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#### This month:

Advanced local solutions for mine affected water

Modular RCs for chromite tailings beneficiation

Oxygen: an essential ingredient for stainless passivation

Keyless access for better protection of equipment enclosures

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### **Commitment and optimism in Africa**

#### Peter Middleton







Scan QR code to view the video.

n a video interview earlier this month with Cummins Africa CEO, Thierry Pimi, I asked him why he is so upbeat about Africa's potential. "Africa," he responds, "is the latest frontier of the emerging markets and represents the largest untapped business opportunity for Cummins' portfolio. Whether talking about construction or infrastructure development or power generation, we see Africa as the place to build capacity so that we can pursue growth."

When asked about currently prevailing low growth, he cites the telecoms industry's experience where, unlike mature markets, "growth was stratospheric", leapfrogging the need for traditional telephone lines. By seeking out modern development alternatives in Africa, such as microgrid power solutions, rapid growth potential becomes possible.

Cummins is also a premium brand, an engine choice for numerous OEM equipment brands, all of them world leaders in their own right. To succeed with premium brand capital goods in Africa, one has to have a strong reliability focus. "Machines using our engines have to operate over many years for the maximum possible number of cycles," Pimi notes, which makes service a priority, no matter where in Africa the machinery is used.

But service comes in many different forms, from routine field service to breakdown repairs in small local workshops or it could be complete engine overhauls in facilities such as Cummins' Master Rebuild Centre. "Our ability to capture growth in Africa depends first on our ability to build the necessary service capacity on the ground," Pimi believes.

Cummins' Master Rebuild Centre (MRC) in Kelvin View, Johannesburg is very like an engine manufacturing plant, because of the complexity of the engines and the comprehensiveness of the rebuilds. Cummins brings in used, high-horsepower, end-of-life engines for rebuilding at the MRC – 19 litres and above after 20 to 25 000 hours. Each engine is stripped down, all of the dynamic components are changed and the engine is rebuilt on the same re-machined block – "and we guarantee the engine as a zero-hour rebuild capable of performing as well and for as long as a brand new engine."

After rebuilding, every engine is dyno tested and delivered back to customers, and this service is available all over Southern Africa from the South African Regional Distribution Centre.

Getting engines across borders, however, is a logistics challenge. Pimi notes that it is impractical

to have regional hubs in every country and it would really help if free trade zones could be established, which are effectively borderless with respect to the movement of goods.

This would help to reduce lead times, grow markets networks and create more jobs. Businesses wishing to expand in Africa would all benefit from regional Government cooperation to facilitate easier movement of goods between countries.

In Europe, Pimi says, there are 27 countries with a single border and if one compared the time it would take for a truck to travel from Lusaka to Johannesburg to the same truck travelling between Vienna and Madrid, approximately the same distance, the time and the associated logistics costs are much more favourable in Europe – unnecessarily so.

Cummins also recently broke ground on its new consolidated campus for Southern Africa in Waterfall, which is mooted to become the CBD of Gauteng. The new Cummins Southern Africa Regional Offices (CSARO) will include the Regional Distribution Centre, the Africa Learning Academy; an expanded Master Rebuild Centre and the Cummins Gauteng Operations Centre.

The investment? "Over a ten-year period, we will be investing R300-million," Pimi responds. "In Africa we take a long-term view and this is a demonstration of commitment, which we are sure will bring loyalty and the certainty of more business."

I found it heartening to listen to an African with such a positive yet measured perspective. The ongoing damage done by poor leadership has been overwhelming in recent times, and few of us can see past the ANC's December Conference, the risk of ongoing graft and the prospects of further downgrades by the ratings agencies.

"Look beyond recent shocks and the opportunities are huge," I read in a year-old report entitled Africa's future? There's a case for optimism published by the Cape Times. It cited the McKinsey Global Institute (MGI) research findings that consumption by African households is expected to grow from US\$1.4-trillion in 2015 to \$2.1-trillion in 2025, with business spending rising from \$2.6- to \$3.5-trillion over the same period. That puts the opportunity value of Africa's markets at \$5.6-trillion by 2025.

In the long term, the wheel will turn, leaders will change and new opportunities will emerge. Thank you, Thierry Pimi, for reminding me of that.



