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INVESTIGATION OF ACCIDENTS AND INCIDENTS AT WORK IN CROATIA

Abstract: Accidents *at work are the result of a series of mutually induced factors. The primary objective of the accident investigation is to identify and describe the real course of events (what, where, when), to determine the direct and / or indirect causes that have led to adverse events. The goal is to enable preventive action in the future. This paper provides an overview of recognized and commonly used methods for investigation of accidents at work in the world. The paper presents the results of a study conducted among safety experts in the Republic of Croatia on the methods of investigation of accidents and incidents at work. Croatian safety experts have expressed their desire for professional education (77 % of respondents) in this area, usually stating that they do not investigate accidents at work (47 % of respondents). Only 1.37 % of safety experts are investigating incidents. This information is worrying because the investigation of incidents allows the development of preventive and corrective measures, but without the harmful effects in the accidents at work.*

Key words: *investigation, investigation methods, accidents at work, safety experts.*

INTRODUCTION

Research problem

Accidents at work are not unexpected combination of specific circumstances or result force majeure. According to Turner [12] accident somehow "evolve" over a certain period during which individual events and signals arise and they were not recognized as a threat to safety. The same author defines an accident as a materialized risk, or that moment when we realize that we were wrong in believing certain events and circumstances are safe. Mostly, an accident in the literature is defined as undesirable event occurring as a result of the sequence of events, and the effect he had was an injury, death and / or property damage. The purpose of the investigation of accidents and incidents at work is to determine the course of events that led to the accident and to define preventive and corrective measures.

Special emphasis is placed precisely on prevention and the possibility of learning that rises from investigation of work accidents.

For the purposes of this paper we will use the names of the method as mentioned in the literature.

Objective

Books and technical literature on work accidents investigation in the Croatian language are not available, but there is very extensive literature describing this area and highlighting its importance especially in the area of prevention. A significant number of publications in the form of guides and recommendations are available on the Web sites of organizations working in the field of safety and health at work. There is also a large selection of software applications for the investigation of accidents at work that have evolved from the basic theory and models of accident investigations. The aim of this study is to extract and present the most common methods for accident investigation described in the literature. Also, the aim is to investigate whether and to what extent these methods are used by the safety experts in the Republic of Croatia.

Methodology

To accomplish the aim of the study, the following scientific research methods were used: descriptive analysis, survey method for collecting current and original data. An anonymous on line questionnaire was created at the website Survey Monkey [6], and link to the same were via e-mail to the respondents. Statistical methods were used for statistical analysis of the original data collected through survey.

Information on the survey

The questionnaire consisted of 10 questions, was sent to the addresses of 800 safety experts and delivered to 764 addresses. Experts were chosen randomly from the Register of safety experts in Croatian Institute for Health protection and Safety at Work. The survey, data collection and processing was carried out in March 2014. A questionnaire filled out the 207 respondents which amount to 27% of the basic set. Data from the survey results of 207 valid questionnaires filled online were entered into a computer database, and statistical analysis of data was performed using the tools of statistical analysis within Microsoft Excel.

RESULTS

The basic concepts of work accidents investigation

Methods for accident investigation have significantly developed through the past 20 years. The first one dimensional models developed in the 80s of the last century (Domino Theory). At the end of the 20th century Reason [11] introduced accidents as a result of the two or more causes. The beginning of this century was marked by Rasmussen socio-technical model that focuses on the human behaviour, based on skills, rules and knowledge.

On the complexity of enterprises significantly affects the development of technology. Methods for accident at work investigation were developing in line with the development of technology and complexity of enterprise. Initial methods as the main sources of accidents considered human, machine and organizational failures. Now day's methods use multidisciplinary approach. Engineers, economists, psychologists, insurers and even lawyers are part of the story of the accident investigation, which includes risk management, problem solving, decision making, human error and an organizational culture of safety, safety systems and various interactions of people. [9]

The new methods are being developed mainly in response to an accident on a larger scale. The result of this can be quite a new method that focuses on a specific event, or more likely, some modifications of existing methods as a combination of old and new experiences [7].

ACCIDENT INVESTIGATION METHODS

Having reviewed the relevant literature, we present a brief description of the most common accident investigation methods.

Fault tree analysis (FTA)

FTA method is inductive method, analytical tool, developed in 1960s. It is most commonly used when talking about the technique of tree diagrams. Branching begins by accident (TOP EVENT) and all possible combinations of events that could lead to an accident (event) and which can be linked in a logical unit. The main disadvantages of this method are considered to be the inability of insight into the sequence of events and event attendees and their interrelations.

Management oversight and risk tree (MORT)

Method MORT (Johnson, 1980) was developed for the U.S. Atomic Energy Commission. It is a comprehensive and analytical method for the determination of the causes that led to the accident. This method consists of a very comprehensive checklist with 1500 possible causes of accidents. MORT diagram is a logic tree that contains various elements. Those elements are numbered and numbers refer to a list of specific questions. This method is very effective in identifying the cause of the accident, and is also suitable for the prediction of future events or for preventive activities in order to prevent accidents. The advantage of this method is "asking the right questions," even in situations of lack of expertise. This method is used as one of the most comprehensive analytical techniques (DOE, 1992.) at the U.S. Department of energy (Department of energy).

