



### Case Report

## The Necessity of Risk Management Evaluations in Petrochemical Industries

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### ABSTRACT

The study looked at the need to manage risk in the petrochemical industry due to the horrific events of recent accidents such as India's Bhopal (with 4,000 killed), Ukraine's Chernobyl (with 38 killed), Flixborough, England (With 28 people killed) and Italy's Seveso (with a gas mass released from the blast 6 km long and 1 km wide) (Flixborough Vapor Cloud Explosion). Recent events have drawn public attention to the chemical industry and various risks involved in the petrochemical industry, and then as a result have increased the need for systematic safety analysis of various processes in the chemical industry. According to the International Labor Organization, 5,000 people die every day in the world due to accidents and work-related illnesses and 4% of the world's GDP per year, or 51.53, 1.3 and 2 percent, respectively. Millions of US dollars are spent on direct and indirect costs of work-related illnesses and accidents, which is 20 times more than the total international aid for development of third world countries

### GRAPHICAL ABSTRACT



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## Introduction

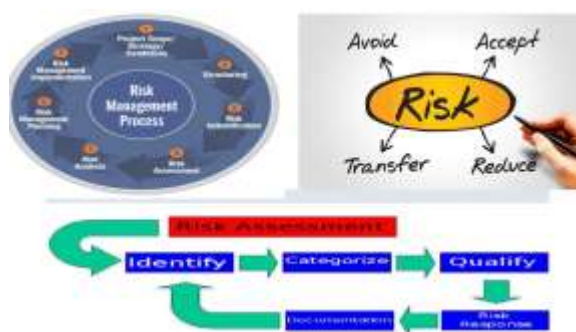
Risk assessment is a logical way to assess risks that identify their potential risks and consequences for individuals, materials, equipment and environment. In fact, it provides valuable data for deciding on risk aversion, improving the environment around hazardous facilities, planning for emergencies, acceptable risk levels, inspection and maintenance policies for industrial facilities, and so on while other items are provided. Since in the oil and gas industry, due to the type of processes and items used, the potential for accidents such as explosions and fires is very high. Due to the safety and implementation of programs such as accident analysis, risk identification and risk assessment in order to prevent the occurrence of horrific accidents is essential [1-4].

In 1993 study by a researcher named Catala showed that 120 million accidents killed 210,000 workers. There are a number of ways to identify a risk and assess safety risks, including methods such as patrols and audit safety inspections, William Fine, risk analysis and its effects (FEMA), Job Safety Analysis (JSA) and Process Risk Analysis (HAZOP) and so on. With the advancement of technology and increasing use of machinery, the process of risking and the possibility of accidents in industrial environments have increased. The process of industrialization of human societies and rapid growth of various technologies in the world with the invention and presentation of new methods in industries and the emergence of scientific and technical inventions and finally, discoveries caused today's man to be exposed to threats and pressures self-made and created. In this situation, the need to protect the health of workforce and other valuable assets in the face of environmental hazards is felt more than ever [5-8]. Over the past fifty years, significant changes have taken place in the materials, processes and types of activities in the chemical industry, especially in the oil and gas industries.

The oil, gas and petrochemical industries are of strategic importance in the country's macro development process. Iran is an oil-rich country and most of its revenues come from this national wealth. Crude oil production in Iran has reached 4,270,000 barrels per day and is projected to increase to 4,400,000 barrels per day by the end of 1988. Will find. Meanwhile, due to environmental changes and increasing uncertainty in the course of these changes has caused the risk of indisputable elements of the industry, including these uncertainties, unexpected changes in crude oil prices and oil products, damage caused by explosions and It's a big fire. By conducting strategic planning in oil projects and by having a systematic thinking and dynamic perception of the driving forces of external and internal environment and the implementation of relevant programs, we will be able to manage risks.

