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Does your Asset Integrity Program Neglect your most Important Asset?

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Abstract:

Industry has a strong focus on maintaining the integrity of mechanical assets to “Keep it in the pipes.” However, the key assets any company has with respect to process safety are the human assets, especially operations and first line supervision. Cost-savings and Lean programs seek to save money through staffing reductions and other measures, but the unintended impact of these measures often threaten the integrity of the human asset base. What are the type of programs that may unintentionally threaten our Human Asset Integrity, and what can we do to strengthen the integrity of that asset base?

Asset Integrity

According to the CCPS Guidelines book on Risk-Based Process Safety, *Asset Integrity is the element is the systematic implementation of activities, such as inspections and tests necessary to ensure that important equipment will be suitable for its intended application throughout its life. Specifically, work activities related to this element focus on (1) preventing a catastrophic release of a hazardous material or a sudden release of energy and (2) ensuring high availability (or dependability) of critical safety or utility systems that prevent or mitigate the effects of these types of events.*

As operations and process safety engineers, we spend significant time and effort on Mechanical or Asset Integrity programs to ensure the proper integrity (function and containment) of the equipment and instrumentation throughout the refineries and chemical plants in which we work. This is all for good reason, as mechanical integrity failures can lead to unplanned loss of production, upsets, and more significantly loss of containment events which can lead to environmental damage, product loss and injury or even death of one or more persons.

However, with all of this attention to the mechanical integrity of instrumentation and equipment, are we failing to ensure the integrity of the most important asset found in our plants?... yes, our people.

The purpose of this paper is not to provide the answers to making your human assets more reliable, but rather to raise awareness of the issue of human asset integrity, to identify various factors that impact the reliability of our human assets, and to make others think about their own Human Asset Integrity programs.

What Factors Impact the Integrity of our Human Assets (and what can we do about it)?

For the purposes of this paper, we will limit our discussion of Human Assets to the immediate Operations organization including operations managers but focusing primarily on supervisors and operators. The reliability of these Human Assets is generally measured by the number of correct actions or decisions made divided by the total number of opportunities. Human reliability figures are often ascribed in terms of the complexity and frequency of a task performed (see figure 1), yet this simplification neglects the impact of the many management-related programs and systems that can impact our people.

The following is a listing of other factors that can positively or negatively affect human asset reliability in more systematic fashion:

1. Training – Management, Supervisors and Operators
2. Procedures – Style, level of detail, up-to-date
3. Fatigue – Average and maximum overtime being worked
4. Staffing – Multi-tasking, also impacts Fatigue
5. Work Climate – Housekeeping, Mechanical Integrity, Design Integrity
6. Retention / Turnover Rate – includes use of Contingent staff instead of full-time

All of these factors can be influenced by operations and/or line management to some extent.

