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### BP WOS: FLEXIBLE PIPE INTEGRITY MANAGEMENT

This case study outlines the work that MCS has performed for BP to develop and implement an integrity management strategy for all BP's flexible riser and flexible flowline assets on their West of Shetland field developments, Foinaven and Schiehallion. The strategy has been developed using a best-practice industry approach originally formulated through a joint industry initiative led by MCS in the mid-nineties.

The Foinaven and Schiehallion fields are located approximately 150km West of the Shetland Isles in the area generally termed the "Atlantic Frontier." The wave and current conditions in this region are harsh compared to the North Sea environment, and the water depth is also significantly deeper ranging from 395m to 500m across the two fields. Both fields are developed using floating production vessels (FPSOs), which are connected to subsea wells via flexible risers and subsea flowlines, with seabed flexible jumpers from subsea manifolds to the individual wells.

#### SCOPE OF DELIVERY

- Best practice approach to the development of an integrity management strategy for the flexible risers and flowlines for all BP's West of Shetland assets.
- Implement a methodology that establishes risk in a consistent manner and enables the mapping of this risk onto a monitoring and inspection strategy to mitigate undesirable risks in operation.
- Strong understanding of flexible pipe failure modes based on knowledge of flexible pipe design and how these pipes behave in operation. Combine this with an advanced analysis capability - loads and response are accurately computed, thereby reducing conservatism, demonstrating remaining service life with a strong degree of confidence.
- Periodic review process for clear and regular reporting to BP management on the state of integrity of their flexible pipe assets highlighting when actions need to be taken to maintain integrity and keep risks within acceptable standards.

#### BENEFITS

- This strategy has provided BP with a structured framework addressing all flexible riser and flexible flowline integrity issues. The strategy has continuously evolved as integrity measures are implemented and results are received from the offshore inspections and monitoring procedures.
- A key benefit to BP has been to record the complete operating life of the flexible pipes in the harsh environment of the Atlantic Frontier. By regularly analysing and comparing operating conditions with the original design assumptions, the periodic review process has demonstrated conservatism in the design. This provides BP with a comprehensive database of evidence to assess possible life extension of the assets should new tieback opportunities present themselves later in the field life.
- Increased learning in the implement -action of flexible pipe inspection and monitoring procedures offshore, particularly with testing of the flexible pipe annulus environment.