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Removal of a Hydrate Plug From a Subsea Christmas-Tree Located in Ultra-Deep Waters With the Aid of a Heat-Releasing Treating Fluid

E.A. Evangelista, C.M. Chagas, J.A.F. Melo, J.D.H. Rocha, Ney B. Filho, and L.C.C. Marques, Petrobras

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Abstract

The paper describes the actions taken to re-entry a well located in ultra-deep waters (1541 m water depth) whose sub sea Christmas-tree was blocked by a solid hydrate plug and therefore could not be liberated by means of its standard releasing tools.

A heat-releasing treating fluid – the so-called self-generated nitrogen (SGN) fluid – was successfully applied to heat and dissociate the hydrate plug, which was totally blocking the locking mechanism of the Production Vertical Connection Mandrel (PVCM) of the tree. The heat applied around the Xmas-tree body was conveyed by the pumped SGN fluid batches. By doing so, the hydrate plug was completely dissociated (melted down) and then the unlatching mechanism became operational again.

This paper comprehensively describes the steps of this different hydrate treatment job. In broad terms, a technically challenging job which encompassed the following issues: - development of a “tailor-made” environmental-friendly SGN formulation, - heat exchange simulations to design the optimum volume for the SGN treatment batch, - a review of the theoretical aspects of hydrate formation/dissociation, - use of an instrumented/insulated drill pipe riser (DPR), - and job safety procedure reviews. A PLT logging tool (PLT) was also used to keep a record of the temperature profile inside the DPR.

In view of the pioneer aspects of the operation, the combined use of an ROV and PLT was of paramount importance to monitor every step of the operation since its very beginning. Along the job, the Christmas-tree, the reactivity of the treating fluid batches, the temperature changes, and the hydrate blockage, were monitored on a permanent basis. The combination of these two tools has provided precious pieces of information that have enabled us to gain insight into what was going on along the job and take the necessary measures to its real-time optimization.

Introduction

Hydrate and paraffin blockages are currently the major causes of oil production losses in Campos Basin’s deepwater scenarios. In many instances, these blockage problems have been solved by means of a treatment with the heating-releasing SGN fluids.

One typical Campos Basin ultra-deepwaters well (1541 m water depth, 4°C at seabed) completed with a subsea Christmas-tree (within the hydrate formation envelope) was initially producing to a floating production plant through a subsea flowline (FL). This well was scheduled for a routine work-over job whose objective was to replace the damaged FL by a brand new one. Briefly, in order to retrieve the line, first it is necessary to unlatch it from the Production Vertical Connection Mandrel (PVCM) located aside the Xmas-tree. See Figure 1. From this point on, the line has to be pulled out and winded on a reel for later work-over or disposal. The main thing is that