Maintaining a balance

Why is it that, when plant can fail so completely and expensively, many organisations still turn their backs on preventive maintenance tools? Brian Wall looks at some options

Above: Eriks' engineers survey for air leaks Right: An Olympus Iplex MX videoscope, used by Veolia to survey packing material in a cooling tower

Given that maintenance costs represent a major portion of total operating expense on most plants, why haven't more organisations taken advantage of predictive maintenance? Can it be that old habits die hard? Is it fear of change? Are initial setup costs so high?

Whatever the impasse, there is no doubt that the range of plant condition monitoring technologies that have made predictive maintenance so highly regarded do work very reliably. They also provide a powerful means to reduce the waste, not only of maintenance budgets on costly emergency repairs, but also of plant downtime, sub-standard product quality and the resulting rework issues.

By how much? Difficult to say, but a recent study conducted in the US concluded that between one third and a half of maintenance budgets (labour and material) are usually wasted. That's particularly the case in run-to-failure operations (widely recognised as being the most expensive – three times that of preventive), but also to a lesser extent with scheduled preventive maintenance. Why? Because of a lack of data to enable plant engineers to pinpoint when and what kind of maintenance is really needed for machinery and plant equipment.

Without hard and fast information, maintenance scheduling remains largely determined by equipment manufacturers' published inspection and maintenance periods, the experience and gut feel of time-served engineers and, you guessed it, failures. And the result: high spare parts inventory costs, high overtime costs, unnecessarily high machine downtime and lower production availability.

"Middle and corporate level management have largely ignored the impact of maintenance on product quality, overall operating costs and, even more importantly, bottom-line profit," suggests Ken West, regional marketing manager with test and measurement giant Fluke (UK). And hence, without a kick from the powers that be, the status quo continues on and on – with maintenance still seen as a cost, rather than a productivity improvement opportunity worth some investment.

"Yet when modern predictive maintenance technologies, such as infrared cameras and vibration monitoring, are used, they provide the means to optimise total plant performance, useful equipment life, and the life cycle costs of the facility and its assets," states West. "CMMSs [computer-based maintenance management systems] provide the historical data and means to use the data derived from that condition monitoring."

So what are the most useful techniques in the condition monitoring toolbox? Vibration analysis, using fixed or portable accelerometer kits for attaching to machines under test, is one major player.

Frequencies and amplitudes of vibration provide excellent insight into everything from bearing condition to lubrication status and alignment problems. And, at the other end, for rectifying problems it reveals, there are also new tools: for example, laser alignment and on-site balancing equipment for rotating components.

"Laser alignment is principally used to correct misaligned couplings, and greatly reduces the risk of damage to bearings and seals, as well as minimising energy losses," comments Ian Smith, technical manager of Eriks Electro-Mechanical Services. "Also, on-site balancing ensures that machines run smoothly, prolonging their useful life and, once again, reducing power consumption."

Thermography and MCM

Another technique seeing huge take-up is infrared thermography – although mostly for plant maintenance surveys, rather than predictive maintenance scheduling. "This can be useful, for example, to reveal a bearing that's running hot or other areas where there is excessive friction in a machine," says Smith. And he rattles off a whole raft of other uses, from pinpointing poor connections in electrical circuits to faulty contactors and circuit breakers, problems with electric motors etc.

Talking of electric motors, specialist Artesis recently launched its MCM (motor condition monitor) system on a card (SoC) for OEMs (original equipment manufacturers). It wants them to integrate its impressive fault diagnosis technology into control equipment for electric motors, generators and alternators, so that users can get automated maintenance alerts.

"The MCM predictive maintenance system is fast becoming a standards-based solution of choice for a wide range of applications in many industries," comments Andy Bates, director at Artesis. Existing users say it works very well, even when applied to equipment with varying speed and load conditions – and that it also detects and diagnoses faults on the driven equipment. They also point out that only one connection is necessary to the motor or generator supply cables, and that there is no requirement for sensors on the equipment itself or any specialist knowledge to interpret the system's findings.

Meanwhile, for compressed air, hydraulic systems and machine bearings, ultrasonic surveys provide another useful tool. "Leakage of air or hydraulic fluid often generates ultrasonic sound, and suitable monitoring equipment can pinpoint the source of the problem quickly and accurately," states Eriks' Smith. "Ultrasonic surveys can also provide valuable data about the condition of chain drives and slow-moving rotating plant, where vibration monitoring might be less revealing."

Finally, no piece on condition monitoring would be complete without mention of acoustic emission sensing (formerly called stresswave analysis), aimed at detecting problems with plant rotating at, say, less than 80rpm, where vibration sensors tend to struggle. Equipment is available to reveal anything from plant degradation trends to fault tree analysis, from the likes of CNES (Corus Northern Engineering Services) and Holroyd Instruments.

As Trevor Holroyd, managing director of Holroyd Instruments, says. "We've made this technology very practical for fitters and maintenance engineers. The sensors are easy to attach close to bearings, whatever the size and type, and we've taken all the complexities out of getting an instant indication of problems, irrespective of the machine." PE

Pointers

- Condition monitoring can lead to a huge cut in plant maintenance costs
- Run-to-failure is typically three times as expensive as preventive maintenance
- Predictive maintenance helps to optimise plant operations most efficiently
- Key technologies: vibration and acoustic emissions monitoring, thermography, ultrasonics and motor condition monitoring
- All these techniques have been developed for use by fitters and technicians

Conditional thinking

Cooling towers are a surprising, but key area for new technology when it comes to maintenance. Unless well maintained, a build-up of potentially hazardous bacteria, including legionella, can occur. Slime, scale and algae can also affect performance, while physical obstructions are often found during checks.

In the past, it has been common practice to remove cooling tower packs for inspection and cleaning, regardless of whether the tower actually needed to be cleaned. However, depending on size, this can take anything from a few hours to two days. During this time, the cooling system is shut down, resulting, in many cases, in closure of the facility.

However, endoscopic inspection can be undertaken in just a few hours and colour digital images obtained and kept for records. Veolia Environmental Services, for example, used an Olympus Iplex MX videoscope, hired from Ashtead Technology Rentals, to survey packing material in one cooling tower at its Ellesmere Port hazardous waste incinerator.

Dave Smith, technical manager at the Veolia incineration plant, says that, as a result, the company was able to ensure the operation was completed as quickly as possible. "We operate the site around the clock and had a short shutdown planned when we had an opportunity to inspect the cooling tower. This was the first time we had used this kind of equipment and we were able to carry out the check with minimum disruption.

"When we have carried out checks in the past without a videoscope, the inspection would take a lot longer. With this equipment, the process is quicker and more efficient."