OTC 18540

Dalia Field — System Design and Flow Assurance for Dalia Operations

A. Courbot and R. Hanssen, Total E&P Angola

This paper was prepared for presentation at the 2007 Offshore Technology Conference held in Houston, Texas, U.S.A., 30 April–3 May 2007.

Abstract

Evaluating flow assurance risks for the development of Dalia was a key task during system design to safeguard the production over the 20 years design life. A low energy reservoir, heavy, viscous, acidic crude oil sensitive to hydrate formation and one of the world's largest subsea networks in deep water to operate and preserve, led to flow assurance requirements above oil industry experience. Innovative technologies and strategies were required to meet the challenges.

State of the art software tools have been utilised to the edge of their capacity in order to assess the thermal performance of complex subsea structures and the challenging flow conditions associated with relatively large flowline and riser dimensions.

Extensive studies have been carried out to help prepare detailed operating procedures, focusing especially on hydrate management and slug handling. Uncertainty in fluid behaviour, naphthenates in particular, has fostered discussions between the project team, partners and expert groups to define best practice management strategies and reduce risk of operational problems.

The paper presents the flow assurance strategies developed to handle the main risks as well as a description of the production system specifics to meet the challenges.

Key Parameters and Flow Assurance Risks

The subsea production network for Dalia is located at a water depth of 1,200 to 1,450 metres. The Dalia field is part of the Angolan Block 17 (Figure 1) and consists of four main reservoirs formed at the Miocene period (Figure 2). They are situated 800 to 1,000 metres below the mudline and are characterised as unconsolidated and highly heterogeneous. They cover an area of 230 km^2 and the subsea production system covers an area of 100 km^2. Dalia oil is acidic and heavy with an API gravity of 21-23, a viscosity of 4-7 cP at down-hole conditions and the gas oil ratio (GOR) is in the order of 70 Sm^3/Sm^3. These characteristics combined with the low reservoir temperature (46 to 55°C) and an initial pressure of 215 to 235 bars present one of the greatest technical challenges for operations. The main characteristics are shown in Figure 3 with a comparison with Girassol, which was the first field developed in Block 17. The figure illustrates important differences between the two fields, leading to different system design requirements and flow assurance challenges.

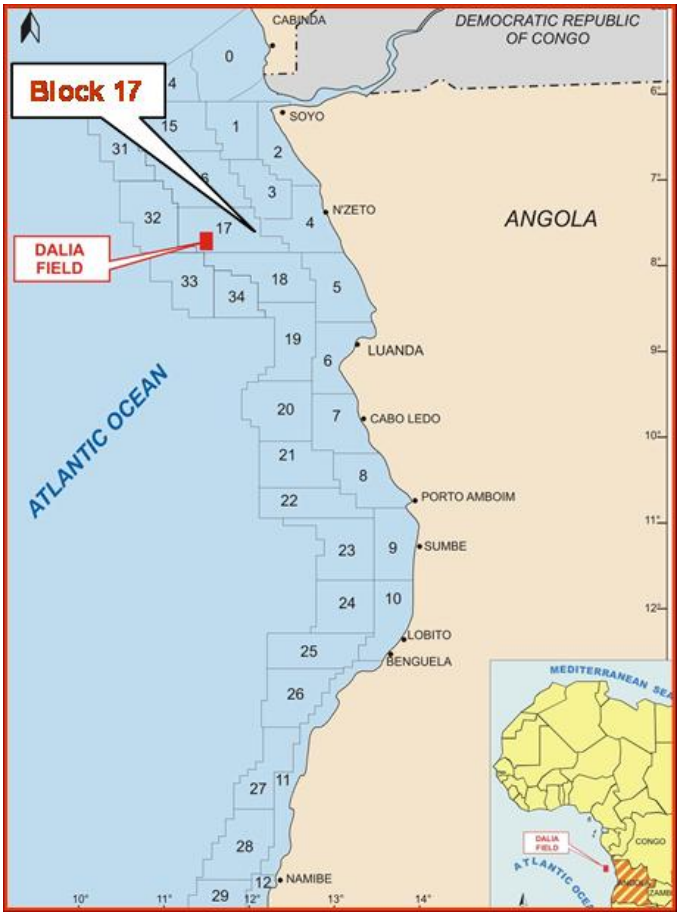

Figure 1 - Dalia Field Location