

## Further Investigation into the Fatigue Performance of Risers in Sour Service by Full Scale Testing



### JOINT INDUSTRY PROJECT OUTLINE

**PR23148**

### Summary

Steel catenary risers (SCRs) are commonly used within deep-water oil and gas developments, and fatigue performance is often a critical factor in overall design. Resonance fatigue testing of full scale girth welds has become standard industry practice to demonstrate adequate performance. However, these tests alone take no account of aggressive service environments such as sour production fluids. In these instances qualification testing is traditionally a two-stage process involving resonance fatigue testing to demonstrate the required performance in air, and strip fatigue testing (in air and in a sour environment) to determine a fatigue life reduction factor that is then applied to the base design curve. This is primarily for experimental convenience as sour environmental control is achieved by immersing a sample in an aqueous environment contained within a test vessel. Previous TWI work has illustrated that small and full scale tests on riser girth welds in air give different results and has established the relationship between the two test types. There is a need to repeat this for sour environments, to provide validated design guidance to industry.

A previous Joint Industry Project conducted at TWI investigated the above by conducting fatigue tests in a sour environment using full scale girth welded pipe specimens (TWI JIP 20324). The project aimed to eliminate the uncertainty associated with deriving fatigue life reduction factors from small scale specimens.

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## Objectives

- Determine the influence of the severity of the environment;
- Determine the influence of pipe geometry, specifically D/t ratio;
- Characterise the residual stress distribution in the girth welds.

## Benefits

This project aims to build on the results of the first Phase by investigating a second pipe size and a second environment, building further confidence in the findings of the previous project, and a better understanding of the mechanisms responsible for the geometry effect. This has the potential to lead to economies in qualification testing, and relaxation of excessive conservatism in design and manufacture of subsea lines bearing sour fluids.

## Approach

It is proposed to conduct further full and small scale tests to achieve the two primary objectives listed above. This will involve corrosion fatigue testing in a mildly sour environment, and testing material with a different D/t ratio. The new work will be planned to integrate with the work carried out in the previous project in order to maximise the knowledge generated. A thorough study of the residual stress distribution in the girth welds is included, to determine the influence of wall thickness, and extraction of strip specimens

## Deliverables

Progress updates will be issued by email every two months. A progress report will be issued every six months, prior to a six-monthly project meeting. On completion of the project a final report will be issued giving full details of the work undertaken, results, conclusions and recommendations as appropriate, followed by a final meeting.

## Price and Duration

The overall estimated price for the work is £792,000 (including allowance for pipe material, but excluding welding) (excluding VAT), which requires £33,000 per company per annum for 4 years (£132,000 total) from each of the 6 Sponsors.

## Further Information

For further information on how a Joint Industry Project (JIP) runs please visit:

<http://www.twi-global.com/services/research-and-consultancy/joint-industry-projects/>

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