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## A study on risk management in reservoir management project

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### ABSTRACT

It's necessary, in reservoir management project, to carry out risk management for the purpose of cutting down risk, reducing loss and obtaining maximum investment income. Based on the features of the reservoir management project, this article has established the basic concepts of risk management in reservoir management project, designed the basic process of risk management in reservoir management project, and analyzed the personnel placement of the risk manager in reservoir management project initially.

### KEYWORDS

Reservoir management; Risk; Project management.



## INTRODUCTION

Reservoir Management Project is a complex open system which has big investment, long period, complex inner structure and involves many factors. Numerous risk factors affect the system and the effective relations are complex. At the same time, the results caused by the risk factors are nondeterminacy. Risk has become one of the main problems that the reservoir management project faces.

According to the features of petroleum exploration and development, the risk of reservoir management project could be divided into some basic types which includes geologic risk, engineering risk, invested environmental risk, technical risk, and economic risk and so on<sup>[1-3]</sup>. Every risk is different in factors and effective degree and can't be treated in the same way. For instance, geologic risk factor, which includes the feature of structure (crevice, faultage and so on), the feature of oil reservoir (temperature, pressure, the PVT number and so on), the feature of reservoir (gyration, sedimentary facies, interlayer and so on), the precision of seismic exploration and so on. These factors are different in the effective degree under different situations and we need to use the risk management theory to analyze and handle them according to the concrete feature of reservoir management project, so as to avoid risk and improve the profits of oil reservoir operation. But by far, there are no systemic studies for the problem of risk management in reservoir management project in the existing books. In this paper, the author will make a preliminary analysis and discussion for the risk management in reservoir management project.

### THE ESTABLISHMENT OF THE BASIC DEFINE OF RISK MANAGEMENT IN RESERVOIR MANAGEMENT PROJECT

Nowadays experts in the domestic and foreign academia give diverse explanations and provisions. to the concept of risk, but in sum-up most of them agree on the opinion that risk refers to the nondeterminacy of the changed degree of which every result would happen under a certain circumstance and in a certain time. This nondeterminacy is a incomplete definition which comes from the recognition of objective things and they can't be used and controlled in a short time; on the other hand, it includes the nondeterminacy of things' results that people can't get the conclusion they designed and wished completely and there often appears some unnecessary or unexpected loss. In reservoir management, risk refers to the possibility of expected profits which can't be gotten. The author gives the define of the risk of reservoir management project to conveniently analyse and study. The risk of reservoir management project refers to the deviation between the real and the expected profits and the chance or possibility of meeting the loss or getting the additional earnings because of the effects brought by the unexpected uncertainty factors in the process of reservoir management. The main features of risk management in reservoir management project are as follows:

#### Objectivity

As a complete unit, risk of reservoir management project is an inevitable phenomenon and an objective reality which will not be diverted on people's subjective wills.

#### Occasionality

Though the existence of risk in reservoir management project has abstractness and nondeterminacy, the appearance of risk has materialities and differences. The occurrence of risk in range, degree and frequency or time, space and intensity and so on can show different shapes which show their own existences with special ways. The recognition of the risk in reservoir management project can find and reveal the inner operation rules only through the countless observation, comparison and sum summaries.

#### Complexity

Firstly, the complexity of risk in reservoir management project is shown on the complexity of happening reasons, appearances, influences and forces. Secondly, the process that risk in reservoir management project formed is complex and people can't understand and master its occurrence completely. Risk might happen in the every link of oil reservoir operation process, but the intensity, frequency and appearance of risk is so different that the operators have some troubles in mastering it.

#### Changeability

The existence of risk is the precondition of occurrence of risk. The occasionality and nondeterminacy of risk's occurrence make us infer the changeability of risk's existence. So the risk in reservoir management project can be transformed under a special condition. This transformation includes the change of risk's nature and quantity, the elimination of some risks in a special time and space and the generation of new risk.

### THE BASIC WORKFLOW DESIGN OF RISK MANAGEMENT IN RESERVOIR MANAGEMENT PROJECT

The basic workflow of risk management in reservoir management project includes the following five dynamic stages: the discrimination of risk, the metrology of risk, the decision of risk management, the execution of the decision of risk management, the evaluation of risk management.

### **The discrimination of risk in reservoir management project**

In the work of risk management in reservoir management project, it is the first but also the most important work to discriminate the risk that is to judge which factors there are, the main reasons that cause these risks, results that are caused by these factors and the serious degree of these results and so on. The other steps are finished based on this step.

