Innovative cementing meets increasing needs

STRETCHING CEMENTING TECH

IN MEXICO, DRILLING in increasingly challenging environments is taking the cementing industry into uncharted areas and stretching the limits of current technology. Current technology can't ensure successful circulation and an effective seal. Failure to achieve a seal can have a large impact on the cost of drilling a well and its productive life.

Traditionally, the industry has relied on two very different technologies for the creation of ultra-light cement slurries — either using nitrogen or via the addition of low specific gravity microspheres into the cement. While both technologies are capable of producing very light cement slurries, neither have been used in an oilwell to form an effective seal at densities below 7.5 lb/gal. In these most difficult Mexican formations where fracture gradients range from 7.5 to 6 lb/gal, current cement densities have reduced chances of successful circulation.

This paper presents case histories showing a melding of the two technologies. Lab data and guidelines are provided for how to best use these technologies at densities down to 5 lb/gal (a world record).

Ultralightweight Cementing Technology Sets World's Record for Liner Cementing With a 5.4 lb/gal Slurry Density (IADC/SPE 98124) DS Kulakofsky, R Bonifacio, O Araujo, Halliburton; I Ramirez, Petroleos Mexicanos.

98124: To adapt for drilling operations in Mexico, melding of foam and microspheres technologies stretched current lower slurry density limits—down to a 5 lb/gal cement that set a world record.

LARGE CEMENT VOLUMES

With deep wells being drilled in the Gulf of Mexico, the volume required to cement a larger casing back to the surface can exceed 20,000 sacks. The conventional jackup rigs used to drill these deep gas wells are generally limited to less than 10,000 cu ft of bulk storage. This bulk storage is generally divided between barite, bentonite and cement.

If liquid pre-mix cement slurry could be maintained in boat tanks during maritime conditions for extended periods of time, it would be possible to perform a 30,000-sack cement job from an offshore supply vessel.

For the liquid pre-mix cement slurry to be considered a viable alternative to conventional cementing technology, it's necessary to determine: Is the agitation system in the liquid mud tanks sufficient to maintain large quantities of premixed cement slurry? Can slurry maintenance be performed on the slurry while it's in the liquid mud tanks? What are the personnel requirements for liquid slurry maintenance while at sea? Can the boat transfer liquid cement fast enough to meet the job requirements? Could the density of the original premixed slurry be increased or decreased in the boat tanks?

This paper will outline the 10-day slurry stability test that was undertaken aboard an offshore supply vessel. This test duplicated the anticipated storage conditions of 650 bbls of pre-mixed cement slurry stored in the liquid mud tanks of a working offshore supply vessel.

Large Scale Feasibility Determination of Storing and Transporting a Liquid Premixed Cement Slurry Below Deck Under Maritime Conditions (IADC/SPE 98894) CJ Fanguy, DR Doherty, DT Mueller, BJ Services.

FLUID DISPLACEMENT

The need for an efficient displacement of drilling fluids from cased wells prior to installation of completion equipment has been relatively undisputed in the past.

Several different fluid systems have been applied, as well as a variety of different mechanical tools, to achieve what is considered to be a clean well in order to safely run advanced completion equipment in the well. In contradiction to the requirements related to running more advanced equipment in the wells is the

fact that several of the fields on the Norwegian shelf are entering the mature phase and tail end production. For these fields, the margins are less, and a significant focus is put on cost-efficient solutions. In many cases, the need for casing cleaning in conjunction with displacement of drilling fluids is questioned.

This paper reviews the results from drilling fluids displacement and cased hole cleaning operations performed on 190 wells on the Norwegian continental shelf over the past five years.

These wells cover a variety of different completion scenarios where both water-based and oil-based drilling fluids have been used.

The results from the survey are presented with a focus on the requirements toward a clean well and the ability to measure the efficiency of the different fluid systems and operational procedures used. The paper discuss different casing cleaning requirements versus well completion scenarios and displacement techniques.

Displacement of Drilling Fluids and Cased Hole Cleaning: What Is Sufficient Cleaning? (IADC/SPE 99104) E Berg, S Sedberg, H Kaarigstad, BJ Services; T Omland, K Svanes, Statoil.

PREVENTING STUCK PIPE

Comparatively little research has been done to predict stuck pipe, and there are few references for quantifying estimates of force needed to free stuck pipe. If the risks that lead to stuck pipe are identified in advance, procedures can be set up to reduce the possibility of their occurrence.

This paper presents an application of neural network methods for understanding the causes of differentially stuck pipe. The method enables drilling industry personnel to estimate the risk of occurrence of stuck pipe during well planning procedure and during drilling. A feed forward error and learning rules are used. The convolutional analysis of the model is based on the constraints of different drilling variables. The trained neural net is shown to be able to automatically detect variables of concern.

The paper also includes field case studies of stuck pipe incidents from the Gulf of Mexico where the neural network methodology successfully predicted pipe sticking.

Stuck Pipe Prediction and Avoidance: A Convolutional Neural Network Approach (IADC/SPE 98378) R Samuel, Halliburton; S Nagarakanti, C Siruvuri, University of Houston; KK Bharucha, Landmark Graphics Corp.

