

Don't Blame Reduce Errors

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Don't blame the last link in the chain

Abstract: This paper is about the persistent pursuit to uncover and understand failure mechanisms that affect paper production. Understanding the error change phenomenon plays a key role in determining how failure mechanisms are activated by the human element. Predictive technologies and root cause analysis are preferred tools for understanding the failure mechanisms that are uncovered.

It is virtually impossible for one or even a few human errors to cause a random event (significant failure), no matter how dramatic the event. This small statement has a meaning so powerful that it's hard to believe we as humans don't take it to heart.

The statement comes from the Error Change Phenomenon, which simply states, we, as humans make errors all the time. Each time an error is committed there is a change in our environment. When there are a number of error changes that cue up in a particular pattern, we have a random event or failure.

This phenomenon was experienced in a paper mill's bleaching line. The line was chronically losing a thick stock pump to coupling bolt failures. This was the main reason for mechanical failures in the area. The coupling had failed in excess of 200 times over two years, costing the company approximately 10,000 tons in lost production. The mindset was to replace the bolts and align the pump using the best people available. This was performed after each failure, only to fail again, often after a few days service!

It was determined the method of diagnosis was clearly not working. Management decided a different approach was necessary to solve the problem. They adopted a root cause analysis (RCA) method that was disciplined and organized. The RCA team performed the analysis using the method and the verified hypotheses led them to a completely different conclusion than was originally thought by the team. By verifying each hypothesis using someone trained in reading fracture surfaces the RCA team determined the bolts failed due to fatigue rather than overload.

All the previous corrective action was based on the suspicion of overload. It was verified the bolts holding the pump to the base were loose, as were the anchor bolts in the foundation. This was overlooked, not because the mechanics were negligent, but because it was invisible to the human eye but detectable to an operating deflection shapes analysis (ODS). ODS is a test that uses motion sensors to build a computer model of the actual movements of the base and all attached components. Another significant discovery was the original design called for a pump that was smaller than the one in service.

The conclusion here might have been to blame the last link in the chain. This would have been the mechanics that performed the repairs. By stopping at the last link, you lose all of the information that led to the incident. By collecting data, verifying hypotheses, and

questioning the actions of the mechanics (and/or others involved) you uncover the errors and the sequence in which they occurred.

This knowledge allows you to improve the ability of the mechanics and engineers to read fracture surfaces. It allows the employees to learn about tests that are available and when to use them and, finally, to learn the reasons for installing pumps that are not rated for the service. By only addressing the last link of the chain a person or company loses sight of all of the errors that led to the failure.

Knowing many errors are made daily by humans working in all sorts of dangerous jobs such as in nuclear power plants and hazardous chemical plants why haven't we, as humans, annihilated our existence?

The reason is because we have learned to break the error chains. We have predictive maintenance programs that are designed to give us early detection of impending problems so we have the time to repair these problems before they reach the catastrophic level that could destroy a plant or take a life. We also have Root Cause Analysis techniques that allow us to learn from our mishaps.

The RCA tool can be used to take predictive maintenance to the next level, Failure Elimination. Root Cause Analysis is designed to help the predictive technologies eliminate failure mechanisms that recur time after time. It is good we can predict failures but it doesn't make sense to predict a pump bearing failure four times a year and just continue to replace the bearing. We have a responsibility to find out why it continues to fail.

There are many challenges in a paper mill that will test our abilities to solve difficult problems. We have tools today like never before to uncover entire failure mechanisms. These mechanisms allow us to learn about latent root systems that are flawed or non-existent. By uncovering entire failure mechanisms companies can eliminate failures by leveraging lessons learned back into the organization and prosper as a company rather than as a single mill.

About the Author

Mark Latino is President of Reliability Center, Inc. (RCI). Mr. Latino came to RCI after 19 years in corporate America. During those years a wealth of reliability, maintenance, and manufacturing experience was acquired. He worked for Weyerhaeuser Corporation in a production role during the early stages of his career. He was an active part of Allied Chemical Corporations (now Honeywell) Reliability Strive for Excellence initiative that was started in the 70s to define, understand, document, and live the reliability culture until he left in 1986. Mr. Latino spent 10 years with Philip Morris primarily in a production capacity that later ended in a reliability engineering role. He is a graduate of Old Dominion University and holds a BS Degree in Business Management that focused on Production & Operations Management. Contact information: 804-458-0645, mlatino@reliability.com.