

Business Audit Solves Inventory and Reliability Issues

The Challenge: Excessive spare parts inventory and a reactive maintenance environment were causing cash flow issues at a large Middle Eastern refinery complex. These issues were also impacting asset availability-reliability and needlessly driving up maintenance-repair costs.

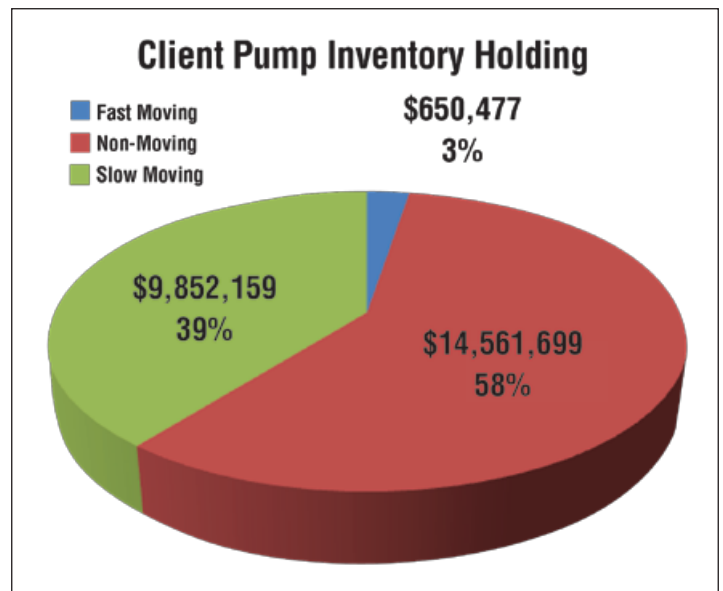
The Solution: A detailed business audit focusing on the plant’s inventory found that a surprisingly high percentage of pump bill of material (BOM) data was incorrect. Reconciling this data would not only address inventory management issues but also dramatically reduce time-to-repair (TTR) and rework rates. Combined with further enhancements to planning systems and maintenance procedures, these improvements will drive 10-year cost savings of up to \$23.1 million and a cash flow increase of \$2.4 million annually.

The management of a Middle Eastern refinery with a total pump population of approximately 1,700 units was growing increasingly concerned due to pump reliability issues, decreased asset availability and long repair cycles. They engaged Flowserve to perform a business audit which confirmed inventory-related CAPEX and cash flow restraints along with reduced margins due to asset availability issues.

Preliminary Audit

A preliminary investigation quantified the problems as follows:

- High carrying costs of approximately \$2.9 million annually due to excessive levels of non-moving pump parts (approximately \$14.5 million) being held in inventory. In an attempt to contain these costs, parts were not ordered to replenish stock until needed.
- Availability issues occurred as pump repairs were delayed awaiting the delivery of both critical and non-critical parts, thus affecting TTR: 128 days for critical pumps and 86 days for non-critical pumps. Approximately 70% of all repairs was accomplished with locally manufactured/fabricated parts.
- A reactive maintenance approach caused by a daily planning system, incorrect criticality assignments, ineffective work order prioritization and an inadequate hand-over processes from field maintenance to the workshop.
- Quick fabricating and reactive maintenance practices resulted in high levels of premature pump failure.



Audit Findings

- **Incorrect BOM.** The actual reason for the high inventory was due to incorrect BOMs. During a previous business system conversion a high percentage of BOM data were either lost or reassigned to the incorrect tag number.

When a pump was taken to the workshop, the BOM was either incomplete or incorrect which caused problems when identifying any required parts for repair. The audit validated that approximately \$0.9 million of incorrect parts were issued against pump repairs and then not returned due to an overly complex inventory return procedure. The audit also revealed that approximately \$1.8 million of parts were directly procured for pump repairs when these same parts were available in inventory, but unassigned to the pump BOM and classed as non-moving. This culminated in a high value of non-moving parts that were actually usable, but their requirement was invisible to plant management.

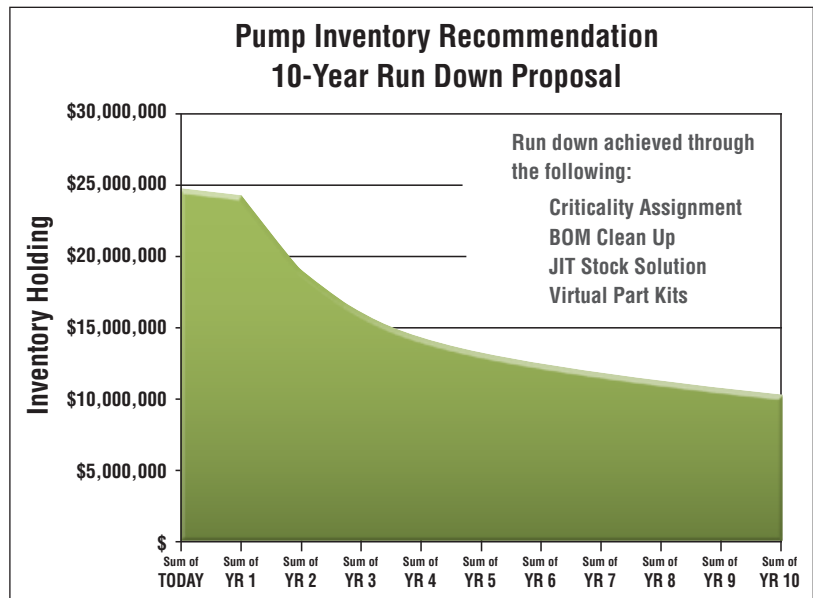
- **Extended TTR.** As parts were either incorrectly assigned in the BOM or not visible to maintenance on 70% of all repairs, pump TTR was significantly delayed due to parts re-order or fabrication. Reactive planning, criticality assignment and hand-over issues were also significant contributing factors to high TTR.
- **Reliability.** The audit revealed that 85% of these premature failures could be traced back to the pumps using non-OEM, locally manufactured parts.

The Results

Flowserve helped the plant operator correctly match \$14.4 million of its total \$24.6 million inventory (59% of total) by generating BOMs. Flowserve also recommended:

- Correcting all pump BOMs
- Creating standard virtual pump parts kits
- Implementing just-in-time (JIT) solutions
- Correcting criticality level assignments
- Improving workshop hand-over procedures

The overall payback of implementing the Flowserve inventory and supply chain solutions recommendations would yield a net 10-year cost savings of \$23.1 million and a cash flow benefit of \$2.4 million annually.



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