Advanced NDT Technique Investigation – At Brent Charlie Pipe Spool Brent Field Platforms in the North Sea

Presentation:

This paper was presented by Innospection Ltd in conjunction with Sonomatic Ltd and Shell EPE at the BINDT North East Branch Meeting and Exhibition in November 2008.

Summary:

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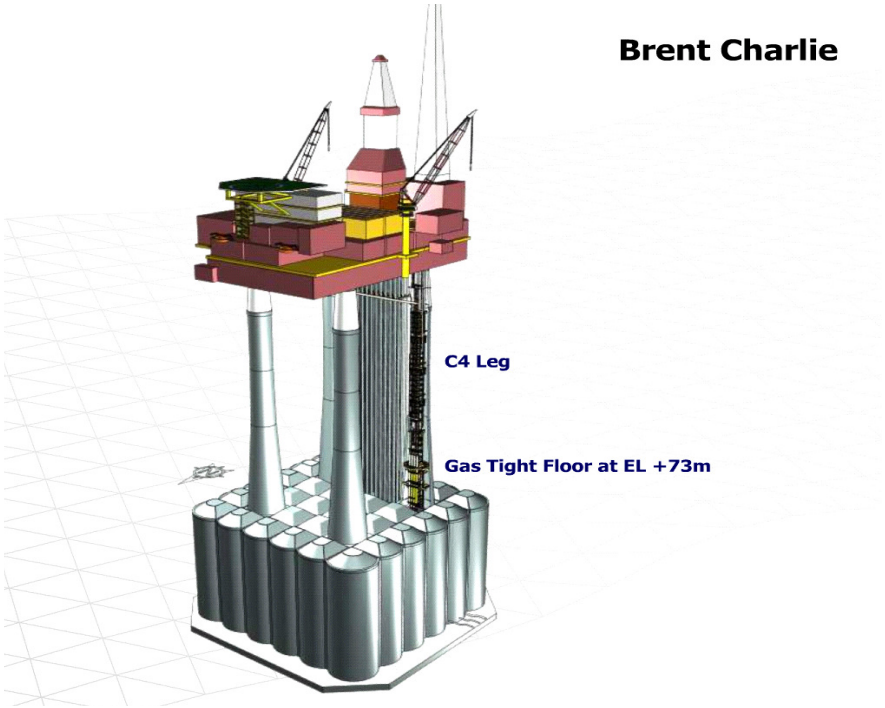
The external pipe inspection offshore can be a challenge due to access, corrosion protection coatings and variety of defects to be detected. The inspection of external pipes in the hollow concrete shafts of the Brent Field platforms is creating one of the highest organizational and technical challenges in the North Sea. A substantial number of the pipes in the utility shafts of the Brent Charlie are coated with tide guard or composite repair wrap.

The internal standard and the criticality of the pipes as hydro carbon carrier requires that the Platform Operator Shell Expro set high requirements for the external inspection of the pipe work at the Brent field utility shafts. The access difficulties to the pipe in the concrete leg, the working condition, the high safety requirements and the pipe coating condition put the inspection itself, the defect detection and mostly the inspection reliability requirement to a high level.

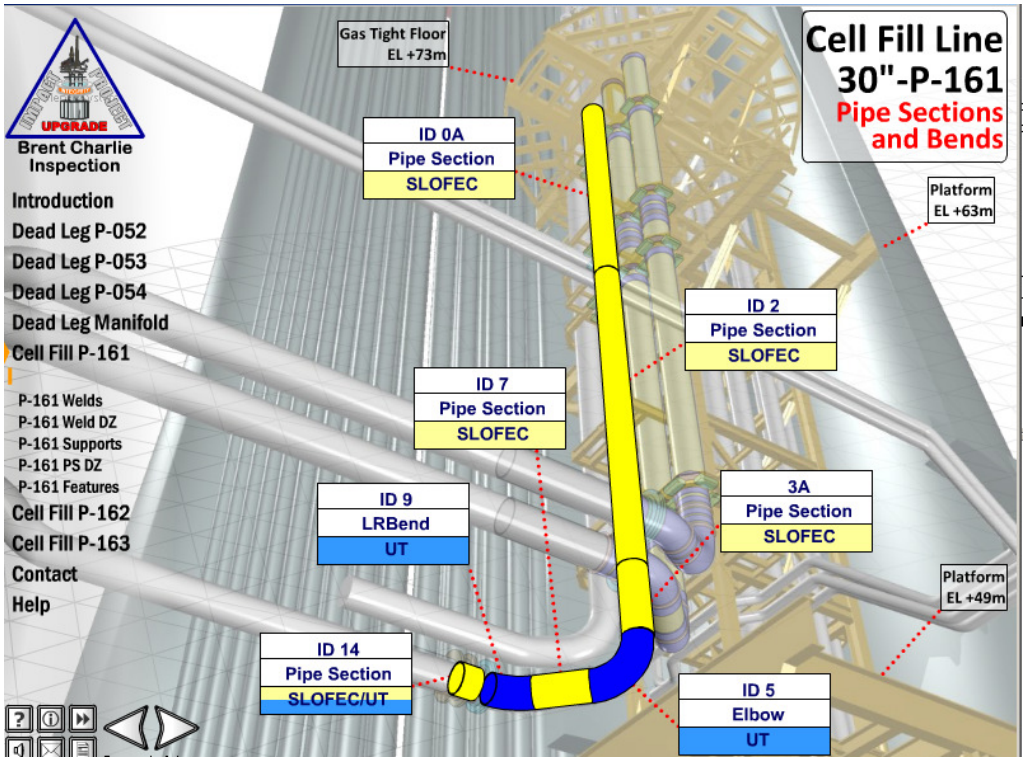
This paper therefore describes a case of a non matching pipe inspection result between manual Ultrasonic Testing (UT) and the SLOFEC™ technique at a 1.5m long 30inch pipe section. The paper further describes the consequent extensive investigation and outcome of the verification work with advanced Ultrasonic techniques.