At present, in addition to expanding oil and gas extraction from oil springs and gas fields, oil-dependent industries have expanded and the variety of products and derivatives derived from them necessitates the construction of well-equipped refineries. We are witnessing a growing trend of large-scale industrial projects in this area that involve very latent economic values. The construction and commissioning of these refining units always involves a variety of risks and hazards. Therefore, to identify the insurable risks of the petrochemical industry and its evaluation and management, insurance industry experts need the cooperation of oil industry experts.

Contrary to tactics, strategies to achieve competitive advantage are fundamentally based on responding appropriately to environmental opportunities and threats and paying attention to the company's internal capabilities and shortcomings.



**Fig. 1.** The Stage of Risk Management

The potential and vast reserves of oil and gas in Iran and the significant economic benefits in this sector have made it clear to officials the need to prioritize and invest more in this industry. On the other hand, number of refineries and their products has increased, and as a result quantity of people working in these industries and the surrounding populations, which are exposed to their dangers, has increased [9]. Therefore, work-related accidents are presented as national loss. Therefore, prevention of work-related accidents is of special social and economic importance. Safety experts believe that more than 80 percent of work-related accidents and diseases can be prevented with simple, low-cost methods. Although the causes of work-related accidents and complications have long been described as unsafe and unsanitary practices, efforts to improve occupational safety and health have shown that these two factors are secondary and that the root causes are primary that is defects in the management system of organizations, in other words, the lack of a health and safety management system in the organization [10-13]. At gas refineries, there are several risks, each of which will have different consequences, depending on the type and nature. The more we go through the process of risk assessment, the better the results. Quantitative assessment can identify existing hotspots and risk factors and take action to prevent or control them by taking preventive and control measures. There are several criteria for identifying work-related accidents, but the most important ones

that were considered in this study are human, environmental and economic issues. In this regard, a scientific and approved method for deciding on it is necessary to justify the costs of eliminating the risk, as well as the need to implement risk control programs as soon as possible. One of the most common methods used by safety experts to achieve this goal is the William Fine technique, which is based on the calculation and evaluation of risk. This technique helps managers take steps to expedite the achievement of achieving specific goals by prioritizing risk and event control programs and determining urgency and control planning. The central and main part of any organization's strategic management is risk management. Risk management is the process by which organizations systematically identify risks associated with their activities with the goal of achieving ongoing benefits in each activity and in the light of all activities. Based on the process outlined above, the first step in risk management is risk assessment; Risk analysis (identification, description and estimation) and risk assessment are defined. Risk reporting, decision making, risk management, residual risk reporting, risk representation, and risk management process reform are the next steps in this cycle, respectively. Also, all the steps of this cycle will be reviewed after each run. As mentioned, the first step in the risk management process is risk assessment. The systematic process that proposes risk through risk concepts, processes and events is known as "risk assessment." In other words, risk assessment involves defining the system and its limits, identifying the detrimental event, assessing the probabilities, and the effects / consequences. As mentioned in the introduction section, two possible and definitive risk assessment approaches have been introduced and used in studies in this field. With a simple search in the literature on risk assessment methods, many materials and

resources are obtained regarding a definite and probable approach [14-17].

### Literature Review

The term risk in insurance culture is defined as the insurance policy, the insurance risk, the cost insured, and the expectation of damages for an insurance policy. Hillson & Murray-Webster (2004) have defined risk as "uncertainty that can have a positive or negative effect on one or more goals." "The uncertainty of the outcome of an accident that has two or more probabilities (commission of insurance Terminology, 1996) has been defined," he said. The oil, gas, and petrochemical industries in most sectors are hydrocarbons, all of which are flammable and can explode under certain conditions, as well as toxic compounds such as hydrogen sulfide and benzene, often present in the industry.

