Costly Unplanned Pump Events Reduced at Flint Hills Refinery

RESULTS

- No significant unplanned environmental, health, and safety (EHS) events in route-monitored machinery in three years
- 18% increase in mean time between repairs (MTBR) on pumps
- 100% completion of vibration data collection on 1500 pumps
- Shorter response time when potential failures are identified

"We are definitely saving maintenance dollars as a result of the extended MTBR on rotating assets."

Michael Popelka,
Reliability Engineer, Pine Bend Refinery

APPLICATION

Essential rotating machinery is monitored through regular vibration checks and supported by a comprehensive pump improvement program.

CUSTOMER

Flint Hills Resources is an independent refining and chemical processing company based in Wichita, Kansas. Its Pine Bend Refinery near St. Paul, Minnesota has a crude oil processing capacity of about 320,000 barrels per day.

CHALLENGE

Several unplanned environmental, health, and safety (EHS) events, including a pump fire in 2008, had an economic impact on the Pine Bend Refinery. Although vibration data was periodically collected on rotating equipment, the condition monitoring program was not entirely effective, advanced analysis techniques were not used, and no limits were in place to initiate a decision to shut down a pump showing signs of degradation. A long pump repair backlog and unclear maintenance work processes were among the underlying problems. The pump fire was seen as an opportunity to implement several significant pump improvement initiatives.

SOLUTION

The first step was a gap analysis conducted by Emerson's team of vibration experts. This in-depth assessment of the refinery's rotating equipment maintenance program identified issues that could be corrected through organizational changes or technology. Because of concerns about rotating equipment, the existing condition monitoring program came under considerable scrutiny.

Recommendations included the expanded use of Emerson's machinery health analyzers and AMS Machinery Manager predictive maintenance software. The refinery was encouraged to establish alarm limits, key performance indicators (KPIs), and integration of significant vibration data with the refinery's OSI/PI database. Rotating equipment engineers and the condition monitoring technicians received training to strengthen their understanding of pump vibration and its impact on operations.

A separate but related program to improve pump reliability was also initiated as a result of the gap analysis. This program incorporated a new root cause failure analysis (RCFA) procedure that has led to better hardware, better operating methods, and better maintenance. In addition, the pump repair backlog was reduced by employing outside contractors during the latter half of 2009. Now, at-risk pumps are repaired faster, and back-up equipment is generally available.

Emerson's local business partner, Novaspect Inc., was instrumental in developing the data link between AMS Machinery Manager and the OSI/PI software. Overall velocity and peak-to-peak acceleration data are two high-level indicators that are passed from AMS Machinery Manager to OSI/PI to help in evaluating the health of rotating equipment. This interface made possible a single SQL database now used by maintenance management to ensure all vibration data collection routes, encompassing more than 1500 machines, are completed every 30 days.

Alarm limits set in each analyzer give the technicians a range of operating conditions for decision making. However, the responsibility for deciding whether to shut a machine down or continue running rests with the proper decision-making level in the organization. This relieves technicians and operators of making high-stakes decisions while enabling them to inform the right persons when unmistakable signs of fatigue appear.

A key result of the overall improvement program has been an 18 percent improvement in mean time between repairs, achieved over an 18 month period up to March 2011. Pump repairs are done right the first time, pumps run longer, and fewer repairs are necessary in the long run. The Pine Bend Refinery has saved money through improved identification of machinery defects, better vibration analyses, and predictive decision making that has eliminated costly unplanned EHS events.

"Eliminating significant EHS events due to the failure of rotating machinery has had a positive safety, environmental, and financial impact on our refinery."

Michael Popelka,
Reliability Engineer, Pine Bend Refinery

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