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THE CULTURAL SHIFT THAT CAN SAVE LIVES

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A Glimpse at the

Editor's note: *From 1996 to 2000, the author had the privilege of doing a greenfield construction and start-up of a chemical plant in Asia. Part of the land was still being reclaimed from the ocean when he arrived. This article describes how he and the work team developed work processes to do things in the way they had always wanted to do them.*

Sometimes, necessity drives people to take positive actions to address unusual circumstances. Such was the case with construction of the chemical plant on Sakra Island, which was part of a Singapore industrial complex made up of five separate islands that were being combined into one island by reclaiming land from the sea. When construction started, everyone knew that the plant would only have ferryboat access until a road could be completed several years in the future. Because of its isolation, it would take first responders and support resources a minimum of four hours to provide any help. Therefore, the personnel on site for each shift had to be trained in the qualifications to safely handle any situation that might occur (e.g., fix minor failures, patch until help arrived, shut down and isolate, etc.).

The implemented solution defines a very effective maintenance and operating process that was developed to address the immediate needs on Sakra Island, but also can ensure optimum performance and competitiveness in today's economic environment for any location. Maintenance excellence, built on a true partnership with operations, is the missing link to being the leader in the world market of tomorrow. A site leadership team (i.e., operations, maintenance, stores/purchasing and site functional groups as core members) drives activities to make maintenance a site issue. Maintenance must be viewed as an investment to add production capacity through more reliable equipment operation and personnel capacity through more efficient wrench time. Because of its positive impact on safety and quality, the focus on reliability is then given top priority.

The site's best practice that had the most positive impact was the operator and mechanic cross-training process. The concept of shift maintenance coordinators (SMC) was created since skilled maintenance mechanics were in short supply in Singapore at the time. These SMCs were mechanics who had electrical, instrument, or mechanical (EIM) skills and then were trained in the remaining skills they lacked so they could provide full support knowledge. This provided each shift with a maintenance leader with EIM skills.

Being isolated on the island, the maintenance philosophy had to be that maintenance is a 24-hour a day job, just like operations. Since there were not enough mechanics to provide shift maintenance coverage, it was necessary to train operators in the maintenance apprenticeship skills to the helper level as part of their orientation training. Each shift crew had one SMC who counted as part of the total operator allotment. The SMC reported directly to the operations shift supervisor and was part of the shift team.

This site has since progressed to the point where the SMC has been operationally crossed-trained and functions as an operator on nights. This has contributed to the site being able to greatly reduce total head count and overtime as attrition occurred. Site staffing has been reduced from 160 to 105. The SMC is the maintenance mentor who leads by doing and showing. The shift supervisor decides which operators are assigned to help the SMC based on plant operations and area of knowledge. One operator per shift is

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assigned to serve as the backup for the SMC as the individual's development and performance progresses.

Due to the shortage of skilled mechanics available to be hired, the plant decided to totally outsource its maintenance function, but would only have coverage on days. Operators, supported by their SMC, were taught enough maintenance skills to allow them to handle emergency situations and make necessary repairs or equipment isolations to keep the plant in safe operating condition until permanent repairs could be performed by the contract mechanics on days. For shift repairs, the SMC orders and collects the needed parts from stores and plans the tasks to be done. Each shift has a crew toolbox maintained by the SMC, who also maintains the computer equipment data for repairs made during the shift.

The maintenance staff developed a list of routine and preventive tasks the shift performs. History has proven that shift operators are closest to the equipment on a continuous basis and can prevent major failures by paying proper attention to warning signs and taking quick action. An understanding of maintenance allows the operators to better operate each piece of equipment and prevent potential damage by regulating its operating conditions.

Development of troubleshooting skills by the shift personnel was required to identify and prevent small problems from becoming big ones. Shift operators take routine data trap vibration readings at night to allow the maintenance staff to analyze the data for repairs by the contract mechanics. Preventive maintenance (PM) activities, like proper oil levels, are worked into the operator's job routes. Operator maintenance efforts are directed by their SMC and focus on required jobs that could impact safety, production, or quality if not properly addressed. In small sites, teamwork is required on each shift and between shifts and day personnel to maximize onstream time, product quality and overall safe operations.

The results of implementing this work process allowed the plant to achieve a maintenance and reliability (M&R) cost as a percentage of asset replacement value (ARV) of 2.69 percent in 1999, the first year of operations, compared to the company's history of a new plant start-up average of 6.13 percent. In 2004, the site progressed to 1.32 percent.

The annualized maintenance costs during the 1999 start-up and construction was $6.28 million, but decreased to $2.2 million in 2003 and to $1.85 million in 2004. The maintenance personnel head count for checkout and start-up went from 46 in 1998 to 28 in 1999 when the last unit went into operations and then 12 for normal operations in 2004.

Here is the present performance for this plant in 2015 to show the long-term successes:

- → Achieved above 90% capacity utilization since start-up;
- → Achieved above 99% YTD prime production since start-up;

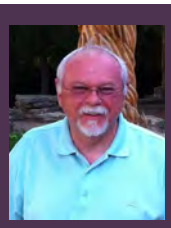
- Excellent unplanned production loss control of < 0.5% average per year;
- M&R cost control accomplishments: under budget since start-up with average M&R cost of 1.5% ARV over last 15 years (1.17% in 2013 as best year);
- 68% reduction of maintenance contractor monthly average head count since start-up, with eight full-time equivalent (FTE) as the target;
- Low maintenance overtime, with 4.6% average total overtime and 0.8% average unplanned overtime;
- High maintenance overall work schedule and PM schedule attainment above 97%;
- Monthly work orders per FTE went from 38.5 in 2007-2009 to 60 in 2011-2013;
- Work orders completed per year with the same head count craftspeople went from 3,611 in 2007-2009 to 5,188 in 2011-2013.

This example can be used to create a great opportunity to obtain productivity gains as you develop improvement plans for your site. These concepts have been expanded into a maintenance vision, philosophy, strategy and processes that can be made available to you to consider for your application.

The approach uses centralized planning with decentralized execution. You plan and schedule to improve how you do your work. Another planning and scheduling best practice is to have the shift crew going on long weekends to provide jobs to be done when they return on days so they can be available with expert input and support. This also allows lead time for developing plans.

Once all the components described in this article are achieved, maintenance will be in tune with site needs and will proactively initiate corrections and enhancements. Maintenance will be an established, well coordinated effort, with all parties having an active role in work identification, priority setting and completion of tasks. Through proper proactive systems using the appropriate predictive technologies, reliability is improved to ensure that equipment is available and in optimum condition to perform whenever needed. These reliability enhancements will reveal the "hidden" plant for extra capacity with minimum capital expenditures.

This maintenance transformation will deliver a competitive advantage to the industries that choose to implement it.



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