

Research of Security Analysis Technology based on Exploratory Well Engineering of Oil Gas

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Keywords: Security, Oil gas exploring, Evaluation.

Abstract: Aims at the security problems on well engineering of oil gas, this article will evaluate the security analysis technology. At first, the writer describes the process of drilling engineering and evaluates the relative risk factors at each phase. In the second place, we can find the security evaluation of this well engineering and provides the system principle of security evaluation. At last, this article analyzes the level standard that based on the analysis system model of drilling security. This paper supports positive function to the drilling engineering workers and security evaluators.

1 INTRODUCTION

The present society is increasing the dependency degree of oil and gas. Oil and gas has significant connections with the national economy development and living improvement. It is nothing to treat oil gas as the “National lifeline”. Oil and gas is the important strategic resources of China. However, the low prospecting degree and special condition of the working environment causes the continuous accident and seriously limited the oil gas development.

2 DRILLING ENGINEERING

Drilling is the system engineering with multiple operations, occupation, continuous operation, and the vertical crossing works. It has the characteristics of high input, high risk and high technology requirement. Security hazard happens everywhere during the drilling process. The once accident might cause maximum loss on engineering schedule and funds, even the casualties.

2.1 Drilling Process

Drilling is the necessary part of oil gas exploitation. Follow the drilling engineering we can sequence the works: prespud operation, drilling engineering and the completions engineer. Each phase needs to have the specific works.

2.1.1 Prespud Preparation

Prespud preparation is the first process of the whole engineering. Confirm the well position, and then we can start the prespud preparation. It includes: well position exploration and land expropriation, bridge and road engineering, well site earthwork, equipment removes and installation and so on.

2.1.2 Drilling Engineering

It divides into first drilling, second drilling and the third drilling. During the drilling process, it needs a drill stem-testing cooperation, electrical logging cooperation, sidewall coring electrical logging of finish drilling and drilling coring. Otherwise, drilling engineering requires pipe service, drilling fluid service, material supply service and drilling service of exceptional well to protect engineering success.

2.1.3 Completions Engineer

Completions engineer needs to do running casing, well cementation, and well cross in order to protect oil gas exploitation.

2.2 Risk Evaluation of Drilling Engineering

Drilling engineering is the complicate project. It includes multiple uncertain factors. The relative

enterprises, management departments need to forecast the accident possibility, evaluate the risk degree, find out the accident rules, reasons, and adopt the remedial measure.

2.2.1 Dangerous Substance

Oil and gas are the flammable and combustible materials. Gas has a higher specific gravity than air. It can spread to lower places and burn once touched the open fire. Otherwise, some crude oil has sulfureted hydrogen, which has toxic. If you intake it in short time, you will shed tears, photophobia, cough, and confusion. The serious condition has coma, edema, even death.

Otherwise, the raw material of drilling engineering is the flammable and combustible materials as well as mountain flour, grease and so on. The drilling process will create effluent, dust, and noise. We need to do the unity collection and management by the professional workers.

2.2.2 Risk Factors of Drilling Engineering

Drilling engineering is full of risks. We need to focus on the security questions. The drilling risks have: object striker, high-altitude falling, fire, well slough, thunder, and poisoning. The well cementation risks have: electric shock, chemistry corrosion, poisoning, casing failure, high pressure damage, and tool damage.

2.2.3 Environmental Factors

Drilling engineering has various difficulties. We need to consider the external environment factors while avoid human error. For example: meteorological condition, earthquake, and road question.

3 RISK EVALUATION OF OIL GAS EXPLORATION

3.1 Risk Evaluation Content.

3.1.1 Drilling Design Evaluation.

Drilling design includes geology, engineering and construction. Geology design needs to collect pressure factors, oil gas location, and geological factor. Drilling engineering design includes standard, regulation, well structure, feasibility and the rationality analysis of well cementation and well

completion. Drilling construction needs to follow the design of geology and engineering to analyze the construction rationality and the risk of uncertainty factors.

3.1.2 Construction Environment Assessment

We need to inspect the geology, weather, and hydrology. Moreover, evaluate the effect proportion and the maximum protection of people and property security when facing the emergency.

3.1.3 Construction Site

From the site test, we can evaluate the security degree of people and equipment, and then formulate rules and safety regulations to protect the correct operation. During the construction process, we can abstract the relative parameters, obtain the materials, evaluate the practical condition and avoid the risk.

3.1.4 Emergency Capacity Evaluation

We can reference the engineering experiences and evaluate the site investigation in order to design the emergency plan and train the workers.

3.2 Risk Evaluation Principles of Drilling Engineering

3.2.1 Systematicness

The whole security system includes people, equipment, and environment. The relative functions build the whole system with the inseparable details.

3.2.2 Pertinence Principle

Drilling engineering is complicated. We need to evaluate the engineering based on the practical condition in order to depend on the experiences and principles. Different engineering has the various security indexes. The details are different with similar keys.

3.2.3 Simple Scientificity

Risk evaluation supports service to the engineers. The evaluation index should be simple and clear that can reflect the detailed engineering condition.

3.2.4 Stabilization Comparability

Drilling process steps should be quantized. We can adjust the operation error.