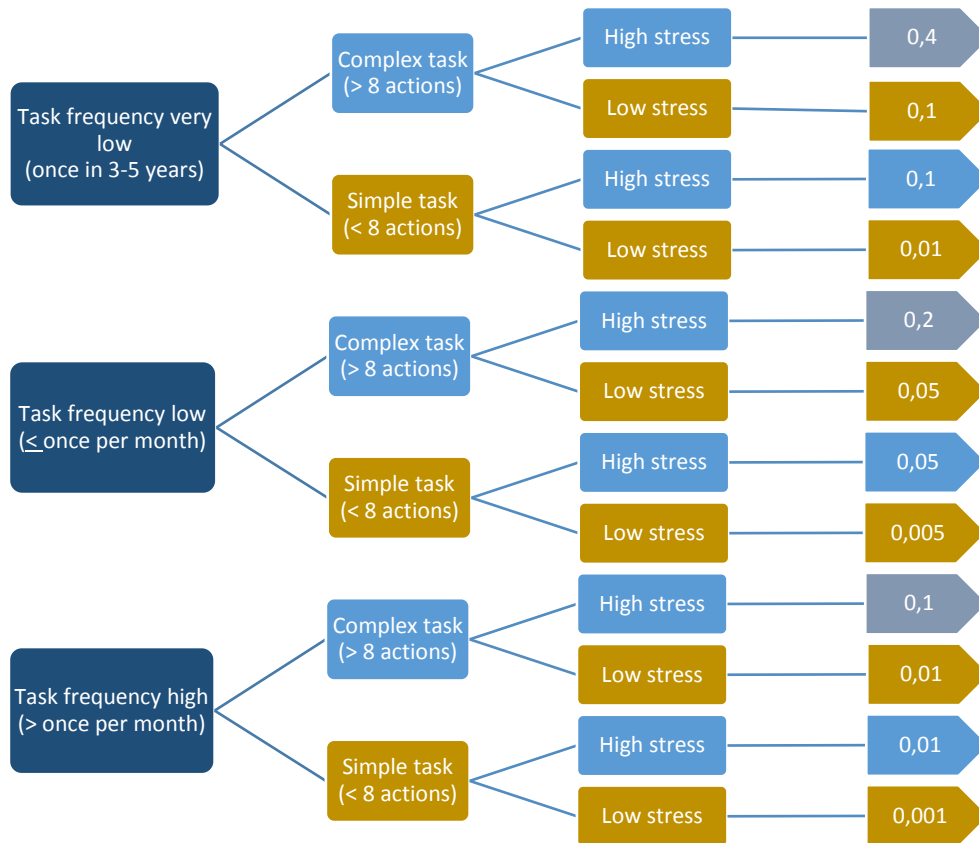


Figure 1 – Relative Human Reliability

Training

Are we adequately equipping our employees to be able to safely run our plants? Do we provide them with the training and experience to know how to troubleshoot and make decisions in abnormal situations, or do we just provide them a recipe for operating the plant under normal situations?

Following the recent spate of collisions between US Navy vessels and merchant ships, a former Navy commander commented in an interview that the US Navy has reduced officers on the watch from 3 to 1 in many cases, and has reduced training from a 16 week course to the content on a single self-study DVD. Are we making similar changes in our staffing and training programs? Do our employees have the understanding they need to safely manage the hazards in our plants?

Procedures

Much research has already been done regarding the design, formatting and content of procedures, and the impact on human reliability. Have we done anything with this information? Is it being used solely to sell the expensive services of consultants, or is this information being put into widespread practice?

Are our procedures being written in such a way that our newer operators understand how to correctly follow them, or are they written by experienced operators using perhaps unclear terminology or skipping steps that seem to be “intuitive” to those with experience?

Fatigue

Are we hampering the reliability of our operators by causing them to (or allowing them to) work too many hours or consecutive shifts? The author’s experience in Europe, Mexico and the US, has shown that employees in the US are often willing to push themselves further, working longer hours at work, and bringing work home, often foregoing true vacations, if there is a perceived benefit in doing so. Do we also make clear the potential dangers of working when fatigued? Do we truly discourage or even prohibit workers from working excessive hours, or do our policies and practices, especially regarding lean staffing, promote such practices?

Staffing

Over the past ~25 years, almost every company has implemented some form of reorganization or organizational optimization (if not several), designed primarily to enable the company to function with fewer employees. In many cases, sources of inefficiencies were identified and eliminated, but frequently fewer people were asked to do essentially the same work as before. This change was often successful when the plant was staffed with experienced, highly trained operations personnel; yet when turnover resulted in the hiring of typically younger, less experienced personnel, the high workload results in higher error rates due to the perceived need for multi-tasking, or for very broad coverage areas, both physical and in terms of job function.

Leaner staffing can more quickly lead to high overtime / fatigue rates when one or more employees is out of work due to vacation, illness, disability or other reasons. These short-staff situations can result in even broader coverage and even greater opportunity for errors as employees feel pressured to work even faster than normal.

