WHITE PAPER

How to Rank Your Equipment

A Straightforward Roadmap

Allied™ RELIABILITY

Contents

INTRODUCTION

A database of accurately ranked assets is the foundation of almost any preventive, predictive, or condition based asset management program. Without accuracy in this process, any program that has its basis in this data will fail. Prior to starting the ranking process, it is important that certain prerequisites are completed. Some straightforward questions should be answered before beginning asset ranking:

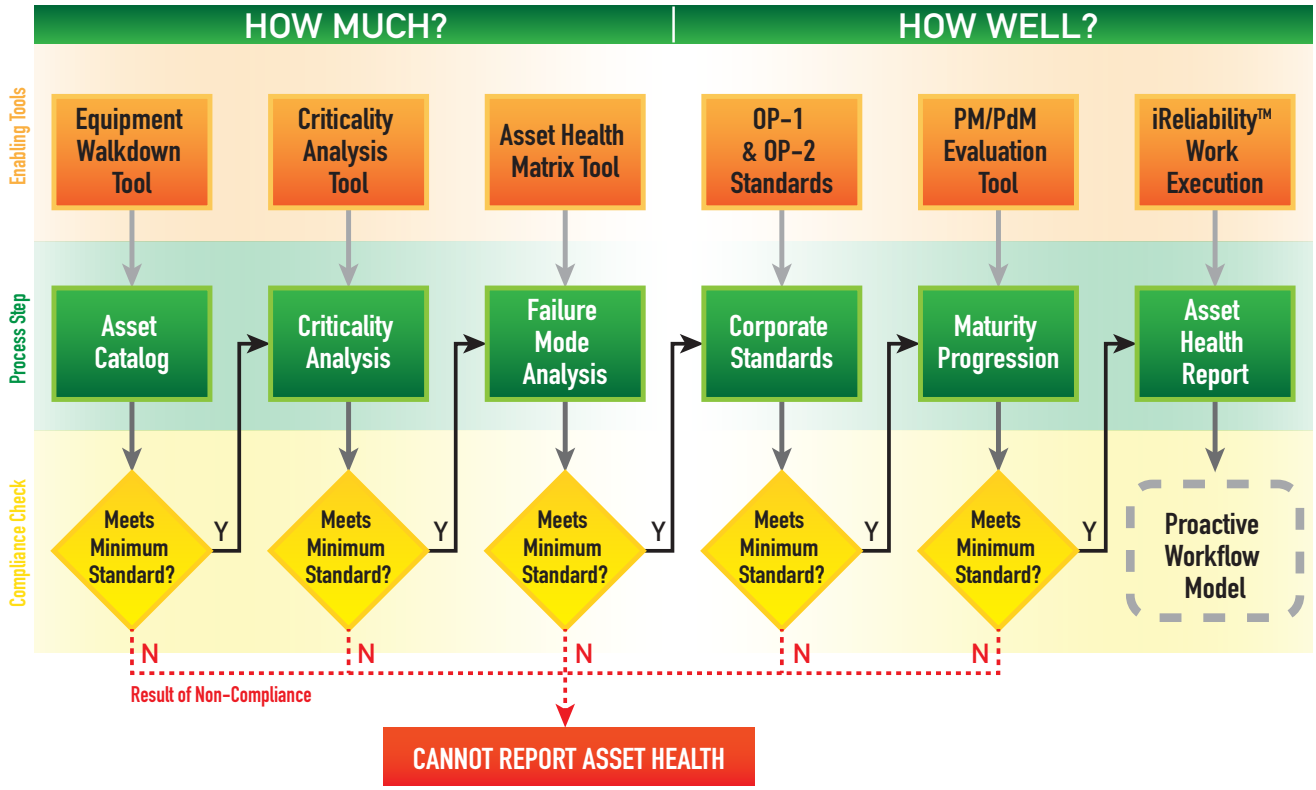
1. How can this ranking information be used for other processes?

