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Avoid Downhole Explosions, Buckled Pipe and Parted Tubing During Snubbing Operations

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Abstract

Snubbing involves the running of tubing and related completion equipment into a well while pressure is present at the wellhead. This operation requires the use of specialized equipment that provides control of well pressure and associated fluids at all times, and enables the movement of tubulars and equipment into and out of the well.

Petro-Canada chose to create their own snubbing guidelines, and share them with industry, because of situations being encountered that were not adequately described in published recommendations and regulations. The Petro-Canada Snubbing Guidelines are intended to compliment, rather than replace, Industry Recommended Practices on snubbing.

Petro-Canada's Snubbing Guidelines contain the following information:

1. Written guidelines, providing information on snubbing and well control equipment, safety requirements, snubbing procedures, and contingent operations.
2. A procedure for preventing downhole explosions when pulling plugs.
3. Pipe buckling calculations, as related to wellbore pressure.
4. Allowable tensile loads, as a function of internal and external pressures.
5. A snubbing operations checklist.

This paper addresses i) avoiding downhole explosions, ii) preventing pipe buckling in pipe-light situations, and iii) allowable tensile loads as a function of internal and external pressures.

Introduction

Prior to the 1970's snubbing was primarily used in emergency situations, such as on blowouts or uncontrolled wells. Snubbing units were mounted on the drilling rig floor, and tubulars were moved through ram blowout preventers (BOPs). Snubbing is now more frequently used to avoid damage to sensitive formations caused by water or kill weight fluids, but snubbing can be used for other situations where it is preferable to not kill the well.

Formation damage can be caused by many well construction or intervention activities¹. Damage can be due to particle invasion into the rock matrix from workover or kill weight fluids. Formation damage can be caused by adverse reactions between water and in-situ clays, or by precipitates resulting from incompatible introduced liquids and formation waters. Damage can also be due to 'phase trapping' wherein invading liquid (water or hydrocarbon) occupies the pore space in a tight gas reservoir, thereby reducing the relative permeability to gas. Drilling an underbalanced well, then killing it with brine to run the completion, would appear to defeat the objective of maximizing inflow potential.

For both drilling and workover scenarios, pressurized well intervention is required when there are well control problems, often because it is impossible to hold a full column of fluid due to lost circulation or crossflow between zones. In addition, wellbore obstructions such as stuck tools, wireline or coiled tubing may be more safely retrieved with a snubbing unit than with a conventional service rig.

Snubbing is the process of running or pulling pipe where the force created by well pressure acting on the cross sectional area of the pipe and plugs is greater than the weight of the pipe. The well pressure is attempting to push the tubing out of the well,