Mean Time Between Failure (MTBF), Mean Time to Restore (MTTR), Availability, Failure Rates! These are just a few of the many measures an industrial plant needs to measure plant performance. Having good quality maintenance history is a key building block of reliability improvement.

Let’s say your manager asks you if a particular heat exchanger bundle is going to need replacement on the next turnaround. How do you answer? If you are collecting maintenance history on that exchanger you can do a probability analysis to make a more informed decision about that bundle replacement. Suppose you are trying to find out which seal manufacturer’s product works best in a particular hydrocarbon service. Again, good maintenance history can help make this call. There are numerous uses for good quality maintenance history on our plant assets.

However, in order to gain these benefits you must have an effective work process to get this critical data. For many organizations this is a difficult task. We have many sophisticated systems in place to help us collect history on our capital assets but yet most would say their asset history is not very good.

There are many reasons for this but I would like to discuss a few that come to mind. First of all, this type of data is somewhat subjective. In contrast to process data that is automatically generated from the control system, maintenance history data is heavily dependent on a person entering it. Therefore, we have to count on them fully describing the maintenance event. This is not always practical as the people who know the most about the event are busy in the field with other responsibilities. A second area of concern is having a data collection work process that is easy to use and does not leave a lot of room for misinterpretation. Lastly, comprehensive equipment taxonomy with adequate codes and technical characteristics must be employed to collect useful history. Otherwise, the data collected will be difficult if not impossible to analyze.

I have seen people struggle with these issues at many of the large process and discrete manufacturing facilities where I have worked. Many of these facilities utilize SAP-PM to help them manage their Enterprise Asset Management (EAM) needs. Although this article is specific to SAP-PM the concepts and work processes certainly can apply to many EAM solutions. These EAM solutions are all excellent tools, and if used properly can provide a wealth of data that can provide “fuel” for plant performance improvement.

I would like to describe some of the common issues associated with data collection in SAP-PM and provide some tips to improve the quality of the data being collected.

**Issue 1 – The work notification or work request is not written against a piece of equipment**

SAP-PM is comprised of functional locations and equipment. The functional location describes a physical location and function within the facility. Each functional location has one or many pieces of physical equipment that serves that function. If the notification does not specify the equipment number of the asset being addressed, it makes it extremely difficult to record history and to analyze the data. Most of the detailed codes for maintenance events are based on the equipment and not the location. There are always exceptions to this but the general rule of thumb is that if functional locations and equipment are being used it is critical to make sure that the equipment is specified on the notification.
I would suggest that each notification be screened to ensure that an equipment number is assigned when applicable to ensure that history can be recorded properly. This will also aid the planner’s understanding of how to accurately plan for the repair.

**Issue 2 – The work notification is written against the wrong equipment.**

In some cases an operator might write a notification to alert maintenance about a problem. They might not know the primary source of the problem so they select the equipment they think is the culprit. It might turn out that the equipment they specified is incorrect. Let’s say they write a notification that indicated that Pump-101 is the problem. After further review, maintenance determines that the problem is with the motor driving the pump. The notification and subsequent work order must be updated to reflect the different equipment. Once again, each notification should be screened to ensure that the equipment in the event is the proper one.

If this is not done, then the equipment that was specified improperly on the notification and work order will be penalized for costs associated with another asset. Also, since the equipment was specified improperly, the codes provided for that notification may not be applicable to the repair that was conducted.

**Issue 3 – Notification is written to a high level functional location**

A functional location in SAP-PM can represent very broad locations such as entire plant sites. If we do not take the time to record notifications down to the lowest level in the functional location hierarchy it will make it very difficult to perform data analysis. Many times there will be notifications and work orders generated at high level functional locations so that a lot of work can be performed at that location. While this might make notification and work order administration easier, it will make it almost impossible to analyze that data for reliability improvement. I often see this during a planned shutdown where there is a large amount of work being performed on a single or few notifications and work orders.

This is closely related to the issues of recording an equipment number on the notification and work order. Typically, equipment is assigned to lower level functional locations. If we make it a best practice to always select an equipment number then that will ensure that you are selecting the lowest level functional location for that equipment.

**Issue 4 - Inconsistent use of the Breakdown Indicator**

SAP-PM offers a field to indicate whether or not the maintenance event represented a breakdown. If this box is checked it will be used in SAP-PM reports for measures like MTBF or Availability. The problem is that most people do not know when to check the box. When in doubt it is left unchecked. Nobody wants to admit that a “Breakdown” took place. I have a different opinion of when that box should be used. I believe that the breakdown box should be used when a functional failure has taken place. You might be asking yourself what constitutes a functional failure. That is a good question. There are many opinions on what the definition of a failure is. I think a functional failure has taken place when the equipment fails to function at all, performs below expected results (e.g. degradation) or has a high potential for an undesirable event. This is very close to the ISO-14224 definition of failure.

