Equipment Criticality and Prioritization of Work Orders

Introduction

Equipment utilization and efficiency data is invaluable information that can be shared across maintenance and engineering teams to improve the plant maintenance schedule. And if the data is collected through a comprehensive SAP software solution it can be used to manage your production work flow and scheduled machine maintenance plan, especially during breakdowns and outages. By monitoring production efficiency and equipment utilization, you can concentrate maintenance efforts and maximize equipment uptime, availability, and reliability.

Being able to compare equipment performance in different plant process areas also enables you to improve maintenance process planning for all equipment categories, including items that can be swapped in and out on a rotating basis, equipment that is mobile, or gear that is fixed or unmovable.

Assessing plant maintenance equipment criticality is a key step to developing a preventive or reliability-centered maintenance process. Comprehensively assessing equipment performance and usage is the foundation for determining the specific overall importance and functional impact of a particular piece of equipment. Once this priority is assigned, you can develop a comprehensive plant maintenance plan and assess your risk management strategies.

What is equipment criticality?

Equipment criticality is a rating used to determine how often equipment should be inspected or maintained or which equipment must be considered as urgent if a failure does occur. Any piece of equipment that could stop or result in increased production costs upon failure is considered critical in the process. In assigning equipment criticality, consideration is given to an assessed piece of equipment based on its likelihood of failure (vulnerability) and on the consequences of failure (criticality). The assessment is numerically scored and allows you to assign a rating of low, medium, or high risk to every applicable piece of equipment.

By giving equipment a criticality rating and setting up guidance rules, you can help ensure that your maintenance and engineering efforts are focused in the correct areas. For example, project schedulers are better able to determine which notifications and work orders will need to be rescheduled immediately, in the event of equipment failure, and which ones can be pushed out to a future date. In addition, this data will help plant maintenance schedulers prioritize any new equipment defects that occur, in order to keep the most critical pieces of equipment available, and to maintain maximum plant uptime.

Equipment maintenance is a major area of concern for manufacturers. A study of 70 manufacturing plants found that over 50% of the maintenance work performed by these firms was reactive (when equipment ran until it failed or had an emergency breakdown). There is a strong correlation between manufacturing cost reduction and following a preventive and predictive equipment maintenance strategy. Over a 5-year period, a study group of companies found that productivity improvements correlated strongly with a number of variables, one of which was following a preventive and predictive equipment maintenance strategy[1].

How to identify and assess equipment risk

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Recognizing the priority of your equipments' criticality and vulnerability allows you to manage your plant's output with the optimal outcome so that there will be as few interruptions as possible. In order to make best use of criticality, you need to use a method to determine the criticality for each plant item or process. In order to carry out this work, consider the following steps:

1. Identify the equipment
Prior to evaluation, create a list of all plant items that will be assessed. The initial list should include any items that may cause significant interruption to production or output if the equipment were to fail. Equipment that is less likely to cause interruption should also be noted, but can be included in later studies.

2. Form an assessment team
To get a full picture of the impact of the criticality, create an assessment team which includes several departments and individuals who have experience at various steps within your plant maintenance processes. The maintenance management system can also be used as a tell-tale to see where equipment has failed previously.

3. Rate the equipment while considering business risk if an item fails
Before you can identify and assess equipment risk, you need to determine the vulnerability and the criticality of equipment failure. The determination for each rating is a score from 1 to 5 and is based on the equipments' parameters with regard to the overall production process.