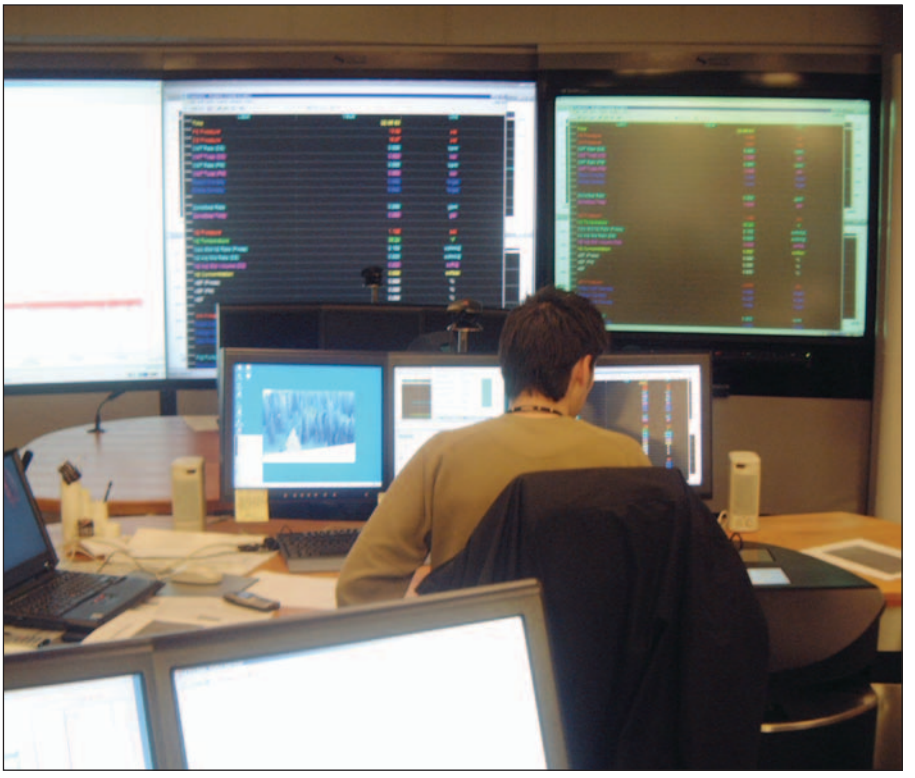
DOWNHOLE PREDICTIONS

This paper will explain how design data and real-time simulation of cementing jobs can be used to make detailed predictions of well parameters and provide information so that adjustments can be made during the cementing operation. The tools allow a more accurate prediction on cement tops, changing casing programs, controlling flowback rates and pressures, monitoring equivalent circulating density (ECD) on specific zones, or enabling personnel to create a better design for the next well in the field.

Computer simulations that model surface and downhole conditions can prevent cementing failures both before the actual cementing operation and during the operation. Maintaining control and predicting problems can be determined by taking into account all the monitored and calculated variables on a real-time mode and comparing the outputted predictions with the pre-job design and the actual ongoing job.

Demonstrated by examples and case studies, the simulation process performs steps needed to give precision to predictions in placement calculations. Multiple design program runs may be taken without actually jeopardizing the integrity of the well.

Study Comparing Computer Simulated and Monitored Real Time Cementing Designs vs. Actual Jobs in Progress (IADC/SPE 98079) PG Creel, MR Briney, H Pipes, DD McKenzie, Halliburton.



98079: A designer plans a cement job that will be monitored in real-time. Design data and real-time simulation of cementing jobs can be used to make detailed predictions of many well parameters and provide information so adjustments can be made during the cemeting operation.

CASING/LINER DRILLING

Recent technological advances are driving casing and liner drilling from a niche market into the mainstream environment. Improved connections, tubulars, advances in rig technology and pipe handling have enabled operators to consider drilling with casing/liner as an option on many new wells.

In a mature South Texas field, an operator discovered the difficulties of drilling into formations with weak matrix strengths, loss circulation zones, and tight pore pressure/fracture gradient windows. These issues have deemed the field sensitive to aggressive drilling techniques, and the operator has been forced into a conservative drilling program with reduced flow rates and lower weight on bit capacity.

99110: In a South Texas field, a liner drilling system was used to allow the operator to ream and drill liner to bottom. The system includes a robust fixed cutter and a drill in liner assembly designed to handle rotation and torque.

A service company introduced a new liner drilling system engineered so the operator can ream and drill liner to bottom. It is comprised of a robust fixed cutter casing bit and a drill in liner assembly designed to handle rotation and torque.

The liner system utilizes a running tool that allows the liner to be pushed, pulled and rotated without fear of release. Once at desired setting depth, the hydraulic balancing tool is released with a setting ball. The casing bit is manufactured from a specialized steel alloy that allows technicians to braze PDC cutters directly to the one-piece bit, ensuring a robust cutting structure capable of efficiently drilling new formation, as well as reaming existing hole. Even with less than optimal drilling parameters, the system allows the operator to run the liner to section TD, cement, and then drill out with no damage to the BHA.

To date, seven intervals have been drilled with this system.

Managing Uncertainty and Reducing Risk: Liner Drilling Operations in South Texas (IADC/SPE 99110) LI Clark, EE McClain, Hughes Christensen; K Evans, Baker Oil Tools.