TMG News

The Manufacturing Game®

October 15, 2009

"Sharing Information to Improve Reliability"

The Consequences of Doing Nothing
(The Conflict Between Production and Maintenance)

By Winston P. Ledet

In today's world an operator is content if he has spare equipment to use in case a piece of equipment stops functioning properly. A maintenance person is content if he has a backlog of equipment to work on so that he can work more efficiently. These two things are not always compatible.

Experience tells us that there is a natural conflict between operations and maintenance that is created by the different nature of work in the two functions. The maintenance people primarily deal with static or potential energy as the risk element in their work while the production people primarily deal with kinetic or dynamic energy as their risk element. This difference is experienced in the consequences of doing nothing. In most maintenance work, if something goes wrong usually the best response is to stop doing what you are doing. Since maintenance people are primarily dealing with potential energy, the risk usually dissipates when the work stops. In production work, the sources of potential energy are secured so the risk of something falling on a person or a person falling off of something is much less, but the risk of the process running away because of the loss of control of the kinetic energy is much higher. Therefore, when something goes wrong in a production operation, the consequences of doing nothing can be very dire. When control of a process is lost, some action is required to stop the flow of the kinetic energy or something catastrophic can happen.

This difference is illustrated in an explosion that happened at one plant. The initiating event for this explosion (which cost a person the sight in one eye) was the failure of an underground electrical feeder to the powerhouse. The feeder insulation failed and the feeder went to ground, which tripped the breaker in 2 cycles of time. Since the electrical feeder normally functioned at 60 cycles per second, this time period was only 2/60 seconds long. The high current short of electricity to ground caused the voltage in the electrical feed to the powerhouse to drop to almost zero. The drop in voltage caused a relay in one boiler's interlock circuit to trip, which stopped the fuel to that boiler. This was the newest boiler in the powerhouse, and the design used fast reacting relays to stop the boiler when anything went wrong.

During this incident, the powerhouse was running at one million pounds per hour of steam production, which was near its maximum capacity, but the same rate the units had been running for several years. The first consequence happened when the one boiler stopped producing steam; the other three boilers' control systems

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The Mischievous Miscible Injection Compressor

To enhance the production of oil, fluids or gas is injected into the well to increase oil flow. The Miscible Injectant (MI) compressor at BP Alaska had a long history of breaking down and was difficult to maintain even though significant changes had been made over time. Control design problems had resulted in multiple "hard landings" with unexpected shutdowns. A large portion of downtime was attributed to the ability to troubleshoot and determine what needed to be done before restarting. In some cases a decision was made to restart without first determining the root cause of the breakdown and only fixing the immediate problem. In order to return the MI Compressor to a steady running state and increase MI Production, it was necessary to remove a few defects.

After review, the Action Team of Louis Cusack, Clifton Yocom, Tony Jackson, Dana Lowther, Mike Malachowski, Elizabeth Babaian-Kibala along with Johnny Payne, Ric Tayler, and Paul Monus acting as consultants was formed to determine how to achieve sustained reliability.

One of the initial difficulties was extensive control issues due to vendor design problems. These

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What's Inside?

SCHEDULE

Throughout the year, The Manufacturing Game® holds workshops for the general public at universities and/or professional organizations. For more information visit *www.mfg-game.com*

Conferences of Interest

Bonus Workshop at Solutions 2.0 November 17, 2009

Winston Ledet along with Michelle Ledet Henley will be presenting a Bonus Workshop **"Using Microworlds to Change Organizational Culture"**. The workshop shows how a microworld, can be used to change the culture from the Reactive Domain to the Precision Domain. With the use of an agent based computer model they will demonstrate the emergent behavior that results in improvements and sustainability. Participants will receive an applet that they can use to decide the best strategy for their own site, along with a copy of Winston's book Don't Just Fix It, Improve It! This workshop is open to those who want to create a successful organizational change to bring their facility to peak performance.

Mark Your Calendar!

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increased the steam production to keep the pressure in the steam header up to normal. Since the use for steam exceeded the capacity of the three boilers, the pressure began to drop, and the boiler control systems increased the steam generation rate causing the interlock system for each boiler to shut off the fuel to the boiler, avoiding possible flameout caused by insufficient air to burn the fuel. This domino effect caused all the boilers to shut down.