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Sustainable Productivity



### **Engineering excellence from Process Industries** Think globally, act locally



rocess Industries is one of thyssenkrupp Industrial Solutions' six global business lines and, from its Sunninghill offices in Gauteng, the company services South Africa's process plant needs through thyssenkrupp Industrial Solutions SA (TKISSA) and, through its matrix structure, installs plants across sub-Saharan Africa.

"There are a number of business units (BUs) within Process Industries," Eve explains. "From the Fertilisers (FER) BU, we develop plants for the manufacture of ammonia- and urea-based fertilisers using proprietary technology, as well as phosphatics under license.

"Through our Electrolysis and Polymers (ELP) BU we offer proprietary Chlor-Alkali and HCl technologies, which are widely used to manufacture chlorine, hydrochloric acid and caustics, and the Industrial Specialities (SPC) BU has a broad project-driven chemical and engineering design focus, centred out of India where a huge amount of greenfield plant work is being done," he tells *MechChem Africa*.

"Globally, we acquired a company called Edeleanu, a specialist in clean fuel technology for refineries. Through SPC, we have completed a lot of work in Europe, converting refineries to meet Euro 5 and Euro 6 emissions standards, and we have done similar design work on improved technologies in Secunda to remove sulphur and benzene," Eve adds.

Currently in South Africa, however, brownfield work dominates: "We provide spares and equipment replacements for our proprietary plants and we do revamps, refurbishments, upgrades, optimisations and expansions – and this work is done under the auspices of *MechChem Africa* visits thyssenkrupp Industrial Solutions South Africa and talks to Bruce Bassett, senior manager for Special Projects, and Process Industries GM, Neville Eve.

our Services BU. This is a big proportion of our current business. Currently, few if any companies in our industry are expanding and clients are sweating assets and extending plant lifecycles," he says.

Describing how the organisation is run, Eve says that thyssenkrupp is a matrix organisation. "The technologies we represent are centred in Dortmund in Germany, which takes responsibility for developing saleable technology products that can be engineered and sold from the regional offices around the world. Germany also provides technical and engineering design support for those involved in specific projects and assists in completing the detailed plant designs where the resource demands exceed local capacity.

"The local offices, such as TKISSA, take responsibility for sales and servicing of the processes and technologies developed in Germany – our products are conceived in Germany and sold locally," he informs *MechChem Africa*.

"In South Africa, for example, we are responsible for the end-user interests across sub-Saharan Africa. As well as the Process Industries BUs, Industrial Solutions' other business lines include: Materials Handling; Mining, Minerals Processing; Power; and Cement – and strong Service business line ensures long-term support of our customers in the various industries.

"Each business line has its own management and structure, but they are all integrated into a single legal entity in South Africa," Eve explains.

In South Africa, thyssenkrupp has been involved in the development of South Africa's chemical plant capacity for nearly 60 years. "We have an installed base of some 35 plants in South Africa, many of which are integrated into the plant complexes of major chemical industry players such as Sasol, Omnia, NCP and AEL to name a few," he tells *MechChem Africa*.

The Process Industries Business Line specialises in plants that require gases as feedstock; "hence our involvement in ammonia-and urea-based fertilisers and polymers, which are all processed from gas as a feedstock."

A recent success for thyssenkrupp Process Solutions in South Africa has been adding the capability for modular

design, which has been implemented on the Coal Tar Filtration plant currently being constructed by Sasol in Secunda. "This plant was originally designed as a purely 'stick-build' onsite construction, but the price of onsite construction proved excessive. In collaboration with Jacobs Engineering to find a cheaper way, the engineers came up the modularised approach and we re-designed the plant accordingly.

"The new modular design enables about 60% of the plant – primarily the units not directly part of the filter press system – to be built offsite," Eve says.

"Coal tar filtration takes the harmful volatiles, organics and heavy metals out of the syngas process stream, creating a cake that can then be safely incinerated. This improves the efficiency and reduces the environmental impact of coal to gas process – and this is a world first from our proudly South African leaders in this technology," he notes.

"While we are very proud of our contribution to this project, modularisation is not a panacea," Eve cautions, "because it raises logistics challenges and costs" – massive cranes are required, for example. "For the Coal Tar Filtration plant, it was the piping density that makes stick build construction very difficult, so it was more efficient to construct modules in a workshop. But every project is unique and the approach always needs to be backed by a thorough appropriate methodology and best practice analysis," he advises.