The Case:

Subject of the investigation is the inspection of a horizontal pipe section below the gas tight floor, which is 1.5m long, 30in diameter and 9.5mm wall thickness with approximate 2mm tide guard coating.

Brent Field – Utility Shaft Pipe Inspection



The pipe section was the subject of a SLOFEC™ scan by Innospection Ltd. However prior to the mobilization, a number of manual Ultrasonic spot checks with a 0° compression wave probe were showing some severe localized defects with diameter of 10-15mm and minimum remain wall of down to 2.6mm.

Even though the Operator was aware of the localized defect detection sensitivity of the SLOFEC™ technique, they have still carried out an analysis by workshop tests the defect detection sensitivity at various smaller volumetric defects in a same pipe configuration with various coating thickness.

A pipe section with the same dimensions was tested with internal localized defects of diameter 16mm, 8mm and 5mm diameter with wall loss 20%, 40%, 60% and 80%. The detectability tests were done with coating thickness simulation 2.5mm, 5.0mm and 7.5mm. The result was that all defects were detectable with the appropriate SLOFEC™ scanner by Innospection through all three coating layers.

With the high satisfaction of defect detection sensitivity, the SLOFEC™ system was mobilized to run on the 1.5m coated horizontal pipe section in the utility shaft. The result showed a number of matching detected defects, as with the same using the manual Ultrasonic Testing. However a number of indications detected with manual Ultrasonic Testing were not detected with the SLOFEC™ technique – defects down to 2.6mm remaining wall thickness. Repeated inspection with the SLOFEC™ technique showed exactly the same result.

For the criticality of the inspection continuation at the pipe work and the requirement to know the reliability of the inspection techniques, it was important to understand the reason for the mismatch.

For the investigation of the defect detection mismatch, the Operator selected Sonomatic Ltd because of their technical capability and track record. To develop the methodology for the true defect condition of the pipe section, workshop preparation tests were performed prior to mobilization.

The techniques for the specification developed were:

- High resolution 0 degree inspection
- 45 degree angle beam in all 4 directions
- Time of Flight Diffraction (TOFD)
- Full data capture
- Data imaging
- Test only selected areas

Applying the mentioned investigation methodology at the pipe section support of the Nautilus scanner device allowed high resolution scanning and optimum defect sizing. The advanced Ultrasonic Testing scanning with various techniques brought up the result for the mismatch: the indications in question were all mid wall laminations detected as wall loss by manual Ultrasonic Testing with a 0° compression wave probe - whereas the SLOFEC™ technique did not detect these indications.

The result of the advanced Ultrasonic Testing in the analysed pipe section confirmed the correct and reliable defect detection of the SLOFEC™ technique in the substantial wall loss but not for the minor “pitting” or laminations. On the understanding that neither the “minor” pitting nor laminations were critical for the fitness of the pipe for service, the continued use of the SLOFEC™ technique for this application was valid.

This complete project took place between August 2007 and February 2008. Despite the long time frame and substantial cost impact, the Operator demonstrated its commitment for the analysis and further to the analysis, for the investigation of the inspection techniques’ reliability.

In conclusion, this paper and the inspection example displays the excellent complement between the fast scanning technique SLOFEC™ and the advanced Ultrasonic solutions. Innospection and Sonomatic are displaying its well matching alliance due to the individual inspection capabilities and know how.