

RISK MANAGEMENT. EVALUATION METHOD OF THE PROFESSIONAL RISKS

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ABSTRACT: Planning control sequences is part of preparation phase. If a technological process that takes place in a facility with continuous operation it is generally the flow of production from which we must start the Control. In a facility with discontinuous operation, control is not dictated automatic by flow chart. So multiple tasks have to be performed at the same time and then maybe you need to represent differently work and the technical condition of the items of machineries on a time axis. Setting the time and calendar of meetings is important and it must be well established approach from the beginning. Setting the required time depends on the depth of analysis, team efficiency and quality of documents provided by the organization.

KEYWORDS: health, security, management, method, risk

1. INTRODUCTION. THE LIMITS OF THE WORK SYSTEM

1.1 Definition of the System Limits – Definition of System

Before starting a health and security analysis, the limits of the system from the analyzed sector or process has to be studied . Therefore we must define in a precise manner what is part of the system, meaning what we always must take into account for the identification of dangerous phenomena, and what is located outside the system. It is advisable to divide processes or big sectors in smaller items. If a sector of activity or process contains a complex production line, composed of several installations, then the partial sectors or processes in which we divided the line must correspond (to the extent possible) to a phase or a process.

The interface of the entire system to the environment and the interface of the different sectors or processes in which it is divided must be highlighted and defined. It is necessary to specify the type of analyzed dangerous phenomena, to indicate to who or to what the products refer to (operators, equipment, environment, etc.). On the other hand it should be also clarified and highlighted interactions with neighboring installations to be retained, as well as matters that not require inspection. At the end of the system boundaries determination for installations and machinery, the following points need to be clarified [1], [2], :

- "stage of life" considered (construction, installation, inspection, use, disposal, etc.)
- considered functioning (normal operation, cleaning, repair, adjustment, installation)
- machine limits considered for normal use (both in use and in proper operation of the machine, but also in case of malfunction or foreseeable misuse)
- full inventory of the predictable patterns of use (industrial, commercial, household)
- preparation (training) of potential users
- surroundings (environment) including: neighboring systems and the interactions between them, all persons potentially exposed.

2. DESCRIPTION OF ACTIVITIES

Description of the studied health and security activities can be done according the following steps:

- highlighted hazardous phenomena, to whom and / or what they mean (operators, equipment, environment, etc.)
- issues to be considered, but don't need control or require additional inspections (constructions static, type of chemical processes, etc.)

Given the above, for defining the system, the analyzed exploitation type must be mentioned: normal, special or maintenance. These three modes of operation are defined below:

- normal exploitation -the machine fulfills the function for which it was designed.
- special exploitation- refers to the preparation, processing, installation, adjustment, verification, debug, clean installation.
- maintenance
- control (measurement, control, recording), determination (comparison) real and set operating parameters.
- maintenance (cleaning and maintenance), steps to keep the machine at set (designed) operation parameters.
- restoring the machine operating parameters to those stipulated in its design phase (parts replacement or subassemblies, improving functioning). *Attention to adaptation to technical progress.*

2.1 Man / Machine / Environment

First it should set different processing phases of activity by sector and / or manufacturing processes. All phases must be documented in chronological order, as well as the operational ones. The steps required to install a machine, for example their transport from point A to point B can not be omitted, even if employees or third parties who perform this operation poses no direct or obvious threat (danger). In certain situations some activities can be regrouped. By doing this way we can reduce the time it takes to assess risks, but we will also reduce the accuracy of the assessment. Such grouping is indicated in absence of major risks, or when we don't analyze a particular configuration to showcase the sector's main hazardous phenomena, because we use a branch solution and will highlight only specific enterprise risks. The activities should be formulated for the three modes of operation:

- normal
- particular
- maintenance.

For descriptions of activities they should be structured, if possible, in the following manner:

- material
- activity
- start and finish.

Activities can be formulated at the team meetings or already in the preparation phase.

2.2 Identification of hazardous phenomena in team

During this phase the dangerous phenomena that can occur in carrying out the activities described had to be defined. The team leader is the one who leads the debates. A team member is tasked to write the minutes. The team leader chooses the first partial process and highlights activities for all team members (may even use a flip chart). The team begins the analysis with the first activity. Using a structured brainstorming, the team is looking for hazardous phenomena that can occur in the described activity. In the following there are presented a repertoire of hazardous phenomena to be taken into account during analysis.

It is important to review even those dangerous phenomena for which, at the moment, it seems unlikely, or even impossible, for them to cause an event. The team leader must supervise the

process or sector concerned are analyzed in a more complete manner. It should also be chosen a pace of work that does not bore or stress the team. If a discussion between two experts is prolonged, it is advisable to propose them to write down every point of view in the minutes, and these should be clarified outside the meeting [3],[4],[5].

