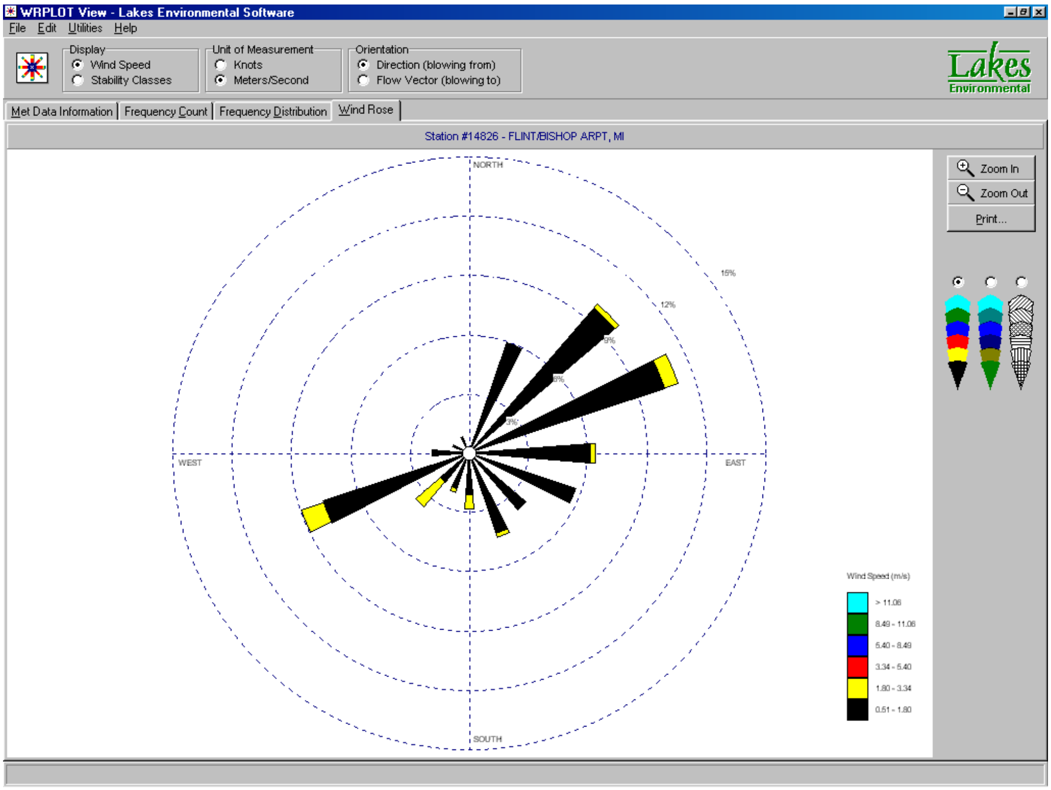

Fig. 1 Distribution of velocities

Simplifying assumptions adopted refers to these aspects (limitations):

* Source keeps issuing considered infinite transmit power, chemical reactions do not occur, the emission is a function which admits a stable solution during the analyzed:
* Gradient wind and the temperature in the layer where mixing occurs with atmospheric plume are constant respectively;
* Distributions across the vertical direction and wind direction are of Gaussian type, the edges of the plume is achieved when the distribution falls below 10% of the principal axis of advancing;
* Best results are obtained for analysis related to land flat on the distance of max. up to 100 km, according to some authors even 200 km. The existence of natural topographical or architectural obstacles, this large water areas in the vicinity affect reliability and performance results;
* Classes Stability refers to conditions stable, unstable and neutral, and to limit their combinations.

The programs offer answers to the various impact assessments for any issuer (stationary, mobile) at any height (reception), regardless of origin or number (industry, combustion equipment, ventilation equipment, intersections, parking garages and tunnels, etc..) size, location (urban or rural), etc..

Determine pollution locally or remotely, as appropriate and transboundary pollution, directly dependent probability density in the range chosen.

Dispersion analysis of substances can be lighter or heavier than air (eg. Typical combustion gases, particles of slag heaps, carcinogenic substances, solid, etc..) Critical situations can simulate fire, burglary and fuel pipelines then switch volatiles, etc..