There are many ways can be used to discriminate the risk in the reservoir management project, such as Delphi, SWOT, workflow picture, brainstorming, fault tree, scenario analysis, statement analysis, environmental analysis, losing static record analysis and so on. But the reservoir managers should pay attention to some limitations in every way. They must combine kinds of ways according to the reality of reservoir management project and the using of every way, because no way can reveal all the risk in reservoir management completely, nor all the factors caused the risk incidents. Meanwhile the reservoir managers must choose the best way or combinatorial methods according to the physical condition because of the limitation of the funds and the decrease of the profits that is caused by the growing work costs. The discrimination of Reservoir management project risk is a continuous process. The problem can't be solved just depends on investigation analysis for one or two times, and the accurate answer of many complex and potential problems can be gotten after repeated discriminations.

### **The metrology of risk in reservoir management project**

After distinguishing the various risk and the potential loss that reservoir management project faced, to conveniently evaluate the relative importance of every potential loss, the reservoir manager should measure the risk and estimate the frequency of various loss that could happen and the serious degree of these loss, and make prepares for making initial draft for the risk dealing and making the decision of the risk management.

The metrology of risk in reservoir management project mainly includes the following works: (i) collecting the materials which could be helpful for estimating the futuristic loss; (ii) arranging and describing the lose material; (iii) using the probability statistic tools to analyze and predict; (iv) knowing the flaw of estimation ways and avoiding errors through reducing the limitation of them.

It is the most challenging job in risk management in reservoir management project to measure the risk and confirm the happening frequency and the loss degree of the reservoir management project. The "nondeterminacy" is the subject that probability statistics studies. Through establishing the probability distribution based on relative data and revealing regulation of the happening frequency and the degree of loss, the reservoir managers could measure and predict the risk more completely and accurately.

### **The decision-making of risk management in reservoir management project**

Traditionally, people often based solely on work experience and subjective judgments to deal with the risks. With the breadth and complexity of risk, scientific and rational decision-making will directly affect the effectiveness of risk management. The decision-making of risk management in reservoir management project is the core of the risk management for an entire reservoir project. However, different decisions have different understandings about risks. So the results are also different. In the risk management decision-making in reservoir management project, it is crucial to determinate the expected value and utility for the loss of decision-makers, which also can reflect the characteristics of decision-makers.

The decision-making of risk management in reservoir management project is a series of activities to dispose reservoir management project risk with the help of reasonable choice of tolls, which is in the science-based risk identification, measurement according to its objectives and purposes. It should include the following three basic elements:

Process of decision-making on information. To understand and identify the existence of various risks and nature of the risks, and to estimate the size of the risk, are also to the deepening of the two previous stages.

Planning process of risk management program. Develop a number of programs for a specific objective of the reservoir project risk management.

Selection process of the program. As noted in the decision-making objectives and principles, using a certain decision-making tools, we can obtain the best treatment choice of a particular program or the best combination of several risk plans.

## **THE SET OF PERSONNEL FOR THE RISK MANAGEMENT IN RESERVOIR MANAGEMENT PROJECT**

Modern reservoir management organization is in flat way, which was formed by multi-disciplinary subject groups. It emphasized the interaction between several professionals and the interaction with the geology, engineering, economy, regulation, which can be used to remove the barriers between departments and establish a "basketball" mode. As the risk management in reservoir management project has been not only always operated vertically through the reservoir, but also be closely and horizontally linked with various professional groups, it is necessary to set up a dedicated risk management division. A dedicated risk management division should be the same as geological engineers, reservoir engineers, development engineers, chemical engineers, drilling and completion engineers, computer engineers and other the members of delegations, whose work are for the success of the project reservoir management and who can enjoy the corresponding responsibilities, rights and interests.

A dedicated risk management division is mainly the following aspects of the responsibilities and rights:

To identify and measure risk, to develop, select and implement risk management programs, and to evaluate its effectiveness.

In addition to these risk-related responsibilities, there is a very important task-- to obtain the assistance from other groups and to work with engineers of other disciplines with a shared risk management decision-making and shared decision-making results.

In the overall plan, risk manager should help the project leader to formulate a correct risk policy, plan and organize resources to maximize the effectiveness.

To build a clear responsibility and authority, information flow network throughout the various components of risk management, so that it is flexible to adapt to small changes in the environment.

In risk control, risk manager must create a risk awareness by the means of reward and punishment clearly so that every project members can consciously engage in risk control.

Risk manager should also measure the relatively cost-effective to identify that the appropriate risk management approach has been implemented.

## CONCLUSIONS

Risk management is one of important parts in reservoir management project, the effect of which will directly affect the success or failure of the reservoir management project. Risk management in reservoir management is also a new topic which is placed in front of scholars. This article presented the basic contents and processes and reached a preliminary discussion of the responsibilities and rights for the risk management division. Meanwhile, it needs further studying with a view to establish a sound risk management in reservoir management project system.

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