Reliability – The Key to Safety?

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There are a lot of good arguments for having a dedicated reliability program in your organization. Reduced down time, more consistent quality output, and greater control over maintenance costs are just a few. When used consistently, even the most basic reliability strategies can show marked improvements in all of these areas.

Reliability requires an investment, however. There is additional training in reliability theories and methods; additional tools such as condition monitoring equipment, tracking software, and contractor services; costs for repairing or replacing equipment to achieve a suitable baseline, and the additional logistics required to put the entire reliability strategy in place. The effort may appear daunting and discouraging to those who see the benefits as too far down the road or too abstract to justify.

The hesitation to invest in reliability is compounded by the fact that many companies have issues, like safety, that they may consider more urgent. The drive to reduce injury rates can be overwhelming. It can consume resources for training and engineering controls that might have otherwise gone into honing maintenance and reliability skills or improving and replacing equipment.

It's true that safety should be a critical value to any company. A good safety record preserves reputation and worker morale, keeps insurance, workers' compensation and legal costs down, and reduces down time due to incidents. Beyond all of that, there is the simple fact that people should be able to leave the workplace in the same condition in which they entered. It is this "human factor" that makes safety the 800-pound gorilla when increasingly tight resources are being allocated. It might seem counterintuitive to suggest that putting resources into reliability could actually be an investment in safety as well, but consider the following:

- Maintenance was a factor in 30-40 percent of major industrial and occupational incidents in the hydrocarbon and chemical process industries[1]. This statistic includes both the preparation for and performance of maintenance and incidents caused by the lack of proper maintenance.
- The same research showed that 76 percent of incidents related to maintenance performance occurred during the maintenance itself. The remainder occurred during site preparation or transition to or from production activities.
- Maintenance activities expose workers to greater risks because of changes in work activities and locations, exposed electrical and mechanical hazards, and the use of chemicals and tools not in routine use in the production and manufacturing processes.
- Even routine machine and equipment adjustments to maintain product quality can expose workers to process hazards and energy sources. If adjustments become more frequent, the risk of exposure increases.

A reliability program can minimize these hazards by improving control over equipment life and repair/maintenance cycles. The rate of improvement may vary from site to site, but in general, the more your equipment is up and

running, the fewer opportunities there are for incidents and injuries. Among the reasons:

- Most plants are built around the tasks of operation and production workers, so workstations, consoles and other points of normal human interaction with equipment are away from potential hazards. Maintenance and repair jobs, however, put workers into the most dangerous areas of the equipment – power centers, pinch points, shafts and more.
- Normal operation means that equipment is not transitioning from low or no activity. Breaking the inertia of inactivity consumes more energy over a given time, puts greater strain on mechanical components than when they are under during normal operation, and changes the state of the equipment significantly over a short period of time. Failures at this point can be catastrophic as the energy needed to break inertia is suddenly released.
- Startup and shutdown procedures are practiced less frequently than normal operating procedures, so they may be less familiar to personnel, and more prone to error.
- This assumes, of course, that good lockout/tagout procedures are being followed during the entire process.

In order to achieve the kind of results that will significantly reduce the hazards associated with shorter maintenance cycles, a reliability program must move beyond simply keeping equipment running predictably. Preventive maintenance, which includes repairing or replacing worn parts before they fail, will restore equipment for the short term, but the reason those parts have worn out or fail is still lurking. The parts will continue to fail prematurely until the sources of the defects are addressed. The cycle may be predictable, but it does not have to be inevitable.

A reliability program helps to extend the time between maintenance cycles by reducing or removing the sources of defects in equipment. The main sources are:

- Improper matching of equipment to requirements
- Harmful operating conditions
- Poor workmanship in repairs and maintenance
- Previous equipment failures
- Inferior parts used in manufacture or repair.

Each of these defect sources is detected by studying patterns of failure in individual pieces of equipment, equipment types, and plant-wide. By observing and accurately recording the types of failures, their timing, and their causes, and applying statistical methods to the records, it is possible to identify the defect sources. Once the defect sources have been addressed, there will be widespread improvements in reliability, and therefore, safety. Such efforts may include:

- Reviewing and improving maintenance procedures and training
- Changing parts sources or contractors
- Adjusting operating parameters
- Reviewing the procedure for developing equipment specifications.

Defects don't simply cause shutdowns. They can also affect product quality over time. As parts wear down or begin to fail, manufacturing tolerances can slip causing product to not meet specifications. In many cases, these issues are considered part of the normal production process and adjustments to equipment during production become routine. These adjustments may expose workers to power sources or moving parts that would normally be either locked out or machine guarded. The increase in the rate of adjustments can lead to more exposure and put workers at greater risk for an incident.

The same reliability practices that keep equipment running longer can also help reduce the need for adjustments during operation by slowing the gradual decline in tolerances that defects can cause. This in turn reduces worker exposure to hazards and lowers the risk of an incident.

These disciplines will actually be familiar to an organization with a relatively mature safety culture. They are the same basic principles used in targeting safety incidents and exploring methods to reduce them. In fact many of the practices used in improving reliability can be extended to areas of safety.

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In addition to the statistical analysis of equipment and system failures, a reliability program uses risk assessments, also known as Failure Modes and Effects Analysis (FMEA). These help determine which areas pose the highest risk of failure and associated costs in downtime, repair/replace efforts, and collateral damage. A thorough FMEA also includes personnel risks, so safety is actually built into a sound reliability program.

Predictive maintenance (PdM), often thought of as a tool for simply determining the optimal time for performing maintenance, can also be a valuable part of a reliability program. In addition to using the recorded PdM data for condition monitoring and analysis, PdM methods can be used to check the quality of a repair. This can result in improved repair techniques, leading to longer Mean Time Between Failures (MTBF) and reduced risk to workers.

It's important to remember that in both reliability and safety, the goal is the same – continual improvement with the goal of reaching zero failures.

Source

[1]Okoh, P., & Haugen, S., Maintenance-related major accidents: Classification of causes and case study, Journal of Loss Prevention in the Process Industries (2013), http://dx.doi.org/10.1016/j.jlp.2013.04.002