Developing a Risk Based Remaining Life Assessment Approach and Software for temporary repairs

JOINT INDUSTRY PROJECT OUTLINE

PROP301233

Summary

Leaking or Non-leaking piping system defects such as corrosion, dents, gouges, pits, and cracks can cause piping to rupture. According to the U.S. Department of Transportation (DoT), there are three primary methods of repair for non-leaking defects on steel pipe:

- Cut out damaged segment and replace with new pipe.
- Install a full-encirclement steel split sleeve over the damaged area.
- Install a composite sleeve over the damaged area (composite wrap system)

One of the challenges for plant operators is integrity management of sleeves and composite wrapping on their piping systems.

Currently plant operators make estimations of remaining life based on either advice from the vendor of the sleeve or composite wrapping or, in rare circumstances, based on their own experience. However there is no industry-wide agreement on how best to tackle the issue or recognised standards. Additionally, there is extensive uncertainty surrounding the behaviour as well as inspection of these temporary repairs which makes life prediction very challenging.

The use of a Risk-Based Life Assessment (RBLA) process has been proven, especially in the oil and gas industry, to be one of the most effective approaches to make decisions regarding the integrity of such structures. In this approach, the relative life of the sleeve and composite wrapping is estimated against a risk target by considering factors which influence the integrity and consequently the life of the temporary repair system. Such factors can be the type of sleeve or wrapping, the surface preparation, the exposure to specific environments (e.g. UV, moisture) and knowledge of the sleeve application or wrapping condition through inspection. This approach allows the user to take the uncertainty into consideration and at the same time to have a thorough understanding of the relative remaining life of the repair.

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Objectives

- Develop a procedure and an algorithm to enable the group of sponsors to perform Risk Based Remaining Life Assessment of sleeves and composite wrapping on Pipework
- Develop a software tool to automate this assessment

Benefits

The primary benefits of the proposed development to plant operators are:

- Optimising the utilisation of operators' inspection or maintenance budgets
- Minimised unplanned outages
- Improved scheduling of inspection and repair
- Deferred CAPEX by optimised replacement planning
- Useable by non-specialist maintenance personnel thus ensuring widest possible uptake

The benefit of using TWI for the proposed work stems from the fact that TWI has a combination of expertise on welding and composite materials together with an extensive track record in probabilistic risk based techniques and associated software development experience which has been implemented worldwide.

Approach

The approach consists of two stages:

Stage 1 is the development of the RBLA algorithm and the framework. This stage includes the following tasks:

- Task 1- Collecting material data and information
- Task 2 – Probabilistic life assessment
- Task 3 – Inspection feedback protocols
- Task 4 – Cost Risk Optimisation (CRO)

Figure 1 and figure 2 illustrate the approach which will be taken in this work.

Stage 2 is the software development. Based on TWI previous experience with similar projects, it is envisaged that the software development will start and run in parallel with the later tasks of stage 1, after the initial framework is completed and agreed.

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Deliverables

The main deliverable will be a user oriented decision support software product for through-life optimised inspection, repair and replacement planning for selected temporary repair systems (ie sleeves and composite wrapping) on piping. The software product including user guide will be provided on completion of the project.

Price and Duration

The overall estimated price for the work is £200,000 (excluding VAT), which requires £20,000 per company per annum for 2 years (£40,000 total) from each of the 5 Sponsors. It is anticipated that the project will commence with an agreed scope of work with a minimum of 5 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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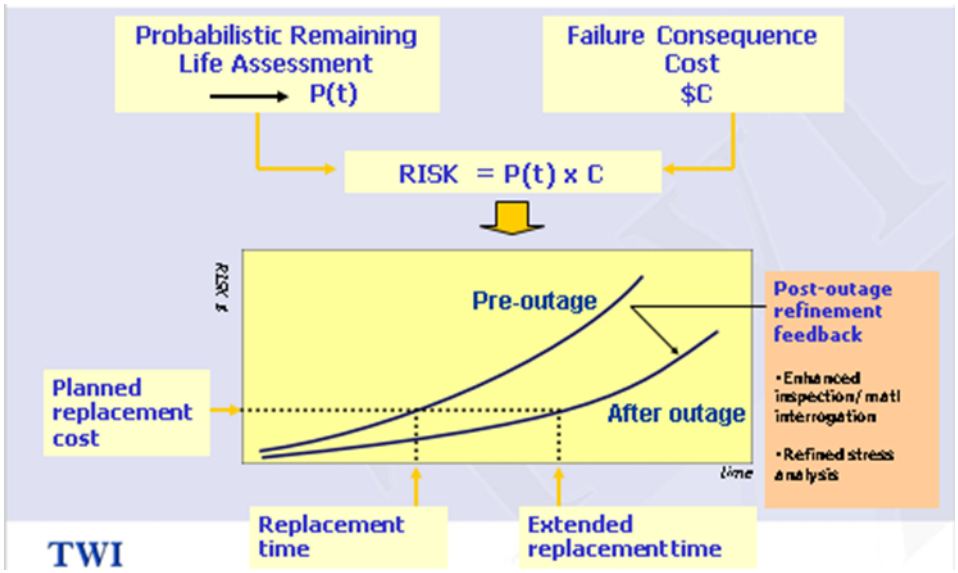

