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Efficiency in Economical Approach of Work Place Security in an Industrial Plant

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Abstract: In this paper we made a research viewing the economically approach on main work place and their specific problems in an industrial plant. It shall also take into account aspects concerning the security of work place elements, in the context require of Europe Union. Is highlighted the scientific progress and the innovation in the field of risk assessment and environmental security. The structure and content of the paper are aimed to show the workers skills and abilities in the context of work processes specificity and necessary mechanisms that can avoid the risks in industrial activity. It takes in account the elements of risk assessment and tools of investigation and implementation in terms of work performance.

Keywords: work quality standards; risk assessment; security of work place elements

JEL Classification: J81

1. Introduction

Work place security shall be determined, taking into account the effects on health, safety of the workplace and the environment. It is necessary to collect a larger number of information in particular concerning the work place conditions or various chemical agents which are possible polluters of the environment.

Industrial investments develop two forms of risks: workplace risk and environmental risk, both having adverse effects on human health. Minimal risk level (MRL) represent, an estimated daily exposure, to dangerous work place or toxic agent inside of industrial sector.

Prospective study represents information about the exposure at insecure work place and response that is obtained after the study has begun. (Andrews & Moss, 2002)

Reference concentration is an estimate of continuous inhalation exposure, for humans, which can be without appreciable risk or non-cancer health during the lifetime of the exposed.

Risk means the probability of an adverse effect the results of a particular exposure.

Risk Factor is variable in a casual model that is related to a vast response. That variable may act with other factors or in some other way (multiplications)

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Risk Ratio is the ratio determine by the responses in which these risks are inter-related and therefore their approach must be carried out in parallel.

Uncertainty factor represent a whole number used in calculating the minimal risk level, the reference doze or the reference concentration from toxicological data, but not epidemiological results where standard statistical measure is used in stealth (Freeman, 2009). Monitoring risk work conditions, demands reliable methods not only for use within distinct countries, but also allowing exchange of environmental information from one country to another.

2. Research on Working Condition

In order to make a more accurate assessment of working conditions in an industrial sector, we collect a lot of data about work place and then we made a technical survey in function.

We must collect two categories of data for our research so: quantitative and qualitative data from evaluators that are placed in main work places.

This information represents a sum of analytical data and other information that should help the evaluators to express their own opinion in relation to the risk consequences on each work place.

We consider in our paper a case study that can be directly applying the theory in practice viewing the work place security and the risks that existing for each worker in the real context they occur. (Gheres & Serban, 2010)

Like case example we take in consideration a worker called "batch preparatory" that work inside of metallurgical section. His duty inside work area is to ensure the types and quantities of materials (iron ore, coal, dolomite, sunder and cinders), necessary to obtain the casting iron in the blast furnace.

2.1 The Work Process

The means of production like components of the system of work assessed

- Conveyor belts with rubber band, engine, reduction gear;
- Pomp for removed water (Ingress) of galleries;
- Installation of compressed air;
- Sheet feeders with metallic chains;
- Pneumatic hammer;
- Electrical panels (0.4 kV);
- Iron ore, manganese, dolomite, sunder, slag.

Work environment (test report No. 98/17-19.06.2017) is characterized by:

- Low air temperature in winter (when working outdoors);
- Air currents;
- Dust and coal dust;
- Mixed lighting (natural and artificial).

3. The Risk Factors Identified

First of all we identified the risk factors for batch preparatory palace of work due of means of production like:

3.1. Mechanical Risk Factors

- Machine parts in motion-the grip, the drive rollers conveyor, etc.
- Bumping of the automotive when made the transport of materials;
- Sliding parts, materials, stored without stability-in repairs.
- Rolling raw material to clean wagons, conveyor bands, etc.
- Flip pieces, parts, materials stored without stability-in repairs.
- Free fall of spare parts, tools, materials from the higher-odds at work under the catwalks, grills, etc.
- A lot of particles (dust, coke, coal) is involved in air currents or by compressed air jet to clean the trippers, using pneumatic hammers.
- The recoil of sledge hammer used for removing raw materials from wagons (mainly in winter).
- Contact with dangerous surfaces or contours (sparingly, slippery surfaces, abrasive, adhesive surfaces).

3.2 Thermal risk factors

- The lowered temperature of metallic surfaces achieved in cold season.

3.3 Electrical risk factors

- Electrocution through direct touch-current paths unprotected, uninsured by closing electrical panels;
- Electrocution through indirect touch or through the emergence of the voltage step-steel structure expanded, damaged, damp flooring protection.

4. Research on Risk Factors Identified In Work Environment

4.1. Physical Risk Factors

- High air temperature (>40 ^{0}C) in summer, in the control room;
- Low air temperature in the cold season-when working outdoors;
- Air currents-when working outdoors on walkways, technological goals, etc;
- Low-level lighting - no systems suitable lighting combined with escaping dust, in the gallery conveyor belts, etc;
- Natural disasters (earthquakes)-working continuously, regardless of the weather;
- Bacteria and dust present in the workplace atmosphere (according to the attached determination ballot no. 87/16-19.06.2017.

