THE IMPACT OF TECHNOLOGICAL ACTIVITIES CONDUCTED AT UAF MITTAL ON THE ENVIRONMENT

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Abstract: *Study of environmental risk assessment for particulate matter (PM10) aims to identify the impact of technological activities undertaken at UAF Arcelor Mittal Galati air and environmental factors on the health of employees and residents of the area adjacent to the company. To choose the best solutions for reducing emissions of particulate matter PM10 will take into account the recommendations of reference documents on best available techniques (BAT) for iron production facilities, developed by the European IPPC (Integrated Pollution Prevention and Control). Reduce particulate matter emissions from major sources identified in this study, firstly the baskets of UAF, shows that the emission rate (concentration) of total suspended particulate exceeds 15g/s.*

Keywords: *particulate matter PM10, dispersion , UAF Arcelor Mittal Galati*.

1. Intoduction

In case studies, we found that PM10 emissions represent 80% of particulate matter, for the baskets of UAF and the coke batteries 2-6 and 90% for other point sources (stacks).

Adverse human health effects due to particle size (the small particles being the most aggressive, unrestrained by dusting plants), but also due to her chemical composition (due to the presence of potentially hazardous compounds, adsorbed on the particle surface, such as heavy metals, volatile organic compounds - VOCs, the trend is observed particularly in fine-sized particles).

Harmful substances find in the industrial area can be grouped according to the effect, in three categories:

- *with irritating, sensitization or acute poisoning*, for these substances the limits (or peak) are the maximum permissible;
- *cumulative effects*, is important in this case the average allowable limits;
- *carcinogenic substances*, for it is difficult to establish clear limits therefore the rules of different countries ranges from banning the substance in workplace air, up to the levels that are hard to justify experimentally.

Typical air pollutants resulted are: particulate heavy metals, CO_2, CO, SO_2, NOx, VOC. They are supplemented by emissions quantitatively less important, but more toxic, and organochlorinated chloride, dioxins, PCDDs, fluorides, etc..

Air pollution (from point sources or continuous) can be transported at long distances, it can disperse in the air or at ground level can reach by precipitation or sedimentation, and other factors affecting the environment [1].

So they are involved in: climate change - CO_2, CO, NOx, N2O, VOCs, CH_4, photochemical pollution - NOx and VOC, ozone layer destruction - VOC (HCF, CFCs, HCFCs), acid rain - SO_2 and NOx, ecotoxicity and human toxicity - some volatile organic compounds (PAHs, BaP, dioxins, dibenzofurans, etc.) and some heavy metals (As, Pb, Cu, Zn, Ni, Cr, Cd, etc.).

2. Researches and experimental results

The main sources of air pollution from ore agglomeration:

- preparation of raw materials (crushing, sieve, mixing, handling, transport) and tape loading - resulting in emissions of dust; gaseous fuel combustion furnace ignition source is an emission of CO_2, CO, N_2O, NOx, heat, SO_2, VOC including

CH4; combustion of coke fines in the sinter layer is the main source of emissions of CO_2 and CO, N_2O, NOx, SO_2, VOC; the agglomeration process steel; NO :440-710g / t steel; CO :13000-43000g / t steel; VOC: 150g / t steel, HF (florhidric acid) :1,4-3, 5g / t steel; HCl :17-65g / t steel**.**

Atmospheric pollutant dispersion models is an expression of physical-chemical simulation, which link between the source of pollution (emission) and fields of pollutant concentration [2].

The input data required for mathematical modeling of atmospheric dispersion are grouped into the following categories: meteorological data, as such, characterized by the following reported emissions per tonne of steel
: powders:170-280g / t steel; SO :900-1850 g /t source parameters, the network of receivers, topographical data.

The model used for the dispersion of particulate matter is the Industrial Source Complex 3-ISC3, the software being used ISC-AERMOD View, developed by Lakes Environmental Software, Canada and used for assessment and regulation legislation, both the U.S. and for renewable UE. The sources for industrial complex (ISC3) enables modeling generated a wide range of sources that may be present in industrial activity.