Process Industries has expanded its offering to also include less prestigious work in the brownfield environment. "We have taken on several new customers, such as Engen's refinery in Durban, for example, where we are assisting our client in its drive for environmental compliance on emissions; cost effectively leveraging our previous design





**Above:** The Process Industries Business Line specialises in plants that require gases as feedstock. **Right:** The process for producing urea fertilisers is one of Process Industries' flagship technologies. "urea fertiliser is made by combining ammonia with  $CO_2$  using a Benfield column," explains Bassett.

work on the NMPP Pipeline for Transnet Pipelines in designing the tie-in piping work for Vopak Terminals into Transnet Pipeline's Heidelberg terminal; and, for the RAM Group (Sasol, Omnia and AEL), we have replaced the ammonia import lines and are upgrading the ammonia vapour recovery plant at Richard's Bay," Eve says.

Imported ammonia is transferred off tankers via a 2.1 km pipeline into the Bidvest Terminal at Richard's Bay. The ammonia vapour is compressed and put back into the liquid stream. "We are engineering the compressor plant, which is the heart of the ammonia vapour recovery system," he explains.

"We can confidently undertake any onshore engineering that involves moving or processing of chemicals and or hydrocarbons in liquid or gaseous states – filtration, gasification/degasification, compression/expansion – we have these and many more capabilities," Eve assures.

#### Urea, ammonia and Chlor-Alkali processes

The process for producing urea fertilisers is one of Process Industries' flagship technologies. "Urea fertiliser is made by combining ammonia with CO<sub>2</sub>," says Bassett. "In an ammonia plant, a Benfield column removes the CO<sub>2</sub> and then, together with the ammonia, licensed Stamicarbon technology is used make the urea (H<sub>2</sub>N)<sub>2</sub>CO. Our speciality lies in the fluidised bed granulator, a technology originally developed by Uhde," he adds.

"Ammonia (NH $_3$ ) is a key feedstock for our fertiliser technology. To get the hydrogen, our plants typically start with a reformer, which

produces hydrogen from natural gas  $(CH_4)$ . Then, for the nitrogen, we need a cryogenic air separation unit (ASU).

"Fertiliser product lines also produce nitric acid (HNO<sub>3</sub>), by combusting ammonia (NH<sub>3</sub>) with air in a reactor with platinum catalysts. This can then be recombined with ammonia to form ammonium nitrate (NH<sub>4</sub>NO<sub>3</sub>), the key ingredient for explosives. In a prilling tower, we make the porous prills of NH<sub>4</sub>NO<sub>3</sub> that are then used to make explosives. These are granules made by spraying ammonium nitrate slurry at a high concentration from the top of the tower, while a counter current of air rises to dry droplet surfaces to create granules," Bassett explains.

Ammonium nitrate is also combined with limestone to make a fertiliser called `LAN: Limestone Ammonium Nitrate. "We make plants for all of these fertiliser products," he reveals.

Moving onto the proprietary chlorinebased processes, Bassett says that thyssenkrupp Process Industries offers different technologies through its ELP BU. "Our Chlor-Alkali technology is electrolysis-based and it is used to make chlorine and caustic (NaOH) from brine (NaCI).

"Electrolysers have negative cathodes and positive anodes. When an electric current flows, hydrogen comes off at the cathode while chlorine comes off at the anode. In addition, sodium ions migrate across the proprietary membrane towards the negative cathode, where a caustic solution is formed (NaOH) as a second product of the process," he explains.

"We offer big plants as well as modular

plants that can produce 15 to 45 t/day of chlorine. For every ton of chlorine produced, 1.1 t of caustic is available. In Africa, due to the logistics cost of shipping acid, modular chlorine plant makes so much sense. They can be used to make hydrochloric acid (HCI) via a burner, as well as to produce hypochlorite (NaOCI) for use in a host of applications, such as water purification," he says, adding "the business case for manufacture HCI in South Africa and exporting is not good, since a significant percentage of the shipping weight is water."