Many plants fill openings with contingent or leased staff instead of hiring full-time workers. This is often done because of headcount limits or lack of approval to fill open positions. The temporary workers typically stay for shorter periods of time (higher turnover rates) and are less engaged (feel less connected to) the company. As a result, their reliability rate is lower than similarly experienced full-time employees.

Work Climate

Leaders often under estimate the impact that environment has on behavior. Several studies over the last 50 years have been used to test the validity of the “Broken Windows Theory”, which asserts that the appearance of a lack of order, maintenance and care, create an environment in which undesirable behavior is more likely to proliferate. Likewise, in our plants, a constantly

wet pavement or decking signals that spills are of little consequence, or small bits of trash such as twist ties and Teflon tape dispensers left on the ground signal that it is OK for other trash not to be picked up.

As a result, many facilities find that it is difficult to improve a culture poor operational discipline with new slogans or training programs alone. Often visible, physical changes in the plant, such as a fresh coat of paint or replacing leaking steam traps are needed to signal that a culture is changing.

What does the condition of your plant signal to employees and contractors about the operational discipline at the facility? Does your housekeeping demonstrate the value you place on order and doing the job right every time, or does it signal that second best is good enough?

Impact of Turnover on Safety Performance

While some may argue that a low turnover rate is good for an organization, i.e. needed to get rid of poor performers, it is clear that almost any turnover, and especially higher turnover rates can have a significant negative impact on safety performance. This impact is quantified in numerous studies which show that new employees have higher accident rates than employees with more than one year of tenure with the company, see Figure 2.

While this data is based primarily on occupational safety incident rates, one could argue that the learning curve for the process and procedural knowledge needed to avoid / prevent process safety incidents is even greater. Another study has shown that the process related accident rate at a facility drops rapidly for facilities with operations manager tenure of greater than ~2.9 years. For those companies that encourage significant lateral movement among the managerial ranks, they may be unknowingly boosting their incident rate.

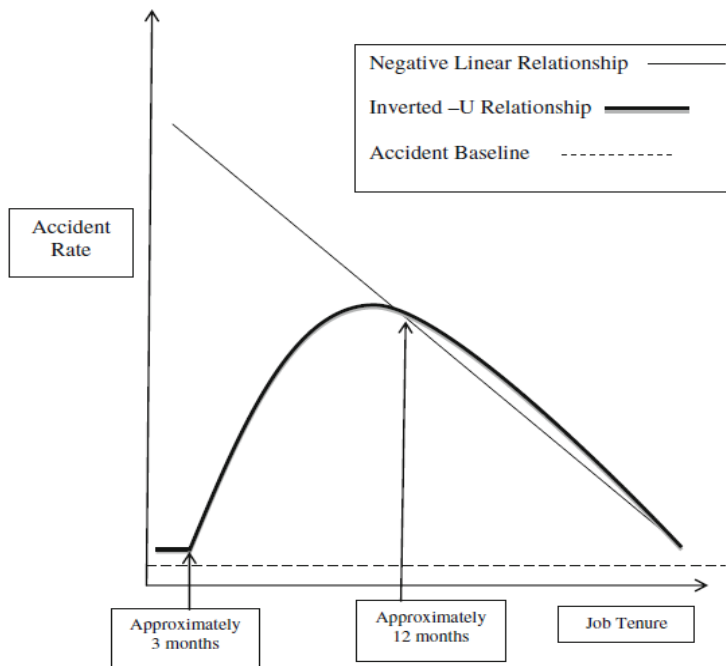


Figure 2: The relationship between job tenure and accident rates.

An in-house data comparison of site turnover rates vs. accident rate (TRIR and PSI) shows a strong correlation that those sites experiencing higher turnover rates among production, maintenance, and utility staff (PMUs) generally have poorer safety performance, in both occupational safety (recordable) incidents and in process safety incidents. In particular, it seems that a turnover rate greater than 10% leads to a significant increase in accident rates, or said differently, a decrease in safety performance, see Figures 3 and 4. Among the 45 sites studied, for data from 2015-2017, sites with turnover of less than 10% had an average TRIR of 0.69 and a PSI Rate of 1.0, compared with site with turnover of greater than 10% which had an average TRIR of 1.32 and a PSI Rate of 2.4.

