CONTRIBUTIONS ON THE ENVIRONMENTAL IMPACT OF SECTIONS OF THE FOUNDRY AN ENTERPRISE TECHNOLOGY EQUIPMENT

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ABSTRACT: The paper presents a method for determining the key pollutants that occur in a polling foundry substances and emissions of polluting substances, pollution coefficient calculation, calculation of indicators of environmental quality and pollution cumulative synergy. It presents and analyzes experimental results obtained from measurements for main sources of pollution in a foundry department: making furnace, heat treatment furnace and cabin sablare. Se make determinations for the main pollutants: particulate matter, the amount of CO, the amount of SO2 and NO2 quantity and compared with the maximum permissible concentration, in accordance with Order 756/97
Keywords: impact, environment, foundry, coefficient, pollution,

1. INTRODUCTION

Interest and priority industrial organization analyzed in the current period and in the future is the high quality of its products and services, care for the environment and working environment, caring for the reduction of pollution is determined both by improving processes and by making products that pollute as little.

The organization analyzed industrial engineering enterprise is an extremely complex, which manufactures equipment for nuclear power plants using highly developed production processes and complicated. Production processes are a sum of complex technological processes, after which processed metals and alloys from development to the finished part and during which manifests almost all physical phenomena, chemical, mechanical and electrical known. In time for the process they are issued in the working environment and the natural environment a number of pollutants affecting all environmental factors: air, water, soil, subsoil, flora, fauna, living beings and their relationships.[2].

The main objective of this work is to establish and determine the impact environmental impacts of industrial organization analyzed taking into account both the work environment and the natural environment. Space is considered the working environment in which they operate all operators participating in technological processes and enterprise space around the natural environment within a radius of 500 m.

Specific objectives imposed by the overall objective were:

- establish a method for determining and assessing the environmental impact of work appropriate to each process equipment production important in terms of existence as a source of pollution (making metals and alloys, blasting, heat treatment, casting itself);
- realization an experimental stand universal, allowing the concentration of pollutants resulting from technological process and nature of pollutants affecting environmental factors;
- the establishment of methods and technology for determining and assessing the environmental impact of industrial organization naturally produced.

2. RESEARCH METHODOLOGY

To achieve the objectives, research began making a detailed analysis of the current status on physical-geographic geographical area in which there is industrial organization with geomorphology, morphology and lithology appropriate environmental.[1,14].

Methodical research and experimental program were prepared by: the nature of technological equipment that make up the production process of casting; nature of physical phenomena, chemical, mechanical and electrical changes accompanying materials during the casting process nature of pollutants emitted during the technological process and the method of determining and assessing the environmental impact on the natural environment and work product of industrial organization.

The generally, research methodology involved the following steps:

- analysis of the technological process of casting different pieces of equipment for technological achievement;
- establishing the main stages of the technological occur pollutants;
- determining the nature of pollutants and environmental factors affected by pollution from them;
- realization of a technology for determining the concentration of each pollutant and an experimental stand universal enabling accurate determination of these substances in different locations of the technological process;
- developing an experimental program determinations in both the work environment and the natural environment, according to each polluting source and synergist;
- definition of pollution coefficients for calculating the coefficient of partial and total pollution;

Experimental research program and methodology were designed so the resulting solutions can be easily extended and applied in any engineering enterprise, without requiring additional expenses from potential beneficiaries.

3. EXPERIMENTAL RESULTS

Determination and environmental impact analysis of a technological process or a technological process through which the component / assembly of a nuclear equipment are very difficult to achieve because:

- the impact is different depending on where the determination is made, however, with many factors contributing to a very different distribution of substanțerlor polluting the environment;
- there are many elements of impact (dust, micropowders, dusts, fumes, gases, volatile organic compounds, ozone, hydrocarbons, persistent organic pollutants, suspensions minerals, etc.) that occur during the course of a technological process, which are more difficult to determine whether they are in small quantities, whether it requires special sensors;
- there are many factors that influence the process, which differs from process to process, from process equipment to equipment, the technological method to technological method, from the nature of materials to be processed and ending with testing conditions, testing and commissioning in function;
- is difficult to establish with precision the equation of mass balance to compute the index of environmental quality because it can not to realize a universal stand complex for determining the impact of all factors at once and concentration that contains them during the course of the technological process and after the technological process;

3.1 The equipment used for measurements in the experimental program

The measurements were performed according to a methodology established experimentally and in accordance with Order No. MAPPM. 462/93 in normal operating conditions in terms

of technology. Schematic diagram of the experimental stand designed and conducted experiments presented in figure 1.

