CONTRIBUTIONS REGARDING IMPACT ON THE NATURAL ENVIRONMENT OF A NUCLEAR EQUIPMENT BULIDING COMPANY

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Abstract: *Paper presents how to determine the environmental impact of nuclear equipment manufacturingcompany. Here are analized the most important sources of environmental pollution (booth blast, furnace annealing and thermal plant) and principal emissions and pollutants of the environment are determined in five distinct points within 200 m of the enterprise, using a measuring original stand. According practical determination, CO,SO_2 and NO_2, concentrations exceed normal values presented in the 462/93 Government Order.*

Keywords: impact , environment , cabin, blast furnace , central, heating

1. Introduction

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[1],[2],[3],[4], [5]:

- the impact is different depending on where the determination is made , however, with many factors contributing to a very different distribution of polluting substances in the environment;
- there are many elements of impact (dust, micropowders, fumes, gases, volatile organic compounds, ozone, hydrocarbons, persistent organic pollutants, suspensions minerals, etc.) that apperas during 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 workpiece materials and ending with the testing and putting into function.
- there are many technological processes used in a process, which differs substantially from one another and should be considered separately and cumulatively, depending on how the environmental impact analysis is done.
- It is difficult to establish with precision the equation of mass balance to compute the index of environmental quality because it can not be made a universal and complex stand for determining the impact of all factors at once, concentration during the technological process and after conducting technological process [9], [10], [11];
- Computing relations established in a case are difficult to generalize because all parameters of physical, chemical, mechanical, electrical, technological, biological and climatic factors, which contribute to the achievement of equipment used in a nuclear power plant are in a dynamic of the often unpredictable

- It is hard to find a mathematical function encompassing phenomena and changes that occur during the technological process , enabling optimization technology then in terms of a minimum coefficient of pollution or an maximum environmental quality indicator.

2. Methodology research and experimental program .

For a real analysis and a more accurate determination for the environmental impact it was chosen a proper, in line with European norms and an experimental and original stand was built that can be used both for determining the impact on the work environment and the natural environment, easy to use and allowing a more accurate assessment of environmental impact.

Also , the measurements were carried out using the same experimental stand under the same conditions but for different locations for determinations, corresponding to the objectives set as follows:

- measuring environmental impact work done in main locations where most pollutants appear;
- measurement of the impact on the natural environment, made in five points different from SC FECNE SA, within a radius of 200 m. from the emitting source, an area that supposedly get all pollutants extracted from the working environment by the exhaust process;

The measurements were performed according to a methodology established experimentally and in accordance with Order No. MAPPM. 462/93 in normal technological operating conditions [7],[8],[9]. Schematic diagram of the experimental stand designed and conducted in experiments is presented in fig.1.

3. Experimental results

Using experimental stand, measurements made were made by different directions and in certain atmospheric conditions for each of the most important sources of pollution: sandblasting cabin; furnace heat treatment and stress relief boiler and thermal heating system.

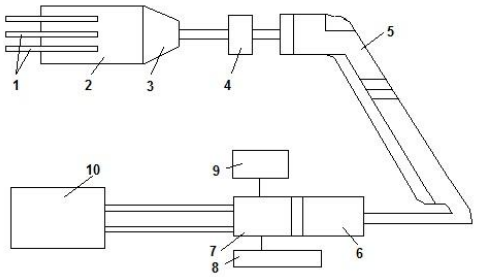

Fig. 1 Schematic diagram of the experimental stand for measurement: 1- sensors; 2 - sampling pump; 3 - the oven; 4 - suction pump; 5 - handle system; 6 - filter elements; 7 - element of protection; 8 - condensate tank; 9 - microcontroller; 10 - information display

3.1. Impact determinationon the natural environment produced by sandblasting cabine

Blasting cabin has a volume of 5000 m3 and is intended for surface cleaning operation parts being provided with the following equipment:

- blasting facility , composed of :
  - blasting vessel , which is a reservoir of corundum under pressure ;
  - mixing chamber air - conrindon ;
  - resistant hose blasting cap;
- necessary equipment corundum recovery ;
- capture facility and retaining fine dust of corundum

Following cleaning operation of different surfaces a variety of corundum fines powders results. Corundum is crystallized alumina Al2O3 (mineral) containing 95 ... 99 % alumina with minor amounts of iron oxide , magnesia , silica and the like.

Sandblasting cabine is equipped with an exhaust system consisting of a loaded machine which comprises a dust forced evacuation system. The cabine is equipped with dust exhaust system fitted with exhaust openings, piping, cyclones retaining powders (2 pieces) , exhaust fans and baskets (2 pieces).

Measurements 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 powder booth blasting but not detain the film of water.

The sources parameters are the following:

- charger system has a stack height H = 15 m ; S = 0.04 mp ; v = 22.5 m/s; $D_{efl} \approx 3250$ mc/h;
- hydro-cyclone has an exhaust system with high H= 8 m; S= 1,0 mp; v = 6.9 m/s; $D_{efl} \approx 24850$ mc/h.

Experimental determinations made under the above conditions have led to the results presented in tab. 1 for charger system and Tab. 2 for hydro-cyclone.