- Mechanical hazardous phenomena - unprotected contact with moving elements
- Slip, stumble, crash
- Electrical hazards - contact of persons with live parts, approach to live parts under high voltage by short-circuit, overload by arcing.
- Contact with harmful substances (chemical or biological) - inhalation or ingestion
- contact with aerosols, gases, vapors, fluids, solids, microorganisms, viruses, etc.
- Fire or explosion hazard - because of flammable solids, fluids, gases explosive atmospheres, explosives, electrostatic charges.

Thermal hazardous phenomena - by contact of person with surfaces by extreme high or extreme low temperatures.

- Physical phenomena: noise; ultrasound; vibration; unionized radiation; ionized radiation; baric regimes.
- Constraints related to work environment: climate, inadequate lighting
- Failure to ergonomic principles: repetitive work, still working, lifting, carrying heavy loads in an inappropriate posture, improper posture or imposed, work in a kneeling position, lying, hanging, work with repeated rotations of the torso or the head, working in a imposed position
- Mental constraints: exhaustion, overload, monotony, work in conditions of isolation, taking difficult responsibility (important, vital), work under mental tension, disruption of business due to interruptions or distractions, undertake the task in a damaging climate (constraints, conflict, fear, etc.)
- Failure of the power supply, providing or interruption of power supply
- Inadequate work organization

2.3 Injury Definition

Each event may involve dangerous phenomenon likely to cause injury (an injury or an attempt on the physical and health). For each identified dangerous phenomenon we must evaluate potential harm and record (by notaries in tables or grids) this. This is done by the evaluation team. The risk is quantified value of a dangerous phenomenon [9], [10]. This value is comprised of injury severity (G) and the probability (P) production of this injury. P likelihood of developing injury is defined in the equation (1).

$$P = \text{as a function of}(e,po,L) \tag{1}$$

It is determined by "e" the frequency and / or duration of exposure to dangerous phenomenon considered; "po" probability of event considered dangerous; "L" the possibility of avoiding or limiting injury through appropriate behavior (the organization, the people involved or existing measures).

Risk is a function $R = f(G;P)$

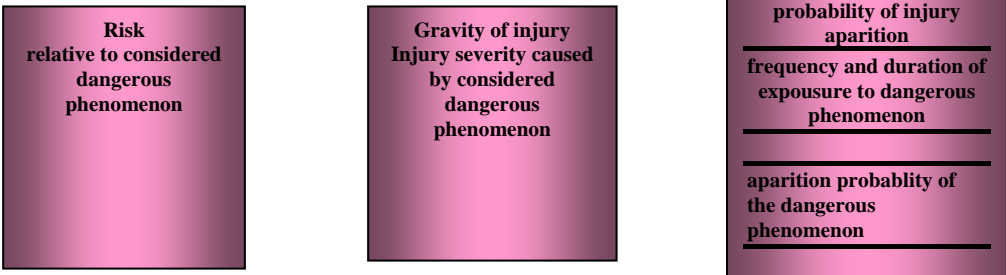


Figure 1. Elements of risk – according to ISO 14121

As a general rule, the probability of a hazardous event occurring and the severity of injury associated correspondent can not always be accurately specified. It is advisable to proceed in a prudent manner, for example: "We expect a high probability of producing and significant injury."

2.4 Gravity of injury

Gravity injuries can be subdivided into 5 categories according table 1.

Table 1. Determination of gravity of injury and its consequence

Category	Gravity of injury	Consequence definition
I	Very serious	death
II	serious	serious disability
III	Less seroius	Light invalidity
IV	light	Invalidity with working stop
V	Very light	Invalidity without working stop

According to elements from this table, the following discussion has to be done:

- serious disability - unable to work for the profession in question or an equivalent profession, large influence on quality of life
- less disability - reduced work capacity for the profession in question or an equivalent profession, little influence on quality of life
- Attacks on health - related ergonomic factors or organizing jobs are in growth. In assessing such risks should be referred to a specialist in safety.

Ergonomics deals adapting working conditions to the capabilities and characteristics of the human body and its ability to adapt to working tasks. Psychology investigates interatiunile between man and his work. It examines, first of all, the design of jobs, but also the qualification, training and human efficiency in performing his work.

Different aids are available to analyze both the ergonomics and work psychology. At this time there are many publications that present methods of analysis and risk assessment of physical activity and mental operators.

2.4.1 Probability

Next it will present a qualitative method to estimate the probability. Procedure for a collective appreciation of risk (for a company or sector which has particular work stations)

To assess the probability of a company or sector which has particular work stations go from the current state, that we consider the facilities and organizing activities as found when evaluating them. There are two possibilities:

1. -A qualitative assessment will be conducted. The probability P is subdivided into five categories, as we have indicated for variant 1. Then we define first category "frequently". This will be the basis for the definition of the other four categories.