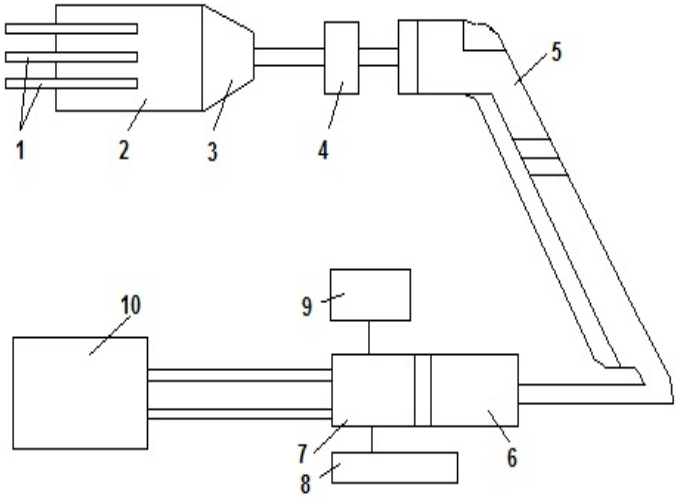

Figure 1. Schematic diagram of the experimental stand for measurement:
1- senzors; 2 - pomp taken; 3 - oven; 4 – aspiration pump; 5 – actuating- handle;
6 - filter elements; 7 - protection elements; 8 - condensate reservoir; 9 - microcontroller;
10 – tehe display information

For the determination of combustion of gas (O2, CO, NO2, SO2, CO2) was used MEGALYZER 9600 type analyzer with standard equipment that has been added to a number of specific sensors determining the certain pollutants.

3.2 Experimental determinations zonal

Measurements were made at the workplace for the main technological equipment in existing foundry department, considered to be the main sources of pollution.[1.13]

Determining the environmental impact produced by sandblasting cabin.Sandblasting cabin has a volume of 5000 m3 and is intended for surface cleaning operation castings being provided with the following equipment, sandblasting facility consisting of: - sandblasting vessel, which is a reservoir of corundum are putting pressure; - mixing chamber air - conrindon; - resistant hose sandblasting cap finished in the body composed port nozzle and nozzle; corundum recovery equipment necessary; capture facility and retaining fine dust of corundum.

În operation after cleaning different surfaces results in a wide range of powders fine corundum. Corundum is crystallized alumina Al_2O_3 (mineral) containing 95 ... 99% alumina with minor amounts of iron oxide, magnesia, silica and others. Cabina sandblasting is equipped with an exhaust system consisting of a loaded machine which comprises a chimney dust forced draft.

The car is equipped with dust evacuation system fitted with exhaust openings, piping, cyclones retaining powders (2 pieces), evacutaion fans and chimneys (2 pieces). [1,9,10].

Determinations were made in the normal course of the technological process and where a hidroclon is in operation but is not supplied with water (there is a danger of frost) realizing extraction and dust from sandblasting cabin but not detention their water film. A hidroclon not been put into operation because the rotor was damaged.Experimental determinations made under the conditions above have led to the results shown in table 1 and table 2. car loading, for hidroclon.

Table 1. Level of particulate emissions from equipment charged

Pollutant	Concentration [mg/mc]	Average concentration +10% error [mg/mc]	The average mass flow [kg/h]
Corundum powder	116,4 129,3 121,0 112,6 118,8 126,5	132,85	0,43 kg/h

From the results shown in Table 1. Experimental that corundum powder with average concentration of 132.85 mg / m exceeding over 2.6 times VLE according to Order 462/93, but it falls within the mass flow (0.5 kg / h).

Table 2. Level of particulate emissions from hidroclon

Pollutant	Concentration [mg/mc]	Average concentration +10% error [mg/mc]	The average mass flow [kg/h]
Corundum powder	78,3 83,6 101,8 94,5 75,0 80,4	94,16	2,34

From the results shown in table 2 that the emission of dust to fall within the VLE hidroclon.[12].

3.2.1 Determine the impacts on the natural environment produced by furnace thermal treatment.

The furnace has a maximum load of 550 t and is used 1-2 times / year; for tempering, heat treatment lasting up to 48 hours.

