TECHNOLOGICAL RISK MANAGEMENT IN THE OIL AND GAS INDUSTRY

PhD Associate Professor Mădălina ALBU [1]

Abstract

This paper addresses how the risks of equipment used the oil and gas industry are monitored and corrected during use equipment. Theoretical aspects related to risk management highlights notion of risk, the main types of risks and a thorough analysis of the technological risk entail notions of technical accident, failure, failure / malfunction, dysfunction. The paper presents the main types of hazards encountered in any field. Technical risk / technology may be defined, also technical security, in terms of quality and quantity. From qualitatively, meaning technical risk is the possibility of producing a major damage during system operation technology. The paper shows how Wells Drilling S.A. Company approaches the issues of technological risk and environmental impact.

Key words *risk management, oil industry, technological risk, risk evaluation*

Clasification JEL: Q52, M11

1. GENERAL DEFINITION OF RISK MANAGEMENT

As the name indicated, the feasibility study is an analysis of the viability of an idea. Currently, the concept of risk we can say that is synonymous with the activity. Although it is omnipresent in business, and not only the risk, most often, is difficult to detect or predict.

Events "unforeseen" that can influence future earnings and investment performance are so numerous and varied that their identification is a challenge even for the most skilled and experienced investors, that the future is essentially unknown.

However, as scientific risk assessment methods have become more sophisticated, the company attention they conflict with the acceptance and risk assessment technologies. The concept of risk has gained general connotations that have allowed the expansion to areas different structures of modern society.

In this context, risk is a problem related to the decision-making process. The analysis is, therefore, connected to the general problem of decision-making under uncertainty. Risks are not objective but are built by companies who make decisions, while the parties involved in the decision process, potential targets of participating in the process but its effects could perceive this as threatening. As stated in psychological studies of risk perception, this analysis has a significant impact on the attitude to the potential hazard. Opportunity to reach a consensus regarding the risk decreases significantly. The increased amounts of information, transparency and active communication with the audience cannot solve, but only to reduce conflicts regarding risk because the problem lies in the difference in content of the phenomena by issuer's decisions and decisions receptors.

1.1. Classification of risks

Given that any activity is at risk, it can be said that existence itself is a continuous assumption of risk. To know these risks, their classification is very useful in addressing risk.

[1]Faculty of Economic Sciences, Petroleum-Gas University, Ploiesti, Romania, malbu@upg-ploiesti.ro

One of the most common classifications of risk depends on the nature of the source that generates namely:

- Pure risk

Pure risk, risk refers to those materials that cause harm or loss. These are called risk insurers because it can take financial measures of safety in terms of effects, measures such as insurance policies protect the insured from the consequences of the event risk and if it did not result in the insured lose premium.

- Business risk

In business there is always the risk of losing risk is outweighed by the opportunity to win. The chance of winning, although that would mean taking risks, leads businessman in risky actions that can bring significant benefits.

From this point of view is a great businessman who takes risks. If very cautious or against risk, business cannot prosper because the risk taken is always determined by the chance and gain volume.

- Risk projects

Every project is a risk because it is always leading the way he has a past back to provide the necessary experience to forecast the future. Risk management projects associated risk estimates and whether the estimates are not correct then risk isn't properly quantified, leading to major problems in the project.

- Operational risk

Operational risk associated with carrying out certain operations or activities. This may include risks related to operation of a technological, management activity, the operation of a computer, etc. The risk occurs when a particular event or activity affects the operations.

- Technological risk

When it was finished an activity for the first time, the risk budget and terms are violated or not targets, it is substantial. This happens often when used technologies. Nature of the new technologies involves risks due to uncertainty in their use for the purposes for which they were designed. For example, a team can finish a task in three days, but this time, for various reasons there may be a technical problem on a machine, for which the team still work late two days. The possibility of developing a technical failure with implications for the smooth running of a business is technological risk.

- Political risk

It refers to situations where a decision maker is constrained by political factors. For example, if an investor wants to build a factory in a foreign country, it may face a hostile government that does not allow the project only under certain conditions.