2. Is your asset catalog accurate?

Understanding how the asset ranking can be leveraged across other areas is powerful. The asset's numerical criticality value can be used to prioritize a repair backlog for planning, a ready backlog for scheduling, where to focus Bill of Material (BOM) optimization, a spare parts plan, and assets to receive scheduled maintenance, both preventive and condition based. Which of these are driving your need to rank assets?

Verifying and updating your site's asset list is an important step prior to ranking. Criticality Analysis is part of an overall reliability improvement process called Asset Health Assurance (AHA). A graphical representation of this process showing prerequisites and reviews is provided in Figure 1.

Figure 1. Asset Health Assurance Model



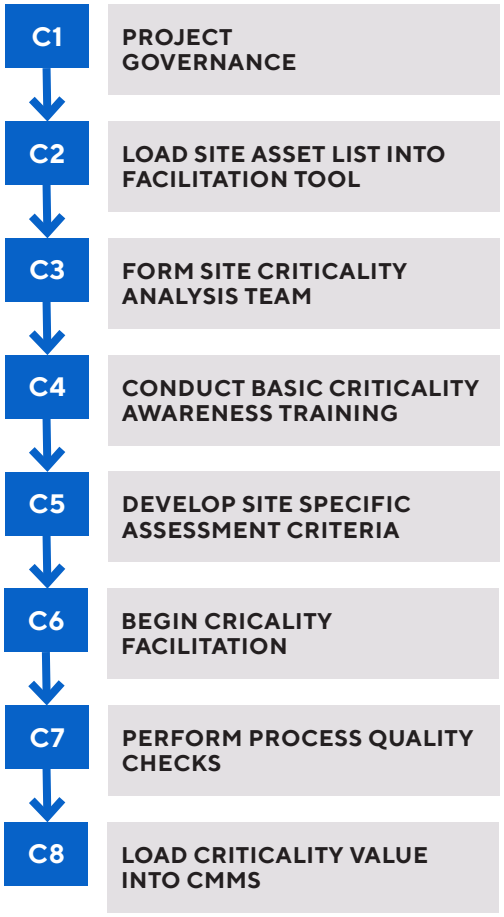
I am sure you are saying that your site asset list is accurate, correct? Over the course of project implementation, I frequently hear the same thing: "We have found an average asset accuracy of 82% and attribute population/accuracy of 19%." Translation: there are assets installed in the facility that are not documented within the Computerized Maintenance Management System (CMMS), which means no scheduled or corrective maintenance is assigned, executed, or accurately documented. Incomplete or outdated asset attributes yields insufficient data for purchasing replacement parts or carrying outdated inventory. Investing the time to update and correct your facility's asset catalog ensures sufficient data is available to support subsequent reliability processes.

Now that the asset catalog is accurate and the reason for asset ranking is identified, it is time to begin. This is not an academic exercise where a single category such as maintenance, production, or safety is used by the reliability engineer to determine the asset's ranked value. "Ranking" describes the process of determining asset importance: assets whose failure more immediately and/or more severely impacts the desired state. Criticality is the name for this combination of importance with failure rate.

THE CRITICALITY TEAM

It must be understood that successful asset ranking is a process that will involve people from various areas of your plant environment. A high level process flow is shown in Figure 2.