The main features of the oven are used fuel: natural gas consumption 1760 NMC / h; the number of burners: 8 pieces.

The main pollutants that have been found are: particulate matter, carbon monoxide, sulfur dioxide and nitrogen dioxide.

For evacuation Evacuation system is used (the oven is equipped with 3 chimneys exhaust flue) with identical characteristics.

The measurements were made during the normal operation (pimples).

The oven operates with excess air technology to ensure the necessary required heat treatment.[1,7,8].

The determined values for the concentrations of polluting substances (dust, CO, SO_2 and NO_2) are given in table 3.

Table 3. The emission of pollutants from furnace thermal treatment

Source	The Pollutant	The measured concentration [mg/mc]	Concentration converted to 3% vol. O_2 in flue [mg/Nsmc]	The average concentration + Error [mg/Nmc]	The average mass flow [g/h]
1	*2*	*3*	*4*	*5*	*6*
Basketful nr. 1	PST	1,18 1,14 0,95 1,40 1,25 1,13	1,34 1,30 1,08 1,60 1,42 1,29	1,47	19,53

Source	The Pollutant	The measured concentration [mg/mc]	Concentration converted to 3% vol. O_2 in flue [mg/Nsmc]	The average concentration + Error [mg/Nmc]	The average mass flow [g/h]
1	*2*	*3*	*4*	*5*	*6*
	CO	21,3 23,6 24,0 25,2 22,8 23,2	24,28 26,90 27,36 28,73 25,99 26,45	27,95	371,32
	SO_2	0,80 SLD SLD 1,20 1,14 1,00	0,91 - - 1,37 1,30 1,14	0,83	11,03
	NO_2	78 75 80 69 83 72	88,92 85,50 91,20 78,66 94,62 22,08	91,17	1211,19
Basketful nr. 2	PST	0,98 1,22 1,18 2,00 1,16 1,00	1,08 1,34 1,30 2,20 1,28 1,10	1,52	20,55
	CO	18,5 21,3 20,0 19,6 19,0 22,4	20,35 23,43 22,00 21,56 20,90 24,64	23,25	314,34
	SO_2	1,12 0,68 0,35 1,20 0,85 0,50	1,23 0,75 0,38 1,32 0,93 0,55	0,90	12,17
	NO_2	112 108 125 98 120 118	123,2 118,8 137,5 107,8 132,0 129,8	131,09	1772,33
Basketful nr. 3	PST	1,65 1,38 1,44 1,21 1,30 2,18	1,95 1,63 1,70 1,43 1,53 2,57	1,98	25,66
	CO	26,2 24,4 25,8 25,0 24,6 28,2	30,91 28,79 30,44 29,50 29,03 33,28	31,84	412,65
	SO_2	0,65 SLD 0,93 0,48 SLD 1,14	0,77 - 1,10 0,57 - 1,35	0,66	8,55

Source	The Pollutant	The measured concentration [mg/mc]	Concentration converted to 3% vol. O_2 in flue [mg/Nsmc]	The average concentration + Error [mg/Nmc]	The average mass flow [g/h]
1	*2*	*3*	*4*	*5*	*6*
	NO_2	73 66 68 70 75 66	86,14 77,88 80,24 82,60 88,50 77,88	86,32	1118,71

Note:Error ± 10% for powder, Error ± 5% - CO, SO2, NO2

3.2.2 Determining the environmental impact produced by casting proper

Steel and iron foundry receives developed under electric steelworks in the medium frequency induction furnace and enables parts with gross weight of up to 250 t**.**Casting department has: an automated preparation station forming mixture Minimix type -1 piece; mill and regenerated mixture formation - one piece; cooling furnace with a capacity of 6 t - 2 pieces; plant Sandblasting - 2 pieces; heat treatment furnaces - seven pieces; modeling for making models; workshop reshuffle; dry cleaning shop.To determine the impact on the work environment and the health effects of pollutants on human operators have made numerous measurements even in working areas of the operators using the experimental stand presented.[3,5]. Using material balance equation (input-output) have established the main pollutant emissions and by-products that result from technological process of molding a piece in soil foundry, presented in table 4.

