Public Executive Summary

Title: Wax Control in the Presence of Hydrates

Name of Offeror: The University of Utah

Project Manager: James Pappas
Principal Investigator: Milind D. Deo

Additional participants: SINTEF Petroleum Research; BP; StatoilHydro; The University of Tulsa

Solicitation Number: RFP2007DW1201 (07121-1201)

Project Start Date: September 2, 2008
Project End Date: August 31, 2011

Total Estimated Cost:	$	500,000.00
RPSEA Maximum Share:	$	400,000.00
The University of Utah Cost Share:	$	100,000.00

Goal

This project will develop a fundamental understanding of alternatives for preventing wax formation in deep water, uninsulated subsea pipelines. This project involves two phases: (1) a comprehensive literature review concerning flow in subsea pipelines, hydrate and wax formation, and methods designed to prevent or mitigate deposition; and (2) experimental evaluation of "one or two" of the most promising technologies/concepts based on the review.

Background

Wax precipitation in flow lines is a serious problem. Unique challenges are associated with transporting fluids through long subsea pipelines. One way of preventing wax precipitation in long subsea lines is to insulate them – an expensive solution. One idea that has been tested recently, but not been implemented commercially, is cold flow. The idea is to use a non-heated, uninsulated pipeline to transport oil-water mixtures in cold, subsea environments where both Projects and waxes are likely to form. The concept in cold flow is to create slurry of Project and/or wax particles and transport the oil-water mixture in the presence of this slurry. The seed particles in the slurry act as nucleation sites and prevent or minimize further wax deposition.

A number of other wax control technologies have been proposed, some of which are being commercially used. These include mechanical methods such as pigging, chemical injection technologies and thermal management strategies, which focus on preventing the problem. In previous studies, no single strategy has proven to be completely effective in preventing and/or remediating the problem. There is a necessity to carefully evaluate all available technologies, and select one or two for further evaluation.

This project uses a two-phase approach to identify the most promising technologies and forwarding them for further testing toward commercial maturity. First a comprehensive literature survey will be undertaken on this subject, and all the possible options for wax control in cold-flow subsea pipelines will be considered. This review and analysis will yield two technologies for further evaluation. These technologies will be selected based on our analysis coupled with interaction and feedback from the industrial board and from RPSEA. Testing of deep-sea flow assurance technologies will require good understanding of oil and chemical characterization, properties measurement, fluid rheology (including slurry hydrodynamics) and interfacial and surface properties. The University of Utah is uniquely positioned to undertake this project because of existing facilities and knowledge and experience in all the aspects described above. Comprehensive projects on wax precipitation in the trans-Alaskan pipeline, high-pressure carbon dioxide induced asphaltene precipitation studies, fluid compatibilities with respect of asphaltenes and waxes and chemometric methods development have all been performed at the University in the last ten years. Laboratories at the University are equipped with oil and gas characterization analytical equipment (gas chromatographs, mass spectrometers, liquid chromatographs, elemental analyzers, etc.), rheometers (including constant stress and equipment necessary for slurry characterization), instrumented flow loops and laser and particle imaging velocimetry (PIV) visualization tools. The team at the University will assemble a high pressure flow loop capable of PIV and a high-pressure rheometer for Phase 2 of the project.

The team of principal investigators at the University (Deo – characterization, precipitation and flow, Magda – rheology and Mclennan – slurry transport), will be complemented by Dr. Rich Roehner, a consultant with significant experience in all aspects of wax control in pipelines. Potential benefits of the project include identification and testing of two of the most promising subsea wax control technologies for further evaluation.

Potential Impacts

This research will identify and test two of the most promising technologies that can be commercially developed to prevent wax precipitation in subsea pipelines, and identify the steps needed to prove these concepts. This information will accelerate the pace of development of new and more effective ways to reduce or eliminate problems of wax deposition in deepwater pipelines. In turn, this will accelerate the speed with which deepwater Gulf of Mexico fields can be brought online, increasing the volume of domestic production of oil and gas. In some cases, these technologies may enable development of fields which would not have been economically producible with current wax deposition prevention technology.

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