Downstream consequences began to happen. Seven chemical process units had to shut down due to lack of steam. One of the units required water to clear the reactors and piping to stop the reaction from running away in the pipes. Lack of steam in the powerhouse limited the production of process water, and the stored water ran out before the unit could be cleared up. This led to an explosion in a pipe while the operating people were still trying to clear up the lines. A person in the area of the pipe explosion was burned with acid and eventually lost the sight in one eye.

Anyone of six actions could have prevented these consequences if taken during the incident. One action would be to cut off steam from some large users when the first boiler interlocked. The design of the control panel in the powerhouse included three buttons that could be used in an emergency to cut off steam flow to large users. The control room operator was still in training and did not punch those buttons. He was an experienced person but had been in maintenance until he bid over to operations about two years before the incident. He was hesitant to punch the buttons in the first 30 seconds of the incident because his conditioning in maintenance was to stop whatever he was doing whenever something went wrong. This was such a strong conditioning, he had not yet transitioned to an operator mentality. There were five other actions, which could have prevented the consequences as well. The operator's action was not the basic cause of the incident, but it points out the fundamental difference in the maintenance and operations mentality.

Another action that could have been taken to avoid this incident was to limit the steam rate in the powerhouse to 800,000 lbs per hour. At this rate of steam generation, there would have been enough capacity in three boilers to handle the loss of the fourth boiler without shutting down the users of steam. In the past this facility could easily have handled this incident without hurting anyone. An experienced crew would have gotten the steam load down quickly enough to avoid shutting down all of the boilers, but they did not at this time because of inexperience. The plant where this powerhouse existed was adding a large new process facility so there was a big demand for people to construct and run the new facility. The company's desire to have highly qualified people running the new facility, where the biggest hazards would be, left 38% new people, who were at some stage of training, in the older facility. This drained the experienced personnel's time to train people on the job even though they had a good process for classroom training. Everyone was operating at his or her limits. There was no room for error. So the dilemma was, "How do I make maximum production while training all these new people?" The answer was very simple after the explosion. If a policy had been established that limited the steam rate in the powerhouse to 800,000 pounds per hour, there would not have been an explosion. The people in the powerhouse could have survived the loss on one boiler without further consequences. That policy was quickly implemented, and in fact over the next nine months or so, the crew was able to run at maximum rates in all of the units without needing the extra steam. This policy not only made the operation safer, it made the whole operation of that area more

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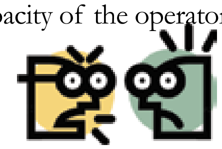
energy efficient.

The hazard of operating the powerhouse at the high rates was not recognized because the management failed to see that the people doing the work in that area needed production to be constrained so they could have enough margin for error while training all the new people. It is necessary to match the tasks undertaken to the level of competency of the resources. In order to do this you must reduce the tasks or increase the capability of the resources. Actually the potential ability of the crews at the time of the incident was much higher in that plant than any time in the previous 20 years. The people that were hired had incredible potential and the development of these people was the best available in the 50 years of operating that plant. However, potential does not count in dynamic situations. Only the actual competency is relevant when an emergency happens. That still left four actions that led to and could have avoided the explosion:

1. A foreman left the unit to escort a truck to the gate during the incident instead of staying to direct the inexperienced operators.
2. An operator closed a valve he should not have closed because of his inexperience.
3. The use of steam to clear lines when the water ran out.
4. A design change in the boiler using a slower acting relay could have avoided tripping the first boiler that created the whole incident because of a very short disruption of voltage.

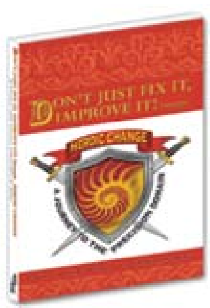
Numbers one through three are due to the state of the organization in an expansion and part of what should have factored into the decision to not let the powerhouse steam at a rate of one million pounds per hour. The design of the relay is an interesting one. The relay in fact acted too fast so it was an error of over control and points out the dilemma of action. Action not taken is bad, but action taken too fast is also bad. This is where the judgment of the designer must recognize the limits of people. People cannot react in 2/60ths of a second to save a piece of equipment from tripping if that is appropriate. Extra trips of a boiler add to the risk in this situation. Faster is not always better.