Tab.1 Level of powde emissions at charger system

Polutant	Concentraţion [mg/mc]	Average Concentration +10% eroare [mg/mc]	Average mass flow [kg/h]
Corundun powders	116,4 129,3 121,0 112,6 118,8 126,5	132,85	0,43 kg/h

The analysis of experimental results presented in tab. 1 shows 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).

Tab.2 Powder emission at hydro-cyclone

Polutant	Concentraţion [mg/mc]	Average concentration +10% eroare [mg/mc]	Average mass flow [kg/h]
Corundun powders	78,3 83,6 101,8 94,5 75,0 80,4	94,16	2,34

From the presented results in tab.2 results that the emission of dust for hydro-cyclone fall within the VLE values.
Given that the average mass flow rate exceeds over 5.7 times the amount required by Order 462/93 (≥0,5 kg / h), high concentrations, with an average of over 2 times higher than ELV (according. Ord . 756/97 - "intervention threshold") is considered impact on air with powders in suspension. Considering that both hidrocloane would work (supplied with water) since the removal efficiency is 90 ... 99.5% (according to the literature) dust emissions have decreased substantially as shown in tab.3.

Tab. 3 The level of particulate emissions when both cyclones are running

Efficiency [%]	Concentraţion [mg/mc]	Cumulative mass flow [kg/h]
80	9,416	0,468
85	7,062	0,351
90	4,708	0,234
95	2,354	0,117
99.5	0,235	0,012

As shown in Tab. 3 when both hydro-cyclone will operate under normal conditions, dust would fall under the ELVs and are below the alert threshold to a higher efficiency of 80%.
To maintain high efficiency of dust retaining, the following are recommended:
- Maintain a constant water level, ideal in the hydro-cyclone basin;
- Adapting a system for heating water in the basin of hydro-cyclone in winter to avoid freezing.

3.2. Impacts determination on the natural environment produced by furnace annealing (tempering)

The furnace has a maximum load of 550 t. and is used 1-2 times/year for tempering, when heat treatment lasting up to 48 hours [6].
The main features of the oven are:
- Used fuel: natural gas
- Consumption 1760 Nmc/h;
- Number of burners: 8 pieces.

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

For exhaust, an exhaust evacuation system is used (the oven is equipped with 3 chimney exhaust flue) with similar features.
The measurements were made during the normal operation (all chimneys).

Tab. 4 The emission of pollutants from annealing furnace

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

NOTĂ:Error ± 10% for powders
Error: ± 5% - CO, SO_2, NO_2

From the analysis of experimental results presented in tab.4 follows that concentrations of fpur pollutants fall into VLE according to Ord. 462/93. They are below the alert thresholds according with Order 756/97, for each of the three emission sources (three chimneys).

3.3. Determining the environmental impact naturally produced by the heating system

The analyzed heavy engineering organization, has central heating gas-operated with the following characteristics: chimnei height with: H = 15 m, section S = 0.592 sq m, v = 2.9 m / s, measured flow D = 6180 m/h fluent flow D ≈ 4300 Nmc/h, T = 120 °C.

O_2 content in efluent = 7,3 % vol.

The emission of pollutants from heating system is presented in tab. 5

Tab. 5 The level of pollutant emissions from heating station

Pollutant	Measured concentration [mg/mc]	Concentration converted to 3% vol. O2 in fluent [mg/Nsmc]	Average concentraţion + Error [mg/Nmc]	The average mass flow [g/h]
PST	1,12 1,30 0,98 0,85 1,00 1,24	1,47 1,71 1,29 1,12 1,31 1,63	1,56	6,71
CO	16,8 14,4 14,6 18,3 15,0 19,3	22,08 18,92 19,18 24,05 19,71 25,36	22,63	97,31
SO_2	0,95 1,03 SLD 1,14 0,73 SLD	1,25 1,35 - 1,50 0,96 -	0,89	3,83
NO_2	108 97 112 123 118 103	141,91 127,46 147,17 161,62 155,05 135,34	152,00	653,6

Error ± 10% - PST

Error ± 5% - CO, SO_2, NO_2

Results presented in Tab. 5 shows that all concentrations of PST, CO, SO2 and NO2 situated entirely under V.L.E. according to Ord. 462/93 and below the alert threshold corresponding Ord. 756/97.

4. Conclusions

1. The environmental impact is different depending on where determination is made, because many intervening factors contribute to a very different distribution of pollutants into the environment;

2. there are many elements of impact (powders, micropowders, dusts, fumes, gases, volatile organic compounds, ozone, hydrocarbons, persistent organic pollutants, suspensions minerals, etc.) occurring during the technological process that are difficult to be determined, either that are in small quantities or that require special sensors;

3. to find impact on the natural environment determinations were made after different directions in different areas and under certain atmospheric conditions for major pollution sources: sandblasting booth, heat treatment furnace and boiler;

4. the analysis of experimental results showed that corundum powder machine-loaded, exceeding by more than 2.6 times and concentrations of CO, SO2 and NO2 exceed ELV under Order 462/93.

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