Original Article: The Need for Risk Assessment in Occupational Health

Amir Samimi

Process Engineer & Risk Specialist of Oil and Gas Refinery Company, Iran

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ABSTRACT

In today's world, accidents are considered as one of the most important risk factors in relation to economic, health, social and even political aspects. Studies have shown that the main cause of most accidents is unsafe human behavior. Obviously, to control these types of behaviors, it is necessary to know their relationship between employees, type and also the factors affecting them. To assess the health risk of exposure to chemical harmful agents, it is necessary to assess the degree of exposure and their risk. The degree of exposure is determined by measuring the factors based on standard methods. The degree of danger is determined according to the type and intensity of damage to humans and based on studies. Risk assessment is the center of gravity of occupational safety and health management that focuses on eliminating and minimizing risk. Basically, special techniques have been used for risk assessment and several methods have been presented and developed by researchers for different conditions. The choice of the appropriate method varies according to the studied industries and the objectives of the studies. What if risk methods used in process industries can be What if? Hazop, FMEA and ETA noted that each pursues specific objectives and conducts risk assessment with a specific objective. This study addresses the need for risk assessment in occupational health.

Introduction

In the era of industrial development and technological advancement, factories play an important role in the production process and economic cycle of countries, and workers as human factors to use superior technology, are considered valuable assets, so maintaining and improving physical abilities and the mentality of workers as a productive force centered on the development of society is a must [1-3].

In fact, manpower as the most important factor in production and services is always threatened by several factors, one of the most important of which is work-related accidents. Dangerous and complex working conditions, technological advances and the increasing use of various machines and the existence of a variety of harmful health factors have increased the risk-taking process and the likelihood of accidents in the workplace. Statistics from the International Labor Organization show that an average of 250 million occupational accidents

***Corresponding Author:** *Amir Samimi(amirsamimi1161@gmail.com)*

occur worldwide each year [4]. Figure 1 shows the risk management approach for occupational safety and health.

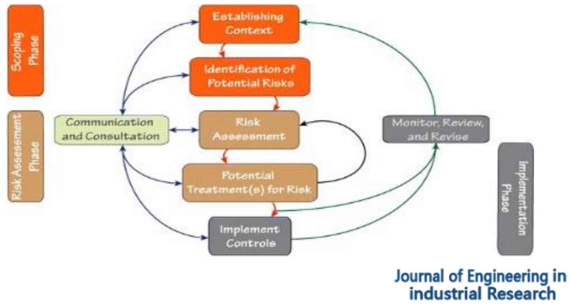

Figure 1. Risk management approach for occupational safety and health

Mortality rate from occupational accidents is 31 per 100,000 people. Statistics also show that the average cost that human societies directly or indirectly pay for accidents is about 1 to 1 percent of the average GDP of the world. This rate is something around the annual economic growth of some countries. Developing countries have 61% of the world labor force (Figure 2). In addition, studies show that the costs of accidents and work-related illnesses in some developing countries in accounts for about 4 to 31 percent of the plant's total profits [5].

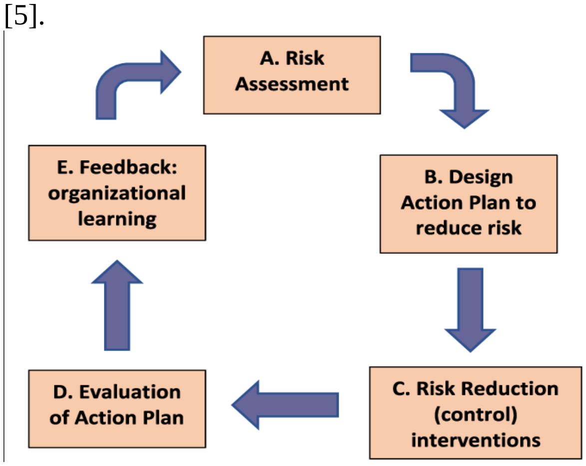

Figure 2. The WHO occupational health risk management framework for toolkits

A survey of industrial accidents around the world shows that there are 2 deaths due to workplace accidents in the world every minute (Fig. 3). This figure is exclusively in developing countries at least 4 times more than the global average, and due to the growing industrialization of the world, 250 million work-related absenteeism jobs are expected to occur annually by 2020 [6-8].

It is estimated that at least one person dies per hour in average due to various accidents in Iran and the cost of non-compliance with safety rules and principles is equivalent to oil export revenue. The main reasons for the development of risk analysis methods are the complexity of the situation, the difficulty of combining information, and uncertainty of decisions. There are many well-known techniques for achieving risk assessment goals, and researchers utilize a method considering the type of evaluation, the purpose and the process being evaluated. In recent years, significant efforts have been made to increase our knowledge and understanding of both the consequences and the likelihood of adverse events [9-11]. Figure 3 illustrates the Skip to main content Skip Navigation Navigation Home Site pages.

