

Life of Ten Heat Exchangers Tripled (Savings: \$600,000 every month)

Imagine a slurry (30% mineral-suspended solids, 475°F, 650 psi, pH <1) flowing through a titanium shell-and-tube cooler at 6 ft/s; how long do you think this unit will last?

The leach plant of our client operated 10 coolers, under the above conditions, with an average life of 20 days. The maintenance and operations losses from these failures were \$12 million/yr.

When the leach plant became the production bottleneck, a cross-functional team of 6 employees, led by Tony Rodriguez of Pemmax Consultants, was given the challenge of doubling the average operating life of these coolers. Using PROACT Root Cause Analysis (RCA) methodology, the team analyzed the problem for two weeks and made many recommendations, mostly related to changes in operations and maintenance procedures; these recommendations were implemented immediately, raising the average life of the coolers to 25 days.

The team also identified the following potential failure causes:

1. **Excessive turbulence at approximately 6" from the inlet of the first-pass tubes**
2. **Vortexes created by crust lodged at the inlet of the first-pass tubes**

During the following two months, every failure was analyzed against the above two hypotheses and it seemed that both of them caused failures.



Then, to verify the above hypotheses, cones were installed at the entrance to the first-pass tubes



...and a very ingenious filter/screen was incorporated inside the feed-head of one of the coolers.



These modifications tripled the life of the cooler and similar results were attained on subsequent modifications. This proved, conclusively, that the hypotheses were indeed the main root causes of the failures.

Currently, the coolers last 70 to 90 days and we continue improving inspections and overhaul procedures to ensure that all the units last a full production campaign.

Before this analysis, the short life of the coolers was mostly attributed to high acidity and flow rates. After eliminating a total of 27 root causes, the life of the units has more than tripled, even though, the all the adverse process conditions remain the same.

Additional to the economic benefits for production and maintenance, eliminating cooler failures reduced the work demands on many hourly and supervisory personnel. The latter benefit encouraged most of the personnel to solve many other problems creating a proactive-work environment that is presently allowing the company to raise production and reliability standards.

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