



CASE STUDY

FMECA PILOT PROJECT SHOWS SIGNIFICANT COST SAVINGS FOR DOWNSTREAM OIL COMPANY

This downstream oil company refines, distributes and markets petroleum products with their largest location in Texas with a capacity to refine over 600,000 barrels of crude oil per day. The maintenance and asset management experts of MaxGrip were asked to support their Reliability Improvement Program with a FMECA pilot project.

OBJECTIVE: OPTIMIZING RELIABILITY

The oil company aims to be the world's safest downstream company in the world. As part of the client's Reliability Improvement Program, they wanted to perform Failure Mode Effects Criticality Analysis (FMECA) to further optimize asset reliability proactively. FMECA helps to identify, assess, and mitigate potential risks, enhancing operational reliability and efficiency. Its systematic approach helps to prioritize maintenance activities, reduce costs associated with unexpected failures, and comply with safety regulations.

The FMECA process aimed to:

- Establish a baseline for the failure modes of a selected equipment scope;
- Identify the localized and system-wide effects of potential failures, such as the impact on system availability;
- Assess the operational risk associated with each identified failure mode;
- Develop risk mitigation strategies and necessary maintenance tasks to reduce the risk to acceptable levels;
- Set a justified baseline for an optimal maintenance budget;
- Determine the optimal cost of ownership to rationalize the repair or overhaul approach for this scope of equipment.

APPROACH: FMECA STUDY

The initial focus of the FMECA project was a selected scope of equipment, specifically chosen to highlight the interconnected relationships among these equipment assemblies. The project was executed in three stages.

Stage 1: scoping

The first stage of the FMECA study started with a rigorous review and validation of documentation including historical failure data. This process ensured an accurate understanding of the project's parameters. Subsequently, the functional system and its boundaries are defined to clarify system-environment interactions. Identification of associated P&ID's and tags forms the next step, providing a detailed system overview. The final segment entails the generation of an equipment list and a consolidated FMECA study delivery plan, which sets the stage for the ensuing analysis.

Stage 2: FMECA Execution

The execution starts with the repopulation of the FMECA to the specific items of equipment under scrutiny. The next step was conducting a FMECA workshop with a cross-functional team comprising the client's engineers, operations specialists and facilitated by MaxGrip consultants. The workshop was primarily focused on assessing the operational context of the scoped equipment with. Based on the workshop outcomes, the FMECA study is finalized with the validation of failure modes, as well as determining operational consequences and risks tied to each failure mode. The FMECA study also included a tailored care strategy for each tag that was generated.

Stage 3: Implementation of Equipment Care Strategy

In this stage the insights of the FMECA study were used to develop effective Preventive Maintenance (PM) strategies. Risk mitigation strategies and maintenance tasks underwent rigorous validation to confirm that the inherent design safeguards and current operational philosophy were robust enough to maintain failure risks within acceptable limits. The FMECA insights and PM strategies were then handed over to the team for upload and implementation in the EAM system. This ensures accurate, digitalized asset management.

Trade-off Analysis

The results of the FMECA also includes the findings of the trade-off analysis that was carried to optimize the overhaul strategy for the high-risk assets and to justify the maintenance budget for the overhaul strategy. The trade-off analysis examined the cost benefits of the current overhaul strategy versus a twelve year scheduled overhaul strategy. A 20-year Total Cost of Maintenance (TCM) forecast was used to baseline cost efficacy of the two competing overhaul strategies.

