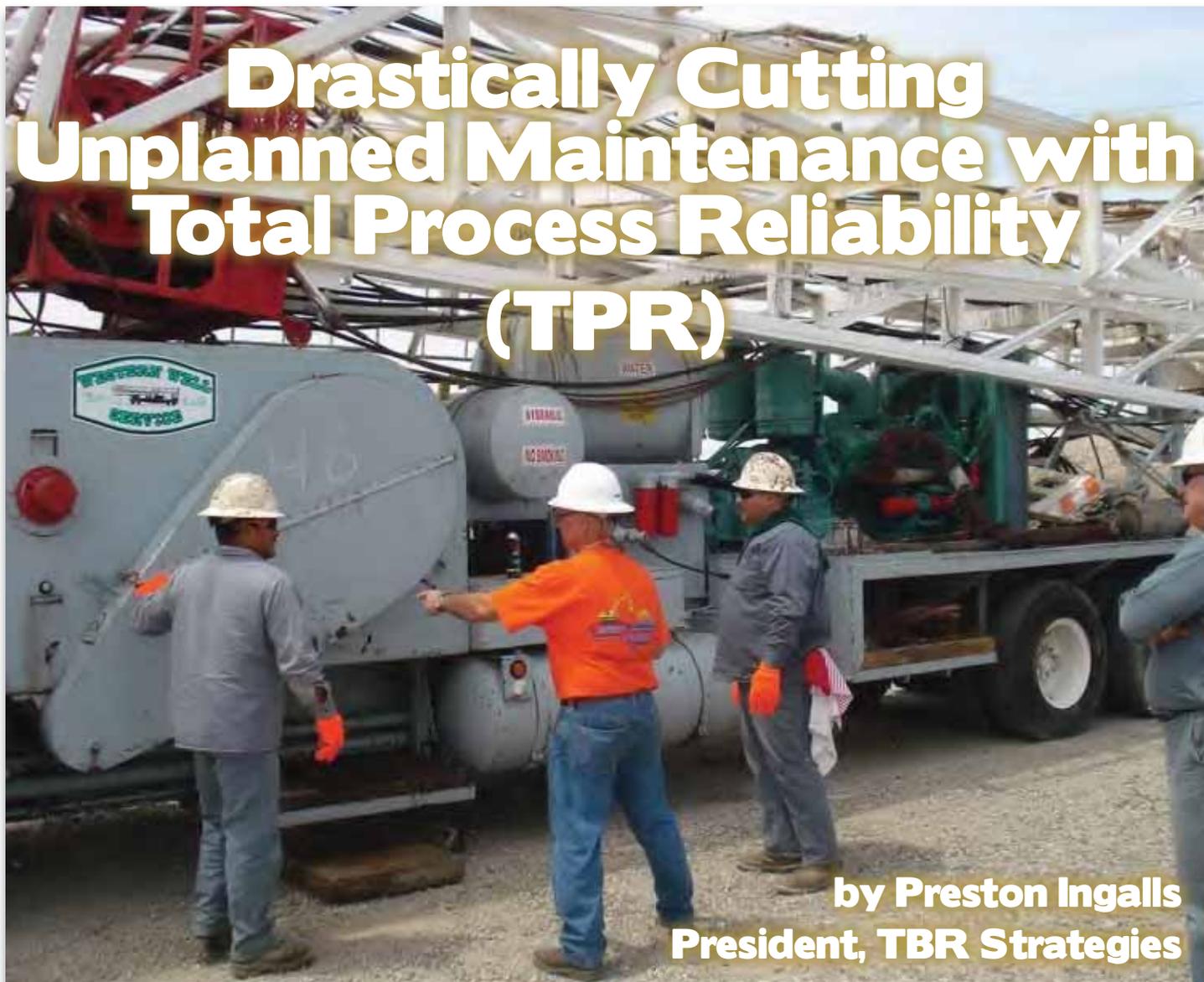


Drastically Cutting Unplanned Maintenance with Total Process Reliability (TPR)



by Preston Ingalls
President, TBR Strategies

OUTSIDE OF EMPLOYEES, EQUIPMENT IS THE SINGLE largest asset for drilling and well service companies. Used and maintained efficiently, it can provide quality service and output to meet the demands of customers at reasonable costs. Used or maintained inefficiently, quality of service degrades, downtime occurs and costs increase.