Figure 2. Criticality Ranking Process

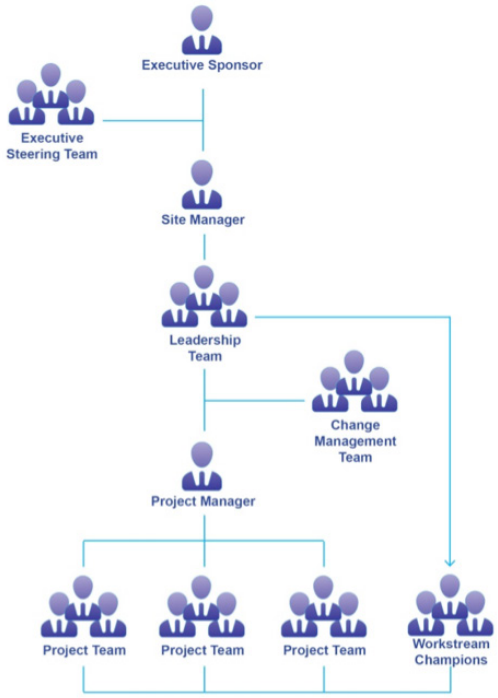


C1: PROJECT GOVERNANCE

A reliability improvement element reaches beyond those in the maintenance organization. While it is common for area craftsmen, area operators, maintenance supervisors, and operation supervisors to be included as team members, other stakeholders must also be included. Representatives from Safety; Environmental; Purchasing; Maintenance, Repair, and Operations (MRO) Materials; and Planning should participate.

This is a good time to discuss the necessary site governance structure (Figure 3) and roles required to support the criticality process.

Figure 3. Project Governance Structure



Executive Sponsor

The rule of thumb for executing process improvement projects is to locate the role that controls all of the resources necessary for successful implementation. The scope of the process improvement determines if an executive sponsor is required. The executive sponsor should be at the corporate level in an operational or continuous improvement director, regional director, or VP position. This level of the organization is responsible for making changes to policies and procedures to improve organization performance. The Executive Sponsor's role is to engage the Executive Steering Team and the organization in monitoring the successful implementation of the project and achieving the return on investment. He or she will provide an organization charter to the sites, take actions to align competing initiatives, remove obstacles, and provide realignment of organizational constraints to reinforce new behaviors.

Executive Steering Team

The executive steering committee is comprised of the owners of the functions that support the new processes and must be realigned to drive and sustain new behaviors, at a minimum. About 40-60% of the site's constraints are controlled at the corporate level; therefore, the role of the Executive Steering Team is to realign the constraints they control that have a direct impact on successful implementation and sustainment of process and behavior. They monitor implementation progress and benefits return, remove obstacles, and set priorities. Additionally, they monitor risk factors to the site's ability to implement and sustain the initiative and take actions to mitigate or eliminate the risks that they control.

Site Manager

The Site Manager is normally the Site Sponsor or the owner of all of the resources at the site level necessary for successful implementation. The Site Sponsor is responsible for monitoring implementation and benefit return and setting priorities for implementation by aligning competing initiatives and removing obstacles. The Site Sponsor realigns the organizational constraints under his or her control that will reinforce implementation and sustainment.

Leadership Team

The Leadership Team is usually the direct reports to the Site Sponsor as they typically are the department heads who own a specific functional responsibility at the site. They are engaged to support the project implementation by aligning their part of the site organization to ensure successful implementation of the project and its sustainment. They help align competing initiatives by setting priorities, remove obstacles, provide resources, and demonstrate active leadership presence in the implementation.

Project Manager

The site Project Manager is the Project Facilitator and is responsible for successfully implementing the project at the site. The Project Facilitator engages the site Leadership Team and Site Sponsor in executing their roles with assistance from the Change Management Team. The Project Facilitator provides project management (time, cost, and quality of the project's functionality) and ensures that change management actions occur with regard to engaging the workforce, effective communication, and establishing reinforcing systems that will drive and sustain the correct behaviors.

Change Management Team

The Change Management Team is a working group chartered by the Site Sponsor and Leadership Team and charged with the tactical actions needed to drive change at the site. They support the Leadership Team and manage the Risk Management Plan, Communication Plan, Site Employee Engagement Plan, and Change Management Plan, which identifies constraints and recommends performance metrics that will drive and sustain the correct project behaviors.

Workstream Champions

A Workstream Champion is someone who is an advocate for a particular workstream (Team), defends decisions made by the Team, and actively supports the overall project improvement process. They serve as the workstream's liaison to the Leadership Team to present issues that may prohibit successful implementations of the project output or solutions.