Process Industries' other core specialty is polymers: "From gas feedstocks such as ethylene and propylene, we build the plants that produce polyethylene and polypropylene. To make low density polyethylene, for example, very high pressures (3 000 bar) are required. We use what I call 'gun-barrel metal' – very thick walled tubes – in a serpentine arrangement inside blast proof walls able to contain any potential explosion.

"Our high-pressure division in Hagen, Germany, makes these tubular reactors along with the high pressure pumping systems required," Bassett notes.

"We see growing potential for fertiliser and Chlor-Alkali plants across Africa, and these can be easily installed locally based on sound business cases.

"Urea, in particular, is an ideal fertiliser for Africa, because all that is needed is an ammonia plant with a urea plant behind it – and these custom-built plants can cost-effectively produce 600 t/day of urea for better servicing the local agricultural needs of African countries," Bassett concludes.



### Attainable Region Theory: An introduction to choosing an optimal reactor

by David Ming et al

On 12 October, a new book for chemical and plant engineers on attainable regions was launched, a theory that principal author, David Ming, outlines below.

uppose you (an engineer) and a colleague (a pastry chef) are supplied eggs, sugar, flour, vanilla and jam, and asked to each bake a Swiss roll. Although it is almost certain that your friend, with his training and experience, will produce a better tasting result than yours, how does one know with certainty that it is truly the best?

Although we don't think of it in this way, process design faces a similar problem: given set of raw materials and design constraints, how do we produce desired products with the least waste, lowest cost, highest purity, etc? Often, training and experience is crucial in separating a good design from a bad one, but given one good design, how do we know that there are no other superior designs?

As engineers we might not even ask this question, yet understanding where you stand in terms of global performance may often affect future decisions. For instance, would



Published by Wiley-Blackwell, the book is co-authored by chemical engineering stalwarts, David Glasser, Diane Hildebrandt, Ben Glasser and Matthew Metzger.





Ming's attainable theory work comes out of research done at the Wits School of Chemical and Metallurgical Engineering.

you try to optimise your design if you knew it was 50% of the absolute best or 99.9% of the absolute best? Asking the question 'how do we know that we are the best' is ultimately the idea behind performance targeting.

For chemical reactors, formulating even a single design might be a challenge in itself. Why select a single reactor when multiple reactors could be arranged to work together as a reactor network? The optimal design of a network of chemical reactors for a given duty is called reactor network synthesis (or RNS). A common approach to the RNS problem is to create a very large, generalised, reactor network, called a reactor superstructure, where the optimal answer is a subset of the superstructure. But even the most sophisticated superstructures are subject to performance targeting, because there exist infinite numbers of superstructure designs.

Attainable Region (AR) theory seeks to help understand both the performance targeting and RNS problems. The AR is the collection of all possible outputs for all possible reactor designs, even those that we have not yet imagined. This is achieved by interpreting chemical processes as geometric objects that define a region of achievability without having to explicitly enumerate all possible design combinations.

By disassociating the physical equipment from what is achievable, one can target an achievable state and then work backwards to find the physical equipment required to achieve that state. Consequently, the resulting design from this approach is then more appropriate, as we know how well it performs in terms of the global pool of designs.

Ultimately, it is important to appreciate that you cannot fix what you don't know. And although we may never know who makes the best Swiss roll, it is possible to know what the best chemical reactor network looks like. Design is understandably difficult, but great designs first come from understanding where you stand.

To learn more about AR theory, see the AR theory textbook ('Attainable Region Theory: An Introduction to Choosing an Optimal Reactor'), and visit the AR website.

www.attainableregions.com

#### SAICHE KZN branch news

The KwaZulu-Natal branch (SAIChE KZN) hosted its annual research day on the 30th of August 2017 in the Engineering building of the University of KwaZulu-Natal. Six researchers from local universities and universities of technology participated in the event, delivering talks on waste resource valorisation, energy recovery and management, prediction of phase equilibria and cogeneration. The participants also presented posters on their topics during a mid-programme poster session and refreshment break.

This year, five of the six presenters were women researchers. The overall winner was Grace Kakonke, a researcher at the CSIR Forestry and Forest Products Research Centre. Her presentation was entitled 'Valorisation of chicken feathers: Needle punched superabsorbent nonwoven fabric for diaper production'. Her talk stimulated a good discussion amongst the attendees and was very well received.

