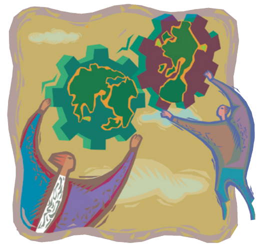
“Sharing Information to Improve Reliability”

TMG News

The Manufacturing Game®
October 15, 2007



Getting Rid of the “Noise” Created by Defects

Many companies pursuing a high percentage of planned work (92% - 96%) think that this can be achieved with the standard tools of planned maintenance – inspections, planning, scheduling, materials procurement, CMMS system, etc. Our documented findings indicate that since only 60% of the work is by nature plannable something else needs to be included to raise the percentage of planned work. Random defects (the noise in our system) cause the breakdowns that are attributed to keeping plannable work at 60%. An organization must introduce a program to eliminate these random defects so that the 40% of unplannable work becomes only 4% to 6% of work that is not plannable. Once a program of defect elimination is established it becomes quite easy to extend the 60% of planned maintenance into the 92% to 96% category. The reason for this is that a lot of the work has now gone away, and it is easier to plan and schedule the remaining work. Creating defect elimination habits is the means to reduce the unplannable work and will definitely prevent catastrophic failure events. Since we have worked with companies who have been successful with this at multiple sites we are puzzled over the question of “Why don’t people understand and implement defect elimination even when they have seen some preliminary results at their own sites?” The problem is not whether it is a worthwhile goal, but rather that people don’t truly understand what defect elimination really means.

Failures occur because things that exist are not perfect. To reduce failures we must eliminate as many imperfections as possible. One of the classes of imperfections is defects. Our studies have concluded that all failures of equipment and processes can be traced back to defects. Therefore, defects are the basic cause of all of our failures.

Most people underestimate the significant impact that defects can have. People waste much of their time and energy trying to prioritize a long list of failure repairs that should never have occurred. People refuse to accept that careless work habits cause most of the “noise in the system” because they equate carelessness with irresponsibility.

Typically people fail to understand this way of looking at defect generation because it is hard to acknowledge that we could operate that badly and still survive. The validation for this

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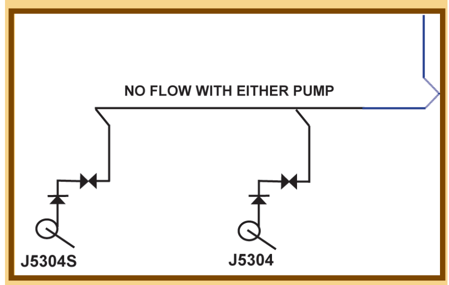
Can We Have Our Ball Back, Please?

For over a year SembCorp Utilities UK have been running Manufacturing Game workshops at Wilton Power Station in the UK, facilitated and supported by Reliable Manufacturing Ltd.

Part of the facility is a large water treatment plant which serves not only the power station itself but other major customers on the Wilton site. The plant operators were unable to establish flow from a pair of caustic pumps, and this was affecting demineralised water production with the danger of restricting flow to both the power station and the external customers.



The lines had previously been dismantled leading to the discovery of pieces of broken metal. On reinstatement of the pipe work; however, flow could only be established from one of the two pumps. More pipe work was removed, and it was found that a non-return valve had disintegrated and the pieces of broken metal were identified as parts of the valve seat. The non-return valve was replaced, but flow could still only be established from the other pump. It was realized that the ball from the non-return valve was not accounted for, and it seemed strange that all the

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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

IMC Mastering The Maintenance Process

22nd Annual International Maintenance Conference (IMC)
Daytona Beach, Florida
December 5–7, 2007
To register or for more information please visit:
www.MaintenanceConference.com
or call (888) 575-1245

MaRS Symposium
Houston Chapter of SMRP
Brady's Landing in Houston, TX
February 28, 2008
Inquire: Ed Foster
EdFoster@mundycos.com

EAM Mastering Enterprise Asset Management
RCM Reliability Centered Maintenance Managers' Forum
Mastering Reliability

Reliability Centered Maintenance Managers' Forum & Enterprise Asset Management Summit
Las Vegas, Nevada
March 18–20, 2008
For more information or to register visit www.MaintenanceConference.com
or call (888) 575-1245

Mark Your Calendar!

