

# Comparative Analyses of a Finite Element Modelling: Hydrate Blocked and Unblocked Flexible Pipe

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## Abstract

A 2.8 m flexible pipe of unbonded layers which is 100% blocked by methane hydrate formation was created with ABAQUS finite element software. The effects the hydrate created on the layers during regular operation of eliminating the blockage was simulated and analysed. The investigation analysed the behaviour of the hydrate blocked flexible pipe under a combined load that consist internal pressure and compressive force.

Adopted method was based on the existing papers and research methodologies, thus this paper was investigating the common but neglected or never thought effects of hydrate blockage in a flexible pipe. The finite element model (FEM) model investigated a 6", 2.8m long 7-layers flexible pipes that have its layers modelled separately with the non-metallic and metallic parts modelled in C3D8R solid element cylindrical pipes. However, the equivalent materials, orthotropic using engineering constants were added to complement the strength of the Carcass and Pressure armour in order to have better and nearly accurate result according to [1]. The tensile wires were modelled as a revolved rectangular strip of dimension 2x7mm, assembled together based on the number of tendons in the case study. The first and second tensile wires have 40 and 44 wires put together to for the cylindrical pipe though with almost a thin wall considering the thickness of the rectangular end and distance of the diameter from the centre. The model considered contact interfaces; interaction between layers were considered and formulated the contact interaction, geometric nonlinearity, normal behaviour of stiffness and friction were considerably considered to simulate the structural behaviour of both the blocked and unblocked flexible pipe samples. The model includes the main features of the flexible pipe geometry with very little simplifying assumptions. The respond of the methane hydrate blocked pipe shows a wider different and sensitivity when in operation.

**Keywords:** (NNPC Ltd) Lagos unbonded flexible pipes, Abaqus, pressurization, depressurization, pigging, blocked, unblocked, hydrate, Sample-A, Sample-B