Improving plant reliability

CMMS is an important component of a successful reliability-centered maintenance program.

David Berger

USA

PUBLICADO
15/12/2002

Reliability is one of the oldest concepts in asset management, but in recent years it's become one of the hottest focus areas for many capital-intensive companies. Consequently, CMMS vendors have enhanced their program features pertaining to reliability. What follows is a primer on how to use your CMMS as part of an overall reliability-centered maintenance program.

Criticality analysis

By examining the end-to-end processes carefully, you can determine the criticality of each piece of equipment and its component parts (see "Criticality analysis," May 2001, pg. 27, for more on this topic). Identify critical process inputs and outputs, as well as related sub-processes. In addition, locate points where a potential component or part failure could disrupt critical inputs and outputs.

Many CMMS packages record criticality as a coded field on the equipment master file. Preventive and predictive tasks can be defined to avoid failure of assets having a high criticality. The user also can input required corrective tasks.

Failure analysis

Coded fields on the CMMS simplify data collection greatly and force consistent reporting of failures by narrowing the choices. Descriptive fields for detailed explanations also are also available on most CMMS packages.

Problem codes, for example, report the breakdown. It's usually tied to a given asset class, such as motors, pumps or rooms. Cause codes are issued after the problem has been investigated. Some of the more advanced CMMS packages provide a set of cause codes for a given problem code by asset class, thereby creating a code hierarchy. Action codes record the work performed to fix a problem. Finally, delay codes explain why operations have temporarily ceased, and includes items such as awaiting raw materials, operator breaks or product changeovers. Identifying the most frequent and time-consuming delays provide valuable insight into establishing priorities.

Pareto analysis

Failures can be prioritized in terms of their impact on safety, operations, output and cost. Pareto analysis is one statistical tool that for analyzing equipment history to determine the frequency, impact and causes of problems. A Pareto chart plots the frequency distribution of problem codes on a simple spreadsheet. Most sophisticated CMMS packages assist with this analysis.

Root cause analysis

A fishbone diagram, also referred to as a cause and effect diagram, is probably the most popular root cause tool. It's a simple manual tool used in brainstorming sessions to focus discussion on possible causes of the higher frequency problems suggested by the Pareto chart. The CMMS should link problem and cause code occurrences with the corrective action required. Various predictive and preventive maintenance tasks can be explored to prevent a problem from occurring.

Diagnostic analysis

The most advanced CMMS packages now incorporate a knowledge- or rules-based troubleshooting database, which allows users to identifying the best course of action for a given problem. For example, if a motor fails in a given piece of equipment, the diagnostic tool determines the statistical likelihood of each cause code, and suggests corresponding actions to consider. Additionally, correlations can be made with specific equipment or parts to determine if there is a higher failure rate originating from a given vendor. This allows you to take preventive or predictive actions or find a solution with the vendor.

Once a pattern is determined, a knowledge-based diagnostic tool predicts failures in similar parts, components and equipment. This allows condition monitoring of key components.

Status change analysis

Status fields on a good CMMS should track the duration of various activities and delays. Work order status field options include worker assignments, downtime waiting for parts, etc. Equipment or component status field options include commissioning, warranty work and third-party repair.

Studying the history of status codes provides valuable insight into how to improve asset reliability. Problems, such as long lead times and inadequate authorization, may suggest obvious corrective action. Differences between cycle time (i.e., elapsed time, including delays) and touch time (actual hands-on productive time) highlight problems with maintenance department responsiveness.

Asset performance analysis

One effective way to focus the attention of both operations and maintenance departments on asset care is to show the relationship between equipment reliability and operational productivity. This can be accomplished by using the CMMS to track simple measures such as maintenance cost per unit of output or operations cost per minute of equipment downtime. More important than the actual value of each measure is the trend over time.

Analysis of other measures
CMMS software vendors have added other measures to their toolboxes. Two of them are mean-time-between-failure (MTBF) and mean-time-to-repair (MTTR). By tracking MTBF and MTTR for each critical asset, the maintenance department can measure progress in improving reliability.

Condition monitoring and analysis
This is becoming an important feature of every CMMS. The simplest packages allow users to input data, such as setpoints or equipment usage meter readings, for triggering PM routines. The more sophisticated packages connect to PLC's for automated data collection through integration with third-party software. The software analyzes incoming data to ensure that trends are within user-defined control limits. When data strays outside these limits, users are notified and action, such as issuing a work order, sending a pre-defined email or activating someone's beeper, is taken.

PM cost analysis
Everyone agrees that a planned environment is superior to a reactive one. What is not clear is where the breakeven point is between the two. There is a technique, sometimes referred to as Weibull analysis, that graphs the decreasing cost of planned maintenance against the increasing cost of unplanned maintenance as the PM interval increases. When the two curves meet at a given PM interval, the cost is optimized.

Predictive maintenance analysis
A simple example of this is comparing the history of engine failures with the condition of the lubrication prior to failure. It may then be possible to predict the need to replace the oil, replace the rings and so on, given the trends in oil temperature, viscosity, and the amount and type of particulate in it.

Lifecycle analysis
One of the key decisions in any reliability management program is when to repair and when to replace a given asset. A statistical analysis of equipment and cost data can help justify repair/replace decision.