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The Cliff Head Field Development—Flow Assurance and Production Chemistry Challenges in a Marginal Field Context

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Abstract

The Cliff Head Field, offshore Western Australia faced significant development challenges due to the field location and reservoir fluid properties. The influence of these challenges is apparent in the development solution adopted from sand-face to market. The modest reserve size required the application of a number of firsts, including multiple, innovative, new technologies in artificial lift, completion systems, CT (Coiled Tubing) deployed ESPs (Electric Submersible Pumps) combined with intelligent completion technology, a novel water “spike” approach to waxy crude transportation, a distributed chemical injection system, a remote controlled, not normally manned production platform, produced water re-injection and “hydrofrac” water-injection capacity. The application of these processes and technologies is described and the production history to date establishes the field as economic despite the challenges of a location away from existing oil field infrastructure and in an environmentally sensitive fishing area.

This paper describes the Flow Assurance and production chemistry challenges facing the development and the resulting Cliff Head development solution and production history to date.

Introduction

The Cliff Head field is located in Commonwealth hydrocarbon exploration permit WA-286-P in the offshore Northern Perth Basin, Western Australia as illustrated in Figure 1. Cliff Head is the first offshore development within the region. The facilities consist of the following components (Figure 2):

- A minimum facilities, unmanned wellhead platform, Cliff Head Alpha (CHA) approximately 7 miles offshore, to accommodate the dry well heads and support equipment;
- Six production wells with Coiled tubing deployed ESPs for lifting crude oil to surface and to shore;
- Two water injection wells;
- Arrowsmith Stabilisation Plant (ASP) located approximately 2 miles inland, which separates the oil and produced water and stabilises the oil ready for transport;
- A 9 mile insulated sub-sea production pipeline, which transports the produced fluids from CHA to ASP, crossing beneath the shoreline and the dune system, by means of horizontal directionally drilled (HDD) holes;
- A 9 mile insulated subsea water injection pipeline from ASP to CHA;
- 2 x 1 mile Horizontally Directionally Drilled (HDD) pipeline holes
- Onshore source water well to supply make-up water for injection;
- A subsea umbilical power, control and chemical supply cable running from ASP to CHA and
- Crude oil truck load-out facilities and transport by road to a refinery

The field was discovered in December 2001 when Brent crude prices were at US\$ 20 per barrel. The field contains an estimated 15.7 million barrels of proven and probable EUR.