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insight is well documented from the TPM award winners in Japan who told the story of eliminating 90% to 98% of their failures as far back as 1991. The data to support this has been around a long time. It is simply hard to believe. This is the blindness created by our assumptions. The BP Lima refinery eliminated 87% of their pump failures when they implemented defect elimination. One assumption that blinds us is that the failures are avoided by doing a repair early as a preventive task. This is clearly not what was done at the TPM award sites. The defects that cause the failures were removed without need for a repair or the defects were never generated in the first place.

Each and every employee at a site needs to be able to answer the question, "How do I personally contribute to the company's vision?" Any employee who cannot answer that question is unwittingly contributing to the "careless" category of defects. There is no way companies can achieve inspirational visions unless they become outstanding in their core business. They should encourage every employee to contribute to the cause of identifying defects very early in their life and eliminating them before they become production limiting upsets or safety and environmental incidents.

The Life of a Defect

To understand why careless work habits are such a large part of the failures category, it is helpful to consider a typical life of a defect. A defect is born when something is done that is not perfect. For example, the nut on a bolt that holds down the base plate of a pump is not tightened to the right torque. Life begins as a loose nut, which tends to loosen further if there is any vibration in the pump. The fact that it is loose allows moisture to get under the base plate and corrosion begins to form. Thus, our defect has spawned another defect that is also growing. Both of these defects can have long lives since it would take 25 to 30 years for the base plate to corrode through. Then an operator decides to use this pump, he starts running it, which throws some strain into the bolt because of the motor torque and creates some vibration. The vibration causes the nut to loosen further, and now the base plate can warp slightly under the strain, which allows more moisture, creating more corrosion, throwing the pump slightly out of alignment which puts an off balance load on the bearings. You can see where this is going. As the pump operates, defects due to basic wear and tear are generated. On top of that we now have defects being generated from the loose nut because the operator closes down the suction valve to quiet the shaking from the loose nut, which creates some cavitation at the impeller leading to erosion. Therefore, we can see that saying *Defects Beget Defects* can sum up the typical life of a defect.

The rest of the life of this defect is determined by how much people care about the pump. If the operator notices that the nut is loose and uses a wrench to tighten it to the proper torque, the defect has a very short life and never becomes a failure. If no one takes care of the loose nut, it continues to cause more defects until a failure or multiple failures occur to the pump. This brings us to another principle, *Failure Events Create Extra Defects*. If this pump is allowed to run until the bearings seize, the power from the motor could slightly bend the shaft as it is failing which becomes the defect that causes the next failure. So the

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total number of failures that result from a defect is determined by how carefully the pump is operated and maintained.

Noticing defects when they are very small and removing them before they generate other defects or cause failure events is the essence of Total Productive Maintenance.

How Do Defects Affect Safety

If our equipment was perfect and we operated and maintained the equipment perfectly, there would be very few safety problems. Failures inevitably direct energy into places that cannot bear the amount or intensity of the energy and therefore cause collateral damage. This misdirected energy then is the source of hazards to the people and equipment. So the principle is defects create failures that cause hazards that can hurt people and/or damage equipment. Personal Safety programs create capacity in the organization to cope with the hazards when they happen. Process Safety Management programs create capacity in the organization to eliminate the defects that are the root causes of the failures and hazards. The Personal Safety programs are typically designed for the immediate reactions and short term dealings with defects. The Process Safety Management programs deal with all three classes of defects – aging, basic wear and tear and careless work habits.

Recommendations

We recognize that most organizations are stretched and have difficulty meeting the many demands being placed on them. Therefore, we have recommendations for what should be discontinued to free up resources as well as what should be done. Those recommendations were published in the July, 2007 TMG News. For a copy of that article, please visit our website: www.ManufacturingGame.com. Click on TMG Newsletters and read the "Initiative Overload" and "Recommendations on How to Deal With Initiative Overload" articles in the July, 2007 newsletter.