For vulnerability, assign:

- "1" if equipment is unlikely to fail
- "2" if equipment failure might happen
- "3" if equipment failure could occur
- "4" if equipment failure is highly probable
- "5" if it's almost certain that the assessed equipment will fail

[1] http://www.referenceforbusiness.com/management/Log-Mar/Maintenance.html#b

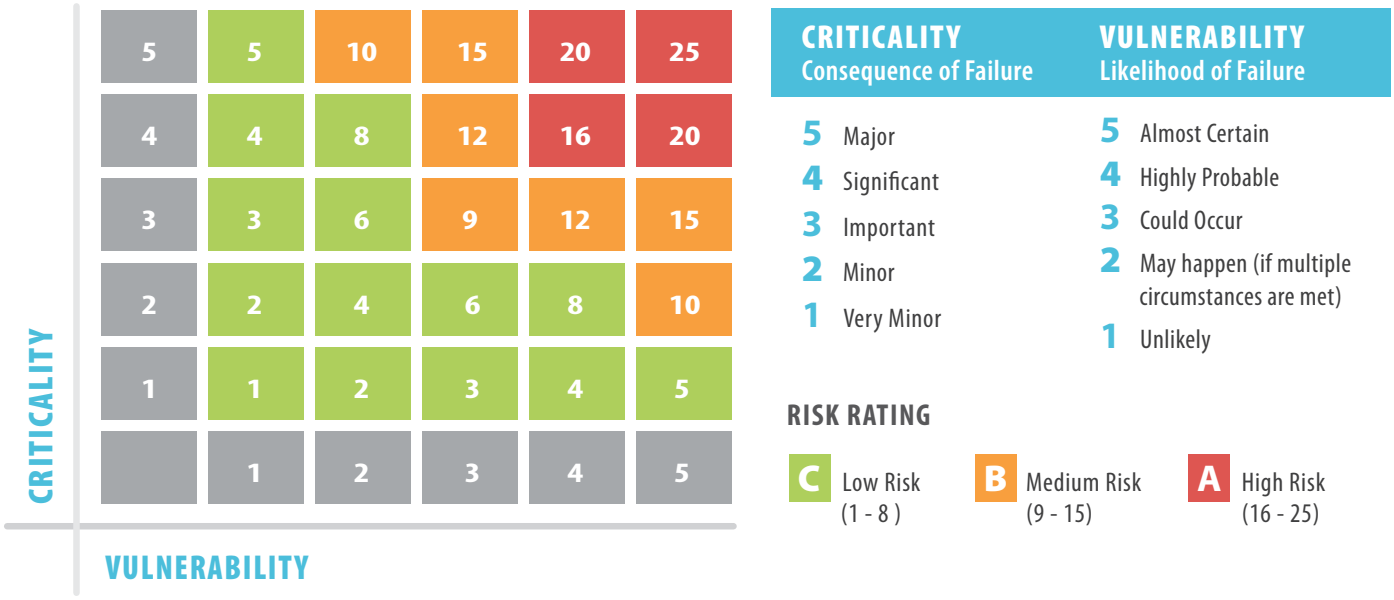
In addition, when scoring criticality, consider an equipment failure against the production process and assign:

- "1" for a very minor consequence
- "2" for a minor consequence
- "3" for an important consequence
- "4" for a significant consequence
- "5" for a major consequence

The assessment team should consider the impact of a failure to the business as well as any potential environmental, health, or safety issues. Also, during the team's evaluation process, it's important to give extra consideration to the reasoning behind any high rating a member gives to a piece of equipment.

Use the risk matrix (figure 1) to convert the vulnerability and criticality score to an actual risk rating. The risk matrix allows an organization to see how the criticality and vulnerability scores translate to an overall risk rating.

Figure 1 – Risk Matrix Example



After rating the criticality and vulnerability of each piece of equipment, you then use the ABC risk matrix indicator for analyzing and developing a plant equipment maintenance strategy. When the criticality and vulnerability ratings are plotted on the matrix, pieces of equipment whose scores fall in the 16-25 range are labeled "high risk/important" and given a designation of "A." Equipment that scores 9-15 for plotted vulnerability versus criticality will be deemed "medium risk/less important" and given a designation of "B." And any

equipment that falls within the 1-8 range will be deemed “low risk/relatively unimportant” and given a designation of “C.” As an example, if a piece of equipment has a vulnerability rating of “4,” and a criticality rating of “3,” this results in the equipment being placed into the “medium risk” category and given a designation of “B.” This means that this equipment should be highlighted on your list of equipment to maintain.