Within an organization, political risk refers to the problems of internal policies. For example, when the marketing department promotes the idea of a new product on the financing conflicts arise because of the economic department in terms of investment, because it believes that the investment budget was exceeded or investment company policy does not allow the financing of a new product.

1.2. Technological risk

Unprecedented technological development in recent decades has devoted a number of areas, leading industries, characterized by the use of highly advanced technological equipment and technological processes in the context of complex claims. Exploiting different lines and plants technology involved, assuming operation quasi them by a significant reduction in the closures of weight caused by various disposals / failure under conditions suitable protecting medical personnel and the public, and in the context of environmental conservation requires the provision and maintenance of high levels of reliability and safety technique.

The development of modern technologies has resulted in giving a new dimension quality concept, which currently reflect not only guarantees the performance levels of the new technological system, but also to guarantee the conservation system performance during operation. This general property, while maintaining performance processing system was created in an individualized concept called reliability. Thus, the dynamic component identifies the technological effectiveness of quality - maintaining adequate levels of technological performance during operation.

Industrial practice has shown that no matter how much they would invest in to achieve and maintain a high level of reliability of a technological system cannot provide excellent reliability that cannot be put in a system that does not degrade over time. At the same time, a significant increase in the reliability of their high values usually involves a significant increase in investment costs involved during the design and development of system technology. In these circumstances, they should acuity achieve and maintain optimal levels of system reliability technological variables involved and the importance of life destination system proposed investment costs (relating to the design and implementation) and operational.

In terms of quality, the concept of reliability processing system designating system's ability to properly perform the required functions specified operating conditions for a period of time. This property, while retaining the performance of a processing system operating conditions specified undergoing an aggregate randomly complex material factors and human features all phases of successful automation system installation.

The safety concept and technical risk are inextricably linked with the notion of major damage. This is one of the possible consequences of a technical accident and requires, in essence, both the end system's capacity to perform adequately the required functions, and change or loss of physical integrity of these in the context of the severe consequences on health related technology equipment and / or staff of life and possibly the population and the quality of the environment or ecosystem balance.

2. ANALYSIS OF TECHNOLOGICAL RISK

Identifying potential major damage from the set of all possible damages related to a technical accident, it requires, first, evaluating all the possible consequences of the accident. Once known, they will be ranked according to criteria of evaluation / assessment of their seriousness; establishment of criteria is subject to negotiation between stakeholders (leader / designer, contractor, beneficiary and government authorities). In the circumstances of the adoption agreement, the limits of acceptability of the consequences, the damage can be discriminated against minor damage and major damage. The failure of major identifies with one of the possible consequences of technical accident occurred in the operation of technological system, therefore constituting a danger of view of the physical integrity thereof, and related systems, the human health, quality of environment and / or balance ecosystem .

As technical accident is a random event, it is clear that production of major damage is a random event.

Therefore, technical risk can be defined like technical security, in terms of quality and quantity. In terms of quality, the significance of technical risk is the possibility of a failure during operation major technological system. In terms of quantity, technical risk is the likelihood of major damage during system operation technology.

In the circumstances substantiating criteria evaluation / assessment of the severity of the consequences of the accident technical evidenced by the adoption of a ladder conventional quantify gravity and imposition (establishment) limits of acceptability of their plan coordination can be defined three areas specific technical risk :

a) the negligible risk, associated with a rule, transfer / actual failures or minor accidents (with the consequence of reduced gravity), rare and rare (with low probability, very low production, respectively);
b) the acceptable risk, for the minor fault common (with high probability of production), or major accidents (with the consequence of high severity), rare and rare;
c) The risk unacceptable for the major damage possible (with probability of occurrence that cannot be neglected) or common.

Technical accidents, falls into the unacceptable risk must be given special attention. It requires the use of the technical and managerial able to reduce the probability of occurrence and / or reduce the impact of these events on potential targets (reduce the seriousness of the consequences). In this way, technical accidents criteria evaluation / assessment of the severity of the consequences and limits their acceptability.