In second place was Dakalo Ndou, also

from the CSIR, who presented work on the transfer hydrogenation of acetophenone using copper complexes, a study that she undertook at the University of the Witswatersrand.

Matthew Lasich, a researcher and lecturer from the Mangosuthu University of Technology, came third overall for his work on the prediction of gas hydrate equilibria.

The judges for the half-day event, Dr Suren Moodley and Dr Babatunde Bakare, were impressed with all the participants and scored them highly in both the oral and poster presentations.

Prof Anne Stark, SMRI Sugarcane Biorefinery Research Chair at UKZN and chair for the event, thanked all attendees for supporting this edition of the Research Day, adding that she was encouraged by the number of women researchers participating.

Members of the SAIChE KZN branch committee participated in the Ethekwini STEM Schools outreach programme, held at the University of KwaZulu-Natal Edgewood campus earlier this year. The committee members, assisted by postgraduate students, provided information to grade 11 and 12 learners from Quintile 1-3 schools on the chemical engineering discipline, the role of SAIChE and the opportunities for employment and training.

Pupils that visited the exhibition stand greatly appreciated the bursary information that was provided and were interested to learn more about our exciting profession.

The KZN branch also hosted a chemical engineering schools project as part of the University of KwaZulu-Natal Winter School programme in July. The project involved the development of a simple gas-powered boat using plastic water bottles, effervescent tablets and plastic tubing. School pupils were required to optimise their boat designs, carry out test runs and eventually race their creations in water-filled race lanes in time and distance trials.

An enterprising group dubbed team 'Titanic', literally blew the competition out of the water by securing first place in both the distance and time trails.  $\Box$ 



Left: Participants and attendees at the SAIChE KZN Research Day 2017. **Right:** Postgraduate student assistants provided information about the Ethekwini STEM Schools outreach programme.

#### Wits wins beer-brewing competition

The University of Witwatersrand has been named the overall winner of the 10<sup>th</sup> Annual SAB Intervarsity Beer Brewing Championship, 2017. Wits' Big Petr Pils Lager claimed the top honour of the Castle Lager Best Bru Award and the Carling Black Label Best Lager.

An independent panel of expert industry judges noted that the team's winning entry was: "A very drinkable style for South Africa's warm weather conditions. It was well balanced, using the right amount of hops and good brewing procedures were employed for a style that requires precision in brewing technique."

The Best Cider was awarded to Cape Peninsula University of Technology (Apple Adventure Cider); the Best Speciality Beer went to University of Pretoria (Cloudy with a Chance of Ginger); Best Winter Warmer was awarded to University of Johannesburg (British Strong Ale); and the Best Label Design went to Central University of Technology Free State (Yet Another Lemon Tree).

Judges commented that the top beers were all comparable to any of the best home brewing competition. Overall, the quality of entries was improving all the time.

CPUT's Klopse Lager, UP's Dark Deer; UKZN's House Kev



Wits' Big Petr Pils Lager claimed the top honour of the Castle Lager Best Bru Award and the Carling Black Label Best Lager.

Blackberry Dark Mild; UCT's Raspberry Ripple; UKZN's House James Sweet Sorghum Stout; UCT's Brewhouse Ryot Pale Ale; NWU's Mistress; UKZN's Winter Saison; and the labels for the University of the Free State's Bundesadler and Wee Heavyness took the second and third place awards in their respective categories.



### **FILTECH 2018: Targeted solutions** for filtration and separation tasks

FILTECH 2018, the largest filtration event in the world, takes place from 13 to 15 March 2018 in the German city of Cologne, which will be filled with people passionate about the filtration, separation and related sectors. The associated FILTECH 2018 Conference will again feature the latest advances and techniques in liquid/solid and gas/particle separation – dust, gas and air filtration. The conference offers a three-day opportunity to glean in-depth technology knowledge and practical know-how.

ilters clean the air we breathe and purify the water we drink. Filtration in the food and beverage industry removes impurities and extends the shelf life of the products we consume. Medical filters can safeguard sterile environments such as operating rooms by keeping out harmful pathogens and bacteria. Filters in vehicles enhance fuel efficiency and extend engine life. Effective filtration solutions make companies in all sectors more productive, reducing costs and improving efficiencies.