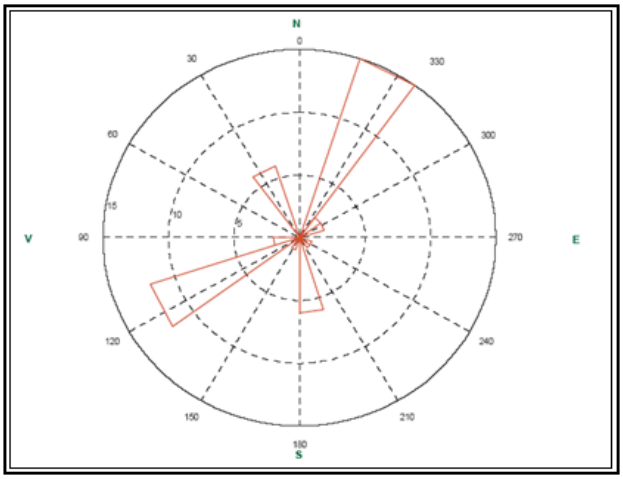

Figure 1. *Galati wind zone in 2012.*

One of the meteorological parameters that influence the dispersion of air pollutants is the wind on the ground. Depending on the frequency of wind directions, speeds and the location of its sources of pollution, some areas are more or less exposed to harm. The annual variation in frequency of occurrence of wind on the ground shows the highest values for the N-W, followed by S-W direction. Figure 1 presents the compass of Galati in 2012.

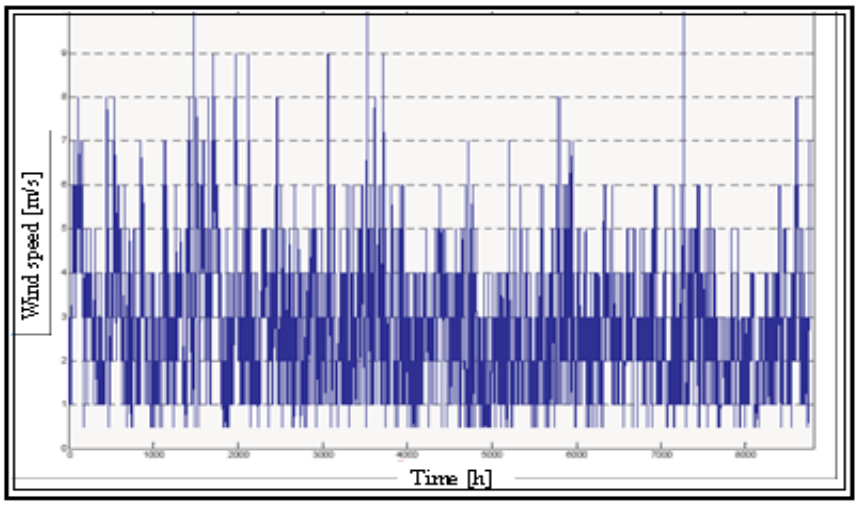

Figure 2. *Hourly wind speed variation in the Galati in 2012.*

Annual average wind speed on the ground in 2012 was 2.74 m / s highs being 10 m/s. Figure 2 shows the hourly wind speed variation, namely the distribution of frequency of occurrence [3].

To obtain a real image of the emisions there are been made simulation of particle dispersion in function of polutants (total particulate matter and suspension particulate, PM10 fraction), emission sources and receiver. (table 1).

As punctiform sources of emissions in all the prognosis scenarios are taken in to consideration all the baskets presents in the Arcelor Mittal SA Galati area (60 baskets).

In other prognosis scenarios are taken into account the two baskets from the Electrocentrale Galati and the five baskets that are burn gas fuel (methan gas, coke gas, furnace gas) from the 2 – 6 coke batteries according to the measurements.

Table 1. *Prognosis for the dispersion of particulate matter*

Case study	Poluant	Point sources	Receiver
1	Total particulate matter.	baskets AMG	P2, P3-border
			P1-Brăila
2	Particulate matter (PM10)	Baskets AMG+ baskets Electrocentrale Galaţi	P4 – Movileni P5 – Şendreni P6-P10 – Galaţi
3	Particulate matter (PM10)	Baskets AMG + baskets Electrocentrale Galaţi +other sources AMG	P4 – Movileni P5 – Şendreni P6-P10 – Galaţi

Dispersion of total suspended particulate concentration daily (max value in 2012) in the border area is shown in figure 3 and the annual concentration is shown in figure 4.

