Proactive maintenance, the nervous system of the Saiccor mill

Sappi Saiccor is not a paper mill. The Umkomaas mill was built in 1952 and commissioned in 1954 as the South African Cellulose Corporation. “While our product does come from trees, we make dissolving pulp or chemical cellulose, which is not used to make paper, its main use is the manufacture of viscose fibre which is used in textiles for the clothing industry,” says Tekete.

The end uses of chemical cellulose include: viscose and lyocell fibres used in the textile industry; moulding powders; cellophane; cellulose acetate for filter tow; and micro crystalline cellulose and ethers for pharmaceutical and food applications.

Almost 100% of the pulp produced is exported to countries in Europe, the Americas and Asia. Unlike many synthetic raw materials, the product supplied by Sappi Saiccor is produced from a natural and renewable resource. The mill’s timber consumption is comprised primarily of Eucalyptus hardwoods. These fast-growing trees are grown in relatively close proximity to the mill, which contributes to Sappi Saiccor’s position as a low-cost producer of chemical cellulose.

Ephraim Tekete is the reliability area engineer for the Saiccor mill and runs the condition monitoring department, responsible for the care of every piece of equipment used in every process.

“In principle, this business is about using machines to process wood into dissolving pulp. The condition monitoring department is responsible for reliability across the plant. We are here to support the maintenance department in maximising plant availability by finding the root cause of problems, preventing secondary failure and providing plant management with quality information in order to make informed decisions,” he explains.

At the start of the Sappi Saiccor process, debarked wood is brought in, either by road or by rail. The wood is first chipped and from there it is ‘cooked’ in a digester: “Wood predominantly consists of cellulose fibre and lignin, which binds it. The ‘cooking’ process removes the lignin without destroying the cellulose fibres,” Tekete explains.

“We can produce around 2 200 t of dissolving pulp per day. To do this, we need a vast number of machines to be working across the full range of mechanical equipment imaginable: motors; fans; compressors; rolls; pumps; valves; hydraulic cylinders; steam traps; and much more. Our target in this department is to monitor all equipment at least once a month and more often on process-critical machinery,” he continues. “On the vibration side alone, we monitor about 12 000 points every month.”

Tekete’s condition monitoring department is a service to the mill’s engineering maintenance department. Conditioning monitoring’s role is the primary...
goes to everybody at the mill, from the MD down. If this index is high it shows that the general state of health of the whole mill has deteriorated.\[...\]healthcare of maintenance engineering. “Our job is to ensure that we keep our asset base healthy within the company. But because our human senses are limited, we need the assistance of the tools and technologies on offer today: vibration monitors; ultrasound detectors; infrared thermography; oil analysis; thickness and hardness testers; laser alignment tools; field balancing; alloy analysis; electronic nip (E-nip) analysis; motor circuit analysis; endoscopy; and many more.”

Vibration analysis – to monitor bearings and identify imminent failure risks – is a big part of the department’s activity. A formalised monthly approach has been adopted for collecting data from every critical machine in every plant of the mill. Trained maintenance technicians from each plant in the mill come to the condition monitoring department based on a published monthly schedule to pick up vibration monitoring equipment. The monitors are pre-programmed with the route that the technician needs to follow around the machinery of his plant. On his return, the data collected is analysed by the condition monitoring team and used to identify and report on the state of health of the plant.

In keeping with the healthcare theme, Tekete opens a typical ICU report for the entire mill. “We produce a weekly ICU report to update engineering departments on the status of machines in need of repair and those recently repaired. We have very well structured rules for putting equipment into ICU, and for managing the process of returning ailing machinery to full health,” he points out. “We use the information to identify hot spots so that management can make informed decisions about what action to take. A fan might be out of balance, for example, but it can’t be repaired immediately because of disruption to production. The minute we detect a vibration level above a threshold, we put the fan into ICU and a set of rules automatically kicks in. We will take readings twice a day or week, for example, depending on the severity, where everybody involved tries to make plans around this machine so that we can repair it at the first possible opportunity.”