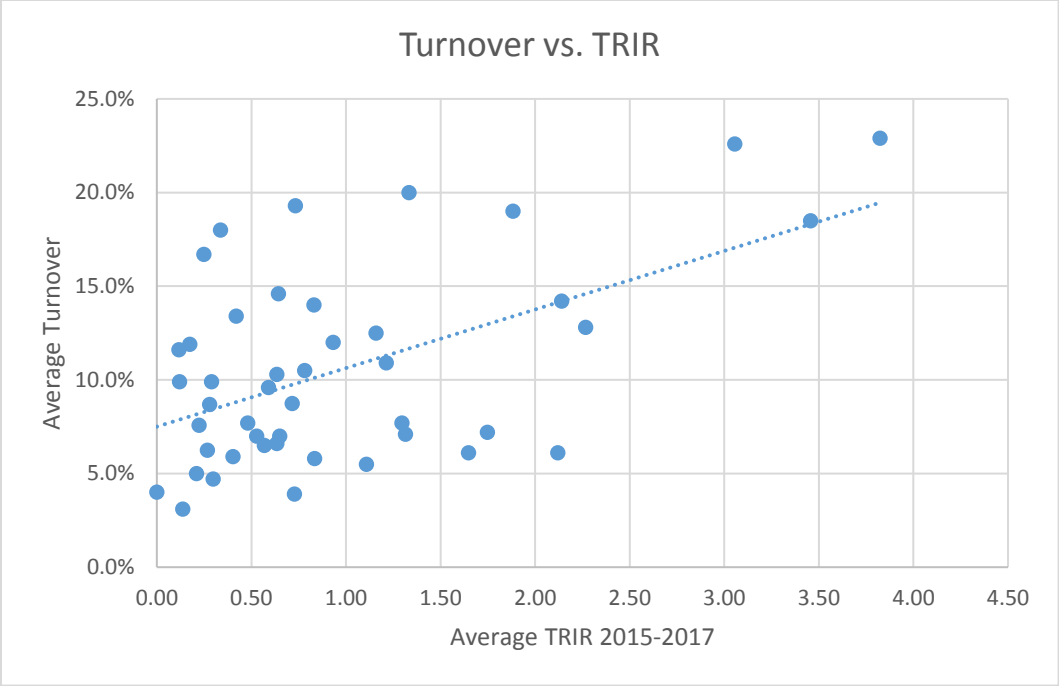


Figure 3: The relationship between Turnover Rates and TRIR for 45 different plant sites