I guess we should have listened to Joe Operator when he said the pump was making a funny noise.

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parts of the non-return valve had not been found together.

The operating team could have continued with only the operational pump, and while this would have allowed full production, it would still have left the plant vulnerable to another pump failure in the future. The people involved had attended Manufacturing Game workshops and an Action Team was formed from operations and maintenance. The main players were Terry Large, Nigel Boyle, Tony Skillcorn, Brian Pattinson, Dave Waters and Gordon Harris.

Initially, there was some doubt throughout the team that they would be able to find a solution, but they brainstormed various possibilities. It was realized that the seat material was relatively light and had been carried downstream with the flow, but the ball was heavier and more likely to have dropped back under gravity towards the pump. The flanged pipe work of the pump was dismantled and the ball of the non-return valve was found. The caustic system was returned to full availability, and the vulnerability was removed.

The key to success was seen as the needed "time-out" during a meeting to discuss in detail what had already been done and possible areas left to examine. The result of this was a detailed list of actions, escalating from simple to more complex plant investigations, based on probable scenarios. The entire team then agreed upon a logical way forward. This was a unique problem that is unlikely to recur; however, the team now feels equipped to deal with the "unknowns" that undoubtedly lie ahead by adopting a similar approach. Somebody remarked later that while there were many problems caused by a "balls up", in this case the problem was that the ball had gone down!

Oil Burner Tips

After a Manufacturing Game workshop at the Wilton Power Station an action team noted a problem with oil burner tips, which are a vital component in coal fired power station boilers. The burners are used during the start up process to oil fire the boilers prior to switching to coal, the main fuel. The tips have a series of small holes used to spray fuel into the boiler, but they often become clogged with combustion products and have to be changed. This leads to an interruption in boiler pressure and temperature build up, delaying the switch over to coal and hence increasing the amount of oil burned. Each boiler has twelve burners and if two or three fail then the start up process has to be put on hold until they are replaced.

In the past there were no spare

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Be the change you wish to see in the world —*Gandhi*

Fall

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tips kept to provide a ready supply of replacements, nor was there a process in place for cleaning tips which had previously come off line. This meant that a clogged tip often had to be cleaned before it could be put back, further delaying the start up. The cleaning process itself was inefficient due to the lack of a suitable cleaning agent.

The Action Team, led by Albert Wedlake, decided that the best way to improve performance in this area was to do the following:

- Buy a new spare set of tips
- Find a suitable cleaning fluid
- Improve the cleaning process

Buying a new set of burner tips proved relatively straightforward. Management approval of the expenditure was easily obtained and the tips quickly bought.

An unforeseen problem was that specifying a previously unused cleaning fluid would require a plant modification, adding to the cost of eliminating the defect and causing additional delays. After discussion with Dave Elderfield (mechanical fitter) and Dave Stamp (stores), an effective cleaning agent was identified that had been used before and was available from the stores.

While working on these problems the team also realized that although a cleaning procedure was available it was not used properly and that operator training could be improved. All operators in the future will be trained by and checked out by Dave Elderfield rather than allowing operators to check out each other. This avoids the dangers of missing important items when passing on knowledge informally.

The standard for routine "burner availability checks" is now to make sure there are always at least fifteen burners, with clean tips, available at all times. A basket for soaking tips in the cleaning fluid was provided to help with this. Delays caused by burner failure are now limited to the time taken to change a burner and not the additional time needed to change and clean tips.

The actions of this team have reduced operator frustration when bringing boilers on because there is now more confidence in the reliability of the burners. It is estimated that this action team could save the cost of 100 tonnes (metric tons)of oil per year (£20,000/$39,517.88) as well as reaping the benefits of improved boiler start up performance.

REMINDER!

Be sure to share your TMG News with a friend.