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Understanding Criticality:

Myths and Pitfalls to **Avoid**

*Understanding criticality and where it fits in your reliability engineering plans is, well, **critical** to the success of your asset management program. But there are some commonly held myths and misperceptions about criticality. These top myths and pitfalls often prevent organizations from performing a comprehensive criticality analysis.*

by Tacoma Zach

Simply stated, criticality refers to the relative importance of an asset or system to the mission of an organization.

Here are seven myths and pitfalls to avoid in understanding criticality in your operation.

1 We know what's most critical already, so we don't need to do a criticality analysis.

This is probably the most common objection to conducting a criticality analysis. Too often, operations personnel declare unwaveringly that they "know what is critical." Usually, this is mostly true approximately 80 percent of the time, based on independent criticality studies conducted at a sampling of facilities.

Or, too often, criticality rankings are really just numbers plucked out of the air, based on a good hunch. This finger in the wind approach leads to real-life examples, like a kitchen appliance in the break room having the same criticality ranking as a key piece of process equipment in a refinery. Inevitably, a proper criticality analysis finds something highly critical has been overlooked, or resources are being misdirected to non-critical assets.

It is also important to ask **who** in your facility *knows* what is critical. How is their knowledge being preserved? What happens when they leave or get injured? A criticality analysis will integrate, document and preserve vital institutional knowledge so your organization is less people-dependent.

Are you relying on a hunch or assumption that your organization truly understands the criticality of its systems?

2 We just did a HAZOP/FMEA so we don't need another analysis. We've got all the information we need.

Congratulations! These studies take a lot of hard work. However, they have different aims and deliver different information than a criticality analysis.

A failure mode and effects analysis (FMEA) starts at the asset level and focuses on asset performance, the ways an asset can fail and the effects of failure on its performance. FMEA does not tell you how important an asset is to the mission of your facility. Here's the bad news: If you completed an FMEA without having a criticality analysis, you may have just wasted resources. FMEA is a resource-intensive and time-consuming effort. A system level criticality analysis prior to the FMEA will help you target your resources only toward assets critical to sustaining your operation.

Similarly, a hazard and operability (HAZOP) study does not help you identify your most important assets. A HAZOP is focused on process safety engineering design to identify inherent hazardous designs for safe operation and functionality. A HAZOP can tell you when the wrong valve is in use, but not how important that valve is.

In contrast to both FMEA and HAZOP, a criticality analysis starts with the big picture, evaluates the importance of systems and assets to the mission of the organization and considers the consequences of failure to overall mission objectives. The criticality rankings then direct further reliability engineering activities, such as FMEA, reliability centered maintenance (RCM), or capital project management.

> *Is a safety hazard being mistaken for a critical asset? Are you wasting valuable resources on non-critical assets?*

3 A criticality analysis is a very expensive and time-consuming effort. We're not sure it's worth the effort.

Like anything else in operations, a criticality analysis can be easily done inefficiently and cost way too much. However, an effective criticality analysis can be accomplished with far less time and cost than you may anticipate. There are several keys to making this possible.

Firstly, an effective criticality analysis starts at the system level instead of the asset level. In a typical operation or facility, the ratio of systems to assets is 10:1. So, starting at the system level dramatically reduces the workload. As critical systems are identified, the analysis is taken down to the asset level in those systems. Systems that are found to be insignificant to the overall mission of the operation can be analyzed later.

Secondly, world-class software tools are available that will help you calculate criticality rankings based on all the relationships of your systems and assets in relation to your mission parameters. It is possible to conduct a criticality analysis with a spreadsheet or even pen and paper, but why would you? The costs of doing it this way really are prohibitive.

Finally, simply ensuring that you have the right personnel participating in the study will dramatically improve your efficiency and the quality of your analysis. You need the right internal subject matter experts, including maintenance experts, reliability experts, operations leaders and someone who can proficiently manage your data. It is also very important to engage competent and experienced facilitators with field experience.

