Data Driven Approach of Hydrate Formation Detection in Gas Lift Network

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Abstract

Development of a Prediction Model for Gas Lift Network Hydrate Formation In line with Bahrain's 2030 Economic Vision, Tatweer strives to maximize oil production. Hydrates form on gas lifted (GL) well pipelines over the winter, decreasing oil production by preventing gas injection into the well. This use-case investigates the patterns of hydrate formation in the Bahrain Awali fields by utilizing data science tools. It will calculate the frequency of Hydrate Tatweer, calculate the number of lost oil barrels, and conduct a cost analysis.

Historical transmitter data of reported hydrate formation incidents were examined to identify patterns to further examine the topic. After integrating well data from several systems, logic has been applied to programmatically find potential cases, which were validated by a production engineer. After that, Auto-Choke-enabled wells were studied to see how effective they were at limiting hydrate formation. Cases were grouped based on their locations, connected laterals, and Gas Dehydration Units (GDU) that were near the wells. Finally, oil loss has been calculated to perform a cost analysis.

Hydrate formation has been observed to occur mainly at temperatures below 15 degrees Celsius, with most recent cases occurring in wells related to certain laterals and GDUs. The issue did not require a forecasting model to detect hydrate formation because hydrate inhibitors (chemicals treatment) were installed on the GDUs, which reduced the occurrence of hydrate cases. The installation of inline moisture sensors is recommended to monitor liquids in the pipelines within the GDUs. It has been concluded that chemical treatment needs to be optimized to only be inserted in GDUs that contribute to the formation of hydrates. As a result, the application will be saved for future use in measuring the effectiveness of Tatweer's chemical injection.

The current approach is novel as it utilizes data science with domain expertise using historical data to perform root cause analysis to limit hydrate formation and enhance production in gas lift wells. This can be used by upstream petroleum oil companies that face hydrate formation challenges in their gas lifted wells.