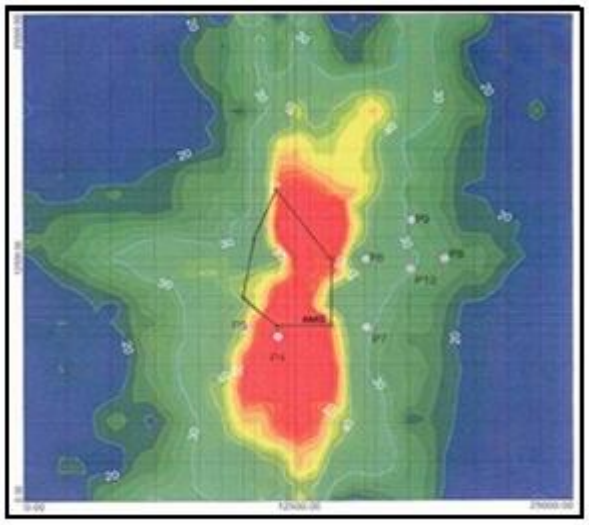

Figure 3. *Dispersion of total suspended particulate. Daily concentration (val. max. in 2012)*

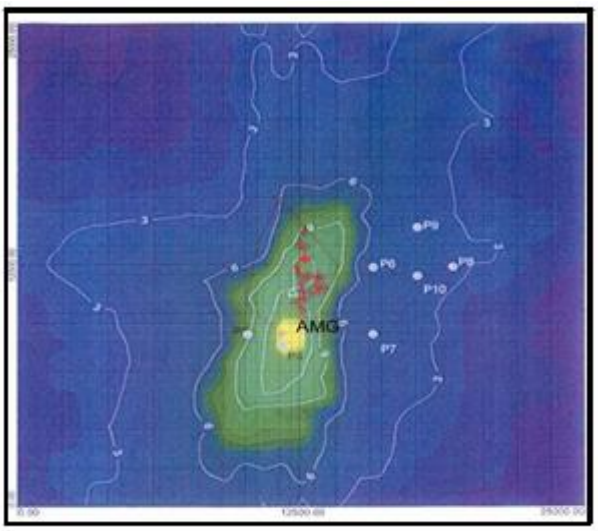

Figure 4. *Dispersion of total suspended particulate. Annual concentration 2012.*

It appears that there is transboundary pollution due to Arcelor Mittal Galati, on the eastern border, for particulate matter, table 2.

Table 2. *Particulate matter- border area.*

Receiver	Daily maximum concentration, µg/m3	Daily concentration limit value PM10, µg/m3	
		2011	2012
P2	17,71	58,34	50
P3	10,20	58,34	50

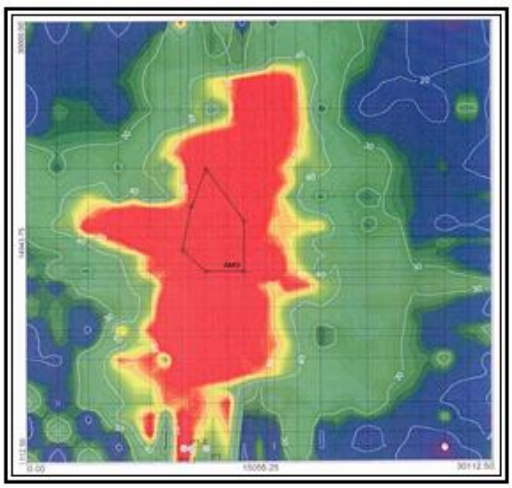

Figure 5. *Dispersion of total suspended particulate. Daily concentration in 2012.*

Figure 6. *Dispersion of total suspended particulate. Annual concentration in the year 2012.*

Dispersion of total suspended particulate concentration daily (max val. in 2012) in Braila area is shown in figure 5 and the annual concentration is shown in fig. 6.

Figure7. *Analyzer portable type Casella-PM10 used to capture, analysing and concentration of particulate matter.*

Lab environment of Arcelor Mittal by Galati, using appliances to capture, analysing and concentration of particulate matter, figure 7 and

It appears that there are very rare in Braila area exceeded the daily emission concentration values total suspended particulate due to activities of support sampling PM10 (receiver) consisting of total filter dust figure 8a, and dust filter PM10 figure 8b.

Arcelor Mittal Galati and only when weather conditions are favorable, table 3.

Table 3. *Case Study - Braila area*

Receiver	Concentration daily maximum total suspended particulate µg/m3	Daily concentration limit value PM10, µg/m3	
		2011	2012
P1	25,22	58,34	50
P1.1	66,50	58,34	50
P1.2	56,53	58,34	50

Emissions due to other sources besides standing in Braila area (construction, local transport, soil dust, industrial sources, etc.), the contribution made by sources of particulate matter in Arcelor Mittal Galati (and evaluated through dispersion made in case No. 2 study) May lead to exceedances of limit values for 24 hours (1-2 days per year). P4 receptor (Movileni) exceeds the maximum limit value, both in 2009 and one in 2012 [4]. The limit value of 2011 there were 12 exceedances of it, representing 3.28% of total calendar days, and differed from the 2012 overshoot was 34, representing 9.31%.

a) **b)**

Figure 8: ***a)*** *Support sampling PM10 (receiver) Total filter dust* ***b)*** *Support sampling PM10 (receiver) Dust filter PM10*

Thus Movileni residents can be exposed for short periods of acute episodes of pollution, with negative effects on their airway. It can be said that the environmental risk of PM10 emissions faced by the rural population Movileni, Sendreni and Galati is relatively low, except for brief periods in the village Movileni (Table 4). Even in this latter case, be kept in mind that exposure to concentrations above maximum permissible limit is not continued [5].

