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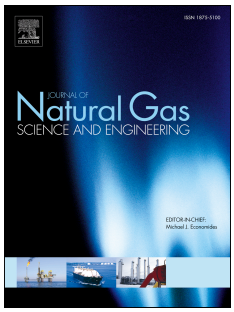

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Piyush Chaudhari, Luis E. Zerpa, Amadeu K. Sum

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A Correlation to Quantify Hydrate Plugging Risk in Oil and Gas Production Pipelines Based on Hydrate Transportability Parameters

Piyush Chaudhari [a], Luis E. Zerpa [b,*], Amadeu K. Sum [a]

[a] *Department of Chemical and Biological Engineering, Colorado School of Mines, Golden, CO, USA, 80401*

[b] *Petroleum Engineering Department, Colorado School of Mines, CO, USA, 80401*

* Corresponding author: Luis E. Zerpa, lzerpa@mines.edu, +1 (303) 384-2627

Abstract

Solid gas hydrate particles may form in oil and gas pipelines in the presence of water at high pressures and low temperatures; typical conditions of subsea hydrocarbon pipelines used in offshore facilities. Gas hydrate particles that form within these pipelines may create blockages following a complex multi-physics phenomenon involving emulsification, hydrate formation and subsequent hydrate particle agglomeration and bedding. Here we present a conceptual model depicting different hydrate plugging risk levels associated with oil-dominated systems, developed based on observations from high-pressure flowloop experiments. Using experimental measurements from these experiments, we develop a mathematical correlation to classify and quantify hydrate plugging risk in oil and gas pipelines. The correlation is based on assessable parameters that govern hydrate transportability in pipelines, such as, liquid loading, mixture velocity, fluid properties, and hydrate amount. A parametric study is performed using the proposed hydrate plugging risk correlation showing the plugging risk increasing with decrease of liquid loading and fluid velocity. The hydrate plugging risk estimation approach using the proposed correlation is illustrated for steady-state and transient operations of a long subsea tieback facility based on numerical transient multiphase flow simulations. The hydrate plugging risk is found to evolve over time as a function of hydrate volume fraction along the pipeline length. The hydrate plugging risk quantification presented, in terms of Hydrate Risk Evaluator, in this study represents an advancement in the area of hydrate risk assessment, as it can be used

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