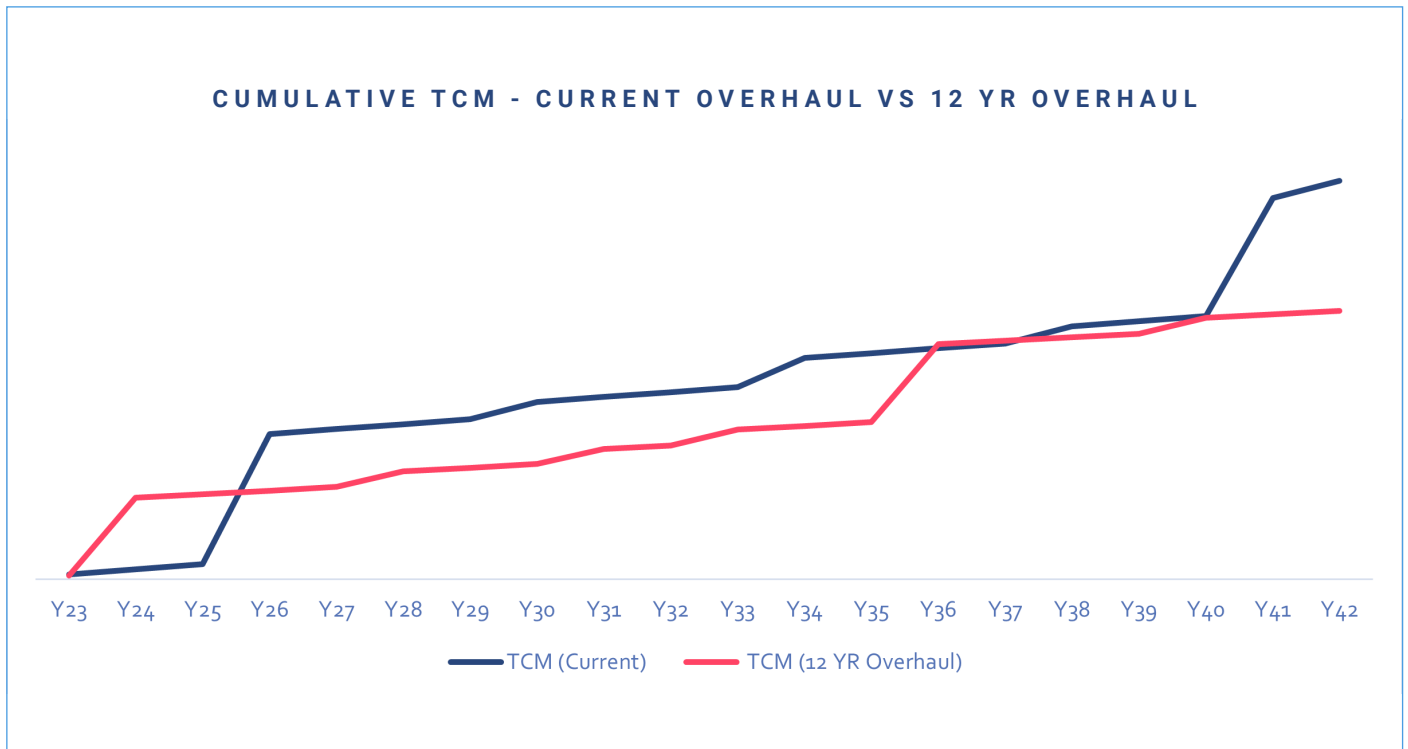


Figure: Trade-off Analysis – Cumulative Total Cost of Maintenance of Current Overhaul vs 12 YR Overhaul

The trade-off analysis shows that the proposed 12-year overhaul strategy is a 33% more cost-effective strategy when compared to the current overhaul strategy (TCM over a 20-year outlook). The contributing factors for the cost effectiveness of the proposed 12-year overhaul strategy are as follows:

- Maximization of the life expectancy of key components of the assets before the scheduled overhaul;
- Reduction in Mean Time Between Repair (MTBR) for the singled-out assets;
- No cost escalation as repairs/replacement of components are scheduled and planned;
- Overhaul cost is more predictable allowing for cost control and optimization.

Recommendations

To fully harness the benefits derived from this pilot FMECA initiative, MaxGrip recommended:

- Incorporate the FMECA data from this pilot into a comprehensive reliability strategy library. This will streamline the rollout process to similar equipment and significantly reduce the associated reliability costs.
- Integrate the condition monitoring strategies for the high-risk assets into a unified asset health monitoring model. This would enhance asset surveillance efficiency, fault diagnosis capabilities, and maximize pump lifespan before initiating overhauls.
- Review and update existing job plans, and link them to the justified Preventive Maintenance (PM) strategies for a seamless workflow.
- Conduct additional reliability analyses to establish the optimal runtime ratio between the duty and standby equipment. This would ensure a balance between maximizing the lifespan of the pumps and minimizing operational risk.

THE RESULTS

Significant Cost Savings

The purpose of the FMECA project was to establish the reliability profile and the optimal maintenance strategy necessary to maximize the reliability, compliance and the operational performance. Some results:

- Technical risk profile, risk mitigating strategies and Asset Care Strategies have been established for the equipment in scope;
- Justification for an optimal overhaul strategy have been established for the high-risk assets with an expected 33 % reduction in Total Cost of Maintenance (TCM);
- A systematic framework has been developed to generate justifiable PMs that reduces the time to generate the PMs by up to 50%;
- Reliability assurance compliance for items of equipment in scope as part of a company-wide asset management compliance program.

As was proven in this pilot study, FMECA can ultimately lead to significant cost savings, improved compliance and a safer way of working. The client is very happy with the FMECA pilot project and they will keep working with MaxGrip to expand the project to other equipment types.



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