Putting reliability back into equipment performance

How do managers in the food and drink industry ensure that their plant performs reliably? Michael Dixey explains some of the reasons for poor plant performance and suggests how these problems may be overcome

Scope to improve plant performance

Many companies have invested heavily in recent years in new plant and equipment. Much of this equipment is running at higher speeds and increased throughput rates, and is operating for longer periods - often 24 hours per day. Yet, despite this investment in state-of-the-art equipment, plant performance may not be reaching target levels. Companies which are measuring plant availability or overall equipment effectiveness (OEE) often find that plant reliability now is little, if any, better than it was before the new investments were made.

In response, some companies focus on increasing the amount of preventive maintenance being undertaken - in an effort to improve performance - often with little impact on efficiencies. Others introduce new computerised maintenance management systems (CMMS) or shop floor data collection systems. These seldom make a significant impact on plant performance. No wonder, senior managers feel that they are 'between a rock and a hard place'.

Yet, the civil airlines learnt during the 1970s that increased preventive maintenance and improved planning systems do not necessarily improve reliability. Indeed their research work showed that certain types of maintenance can reduce aircraft reliability!

Causes of poor performance

To understand why plant performance is poor, one needs first to look closely at the underlying causes. In many companies, most 'performance losses' are classed as downtime, which, in turn, is equated with breakdowns. Breakdowns are seen as maintenance issues, i.e. an engineering problem. However, the reality is often very different. Most equipment in the food and drink industry will run virtually for ever if no product or packaging materials are put through it. The vast majority of the causes of poor performance centre around the machine/material interfaces, and there can be many of these. For example, on a high-speed whisky bottling line there are over 3000 machine/material interfaces.

A typical analysis of these performance losses is given in Fig. 1 for a high-speed packaging line in the food industry achieving, in this case, 64% efficiency. Less than 10% of the losses shown are due to breakdowns.

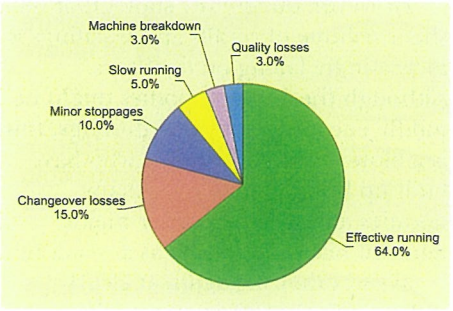
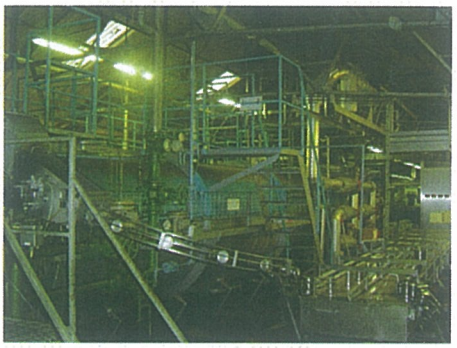


Figure 1. Line efficiency losses.

Most of the losses are likely to be caused by one or more of the following:-

- Poor setting at changeovers and start-ups.
- Raw material or packaging material variations.
- Poor line control philosophy.
- Process capability issues.
- Equipment design weaknesses.
- Process control issues.
- Incorrect operating procedures.
- Inadequate or inappropriate cleaning or hygiene procedures.

Few, if any, of these problems can be corrected with improved preventive maintenance routines. Even the causes of genuine machine breakdowns can often be traced back to problems at the machine/material interface, e.g. mechanical failure caused by repeated jam-ups. To leave it to the engineers to solve these problems on their own is clearly inappropriate. Yet this is exactly what many companies do.



Stork can cooker. (Photo courtesy of Premier Foods.)

Possible solutions

There are four widely used methodologies for improving plant reliability and performance. These are:-

- Total Productive Maintenance (TPM).
- Reliability Centred Maintenance (RCM).
- Failure Mode, Effects and Criticality Analysis (FMECA).
- Single Minute Exchange of Dies (SMED).

Each of these focuses on a different aspect of performance. TPM was developed in the Japanese car industry. It tends to concentrate on operator-related issues, i.e. ownership of the equipment and the basic disciplines, e.g. the 5Ss (an approach to organising the workplace, keeping it neat and clean, and maintaining the standardised conditions and discipline needed to do an effective job). It also puts great emphasis on the need for continuous

improvement.

