Preventive maintenance: are you getting value for money?

Reviewing your PM routines can reduce workloads and improve plant performance. **Michael Dixey** explains how

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FEW people doubt the need for appropriate preventive maintenance. Who would be prepared to fly in an aircraft that had not been properly maintained? The key word here is appropriate. However, a high percentage of preventive maintenance routines in many companies are inappropriate and are often counter-productive. They were established in the second half of the 20th century when all preventive maintenance was considered to be beneficial.

Typically, they are based on the manufacturers' recommendations and take no account of how the equipment is operated or its criticality. And too often they are based on stripping down the equipment at regular intervals to overhaul it. This approach can be described as 'taking kit to pieces to see why it is still working'. It also provides your equipment suppliers with a steady income stream from spares!

An industry that has a much longer history of coupling a painstaking maintenance environment with a rigorous cost-cutting culture is civil aviation. Despite the focus on costs, the industry has an outstanding safety record. How does it succeed where so much of industry struggles?

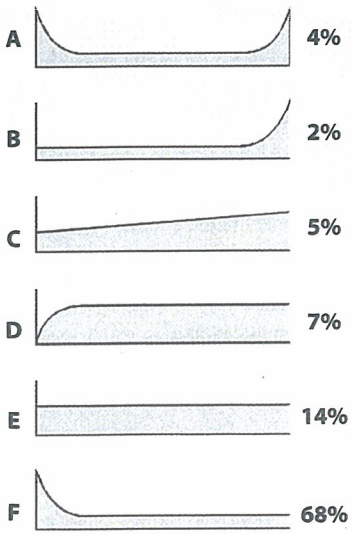

Figure 1: Failure patterns and the frequency of their occurence

the aircraft industry

Traditional maintenance wisdom tells us that equipment, over a period of time, wears out. This wear-out time or life is established from historical data or from manufacturers' recommendations. It is then overhauled or replaced at intervals less than the life of the equipment.

Pioneering research work by the airlines into failure patterns has shown that in practice most failures are either 'burn-in' (when the equipment is new, has just been maintained or has been changed over) or are random (see Figure 1). Six failure patterns were found to exist and the graphs show the conditional probability of failure against age. Only 6% of items have a clearly defined age-related failure pattern – increasing to 11% if pattern C is included.

These findings have since been validated across a wide range of industries including nuclear power, chemical and petrochemical, metal refining, pharmaceutical, food and drink and automotive.

maintenance strategy

The aircraft industry has since developed a highly sophisticated methodology for optimising preventive maintenance routines. It is called Reliability Centred Maintenance (RCM).

With RCM, all preventive maintenance tasks have to satisfy two criteria: they must be technically appropriate and they have to be worthwhile. The technical criteria take into account the failure patterns and characteristics of the equipment and determine the frequency of PM tasks. The worthwhile criteria are dependent on the consequences of failure.

While the 'original' RCM is too airlines-orientated and time consuming for use in the process industries, there are lessons to be learned. These include recognising the significance of random failure, which is driving the move from time-based maintenance to condition-based maintenance, the relevance of the equipment's operating context and the importance of hidden failures – mainly protective systems which can fail unsafe.

PM review

A very cost-effective approach is to use the RCM principles to review a company's existing PM routines. This is called Review RCM. It typically cuts PM workloads by 20–40% while improving plant performance. The process validates the PM routines against RCM criteria and considers safety features and protective systems – frequently omitted in the past but of vital importance to system integrity.

Review RCM is undertaken by a small team of experienced engineers working under the guidance of a facilitator. They work through the current PMs asking a series of questions including:

- what failure mode is the PM task attempting to prevent and what is the root cause?
- what is the failure mode's failure pattern and failure characteristic?
- is the current PM task technically appropriate and does it meet RCM criteria?
- is the frequency correct?
- is the task worth doing, eg cost-effective for failures which affect operational capability?
- is the right person doing it?
- has anything been missed (ie testing of protective systems)?
- is the level of documentation of procedures and methods adequate?

The PMs are then amended, added to or deleted.

implementation

In many applications, the revised PMs will need to be re-launched to improve credibility and signal a break with the past. The revised PMs should be scheduled across the year and audit procedures put in place before the re-launch.

If a high percentage of PM tasks are being routinely completed, a substantial reduction in the PM schedules will have implications for staffing levels. Where completion rates are low, the workload may not change a great deal but the process will ensure that the right jobs are completed.

Moving from time-based to condition-based maintenance and reducing the amount of intrusive maintenance will improve plant performance. A typical review RCM programme for a medium-sized plant tends to take weeks rather than months.

conclusion

Without good preventive maintenance routines, companies will not achieve high plant efficiencies. Review RCM provides a quick and cost-effective method of ensuring that the PM routines are appropriate, relevant and worthwhile. Experience across a wide range of industries has shown that it results in significant reductions in PM workloads together with improvements in plant performance, to a 'win-win' scenario. tce