The program offers options that can calculate the average 30 minutes, daily, yearly, or a defined period of time.

As the input data are more representative and closer to the truth, with both findings are accurate. ISCView4 has the option of graphic processing of results.

On emission concentrations (in the source input) on-line measurement method is indicated, in terms of duration representative

3. Characteristics of pollution sources

In termoelctric Rovinari plant case, stationary sources of pollution are the power units of 330 MW boilers fueled with coal.

The four power boilers are connected to two chimneys, each with a height of 250 m and the tip diameter of 8 m.

Using specialized equipment, were measured monthly average concentrations of main pollutants resulting from combustion of lignite for the chimney stack No. 1 and No. 2: S02, N0x, CO and particulate ash.

They measured the volume of flue gas volume wet and dry flue gas for each chimney.

Results of continuous measurements made during 2009 are presented in Table 1.

Table 1 Measurements of pollutants from chimneys

year 2009	SO_2 (mg/m^3_N)	NO_x (mg/m^3_N)	Dust (mg/m^3_N)	CO (mg/m^3_N)	wet gas volume (mii m^3_N/lună)	dry gas volume (mii m^3_N/lună)
January	3998,22	446,89	141,12	30,22	997140	824569
February	4024,46	498,12	137,14	31,17	884252	713673
March	3897,13	487,46	128,16	32,88	662768	598743
April	3917,80	459,25	140,98	34,15	478654	431128
Mai	3887,61	497,16	124,28	34,76	301239	276542
June	3942,39	486,26	127,75	33,18	688759	611326
July	4112,18	476,82	126,14	31,14	612396	590458
August	4005,39	469,17	128,27	30,88	854238	798768
September	3887,27	491,42	132,54	32,76	589762	525432
October	3994,34	496,85	134,12	33,15	712369	679786
November	4.028,12	476,81	137,67	32,93	889675	825349
December	4.118,36	468,92	128,29	34,16	616598	589674

4. Experimental results

Pollutants dispersion analysis was performed for two different situations: situation S1 (summer) and situation S2 (winter). Characteristics of thermal power plant pollution sources for the two cases analyzed Rovinari are centralized in Tables 2 and 3.

Listed in Table 2 and gas flow rate in exhaust emissions from the chimneys of power in state S1 (summer) and are listed in Table 3 and Table 3 speed exhaust gas flow and the emission through the chimneys of power when S2 (winter)

In Table 4 are calculated immission concentrations of SO2 pollutant that computer program for maximum permitted levels according to STAS 12574-87 analyzed situations S1 and S2. Values calculated immission concentration of sulfur oxides are close to maximum permitted levels STAS 12574-84.

In Table 5 are calculated immission concentrations of particulate pollutant computer program for ash, respectively, according to STAS 12574-87 maximum permissible values for S1 and S2 cases analyzed.

Immission levels calculated values are below the maximum allowable particulate STAS 12574-84.

Şi3 is represented in Figures 2 to 24 hours average distribution of SO2 (in mg/m3N) issued by the chimneys of power for the August episode (case S1) and December (S2 state) in 2009, the ground distance of 5 km, measured from the center of the grid ..

Figures 4 and 5 is represented in 24-hour average distribution of the dust of ash (in mg/m3N) issued by the chimneys of power for the August episode (case S1) and December (S2 state) in 2009, ground, distance of 5 km, measured from the center of the grid ..

Table 2

Nr. crt.	Name	Symbol	U.M.	Measured values
1	Température of burning gazes	t_{gc}	^0C	135
2	Chimney height	H_c	m	250
3	Diameter chimney	D_c	m	8
4	Gas velocity at stack exit	w_{gc}	m/s	16,26
5	Mass flow of carbon monoxide	m_{CO}	mg/s	9876
6	Mass flow of nitrogen oxides	m_{NOx}	mg/s	137963
7	Mass flow of sulfur oxides	m_{SO2}	mg/s	1154238
8	Powder mass flow	m_p	mg/s	49870

