Benefits of Expandable Tubular in the Petroleum Industry

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1. Introduction

Expandable Tubular Technology (ETT) is a downhole cold working process where a conical mandrel is driven mechanically or hydraulically through a solid tubular to expand it to a specified diameter. This technology is one of the interesting innovations for well construction and completion and one of its main long term objectives is the achievement of mono-diameter wells. However, the already existing applications are characterized by a considerable flexibility, wide range horizons, and cost effectiveness for many long outstanding problems faced during well construction and operation. This technology has gained momentum and attracted the attention of operators and researchers, and is rapidly expanding its horizon for field applications. However, still a lot of research and laboratory experiments need to be done before this technology is fully used for commercial applications.

The continual increased demand in deep, directional, horizontal, and extended-reach drilling may create demand for more complex use of ETT. Thus, this technology is particularly an interesting field of engineering research and development. Current research work mainly aims at addressing factors such as reduction of power required to achieve certain expansion percentage, effect of friction and weight during expansion, minimization of surplus deformation, optimization of mandrel shape, mandrel speed, pipe size and grade, etc. Knowledge of post expansion mechanical properties is required for accurate service rating of the tubular products under evaluation. Critical data such as hardness, chemical resistance, post-expansion strength, ductility, impact toughness, burst and collapse strength are needed for selection of a tubular for a given application. Therefore, the objective of this research work is to design an experimental setup to investigate the mechanical expansion process for different expansion ratios. This allows the measurements of the required drawing forces, tubular thickness variation, and stress concentration factors in the neighborhood of induced circular holes. The experimental study will be supplemented by finite element modeling of lab and field cases.

2. Key Features

2.1 Solid expandable tubular technology applications

Maintaining the profitability of old fields and exploiting economically unreachable new reservoirs are two challenges that continue to face operators in petroleum industry. Solid expandable tubular technology provides many applications to address these issues where three major ones are widely discussed in the literature. These are open hole liners, cased hole liner and liner hangers (see Fig. 1), which consist of in-situ tubular expansion in order to conserve hole sizes, avoid trouble zones, extend the reach to unexploited reservoirs and repair damaged zones or increase its strength and integrity. Expandable open-hole-liner is used to reach inaccessible reserves, solve lost circulation problems in borehole and isolate trouble zones [1-3]. The principal use of expandable cased-hole-liner is related to well remediation. This application enables operators to repair existing damaged tubular or reinforce their strength [4]. Expandable liner hanger is used to create hydraulic integrity of the connected tubular in order to eliminate possible leaks in the annulus. Unlike the two previous applications, expansion of liner hanger can be performed using a top-down technique as well as bottom up technique [2].

2.2 Project strategic objectives and current status

Most of the producing wells in UAE are aging; thereby, requiring cost effective rehabilitation and maintenance techniques using state of the art technology. Therefore, the present project has long term strategic objectives consisting of satisfy the needs of ADNOC operating companies through i) simulating real life field applications, ii) building a multipurpose research lab capable of conducting large scale tubular expansion tests, water jet drilling, and tubular burst and collapse tests, and iii) developing cost-effective techniques to maintain aging wells operational. Phase I of the project started the second quarter

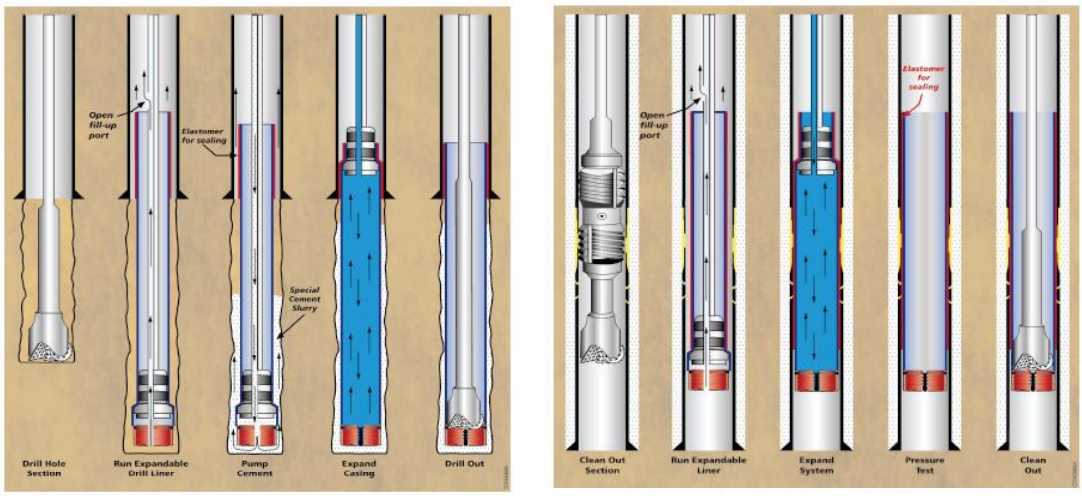

Fig. 1. Downhole tubular expansion in open and cased holes.

of this year and progress in the design of lab experiments based on preliminary finite element results is being made as well as initial testing is underway. Phase II will be pursued after completion of the first phase which is expected to be completed by the second quarter of year 2007.

4. Conclusions

Though expandable tubular technology is implemented in regions throughout the world where extensive well rehabilitation is needed, I am certainly sure that ADNOC operating companies will look into this technology once they start having problems with their aging wells as it provides coast-effective solutions. Therefore, having a research lab at the Petroleum Institute to tackle anticipated problems ahead of time will be beneficial to ADNOC.

5. References and Bibliography

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Author Biography

Dr. Seibi received his Ph.D. degree in Engineering Mechanics from the Pennsylvania State University, USA, in 1993 and has since joined the department of Mechanical Engineering at Sultan Qaboos University in Oman. He is currently working with The Petroleum Institute (PI), Abu Dhabi, UAE. He worked with the Applied Research lab at (PSU) and the Federal Highway Administration in McLean, VA. He has a very active career with the oil and gas sector and made several presentations worldwide to various companies and universities. He has published over 60 refereed papers in internationals and conferences and participated in many committees in international conferences. His research interest focuses on the application of finite element method, experimental/numerical stress analysis, composite materials, and failure analysis. He is currently working on tubular expansion in wellbores.