In July 2007, TBR Strategies of Raleigh, North Carolina conducted a Maintenance Effectiveness Assessment of Western Drilling and Western Well Services. Western was founded in 1943 and located in Taft. Western was acquired by Key Energy in May 2008.

The invitation for the assessment was a result of Fred Holmes, President and CEO, having seen and heard about TBR Strategies' work with Aera Energy in implementing a maintenance

improvement process called Total Process Reliability (TPR). The purpose of the study was to compare Western's maintenance practices against World Class and Best in Class. The results of the assessment showed that Western was primarily in the reactive maintenance mode and performed very little Preventive Maintenance on its equipment outside of lubrication. The emergency maintenance rate at that time was between 75-80%, which is extremely high.

Under the sponsorship of Paul Hancock, Executive Vice-President for Western and supported by Fred Holmes, TBR Strategies was contracted to implement TPR across Western in September 2006. Paul stated, "We knew we had to improve our maintenance practices to reduce the cost so we chose to look outside our industry because it is possible to be the

Best of the Mediocre. We needed to look at the best, regardless of industry, to find the top methods to use. We wanted to move toward World Class and knew we were more likely to find it outside our industry than in it. It was the right move. TBR Strategies had experience working in numerous industries, not just oil and gas.”

Total Process Reliability’s development originated from Total Productive Maintenance which began in Japan with an engineer named Seiichi Nakajima. Nakajima began studying American preventive maintenance in the 1950’s and spent the next 20 years refining his ideas which resulted in Total Productive Maintenance, which went beyond traditional PM. TPM is used by most Japanese companies today to improve equipment output, utilization and efficiencies. Total Process Reliability is the next generation after TPM in that it uses contemporary tools like Lean concepts, Six Sigma elements, Theory of Constraints, Breakthrough Strategy and Continuous Improvement. It is Continuous Improvement focused on equipment.

TPR is a process to improve equipment efficiency and lower costs by involving the entire organization

“Everyone was so used to doing it the same way for so long they couldn’t see the benefit to themselves, or to the company,”

in asset management. The TPR philosophy differs from traditional maintenance in that traditional maintenance generally places the burden of maintenance entirely on the maintenance

department or service personnel. TPR engages the entire organization in asset management.

For Western Drilling and Western Well Service, Inc., the challenge to change was greater than usual. How can you install a comprehensive preventive maintenance program and bolster operator care without first addressing the long-established mindset of the workplace?

When it came to taking care of equipment, the activities and results were all over the board. “Everyone was so used to doing it the same way for so long they couldn’t see the

benefit to themselves, or to the company,” said Randy Dill, Drilling Operations Superintendent, Yard 714. When TPR was started at Western, Randy, then a Rig Supervisor, was asked to assume the newly-created position of TPR Coordinator to help facilitate the process.

As part of the process, a TPR Steering Council was chartered to focus support and direction for the TPR process and to engage leadership in the process as well. This included all of the senior management from Western and several staff members. A vision, mission, set of



Fred Holmes busy at work

goals and metrics or Key Performance Indicators (KPIs) were established to drive improvement. An Implementation Team was formed made up of Drillers, Well Pullers, Rig Supervisors, the Drilling Superintendent, Shop Supervisor and others to develop and execute an operational plan. Breakthrough and Focus Teams were chartered to work on specific issues and systems like identify an information system to capture maintenance activities and costs.

Fred Holmes believed that preventive maintenance on equipment and training of personnel fundamentally required the same sort of system-wide coordination and discipline that its safety policies demonstrated.

