WAX BLOCKAGE REMOVAL: A MODIFIED MICRO ANNULAR PRESSURE PULSE TECHNIQUE FOR MWD SUBSEA PIPELINE

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ABSTRACT
EMP Malacca Strait S.A. in 2010 installed a 3-1/2” x 1200 m pipeline from onshore Well-1 to an offshore platform to deliver 1500 BFPD with a high water cut.

A well intervention program was conducted in September 2012 to drain a shallow sand that produced 508 BFPD initial flow rate at 34% water cut. In response to this low fluid rate and low water-cut, wax mitigation was carried out with paraffin solvent injection near the wellhead. In April 2013, pressure spikes were noted at the flowline discharge, which were rapidly followed by a fully blocked pipeline.

This paper will describe a wax blockage removal technique using the modified micro-annular pressure-pulse (MAPP) technique in a subsea pipeline.

MAPP is very effective for removing long wax plugs in subsea pipelines, using no special equipment or chemicals, and without damaging the pipeline.

INTRODUCTION
Well-1 is located in the M Field, on the eastern side of Padang Island, Riau Province, Sumatra, Indonesia. Produced fluid is delivered to an offshore platform through a 3-1/2” x 1200 m subsea line, as shown in Figure 1. It has 150 m onshore section, followed by 1,050 offshore section. The bare steel pipe is laid on the seafloor in water depths of up to 20 m. The seafloor temperature is approximately 85° F.

From 2010 – 2012, the normal operating condition of Well-1 was 150 BFPD rate with WHFP/WHFT at 210 psig and 125° F respectively. Paraffin solvent/pour point depressant was injected near the wellhead for flow assurance.

PROBLEM DESCRIPTION
After a work-over in September 2012, the well flowed 508 BFPD with a 34% water cut, wellhead temperature of 155° F, and well head pressure of 205 psig. The oil has an API gravity of 36.1 and a pour point of 91° F. Flow assurance was conducted as part of normal operations and the chemicals worked as indicated in laboratory trials. Flowline inlet and outlet pressures were also stable.

In April 2013, WHFP suddenly increased from 205 to 230 psig. Chemical injection was increased from 4 to 6 GPD, but the WHFP continued to increase to 540 psig over 1 day, and then the pipeline became fully blocked.

METHODS
Fluid samples were analyzed to screen potential unblocking methods. The fluid content was oil and water, with low GOR and no sand. The fluid formed an emulsion even though the water cut was quite high. This emulsion solidified as the temperature dropped to ambient temperature. Hence, the chemical injection failed to prevent the pipe blockage caused by wax deposition due to temperature drop.

The wax plug was attacked with mechanical and chemical injection methods - pipe pressurization, hot water and chemical injection, and modified MAPP.

Pipe Pressurization
The required pressure to remove the wax plug was estimated to be 9,650 psi using a pipeline skin friction approach. The pressure was above the maximum allowable working pressure, so pipe