The Workstream Champion evaluates Team dynamics and member participation to provide feedback and direction as necessary to improve the efficiency of the Team, ensuring an on-time completion of the technical implementation plan.

C2: LOAD SITE ASSET LIST INTO FACILITATION TOOL

Take the completed asset list, including hierarchy, and put this information into your site's preferred format. Common formats include a text document, spreadsheet, or database program. This is the list of equipment used for the criticality analysis.

C3: FORM SITE CRITICALITY ANALYSIS TEAM

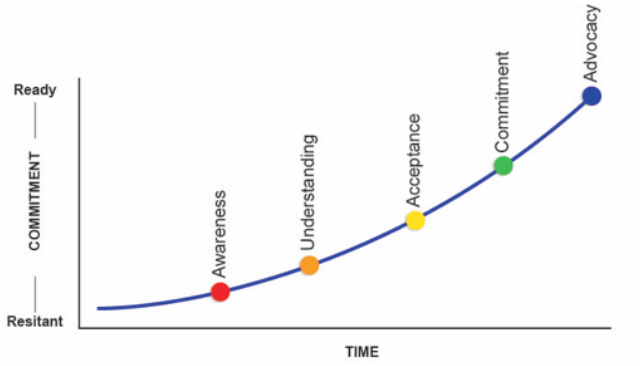
The assembly of the criticality assessment team is vital to accuracy of the equipment ranking. In many instances, sites will want to include department representatives who are new or have little experience in the areas to be assessed. This must be viewed no differently than a project to modify a piece of equipment or change a process. Would you place inexperienced site personnel on this work? If this were done, would you be surprised if the outcome of the project did not meet expectations? A criticality assessment is no different. It requires experienced and knowledgeable representatives on the equipment to be assessed. This team should be comprised of representatives who can speak for the department when answering the assessment questions. It will be a challenge to get the time from the most experienced people, but it is their knowledge that will yield the desired results.

C4: CONDUCT BASIC CRITICALITY AWARENESS

The Project Manager must conduct an awareness session of the criticality analysis process. This will include information on the process itself, resources required, process customization, what to expect, output, and opportunities to incorporate the results into other workstreams.

Communication must be coordinated across all levels of the organization to promote awareness, understanding, acceptance, commitment, and advocacy. The engagement curve in Figure 4 shows how commitment is

Figure 4. Engagement Curve



Awareness	Understanding	Acceptance	Commitment	Advocacy
People know ***why*** the change is happening.	People know ***what*** is changing and ***how*** it will affect them.	People have made a personal ***choice*** to change.	People ***take action*** towards executing the change.	People ***reinforce*** the change for sustainability.

C5: DEVELOP SITE SPECIFIC ASSESSMENT CRITERIA

The decision should have been made as to the level at which the criticality analysis will be performed. Regardless of the level used, assessment criteria must be developed. This will come in the form of specific questions and answers. The questions should be grouped into main categories, such as safety, environmental, maintenance, operations, purchasing, and customer/facility impact. By including these areas in the assessment, the needs of the entire site will be addressed.

Ranking at the system level, equipment level, or failure mode level may be conducted. System criticality is often performed at plants that have not conducted a criticality assessment or may have one that is outdated. Going through a system level criticality assessment

first identifies which systems are most critical to the process or facility. For those who have not gone through a criticality assessment before, it is a great starting point because the number of systems is less as compared to the number of pieces of equipment. The group can begin forming and gain knowledge of the facilitated process.

However, system level criticality is not sufficient for making machine level decisions for resource allocation. The asset level criticality assessment provides the granularity required to compare almost any asset to the next, yielding a clearer path as to where resources should be allocated.

Once asset level criticality is completed, there exists another level of refinement that should be applied to the most critical assets, ideally the top 5-20%. Because of their importance and their failure rate, these assets pose the greatest risk to the plant if they fail. This next step will focus on the failure mode level. This assessment process is known as Failure Mode, Effects, and Criticality Assessment, or more simply FMECA. Reviewing the specifics of how this machine fails will provide a much clearer picture as to which maintenance techniques are warranted to eliminate or at least prevent the failure from occurring. FMECA is an essential part of understanding machinery failures and developing effective and efficient Equipment Maintenance Plans (EMP).

