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The Pursuit of Continuous Improvement in Asset Management

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RPM Method + RCM = Reliability

by Fred J. Weber

Picture this: It's Monday morning and you're the maintenance manager of an industrial plant. On your desk is a printout of 432 open work orders and the operations manager is screaming because air compressor #2 just tripped for the third time this month. To make matters worse, you just remembered two of your technicians went fishing for the week. The question is: "What can this maintenance manager do to improve this situation?" The obvious answer is to go fishing with the two technicians. Maybe a better question to ask is: "What can be done to improve plant performance?"

Do the math: RPM method + RCM = Reliability.

The RPM method and RCM are two proven reliability techniques to improve plant performance. Reliability centered maintenance (RCM) is a structured methodology developed to review the design, operation and maintenance of a system and associated equipment. This technique is used to locate known and unknown failures jeopardizing the safety and reliability of a system. The basic procedure uses seven questions to identify the equipment's function, failures, consequences of failure and tasks to prevent failures. The answers to the questions are generated by the feedback of operators, maintenance personnel, plant engineers, equipment design engineers, or other end users of the equipment. Although this process may be considered time-consuming by some people in industry, the benefits would always outweigh the time spent. The process forces you to dig down deep into every aspect of the equipment and find the hidden failure that could jeopardize the plant's safety and equipment reliability.

On the other hand, the RPM method is a work priority system that grew out of personal frustration with many of the existing work priority systems. Make no mistake, there are countless other work priority systems. There is the famous first in, first out (FIFO), or the 20 code priority system, so complicated that a special decoder ring is required to decipher it! And finally, the familiar HWSL method that most companies use. Not familiar with HWSL? Sure you are, it stands for "he who screams loudest!"

A work priority system is required to prioritize work and get everybody on the same page. The RPM method is based on the actual definition of the word maintenance in the dictionary, which is *to maintain; to repair or preserve*. But anyone working in maintenance today knows the real definition of maintenance as "any work that no one else wants to do!" Simply put, RPM stands for repair, preventive and modify.

"R" (Repair) – Classified as any work required to place an **existing** piece of equipment into its original operating condition while meeting all safety and environmental requirements. Examples of repair work may include a leaking valve, a knocking pump, or a conveyor that won't start.

"P" (Preventive) – Considered the minimum amount of work needed to keep equipment safe, reliable and environmentally friendly. Examples of preventive work include adjusting a setting, monitoring vibration, lubricating a pump, or calibrating a transmitter. Preventive/predictive work should be a scheduled and/or defined task by the equipment manufacturer, maintenance personnel, or engineering designed to keep the equipment running safe.

"M" (Modify) – Any task loosely considered non-maintenance. Examples include installing a new welding machine in the shop or redesigning an existing service water piping system. Quite simply, if it's not an "R" or "P" type work order, it must be an "M."

Now that you know what RPM stands for, how do you apply it? It can be as simple as this: Assume you go to work tomorrow morning as usu-

What can be done to IMPROVE plant PERFORMANCE?

al. First, locate five boxes, labeling them New, "R" (repair), "P" (preventive), "M" (modify) and Closed, shown in Figure 1.

Next, get copies of all your open work orders. Using your knowledge of RPM, classify all your work orders as to whether they are "R," "P," or "M" and place the work orders in the appropriate box. The New box will hold work orders that need a little more information in order to categorize them, while the Closed box will hold work orders that are completed.

So, what box of work orders should maintenance do first? It should be obvious from the definition of maintenance that the "R" and "P" boxes are the priority. But it's not so easy. Maintenance is being pulled in different directions by operations, engineering, purchasing and management. However, the RPM method informs the other departments and management that maintenance's priorities are the repairs and preventive maintenance tasks in the plant.

While the RPM method outlined here is certainly the core of the system, there is much more involved. You shouldn't think that the only thing required to manage your maintenance function is the ability to locate five empty boxes!

Besides managing work orders, the RPM method can be used as a pre- and post-RCM function. As a pre-RCM function, the RPM method supplies the analysis with the "R," "P" and "M" tasks/costs associated to each piece of equipment. This valuable historical data provides maintenance management with the information to justify the cost of an RCM analysis or a system modification. Typically, it's not cost-effective to do RCM analysis on all the plant's equipment. The RPM method points to the part of the plant that would benefit the most and that is the system or equipment with the high "R" and "P" costs associated to them.

As a post-RCM function, the RPM method checks the benefits of the RCM analysis. From the maintenance perspective, the RCM analysis is considered successful if maintenance doesn't have to fix the same piece of equipment over and over again. The RPM method will display the success of the RCM analysis simply by the lack of "R" work orders in six months. Of course, there are other benefits from the RCM analysis, such as locating hidden failures, but most maintenance managers are concerned with how to eliminate the pile of 432 open work orders sitting on their desk.

Another known fact to improve the reliability of a plant is to have maintenance and engineering working in the same direction. Therefore, "Maintenance + Engineering = Reliability."

