IPTC 12788

Top Of Line Pipeline Corrosion Management Through Innovative Subsea Facility Design

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This paper was prepared for presentation at the International Petroleum Technology Conference held in Kuala Lumpur, Malaysia, 3–5 December 2008.

Abstract

The Kipper gas field (~0.7 Tcf gross) in the Gippsland Basin, Australia is being developed by subsidiaries of ExxonMobil (32.5% & Operator), BHP Billiton (32.5%) and Santos (35%) utilising a subsea well and pipeline tie-back. The facilities design required close attention to the process, materials and corrosion design challenges associated with handling water-saturated raw gas streams containing up to 12% CO_2 and low levels of H_2S. These challenges have been met through an integrated approach to address top of line corrosion (TOLC) risks.

A Corrosion Resistant Alloy (CRA) Subsea Cooler was developed by leveraging proprietary tools and local industry experience. The Subsea Cooler is designed to reduce the raw gas temperature and condense bulk water vapour, reducing the TOLC potential before entry to the Carbon Steel (CS) pipeline. This enables use of inhibited CS for the 18 km Kipper subsea tie-back, minimising use of CRA and overall cost. This hybrid solution offers another option for increasingly complex flow assurance challenges to support Subsea developments in the face of increasing materials cost pressures.

The 350mm diameter pipeline is configured in a piggable loop configuration for inspection and batch pigging to support corrosion control and monitoring. The configuration also enhances operability over the life of the depletion drive reservoir, while providing hydraulic capacity equivalent to a single 450mm diameter line.

This design addresses the challenges of providing robust corrosion control while minimising the use of expensive CRA materials. Challenges encountered included:

- Maturity of TOLC theoretical models in presence of H_2S
- Limited industry capability for testing effectiveness of inhibited TOLC systems
- Industry accepted materials selection parameters
- Non-standard heat transfer application

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