In engineering practice are, however, situations where an unacceptable risk is not possible (technical and / or organizational). In these circumstances, there is talk of so-called "residual risks" associated with major damage possible (with the consequence of higher severity and probability of occurrence that cannot be neglected). Residual risks are subject to risk management, appropriate strategies oriented foundation maintenance (technical supervision, monitoring, predictive), the rigorous investigation and profound accidents on designing, updating and implementation of contingency plans in case of emergency / crisis occurrence of damage with serious consequences, respectively, on the development and fulfillment of training / personnel training and / or people for exceptional circumstances.

The considerations so far outlined broadly, the issue of risk analysis. The first step is to identify the technological system disorders investigated; this involves identifying all factors (sources) risk involved in the installation of the system. Knowing the risk factors and the corresponding dysfunctions, it may be appropriate to identify possible scenarios for the production of technical accidents (ie those of events that lead to the production of technical accidents).

3. TECHNOLOGICAL RISKS IMPACT ON THE ENVIRONMENT

The term environmental impact refers to changes that occur in the environment as a result of an action (exhaust emission).

Taking into account the phases and stages of the placement of the ancillary identification of risk factors and systematize grouping them involves the following three categories:

a. factors intrinsic characteristics considered technological system; material not only in nature, being associated with the stages of design and implementation of the system and expressed essentially the defects that it enters into operation from the recipient;
b. factors associated operating conditions and territorial location; These factors also likely not only assets are related to all destructive actions exerted on technological system during its operation;
c. The human factor involved in the operational phase, it groups all the human errors that manifest in maintenance activities and operating throughout the service life of the technological system.

3.1. Technological risks in oil and gas. Case study - Wells Drilling S.A. Company

Crude oil and produced water, natural gas and combustion gases are the main pollutants and compounds belonging to the class of toxic, flammable and corrosive. The extraction of hydrocarbons, industrial or any other activity that affects the environment, both by carrying out its processes - such, and by some unwanted accidents that may occur. Mining and

quarrying hydrocarbon calls for firm measures regarding environmental protection, although it is not among the most harmful, given the area its extensive activities on land and sea, as well as indefinite action for reducing its effects on the environment through the promotion of environmentally friendly technologies, and as the methods and techniques depollution.

Knowledge of the hydrocarbons is needed in order to establish prevention / mitigation and remediation if pollution.

Extracting hydrocarbons that sequence of processes, tools and technologies, should be a sector with low environmental impact because it mostly takes place in a closed system.

The systematic sources of pollution are the most popular thermal emissions from engines or plants producing steam, combustion gases from underground petroleum volatile organic compounds.

In the process of extraction results and other emissions systematic (formation water, sludge, scale), whose impact should not lead to impairment environmental factors given that they are re-injected into the reservoir or is stored safely.

Risk assessment is a process for identifying, analyzing and assessment including hazard identification, probability of an event, effect size, and risk calculation including the importance hazards and environmental consequences affected.

The overall objective of risk assessment is to control risks from a location, by identifying:

- pollutants or hazards most important;
- Resources and receptors at risk;
- Mechanisms by which the risk;
- Significant risks appearing on a site, general measures to reduce the risk to an acceptable level.

The environmental risk assessment involves calculating the probability for an ecosystem or population to receive a certain amount of pollutants or to be in direct contact with it.

In the oil accidental impact with the ground, producing changes in physical, chemical and biological properties of soil, taking place the following processes:

- volatilization of light ends;
- Stratification of the soil profile such that the more polar components and high molecular weight, particularly the resins are absorbed into the structure of the soil in a thin layer on the surface.

According to the Wells Drilling Company, the impact it causes technological risks at ground level, humans and the environment is caused by a number of causes that lead to emergence of pollution in the extraction of oil and gas.

These causes are:

- Inadequate training of company personnel;
- The poor quality materials;
- Existing plant and machinery;
- Conduct improperly technological operations;
- The use of collection-storage systems in open system without recovering the gas phase.

Wells Drilling Company pays special attention and playback aside land occupied by drilling rigs, and for the handling and destruction of waste resulting from the impact of technology on the environment.