A criticality analysis will inform and influence many of your other reliability initiatives. Truly understanding the criticality of your assets allows for mitigating risk, directs further reliability engineering efforts, fine-tunes asset condition management, improves work execution management and lays the foundation for aligning all activities toward the mission of your organization.

> *Has the perceived short-term cost of a criticality analysis prevented you from taking advantage of all the long-term benefits it will bring?*

4 An expensive asset is definitely a critical asset. (Something inexpensive can't be that critical.)

Have you ever been sidelined by a faulty spark plug? A $5 part can make you late for work or miss your plane. However, it is doubtful a rip in your expensive leather upholstery ever kept your car from getting you where you needed to go.

It is very easy to think that if an asset is expensive, it must be critical and deserves lots of attention. While expensive items certainly should be looked after well, as the alternative is costly, they are not automatically critical.

Conversely, it is often assumed that an inexpensive part is unimportant. It is not uncommon for a small part or cheap system (e.g., a seal water system) to have the largest effect on the overall mission.

> *Are you paying undue attention to expensive assets or overlooking something important?*

5 If something is in poor condition, then it is critical.

Confusing condition with criticality is an easy and common mistake – we all speak of things being in critical condition all the time, meaning doing poorly. The condition of an asset does not correlate with its criticality to the function or mission of the system. To be sure, the condition of an asset affects the likelihood of its failure, but it does not change its importance to your operation.

Criticality analysis is different from condition assessment, which falls in the domain of asset condition management. Criticality analysis, combined with condition assessment and management, is powerful for directing work planning and execution.

> *Are you distracted by the condition of assets that are not critical to your operation?*

6 If it ain't broke, fix it.

Sometimes, the assumption is made that a critical asset must be the subject of aggressive preventive maintenance, whether it needs it or not. In fact, a critical asset may just need monitoring or critical spares to be stored.

Fixing something that doesn't need fixing actually increases the likelihood that it will fail by introducing infant mortality. Criticality ranking determines how much attention a system or asset gets, not whether it needs fixing. Determining if an asset should be fixed depends on what constitutes failure and whether it has failed by this definition.

For example, a critical pump might be running smoothly. Its criticality determines paying a lot of appropriate attention to it. But we don't need to fix anything pre-emptively. It is a poor maintenance plan if, as a matter of routine, pump rebuilds occur every six months regardless of whether they are needed, all in the name of preventive maintenance.

> *Are you fixing things that aren't broken?*

7 Phew. We finished our criticality analysis. We can check that box.

Well, not exactly. Criticality is relatively static, unlike condition, which can change from day-to-day or even minute-to-minute. While condition monitoring needs to be ongoing, you do not need to review your criticality rankings daily or weekly.

However, although we just said criticality does not change day to day, it will change. You can't just "set it and forget it."

It is important to update your criticality analysis to reflect fundamental changes in mission objectives, regulation (including permits), sensitivity to safety or environmental issues, economic downturn, commodity prices, commercial terms and contractual terms, and even in some cases SOP and security policy rules.

Best practice is to review your criticality rankings every six months, but no longer than 24 months. Fortunately, revisiting criticality is far more efficient and accomplished in far less time than the initial analysis.

> *Did you set it and forget it? Do you need to update your criticality analysis?*

It is said that the best time to plant an orange tree is 10 years ago. The second best time is today. If you haven't completed a criticality analysis for your facility, the right time to do it is now. It can be done efficiently and will deliver tangible value to all the elements of your asset management program. If you avoid these pitfalls, you will get even better results.

***Tacoma Zach**, P.Eng., of Ontario and Alberta, Canada, is a Certified Reliability Leader™ and CEO of Uberlytics, experts in criticality analysis. With over two decades in operations under his belt Tacoma now helps organizations discover what's most critical to their mission and uses that information to optimize their asset management. His first book, "Criticality Analysis Made Simple" was recently published by Reliabilityweb.com. Find it at mro-zone.com. www.uberlytics.com*