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Development of Subsea Facilities in the Roncador Field (P-52)

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Abstract

The second phase, module 1A of the Roncador field, offshore Brazil, has been developed employing a large semi-submersible production unit (displacement of more than 80,000 tons). This platform, named PETROBRAS 52 (P-52), is moored at a 1,800 meter (5905 ft) water depth and is joined to subsea facilities through 44 risers and 23 umbilicals in total. P-52 gathering system comprises 33 wet completed wells, with production and water injection flowlines directly connected to P-52, while well gas lift flowlines are attached to three subsea manifolds, linked to P-52 through a Gas Lift “Ring” pipeline.

This paper explains the strategies adopted by Petrobras to overcome the challenge of starting oil and gas production at this water depth in a short period of time, which demanded to start the platform construction phase early — almost simultaneously with the FEED of riser system. Some technical solutions adopted in the design and installation of P-52 gathering system are also mentioned.

This paper summarizes:

- The stages of riser system definition, with emphasis on its interaction with P-52 construction.
- Conceptual and detailed design of Gas Lift Ring Pipeline system.
- Pendulous method and lessons learned from its conception to successful use in the deployment of gas lift manifolds.

Introduction

Campos Basin is located offshore Rio de Janeiro State, on the Southeast Region of Brazil. Its area covers approximately 100sq.Km ranging from 20m to 3400m Water Depth (WD).

After the discovery of 2 giant fields, Albacora (1984) and Marlim (1985), Petrobras faced 11 years later to the discovery of Roncador giant field, in northern area of Campos Basin.

Roncador field lies in 1500 to 1900 meters of water in Campos Basin, and has been leading the technological challenges of Petrobras in ultra-deepwater, since it was discovered in 1996 with the well 1-RJS-436A. The concept of the term “ultra deep” has changing along the years, being governed mostly by the technological achievements. For the purposes of this paper, we have taken “ultra-deepwater” to refer to WDs greater than 1500m.

The development of Roncador field was devised through four production modules. Among them, the Module 1A comprises two phases of exploitation: the first one (Phase 1) was put in production in 2002 with FPSO Brasil, moored in approximately 1300m WD, to operate temporarily some of the wells. In the end of 2007, the second phase of Module 1A (Phase 2) started to produce to what is one of the world’s largest semi-submersible production units — with a total displacement about 80,000t, moored in 1800m WD. This Floating Production Unit (FPU), named P-52, has capacity to produce 180,000 b/d of oil (200,000 b/d of liquid) and to process 9.3 million m³/day of natural gas, and is intended to gather all the wells of Module 1A, starting by the new ones and receiving gradually the wells of FPSO Brasil. After replacement of temporary phase, P-52 will be linked to no less than 18 production and 11 water injection wells. There are also four spare wells anticipated.

On the contrary of the temporary phase, that had the purpose of starting rapidly the field production, the drive of the Phase 2 was to improve as much as possible the production rate. In order to manage that condition, it was essential to place the FPU in the area of the wells. This necessity pushed the unit to the WD of 1800m, the deepest location ever envisaged for a platform in Campos Basin.

The paper highlights the remarkable studies, improvements and qualifications performed to produce a viable solution for the gathering system of P-52, which serve to illustrate the subsea technology development and contracting strategies.