This A, B or C indicator should be populated into the Functional Location and Equipment master data in SAP, in the ABC indicator fields. It is worth noting that the equipment will take priority over the Functional Location if both are populated differently. This means that you may have an ‘A’ criticality Functional Location (the system), but a ‘B’ criticality piece of Equipment, in this, the B rating would be brought across to the work order. An example is where a duty and standby pump are installed in a highly critical system.

Equipment reliability reporting in SAP

Equipment reliability reporting stems from criticality ratings and is used to review new work lists or project notifications. The reporting is used for long-term project evaluation to properly assign and focus facility resources, engineering efforts, operational procedures, and maintenance processes.

When reviewing work lists or new notifications, the criticality should be viewed alongside the initial priority entered in SAP. To do this, a list edit variant should be created in SAP, sorted with the most critical items of equipment at the top to allow easy visibility of the equipment which may have the greatest effect on the plant. In addition, longer term reports should be created and viewed. This will allow better decision making regarding where efforts should be concentrated by the maintenance and engineering teams.

As a rule of thumb, the more information about equipment that is included in SAP, the better. The person who is carrying out the maintenance on the equipment should make it a priority to update the history in SAP to maintain accuracy and ensure that all teams have access to this institutional knowledge. Work orders should be completed at the earliest opportunity while the details are still in memory, allowing more accurate results to be entered. The higher the quality of the information entered, the more accurate the future analysis can be.

Benefits of prioritizing maintenance work orders

With equipment properly ranked for criticality and vulnerability, you are then able to prioritize and execute maintenance orders with minimal disruption to each of the six

steps within the work order life cycle (figure 2), which are:

1. Identify work – the where, what, and when of the work order life cycle
2. Plan work – where equipment is validated and the needed labor, parts, and procedures are identified
3. Schedule work – where resource availability is validated
4. Execute work – how work is distributed, performed, and packaged
5. Document work – where work hours are confirmed and work history is updated
6. Analyze work – where plans are tested and intervention frequency is adjusted

Figure 2 – Work Order Life Cycle

It is crucial to establish clear prioritization guidelines, or rules, to ensure that equipment is properly maintained. These guidelines will direct the maintenance and engineering teams on how to proceed with preventive work on the equipment. These rules can help maintenance and engineering teams decide how many times routine

maintenance can be skipped on a piece of equipment. For example, a guideline could state, “Equipment A cannot miss a preventative maintenance routine” or “Equipment B can miss two maintenance routines.”

The rules can also help prioritize defects identified by the ABC indicator in SAP. For example, “Any defect found in equipment A must be addressed within 3 hours.”

Summary

Developing a comprehensive plant maintenance and risk management strategy is mandatory for any efficient production process. Without an equipment maintenance strategy in place, up to 80% of equipment failures cannot be predicted on the age of the equipment alone. The remaining 20% of equipment failures can be accounted for based on repetitive use[2].

By having a clear understanding of your equipments’ vulnerability and criticality, you will be able to minimize and potentially avoid equipment breakdowns and unexpected repairs. Overall plant equipment uptime improves due to awareness of equipment failure consequence.

Objectively assessing equipment criticality and vulnerability, with regard to the production process, is crucial to the development of a preventive or reliability-centered maintenance process. Plant maintenance based on equipment risk ratings provides a foundation for determining the impact to your overall plant operations. Prioritizing equipment maintenance, and establishing guidelines and rules for how to prevent equipment failures, is the ultimate goal.

About Prometheus Group

Prometheus Group is an enterprise application software company specializing in improving the usability and user adoption of SAP plant maintenance. Developed jointly with end users, our software enhances the customer experience with intuitive functionality, graphical visualization, and simple processes. Our certified solutions “live” inside of SAP and enable companies to increase productivity, reduce costs and improve reporting. For more information, visit www.prometheusgroup.com.

[1] http://www.referenceforbusiness.com/management/Log-Mar/Maintenance.html#b