Multilinear events sequencing

Hendrick and Banner have developed a MES method. MES is charting technique that presents events chronologically ordered on a time-line basis [8]. This method is to provide a valid and effective outcome of the investigation structured problem solving and defined processes. [4] MES method consists of several elements or subsystems. The procedure is carried out in three phases: a description of the system that is being investigated, identifying problems, define and control and the development of a plan of improvement.

Systematic cause analysis technique (SCAT)

SCAT method [8] has been developed by the International Loss Control Institute and has its roots in the domino theory. SCAT is based on the graph, consisting of five blocks showing the phases of accident being investigated.

The method has developed checklists with questions to which the answers are entered in defined blocks. The first block describes the event that is being investigated, the second most frequently cited categories of causes which could lead to an accident while in the next two blocks causes are categorized as direct and indirect. The last block is designed for safety experts.

Tripod Beta method

Tripod method was developed in 1990s. as a result of a project cooperation of Universities in the Netherlands and the UK. TRIPOD is intended primarily for the oil industry. In accordance with this method the accident occurs when one or more barriers, did not fulfilled their purpose. The cause for the so-called non-functional barriers are active failures which are direct causes arising from certain fundamental mechanisms of the organization. These mechanisms are called general types of failures (General failure types; GFTs) and include human, organizational and technical problems. In the method, there are 11 categories of failure (GFTs) used for each position in the organization.

Health and safety Executive, HSG245

This method was developed 2004 as a guide for employers, workers' representatives and experts in the field of safety [6]. The investigation is carried out in four stages: data collection, analysis of the data

collected, risk identification and control measures and action plan and its implementation. The goal of this method is to perceive direct, and the underlying causes that are at the root of the accident. The method offers a structured list of questions that facilitate the path to discovering the causes of the accident. It also contains useful forms such as questions to gather information about the event including the form of RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences) in the UK).

Work accidents investigation technique (WAIT)

WAIT method also is built on the Reason theory that the seas accident through the organizational, technical and human components. The method uses terms such as active failures and latent conditions, as a sub¬dimension of causal factors. [5]. WAIT investigation is implemented in nine steps grouped in two phases. The first phase is data collection and the second relates to the in-depth analysis of the data collected.

RESULTS OF SURVEY

General information on business organization and the organization of occupational health safety

The largest number of respondents who answered the questionnaire comes from business organizations that employ more than 250 workers (40.58%). The following are: business organizations that employ 50¬250 workers (31.40%) and in third place are business organizations with fewer than 50 workers (28.02%). According to the type of business organization to legal status in accordance with the Companies Act (No. 111/1993), in the first place are Limited Liability Companies Ltd. with 93 respondents or 44.93%, followed by firms with 62 respondents or 29.95% and third in the state and public administration, with 24 respondents or 11.59%.

When it comes to business activity of our respondents: 38 respondents or 18.36% came from the manufacturing industry. In second place are the subjects active in health and social care, with 27 respondents or 13.04% and third, transport and storage with 21 participants or 10.14%.

The largest number of respondents has formed Occupational safety and health service, 72 or 34.78%. In second place are experts in occupational safety and health who in addition to safety at work, perform other tasks (60 respondents or 28.99%). In third place are full time safety experts. All respondents stated that they had more work-related injuries over the past two calendar years.

Investigation of accidents and incidents at work

Asked whether investigating an accident at work and which types of accidents at work, the majority of respondents, 98 or 47.34%, responded that they don't investigate accidents at work. Serious accidents at work are investigating 38 respondents or 18.36%, while an equal number of respondents are investigating the death and group injuries (23 or 24 or 11.11 or 11.59%). Three safety experts confirmed the investigation of incidents at work.

Out of the 10 most frequently in literature described methods for accidents at work investigation, 124 safety experts (59, 90%) did not recognize, nor apply any of those methods.

35 safety experts or 16.91% are using FTA method, and 12 safety experts (5, 80%) prefer WAIT technique (Figure no. 1)

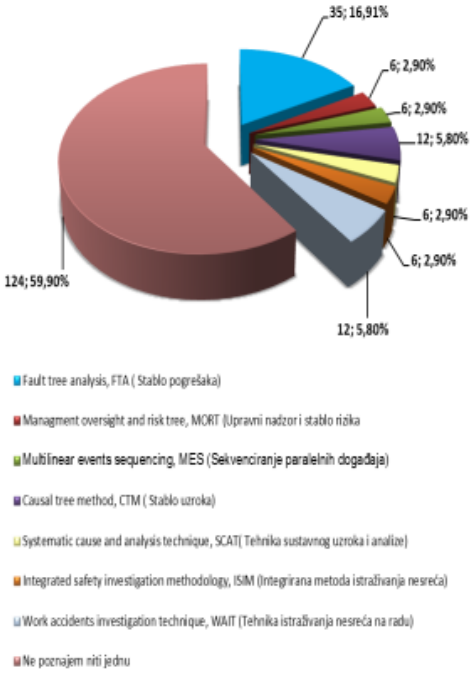

Figure 1. *Accident investigation methods*

As in the previous question, almost half of the respondents stated that they don't investigate accidents at work; they didn't have to answer the question related to characteristics of methods that they apply in their work. The remaining number of respondents who answered this question are using a descriptive method that includes a detailed description of the event (37.00%). 27.00% safety experts begin their research with the occurrence of adverse events (deductive method), and 21 safety expert base their research on various factors that have led to adverse events.

