
Project 2 – Flow Loop Studies of Wax Deposition

Objective

The main objective of this project is to further advance the single-phase turbulent and two-phase gas-oil wax deposition models. The advancement of the model will be achieved through the model closure relationship improvement and a better understanding of the deposition mechanism. The flow loop test results will be utilized for the closure relationship improvement and a better understanding of wax deposition phenomenon.

Project Description

Both single-phase turbulent and two-phase gas-oil wax deposition tests will continue. The parametric analysis concept will be used to generate a meaningful test matrix. One parameter will be varied at a time while other parameters are constant. With this approach, the effect of the parameters, including shear, heat transfer, temperature, Reynolds number, pipe diameter, on wax deposition can be studied independently.

Scope of Single-Phase Turbulent Flow Study

The small-scale flow loop will continue to be used for TAPS (Trans-Alaska Pipeline System) oil wax deposition study. The cross-comparison of the results from TAPS oil and other oils will be performed by taking into account the wax-oil solubility curve. The data from the small scale facility will be considered with the data from other facilities to explore the up-scaling of both the empirical and the model fitting parameter closure relationships.

After the completion of TAPS oil testing, a new oil will be studied. The expected results are deposition data based on the parametric study using TAPS oil and the new oil, and scale-up through closure relationship development.

Scope of Gas-Oil Flow Deposition Study

This project is a continuation of the current phase of TUPDP. The multiphase flow loop facility (2 in. test section) is being utilized for both single-phase wax deposition study and gas-oil wax deposition study. The single phase results will be used for model closure relationship for further development of the two-phase gas-oil wax deposition model. These data will also be utilized together with the data from the small-scale flow loop and the mini-pilot scale flow loop for an up-scaling study. The current study focuses on Slug Flow. After the completion of the current study, the next project will be the further investigation of slug flow as well as stratified flow using the same oil. The expected results from the two-phase gas-oil wax deposition test are:

1. The effect of heat transfer on wax deposition in the case of gas-oil slug and stratified flow patterns
2. The shear effect in gas-oil wax deposition
3. The detailed deposition profile of deposit formed under slug and stratified flows
4. The extension of the single-phase wax deposition model for two-phase gas-oil prediction

After completion of Garden Banks testing, this project will continue with the new oil if time permits.