From all of the condition monitoring data collected in a month, the condition monitoring team compiles a summary report called a ‘condition monitoring dashboard’ that goes to everybody at the mill, “We use the accumulated data to come up with a single index to represent the overall health of the Sappi Saiccor mill. If this index is high, it indicates a general deterioration in the state of health of the whole mill.”

The mill vibration targets have recently been lowered to 2,4 mm/sec PK. “This is displayed on the dashboard overview, and anyone in the organisation can drill down on the reporting system to find exactly where the problems are. Since this is available to everyone, no maintenance technician turns a blind eye to a developing problem. Delivery is critical. Everyone does whatever it takes to make sure that the problems are resolved.”

Tekete splits condition monitoring into two broad categories, proactive and reactive. “Vibration monitors only pick up mechanical movement that is already happening. By the time you are able to measure a vibration on a bearing, there is already a problem. Vibration analysis and infrared thermography are reactive techniques. They help us to manage a failure that is already happening and to minimise its impact,” he explains. “But ultrasound, which can measure friction long before wear problems emerge, gives you a much earlier warning. Oil analysis, ultrasound, NDT, laser alignment, alloy analysis and E-nip impression – all of these are proactive tools. They help us to take action to prevent failure before it happens,” he adds.

“If I align a coupling along a centreline, I minimise energy wasted because of misalignment and I prevent failure in advance, ie, proactively, and the life of the machine is extended. As with balancing, if I balance a fan immediately, then I proactively fix the problem. If I leave it unbalanced, then premature failure is likely to occur.

“Failure reveals itself in many ways, and no one instrument or technology has got all that it takes to monitor equipment health. We need to use and extend all of our senses to see, hear and feel what is happening to give as complete a picture as possible.”

Tekete lifts out ultrasound in particular as a technique that has enabled improved levels of performance and reliability across the mill. “A few years back, the acid plant was having difficulty getting the liquor strength right. No matter how much sulphur it burned, the concentration of the sulphuric acid remained too weak – and this was an ongoing problem. The condition monitoring team was asked to conduct an ultrasound survey. Several vacuum leaks were identified across the section of the plant. Air was being sucked into the SO$_2$ stream and therefore diluting its concentration. Once the leaks were repaired, there was a complete

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The monthly ‘condition monitoring dashboard’ summarises the overall state of health of all the equipment in the plant. This report goes to everybody at the mill, from the MD down. If this index is high it shows that the general state of health of the whole mill has deteriorated.
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turnaround of the acid plant and of the productivity of the entire mill,” Tekete informs *MechTech*. “We now do an ultrasound survey once every three months to identify and repair leaks, and we have never had a problem since,” he says. “This was a lesson for the whole of Sappi Saiccor, that maintenance procedures matter, and simple things can make a considerable difference to overall productivity.”

The proactive maintenance department now uses ultrasound to do routine surveys for steam and air leaks across the mill.

This is to ensure that all of the steam traps are functioning correctly. Steam traps filter out condensate and allow only dry steam to pass through. If a trap fails then condensate can either be passed into the steam lines, which drops the temperature and efficiency of the whole system, or they can be porting steam directly to the drain, which represents a substantial waste of an expensive energy resource.

“Since ultrasound implementation in the mill, many non-functioning defective valves have been identified and replaced,” says Tekete. Also, scheduled air leak detection surveys have resulted in huge energy savings from the mill’s compressors. “Sappi is committed to energy conservation and carbon emission reduction and the return on investment for ultrasound equipment is realised in a few months. In the long term, the savings far outweigh the initial outlay,” he adds.

“We have also invested in an alloy testing machine, for example, so that we can check the material composition of some of our critical tanks, fans and valves. The cost of the instrument was over R300 000, but this has brought substantial savings as well as increasing the level of quality control.”

But by far the greatest benefit of Sappi Saiccor’s proactive maintenance regime is the reduction in downtime. Unscheduled downtime at any one plant costs millions per day in lost production and avoidable repairs. “We provide quality information so that our management can make informed decisions,” says Tekete.

“It is only by continuously monitoring the state of health of your assets that you can know which decisions are the best,” he concludes, “and our company-wide proactive maintenance effort is having a major effect on improving decision-making and, therefore, plant availability and business profitability at Sappi Saiccor.”