Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium, Volume 21, No. 1, ISSN 1726-9679
ISBN 978-3-901509-73-5, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria, EU, 2010
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Annals of DAAAM International

STATISTICAL MODEL FOR ENVIRONMENTAL IMPACT ASSESSMENT

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Abstract: *In the operating processes from foundries environmental pollutants are emitted. It is important to know as precisely as possible the parameters of pollution sources to determine the degree of harm and ways to reduce these sources. The paper presents some aspects of environmental impact analysis in a foundry.*
Key words: *Pollution in foundries, environmental impact, time series*

1. INTRODUCTION

Foundries are industries with high pollution due to processes specific to these segments. Pollution event involves the need for careful monitoring of pollution sources and creation of appropriate legislative framework.

Environmental protection is a permanent concern of scientists and all those who feel uncontrolled pollution as a factor that can also cause significant economic losses and irreversible ecological imbalance (Rusu, 2002). Health and safety at work, emissions from metal casting, debate and waste disposal activities are just a few issues facing the worker from foundries.

The main pollutants factors in a foundry are: dust, dust sediments, fumes, aerosols, toxic gases, noise, thermal radiation, wastewater, solid waste that included heavy metals, oxides, organic materials, etc. (Voicu, 2002).

2. MATERIALS AND METHODS

The data used are the result of measurements and analysis carried out in a cast iron foundry.

To determine the immissions, samples were taken at the limit iron casting chamber. For determination of particulate matter a device type Casella AMS 950 IS was used.

Sampling of gas at the boundary perimeter of iron casting was performed under the same control points where air samples were taken.

Measurements were made with a gas analyzer type Bacharach model CA 300 NSX.

3. THEORETICAL ASPECTS AND RESULTS

Setting pollution index was made after the relation

$$I_p = \frac{Cm}{C.M.A.} \quad (1)$$

where *Cm* is the amount of measured pollutant and CMA the maximum permissible concentration, (Andrei & Stancu, 1995).

In order to study the environmental impact the following environmental factors were taken into account: air, water and soil. Research has enabled quantitative assessments of pollution levels in areas considered.

Evaluation of the impact of environmental pollution sources are based on the creditworthiness scale expressing its state of

$I_p = \frac{C_{max}}{C.M.A}$	N_B	Environmental effects
0	10	Quality of the environmental factors is natural
0÷0.25	9	No effect
0.25÷0.50	8	Environment is affected in the allowable limits, level 1
0.50÷1	7	Effects are not harmful, within acceptable limits, level 2
1÷2	6	The environment is affected more than acceptable limits, at a level 1
2÷4	5	The environment is affected more than acceptable limits, at a level 2, harmful effects
4÷8	4	The environment is affected more than acceptable limits, at a level 3, harmful effects
8÷12	3	Degraded environment, level 1
12÷20	2	Degraded environment, level 1
>20	1	Environment is unsuitable for life forms

Tab. 1. Values of creditworthiness scale

deterioration in notes 1 to 10, note 1 representing a situation particularly serious and irreversible of the examined environmental factors, as we can see in Table 1 (Baron et al., 1991).

Assessment of air environmental factor was based on data derived from measurements at immission. Measurements are average short momentary samples (30 minutes).

Three samples were taken within two days and results are summarized in Table 2. The calculated pollution index has values between 0.32÷1.5.

Therefore, on the scale of creditworthiness we deduce a note N_B*=6*.

Relative to soil environmental factors, measurements and values of quality indicators for wastewater samples taken at entry and exit of the settle are illustrated in Table 3.

Pollution index values between 1.16÷3.97 lead to a creditworthy note 5.

Monthly variation of total suspension of wastewater during IV 2009-III 2010 is summarized in Table 4.