Forced or vicious postures to dislodge raw materials from wagons, cleaning grates (mainly winter) etc;

Dynamic effort - long way from the gate to the trippers, handling large masses etc;

- Execution of operations which were not anticipated in the work load or a different manner than the provisions of technical work.
- Trouble with teammates on / off conveyor belts or trippers;
- Starting equipment (electrically operated) without prior verification of the presence of workers in the plant.
- Movements, stationing in the danger areas - on the driveways auto, under/on the strips of transport, etc.
- Drop at the same level: by imbalance, slide, by tripping - rough terrain, wet, cold winter.

- Falls from height: by stepping into the void, by the high turn-over, through the slip-when working during the displacement to different points of intervention.
- Communication with the operator at the control desk.

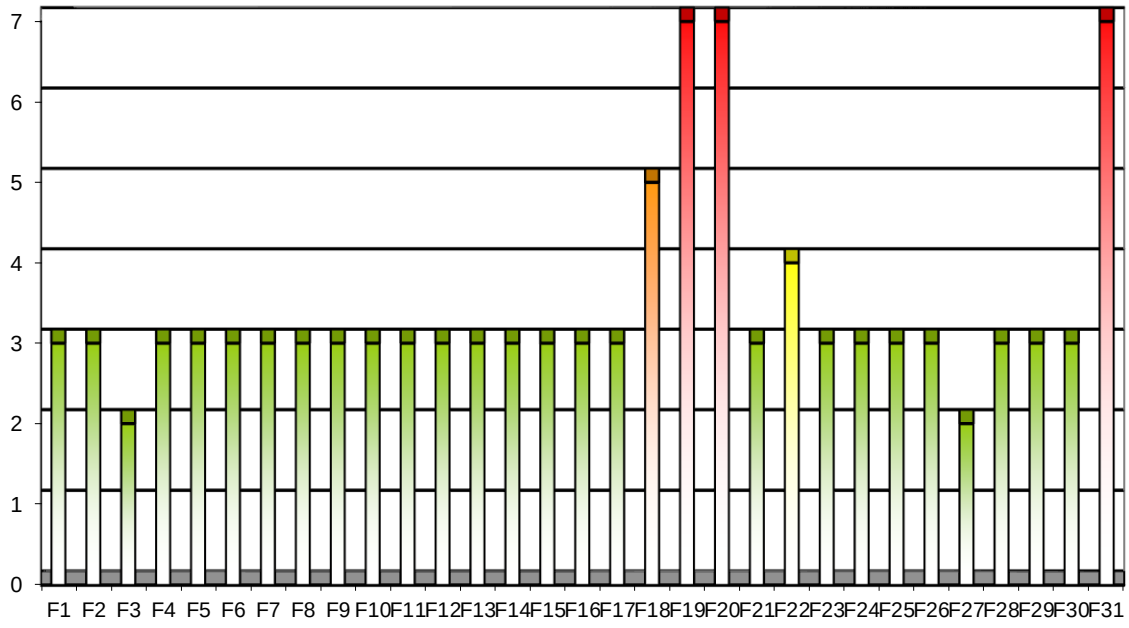
4.2. Chemical Risk Factors

- Carcinogenic substances present in the atmosphere of the workplace in accordance with the annexed determination ballot no. 87/16-19.06.2017.[4].

5. Evaluation and Calculus of Overall Risk Level of the Workplace

In the figure no. 1 are sowing the risk factors (abscise) in correlations with risk level (ordinate). This diagram shows the most dangerous activities for batch preparatory like the 18, 19, 20 and 31 activities.

Risk level



Risk factors

Figure 1. Risk levels and risk factors

Source: (Gheres & Serban, 2010)

The explications for these Risk factors are following:

F1- Machine parts in motion-the grip, the drive rollers conveyor, etc;

F2- Bumping of the automotive transportation or wagons;

F3- Sliding parts, materials, stored without stability-in repairs;

F4- Rolling raw material to clean wagons, conveyor bands, etc

F5- Flip pieces, parts, materials stored without stability-in repairs;

F6- Free fall of spare parts, tools, materials from the higher;

F7- the particles (dust, coke, coal) is involved in air currents or by compressed air jet to clean the trippers, using pneumatic hammers;

F8- The recoil of sledge hammer used for removing raw materials from wagons (mainly in winter);

F9- Contact with dangerous surfaces or contours (slippery surfaces, abrasive, and adhesive surfaces);

F10- The lowered temperature of metallic surfaces achieved in cold season;

F11- Electrocution through direct touch-current paths unprotected, uninsured by closing electrical panels;

F12- Electrocution through indirect touch or through the emergence of the voltage step-steel structure expanded, damaged, damp flooring protection;

F13- High air temperature (>30 ^{0}C) in summer, in the control room;

F14- Low air temperature in the cold season-when working outdoors;

F15- Air currents-when working outdoors on walkways, technological goals, etc.

