

## NOXIOUS EMISSIONS WITH CANCEROUS POTENTIAL IN CASTING PROCESSES

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### ABSTRACT

*In this paper are presents the noxious agents which appear in casting technological processes, emission sources, dispersion mode and this role in cancerous tumors for operating personnel. Are presents a series of statistical dates over the noxious agents quantities, the forming modes and possibilities to reduce the appearance of diseases.*

### 1.INTRODUCTION

The casting microclimate problems and, specially, the professional cancerous problems are, actually, in foreground, and the specialists are looking for technological solutions, which reduce or eliminate the bad effects over the health. The financially efforts which are making in this way in some expanded country casting represents 15% from casting pieces costs.

In the making process of metallic pieces where are using casting semi-product, the casting processing have the major impact over the environment. The casting sector being integrated parts in economical holding which using the casting semi-product and, from employment reason, are placed in very dense populated urban center, the impact of noxious emissions is higher.

In the industrial medium from casting are released a high diversity of noxious emissions, determinate by the using materials composition and the working conditions and procedure, which are using.

In the last years, the molding core-making technologies improvement was based by chemistry process, by binder using in a lot of cases, catalysts, synthetically hardener, which, in case of high temperature conditions from casting processes, involved the pollution emissions and toxic substances, like: phosphoric acid vapors, furfural alcohol vapors, acetone, nitrogen oxides, carbon oxides, phenol, formic aldehyde, etc. These are a very bad influence over the health.

The concentration of this kind of substances in casting atmosphere exceed with 5 – 30 time the admissible concentration, from personnel healthy risk point of view. [3]

## 2. STUDY AND RESEARCHES

The researches which was made are accentuated a big volume of undermicroscopical solid powders, which are emitted in casting area. [1, 2]

TABLE 1.

Sector from casting	The medium volume of shivy air m <sup>3</sup> /h	Emission powder type end quantity	
		The concentration in atmosphere mg/m <sup>3</sup>	The structure of powders
The sand preparation area	52000	92-1200	The silicon oxides; another nonmetallic oxides
The molding core-making sector	63000	210-1037	The silicon oxides; phenilic acid; another nonmetallic oxides, etc.
The smelting sector	66200	1540	The smoke black; ashes; nonmetallic oxides; metallic oxides
The stripping and cleaning of casting pieces sector	161500	30-360	The metallic oxides; metallic powder; abrasive dust; another nonmetallic oxides

The powder particles include the following oxides: SiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, MgO with dimensions under 60µm.

In the next table are presented the medium values of oxides and the dimensions in casting atmosphere. [2, 3]

TABLE 2.

The sector or processing instalation	The oxides content, [%]				The dimensions of suspended particles, [µm]					
	SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub> + Al <sub>2</sub> O <sub>3</sub>	CaO+ MgO	Alți oxizi	0-5	5-10	10-20	20-40	40-60	>60
					The suspended particles content, [%]					
Electric arc furnance	3	96	1	-	60	20	15	5	-	-
The mold dryer	32	61,2	2,1	4,7	5	30	35	14	9	7
The knock-out grating	34	58,5	3	4,5	10	8	43	12,5	4,5	22
The cleaning tables	35	59,5	1,5	4,0	11	2,2	1,0	3,3	6,6	66,9
The blast cabinet	27	63	2,4	7,6	7,5	5,5	8	17,5	21	40,5

In case of moulding core-making procedure, using the binding mixture (bentonite, sodium silicate), the noxious, which appear, are silicosis powder, which generate the breathing affections (silicosis), gases (CO, CO<sub>2</sub>) and vapours (water vapours), the cancerous effect being reduced.

For procedure which using like binding the flax oil or synthetically resin, the degage substances are more dangerously and the risk of injury is bigger.

The dust and the silicosis powder can be easily eliminate from casting atmosphere with a good exhaust and separation, but the big number of toxic substances with are degage in small quantities have a large spectrum of aggressively and is very hard to neutralize.

**Flax oil** is a large utilization like core binding. The drying of core are making with temperatures between 250-300°C and the flax oil are decomposed, are presented aldehyde releasing. From all of this, the acrylaldehyde present a big toxicity with a very strong irritation action over the last years is presents the cancerous potential of these substances.

**The synthetically resin** – the most using are furanical, phenolical and alchidical, which are using like binding for sand preparation together with some catalyts and hardeners.

In technological processes, after the hardening chemical reactions and after this burning in the casting process, are emitted a series of substances like: polycyclic aromatic hydrocarbons, furfural alcohol, formic aldehyde. Etc. Using the experimental researches it was distinguish the cancerous potential of phenol which produce the genetically mutation with neoplasm inclusion.

**The smoke black** is using like mixture in some moulding batches in proportion of 2 – 4%.

The action of smoke black, in combination with SiO<sub>2</sub> smoke is very irritant over the breathing and eyes. In the same time, in contact with liquid alloy, for temperatures between 1000 - 1100°C in partially absence of oxygen, appear the incomplete burning compounds and carbon dust destructive distillation.

**Adding materials** using for moulding box preparation are named secondary products from industry, like: based on petroleum coke, bituminous pitch, turf pitch, wood pitch, molasses, pectin gum, dextrin, etc.

On the high temperatures, from this substances are emitted the toxically and cancerous substances in a very various types.

Using the dates from technical literature the most dangerous substances are: acridine, pyridine, naphthalene, phenyl acid, etc.

Polycyclic aromatic hydrocarbons possessed a very strong cancerous action, over the skin and over the breathing components.

In the next table are presented the polycyclic aromatic hydrocarbons which are emitted from core making:

TABLE 3.

Emitted compound	The polycyclic aromatic hydrocarbons content, [g/g]		
	Smoke black	Deporom	Bituminous pitch
Naphthalene	urme	$9,1 \cdot 10^{-2}$	0,724
Benzopirene	$5,2 \cdot 10^{-4}$	$3,3 \cdot 10^{-2}$	0,172
$\alpha$ methyl-naphthalene	$9,3 \cdot 10^{-4}$	$1 \cdot 10^{-2}$	0,108
Acenaphtene	$8,8 \cdot 10^{-4}$	$1,34 \cdot 10^{-2}$	0,261
Dephenile	urme	$2,6 \cdot 10^{-2}$	0,062
Fluorene	$3 \cdot 10^{-4}$	$4,7 \cdot 10^{-2}$	0,307
Anthracene	$2,5 \cdot 10^{-4}$	0,39	0,358

### 3. CONCLUSIONS AND PROPOSALS

In appreciation of exposure risk on this substances is not possible to apply the work medicine fundamental principles, for establish the minimum level of danger, so, is impossible to be quantified in precision protection standards. This thing is explained in the following way: the cancerous action is not the result from a precise quantity or concentration of substance; this cancerous action results from irreversible injury which are made in time.

Using all of this dates, is important for every casting area to introduce some avoided measures, like:

- Periodical analysis of pollution from casting environment;
- The chosen with a high precaution of technologies which using the bindings and mixtures for moulding box and avoided the products that, during the process, emitted substances with cancerous potential;
- The develop of technologies which using the safety mixture (naturals, minerals) and of some powder and protective paint for mould protection, products which not emitted the noxious substances;
- Projection of protective systems on installation and machines from casting area which blocking the emissions of pollution substances;

-To concept and to apply some noxious substances neutralizations solutions, for avoided the infection of industrial area.

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