Managing Refinery Maintenance –

Key Steps Towards Sustainable Backlog Reduction

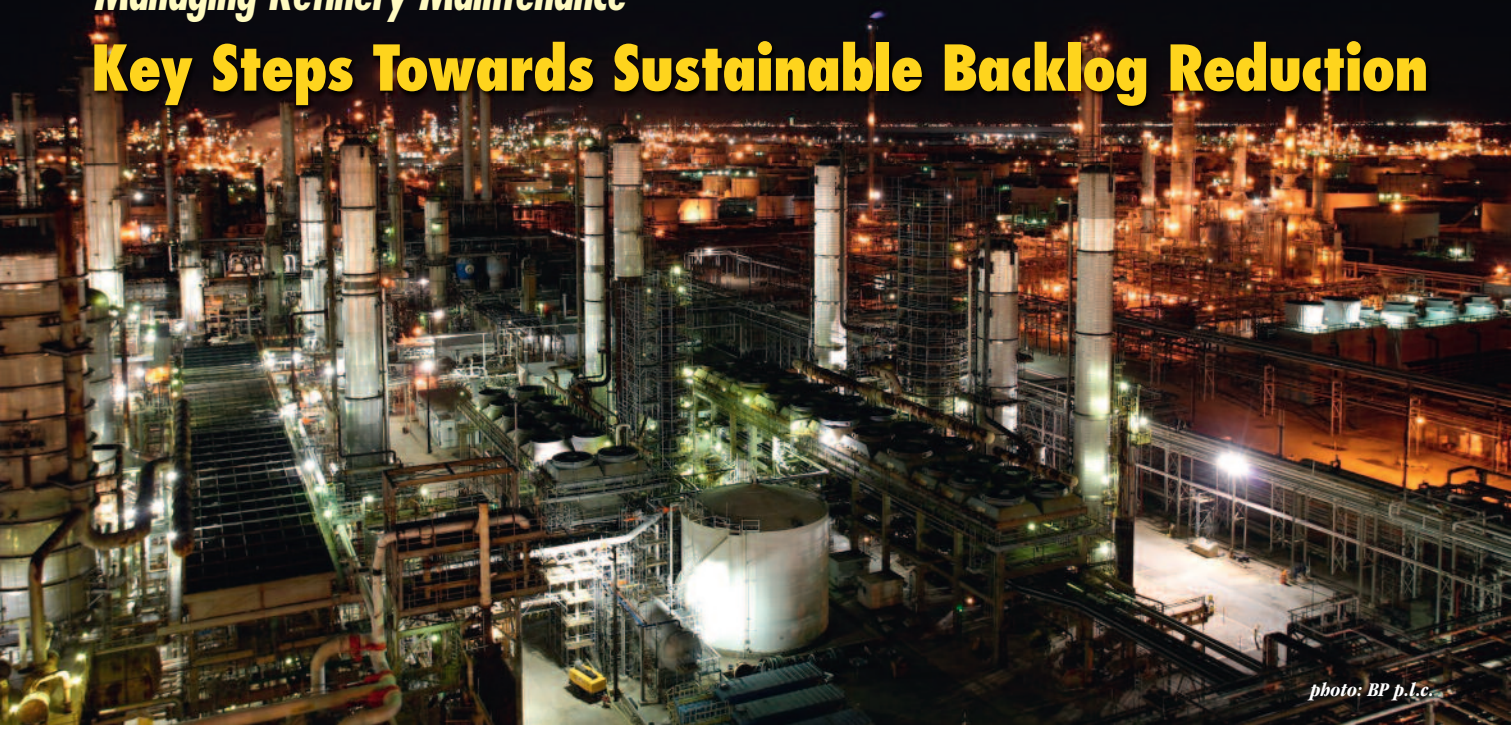


photo: BP p.l.c.

The volume of maintenance work modern refineries generate can require considerable skill to manage. As work orders build up over time, prioritising which repairs are critical and executing them efficiently is crucial to sustaining optimum output and safety levels.

BY DIRK FRAME

At many refineries, site maintenance is usually handled by a large combined team of onsite technicians and contractors. In a culture where every single defect or fault, regardless of importance, is identified, logged and catalogued and a notification filed for each, a vast input of work orders is produced: co-ordination between departments and in-house and contractor teams must be excellent if the right work is to be done on time. However, maintenance teams often struggle to execute the sheer quantity of orders filed and the backlog of incomplete work begins to grow.

This can have unpleasant consequences: productivity losses, unscheduled overtime growth and poor contractor management for example, all of which can lead to unsustainable cost increases. As a result, cost-saving efforts are then focused on these effects, rather than the reasons for their growth: operators rush to treat the symptoms rather than the root causes.

Expert Reliance

By identifying the key reasons for maintenance backlog growth and putting systems and processes in place to counteract them, work order backlogs can be rapidly reduced, positively impacting culture, productivity, and safety. In my 20 years of experience in the petrochemical industry, maintenance overload has largely been due to two key factors: reliance on non-expert evaluation of defects and insufficient assessment of fault criticality.

While it is indeed vital that each fault or defect is identified and catalogued, there is a vast difference between the urgency of them: expert knowledge is crucial. An electrical technician may be an expert in his field of control of motors and pumps, but only have limited knowledge about the lasting implications of changes to the frequency and type of bearing lubrication. The assumption would be that because he has responsibility for the pumps, he will be doing everything necessary to keep them working reliably. Without expert knowledge however, that judgement cannot be made properly, meaning that most defects are identified, catalogued and added to the expanding pile of work orders without being sufficiently evaluated. If all are organised on a "first come, first served" basis, maintenance teams have no way of combatting the mountain of work in front of them.