A study of the literature on the subject shows that there is little effort by risk management researchers to implement risk management DSSs for project environments. Rasmussen and Goodztin designed a public system to help managers of high-risk industrial projects to analyze risks. Prasanta's research included preparing a DSS to manage the risk amount of construction projects; in which the hierarchical analysis process and the decision tree analysis process were used to analyze its value. He implemented this DSS in the Indian oil and gas industry. Lou and Zheng also presented their DSS in Excel spreadsheet environment for evaluating construction and building projects. In this DSS, the computational core of the model base is fuzzy AHP for weighting risk factors. Nye and Watt designed a DSS for the e-business environment. The system was designed as a web site and used fuzzy calculations to calculate the probability and effect of risks. Seyed Hosseini et al., By posing the issue of consumer proximity, modeled it as a mathematical programming and presented an innovative algorithm to solve it. They provided a numerical example describing the use of CAP to

rank project risks. Research by Arish et al. includes providing a DSS for project risk response planning. The DSS model backbone is based on a combination of case-based reasoning and TOPSIS technique. Seyed Hosseini and Hatefi provided a model for project response to project risks. As a result they designed risk acceptance. In his doctoral dissertation, Taron designed a DSS to analyze and assess the risk of construction and building projects. In his work, he used intuitive reasoning, which is used in discussions of belief and function of justification. These two functions are adapted from Shakespeare's Dempster 23 theory to express uncertainty.

Feng et al. developed a risk network-based model for project risk management. In the designed risk network, the nodes indicate the risk and arcs indicate the priority communication between them. In their work, the effects between risks are considered in the form of risk chains and risk rings. Pordavar et al. proposed a framework for integrating knowledge management concepts with the risk management cycle, under which knowledge subsystems, risk recording, risk detection, risk testing, risk sharing, risk assessment, risk repository and risk-based training were taught. They must be based on knowledge. Pak Gohar et al. presented a DSS in two phases of the project, including a tender for the selection of a contractor and project planning [18-20].

### Project Risk Management

According to Karzner's definition, risk management is a set of activities and actions that are taken in dealing with risks and risk planning, risk assessment (risk identification and analysis), selection of risk response and monitoring measures and finally risk control includes. A systematic approach to the issue of risk has led to the introduction of risk management process (RMP). In a risk management process, risks are typically first identified and analyzed, then risk-taking measures are planned and implemented.



Risk identification involves determining the risks that affect the project. In the risk analysis phase 8, the risks are ranked by combining the probability and effect characteristics. Here, in addition to these two characteristics, analysts may use other indicators. Risk response also includes identifying and analyzing the actions needed to respond to risks. Before these activities, planning for these activities is generally discussed, followed by monitoring and control. Risk management planning answers questions such as: How and with what process should risk management activities be carried out? How deep and in what detail are risks identified and analyzed? What are the indicators for measuring success? Risk monitoring and control includes matters such as tracking and monitoring the status of risks during and after the implementation of response measures, measuring residual risks, identifying new risks and measuring the effectiveness of the project's RMP [21].

Emerging risks are not easily understood because their scope of expansion and potential impacts are unclear, but they are dangerous because they can quickly become major losses for the insurance industry. Professional identification and evaluation of emerging risks is an emerging element in risk management and distinguishes corporate risk management from traditional risk management. Score's strategy for identifying emerging risks is to form an internal network of observations and reports from legal experts, claims experts, insurers and risk managers, combining external information sources with insurance experts for the entire insurance industry to filter and evaluate. It is worth to say that identifies emerging risks. Although the main purpose of processing an emerging risk is to avoid unexpected losses and increase its unpredictability, it can be used to identify potential strategic opportunities associated with emerging risks [22].



**Fig. 2.** Risk management analysis in petrochemical industries

As can be deduced from definition of risk, each risk consists of three elements or components and therefore definition of risk means a precise determination of these three elements. These three elements are: threat factor, capital and threat effect in other words:

$$\text{Threat Factor} + \text{Capital} + \text{Threat Effect} = \text{RISK} \quad (1)$$

As can be seen in the above relation, by changing any of the components on the right side of the above equation, a new risk value is obtained. As a result, it is often possible to identify several different risks for a given asset depending on the type of threat factor and so types of effects. In this case, for each case, a risk ID will be provided separately.

