

**TWI GROUP SPONSORED PROPOSAL PR9519
SULPHIDE STRESS CRACKING & PREFERENTIAL WELD CORROSION
PERFORMANCE OF WELDS BETWEEN MODIFIED A707 AND C-Mn SCR PIPE**

INTRODUCTION

Tapered Stress Joints (TSJ) of steel catenary risers (SCR), jumpers etc are often specified in modified grades of ASTM A707 material, which contain appreciable levels of Ni. During service it is known that over time wells can become sour and there is currently a large programme of work in progress within the industry addressing the performance of SCRs under mildly sour corrosion fatigue conditions (e.g. TWI project 14135). Although TSJs do not experience the same fatigue loading as SCRs, there is some concern that there are no sulphide stress cracking (SSC) or preferential weldment corrosion (PWC) data relating to the SCR/TSJ weldment, particularly with respect to the modified A707 materials. SSC is of concern in mildly sour environments, whilst PWC is primarily of concern in low conductivity, sweet environments specifically those involving condensed water with low chloride concentration which are known to cause high rates of corrosion of Ni-containing steels (1). Nevertheless, PWC potentially could occur in mildly sour conditions.

Presently, a new TWI JIP (PR8707) is under development to harmonise the ISO15156/MR0175-2003, DNV OS-F101 and EFC 16 restrictions on nickel content of welding consumables in sour service. The project aims to extend the limits to above the 1% maximum level stipulated in ISO15156/MR0175-2003 for mild sour conditions. The consumables used for the dissimilar joint between A707 and the SCR pipe (e.g. X65) are nickel containing, and the Ni concentration in the A707 steel can be greater than 1% for Grade 2 and 3. Hence, there is uncertainty with respect to the suitability for mildly sour service of such joints.

In addition, the dissimilar materials in the welded joint raise concern that preferential weldment corrosion could occur in service. It is proposed that testing will initially examine an uninhibited, simulated sweet service environment.

The data generated in this present work scope will therefore extend knowledge of any SSC and PWC risks for these specific weldments to support material selection. The mild sour conditions are the worst case presently anticipated for SCR operations in the Gulf of Mexico with respect to SSC but sweet conditions represent the worst case with respect to PWC. Additional work could be proposed, with agreement by the Sponsors, to extend this testing to the confirmation of PWC behaviour in mildly sour conditions.

The following proposal describes work that will address these issues by carrying out SSC testing on A707 Grades 1 and 3 welded to C-Mn steel specimens in a mild sour condition and PWC tests in a sweet condition.

Depending on the outcome of the project, future work generating knowledge of SSC resistance in sour test conditions and PWC tests in mildly sour conditions may be recommended.

OBJECTIVE

To determine the SSC and PWC behaviour of specimens manufactured from modified ASTM A707 grade steels welded to C-Mn SCR material in simulate Gulf of Mexico conditions.