The problem with this definition as it relates to the breakdown box is that it is open for interpretation. Perhaps it would be easier to say that anytime a repair takes place on a component then the breakdown box should be
checked. As far as I am concerned, the breakdown box simply indicates that a reliability event has taken place and should be used in any reliability analysis that takes place on that asset.

Whether you agree with this opinion or not, there must be very clear definitions for when the breakdown box is used. If not, you may not be able to differentiate which events to use when performing reliability analysis.

**Issues 5 – Notifications do not delineate multiple items when multiple components are repaired.**

Let’s take an example of a mechanical seal repair on a centrifugal pump. Often times maintenance will decide to replace additional components in the pump while it is available for repair. This is often referred to as opportunistic maintenance. For example, they might replace the bearings and possibly the impeller.

In this scenario, it is critical to create three items on the notification to document that the seal, bearing and impeller were all worked on. Otherwise there will be no way to determine the life of the existing components and it will appear from the work order that all the cost is associated with the seal repair. SAP-PM easily accommodates this functionality and it should be utilized to it fullest potential.

**Issue 6 – Dates do not reflect the actual timeline for the events**

SAP-PM offers an array of dates. In many ways this provides significant flexibility to describe the timing of maintenance events. On the other hand, it can be overwhelming trying to determine the best use of the date fields. I would like to focus on the malfunction start and end dates on the notification. The malfunction start date often defaults to the date that the notification was written. This is okay if it was a complete breakdown and the equipment will be repaired immediately. However, there are many notifications that are written where the equipment is not worked on for several days or even longer. In these cases, I would suggest changing the default malfunction start date to the date that the equipment was repaired. This can effectively be considered the reliability event date that will be used in many reliability calculations.

The malfunction end date should be populated with the date and time the equipment was returned to Operations. SAP-PM will use these fields in some of their maintenance and reliability reporting (e.g. MTBF, Availability). Note that the breakdown duration field on the notification will only be populated if the breakdown box is checked.

**Issue 7 – Multiple notifications should be created if multiple pieces of equipment are involved in the maintenance event.**

Typically, maintenance event codes are related to individual pieces of equipment. Therefore, if a technician is working on a pump and determines that additional work is necessary for the motor then they should create an additional notification for the motor linked to the original work order. This is necessary so that the proper code sets will be available for the motor. Otherwise, the technician will only see codes for the pump and the event
will not be completely documented. It would appear that all the cost for the maintenance event is on the pump even if significant work was performed on the motor.

**Issue 8 – Equipment is not dismantled in SAP-PM when it is moved in the field**

Much of the equipment in an industrial facility can be moved from one functional location to another (e.g. electric motors). For example, MTR-101 might be installed at Functional Location 101 and then it is removed and taken to the shop, repaired and put back into service at Functional Location 102. If this situation occurs, it is important to make this change in SAP-PM so that the history of the equipment moves with the asset. If this is not done, then a brand new asset might inherit the history from a previously installed asset giving totally inaccurate information to the maintenance and reliability team.

**Issue 9 – Lack of detailed equipment taxonomy**

It would be very difficult to do financial accounting if there were not guidelines, rules and definitions like GAAP (Generally Accepted Accounting Principles). The same is true when trying to document the maintenance history of plant assets. There must be a complete classification of all the different categories, classes and types of equipment. In addition to this classification, there must be ample codes to document the maintenance events along with technical characteristics for each equipment class/type. For example, there must be a list of components (e.g. object parts), conditions (e.g. damage), and actions (e.g. activity) for all documented equipment. These help to codify the maintenance events so that data analysis can look for trends and correlations in the information. For example, why are we having so many seal failures on P-230-A and not having any on P-230-B? Are we having more problems with one manufacturer’s components versus another?

Equipment taxonomy is a broad subject and is well beyond the scope of this article. However, a comprehensive taxonomy is a critical element in the documentation of maintenance events and should be given a great deal of thought.

These are issues are the key areas to focus on when trying to improve your maintenance data collection process. You should do an audit of your existing data to see how well you are doing in these key areas. If you find that you are not utilizing you EAM solution to its fullest capacity then you should begin to make a concerted effort to address these key issues.
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