Earlier it was stated that: "RPM method + RCM = Reliability." Now you have two departments that have an impact on reliability and two proven methods to improve reliability. All you need to do is define who is responsible for what. A simple way to do this is to define who does what by asking the following questions:

- ☑ Who should be responsible for the hands-on work required for "R," "P" and "M" on the equipment? The answer would be the maintenance staff because it's the reason they were hired in the first place. Does this mean engineering can't help maintenance troubleshoot a piece of equipment? No, it just means that maintenance is responsible.
- ☑ Who should be responsible for keeping track of the material and labor costs associated with each "R," "P" and "M" work order? The answer is maintenance personnel because they are doing the task, so they should be responsible for keeping track of the data.
- ☑ Who should be responsible for justifying and implementing the RCM analysis? Engineering is responsible for showing management the benefit of the RCM analysis. The engineering justification needs to look at the maintenance benefit of a potential reduction of an "R" work order and operational savings from an increase in production or reduction in scrap.
- ☑ Who is responsible for the final approval of all design changes developed from the RCM analysis? The answer is engineering. Does this mean that engineering should be the only decision maker of design changes and preventive maintenance tasks? Of course not, but engineering needs to take the responsibility for the final approval. Engineering has access to design information, such as load, stress and flow calculations. Engineering personnel are also familiar with engineering codes and standards that the equipment must meet.

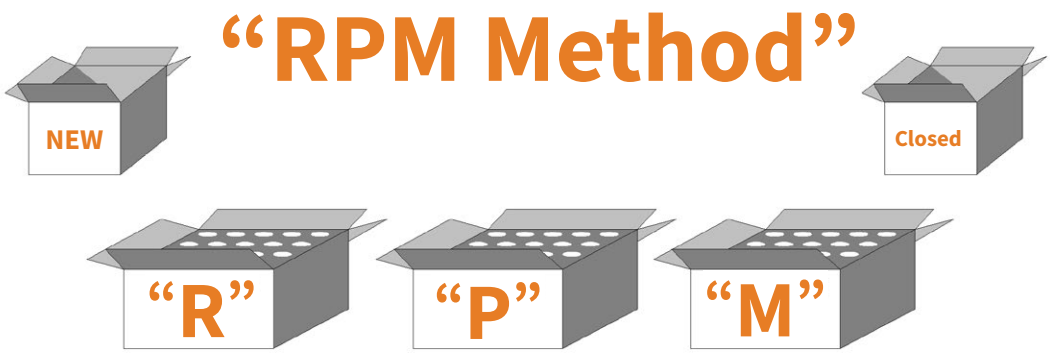

Figure 1: RPM method

The best way to show the benefits of maintenance and engineering applying the RPM method and RCM analysis strategies is with an example. Assume there is a problem with a plant's wastewater system. The first thing to do is implement the RPM method to make sure there is a problem in the wastewater system. After applying the RPM method, the problem with the wastewater system becomes obvious by the number of "R" and "P" work orders recorded in the system. This high number of "R" and "P" work orders can be used as a pre-RCM function by engineering to support the need for an RCM analysis on the wastewater system. Once an RCM analysis is approved, maintenance needs to generate an "M" work order to record time spent supporting the RCM analysis on the wastewater system. Why is an "M" work order generated? As stated earlier, since it's not repair or preventive work on the wastewater system, it must be an "M."

Now it's time for the RCM analysis. The RCM analysis reviews the design, operation and maintenance of the wastewater system. Assume during the analysis that the root cause of the problem with the wastewater system and some hidden failures turn up. These findings would have affected the safety and reliability of the system, such as a missing check valve in the system. All the maintenance and engineering time associated to this analysis and insulation of equipment is accumulated on the "M" work order to track costs to this modification.

Was the RCM analysis a success? Using the RPM method as a post-RCM function, you can now define maintenance success of the analysis simply by no more "R" work orders in the wastewater system. If "R" work orders start to show up, it's time for engineering to revisit the RCM analysis.

So, how is success defined by the maintenance manager with 432 open work orders, a screaming operations manager and a tripped air compressor #2? The ability to go fishing with the other two technicians without worrying about the plant safety and reliability!

Fred J. Weber, *P.E., is President of Wrench Time, Inc. He has over 35 years of experience working with and learning from maintenance and construction people in the mining, manufacturing and power generation industries. Fred is the author of the books, "Wrench Time…using the RPM method to manage maintenance" and "Weber's Thermodynamics Notes."*
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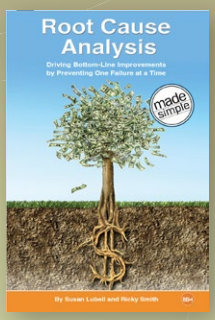

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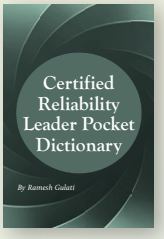

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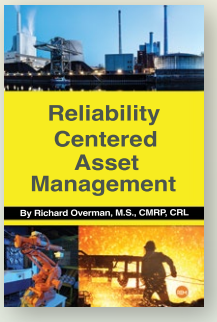

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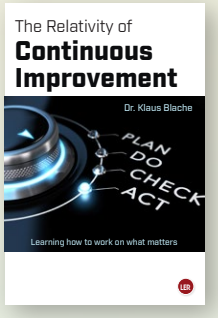

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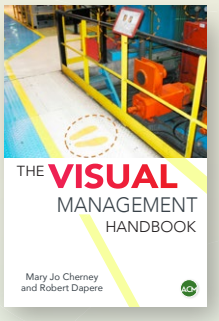

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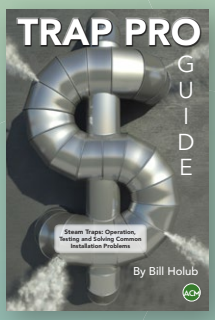

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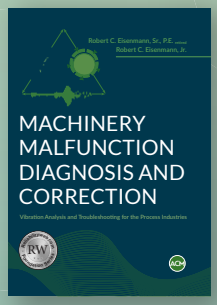

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