This issue of the Crisman newsletter contains brief descriptions of four on-going Crisman research projects.

1. **Casing Failure**
2. **An Advisory System to Select Drilling Technologies and Methods in Tight Gas Reservoirs**
3. **Advanced Development of an Advisory System on Evaluating Potential Unconventional Hydrocarbon Resource**
4. **Enhanced Oil Recovery with Polymer-Surfactant Flooding**

For more information on these and other Crisman projects, please visit our website at: [http://www.pe.tamu.edu/crisman/index.html](http://www.pe.tamu.edu/crisman/index.html). A compiled list of the projects, including categories and links to each project’s web page, is available at: [http://www.pe.tamu.edu/crisman/projects.html](http://www.pe.tamu.edu/crisman/projects.html). For detailed information, contact one of the key investigators listed on the project.
Casing Failure

Objectives
Casing that can resist the formation stresses and prolong the life of the well is to be desired. The objective of this research is to develop a tool that helps in casing selection against the environments where casing failures are problems. Well production and stimulation change formation effective stresses that induce casing failure. Failure mechanisms are described according to stresses associated in the formation as being tension, compression, and shear failure, though shear failure is usually caused by slippage in the formation or fault. Fig. 1 shows different modes of failures in the formation. Formation effective stress changes relative to the amount of oil produced, water injected, and temperature. Decrease in pore pressure as a result of production causes reservoir compaction, which can bring about compression failure on casing. Water injection for driving oil to the production well creates heaves (upward deformations near the surface) that generate excessive tensile stress on casing. Further difficulties associated with casing failure have to be studied, such as fracture, type of reservoir, and geothermal type well. The objective of this research is to perform proper casing tests by simulating actual environments to validate a casing’s potential to extend the life of the well.

Approach
Various research papers are being studied to cover causes related to casing failure, failure mechanism, and material properties of casing that play roles in resisting failure. In addition to the literature reviews, field data will need to be acquired to simulate the testing environment. With field data, simulation development of the actual environment can be set for the testing. Setting up the simulation according to a real environment will be a challenge. Because casing fails in many modes, our lab equipment is robust enough to simulate all failure modes. Casing may be sent to another lab to be tested. The resulting interpretation of the findings is the last step toward proving casing potential as a factor in increasing the workability period of a well.

Significance
Because casing failure is a problem in both developing and developed wells, choosing casing that performs without problems can bring good economic outcome to the project. Casing is essential to protect wells against formation pressure and to increase production. Casing failure stops a well’s total production, which results in loss of income and more money spent on the project.

Fig. 1—Various modes of casing failures are depicted.
An Advisory System to Select Drilling Technologies and Methods in Tight Gas Reservoirs

Objectives
The number of tight gas wells being drilled in the U.S. and worldwide has increased considerably over the past few years and is forecasted to keep this trend in the coming decades. To develop tight gas reservoirs, engineers face complex problems. One of them deals with drilling technology and method selection. Thus, a “system” collecting industry expertise could assist drilling engineers making decisions when drilling tight gas formations.

Approach
A computer program based on “case-based” reasoning, flowcharts, Boolean and fuzzy logic functions has been created to deliver guidance and recommendations about drilling technologies, methods selection, drilling time and cost estimation.

Accomplishments
The “advisory system” performs four main tasks: the selection of drilling technologies among conventional drilling, casing drilling or coiled tubing drilling; the determination of drilling methods to associate with the drilling technologies previously selected among overbalanced drilling, underbalanced drilling or managed pressure drilling; an estimation of drilling time, in days; and drilling cost, in U.S. dollars, for each section of hole from surface to total depth.

Significance
The research project shows the petroleum industry that a drilling advisory system can be an efficient tool to capture the industry best drilling practices, and help select efficient and successful drilling technologies and drilling methods for tight gas reservoirs by mimicking expert decision making.

Figure 1-Drilling parameters for each section of hole to be drilled.

