

SAFETY RISKS ASSESSMENT AND SECURITY EVALUATION OF MANUFACTURING ENTITIES

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ABSTRACT:

The article deals with security as a scientific discipline dealing with the assessment of the technical condition of machineries, hazards identification and risks assessment which could lead to fatal consequences. Article highlights the importance of using methods of risk assessment as well as the importance of the security evaluation in manufacturing companies. This article provides an overview of the most widely used risk assessment methods and specifically referred to point method, which is one of the most widely used risk assessment methods.

KEYWORDS:

Risk assessment methods, machine safety, hazard in operation, risk identification

1. Introduction

With the emergence of industrialization at the beginning of the 20th century, we began meeting with various concepts that

were not previously known to general public in practice. New terms, such as production line, development of technological operations, such as welding or forming processes in

engineering took quick turn that has been progressing till now. All these and many other manufacturing operations have one common denominator. That is a safety of operation.

However, it is not sufficient just addressing the many security issues by dealing with the existing crisis situations and focusing only on the solutions to these phenomena, i.e. responding to negative consequences (Křižovský & Kavečanská, 2009). It is important to pay attention, in particular, to prevention, thus anticipating threats. Security is a result of the processes and activities of social entities, which are oriented on the early identification, reduction, elimination, and prevention of hazards and risks, which have the potential to destroy or severely damage the spiritual and material assets, cause significant damage, disable or limit the continued existence and development of individuals, social groups, the state or humanity as a whole.

The term safety can be applied to every human activity in which we are in everyday contact. In these busy times in which everyone pursues their own aims, it often happens that people are unaware of possible risks that are becoming a part of their common lives. Production hall with plenty of installed machines and equipment is like a cradle of dangers that when neglected (by not following the basic security rules of operation and usage of machines), can cause injuries or death. That is why the term of risk management has been introduced into technical practice. Its main aim is to on the basis of the determination of various connections evaluate and minimize the conflict states possible. Risk management represents interrelated procedures which in certain conditions require specific actions and methods of their application.

More safety is the aim of all decisions when planning new machines, complex devices as well as various kinds of activities. In order to achieve this aim, it is important to pay attention to all components of “man-machine-environment” system. Neglecting one of them may lead to the loss of system

balance. Due to unwanted negative phenomenon and its formation, the production process or performed actions are interrupted, which has consequences on all its components.

New approaches in the system of risk management and health and safety at work require that each person should realize the risks in which he/she needs to live at the workplace as well as in everyday life. The duty of the employer is to identify, remove, or minimize the risks connected with the working process. The employer also needs to inform his employees about the residual risks.

So it is possible to talk about security education, focused on the theoretical and practical knowledge in the area of protection of persons and property, and its versatile application, even in the European security environment. The essence of education lays in the security analysis activities, which aims to avert or minimize the security risks of different forms and causes to individuals and to society as a whole (Kováčová & Klimo, 2013).

Currently, ever increasing demands are placed upon secondary schools leavers as well as university graduates. The opportunity to succeed in a particular work area is conditioned by a broader horizon in several areas of social life, science and technology. The aim of higher education institution therefore is to prepare such graduates who will possess the knowledge and skills related to safety and security in economics, environmental science, law, crime prevention, civil security, but also the humanities and technological sciences, due to the fact that these areas are closely interconnected. When addressing the challenges and problems referring to civil security the researcher needs to orient himself/herself in the technical issues, bring space into them, imagination, peripheral and abstract vision (Pavlenko, Haľko & Litecká, 2011).

2. Methods of Risk Assessment from the Point of View of Machine's Security

All Manufacturing companies have risky technologies; therefore, they have to deal with systematic and complex management of risks into which the methods of risk assessment can be included. It is therefore important for manufacturing companies to consolidate procedures and methods for risk assessment, in the phases of identification of analysis, and evaluation that are part of materials for their future management (Hal'ko et al., 2010).

