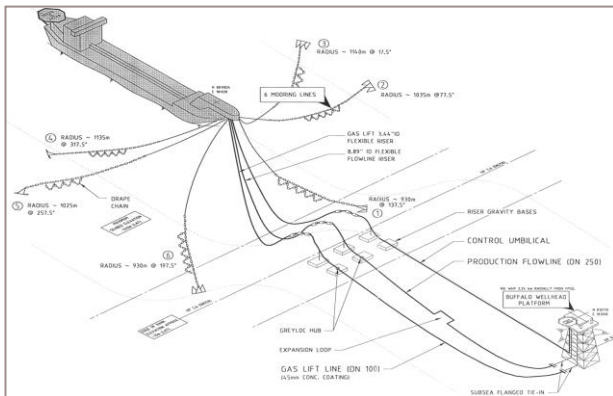


NEXEN PETROLEUM BUFFALO FIELD ABANDONMENT Engineering and Contracting Strategy

ICON Engineering has been involved with the Buffalo field since the initial feasibility studies with BHP in 1997. ICON initially installed the Wellhead Platform (WHP) in 1999 using a jackup rig to lift the structure and install the piles.

Since the field was taken over by Nexen Petroleum in 2001, ICON continued to provide ongoing facilities engineering support for the field, and was contracted to develop an abandonment strategy for the field.

The field consisted of a 380 tonne Wellhead Platform (WHP) in 30m water linked to a 70,000 DWT FPSO anchored approximately 2km away in 300m water depth. The field was characterised by the fact that the WHP was on top of a steep edged shallow bank.



Buffalo Field Layout

The platform and FPSO were linked via a 10" Production Line, 4" Gas lift line and an umbilical. The Buffalo field became uneconomic at the end of November 2004.

ICON's work scope included:

- ▶ Extensive research of worldwide abandonment practices to assist in preparing government submission for abandonment.
- ▶ Participation in meetings with regulators.
- ▶ Assistance in development of abandonment contracting strategy. This resulted in a decision to separate removal of the WHP and plugging and abandonment of the wells and to defer them until mobilisation costs for the spreads could be shared with other operators and projects.
- ▶ Supervision of ROV surveys of the facilities.
- ▶ Detailed stability assessment of pipelines and preparation of submission to justify leaving the pipelines in situ.
- ▶ Review of rigless abandonment options for the production wells.
- ▶ Review of abandonment of the platform using jackup rig, heavy lift ship and derrick barge.

- ▶ Detailed costing of abandonment options.



Installation of the Buffalo WHP by ICON using a Jackup Rig

ICON also investigated the following subsea cutting techniques for cutting rigid and flexible flowlines, jacket legs and piles (below the mud line):

- ▶ Abrasive water jet cutting.
- ▶ Diamond wire cutting.
- ▶ Band Saw cutting.
- ▶ Explosive (shaped charge) cutting.
- ▶ Thermal cutting using divers.



**Buffalo Venture FPSO 6 Point Mooring,
Riser and Control Umbilical**

Realisation

In line with ICON's recommendations, the Buffalo wells were plugged and abandoned using rigless intervention techniques in late 2004. This same vessel of opportunity was also contracted to remove the WHP, pipelines and umbilicals in the 30 m water depth zone and to assist with disconnection of the FPSO. The Operator obtained approval to abandon the FPSO mooring legs insitu at 300 m depth.