Abandonment of preventive maintenance or across-the-board task interval extensions are possible but risky responses to squeezed maintenance budgets. The author shows how, for a relatively modest effort, the maintenance department stays in control and up to 50% savings can be achieved without compromising plant performance or employee safety.

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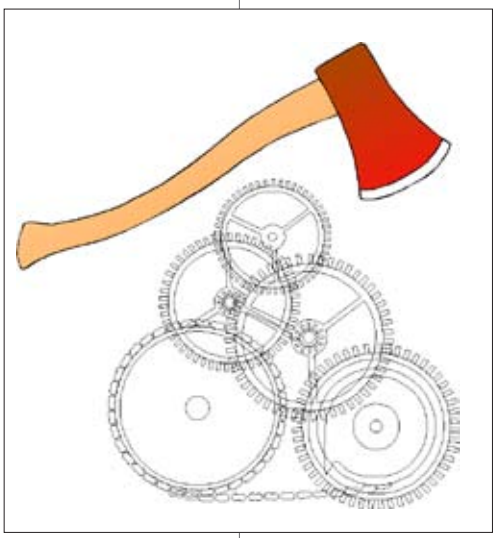
Cutting Maintenance Costs — **Safely**

Maintenance has historically been the Cinderella department. When any cut-back has been required, the axe can be expected to fall there pretty quickly. A common response in industry is to stop or severely curtail planned preventive maintenance (PM). When plant subsequently fails, there is an obvious excuse ready to be paraded, "We had to cut out all inessential maintenance", and clearly a breakdown takes precedence over less immediate threats. Given this handy excuse, more cynical maintenance managers may not be too opposed to slashing PM tasks. An alternative response to the demand for savings may be an arbitrary extension to all PM intervals (double them?). But surely we can and should do better than this?



Make sure you decide where the savings take place!

The nature and consequences of failures

The key lies in understanding the nature and consequences of plant failures. From this we can see logically if PMs are required, what we should do (and not do), and how often we should do it – rather than just throwing in the towel and abandoning preventive maintenance. Failures can be divided broadly between those that occur randomly and those that are age-related (items wear out). In addition, the plant or plant item may show warning signs before it fails and stops working, or failure may without warning and virtually instantaneous. These characteristics dictate what types of preventive maintenance might be effective and worthwhile. If the PM task is not appropriate for the nature of the possible failure, it can be dropped without compromising safety or plant performance. If the task interval is too long, failure may occur between PMs - in which case they have been wasted. If it is too short, maintenance effort is again being wasted. There is good logic available for deciding whether a PM task is appropriate and how often it should be done, and it need not take many seconds to apply this logic.

Dealing with less serious failures

Where the consequences of failure are not severe – no-one is likely to get killed or injured and no significant downtime is likely to occur – probably all that should be done is to keep the plant clean and lubricated. Any other PM tasks should be dropped unless there is an obvious high return – big savings for little effort. Cutting out cleaning and lubrication tasks only provides short-term benefit since lack of proper attention to these two aspects results directly or indirectly in a significant percentage of all failures. It may also be appropriate to make cost savings by transferring responsibility for cleaning and maintenance from maintenance to operations (if this has not already happened). But be sure that whoever does it is competent and knows what to do. Any change of duties has training implications.

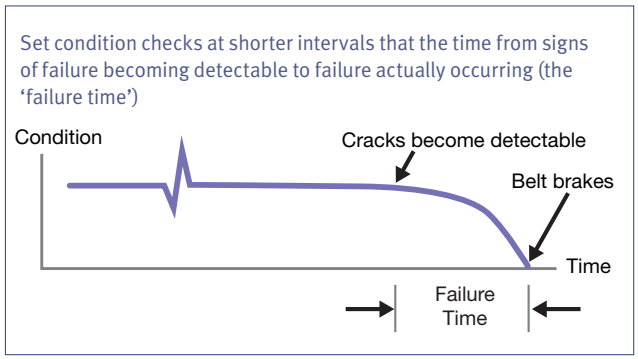


Figure 1

Where the failures are serious

If the consequences of failure are more serious, we need to decide which PM tasks would be worthwhile and drop or amend the rest. Unless the plant (or component) fails with age or use, regular overhaul or replacement will not prevent failure and is therefore not worthwhile and should be dropped. Sticking with serious consequences, if failure does occur through predictable wear-out, we need to get as much life as we can from the plant and minimise our costs. We ask the question, "Are there warning signs before failure?" If so, it will usually be more cost effective to make simple condition checks and replace when wear is apparent rather than replace at fixed intervals. As a simple example, Vee belts may crack before they fail. This may be easy to spot and can extend the interval between belt changes to the maximum possible. See *Figure 1*.