C6: BEGIN CRITICALITY FACILITATION

An often overlooked part of the criticality team is the facilitator. Their job is to assist the group in understanding the common objective of the criticality process and then enable them to reach consensus, while remaining neutral. Do not interpret this to mean they are not interested in whether the team completes the analysis. To the contrary, they want the process to be completed to the best of the group's ability without taking sides or influencing the results. This can be problematic since discussions can become quite heated as individual personalities collide. A seasoned facilitator will expect the emotional up and downs that are common during the process and will use an adaptive leadership style to guide the groups through the inevitable conflicts. The role of the facilitator is one of referee and should challenge the team when questions are not consistently evaluated from one piece of equipment to the next.

The first step in the process is to document the assumptions for the analysis. An assumption is used as a frame of reference and a source of consistency

during the analysis. Start with a few easy ones to get the group moving in the right direction. One example would be to gain consensus that the most reasonable work case scenario will be used. The point of the analysis is not to select the catastrophic failures that may only occur once in the site's operation. With that said, if the site has experienced such a failure in the past, then it is reasonable, particularly if no root cause analysis was conducted and mitigating actions implemented. Continue building the assumptions list, but keep in mind that assumptions can be added anytime during the analysis when the group decides it provides value.

Begin the equipment analysis process and remind the team to focus on the question being asked and provide their input as to the best answer to select. The first few machines will take an excruciatingly long time to complete. The facilitator must allow some of the posturing to take place between team members during this time, but must move the team back on task. After the first 8–10 machines, the group will enter a flow and move at a more reasonable pace. The goal is to randomly select approximately 100 machines to rank so an initial quality assurance check can be done.

C7: PERFORM PROCESS QUALITY CHECKS

A review of the answer distribution and overall machine ranking must be conducted to verify that the rationale behind a question or group of answers is sound. A good place to begin this review is on questions where the answers are a range of values. For example, the answers to maintenance downtime may be given in a range of hours that should be checked to make sure one or two answers are not being selected routinely. If this case exists, pull the team together and ask for their input on refining the range of hours available for selection. These types of adjustments are common in the beginning and demonstrate to the criticality team that the process is not an academic exercise.

Another area to review is the ranking distribution. Evaluate the histogram to see if you see any tendencies, high or low, in the scoring. It is possible that the initial group of equipment selected is actually similar in ranking, so verify with the team. You may find it necessary to select another group of 30–40 machines to rank and then reevaluate the distribution. The point is that the quality assurance process is ongoing and the responsibility of the facilitator.

C8: LOAD CRITICALITY VALUE INTO CMMS

Once the ranking is completed and the result approved, the values must be added to the CMMS. Do not lose sight of the reasons why criticality analysis was required. As a reminder, using the asset's numerical criticality value can be used to prioritize a repair backlog for planning, a ready backlog for scheduling, where to focus Bill of Material (BOM) optimization, a spare parts plan, and assets to receive scheduled maintenance, both preventive and condition based. None of these can be accomplished without migrating each machine's criticality value from the system used to develop the score into the daily work management system used to support the functions previously listed.

CONCLUSION

To efficiently and effectively complete criticality analysis, there are key enablers to the process. Often overlooked, but a crucial component is establishing the governance structure for the project. Establishing a logic process for the analysis, obtaining the required personnel, and selecting a knowledgeable facilitator will provide tremendous return on the effort put forth during the analysis. Completing the analysis is only part of the job, so follow through on adding the machine's ranking to your CMMS. After a few weeks of incorporating criticality into your daily work processes, you will have a full appreciation of the value it provides.

Contact us

Global Headquarters

10344 Sam Houston Park Drive, Suite 110

Houston, TX 77064

www.alliedreliability.com