The basic task of workers operating within various levels of operation security is to have an ability to correctly identify the unwanted conditions in the operation of machines and equipment. Proper estimation of possible risks and dangers affecting is provided by various methods of their evaluation. Following methods can be included into the category of basic methods of risk assessment in manufacturing companies:

a) HAZOP (Hazard and Operability)

– HAZOP method has originally been developed for the chemical industry. Nowadays, it is suitable for investigation of hazards and threats related to the use of technical equipment. Its main aim is to examine the parts of the system and relations in terms of the possible occurrence of divergence from its required function, or parameters of the process.

b) Method PHA (Preliminary Hazard Analysis) – This method is usually applied in the initial phase of the operation project's design, in the phase of distribution or designing of the process with the aim of producing a list of potential dangers that may occur in the process. The list of threats, dangers and of general situations is set on the basis of materials used, equipment used, operating environment, location of machines and the like.

c) FMEA (Failure Mode and Effects Analysis) – the purpose of the analysis according to FMEA is therefore to identify faults of equipment or system and their possible consequences that influence the system or the whole company. Faults shall be ranked according to the significance

of their consequences, frequency of occurrence and difficulty of their detection. Subsequently, recommendations for increasing of the equipment's reliability and for improvement of the process safety will be created.

d) Method FTA (Fault Tree Analysis) – The aim of this method is to analyse the likelihood of the failure of the part or the whole system. Design of the possible preventive measures is closely connected with the analysis itself. This method is well usable mostly in quantitative, therefore subjective expression of the probability of fault's formation for a certain period of time.

e) ETA – (Event Tree Analysis) – The purpose of ETA is to determine the probability of the final event that is dependent on the probability of formation of each chronologically following event leading to the result. Each event following after the initiating event is conditioned by the occurrence of the previous event.

f) The risk matrix – is based on the procedure of the verbal description of a consequence and the degree of probability that are assigned certain point value. Using the obtained values, that are inserted into matrix containing the classes of multiplicity and categories of the result, we are able to identify the size of the risk (Pačaiová, Sinay & Glatz, 2009).

For compiling the matrix, we use a combination of multiplicity parameters and negative phenomena consequence that determine the value of the risks. The greatest risk with the value 1 occurs for the high multiplicity and disastrous consequence. On the other hand, the most favourable condition with the value 20 occurs at very low multiplicity and negligible consequence. The resulting matrix is the point expression of the risk. The resulting numerical values for the starting point of security can be divided to several numerical groups characterising the scales of risk (Vacková, 2014).

3. Implementation in the Area Health and Safety at Work

One of the parts of education of employees must also be an education in the area of health and safety at work. Employer has the duty (that results from the law) to familiarize and inform employees about given safety regulations, principles of safe behaviour, safe working regulations, and about the threats and risks at work and protection against them. Employer is also required to verify the knowledge of employees about previously mentioned topics.

Education in context of following the principles of HS (health and safety) is one of the parts of security education. Security education contains theoretical and practical knowledge about protection of people and property with possibility of their versatile use in European security environment. The essence of security education lies in analytical activity that is aimed at averting or minimization of security risks of various forms and causes towards individuals and society as a whole. One of the aims of security education is to create certain moral attitudes of inhabitants – e.g. defensive, as well as to prepare them for specific protective measures in case of war and in time of emergency, or create their psychological resistance. All of this should concern the heads of government authorities, business, civil and social organizations, sections of civil protection, pupils and students, as well as other members of society (Kováčová & Klimo, 2013).

The issue of HS and methods of prevention of risk are the subjects of education at schools preparing pupils and students for work and further education of adults including requalification.

Law no. 124/2006 Z. z. about safety and protection of health at work requires duties for employers in context of educational activities. One of them is to provide training in necessary extent, it means that the employer has an obligation to regularly, clearly and demonstrably inform each employee about:

- legal regulations and other principles for ensuring health and safety at work, with principles of safe work, principles of

protection of health at work, of safe behaviour on workplace and with safe working procedures (employer also has an obligation to verify the knowledge of employees);

- with occurring and predictable threats, their effects on health and with protection against them;

- with ban on entry and staying in an area and with carrying out of activities that could directly endanger the life or health of the employee;

- and with other facts related to HS and inform mostly about the factors that influence or may influence health and safety of employees.