RCM is from the US airline industry, and is more concerned with developing and optimising preventive maintenance routines. It also identifies where maintenance alone cannot deliver the required reliability.

FMECA comes from the off-shore oil and gas industry. It is now most widely used at the equipment design stage, with the purpose of improving the design to eliminate failures or mitigate their consequences.

SMED is from the press shops in the car industry. It focuses on reducing start-up and changeover times and losses. (In the author's experience, over half the waste in the food and drink sectors can be directly attributed to poor changeover or start-up procedures.)

All four of these approaches have their strengths, but none of them addresses the complete range of problems which affect plant performance in most companies.

Recent developments

Working closely with a number of household-name companies, GGR Associates have developed an approach to overcome these limitations. It is based on the structure of RCM but it incorporates many of the best features of TPM, FMECA and SMED (see Fig. 2). This approach, which is called Fast-track RCM, has three stages. These are:-

- **Failure Analysis:** an analysis of all the ways in which the equipment can fail to perform together with the causes. These are identified under seven categories, somewhat similar to TPM's six losses. The categories include much more than the 'breakdown' failures: they cover intermittent stoppages, slow running, quality losses and contamination issues, low yields, start-up and changeover losses, material problems, access issues, safety, etc.
- **Consequence and Criticality Assessment:** the consequences and criticality of each failure are evaluated, including an assessment of both the probability and the severity of the failure modes.
- **Recommended Actions:** the recommendations are made with the help of a logic diagram. The actions available are many and include cleaning and lubrication, preventive maintenance tasks, changes to procedures or setting routines, improved training, raw material changes, plant modifications and redesigns, rectification work and spares recommendations.

The analysis is done by a small team that knows the equipment well working under the guidance of a facilitator - similar to the TPM approach - and involves both operators and technicians as well as relevant specialists. The focus is on improving overall plant performance.

The approach is much quicker than classical RCM (e.g. RCM2 or MSG-3), typically taking about one-third of the time. And unlike TPM, it can be done on a machine by machine basis, rather than as a site-wide initiative.

Its application has led to step changes in performance levels in a wide range of industries including food and drink, pharmaceutical, paper and packaging, engineering and petrochemical.

Krones volumetric can filler. (Photo courtesy of Carlsberg.)

Conclusions

Performance improvement initiatives are usually started with much enthusiasm but they tend to be short-lived and have a limited impact. This is often because the techniques and methodologies being used do not address the wide range of issues being faced by production management.

Such initiatives may also be seen as being imposed from above and not relevant to those at 'the sharp end'. The absence of substantial, tangible business benefits within a reasonable timeframe will also cause many improvement initiatives to simply disappear into the sand.

A methodology that does not closely match the problems or one that grinds on with little to show for the effort expended puts the project in jeopardy from the start. But, with the right approach, this does not need to be the case.

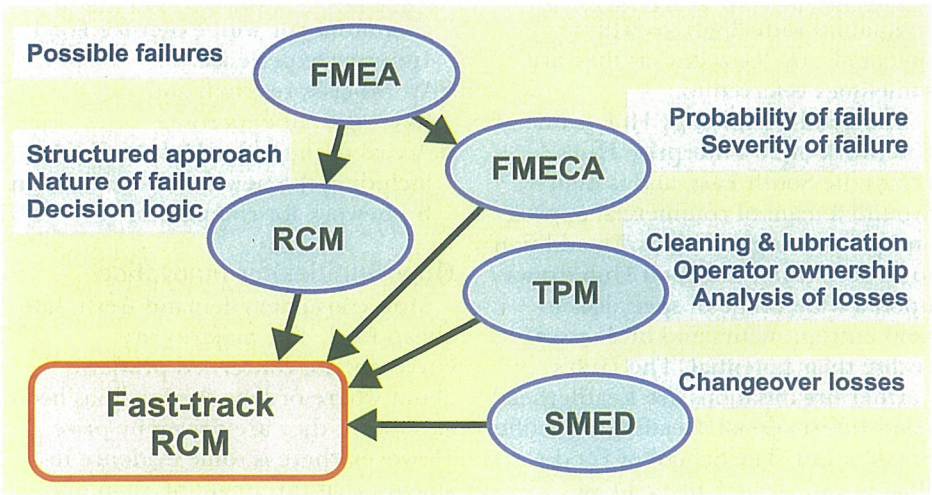


Figure 2. The Fast-track RCM approach for improving plant reliability and performance.

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