Following the technology company has signed contracts with various companies authorized to collect waste and thus avoid spills and environmental pollution from the activity.

By complying with environmental protection, the company has not recorded any incident related to the environment. No, and expected disputes over infringements on environmental protection.

3.2. Potential sources of pollution on the environment for operation of oil and gas deposits

For any company, environmental protection is of major importance as economic development takes place within the framework of the environment in which we exist and operate. The impact of environmental issues has profound implications for all organizations, regardless of size. Positive attitude to environmental protection is a key factor in developing an indefinite period of each organization. The extraction of hydrocarbons, as any industrial activity affects the environment, both by carrying out its processes - such, and by some unwanted accidents that may occur.

Complexity of the oil extraction causes wide pollution sources to be expanded to include near sources of pollution from human activities and pollution sources. Since polluting sources have the largest share, and the effect their infestation has lasting negative impact on the environment, it is necessary to identify those sources and possible courses of action on ecosystems. The activities of extraction and exploitation of deposits of hydrocarbons are considered as factors of production with a high degree of environmental pollution phenomena. Oil extraction in scaffolding system is closed, which should lead to avoiding or minimizing any form of pollution.

Wells Drilling Company has identified key areas where there are potential sources of discomfort to human health due to the operation of a well during drilling and oil extraction is: air pollution, noise pollution, water pollution, soil pollution.

The main sources of pollution and environmental impacts of these may be:

- Access roads require removal from circulation of forest land areas, agriculture, which remains affected by objective, while it is running;
- industrial areas and environmental factors affect the utilities landscape, noise, waste disposal specific activity;
- Pipes, phenomena of corrosion, cracks, breakages. Such pipes can be placed carelessly damaged by mechanical equipment operation, due to erosion, erosion;
- Probes drilling fluid and the spread of the use of chemicals, noise, vibration blowout result of drilling cuttings;
- probes in production samples of land subsidence possible emissions to the atmosphere
- injection wells injection agent (salt water, wastewater, gas), the infestation can occur at the surface and / or the column depth by breaking through cracking of drainage;
- Abandoned wells can affect the environment by effluents or the collected fluid piping, in particular of gas, image, traces of extraction.

Considered hazardous pollution sources are the emission of toxic compounds to environmental factors with respect to hydrogen sulfide, carbon monoxide, aromatic polycyclic hydrocarbons and heavy metals or radioactive.

Sources of pollution emissions toxic compounds should be subject to a monitoring program to know both the quantities issued and dispersion into the environment.

3.3. Measures for the prevention and reduction of negative effects on the environment

Remediation technology must be suitable treated case and at the same time be available on the technological market.

Necessary investigations aimed at the diagnosis of polluted areas mainly soil, the subsoil and ground water.

Diagnostics polluted areas are done by:

- Identification and characterization of pollutants into the environment determining the concentration, location of the affected areas of the gradient distribution or dispersion;

- determination and causes pollution sources;
- Physic and chemical characterization and the hydrogeological conditions of the contaminated area in order to determine the vulnerability of the environment.

Site characterization is the first step for any remedial activities affected areas. It is necessary to complete the study of both regional geological characteristics and contaminant distribution underground.

Geological features include layering, regional geology and hydrogeology groundwater. All of these factors affect the distribution and transport of underground contaminants.

Due to the complexity and heterogeneity underground, necessary information to determine the well bore front of pollution and contamination source and type of contaminants and form in which they are located.

As an actual implementation of remediation technology is seldom designed and implemented based solely on measurements of site characterization.

To obtain good results, the necessary guarantees of effectiveness and reliability of the proposed technology, not only on a laboratory scale but also in industrial conditions.

Before the effective application of technology, attempts are being made pollution, which gives a good estimate of the actual effectiveness of pollution, which are essential if biotechnology.

Behavior and pollutant characteristics are essential to move towards a particular method of remediation.

Remediation technology selection must take into account the type of pollution and pollutants. Thus, the volatile pollutants are proposed methods of natural gas extraction from the ground, while the biodegradable pollutants biotechnology is recommended orientation.

