## Public Executive Summary

**Title:** Hydrate Characterization & Dissociation Strategies

**Name of Offeror:** The University of Tulsa

**Project Manager:** James Pappas
**Principal Investigator:** Dr. Michael Volk, Jr

**Additional participants:** BP America, Inc.

**Solicitation Number:** RFP2007DW1603b (07121-1603b)

**Project Start Date:** September 22, 2008
**Project End Date:** September 21, 2010

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| **Total Estimated Cost:** | $ | 181,719.00 |
| **RPSEA Maximum Share:** | $ | 120,000.00 |
| **TU Cost Share:** | $ | 61,719.00 |

**Goal**

This research will introduce a new technology for characterizing hydrate plugs in subsea equipment and criteria for selecting the most effective dissociation technique. Knowledge of typical hydrate plug character, including permeability and porosity, will be key to the evaluation of dissociation technique feasibility.

**Background**

In deepwater wells, thermodynamic conditions are favorable for the formation of hydrates, which tend to agglomerate and eventually plug pipelines. One of the offshore industry's major concerns is how to cost effectively eliminate hydrate plugs from pipelines after they form. While a number of case histories have been recorded related to the formation and recovery of hydrate plugs, very few have been quantified to prevent future plugging. It is very important to be able to predict the location and timing of plug formation to prevent emergency situations from arising.

Different remediation strategies, such as melting, depressurization, and the application of inhibitors, may be implemented, little is known about the properties of the plugs themselves, in particular, their porosity and effective permeability to gas or liquids. Therefore, little quantitative information is known about the efficiency of dissociation methods as a function of these properties and environmental conditions. The aim of this project is to bridge the knowledge gap between plug characterization and dissociation, leading to the selection of the most effective plug dissociation method for different plug scenarios.

Different dissociation strategies, such as depressurization, wall heating, and thermodynamic inhibitors will be evaluated, and a comparison of their efficiency will be provided based on characterization parameters. Databases for dissociation will be compared with existing models for wall heating. An engineer's estimation tool will be developed to help facilitate the design of appropriate dissociation methods for different operational conditions.

The scope of work for this study includes modification of the University of Tulsa's high pressure Flow Assurance Loop (FAL) to generate solid hydrate plugs and evaluation of the efficiency of hydrate dissociation strategies. To do this, after hydrate plugs are formed under different scenarios, plug characteristics, such as porosity and permeability, plug length, and pressure drop across the plug will be determined. The FAL consists of a 3" pipe flow loop mounted on an 80-ft long tilt table. The flow path is 160 feet long and fluids can be set in motion by a multiphase pump or by the rocking motion of the flow loop deck.

Solid hydrate plugs will be formed in the high pressure flow loop and the length and density of each plug will be obtained by using a scanning gamma densitometer to obtain porosity values. A fluid handling system will be utilized for displacing the liquids out of the system by injecting gas and pressure drop data will be acquired. Permeability values will be calculated from the pressure drop data and plug length measurements. Finally, a variety of dissociation strategies will be applied to the plug: depressurization, wall heating, and inhibitor injection (MEG or Methanol). The dissociation times will be assessed and compared.

**Potential Impacts**

This research will provide a tool for a production engineer faced with a hydrate plugging problem to use in selecting the most appropriate dissociation strategy. This will be a step change improvement as models for determining the best dissociation strategies and expected dissociation time are not available for plugs formed in oil producing environments. Application of this tool will lead to safer and more profitable operation of deepwater production facilities and subsea equipment.

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