Asked whether the research methods that they apply, allow the creation of preventive measures, 62 respondents or 59.62% replied positively. Negative feedback gave 42 respondents or 40.38%. 72.12% of respondents stated that the investigation of accidents in

the work is carried out by a team of experts, while 29 respondents or 27.88% said that they carry out investigation of accidents at work on their own.

104 respondents were asked about the activities carried out after an investigation of an accident at work. 31.25% of respondents stated that the Occupational safety and health service discusses the results of the investigation. 85 of them or 40.87% notes that corrective and preventive actions arising from the investigation are being implemented. 3.37% safety experts are informing workers of the results of research through bulletin boards. 24 respondents stated that they inform workers on results of investigation through their representative, while employees are not informed of the results of research in 27 cases or 12.98%.

Interest in education in the field of accidents at work investigation showed an extremely large number of safety experts (77.29%), while only 23 respondents or 11.11% declared that they were not interested in education, and 24 patients remained undecided on the issue of interest for education.

DISCUSSION

A significant number of guides and guidelines made by the relevant institutions support the thesis about the importance of accidents and incidents at work investigation. The fact that almost half of the surveyed experts for occupational safety do not investigate accidents at work, and only 1% of their attention is directed towards the incident, speaks of the need for investment and training in this area. The legislation did not define the obligation of investigation of accidents at work. Accidents are investigated in the framework of inspections regarding heavy, group or fatal injury at work, but with a completely different objective from that described in this paper and the literature. It was noted that the corrective measures have precedence over prevention measures and how the 13% of workers are not informed about the results of the study. Described research shows that investigation of accidents at work in Croatia is not recognized as a preventive measure against future adverse events, but the emphasis is put on correcting the consequences that this event occurred. Positive impression still leaves the fact that safety experts are interested for training in investigation work accidents.

CONCLUSION

Except for unwanted consequences, every accident at work should be viewed as an opportunity for learning and gathering knowledge necessary to raise the level of organization safety. Investigation of accidents at work is a very important source of safety information because it gives an answer to the question of what, how and why it happened and her ultimate goal is prevention. After the accident happens interests of stakeholders in the investigation as well as those who have nothing to do with the investigation are different. Attention of this paper is on safety experts. Safety experts are investigating an accident, and they have to find ways to make improvements and / or positive changes. This can be done by analysing the collected data, suggesting corrective and preventive measures and applying those measures. The research confirmed the initial hypothesis of insufficient recognition of the importance of investigating work accidents as preventative actions that can improve the state of health and safety at work.

Investigating methods are different, but the phases of data collection, analysis and making conclusions and recommendations, and the final goal, prevention, all are common. There is no question whether an accident at work should be investigated, question is how to get the most of investigation and learn something so such and similar events in the future can be avoided in the future.

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BIOGRAPHY

Ivana Krišto was born in 1981. in Zagreb where she lives with her family. She graduated from the Police Academy (2003.) and the College of Applied Sciences in Safety (2005). She defended her master's thesis 2011. at the University of Zagreb, Faculty of Organization and informatics, Varaždin, in the field of Information sciences. She is currently working on the doctoral dissertation, also in the field of Information sciences at the Faculty of Philosophy in Zagreb. She is an active participant in scientific conferences and author or coauthor of scientific and professional papers.

ISTRAŽIVANJE NESREĆA I INCIDENATA NA RADU U HRVATSKOJ

Ivana Krišto, Ana Šijaković

Rezime: *Nesreće na radu su rezultat niza međusobno uslovljenih faktora. Primarni cilj istrage udesa je identifikacija i opis pravog toka događaja (šta, gde, kada), utvrđivanje direktnih i / ili indirektnih uzroka koji su doveli do neželjenih događaja. Jedan od ciljeva je da se preduzimanje preventivnih akcija u budućnosti. U radu je dat pregled poznatih i najčešće korisćenih metoda za istragu nesreća na radu u svetu. Rezultati istraživanja o metodama istrage nesreća i incidenata na radu, koje su sproveli stručnjaci za bezbednost u Republici Hrvatskoj, predstavljeni su u radu. Hrvatski stručnjaci za bezbednost su iskazali potrebu za stručnim obrazovanjem (77% ispitanika) u ovoj oblasti, uglavnom navodeći da oni ne vrše istraživanja o nesrećama na poslu (47% ispitanika). Samo 1.37% stručnjaka za bezbednost vrši istraživanja o incidentima na radu. Ova informacija je zabrinjavajuća, jer je istraživanje incidenata na radu od velikog značaja za razvoj preventivnih i korektivnih mera u sistemu zaštite na radu.*

Ključne reči: Istraga, metode ispitivanja, nesreće na radu, stručnjaci za bezbednost.