These needs, along with more stringent government regulations and environmental concerns to curb rising pollution levels, have put the global filtration market on a path of continued growth.

As per a recent report from Grand View Research, the global filtration market is expected to be valued at over US\$110.82-billion by 2024, this based on compound annual growth rate predictions of 6.4% from 2016 to 2024. In addition, air filtration systems used in various industries, manufacturing facilities and automobiles is projected to further lift growth in the market through 2024, the report states.

Development is also supported by the growing importance of indoor air quality

(IAQ). The growth of the fluid filtration market, on the other hand, is driven by macro trends: increasing population, depletion of water resources and ground and surface water contamination, which lead to the need for



With more than 380 exhibitors and 12 000 visitors, the FILTECH Show is the largest filtration show in the world.

highly engineered water treatment processes.

The filtration industry will continue to grow to meet the ever increasing needs in support of global trends, including the environmental crisis; more efficiency in manufacturing to meet the need for higher productivity and lower cost; and a shifting culture towards better air quality in our cities.

FILTECH is the largest and most important worldwide filtration event and is made up of two components: the Show and a Conference. The FILTECH Show is the largest filtration show in the world and a must for all those concerned with purchasing, designing, improving, selling or researching filtration and separation equipment and services.

With more than 380 exhibitors and 12 000 visitors, it provides an international platform for finding solutions across all industry sectors. In 2016 more than 31% of all foreign guests came from overseas and, in total, 76 nations were represented.

#### The conference, plenary and keynote lectures

FILTECH 2018 Conference will feature more than 180 presentations from specialists from 30 different countries. The exciting programme gives a representative cross-section of the different procedures and appliances of separation technology as well as across the industry's application needs, from the preparation of mineral raw materials, the chemistry, environmental technology and water purification and through to the high purity requirements of the pharmacy and biotechnology sectors.

The latest results from basic research, innovative equipment-based solutions and procedures will also be presented. Delegates from industry as well as researchers are sure to benefit from the availability of high-level knowledge transfer and information sharing.

One plenary and three keynote lectures by leading filtration experts will kick start the

FILTECH Conference on Tuesday, March 13.

In the morning, Roger Ben Aïm, the scientific advisor for IFTS in France, will present the Plenary Lecture on 'Pore size characterisation of porous media: A true need but do we know what we are measuring?'

"Characterising the porous structure of media by its 'pore size' has always been a need for the industrialists: hydro geologists for the qualification of aquifers; engineers in the oil industry for reservoirs; pharmacologists for the controlled release of drugs; biologists for bio membranes, which characterise all living systems from cell membranes to skin; and the liquid and gas filtration industry specialists, for their sand, cartridge and membrane filters," Aïm explains.

Over the years, pushed by these different industries, different pore size characterisation methods have been developed for different applications, leading to the need for clarifying the differences and similarities.

Keynote Lecture 1 (K1) will open Day 1's afternoon session and will be presented by Christine Sun of the American Filtration Society on the 'Filter media market, technologies and trends'. "Filter media technology has become the core of today's advanced filtration technologies, with non-woven, membrane, ceramic, metal, activated carbon, nano-fibre and other porous materials all commonly used. In this talk, we will review the global filter media markets and their applications in various air and liquid filtration. The technologies, emerging challenges and trends for future developments will also be discussed," says Sun.

At 14:45, Prof Dr Ioannis Nicolaou of NIKIFOS Ltd in Cyprus will present K2 on 'Cake forming filtration of suspensions – from the theory-based analysis of test data to the reliable performance prediction of filters and filter centrifuges'.

"The operation of filters and filter centrifuges – such as Nutsche filters; filter presses; belt, drum, disc and pan filters; candle and pressure leaf filters; vertical basket, peeler and inverting filter centrifuges – all involves cake forming filtration of suspensions with the optional steps of cake deliquoring and cake washing," says Nicolaou in introducing his paper.

K3, The third Keynote Lecture for Tuesday, March 13, is on the 'Principle and implementation of filter media designs for liquid and gas filtration applications', to be presented by Prof Dr Kyung-Ju Choi of Clean & Science in Korea.