Assessment of Criticality

While some form of risk assessment process exists at almost every refinery, such processes are often not being used efficiently or have not been properly applied to the relevant equipment. So while in the Senior Managers' offices or even at Board level, a risk evaluation tool may be prominently displayed which rates the seriousness of some machinery failing and the likely consequences, in practice it may not be used or effective on the shop floor. Typically this is for two main reasons: people have a natural tendency in this environment to flag faults as being of higher significance than they really are, and secondly, they are not sufficiently aware of the genuine process criticality. As a result, most faults are (at least initially) categorised as urgent and Maintenance Coordinators rush to allocate their teams to fix everything, when some repairs could be postponed without causing any significant problems.

Where criticality matrices already exist, they must be used actively to quantify maintenance work according to urgency and relevance. At the senior level, what does and does not constitute a critical event is often well understood and may even be described in detail. However, as one progresses down through the organisation to Operations Managers and Shift Leaders, what constitutes criticality tends to be more widely viewed as process disturbances and equipment conditions which might lead to critical situations, but are not critical in themselves. What is needed is a common understanding of what will cause a genuine disturbance to production in the immediate future or with lasting consequences.

Operations staff are usually entrusted with determining criticality and should be able to both recognise process disturbances as such and differentiate them from equipment faults and conditions which in all probability, will not lead to any immediate failure. They should also be able to differentiate between equipment which is in the direct production flow (batch or process) and equipment which is essentially redundant. If the reliability and process engineering department(s) are working closely with their operations colleagues, then determining such facts, having reliable MTBF numbers and recognising true process criticality will likely mean that the break-ins can be reduced and the backlog kept in check.

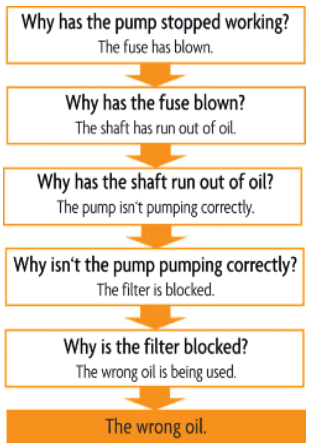
At a leading European petrochemical manufacturer for example, exactly this issue was causing cost hikes across its South American sites. However, by clarifying what constituted genuine disturbance and training staff to use a criticality matrix properly to assess the calibre of necessary repairs, the entire maintenance team was able to work through the non-urgent orders methodically and rapidly reduce their overall backlog, resulting in a 25 percent increase in maintenance efficiency.

Efficient Execution

Following successful prioritisation, certain steps need to be taken in order to execute work orders efficiently.

Firstly, maintenance norms and standards need to be defined so that jobs can be planned and prepared properly. Technicians and supervisors both need to understand the framework of expectations: which skills are required of them and when. Through a combination of workshops and on-the-floor coaching, training will need to be conducted so that defined methods can be properly implemented. While it may seem like a time and cost intensive process, investing in staff will certainly be cheaper than the long-term effects of outsourcing skills, and will mean that priceless expertise stays within the company. Setting up and delineating Key Performance Indicators (KPIs) will also allow managers to measure performance against expectations, providing further visibility as to what needs to be improved and where.

Secondly, establishing a system for the analysis of breakdowns and their reasons means that future preventive and predictive actions can be agreed upon. This can be as simple as compiling and working through a list of breakdowns and then prioritising those "bad actors" that have a major impact on safety and/or cost. For example, if an oil pump needs continuous repair because its fuse keeps blowing, instead of simply replacing it and expecting the pump to function properly (treating the symptom), it must be established why the fuse keeps blowing. As summarised in the diagram below, successively asking "why" until the root cause has been identified is



imperative: in this case, the cause of the oil pump malfunction is the use of the wrong oil. This has blocked the filter, preventing the pump from pumping correctly and starving the shaft of oil, which has then overheated and caused the fuse to blow. Identifying the root cause of a chain of faults and addressing it (in this case, by administering the correct oil) means that symptoms are unlikely to recur.

By working through each bad actor on the list in this way, the key members of the maintenance, operations and reliability team will gain a deeper understanding, not only of what needs to be identified and acted upon, but of how to prevent the same problems from cropping up time and again.

Finally, applying a gatekeeping process in which Production and Maintenance teams work together to establish both standardised notification and execution processes and proper communication channels, means that lost time and overlapping roles and responsibilities can be eliminated. It is essential that hours which have been planned, allocated and scheduled are used wisely and tracked closely. It should be unacceptable that any maintenance supervisor allows hours to be wasted, lost or go unaccounted as that negates the whole purpose of planning and scheduling.

Through a combination of the above approaches and a concerted effort to understand how the maintenance hours were allocated and used at a global chemical manufacturer in the United States for example, a USD 2 million reduction in unscheduled overtime hours and a 35 percent reduction in the site maintenance backlog was achieved in just seven weeks.

Sustainable Management

Tackling and overcoming maintenance backlogs does not have to be as arduous as it often seems. To bring about sustained reduction however, addressing the root causes of the overload is vital: if the effects remain the focus of treatment, operators are essentially throwing good money after bad. However, by ensuring employees are fully trained and that criticality matrices are properly used and understood, maintenance backlogs can be both steadily reduced and sustainably managed to achieve optimum safety and productivity. ■

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Dirk Frame is Managing Partner at T.A. Cook Consultants. A Chartered Engineer with an MBA from Cranfield School of Management, he has over 20 years' experience across many countries and is an expert in maintenance and capital processes in asset-heavy businesses. Following senior positions at Proudfoot Consulting and Celerant Consulting, Dirk has helped propel T.A. Cook to the forefront of Asset Performance Management consulting across Europe and the Americas since 2004.