The employer is obliged to appoint one or more employees as representatives for safety based on the proposal of given union body, works council or on voting of employees if a union body or works council do not exist. Employer is obliged to provide education and training necessary for performance of tasks to his representatives for safety. Safety-technical service provides the employer with advisory services in the area of professional, methodological, organizational, control, coordination, educational and other tasks at ensuring safety and protection of health at work, mostly in terms of adequacy of work spaces and structures, work processes and practices, work equipment and technical devices, work environment and its technical, organizational and personnel support. The tasks of security-technical services are performed by safety technician and authorised safety technician, possibly some other expert on prevention and protection in specific area of health and safety at work.

Individuals and legal persons are entitled to organize and conduct education and training in the field of protection of work and in the extent of individual activities only on basis of authorization issued by National Labour Inspectorate or given supervisory authority. Authorization is not required for high school and college that prepares pupils and students for the job and also for employer on education and training in the area of protection of work of

his own employees and leading staff. Education and training of safety technician and employer who is going to personally perform task of safety technician or authorized safety technician can be only organized and performed by school or person authorized to education and training, who is a legal person. Safety technician is required to complete a basic course, where a certain number of hours are necessary to educate for HS. The result of this course is the final exam, where knowledge gained on course for safety technicians is demonstrated. Law characterizes the authorized safety technician as a person who needs to undergo professional practice for the period of two years and subsequently successfully passes the final exam in front of a commission. Person also becomes an authorized safety technician when he/she meets the conditions and works in the area of HS for minimum of five years in a service or civil service employment. National Labour Inspectorate will issue a certificate of an authorized safety technician.

4. On Security Education Carried Out by Manufacturing Companies

Strategic direction of a company, the level of security requirements and presence of security risks are the key factors influencing security education in the company. Goals and means of achieving them is conditional upon the actual interest of the company to create favorable security environment and upon the applicable general binding rules of the Slovak republic, the European union, NATO and other international standards. The security education proposal and selection of the means and measures must take into account many factors in terms of the goal. The security education in practice consists of the two basic parts. In the first place, it is the processing of the proposal of the security education implementation for a particular organization and secondly, the actual implementation of the security education within the organization. There is a possibility to assess security awareness before and

after the implementation of the security education.

Procedure for the security education proposal:

1. Meeting the representatives of the organization, defining the needs of the organization, its objectives and areas of security to be focused on.
2. Processing of an assignment, where the focus, range, contents and the methods of education will be described.
3. Work on the contents of education and products that will be included in education.
4. Presentation of a preliminary proposal, implementation of the potential corrections by the representatives of the organization.
5. Submission of the final product of education.
6. Implementation of the education in the organization, which includes initial monitoring of their security awareness.
7. Progress assessment of the employees' security awareness.
8. Education in practice is a continuous and repetitive process which needs to adapt to external and internal threats changes. Hence, security education in organizations needs to be repeated periodically and must react to the significant development of risks.

5. Conclusions

Occupational health and safety is focused on the prevention of accidents and diseases which may occur at work, it deals with the protection and care of human and other resources in the workplace. To what extent health and safety at work is perceived as part of the corporate culture and what support it is given from the company, depends mainly on the attitude of employers and employees. It is true that the greater the interest of the corporate management, the earlier it becomes part of standard business practice and the awareness of all employees.

Risk identification and assessment of technological processes in manufacturing companies is an issue which is currently high on the agenda. At present technological

processes disposing hazardous substances are potentially threatening not only the company staff but also the public, property and ultimately the environment.

Nowadays, a high emphasis is put on safety of technological processes and therefore prevention, in this case, becomes a priority, part of which is risk assessment, referred to in the present article.

When using different methods of risk assessment, we meet with the methods which have their strengths but also weaknesses. A certain method may be used within companies focusing on mass production, but when applied to a piece production, we can come to different

conclusions. For this reason, safety technician has a wide range of different risk assessment methods available, which can be successfully applied to the specific conditions in a particular production plant.

This article deals with the identification of risks in terms of machine safety as well as methods used in standard safety practice. The aim was to describe and sufficiently analyse risk assessment methods of production machines. The article tries to point out the importance of health and safety engineers training, because high demands are put on them in terms of maintaining safety in manufacturing companies.

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