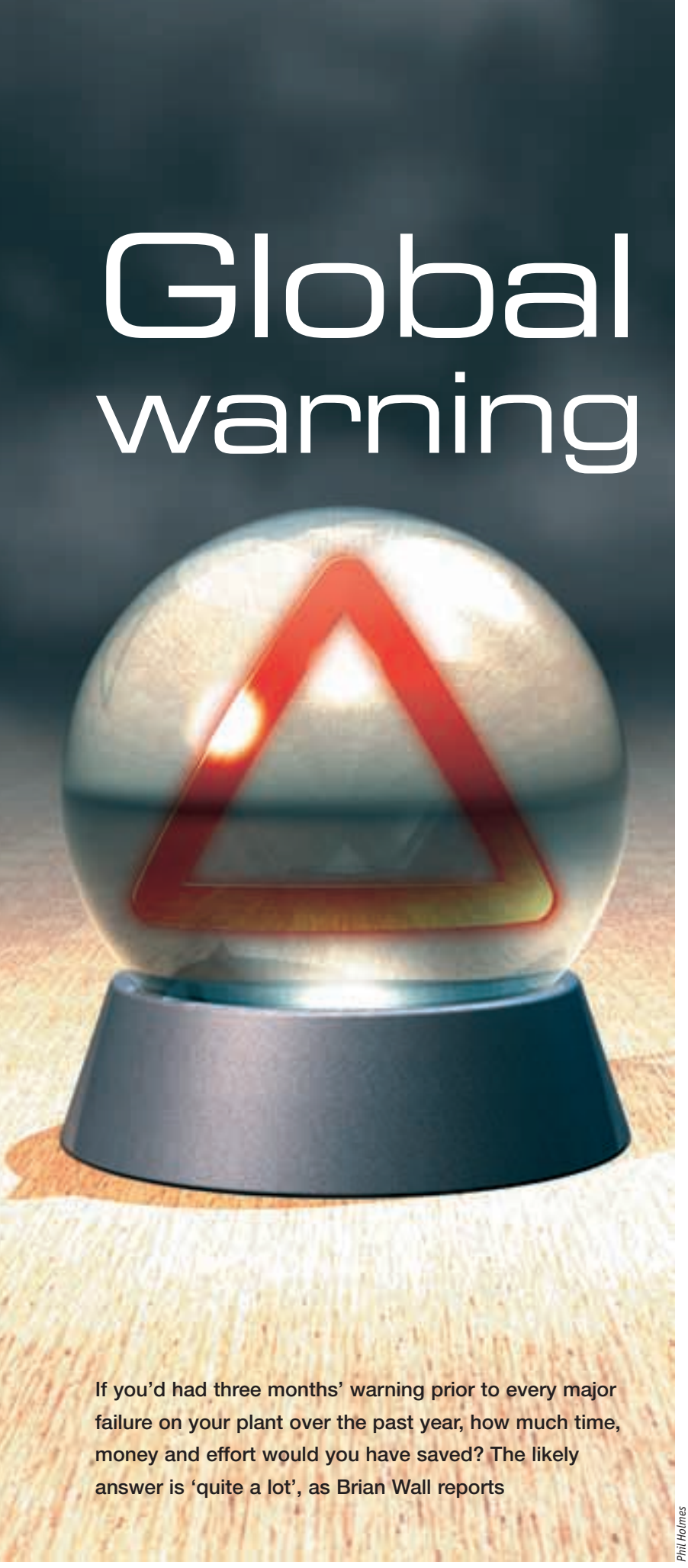
Global warning



If you'd had three months' warning prior to every major failure on your plant over the past year, how much time, money and effort would you have saved? The likely answer is 'quite a lot', as Brian Wall reports

Phil Holmes

For some engineers, questions about how much money could have been saved if a major failure had been predicted, trigger thoughts about the cost of expensive process interruptions and downtime. For others, it's all about avoiding unnecessary plant strip-down and rebuild costs caused by resulting damage. And for others again, the relevant measure relates to degradation in the quality of the product or service provided.

Some will rightly consider the impact of infringements of health and safety regulations, and possible resulting personal injury claims and litigation. Many will also reflect on how predictive maintenance (PM) could cut excessive planned maintenance workloads, not to mention the savings from reduced spares holdings. Whatever the reason, most agree that the potential savings from predictive maintenance can be substantial – particularly when its roles in improving plant efficiencies and reducing rework are included.

So why doesn't everybody do it? Why, despite the fact that reliable predictive maintenance technologies have been available for decades, are an estimated sub-one per cent of the organisations that could benefit, actually using PM? The answer has to do primarily with accepted practice. Predictive maintenance used to be seen as a prudent optional extra and, although attitudes are changing as engineering graduates enter industry, wholesale change is bound to take time.