The basic cause of this incident from an operations viewpoint was failure to constrain the production in the powerhouse to match the competency of the resources. The basic cause of the incident from a maintenance viewpoint was the failure of the underground electrical feeder to the powerhouse. The solution is to recognize that the operation of a facility depends on the ability of the operations people to respond to upsets in time to avoid catastrophic failures. This is best seen in the light of the consequences of doing nothing. If the consequence of doing nothing is to have a catastrophic event, you have to insure that the operators have enough time to act before the event happens. This is the art of operations management, matching the rate of production to the capacity of the operators to respond.



Don't Just Fix It, Improve It

A Journey of Heroic Change



Joseph Campbell tells us through his books that story telling is the means by which religions and cultures have passed down their history and important findings throughout time. Winston P. Ledet has always been an advocate of story telling as a way of getting important messages across. He has written many articles, given numerous presentations and accumulated vast knowledge about the world of manufacturing. He compiled the information gathered from his years within DuPont, working with numerous industries around the world, his life experiences and made several attempts at writing a book about this material but was never satisfied with the results.

Winston has always valued the writings of Howard Gardner, a Harvard professor, who says in his book, "The Unschooled Mind: How Children Think And How Schools Should Teach", that a core competency of a five year old is the ability to tell a story. Since Winston is well beyond the age of five, he decided that it was time to tell the story that he had been attempting for years. With the help of Sherri Abshire and Winston J. Ledet, and the encouragement of Terry O'Hanlon, he has incorporated the information he has gathered over a lifetime into a fictional book based on real data —"Don't Just Fix It, Improve It!".

After several months of writing and rewriting "Don't Just Fix It, Improve It!" is a reality. The hope is that everyone who reads the book will gain insights into what is possible, how it can happen, the obstacles that frequently get in the way of lasting change and the understanding that you can only change the behavior of people with action. This story was written to turn the abstract ideas that we all discuss into concrete applications.

Our wish is that this book will help people to achieve the goals and higher levels of performance that they have set for their companies. Ledet Enterprises, Inc. would like to hear your feedback on what you have accomplished and the results that you attained so that the story of Heroic Change can continue.

"Don't Just Fix It, Improve It!" is available through MRO-Zone.com or through the ReliabilityWeb.com website.

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Conflict is inevitable in a team ... in fact, to achieve synergistic solutions, a variety of ideas and approaches are needed. These are the ingredients for conflict.
– Susan Gerke, IBM, Leadership Development

Fall

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Mischievous... **from page 1**

problems have now been understood and improvements or permanent fixes were put in place. Control design problems led to a lot of hard landings. One of the consequences of the hard landings was the crushing of ceramic bearings that are used as back-up to the magnetic bearings. Today, the Action Team has improved the control system design and does not have as many hard landings.

They decided to send the forty-eight digital valves back to the manufacturer for a complete tear down, inspection and rebuild, including the spares. These were returned, reinstalled, and the compressor restarted in November 2008. Batteries were also put on PM and spares were put in order. Based on the opinion of engineering, operations and maintenance they expected these modifications would be sufficient to run the MI compressor without any major glitches through the winter of 2008-2009, and in fact the results proved them right. The Team has made significant changes to the design since first start-up and now has more experience with it.

MI Production Data shows that in 2008, the compressor ran 100 days out of a possible 240 (8 months)—an operating factor of approximately 42%. In the first few months of 2009 the machine has operated 88 days out of a possible 102 for a year to date operating factor of 86%. In other words, the machine delivered more production in the first 3 months of 2009 than it did the entire year of 2008. In the several years immediately prior to 2008, the machine's operating efficiency was at or below the 2008 operating factor. This equates to an actual increase to the bottom line of 5,800 barrels or $278,400 (at $48 per bbl).

An additional five months of production is anticipated which would, at an operating efficiency of 86%, provide 129 days of production at an average rate (2009 YTD) of 28.7mmscfd (million square cubic foot/day) which would equal an additional 2,800 barrels per day of production. Projected future 2009 production value is $17,337,600. The total estimated prize of this project could be $17,616,000.