If fixed interval overhaul or maintenance is essential, perhaps on account of plant unavailability for maintenance except during planned shutdowns, it may still be appropriate to extend the interval. An assessment of the risk incurred by so doing is then necessary.

Most failures occur randomly and, as established

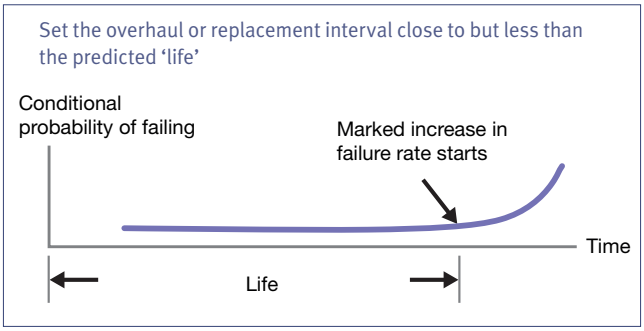


Figure 2

above, fixed interval overhauls or replacements are not appropriate and any currently done are obvious candidates for making savings. Given the risks inherent with intrusive maintenance, they may well increase the risk of failure. We have just two options here for potentially serious random failures:

- Condition-based maintenance, where we check for signs of starting to fail as in *Figure 1*, or
- Redesign, to design out the potential failure.

Where the failure consequences are not serious, run-to-fail (no preventive maintenance) is an alternative to redesign.

Hidden failures and protective systems

Not mentioned so far are the hidden failures that are mainly associated with protective systems – interlocks, relief valves, etc. It is always necessary to ask whether a failure would be apparent. If not, the most likely PM task will be failure finding (or proof testing). Typical PM tasks here would be periodic functional tests of emergency stops, alarms and pressure relief valves.

Few protective systems are subject to predictable wear-out and failure is usually random. Since the ultimate consequences of protective systems failing are often serious (the systems would not have been installed otherwise), PMs here should never be discarded without due consideration. That said, the interval between failure finding checks should be open to review. Somewhat surprisingly, there is little guidance publicly available on how often the checks should be made. Yet lives could be at risk if you get it wrong or you could be wasting a lot of resource if the checks are too frequent. The savings that can be made here are in direct relation to the reduction in checking frequency so they could be considerable.

Cutting out ineffective PMs: getting the PM intervals right

The process of eliminating PM tasks that are not worthwhile and setting task intervals as long as can be justified is taken in two steps. The first step is to identify what fault or failure the task aims to prevent and to understand the characteristics and consequences of the failure, see *Figure 3*.

The Failure
• What fault or failure is the PM task aiming to prevent?
• Is the failure apparent (if in doubt, assume "no")?
• How serious is the failure (safety, environmental or production consequences)?
• Is the failure age-related or random?

Figure 3

The second step is a review of the task itself to see if it is worthwhile and to amend it or drop it accordingly, see *Figure 4*.

The PM Task	
Where failure consequences are not serious:	
1. Cleaning & lubrication	• Extend interval as far as is practicable within the plant item's 'failure time', or
2. Other task types	• Discard unless the PM cost is low and the benefit is high
Where failure consequences are serious:	
1. Cleaning & lubrication	• Extend interval as far as is practicable
2. On-condition tasks	• Extend interval as far as is practicable within the plant item's 'failure time', or
	• Discard task if not worthwhile
3. Fixed interval overhauls and replacements	• Discard task if failure is random, or
	• Replace with an on-condition task where practicable, or
	• Extend interval as far as is practicable within the item's expected 'life'
4. Failure finding	• Extend interval as far as is practicable consistent with risks and reliability

Figure 4

The approach outlined above is applicable in general manufacturing and process industries, and the level of documentation can be kept light. For more critical processes and industries, the review process logic may be extended and comprehensive documentation of the changes prepared.

The results that can be expected

The benefit from this approach is that PM tasks that are inappropriate or not worthwhile are weeded out. Those that remain get carried out at the longest interval that can be justified with reference to the failure characteristics. Plant performance should not suffer as the maintenance effort and cost is trimmed. In practice, a check should also be made that all protective systems are being properly maintained even if no PM tasks had previously been set.

Reviews of PM tasks following the logic outlined above in food, drink and pharmaceutical companies have typically resulted in reductions in scheduled PM task workload of 30 to 50%. Furthermore, the review process can be completed for most plants in a matter of days. After a brief period of training and demonstration, maintenance managers usually take over and complete the review process without further assistance.

The arbitrary axing of PM tasks or reduction in their frequency will adversely affect plant performance and can put employees' safety at risk. Given the ease and speed with which a sound PM regime can be established at much reduced cost, it should be a no-brainer.

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