Costly perception

But it's also about engineers' perceptions of set-up costs and, for some, a concern about PM's real value versus possible dangers when compared to traditional preventive, or even planned maintenance, methods – particularly on some critical, fast-rotating plant in asset-intensive industries.

"For most people, implementing a predictive maintenance programme, through condition monitoring, has just been too expensive and complicated to make practical sense," says Andy Bates, director at electric motor condition monitoring specialist Artesis. And while that may still be the case for much of plant engineering, he points to his company's intelligent, yet ultra-simple-to-use, PM system for motor condition monitoring – a small instrument that provides "complete predictive maintenance cover for a complete electric motor-system, including the driven equipment".

Requiring no special sensors, Artesis' MCM takes its inputs from the supply cables to the electric motor and monitors conditions, using mathematical modelling, he explains. "It can be installed in a motor control cabinet in less than an hour, trains itself in a few days, and provides automated diagnosis of a very wide range of mechanical and electrical faults," says Bates.

Which is why it's appealing not only to traditional

users of predictive maintenance, but also to those in industries such as the utilities, food processing and building services, where uptake of PM has hitherto been low. “They can now enjoy the benefits of predictive maintenance, with a fraction of the effort and cost of earlier approaches,” states Bates.

But there’s more to plant maintenance than worrying about electric motors and driven systems, important though these are. Fortunately, other condition-based PM technologies are also well developed, the classics ranging from lubricant analysis and monitoring to vibration analysis, infrared thermography, ultrasonics, remote visual inspection and acoustic emission monitoring. Between these, the vast majority of plant can be covered.

Which works best where depends on whom you talk to. “While the easiest conditions to monitor are typically temperature and electrical current, neither necessarily provides sufficient warning of the likely failure of machinery,” observes Huw Finney, head of electronic engineering at vibration sensing specialist Monitran, for example. “The earliest indication of a problem tends to be excessive vibration. It’s a form of energy loss, so if a pump, motor, gearbox, drivetrain or servo-valve vibrates more than usual, then either the component is being overloaded or its sub-components – such as bearings and teeth – are probably failing.

Above and left: stripped down plant reveals all its maintenance secrets Page 12: A Bedford Pumps DV.90.23.10 volute unit at Thames Water’s Datchet pumping station, equipped by Monitran for vibration and temperature sensing

Good vibrations

“Monitoring vibration is neither as difficult, nor as costly, as most assume, particularly when you consider that vibration sensors and associated signal conditioning hardware are an extremely cost-effective alternative to failing equipment. Other benefits include reducing or eliminating unscheduled downtime and potentially also the ability to extend service intervals: replacing parts when they start to wear and not just because they are at the end of their expected planned maintenance life.”

In fact, though, predictive maintenance should be thought of as more than just a programme for identifying problems with plant equipment and machinery before they become catastrophic – whatever the combination of techniques used. Practitioners urge treating PM as an integral part of overall plant asset management. A well implemented PM programme engenders what John Sykes, of engineering consultancy AV Technology, describes as a ‘measure-assess-improve’ regime within a plant, establishing the basis for improving reliability, reducing downtime, stepping up productivity, meeting relevant legislation and, ultimately, reducing costs.

“In isolation, PM techniques may have limited effectiveness, so a plant-wide PM programme should be adopted, using as many of the technologies as are appropriate to provide useful data from plant and machinery,” says Sykes. “Exploiting the maximum potential of individual PM techniques is also important. For example, a lubrication monitoring programme can provide a wealth of information and cover aspects including lubrication selection, change-out periods and debris analysis, as well as procurement and recycling.”

Naturally, he advocates outsourcing the predictive maintenance. “Firstly, companies do not have to invest in additional personnel or equipment – but that’s just the start. Outsourcing also gives companies access to a broad range of experience and capabilities from within the consultancy, and the PM programme should be seen as a partnership. Typically, the consultancy sets up the PM

Outsourcing compressed air

Compressed air is often thought of as the fourth utility, because for many companies it is as fundamental as electricity, gas or water. But when it comes to sourcing compressed air, businesses can either choose to purchase a compressor, or take the alternative option of outsourcing all of the air supply – following the utility model – thus avoiding the capital cost.

Says Alec Elliot, service director at CompAir: “Unlike other utilities, compressed air is almost always generated fairly close to the point of use. More often than not, users own and run their own compressed air systems. While this approach gives the benefits of ownership of the equipment, it also brings with it the obligation of regular maintenance and a requirement for up-front purchase of capital plant that may not be directly revenue generating.”

He points to another option, citing a package from CompAir, known as AirWorx, which can remotely monitor users’ new or existing compressed air installations, so that companies can outsource the management of their entire compressed air supply with confidence.

“In effect, CompAir acts as a utility supplier, and is also responsible for all routine and emergency maintenance,” explains Elliot. “CompAir has a range of AirWorx options, from remote management of compressed air plant, through to supplying and owning equipment on a customer’s site, with the customer paying an all-inclusive monthly fee for their air supply.”

