



OTC 18387

To Pig or Not to Pig: The Marlin Experience With Stuck Pig

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This paper was prepared for presentation at the 2006 Offshore Technology Conference held in Houston, Texas, U.S.A., 1–4 May 2006.

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Abstract

On June 11, 2004, a pig was stuck in the BP deepwater Gulf of Mexico Marlin TLP oil export pipeline. The pig was stuck approximately nine miles from the Marlin TLP in 1200 feet of water depth. The pig was successfully removed ten days later.

This paper described the Marlin TLP oil export pipeline wax management strategy and the circumstances that led to the stuck pig incident. It also details the “stuck pig” removal process and the lessons learnt from the incident.

Introduction

The Marlin Tension Leg Platform (TLP) is located in Viosca Knoll Block 915 in the Gulf of Mexico. The water depth at the platform location is approximately 3,250 feet.

The Marlin TLP is host to three Marlin Field dry tree wells, two Marlin Field subsea wells, two subsea King Field wells, one subsea King West Field well and one Nile Field well. These multiphase production well fluids are separated and processed on the Marlin TLP prior to export via two dedicated pipelines, a 14-inch gas export and a 10-inch oil export to neighboring shallow water facilities; Main Pass 260 and Main Pass 225, respectively. Both of the Main Pass (MP) facilities are not operated by BP.

Wax Management for Marlin Oil Export Pipeline System – Original Design

The Marlin TLP to Main Pass 225 Platform oil export line is a non-insulated pipeline approximately 22 miles long.

The oil leaves the Marlin TLP at a temperature of approximately 120 °F and drops to 40 °F over the first 7,300 ft (1.4 miles) of flowline due to the sea water temperature gradient. The oil then warms to about 65 °F at the MP 225

location which is located in approximately 200 ft water depth. **Figure 1** shows the estimated temperature profile for the Marlin oil export line for different flowrates. Since this pipeline does not have any insulation, the higher flowrate fluids retain heat for longer distances.

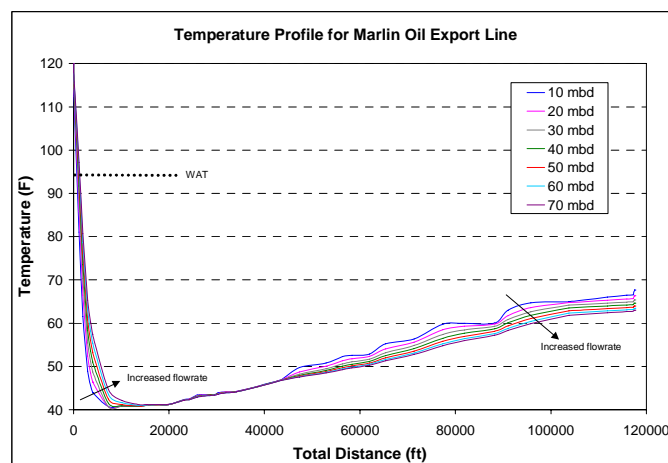


Figure 1 – Marlin Oil Export Line Temperature Profile

Heat loss to the surrounding seawater causes the fluid temperature to drop below its wax appearance temperature (WAT, which is approximately 95°F to 100°F) in the first few miles. Since the pipe wall has the lowest temperature, the heavy molecular weight paraffinic hydrocarbons begin to solidify and deposit on the pipe wall over time and eventually give rise to an exponentially increasing pressure drop (due to reduction in the flow diameter and / or increases in the pipe roughness.)

Wax deposition models run for the Marlin oil export pipeline earlier in the project indicated that a wax buildup of 0.009 inches thickness occurs in the Marlin oil export line at 40 mbod flow rate after 40 days (**Figure 2**). The models also indicated that the most of the wax is deposited in the first 30,000 ft (5.7 miles) of the Marlin oil export line. Total volume of wax deposited for this case is estimated at 135 bbls.