F16- Low-level lighting - no systems suitable lighting combined with escaping dust, in the gallery of conveyor belts;

F17- Natural disasters (earthquakes)-working continuously, regardless of the weather;

F18- Bacteria existing in the workplace atmosphere (according to the attached determination ballot no. 98/17-19.06.2017);

F19- Carcinogenic substances present in the atmosphere of the workplace ;

F20- Technological process which does not provide a working environment in accordance with the provisions of the legislation in force;

F21- Forced or vicious postures to dislodge raw materials from wagons, cleaning grates (mainly winter) etc.;

F22- Dynamic effort that consist in handling large masses etc.;

F23- Execution of operations which were not anticipated in the work load or a different manner than the provisions of technical work;

F24- Trouble with teammates;

F25- Starting equipment (electrically operated) without prior verification of the presence of workers in the plant;

F26- Movements, stationing in the danger areas - on the driveways auto, CF, under/on the conveyor belt;

F27- Fall at the same level: by imbalance, slide, by tripping - rough terrain, wet, cold winter;

F28- Falls from height: by stepping into the void, by the high turn-over, through the slip-when working on the wagons or during the access to different points of intervention;

F29- Damage when the communications with the operator at the control desk are interrupting;

F30- Skip to operations which ensure his personal security;

F31- Non-utilization of other means of protection of the equipment provided.

For calculus of overall risk level we use the next formulas[2]:

$$\mathbf{N_{rg}} = \Sigma R_i r_i / \Sigma r_i \qquad (1)$$

$$\mathbf{N_{rg}} = \frac{3(7x7)+0(6x6) + 1(5x5) + 1(4x4) + 24(3x3) + 2(2x2) + 0(1x1)}{3x7 + 0x6 + 1x5 + 1x4 + 24x3 + 2x2 + 0x1}$$

$$\mathbf{N_{rg}} = 412/106 = \mathbf{3.89}$$

Global risk level calculated is equal to the value 3.89 and lead into the category of jobs with unacceptable level of risk.

For reduction or elimination of the risk factors (which is located in the field unacceptable), generic measures shown in the "Worksheet measures proposed" for the workplace.

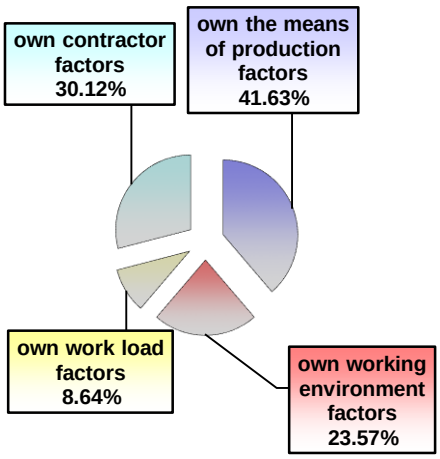


Figure 2. Share risk factors, identified by elements of the workplace

Source: (Negrei, 2016)

In terms of the distribution of risk factors on generating sources, the situation was as follows (see fig. no.2):

- 41.63%, own the means of production factors;
- 23.57%, own working environment factors;
- 8.64%, own work load factors;
- 30.12%, own contractor factors.

From the analysis of the evaluation data sheet, shows that 71.96% of the identified risk factors are likely to have irreversible consequences on the contractor's (disability or death).

The five risk factors which are unacceptable in the field are: Carcinogenic substances present in the atmosphere of the workplace; Technological process which does not provide a working environment in

accordance with the provisions of the legislation; Non-utilization and other means of protection of the equipment provided; Dust and bacteria present in the workplace atmosphere; constant and continue effort on long way.

6. Conclusions

In case studies selection, we considered, on one side, the uniqueness of each case study and his importance inside of an investment.

We considered study case taking into account that it might be a representative case for the important sector in Romanian metallurgical plant. Like the result of evaluation of the total of 31 risk factors we identified in our research the 18, 19, 20 and 31activities that exceed the average level of work risk factor. Number 3 is in the category of maximum risk factors, number 4 falling in the category of very high risk factors. Number 1 being, in the acceptable category of risk factors and the number 2 represent the average category of risk factors.

Using of new concepts of work security, our main goal is to pull an alarm signal for the work place creators, with potential dangerous activities in some industrial sectors.

These important ideas can be apply in the field of the work place security.

Research carried out are important because it gives us a real image of work place danger, viewing the life of the worker and allows us to find ways to avoid or minimize the risks faced by some jobs.

The system for the assessment of work place risk is a tool that helps in the taking of decisions regarding the protection of employees in case of the existence of problems with a work place.

Protection of the rights of the employees is based, first of all and the assessment of the risks and implementation of a policy of prevention adapted.

7. Bibliography

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