Figure 2-Drilling technologies and methods recommendations for each section of hole.

Project Information
1.1.12 Developing an Expert System for Well Completion in Tight Gas Reservoirs

Related Publications


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Nicolas Pilisi
Advanced Development of an Advisory System on Evaluating Potential Unconventional Hydrocarbon Resource

Objectives
Unconventional hydrocarbon resources will play an increasingly important role in meeting global energy demand in the coming decades, according to Masters’ Resource Triangle Theory. Therefore, it is imperative to develop an advisory system to identify and quantify the potential unconventional hydrocarbon resource in basins around the world. Based on knowledge and data searched from literatures worldwide, we will present an advisory system to evaluate and direct the exploitation of an unconventional hydrocarbon resource. At present, we have performed the advanced development of its two components: Basin Analog Approach (BASIN) and Petroleum Resource Investigation Summary and Evaluation (PRISE).

Approach

BASIN
To identify analog basins, we will build an information database covering the information for both conventional and unconventional resources of basins in North America, which are called “reference” basins. Then a system will be built for matching a frontier basin with the closest analog in the “reference” basins database. In this system, the user can get assistance on “reference” basins which are mostly ranked analogous to the frontier basin. Finally, the user can use the analog basin to evaluate the potential unconventional resources in the frontier basin.

PRISE
PRISE is built to provide a methodology for estimating unconventional recoverable resources in basins with no or very little unconventional resource information. On the basis of PRISE, the petroleum industry can better understand the potential unconventional resources in the frontier basins worldwide. For this research, we searched available resource information from many agencies, including National Petroleum Council (NPC), Potential Gas Committee (PGC), Gas Technology Institute (GTI), Energy Information Agency (EIA), and the United States Geological Survey (USGS), to quantify recoverable resources in North American basins.

Significance
So far the significance of the findings has shown this to be an effective and powerful system to evaluate unconventional hydrocarbon resources in North America basins. However, there is still great potential for further research on advanced development:

» The BASIN logic needs to be optimized;
» We only have the EXCEL VBA version for PRISE, so we have to update the version into VB2005.net and improve its performance;
» The information database is limited to North America basins, so we can extend the experiences in North American to other regions through searching for more basins information all around the world.

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Project Information
1.1.19 Developing an Expert Advisor for Unconventional Gas Reservoirs

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Enhanced Oil Recovery with Polymer-Surfactant Flooding

Introduction
More than 224 billion barrels of immobile oil remain in the U.S. domestic reservoirs and, for a number of them, chemical flooding may be the only viable method for significantly reducing oil saturation in the field. Research needs to be conducted to fill in the gap between newly synthesized polymer/surfactants and the current oil industry practice. Polymer flooding has been proven to be a viable method for enhanced oil recovery by improving the sweep efficiency due to better mobility control; adding surfactant and alkaline to it improves the recovery factor even further due to lowered interfacial tension between oil and water.

Objectives
Based on the foregoing, main research objectives are as follows:
» investigate which polymers can be used in EOR besides the most commonly used HPAM (partially hydrolyzed polyacrylamide) polymers.
» design a surfactant-polymer system that may achieve oil recovery as high or higher than with HPAM polymers but is also less costly.

Approach
The study will consist of two parts: experimental study and simulation.

Main tasks in the experimental study are as follows.
» to determine the important physical properties of various polymer-surfactant systems, e.g. viscosity, phase behavior, etc.
» to determine the performance of the polymer systems by core flooding experiments.

Simulation will be performed using UTCHEM to history-match the oil recovery performance obtained from experimental runs and then to perform scaled up 3D reservoir simulation.

Accomplishments
We have found several interesting polymer candidates. Experiments are currently being conducted to evaluate the properties of these polymers.

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Project Information
1.3.23 Experimental Study of Steam Injection with Surfactants for Enhancing Heavy Oil Recovery

Related Publications


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