Chapter 1
General Approach to Risk Analysis

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ABSTRACT

Broadly accepted methodology that is implemented in the oil industry when dealing with risks includes as the first step the identification of possible hazards. That is done by gathering information about degree of risk according to working procedures, processes, and individuals involved in the operation of the process. That is the first step in risk management, an iterative process that must lead to the use of proper measurements in the way of protecting people, facilities and environment. The analysis is done based on the combination of probability and severity of undesirable events, and the final consequences. Explanation of basic terms, their interdependence, dilemmas, and methods of risk analysis are introduced. Each method is shortly described with main anteriority and shortcomings. Differences between quantitative methods, qualitative methods, and hybrid methods (the combination of qualitative-quantitative or semi-quantitative methods) are elaborated. The impact, occurrence, and the consequences are at the end compared to risk acceptance criteria concept. The ALARP (As Low as Reasonably Practicable) framework is explained with some observation on the quality and acceptance in petroleum industry. Finally, the human impact on the risk and consequences is analyzed.

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INTRODUCTION

The best approach in defining the risk is the implementation of risk management. It includes at the same time measures to avoid the occurrence of the hazard and other to reduce possible harms. Reason for that is the cognition that risk cannot be eliminated; so it has to be managed.

In decision-making process or system design; the hazard analysis, the risk analyses, and at last the risk assessment should be conducted as the part of the risk management process (Kavianian, 2003). They are used to identify possible hazards and treats, analyze the causes and consequences and give the description of possible risk. To understand the meaning of risk analysis, some differences and meanings attached to the term should be precisely defined. The term "risk analysis" has been adopted by petroleum industry rather than "hazard analysis" adopted by some authors involved in chemical industry problems (Kletz, 1999). Nevertheless the term would be (risk analysis or hazard analysis) it is used to describe methods that are used to identify hazards and help to estimate the probability and possible consequences of possible accident. The relation of probability and severity of the undesirable event, can determine if the risk is acceptable or not. When it is not acceptable, must the system be modified to lower one or another or both causes of the accident. To repeat in other words; the term "risk analysis" in this book will be addressed to description and identification of the undesirable events and characterization the cause and effects of "hazards". Two important items in the analysis terminology are "risk" and "hazard".

The risk assessment will indicate the appropriate process hazard analysis methodology that should be applied to the process. This will add in identifying of the different types of hazards that influence the system components acting. Also that will help to select possible solutions to eliminate the hazard. A hazard can be defined as a substance, event or situation, with the potential to cause direct harm or initiate a sequence of events leading to harm. Harm is defined as a physical injury or damage to the health of people or damage to property or the environment (ISO/IEC, 2012). In petroleum engineering it can include release of flammable or explosive substances or vapors, chemical spills, leaking pipes or valves, falling objects, etc. The effects or the consequences of the hazard can be immediate or long-term. They should impact people, the environment or the economic resources. The problems themselves are many and varied, and different methods are required in order to deal with them. Most of the techniques developed to date are applied during the development of a specific project. Therefore they should be discussed according to the normal sequence of project development phases: conceptual design and planning; detailed analysis; construction; commissioning and operation. The identification of a hazard is referred as the most important step in a risk assessment process. It relies on knowledge retention, which means, to be able to store and retrieve the information and knowledge generated earlier, learning through experience and accidents involved. It also includes the ability to predict hazards and combinations of hazards that have not yet been encountered. Figure 1 is an illustration of the hazard identification process.

Probabilistic risk assessment (PRA) methodology, that was developed by nuclear industry, and can be implied on oil and gas industry, in fact answers three questions: (1) What can go wrong in the process?; (2) How likely is the accident scenario to occur as the probability or a frequency?; and (3) What should be the consequences? In quantitative risk assessment (QRA), hazard identification can be the most important step. The explana-