Multi-layer composites with nano-sized filaments seem to be the recent trend throughout the filtration industry. The filters with multi-layered nonwoven material generally increase the dust-holding capacity if designed properly. "I will detail the basic methods of manufacturing multi-layer media in which the basic principles of fluid mechanics have been applied. These principles have been extended to design the filter media with multi-layer material to maximise filter performance.

"By utilising the multi-layer design equations developed for each individual layer using known pore properties, it is possible to design the multi-layer microfiltration/ultrafiltration media with a precisely tailored pore size distribution," he notes, adding that green products that reduce waste and result in a cleaner environment, along with gas-phase filtration will also be discussed.

#### Short courses: Monday March 12

**Course I: Solid/liquid separation:** This 1-day course is of interest to engineers, scientists, managers and other technical personnel involved in solid-liquid separation in the process and other industries. Participants will find the course informative, regardless of whether they design, purchase, research or use filtration and separation (F&S) equipment.

Plant engineers, technicians and operators will find the material directly applicable. Research students will value the expert introduction to the technologies. A comprehensive



The Nordson Corporation will be demonstrating its adhesive dispensing systems at FILTECH 2018, Booth D48.



The Poster Area where summaries of FILTECH Conference presentations are put on display. Oral presentations of posters are given during congress breaks.

### FILTECH

March 13–15, 2018 Cologne – Germany

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Contact Exhibition: Jens-C. Chittka Phone: +49 (0)2132 93 57 60 · E-mail: jens@filtech.de review of the processes involved in the separation of solids from liquids will be delivered, which will emphasise practical aspects and present appropriate theoretical information as necessary.

The course will be presented by Dr-Ing Harald Anlauf, the Academic Director at the Karlsruhe Institute of Technology (KIT), a member of the Institute of Mechanical Process Engineering and Mechanics and active in the field of solid liquid separation technology for 35 years.

Topics covered will include: The characterisation of particles and particle separation; Density separation – static thickeners and solid bowl centrifuges; Depth, cross flow and cake filters; Filter media; Suspension pretreatment to enhance separation properties; Alternative separation solutions and apparatus combinations; and Selection criteria for separation equipment.

Short Course II: Fine Dust Separation: Also of interest to engineers, technicians, scientists, managers, and other personnel involved in gas-solid separation in the process and other industries, this course is informative to those who design, purchase, research, or use dust separation equipment for product recovery, emission control, air cleaning or process gas cleaning. The course is a comprehensive review of the processes involved in the separation of solid or liquid particles from gases. Practical aspects will be emphasised and appropriate theoretical information presented as necessary.

Short course II will be presented by Prof Dr-Ing Eberhard Schmidt,

who is a full professor for Safety Engineering and Environmental Protection at Wuppertal University.

Key topics include: Evaluation & selection of dust collection equipment; Wet scrubbers; Centrifugal collectors/cyclones; Electrical



PhenomWorld, the global market leader in desktop scanning electron microscopes (SEM), takes visitors on a virtual tour of its technology. PhenomWorld SEM systems will be on show at FILTECH 2018 at D18 in Hall 11.1.

precipitators; Fibrous/deep-bed filters; Raw gas characterisation and conditioning; and Fabric/surface filters.

A conference programme can be downloaded from: www.filtech.de/conference/ conference-programme-2018

#### BOKELA – Clever filtration at FILTECH 2018 - Stand H17

BOKELA ranks as one of the leading suppliers of filtration technologies for process filtration. The company's innovative highperformance filtration technologies define the state-of-the-art. They are tailored to individual product and process demands to offer economic and sustainable solutions for clients in the chemical, petrochemical, food and raw materials industry.

BOKELA drum filters are characterised by high throughput performances, intensive cake wash, low moisture contents and complete cake discharge. As plug & play technology, BOKELA drum filters ensure fast commissioning and reliable operation, while exchangeable filter cells allow unparalleled simple and fast replacements for highest availability and non-stop production.

BOKELA pan filters are used for filtration and washing of coarse products. They represent a new pan filter generation with a lot of innovative features. These pan filters save up to 25% of wash water used and application areas include alumina refineries, iron ore concentrates, quartz sands and fertiliser.

The company's Boozer Disc Filters are high-performance disc filters with outstanding high-throughput rates. Their main fields of

application are, for example, alumina refineries, coal washing plants and for tailings dewatering.

