COST/RISK OPTIMISATION CASE STUDY

REF:	001
INDUSTRY:	Water supply
PROJECT:	Preventive maintenance
DECISION TYPE:	Optimum PM intervals; PM task evaluation; Optimum shutdown Interval; Optimum run lengths between shutdowns; Reliability, efficiency & longevity combinations
CLIENT:	UK privatised utility
TASK:	Using a single test site, determine an optimum overall interval for borehole pump maintenance and examine the separate contribution to the optimum strategy made by reliability and efficiency issues.

RESULTS

An analysis was undertaken to determine the optimum maintenance interval for the bundle of tasks required by each borehole pump and to assess the separate contributions made to the results of reliability and efficiency issues. Results were provided that included and excluded efficiency patterns. Reliability and efficiency profiles were also produced.

The reliability profile formed a series of three graphs demonstrating the component survival rate, failure density and hazard rate. The resulting patterns illustrated the lifespan of the wear rings and thrust and motor bearings and demonstrated the versatility and level of details available with APT-MAINTENANCE.

Similar graphs were provided on the efficiency profile for electrical consumption and pumping capacity which are the two main indicators of borehole efficiency. They displayed increases in operating costs and decreasing operating performance over time.

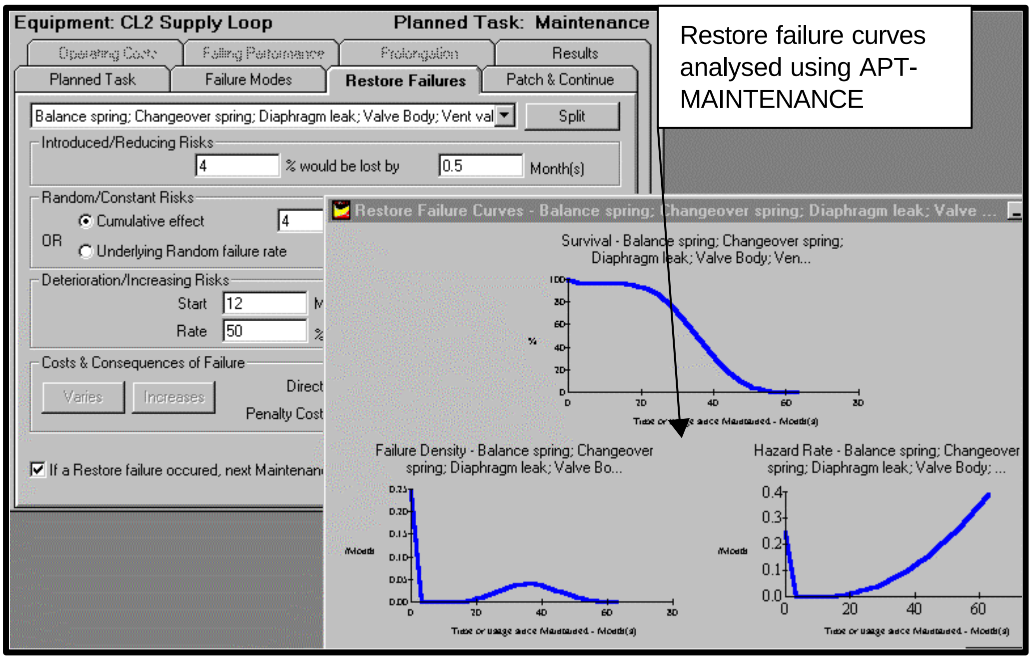
The optimum maintenance interval when efficiency patterns were included in the calculations was shown to be two-yearly. This was justified on the basis of amortised capital costs - efficiency and life extension - rather than reliability. Compared to the existing on-failure policy this represents a reduction in the Total Business Impact of £1,300/pump/year.

When efficiency patterns were separated from the analysis, the existing on-failure policy - 40-45 monthly intervals - was found to be appropriate.