Table 4. Polluting emissions and by-products resulting from the realization of a piece molded from a mixture of the usual training ground foundry, expressed in kg / t molded piece

Nr. crt.	Emission or polluting by-products	U.M.	The maximum amount
1	Dust in the air	Kg/t	64,8
2	CO	Kg/t	306,2
3	CO_2	Kg/t	8522,0
4	SO_2	Kg/t	160,1
5	SO_4	Kg/t	201,7
6	NO_x	Kg/t	7,3
7	NH_3	Kg/t	8,1
8	H_2S	Kg/t	16,7
9	Flue gas(more)	Kg/t	12799,4
10	Heavy metal particles	Kg/t	12,4
11	Slag	Kg/t	157,3
12	Splash	Kg/t	18,9
13	Scrap metal	Kg/t	278,2
14	Volatile organic compounds (COV)	Kg/t	64,2
15	Powders volatile	Kg/t	30,6
16	The vapor	Kg/t	42,3
17	Steam	Kg/t	256,2
18	Refractory waste	Kg/t	7,8
19	Powders	Kg/t	42,6
20	Aromatic hydrocarbons	Kg/t	37,9
21	Dioxins and furans	Kg/t	33,0
22	Hexaclorbenzenw	Kg/t	7,2
23	Oils	Kg/t	6,8
24	The reusable mix	Kg/t	10337,0
25	Wood wastes	Kg/t	48,2
26	Used water	Kg/t	550,5
Total		Kg/t	34019,0

The impact on the work environment was assessed using a coefficient of pollution pouring Cpt calculated with a formula deduced from mass balance equation of the form:[1,2,9]

C_{pt},= Q_{tp} ·Q_e [kg emisii] (1)

where: Q_{tp}s total emissions and substances emitted in the environment, emissions in kg / 1 ton molded piece;Q_e,- mount of material castings, cast material in tonnes.

The total amountQ_{tp}be calculated with:

Q_{tp}= Q_{tpa}+ Q_{tpl}+ Q_{tps} [kg emisii] (2)

where: $Q_{tpa}$is the amount of pollutants emitted into the atmosphere, emissions in kg / 1 ton molded piece; Q_{tpl} – the amount of water pollutant, emissions in kg / 1 ton molded piece;Q_{tps} – the amount of pollutant soil emissions in kg / 1 ton molded piece.From measurements made during a single work shift, where the process takes place normally, the average samples taken from the work areas were found the following: inhalable particulate.

- concentrations containing SiO_2, aerosol and fumes from various metals exceeds the CMA Order no. 1957/1995 in all investigated areas and in different proportions;
- concentrations of formaldehyde exceed the CMA Order no. 1957/1995, in the MINIMIX;NOx concentrations exceed the value of the CMA Order no. 1957/1995 in all investigated areas and in different proportions;
- CO concentrations exceed the value of the CMA Order no. 1957/1995 in all investigated areas and in different proportions;[1,8]
- white spirit concentrations exceed both the value of the CMA Order no. 1957/1995 in all investigated areas and the average amount admitted;;
- xylene concentrations exceed both the value of the CMA Order no. 1957/1995, in all the investigated areas of 100%, and the average value permitted;
- iron oxide concentrations exceed both the value of the CMA Order no. 1957/1995 in all investigated areas and in different proportions;

4. CONCLUSIONS

The environmental impact is different depending on where the determination is made because many intervening factors that contribute to a very different distribution of environmental pollutants.

There are many elements of impact (dust, micropowders, dusts, fumes, gases, volatile organic compounds, ozone, hydrocarbons, persistent organic pollutants, suspensions minerals, etc.) occurring during the course of a technological process, which are most often difficult to determine, whether in small quantities or that require special sensors.

Our analysis and evaluation of experimental results obtained are as close to reality was a stand designed for universities, logistics experimental determinations in which the most important is the type analyzer MEGALYZER 9600.

To determine the impact on the natural environment in an industrial organization determinations were made after different directions in different areas and under certain atmospheric conditions for major pollution sources: sandblasting cabin, thermal treatment furnace and pouring proper

The analysis of experimental results showed that corundum powder machine-loaded with a concentration of 132.85 mg / m3 VLE exceed more than 2.6 times under Order 462/93, but it falls within the mass flow (≥ 0.5 kg / h) and the hidroclon the emission of dust falling into the VLE.

The determinations for thermal treatment furnace main pollutants (dust, CO, SO_2, and NO_2) found that concentrations of four pollutants fall in VLE, according to Order 462/93, which is below the alert praguirile date Order 756/97.

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