Table 2. Probability "p" estimation

Category	Probability definition P
A	frequently
B	occasional
C	rare
D	not probably
E	Almost imposible

2. Definition an index of probability P, which is determined by three elements evaluated individually. To do this we make the following hypothesis evaluation considering equation (2).

$$P = e + 2po + L \quad (2)$$

It was assigned a double scoring element "po", because the probability of a dangerous event, under the rules of technical safety and activity has a more important place than the other two elements. This formula is based on probability presentation in standard EN 1050 "Safety of machinery - Principles for risk assessment"

Table 3. Index of frequency and exposure to dangerous phenomenon

Nr.	Duration of exposure
5	40h/week – complete programme
4	20h/week – programme 50%
3	8h/week – 1 day/week
2	4h/week – ½ days/ week
1	2h/week – 1 day/ month

Probability of a dangerous phenomenon apparition is defined and presented in the table 4.

Table 4. The apparition probability of a hazardous event "po"

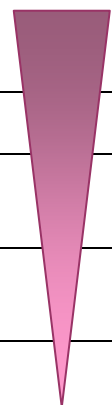
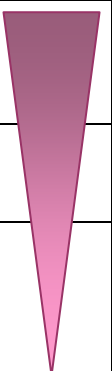
5		5	it is evident that this event will occur (there are no preventive measures)
		4	This event is expected to occur (poor preventive measures)
		3	the event is likely to occur (there are measures, but obviously they are not enough)
		2	imaginable event, but it is not impossible to produce it (no steps)
1		1	it is difficult to imagine the event (the measures are taken in accordance with technical progress)

Table 5. Possibility of avoiding or limiting injury L

5		5	- threatening Unnoticed - Lack of measures, instructions - insufficiently qualified personnel, formed, trained
		3	- existence of one or two of the criteria in paragraph 1 (below), but not enough
3			- hazard identified (before) - o instructions made (and regularly updated)
1		1	- Good skill, training, staff training

The probability P (index) for producing a G injuries resulting from adding the values of its components according to equation 2 is presented in table 6.

The result of this summation can be evaluated using the table below. The relationship between the different numerical values and including them in categories from A to E has been verified in practice.

Table 6. Probability p

Category	Probability definition	$P = e + 2po + L$
A	frequently	19, 20
B	occasional	17, 18
C	rare	14, 15, 16
D	improbably	11, 12, 13
E	Almost impossible	1, 2, 3, 4, 5, 6, 7 8, 9, 10

2.5 Determining the causes, facts

An undesirable event (accident or occupational disease) occurs based on a dangerous phenomenon and a trigger event. In addition, various causes and facts (different) train this event. To find appropriate security measures necessary to conduct a systematic examination of causal relationships that lead to this undesirable event. Facts or causes that are at the origin of this event may be, for example, home technical deficiencies in the organization or training.

2.6 Risk assessment

To evaluate the risks, a risk matrix will be used. Table 7 presents a risk matrix subdivided into three zones. This solution corresponds to the situation in an enterprise, but this does not mean that it is valid for all businesses. Risks are assessed by estimating the probability and severity of injury, according to tables 1 to 6. Risk matrix is defined by interdisciplinary assessment team members in collaboration with the employer (company manager).

Table 7. Risk Matrix

probability	A	3	2	1	1	1
	B	3	2	1	1	1
	C	3	2	2	1	1
	D	3	2	2	2	1
	E	3	3	3	2	2
		V	IV	III	II	I
injury severity						

In this case they decided that the risks classified in different areas of the matrix to be framed (ranked) in three areas:

1. important risks
2. The average risk
3. Low risk

Table 8. Zone definition

zona 1	riscuri importante securitatea nu este asigurata
zone 2	risk environments security is not ensured
zone 3	risks low security is largely insured

Risks in zone 1 are treated with priority, these risks are dealt with in the second and third risk area are treated last. Defining priorities must be done before you start treating risk (analyzing them, drawing on components which we act and take measures to prevent). Subdivision matrix in the three zones is based on personal conception (of the organization, agreed with the assessment team established by the health and safety policy, ...) and it depends on the security

objectives that we have set [6], [7],[8]. It is observed at the same time prioritizing, and applicable laws, ordinances and directives.

Security objectives must take into account, at the same time the interests of operating the plant, but also the interests of users, the residents, collaborators, etc. For a company that exploits the same plants but in another location, security objectives may vary. This may set higher demands, which will have to allocate adequate resources and or lower (linked to the economic situation), but they have to comply with at least the minimum health and safety requirements stipulated in legislation.

2.7 Conclusions

In order to determine areas of risk hierarchy and the allocation matrix for each risk, the company must define priorities in the action to protect the health and safety of workers. Should be defined objectives for prevention and protection specific to each identified hazardous event. In this regard it is established, even for events that seem less likely to occur, given that they may take place but also prevention and protection measures appropriate to them.

In the article, a function of probability "P" was defined and different considerations about: Determination of gravity of injury and its consequence, Probability "p" estimation, Index of frequency and exposure to dangerous phenomenon, The apartition probability of a hazardous event "po", Possibility of avoiding or limiting injury L and very important a Risk Matrix.

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