Concentrations of pollutants in soil and groundwater and endpoints covered by the clean-up will also hold a high importance in determining remediation technology.

Wells Drilling Company pursues ever-modernizing technologies used by investing refurbishment and replacement of equipment, which are made gradually, depending on the priorities, the level of technical and moral depreciation of equipment, and according to the technical possibilities for performing specific operations.

Given that the activity taking place in the oil industry is polluting investments in this area plays an important role in environmental protection and ecological balance where it was broken.

4. CONCLUSIONS

Risk is a problem related to the decision-making process. The analysis is, therefore, connected to the general problem of decision-making under uncertainty. Risks are not objective but are built by companies who make decisions, while the parties involved in the decision process, potential targets of participating in the process but its effects could perceive this as threatening. As stated in psychological studies of risk perception, this analysis has a significant impact on the attitude to the potential hazard. Opportunity to reach a consensus regarding the risk decreases significantly. The increased amounts of information, transparency and active communication with the audience cannot solve, but only to reduce conflicts regarding risk because the problem lies in the difference in content of the phenomena by issuer's decisions and decisions receptors.

Important not only to identify the opportunities and factors acting in each case, including the probability of occurrence and showing them, but the intensity with which they can act in one time or another, and therefore not simply identifying the consequences but estimate of the measurement, the measurement of these effects. Or just their exact determination - except

in very limited categories or specific conditions - is if not impossible, extremely difficult, and their determination based on the estimated (approximate) involves important risks itself.

Complexity of the oil extraction causes wide pollution sources to be expanded to include near sources of pollution from human activities and pollution sources.

Since polluting sources have the largest share, and the effect their infestation has lasting negative impact on the environment, it is necessary to identify those sources and possible courses of action on ecosystems.

The activities of extraction and exploitation of deposits of hydrocarbons are considered as factors of production with a high degree of environmental pollution phenomena.

Oil extraction in scaffolding system is closed, which should lead to avoiding or minimizing any form of pollution.

Site characterization is the first step for any remedial activities affected areas. It is necessary to complete the study of both regional geological characteristics and contaminant distribution underground.

Geological features include layering, regional geology and hydrogeology groundwater. All of these factors affect the distribution and transport of underground contaminants.

Due to the complexity and heterogeneity underground, necessary information to determine the well bore front of pollution and contamination source and type of contaminants and form in which they are located.

As an actual implementation of remediation technology is seldom designed and implemented based solely on measurements of site characterization.

To obtain good results, the necessary guarantees of effectiveness and reliability of the proposed technology, not only on a laboratory scale but also in industrial conditions.

Wells Drilling Company, to prevent any technological risks on the environment, adopted the plan of environmental protection which describes how the entity ensuring the performance of all activities in a manner acceptable environment and in accordance with Romanian laws and regulations under force. As a general conclusion we can say that risk management is a priority issue in all companies

5. REFERENCES

Albu, M., *Technical and Economic Contributions in the Field Of Monitoring and Reducing the Impact of the Oil and Gas Industry on the Environmental Factors,* Advanced Engineering Forum Vol 13, 2015, Chapter 3, pp 233-240 © Trans Tech Publications, Switzerland, http://www.scientific.net/AEF.13 ISSN: 2234-991X

Albu, M., *Integrarea componentei de mediu în strategia companiilor petroliere,* Editura Universităţii din Ploieşti, 2013

Albu, M., *Risk management process applied in the oil and gas industry,* International Conference Education and Creativity for a Knowledge based Society, 10th edition, 17-19 November 2016, Universitatea Titu Maiorescu, Bucharest, p. 16-19, ISSN 2248-0064, ISBN 978-3-9503145

Ciocoiu, C. N., *Managementul riscului: vol 1: Teorii, practici, metodologii.* Bucureşti: Editura ASE, 2008

Ciocoiu, C. N., *Managementul riscului: vol 2: Modele economico-matematice, instrumente şi tehnici.* Bucureşti: Editura ASE, 2008

Opran, C., *Managementul riscului*, Editura Comunicare.ro, București, 2004