Members of the risk assessment team can use this sample risk classification as a starting point to identify the types of risks applicable to assets. It is important to note that team members must identify all possible risks to the set under review based on their experience and expertise as well as using records of past events. When identifying risks, it is important to note that only risks that are likely to be zero (impossible and impossible) can be ignored. Otherwise, even the least likely risks should be recorded. Another point is that some risks may be applied by different factors, each of which must be prepared separately, as mentioned earlier. All in all, risk assessment will ultimately lead to a risk control program.

Following are five steps you can take to begin the process of preparation for mediation.

Step 1: Identify risks;

Step 2: Determine who and how may be harmed;

Step 3: Investigate the risks involved and take precautionary measures;

Step 4: Record Findings and Results;

Step 5: Review the evaluation and update it if necessary.

The assets in the domain are examined so that the risks to each of them can be fully identified. Assets are divided into four categories: information assets, software, hardware, and human resources, and examples are provided for each.

Hardware assets: include servers, personal computers, CDs, floppies, printers, scanners, notebooks, flash drives, portable drivers, communication network components such as routers, modems, switches, etc.

Software Assets: Includes software that is produced within the organization and used in line with the organization's mission and activities; software that is prepared outside the organization and is used in line with the organization's mission and activities, such as office automation systems, financial software, warehousing, etc.; and the usual and available software on the market that is used to do normal things, such as typing and spreadsheet software, mapping, etc.

Information Capital: Includes any kind of information, whether physical (paper, letter, etc.) or non-physical (data) that is valuable to the organization: work and organizational information such as project records and activities existing tasks, existing organizational missions and reports, organizational trends and plans, etc.; personal information such as legal information, personal information, work and service records, bank account numbers, etc.; security information such as passwords, encryption information and user authentication, etc.; databases on servers,

data files stored on users' servers or computers and more.

Human capital: Human capital includes all employees who work in the organization and if they lose, the executive process of the organization and work and organizational processes will be damaged: senior managers, various organizations and their successors and deputies; heads of departments and offices; specialized and experienced staff; managers and experts in the field of information technology and information security; specialist and technical personnel in the departments and other cases. After identifying assets, the valuation team identifies the risks associated with each asset.

## Conclusion

In general, many international coatings of oil, gas and petrochemical industries are also offered in our country. In many cases, these industries are covered by CAR and RAE insurance policies, completed structures, types of liability insurance and Special coverage of oil fields is also provided with the help of international insurers. In some cases, such as leakage and pollution insurance and damage to the environment, insurers are not considered, one of the reasons is the lack of attention of environmentalists and the lack of proper response from oil industry owners. The environmental damage caused by the environmental protection organizations has not been followed up and the owners of the polluting industries do not see the need to provide this coverage because they are not accountable. Given the above explanations, knowing more about these two developing and self-sufficient industries will have a significant impact on the peace of mind of the owners of oil, gas and petrochemical industries and the development of the insurance industry. These industries are not conceivable. In many cases, due to the import of modern technologies in the oil industry and refining, the need for more cooperation of experts in these two industries and simultaneous

learning of modern sciences and holding mutual training sessions for these two industries will lead to awareness of both. The products of the industry will be reciprocal, which will lead to the design and presentation of the required coverage of the country, and on the other hand, the knowledge of oil, gas and petrochemical industry experts will meet the needs of their units. It leads to the slow movement of these two industries.

An important tool for identifying and evaluating process risk systems is a company's internal control system. The basis of the internal control system is the correct understanding of the company's processes. There is a distinction between major processes such as compensation or financial accounting and support processes such as investment management and information technology infrastructure management. Process experts identify process-based risk control based on the risk control matrix. The internal control system plays an important role in identifying operational risks.

### Conflict of Interest

No conflict of interest was declared by the authors.

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