Table 3

Nr. crt.	Name	Symbol	U.M.	Measured values
1	Températu12re of burning gazes	t_{gc}	^{0}C	132
2	Chimney height	H_c	m	250
3	Diameter chimney	D_c	m	8
4	Gas velocity at stack exit	w_{gc}	m/s	15,86
5	Mass flow of carbon monoxide	m_{CO}	mg/s	9763
6	Mass flow of nitrogen oxides	m_{NOx}	mg/s	138623
7	Mass flow of sulfur oxides	m_{SO2}	mg/s	1058240
8	Powder mass flow	m_p	mg/s	48975

Tablel 4

Period	SO_{2max} 30min. .	SO_2 max 30min.	SO_{max} 30min.	SO_{2max} 30min.	$SO_{2\ max}$ 24hours	$SO_{2\ max}$ 24ore	SO_{2max} 24hours	SO_{2max} 24hours
	$(C_{max})_{STAS}$ [mg/m^3_N]	$C_{calculated}$ [mg/m^3_N]	X [m]	Y [m]	$(C_{max})_{STAS}$ [mg/m^3_N]	$C_{calculated}$ [mg/m^3_N	X [m]	Y [m]
summer	750	240,2	2918	2598	250	31,8	2926	2956
winter	750	316,8	-1815	-1629	250	20,7	-3165	-3118

Table 5

Period	dust $_{max}$ 30min.	$dust_{max}$ 30min.	dust $_{max}$ 30min.	dust $_{max}$ 30min.	dust $_{max}$ 24 hours	$dust_{max}$ 24 hours	dust $_{max}$ 24 hours	dust $_{max}$ 24 hours
	$(C_{max})_{STAS}$ [mg/m^3_N]	$C_{calculated}$ [mg/m^3_N]	X [m]	Y [m]	$(C_{max})_{STAS}$ [mg/m^3_N]	$C_{calculated}$ [mg/m^3_N	X [m]	Y [m]
summer	500	36,4	0	3400	150	6,4	2948	2956
winter	500	34,8	0	4100	150	1,2	0	4000

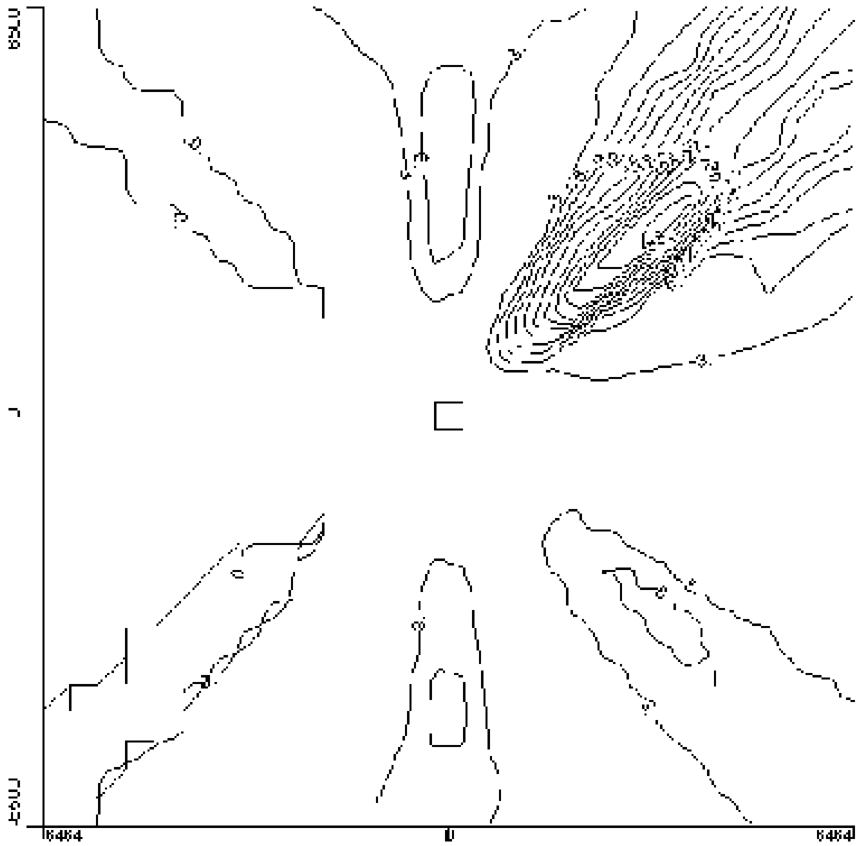

Fig. 2. Distribution of 24-hour average SO2 (in g/m3N)