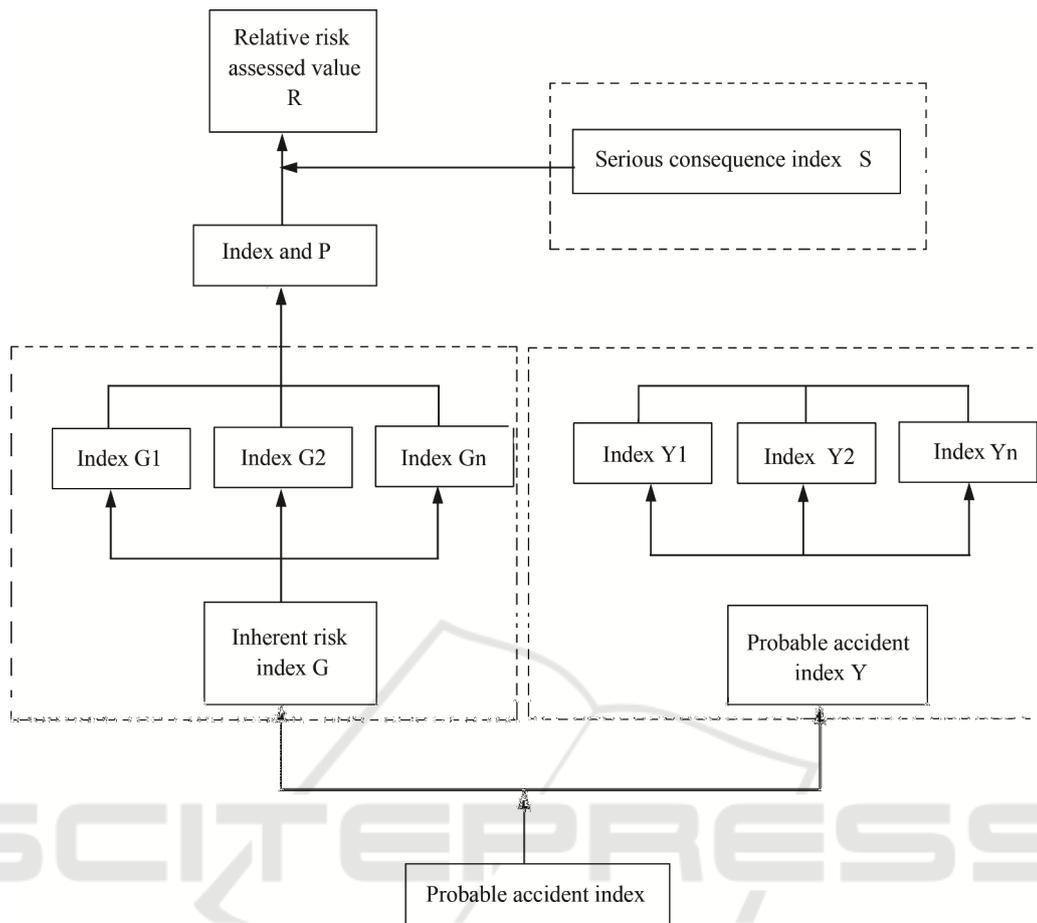


Figure 1: Model of security evaluation system.

3.2.5 Indexity

Use detailed value to analyze the security degree will raise the staff attention from each number changing and reflect the safety condition.

3.3 Index Evaluation System

The evaluation system combines with index system, scoring system, risk ranking standard and specialists. The security risks of different phases of the index system. The advantage of perceptual intuition requires more consideration. Scoring system provides reasonable values to each index. The advantage of its abundant information content has the disadvantage of stronger subjectivity. Risk level depends on the risk standard and the probable hazard rating. The specialists include relative technician and the experts from other fields to help the data analysis.

4 ESTABLISHMENT OF SECURITY EVALUATION SYSTEM

4.1 Model of Security Evaluation System

The model of the security evaluation system combines with inherent risk index, serious consequence index and probable accident index. Figure 1 is the basic model.

(1) Inherent risk index: all the drilling engineering has this unmodifiable risk. For example: the environment and geology of this engineering

(2) Probable accident index: drilling engineering is complicated. The accident did not happen individually. It might be caused by one small accident, then give rise to the serious accident. We can use the formula (1) to describe the accident ponderance.

$$R = P * S = (G + Y) * S \quad (1)$$

R is the relative risk assessed value, P is the sum of the inherent risk index (G) and the Probable accident index (Y), and S means the serious consequence index.

(3) Probable accident index: during the engineering operation, the probable accident is changeable that we can avoid the accidents through regulation and security operation.

4.2 Risk Ranking Standard

Based on the practical condition and evaluation system of the drilling engineering, this article divides the risk into four levels through the security question research of the oil gas drilling engineering. The details are in table 1.

Table 1: Risk ranking standard.

Level	Value-at-risk	Description
1	Less than 100	Los risk
2	100--200	Medium risk
3	200--350	Superior risk
4	350--500	High risk
5	More than 500	Extreme risk

5 CONCLUSION

This article starts the research based on the security analysis of oil gas drilling. The oil gas exploiting has the direct bearing on the national economy and the people's livelihood. At the same, the exploratory well engineering of oil gas is complicated with high risk. It will cause as minor cost as the waste of funds, equipment and time. Moreover, it might to cause the casualty, which requires relative people pay high attention to it. For the length limitation, this article did not support the related index of security evaluation system. Hope the interested readers will perfect this article based on the local requirement.

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