“I could see we really needed it. I’ve seen much larger companies implement this type of program, and while we may not produce like that, we can certainly emulate an approach,” stated Holmes.

As in many companies, it is often the most tenured or senior employees that are more

resistant to change. Although that resistance is not always rooted in skepticism or deliberate reluctance, but more often in the inability to break operational habits that for so long seemed to drive success. It's that longevity, however, that can sometimes lead to complacency. And when it comes to equipment management, complacency can become costly.

Therein lied the challenges, Dill said, "Overcoming the status quo is a huge hill to climb. And it was a big hill at Western."

Holmes concurred. "Buying into something doesn't just mean being willing to pay for it," he explained, "I was right in the trenches; I wanted to make sure I led by example." Holmes knew that for years the company needed a focused effort to continue to grow: "We didn't know what it was going to take until TPR came along."

Prior to the implementation of TPR two years ago, rig maintenance was a somewhat open book, free to be edited by all authors. Supervisors and crewmembers handled maintenance on a rig-by-rig basis, where each team's collective knowledge of machinery was put to use. This effective, but less than structured, approach led to some rigs having more uptime than others, based on the level of knowledge of each crew.



Gary Shafer, TPR Coordinator

According to Dill, the company "had relied on tribal knowledge" to check oil and complete lubrication tasks. It was not consistent and the results were fair to poor.

Now, through TPR, a uniform team approach emphasizing employee safety and effi-

ciency is in place. Rig teams, working with the shop, run high pressure flex hose through the equipment to target bearings and grease fittings in challenging locations. The hoses are then connected to lube manifolds on the outside of the equipment. As a result, they can lube up to 20 grease fittings without sending crewmembers into tight, often-dangerous equipment locations. Each lube point is color-coded to identify the type of lubricant to avoid costly mistakes and marked on a laminated standard with pictures to show the locations on the equipment.

Additionally, since many vital oil check points on a rig are located within the equipment, teams now plumb these hard to reach oil check points to the outside of the rig's frame rails. This enables the checks to be made quickly and easily. Dill added, "These types of improvements on our equipment and the Level (Type) One Preventive Maintenance training classes we conduct with the work force greatly increase the probability that these checks will be performed." Level or Type One Operator training is normally a half-day program and is conducted after a half-day TPR Overview.

Today, accessibility and ease of repair are concepts that drive equipment decisions even during the fabrication process. According to Dill, "Improvements in accessibility, serviceability, and improvements for operational effectiveness make our equipment easy to service and easy to use." Changes and improvements are made in the shop before equipment is moved to the field.

Gary Shafer, TPR Coordinator and former Shop Supervisor, is very pleased with the improvements as well, having seen a dramatic decrease in lubrication-caused emergency maintenance issues. "As the Shop Supervisor, we had mechanics on call 24-7 who were being called, on average, 3 to 4 times per week. Now, we've knocked it down to roughly once a week or less." Shafer said, "The guy on call is getting more family time because he's not called out all the time. That's a tremendous benefit to him. It has been a big help to the organization."

Western also established ongoing Equipment Improvement Team efforts to increase operator involvement. Cross-functional teams were brought together to restore equipment to

an “as-designed” state. These workshops are usually one week long and include training and hands-on activities. Through cleaning and inspecting, crews learn more about their equipment and its needs, and begin repairing defects and making improvements and modifications called countermeasures.

Another team focus is called “Five S” (5S). One responsibility of a 5S team is to plan and execute 5S events focused on organization and orderliness. During these, members: (1) sort, (2) set in order, (3) shine, (4) standardize, and (5) sustain specified equipment or work areas. This strategy establishes critical cleanliness and organization in the physical workplace. Teams are formed and asked to choose a workplace or equipment on which to perform a 5S event. To measure 5S effectiveness and maintain consistent practices, monthly audits are performed.