Pointers

- Whereas implementing predictive maintenance programmes used to be expensive, that need no longer be the case
- Classic PM technologies include lubricant analysis, vibration monitoring, infrared thermography, ultrasonics, remote visual inspection and acoustic emission monitoring
- Care must be taken with predictive and preventive maintenance programmes, to ensure that critical and/or safety related plant is not compromised

programme with the customer and then, using either suitably trained internal capacity or the outsourcing company, can carry out day-to-day measurements."

Make it easy

Most important, Sykes makes the point that, whereas gathering inspection data has traditionally been labour intensive and time consuming, with engineers transferring information from clipboards to spreadsheets or logbooks, that is no longer the case. AV Technology, for example, has adopted the Maintelligence integrated asset maintenance system, the CMMS (computerised maintenance management system) from Design Maintenance Systems. "AVT has found that automating the inspection process is the most effective method for not only maximising the data, but ensuring optimum buy-in from clients, so strengthening the collective effort involved in reliability issues."

Phil Burge, marketing manager at bearings solutions company SKF, takes a similar view, stating that what is now needed is a holistic solution that takes into account the needs of whole organisations, simultaneously analysing, assessing and managing maintenance issues. Such a programme, he insists, can enable companies to minimise costs and maximise profitability through consistently high levels of uptime and productivity. "Asset efficiency optimisation [AEO], developed by SKF, is an example of this approach, enabling a company to manage its plant assets more effectively, as part of an integrated maintenance strategy," he says.

"In order for plant engineers to identify the root cause of machine failures and proactively plan corrections and upgrades to equipment and maintenance programmes, it is essential that asset information is collected and used effectively," insists Burge. "Capturing and documenting both current and historical data is a key component of a successful asset management programme, and can enable an organisation to balance maximum performance with minimal, timely maintenance to achieve its cost and production goals."

Nowhere is that more the case than in the process industries – and particularly the oil and gas sector. As Anthony Mayall, process control systems manager with Siemens A&D, says: "With estimates showing the cost of downtime running into hundreds of thousands of pounds a day, oil and gas companies are understandably using software as a weapon in the fight to reduce or eliminate unexpected downtime… Many of the most cutting-edge predictive maintenance technologies are being developed here, although some other industries are also recognising the benefits and are being encouraged to take advantage where possible."

But that's still not the case universally. "Unfortunately, some companies still view maintenance purely as a cost, and many are discouraged from investing in predictive maintenance technologies because of the high initial capital investment required," Mayall explains. Which is odd: best estimates reveal that maintenance is the largest single operating expenditure on process plant, costing as much as 12.5% of revenue and sometimes exceeding profit margins. "It is surprising that more industries are not implementing planned maintenance programmes," comments Mayall. PE

Disasters waiting to happen?

As maintenance departments strive to keep costs under control, they could be walking into serious problems, warns Centriquip, the UK's largest manufacturer of decanter centrifuges. Centriquip is concerned that apparent cost savings from predictive maintenance might not live up to expectations. Furthermore, the company says it is concerned that using the approach exclusively could lead to disaster, particularly where large, fast-rotating plant is concerned.

The problem, as Neil Lacey, service manager for Centriquip, sees it, comes down to certainty. If something is critical, either to production or safety, engineers need that certainty, he insists, and predictive maintenance is based only on probability. "If the consequences of a failure are manageable, then engineers can afford to be a little cavalier with condition monitoring," says Lacey. "If failure means disaster, a more cautious approach might be more appropriate."

It's a moot point: at a general level, his argument fails to take account of the potential for uncertainties with equipment components themselves, not to mention those resulting inadvertently from the planned and preventive maintenance work itself. Problems caused by engineering in what turns out to have been needless planned maintenance are well documented in several industries, especially in the process sector.

Nevertheless, Lacey is worried that any increase in the use of condition-based monitoring – and particularly of endoscopes for checking inside decanter centrifuges – might be leading users into danger. Endoscopes cannot see some of the critical areas in a decanter, he points out. Likewise, he insists, vibration monitors cannot always predict the catastrophic failure of a bearing.

Decanter centrifuge drums can weigh many tonnes and rotate at speeds up to 3,000rpm. "If a bearing disintegrates at full speed, you don't want to be in the same building. We prefer to replace parts when they come to the end of their service life, not push them to the limit. Although we use endoscopes to check port wear, an endoscope cannot check a bearing or the condition of flight tips. For that, we need to perform a scheduled strip-down. That way, we know we are safe."

Centriquip managing director Richard Montanaro worries also that the benefits of condition monitoring might be being overstated. "The idea of running components until they show signs of wear is fine, but no company is going to risk a disaster. I suspect machines will be stripped down and parts replaced just as often as with a preventive maintenance programme."