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RCFA Provides Whirlpool Corporation with Immediate Improvements

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Introduction

In early 1999, the Whirlpool Corporation's Ohio Divisions (Clyde, Findlay, and Marion) jointly funded and participated in RCFA Methods training for thirty of their employees. During two separate training sessions, five people from each division attended the three-day class, conducted by the Reliability Center, Inc. The company's goal was to introduce RCFA methods to floor-related engineers, supervisors, and technical personnel, in hopes of quickly solving chronic problems at each of their facilities.

The following RCFA case study comes from the Marion Division, and was performed two weeks after the initial RCFA Methods training was completed.

Chronic Equipment Failures

Since May 1997, a total of eight (8) equipment failures had been experienced, on a parts transfer system, for a drum fabrication process. A total of $43,200.00 in labor and material had been spent on repairs, with $16,000.00 invested in two failures, which occurred approximately 30 days apart! In addition, the equipment failures caused part shortages to occur, which drove the entire manufacturing facility into costly unplanned schedule changes.

The transfer's function is to shuttle parts to and from each station, through a progressive fabrication process. The transfer drive assembly was comprised a multi-speed air/brake drive unit, coupled to a right-angle gearbox assembly, which drove the transfer. The chronic failures were occurring at the multi-speed drives. The drive would stop operating completely, or erratic operation would occur, that required constant air pressure adjustments. When the drives would fail, the maintenance personnel would remove the failed unit, obtain a re-built unit from the spare parts inventory, and install it on the equipment. The failed drive unit would be sent to a repair house and the unit completely refurbished. After the drive repairs were completed, it was then sent back to the division and stored until a future breakdown occurred.

Due to the re-occurring frequency of the equipment failures and the impact they had on divisional production requirements, the problem presented a perfect application for the RCFA methods.

RCFA Team

Ironically on a day when a drive failure actually occurred, a cross-functional team of five employees was being assembled to begin the analysis. The team was made up of engineers, equipment operators, and maintenance personnel.

In an effort to quickly return the equipment to production, the repairs had to be completed as soon as possible, but the team realized as much evidence as possible had to be preserved. Members set out to locate key elements that would aid them in the analysis. The recently failed drive was obtained so it could be used in the investigation. Historic data was compiled, such as: process settings, work orders, spare part listing, etc.

Building the "Tree"

The team began their RCFA by building the Top Box, which contains the Failure Event and Failure Modes. After the Top Box was complete, the team developed hypothesis on the various causes for each Failure Mode. As each hypothesis was developed, a verification plan was made. Each team member was given specific assignments for investigating and verifying each hypothesis as true or false. Only hypotheses that were supportable by data were considered. This process was repeated again and again, until all of the root causes were determined.

It was determined that a total of eight (8) root causes were involved in the chronic equipment failures. There were four (4) human roots, which were related to incorrect repairs and installations during each failure. There were three (3) latent roots, attributed to the lack of repair, installation, and set-up procedures. Also the lack of operator and maintenance personnel training was identified as latent root. One (1) equipment root was also sited, which was related to unsuitable air pressure gauges.

Recommendations & Corrective Actions

When the analysis was completed, and all of the solutions related to the equipment failures identified, the team set out to make the necessary corrective actions. Since all of the root causes attributed to the failures were within the group's influence and control levels, plans were developed to prevent future re-occurrences of the multi-speed drive failures.

The vendor was brought in and the repair procedures were discussed. Changes were made in the vendor's repair procedures to eliminate the roots found in past repairs. Procedures were developed and instituted for the maintenance personnel and equipment operators, which will aid them in situations related to future set-up, trouble-shooting, and installations/repairs.

Process definition work was completed, so the proper settings and adjustments were determined. These actions were taken to establish the optimum settings for the transfer drive, which would be compared against daily reading, turned in by the operators.

The data would then be trended and compared against the norm, in an effort to spot unfavorable parameters. When it was identified that the process was trending out of control, immediate efforts could then be taken to correct the situation and prevent equipment failures.

Summary

All together, this RCFA showed total savings of approximately $96,000.00 when maintenance labor/material, scrap, and lost production costs were tabulated. By identifying the root causes related to the equipment failures, and taking the proper steps to eliminate future occurrences, the reliability of the equipment as been dramatically improved.

In addition, the RCFA demonstrated to the team members how powerful a tool RCFA can be, and how it makes the approach to problem solving much easier.