Figure 1 Illustration of the evolution of risk of failure and associated costs

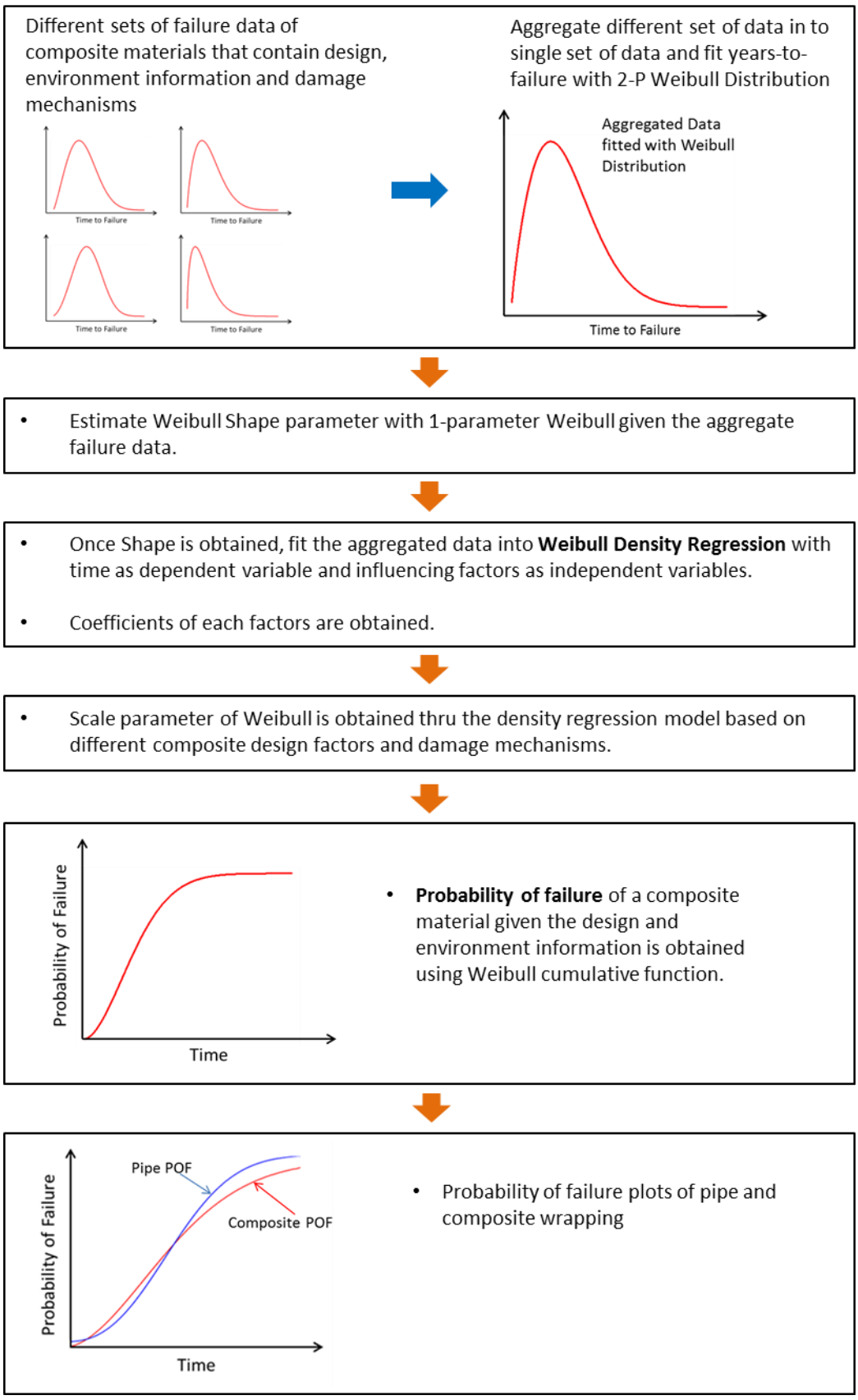

Figure 2 Framework for estimating the probability of failure for composite wrapping