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A Novel Technique for Monitoring Hydrate Safety Margin

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Abstract

A novel technique has been developed for optimizing hydrate inhibitor dose rates by monitoring the actual hydrate safety margin. The technique is based on measuring acoustic velocity and electrical conductivity in an aqueous sample taken from the pipeline/separator. The developed system then determines salt and organic inhibitor concentration (e.g., methanol, mono ethylene glycol, kinetic hydrate inhibitors, etc). In the case of thermodynamic inhibitors the information is then fed to a thermodynamic model determining the hydrate stability zone. Superimposing the pipeline operating conditions (e.g., P&T profile) the developed system can determine the hydrate safety margin. The system can provide warning if the operating conditions is inside the hydrate stability zone or too much inhibitor is being injected.

The technique can be used in optimizing inhibitor injection rates, reducing the impact on the environment and operational costs. It can also improve the production system reliability by constant monitoring hydrate safety margin and protecting the system against pump malfunction and/or changes in process variables (e.g., water cut).

The above technique has been developed through a joint industry project and its performance has been intensively evaluated using the synthetic samples and real produced water samples by the authors, the project sponsors and field trials. The results demonstrate that this system can be used for different inhibitor systems including methanol-salt, mono ethylene glycol-salt, and kinetic hydrate inhibitor-salt systems with good accuracy.

The developed system can have a major impact on reducing the inhibitor injection rates, reducing environmental impact, and improving the reliability of production systems against risks associated with hydrate formation. The developed system can be lab based, mobile unit or on-line with near real time taking samples from live pipelines/separators.