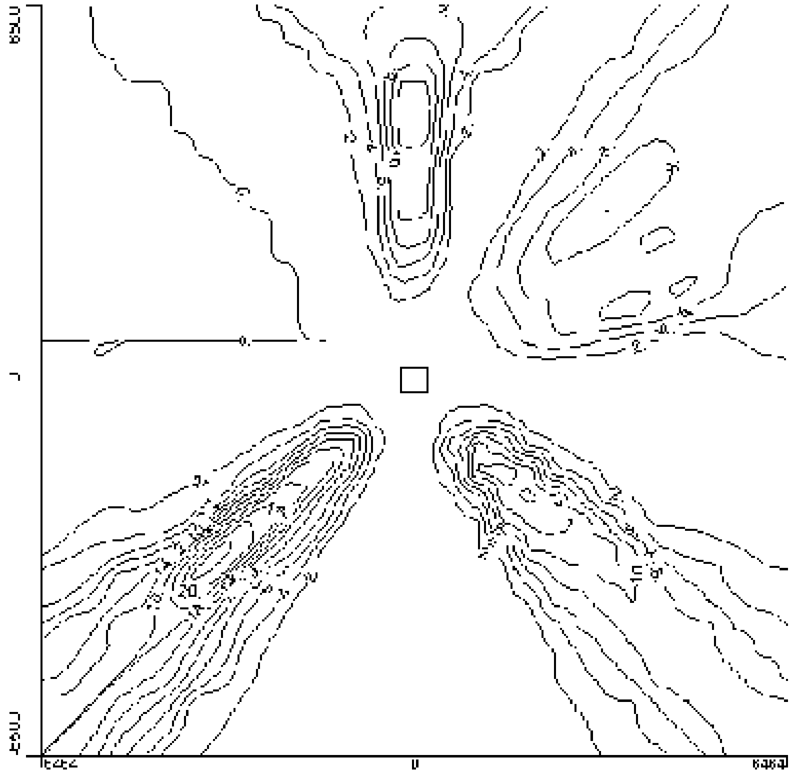

Fig. 3.Distribution average 24 hours of SO2 (in g/m3N)