Likelihood	Consequences				
	Insignificant *(Minor problem easily handled by normal day to day processes)*	**Minor** *(Some disruption possible, e.g. damage equal to $500k)*	**Moderate** *(Significant time/resources required, e.g. damage equal to $1million)*	**Major** *(Operations severely damaged, e.g. damage equal to $10 million)*	**Catastrophic** *(Business survival is at risk damage equal to $25 Million)*
Almost certain *(e.g. >90% chance)*	High	High	Extreme	Extreme	Extreme
Likely *(e.g. between 50% and 90% chance)*	Moderate	High	High	Extreme	Extreme
Moderate *(e.g. between 10% and 50% chance)*	Low	Moderate	High	Extreme	Extreme
Unlikely *(e.g. between 3% and 10% chance)*	Low	Low	Moderate	High	Extreme
Rare *(e.g. <3% chance)*	Low	Low	Moderate	High	High

Figure 3. Skip to main content Skip Navigation Navigation Home Site

Risk Assessment

Risk assessment is identifying the risks in a process or a job, calculating their risk number and providing appropriate solutions to control them. In fact, it provides valuable data for decision-making on risk mitigation, improvement of hazardous environments and facilities, emergency planning, acceptable risk levels, inspection policies and industrial facilities, and so on. The risk assessment process can be done with qualitative and quantitative methods (Fig. 4). The further we go in the risk assessment process, the better the results. Quantitative evaluation can identify the existing foci and risk factors and take preventive and control measures to eliminate or control them [12].

Likelihood of harm	Severity of harm		
	Slight harm	Moderate harm	Extreme harm
Very likely	Very low risk	Very low risk	High risk
Unlikely	Very low risk	Medium risk	Very high risk
Likely	Low risk	High risk	Very high risk
Very likely	Low risk	Very high risk	Very high risk

Key:

	Acceptable level of risk
	Risks should be reduced so that they are acceptable/tolerable
	Unacceptable level of risk

Figure 4. Risk Assessment - Inertia Safety Limited

Introducing the checklist method

The checklist method entails the following cases: a) structured process for risk and risk assessment, b) the most common method of identifying hazards, c) sing it to evaluate methods or behaviors. Formal training is not required to do this, but it is important to make sure that the checklist compiler understands the purpose of each question.

Why use the checklist method?

There are reasons why a checklist is used: a) potential limitations in hazard identification, b) limits of human memory, c) not losing details, d) potential limitations in hazard identification, human memory and lack of detail There are two basic types of checklists: process-oriented and behavior-oriented, e) sometimes, combining process and behavior-based checklists [13].

The most important feature of the method

The most important features of the method include: a) fast speed and ease of use, b) no need for special skills or training to conduct assessment (general familiarity), c) low cost, d) helping people identify their workplace hazards (training during assessment), e) ability to compare risks and solutions used in the same units if using a standard checklist, e) extraction of standards and operational experiences, f) focus on areas where the potential for error is high, g) focus on issues that have plagued you in the past, and h) prepared by experienced personnel familiar with the design, functions, procedures and organizational standards [14].

Update checklists regularly

Checklist method

Checklists are usually derived from standards and operational experience. As a result, they focus on areas where the potential for error is high or where problems have arisen in the past. Checklists are prepared by experienced personnel familiar with the design, functions, procedures, and organizational standards. Checklists are regularly reviewed and updated to include new experiences, including the results of events or events, and may be general or partial depending on the intended use [15].

How to use the checklist method

In the first stage, the checklist is designed in the form of a general plan and in the next step, the same swat will be compiled in the form of swat with the answer yes and no to minimize the number of swat without use. Swat with a yes answer should be designed in such a way that the desired answer (safe situation) is always "yes" [16].

What should be asked in the checklist?

To develop a checklist, we are required to take into the following items: a) hazards of materials used along with control methods, b) how people are at risk, c) existence of engineering controls (coverage of standards and regulations), d) examining the existence, adequacy and appropriateness of personal protective equipment, e) continuous monitoring of people's health, f) training before and during work, g) existence and adequacy of monitoring, h) job qualifications and basic characteristics of employees, and i) existence and adequacy of emergency response methods.

In 2014, the world witnessed the 30th anniversary of the worst industrial accident ever. In December 1984, more than 40 tonnes of methyl isocyanate were released as a result of an unintended chemical reaction at a plant in Bhopal, India. In this incident, more than 3,000 people died shortly after the incident, more than 500,000 people were injured [16-18]. Estimates vary, but a total of more than 25,000 people died from exposure to isocyanate. The continuing effects of this accident include birth defects and environmental pollution. The disaster still has significant health and environmental pollution effects on Bhopal over a long period of time [20].

