

## ***Business Audit Improves Inventory and Asset Maintenance Strategies***

**The Challenge:** Site-wide pump reliability performance issues were causing serious concerns for a Middle Eastern petrochemical plant. A reactive maintenance environment was severely and negatively impacting asset availability and reliability while increasing maintenance and inventory costs.

**The Solution:** Flowserve conducted a business audit to identify and validate strategies to improve reliability and availability, while reducing life cycle costs. Audits identified opportunities to improve asset maintenance processes, inventory optimization and workforce competency. Multi-million dollar savings are projected.

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A Middle Eastern petrochemical plant producing ethylene, poly-ethylene and ethylene glycol has approximately 1400 pumps of which 20% are Flowserve product brands.

Recognizing their operational problems, plant management executed internal initiatives to address downtime and maintenance cost issues. After 18 months, however, no significant improvements were realized, at which point management requested Flowserve perform an audit of the plant's maintenance and inventory management strategies and practices.

### ***Business Audit Findings***

The audit revealed several opportunities to improve performance and reduce cost.

- **Pump criticality and work order prioritization.** Nearly 80% of the plant's pumps were categorized as "critical" whereas the industry standard is typically between 5% and 10% of total pump population. As a result, 52% of all repairs were classified as "emergency" with a 24-hour return-to-service goal. This directly led to increased rework levels and a 66% increase in average pump maintenance breakdown cost over three years.
- **Daily planning activities.** Pumps would arrive in the workshop without any pre-outage material requirement assessment. This resulted in an average time-to-repair (TTR) of 61% to 81% over target based upon client prioritization.

- **Stock inventory.** Inventory data was found to be wholly inaccurate due to importing errors during conversion to a new computer system. In effect, BOMs did not align with the pump tags they corresponded to. The findings revealed non-moving stock with a value of \$1.3 million. Incorrect parts were withdrawn and not returned (due to complex forms) causing additional incorrect parts to be re-ordered for stock replenishment. Correct parts remained invisible to the organization and showed as non-moving stock since required parts were ordered directly as needed for repairs.
- **Bad-actor program.** The existing program was subjective and not data driven. The audit revealed that over a three-year period, 20 bad-acting pumps were causing 16% of unplanned repairs and 31% (approx. \$2.36 million) of unplanned repair cost. Yet only three of these pumps were included in the existing program.
- **Re-work levels.** A review of all work orders revealed that 80% of repaired pumps were failing in less than three months.
- **Workforce competency.** A competency knowledge assessment revealed a substantial gap in pump repair knowledge. These findings, coupled with a detailed work order analysis, confirmed that high levels of rework were directly related to personnel competency.

**The Results**

The audit has been completed and asset maintenance and system data (CMMS, DCS, etc.) issues are being addressed. Nevertheless, in the early stages of implementation, tangible results are being realized.

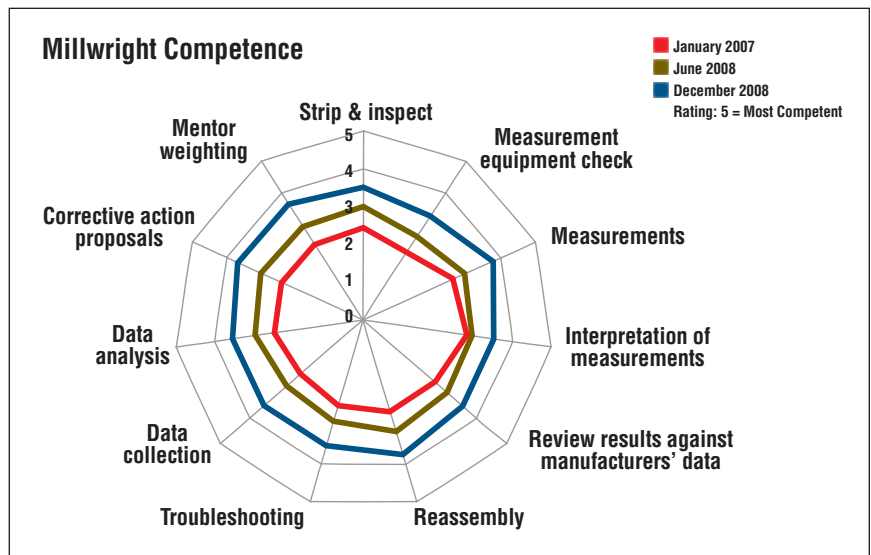
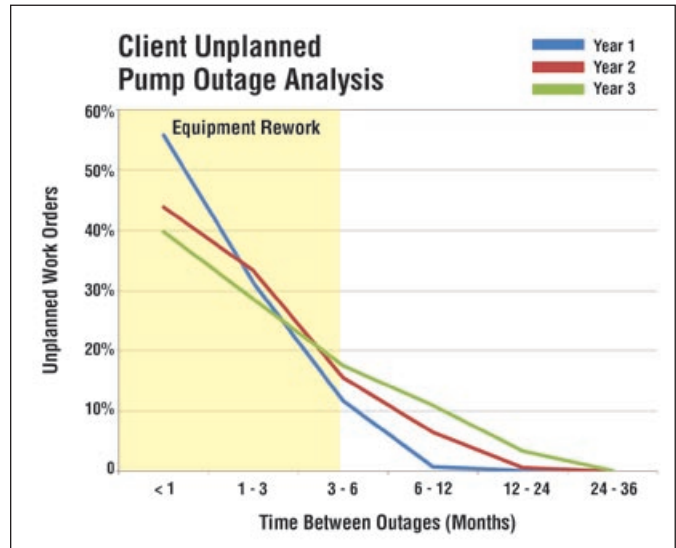
Multi-millions of dollars in inventory cost savings and bad-actor repair/operating savings are projected upon program implementation.

A bad-actor program is now in place to focus on reducing the \$2.36 million in unplanned repair costs.

Inventory BOM data has been corrected for Flowserve equipment and a program is underway to address other OEM equipment. Projected savings is \$260,000.

An Educational Services program to enhance workforce competency has commenced, already resulting in a 16% reduction in rework in the first 12 months and a validated life cycle cost (LCC) benefit of \$180,000.

Based on audit findings, the customer has also launched internal initiatives to move to weekly planning and to re-assess pump criticality levels.



Bulletin FSG-SS-009a (E) Printed in USA. July 2010.  
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