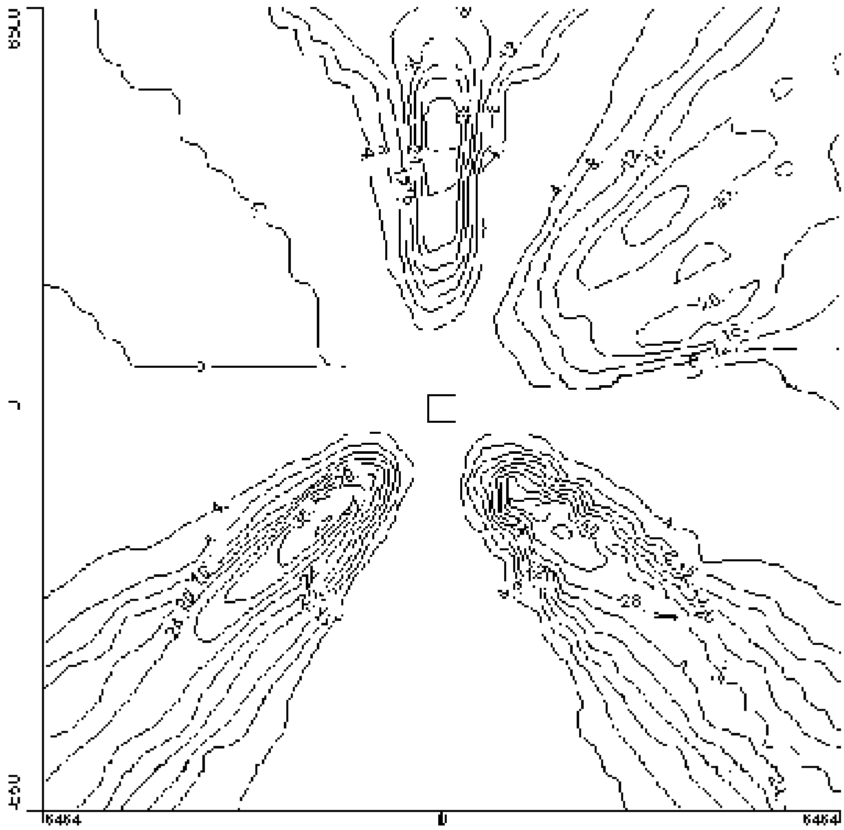

Fig. 4. Distribution of 24-hour average ash dust

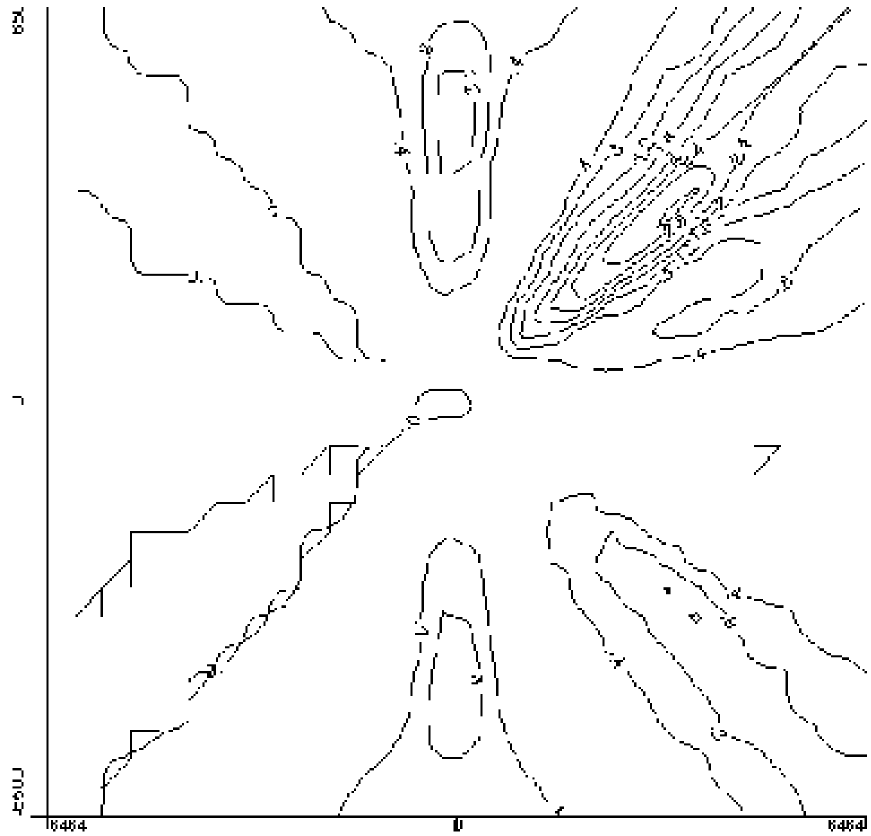

Fig. 5. Distribution of 24-hour average ash dust

5. Conclusions

Results from the analysis by simulating pollutants dispersion maps in power plants is considered that pollution can pull away conclizia not exceed the limits allowed by law.

For each pollutant analyzed can say:

- Max SO2 calc.24ore situation appears S1 to 3.8 km northwest of the central and the state S2 at 3.5 km SE of center.;
- Dust max calc.24ore situation occurs for S1 to 1.9 km SW of the central and the state S2 to 4.2 km northwest of the center.

High chimney height (250 m) which is discharged pollutants into the atmosphere leads to a better dispersion of acesora.Din this reason imissions Rovinari polluting thermal power plant within the limits allowed by law on environmental protection.

Due to high chimney height of the plant, dispersing pollutants in the atmosphere is good, imissions of pollutants falling within the limits allowed by Romanian law on environmental protection.

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