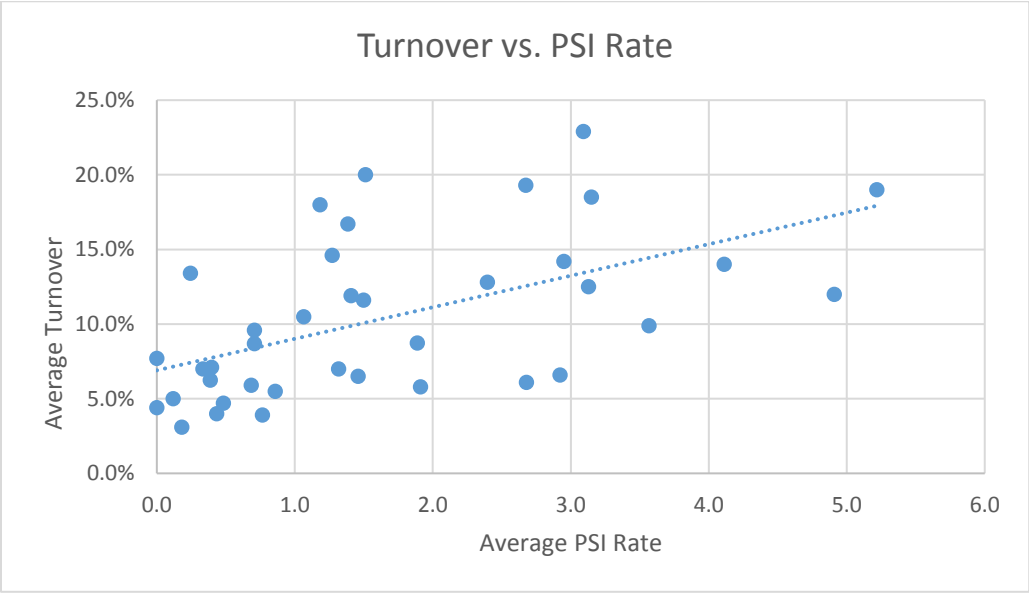


Figure 4: The relationship between turnover rate and Process Safety Incident Rate

Encouraging Turnover?

Companies normally do not set out to encourage employees to leave, except in the case of poor alignment or performance, yet many companies adopt practices or implement programs which

result in higher turnover. In some cases, the result is immediate, in others, the impact may not be seen for a number of years. Unfortunately, it can be very difficult to recover from a period of high turnover once initiated.

What types of practices or programs result in increased turnover within the chemical and refining industries?

One company with operations along the gulf coast discovered that it was paying operations personnel significantly above the market rate. As a result of the finding, the decision was made to reduce pay increases in order to align pay rates with the market median. After several years, as the pay rates approached the median market pay rates, the industry experienced a period of rapid growth. New companies entering the US Gulf Coast and existing companies who were expanding recognized that there was not enough new labor to satisfy the demand, so they 'poached' experienced operating personnel from other companies. This company that sought to align pay rates with the market averages soon found that many of their more experienced operators were leaving for the higher paying jobs.

As a result, new trainee technicians were hired and assigned to plants, training under the remaining experienced operators. However, due to the increasing turnover, experienced operators were often asked to each take on two or more trainees. This resulted in a much higher workload, and decreasing satisfaction with the job. As more of the experienced workers left the company, the training role was now being shifted to younger, less experienced operators. Now, instead of leaving for higher paying jobs, operators were seeking other jobs due to the heavy workload and lower job satisfaction.

At another company, the operating technician staff was very experienced. As a result, they were each very proficient at numerous roles across the plant. As several of the workers retired, company leadership decided that they could operate with fewer personnel. Due to the high experience level, the site was able to successfully operate with the leaner staff. However, following additional retirements and replacements, the experience level of the operators decreased rapidly, and the plant began experiencing many more "human errors," many attributed to multi-tasking.

Conclusion

This paper does not address every factor that can impact human reliability or human "asset integrity", and there is no panacea or miracle cure for human error. However, one commonality among the issues is the human element: how engaged our people are with their jobs, their co-workers, the site, company and community. Engagement has been defined in many different ways such as "People want to come to work, understand their jobs, and know how their work contributes to the success of the organization" [Baldoni]. More simply, the degree of employee engagement can be summed up as how much they care. Do they care about their job and the impact it has? Do they care if they do it right? Do they care about their co-workers and

protecting them from the hazards all around? Do they care about protecting the community and ultimately the company and its reputation from those same hazards?

But Employee Engagement is not solely a matter of how much the operators care. A significant part of their engagement comes from the engagement of their leadership, starting with their direct supervisors, and including engineers and operations managers, who in turn are influenced by site and business unit leadership.

We all have a role to play in improving employee engagement. It can be as simple as sitting down and asking an operator how he or she might solve a particular problem, going through a procedure with the operator to understand pain points or walking through the plant and picking up trash. A successful Human Asset Integrity program is built based on the investment we make in our people on a daily basis...and if we make that investment in a consistent, sincere manner, we can and will improve the integrity of our most important assets.