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Abstract

With the recent discovery of High Pressure and High Temperature (HPHT) sour gas field. The offshore facilities have been developing with many challenges, especially HPHT conditions with WHSIP of more than 600 barg and WHFT of more than 150 C, with high H₂S. This paper presents qualitative assessment of various aspects for the selection of the optimum wellhead platform configuration and overpressure protection system configurations for further development in FEED phase.

The schemes of flowline, wet gas flow meter (WGFM), production manifold and PSV were investigated and compared between common and individual facilities as well as between full rated and de-rated flowlines. All possible wellhead design options with overpressure protection were defined. With the relatively high H₂S level in the region, the piping material which is compatible for severe sour service has been considered and the carbon steel with Corrosion Resistant Alloy (CRA) clad i.e. Alloy 625 was selected compliance with NACE MR0175/ISO 15156. Furthermore, the well condition is classified as the HPHT well thus the pipe rating up to API 15000 has been validated to accommodate the HPHT circumstance.

Having conducted the hazard risk assessment using mini-HAZOP and LOPA, it is to demonstrate whether the proposed configurations met the required safety level. The qualitative high level comparison was performed considering safety, cost, operation and maintenance (Not Normally Manned). Furthermore, the advantages and disadvantages were comparatively evaluated. As a result, the appropriate wellhead design option was recommended.

Various configurations were investigated identifying key equipment, piping and instrumentation for further cost estimate. Mini HAZOP and LOPA has been performed to determine the required SIL and the highest requirement is still within SIL 2 for all configurations. As a result of assessment, the fully rated flowline with common test manifold (option 1B) provide the lowest CAPEX with the drawback on intermittent well test data and significantly higher number of actuated valves comparing with individual WGFM. Fully rated flowline with individual WGFM (option 2B) minimizes burden of maintenance activity and provides continuous well monitoring, however CAPEX is slightly higher than option 2A. Derating flowline concept would lead to numbers of PSVs to be maintained. Considering the high H₂S service, minor cost saving is considered not justified additional personnel exposure risk to H₂S during operation and maintenance.

Qualitative ranking has been performed for cost, safety, operational and maintenance aspects, and Option 1B and 2B are similar. Project decide to go with simplest configuration – option 2B, to minimize offshore personnel intervention and risks.