Offshore Marine Terminals: Five Pitfalls of SPM Terminal Life-Extension Projects

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Whitepaper

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Introduction

With first and second design generation single point moorings (SPM) in operation since the 70s and 80s, many refineries and tank farms face the difficult question of how best to manage their ageing asset, while maintaining safe and continuous operations.

The offshore loading system often represents the lifeblood of the plant operations, as it ensures the export/import of product from/to the plant. Loss of reliability or availability can, therefore, have dramatic financial consequences for the terminal.

Different options are available to operators to ensure that their system is **fit to operate**, from purchasing a new system to refurbishing or upgrading the old ones. The challenge is to select the best strategy, which will sustain the long-term operating needs and prove the most cost-effective.

As recognised industry experts, our marine terminal team often encounters operators facing the challenge of solving this difficult problem. Below are five main pitfalls commonly encountered on these types of projects:

1. Lack of Strategic Planning and Early Concept Definition

As systems have been operating satisfactorily over 20 or 30 years, one of the most common behaviours is to adopt a ‘replace like with like’ strategy.

It is, however, time and money well spent to start by defining and assessing the long-term operating strategy for the asset, in particular evaluating the current and future throughput requirements for the facilities and establishing the effectiveness and robustness of the existing system design.

Design techniques and technology have evolved significantly over the years, and there are multiple areas that may offer opportunities for optimisation, improvement and, ultimately, cost savings or increased efficiency.

2. Lack of Understanding the Actual Integrity of the Loading System

Typically, an offshore loading system can be divided into five main subsystems, namely the main pipeline(s), pipeline end manifolds (PLEM), moorings, SPM and subsea/floating hoses.

The integrity assessment of individual systems relies on different inspection/testing techniques and the relevant engineering expertise. Understanding the integrity of these components represents in itself a critical phase of assessing the fitness to operate of an ageing asset.

However, before concluding on the fitness for continuous operation of the asset and taking specific maintenance or replacement decisions, it is also important to have a holistic assessment of the loading system condition and understand how the different sub-systems interact and function together.

As an example, a new SPM may have a different dynamic response than its predecessor and, therefore, will influence the loading on the mooring, subsea hoses and PLEM structure.

3. Lack of Key Data to Achieve the Right Results

Due to the age of the asset, it is common to find only very limited original design information for such projects, especially if the terminal has been relying on paper archiving.

While as-built information on the system can be largely recovered by site visits and visual/diving inspections, some critical site data should be collected by surveys and maintained by the operators. The availability of such data is necessary to achieve reliable engineering assessments. This includes but is not limited to:

- Topography of the site – This should be carried out regularly to understand changes in sea levels and potential sedimentation movement to ensure safe navigation and operation on the site.
- Metocean criteria for the site – Operational and extreme environmental conditions of the site should be defined and understood, as these will govern the design requirements for the system.
- Geotechnical data – If not available, a geotechnical survey of the site should be performed as this will impact the design and operation of the system including pipeline, PLEM and, more importantly, mooring line anchors.

4. Use of New Engineering Techniques

Significant progress has been made in computational techniques over recent years. These have largely been reflected in the analyses requirements prescribed by the industry standards and design codes and, therefore, applied to new system design. Areas that have been impacted most include:

- Flow assurance – Understanding the dynamic operational and extreme flow responses of the system. Flow assurance simulations should be used to optimise the system pressure rating, but also include, where necessary, appropriate surge protections in the system.
- Dynamic wave response analyses – Optimisation and potential improvement of the subsea hose design configuration and mooring line loading response, in particular addressing fatigue issues of mooring chains.
- Structural FEA analyses – Better understanding of structural loading and stresses distribution across load-bearing components.

Regardless of the age of the original system, these new techniques should be applied and considered when defining and selecting the technical solutions for the terminal life extension, as these will highlight potential limitations or design optimisations that may apply to the system.

5. Planning for Execution to Minimise Operational Interruption

Depending on the selected approach, planning and management of the project execution phase is critical to ensure minimum interruption and downtime of the terminal operations.

This includes planning the inspections and site interventions carefully to obtain adequate information in between tanker operations, but also anticipates the look-ahead planning and schedule risks of all project activities. If subsea intervention is required or an SPM is being refurbished, interim solutions for continuous operations need to be identified and planned at an early stage to minimise the project financial impact due to operational downtime.

Early engagement of the right engineering expertise is highly recommended on SPM replacement or marine terminal life extension projects, as it will assist operators selecting the best solution for their

terminal in a cost-effective manner.

The Wood Group Kenny marine terminal team combines advanced analytical capabilities, strong technology expertise and in-situ experience to deliver safe, practical and cost-effective engineering solutions to terminal operators.

For further information or guidance on marine terminal life extension or refurbishment projects, please contact us at **marine.terminals@woodgroupkenny.com.**