DEMONSTRATES

- APT-MAINTENANCE's ability to identify and where necessary isolate factors that strongly influence maintenance intervals
- Speed and simplicity of using APT-MAINTENANCE to analyse a complex set of factors determining maintenance intervals
- Significant potential reduction in Total Business Impact when switching to an optimal maintenance strategy based on robust analysis.
- That APT-MAINTENANCE provides a robust justification of new maintenance policies

Restore failure curves analysed using APT-MAINTENANCE



Study	Current interval	Optimum	Improvement vs. current	Comment
Vent valve inspection/cleaning	12 monthly (RCM suggested 3 monthly)	6 monthly	£18,000/yr	= 300 sites
Regulator maintenance (RCM package)	12 monthly	24 monthly	£15,000/yr	= 300 sites
Chlorine supply – pigtail replacement	3 yrs / 20 bottle changes	3 yrs or 22 changes	£0	Current policy correct
Leak detection testing	Monthly	3 monthly	£200/yr/unit = 40% of total cost/risk	
Chlorination failsafe system testing	Monthly	Every 3-8 weeks	£0	Very data sensitive
Dosing analyser cells cleaning/inspection	3 monthly x 3 cells in rotation	2 monthly	£3,000/analyser /year = 45% of total cost/risk	
Analyser cell remote monitoring (single cell)	N/A	+ 2 monthly checks	£1,200/yr payback rate	Capital cost
Analyser cell remote monitoring (multi cell)	N/A	+ 3 monthly checks or "on alarm"	£1,500/yr payback rate	Capital cost

Task-based analysis of maintenance requirements of borehole overhaul

DETAILS

Multiple failure modes combined with performance and energy consumption which varies with time and usage made this study a particularly complicated one. The study team, consisting of client executives and consultants from The Woodhouse Partnership, used a single site as the test-bed for APT-MAINTENANCE and an optimum interval strategy.

The client does not undertake any planned maintenance for borehole pumps because the costs of raising the pump and reinstalling it are high and would be incurred whether work was performed on a planned basis or in response to failure. Each time the pump is raised it creates a significant chance of causing reliability problems due to cable damage or other maintenance-related risks.

The test site was a 74kW combined motor/pump unit without a gearbox and operating almost continuously with a flow of 28.3 litres/second to a head of 171 metres. Determining the optimum maintenance interval demanded consideration not just of the direct and penalty costs associated with failure, but of the pump's reliability and efficiency patterns and the life expectancy and capital replacement requirement.

ANALYSIS

APT-MAINTENANCE was used to analyse the multiple variables that contribute to an optimum maintenance interval for borehole pumps. Probability, lifespan and efficiency patterns were range-estimated, in the latter case in lieu of access to the relevant log books at the time of study.

Consideration was given to the contributions made individually by reliability and efficiency factors. These were assessed by a simple 'what if?' analysis using APT-MAINTENANCE where the two elements were switched in or out of the relevant variables. The software can handle such interactions as 'X% would survive to suffer Y% loss in performance."

A series of clear graphs were produced illustrating the reliability and efficiency profiles and the Total Business Impact of different planned maintenance intervals, including and excluding efficiency considerations.

In the course of this project APT-MAINTENANCE demonstrated the influence that key contributing factors have on deciding the optimum policy for maintaining the borehole pumps and quantified the potential cost savings.

APT-MAINTENANCE

APT-MAINTENANCE has been described as the single most important breakthrough in maintenance decision-making in the last 20 years. It finally gives asset managers the tools to base their policies and strategies on logical calculation and valid evidence, rather than subjective judgement.

APT-MAINTENANCE reconstructs the business role of maintenance by creating a link between business tasks and operational benefits such as reliability, performance and equipment failure. The link is displayed in graphical and cost-tabular formats and clearly demonstrates the best compromise and the dependencies upon each influence. APT-MAINTENANCE interprets historical data records captured by maintenance information systems.
APT-MAINTENANCE calculates the best preventive maintenance interval or equipment replacement point and puts numbers to the costs, benefits and risks of alternative maintenance strategies. It is a highly sophisticated yet simple-to-use tool for balancing equipment reliability, performance and efficiency, maintenance costs, downtime impact and lifespan. It identifies optimal cost and risk strategies, tests the sensitivity of weak and range-estimated information and quantifies the impact of constraints or intangibles.

APT-MAINTENANCE justifies what work is required and when and demonstrates the value of historical maintenance records. Using APT-MAINTENANCE it is possible to select optimum combinations of preventive, condition-based and on-failure techniques.

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