The incident has proven that the focus on changing safety and health practices in the chemical industry, as well as the actions of headquarters such as crisis management, emergency management headquarters, fire department and other relevant bodies and organizations responsible for risk control has accelerated. The incident showed that many aspects of proper chemical management were ignored or used in the operation of these facilities, due to improper maintenance that led to spontaneous leakage of materials, with the permission to build a residential area with very high population density around the factory where the deadly chemicals are located [21].

The loss of life and the loss of a large number of people in this accident was very widespread and preventing such incidents became more essential in the minds of safety and health professionals (occupational medicine). The incident led to some fundamental changes in the approach to chemical safety and risk management of large facilities. ILO Convention (No. 174) on the Prevention of Major Industrial Accidents in 1993 and its accompanying Recommendation (No. 181) focusing on the potential risks of a catastrophic accident and appropriate action planning Preventive and emergency response is based on the Occupational Safety and Health Management (OHS) system. In recent years, several methods and indicators have been developed to identify the risk and determine the amount of risk associated with the operations of units, processes and factories, which have made it possible to classify or embark on comparative analysis of risks [22].

Among the existing methods, the Failure Analysis and Effect Analysis (FMEA) method is the one that has recently been widely used to investigate the potential for defects in various products, processes, designs and services. This method analyzes the components of the system and relates the condition of the components to the condition of the system and tracks the defects of the components in order to determine its effect on the system. The purpose of the FMEA is to determine the causes of defects in the systems and to provide solutions to reduce or eliminate the identified defects in order to increase the reliability of the process. In this case, Ebrahimzadeh et al. evaluated the potential hazards of Shiraz refinery using Hazard Analysis and Impact Assessment (FMEA) method and identified and prioritized the most important risks. Jozi et al. also used the FMEA method to identify and assess the risk of hazards from high voltage transmission lines in residential areas [23].

Discussion

Millions of work-related accidents occur around the world every year. Some of these accidents cause death and others cause temporary disability that can last for months [24]. Accidents at work cause inconvenience to people and economic losses, and society suffers a lot of damage. Therefore, preventing these accidents is an important and fundamental task. Today, tens of millions of workers in the world are victims of accidents that lead to the death or disability of many of them. Many industrial disasters have occurred in the same developed countries, which shows the unpredictability of some accidents. Where do risk identification and risk assessment processes take place? According to statistics published in industrialized countries, one out of every ten thousand workers suffers an accident every year, and as a result of such accidents, 5% of working days are wasted. Hence, work-related accidents, in the one hand, cause discomfort to the worker or his family members, and on the other hand, cause the loss of capital and shake the economic foundation of society [25]. Therefore, such incidents are very important in the following aspects:

1. From a human point of view, any work-related accident, even a minor one, causes pain and discomfort to the worker and his family members, and if the accident is severe and leads to death or permanent disability, this issue becomes more important.
2. Socially, since the progress and development of any society depends on the labor force of that society, the product of each worker is not only the livelihood of himself and his family, but also the capital and support of the economy of a society. It is estimated that about 50 to 60 percent of the population in any society is of working age, but in principle the active population of society, especially in countries with low population growth, is about a quarter of the total population. Now, if some of these people are unable to do their work due to work-related accidents, this will cause instability in the social situation of the society.
3. Economically, accidents, in any form and degree, cause economic losses to workers, employers and society. These losses include damages resulting from work interruptions due to an accident, medical expenses, and finally damages paid in the event of temporary, permanent, or death disability. What should always be considered in organizations is that work-related accidents are caused by unsafe practices and conditions, the prediction of which can lead to the development of programs and preventive measures. Through his research and investigation of various accidents in 21 different industries and activities, 1.8 million accidents and 3 billion man-hours, Brad obtained the ratio of events due to defects and shortcomings in the performance of human tasks and errors with major accidents.

Conclusion

Using the health risk assessment method presented in this study, we can present the results of measurements and evaluations of harmful factors in the workplace in the form of health risk exposure to chemicals, physical and ergonomic factors, which can be allocated resources for control measures and prioritization should be used to reduce the final risk level to an acceptable risk level in industries such as the petrochemical industry. In fact, risk study is done to prevent losses and adverse outcomes. In risk analysis, although all risks must be stated, resource constraints usually prevent this from happening. That is why we use risk assessment. Risk assessment is a systematic and necessary process to determine the impact, occurrence and consequences of human activities on systems with hazardous characteristics and is an essential tool for the organization's safety policy. In general, risk assessment is a systematic process for identification and comparison that considers the key tasks of the organization and examines the threats, probabilities and consequences of risks. Occupational health risk management provides guidelines and instructions on how to identify, assess and control health risks for executives, health, safety and environmental consultants by creating a process called health risk assessment. The design of this process is very flexible, so that it can be used during the activities of a factory, from a complex chemical environment to a simple gas station. Nowadays, there is more information about the actual harmful factors such as chemicals, dust, noise, heat, radiation and microbial agents that can affect people's health. Health risk assessments are designed to ensure that risks that lead to short-term (acute) or long-term (chronic) health effects are controlled.

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