Pollutant	Cm (mg/m^3)	$C.M.A.$ (mg/m^3)	I_p
Suspension powders	0,16	0,50	0,32
CO	6,35	6,00	1,06
NO_2	0,45	0,30	1,50

Tab. 2. Pollution indices of air environmental factor

Pollutant	Cm (mg/dm^3)	$C.M.A$ (mg/dm^3)	I_p
Total suspension materials	238.00	60.00	3.97
Chemical consumption of O2-KMnO4	46.25	40.00	1.16
Ammoniacal nitrogen	3.40	2.00	1.70
Chlorides	1974.00	500	3.95
Filtered residue	7420.00	2000	3.71

Tab. 3. Pollution indices of soil environmental factor

Month	Average suspension mg/dm^3	Pollution index
IV	69,45	1,39
V	62,17	1,24
VI	53,23	1,06
VII	60,45	1,21
VIII	51,35	1,03
IX	58,00	1,16
X	63,12	1,26
XI	78,60	1,57
XII	38,60	0,77
I	41,35	0,83
II	40,00	0,80
III	37,48	0,75

Tab. 4. Monthly variation of total suspension of wastewater

Using data from Table 4 can be built a dynamic series of moments formed by medium suspension indicator.

Each value, based on the time characteristic dynamic range (X), is related to a moment of time well specified on the time axis.

The general form of time series is:

$$t:\begin{pmatrix} t_k \\ x_k \end{pmatrix} \quad k=\overline{1,12} \tag{2}$$

where t_k represents the characteristic time variations.

Trend of the indicator, over time, is plotted in Figure 1, called series cronograma.

Graphical representation highlights the seasonal nature of time series and thus it is the result of seasonal factors that typically occur during the year.

Primary series will form a dynamic range that has on the second row relative indicators with a fixed base as we can see in Table 5.

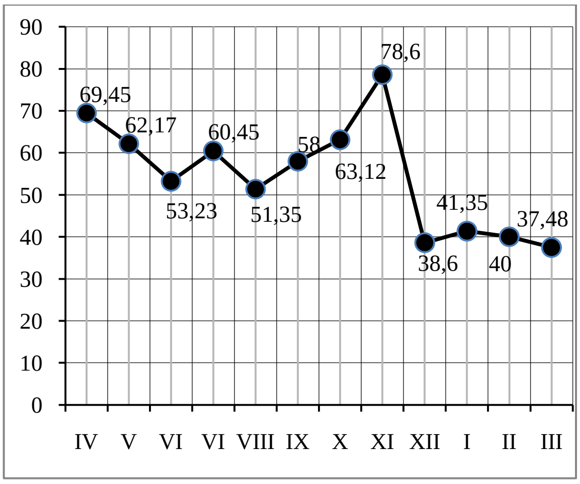

Fig. 1. Average monthly index of the suspension relative to the quality of wastewater

Month	I	II	III	IV	V	VI
$I_X^{i/j}$	110,60	106,60	100,00	185,30	165,30	141,30
Month	VII	VIII	IX	X	XI	XII
$I_X^{i/j}$	161,30	137,30	154,60	168,00	209,30	102,60

Tab. 5. Relative indicators with a fixed base

The relation used for computation is

$$I_X^{i/j} = \frac{x_i}{x_j}\cdot 100, \tag{3}$$

where *i,j* represents the month and x_i pollution index, adequate to the month i, $i=\overline{1,12}$.

Dynamic series consists of fixed-base indices provide information on the extent to which increased pollution index in each month compared to March, taken as reference month, which has the lowest pollution index.

For example, the value $I_X^{6/3}=141{,}3\%$ shows that the pollution index rose in June, to a rate of 141, 3%.

The role of this series is reflected at least in two aspects: it is both about the value of information itself and the possible future use of these results in anticipation research.

4. CONCLUSIONS

According to these results we can say that the activities of the studied iron foundry determine certain actions outside the allowable limits, causing disruption of life forms and ecological imbalances.

Therefore, it is necessary to take measures to modernize the design of new equipment and facilities, which themselves are generating the least polluting products.

Also it is required to rigging up the existing machinery and plants which generate pollution with collection facilities, evacuation and neutralization pollutant emissions, reduced raw material consumption and using more effectively, implementing new technologies that are much closer to cleaner technologies, where the quantities of pollutants and waste will be much reduced, thereby decreasing the volume of data monitored.

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