Several benchmark visits of outstanding operations were conducted to find those practices that made sense. Several were conducted of Aera Energy and Barriere in New Orleans. Aera Energy has been doing TPR for eleven years and Barriere for eight.

Still, formalizing the inspections and work order policies was not without its challenges. The company found that scheduling Type Two



PM inspections (the major components of the rigs performed by mechanics) was difficult because of the coordination between 24-hour rigs and those that shut down at the end of each day. Most were done between rig moves to minimize downtime.

There is an overwhelming consensus that equipment management procedures are

changing the way the company runs. “We can see already it was the right thing to do,” added Holmes. Goals and objectives are measured using Key Performance Indicators (KPIs) and the company has been successfully hitting those goals.

The benefits of the TPR programs have been widespread. Namely, departments that were once distant are more communicative and working toward common goals. Mr. Dill believes attitudes have improved and that frustrations are diminishing. Moreover, the skill level of mechanics has increased through training, enabling repairs to be done quicker and better, significantly minimizing downtime.

Through team interaction and a dedication to safer and better operating equipment, the company’s ongoing efforts to change its culture have been strengthened substantially as operators realize that their jobs and their equipment are considered an indispensable part of the company’s success.

Looking back, Randy Dill stated, “We should have done this a long time ago. The benefits far outweigh the work needed to do it. I can’t say enough--really. It is one of the most beneficial things we have done and should be doing for Key. Raising skills and knowledge of our operators is too important to ignore. Taking care of our equipment is critical to our success.”

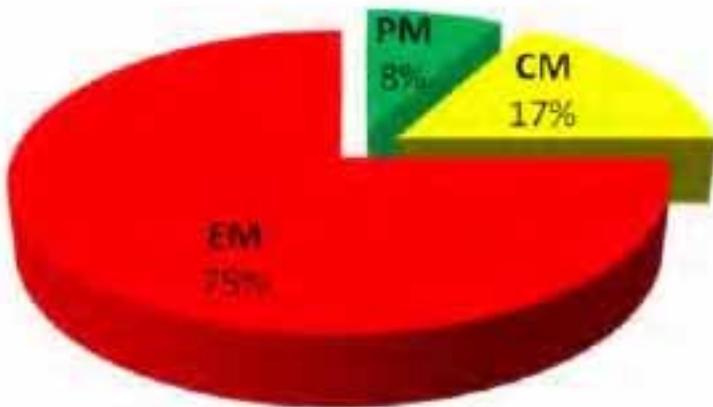
Shafer, whose is now involved with a pilot at the Key Energy Ventura operations, said, “It has been a long hard process but anything having is worth working for. I think the morale in 714 and 715 is better because the guys have more ownership in their equipment. There are a lot of guys who really believe in this process. Recently, when we were auditing Rig 038 at Elk Hills, we asked the Motorman the location of the standards and certain information on those standards. When he was unable to answer some of the questions, he was embarrassed that he couldn’t recall a couple points and guaranteed that when I returned he would definitely know them. Now that is someone who has ownership and cares for his equipment.

Mark Waymire, Drilling Manager, Yard 714 also agreed. “Since we have implemented TPR, the downtime on drilling rigs has dropped

dramatically. When we rolled out this process over to our drilling pumps, being proactive instead of reactive such as changing heads and lines out on an hourly basis, has eliminated pump problems as far as expendable parts. It's a good process."

In a recent TPR Audit conducted by TBR Strategies consultants not involved with Western's implementation, the numbers showing the impact of TPR is nothing less than outstanding. The following charts show the impact of TPR in the last two years. The charts show the breakdown of Emergency Maintenance (reactive work requiring immediate attention), Preventive Maintenance (scheduled service) and Corrective Maintenance (non-emergency work) for 2005/2006 compared to 2008. PMs have increased from 8% of the maintenance man-hours to 18% for 2008. The most significant change was the reduction of Emergency Maintenance from 75% in 2005/2006 to less than 8% in 2008. This equates to more uptime and lower cost.

2005-06



2008