Analyzing the results of measurements for particulate matter PM10 emission "shows the following: the East Gate of PM10 averages vary between 50.16 to 73.87 μg/m3, the South Gate of PM10 averages vary in the range 48.85 -67.83 μg/m3. It appears that appear above the respective maximum permitted under the General Norms of Labour Protection, which can have adverse effects on health of employees.

Table 4 . *Annual concentrations of PM10 values*

Receiver	Location receiver	Annual PM10 Concentration, μg/m3	PM10 annual limit value concentration, μg/m3	
			2011	2012
P4	Movileni	16,34	46,68	40
P5	Sendreni	7,53	46,68	40
P6	Galati	5,33	46,68	40
P7	Galati	4,24	46,68	40
P8	Galati	3,19	46,68	40
P9	Galati	3,67	46,68	40
P10	Galati	4,38	46,68	40

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Leaders entities are required to provide security and protect workers health through a series of specific activities including assessment and risk of injury and disease at work 3 [6].

3.Conclusions

Inside the plant has obtained the maximum values for concentrations of total suspended particulate (TSP, Case Study No. 1): maximum daily concentration: 177.43 μg/m3; There are very rare in Braila area exceeded the daily TSP concentration values (due to activities of AMG), under certain weather conditions. Inside the plant has obtained the maximum values of particulate matter PM10 concentration (Case Study No. 2): 102.49 daily maximum concentration μg/m3; annual concentration - 17.63 mg/m3.annual concentration: from 21.27 to 22.01 μg/m3. It appears that there are daily exceedances of the maximum permissible concentrations of PM10 in the village Movileni (mainly due to activities of AMG) but an integrated part of the maximum acceptable number of exceedances MAPPM Order 592/2002 (35 values). Inside the plant, have obtained the following maximum concentrations of particulate matter PM10 (Case Study No. 3): maximum daily concentration - 116.83 μg/m3; annual concentration - 18.95 μg/m3; It appears that there are daily exceedances of the maximum permissible concentrations of PM10 in the village Movileni (mainly due to activity in AMG), but fall within the maximum acceptable number of exceedances MAPPM Order 592/2002 (35 values).

Annual concentrations are found there exceeded in any of the 7 receptors considered. In order to comply with environmental requirements in the coming period and future, Arcelor Mittal Galati should take the following measures: reduction of particulate matter emissions from major sources identified in this study, the first baskets of the UAF, the rate of emission (concentration) of total suspended particulate (TSP) exceeds 15g/s.

References

[1] M.Balanescu, M.Hritac, I.Melinte, A. Nicolae, *Environmental impact assessment of industrial accident using ISC- AERMOD View, A case study*, in vol., 9th International Conference on Harmonisation with atmospheric dispersion modeling for regulatory purposes, Garnisch-Partenkirchen, vol II, 2004, p.346-351, Ed. Deutscher Forschungszentrum, Germania.

[2] I. Adrian, *Generation and emission prevention for electric arc furnace steel*, Proceedings GEPROPOL 2007, Bucuresti, 8-9 July 2007, ISBN 978-973-718-751-2, p. 98-105.

[3] Ph. Duchene, E. Cotteux, S. Capela, *Applying fine bubble aeration to small aeration tanks*, Water Science and Technology, vol. 44, no. 2-3, 2001, p.203-210

[4] G. Deronzier, Ph. Duchene, A. Heduit, *Optimization of oxygen transfer in clean water by fine bubble diffuset air system and separate mixing in aetation ditches,* Water Science and Technology, vol. 38, no.3, 1998, p.35-42.

[5]. W. D. Deckwer, Bubble column reactors, Ed. John Willey and Ions, New York, 1992

[6]. A. Ioana, *Ecological aspects and solutions in EAF"s Line of work*, Journal The Danube River Environment & Education, no. 3, 2005, ISSN 1583- 7513, Tulcea, 2005.