BOKELA's most modern technology, its HiBar Filtration solution, is designed for continuous pressure filtration and offers economic solutions for fine-grained suspensions. HiBar Filtration works at pressure differences of up to 6.0 bar (7.0 bar<sub>a</sub>), which enables fine-grained products to be filtered with high throughput rates, low residual moisture contents and with very efficient cake washing.

In addition, using patented HiBar Steam Pressure Filtration, extremely low cake moistures can be reached.

The HiBar Filtration is a continuous process comprising a rotary filter – disc or drum – installed inside a pressure vessel. Thus, a powerful and effective separation process is realised with robust and proven components in a simple construction.

For bulk materials such as concentrates from iron ore, coal or minerals beneficiation as well as tailings from beneficiation plants that require large filter sizes, HiBar Filtration plants are constructed with horizontal pressure vessels.



The HiBar Filtration is a continuous process comprising a rotary filter – disc or drum – installed inside a pressure vessel.



BOKELA drum filters are characterised by high throughput performances, intensive cake wash, low moisture contents and complete cake discharge.

#### Mario on maintenance

### Maintenance, IoT and Industry 4.0

Mario Kuisis of Martec talks about the implications of the Internet of Things (IoT) and Industry 4.0 and why maintenance professionals need to sit up and take notice.



oT and Industry 4.0 are creating a stir, in fact, quite a stir. You might be asking, what's all the fuss and hype about? Is it another one of those passing fads? Maybe just sales jargon? Another name for something we are already doing? More importantly, should you be taking it seriously in the real world of maintaining industrial plant and equipment? Especially in an increasingly competitive environment where every cent counts and there is stiff competition for every item in the capex budget.

These are questions I would suggest we should all be asking. I will attempt to put some thoughts on the table for you to consider in your particular situation. I have intentionally chosen to use the word 'you', as I would suggest these questions are just as important for yourself as for the enterprise you work for.

To put it succinctly, I believe we are now living in the last times before IoT and Industry 4.0. In a short time, life for almost all of us in the developed world will never be the same again.

Whether it will be good or bad will depend entirely on your outlook. If you believe that things like mechanisation, cars, air travel, computers and mobile phones were a step forward, then you will happily embrace IoT and Industry 4.0. They are set to change and irreversibly impact the way we live and work to a similar extent as these earlier advances in technology. It is recognised that there will also be significant societal ramifications, but the potential interactions are too complex and the pace of change too fast to permit clear predictions here.

I do not, however, want to dwell on those unknowns. Rather, I would like to explain why I am of the view that IoT is vitally important and therefore engender interest for you to consider how you could learn more and use these upcoming changes to your advantage. To use an old analogy, going with the tide is easy, whereas you are guaranteed to lose if you choose to fight it. The worst position to be in is not knowing the tide is coming in at all.

For a start, let's get onto the same page with definitions. There are numerous organisations and industries working toward standardisation of the Internet of Things, but the ITU (International Telecommunications Union) Telecommunication Standardization Sector (ITU-T) Study Group 20 is at the centre of these and describes IoT as: 'A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies'.

The IIoT (Industrial Internet of Things) is a subset of IoT.

In essence, sensors, devices, digital techniques and communications are being combined with data processing in a standardised way that will permit very wide-scale deployment in almost any environment at low cost without the need for specialist skills. IoT as envisioned will permit economical communication at any time, at any place and with



The IoT enables a vast array of sensing and data gathering devices to be installed, connected and set up at low cost by non-specialist staff with a standardised communication network and data analysis tools.

any thing, whilst taking care of security and privacy in a greatly enhanced next generation global wireless data network.

On the other hand, Industry 4.0 is more conceptual and refers to the 4th industrial revolution, which is going on today. It stems from an industrial trend originating in Germany, bringing a significant technological change in manufacturing. This change includes, for example, the adoption of cyberphysical systems, AI, IoT, Big Data, Cloud Computing and M2M communication.

Talk about IoT has been going on for more than 10 years now. So what's new?

The difference is that there is good progress toward standardisation, which can be expected to be finalised in the near future, if recent ITU experience is anything to go by. One of the main aims of standardisation is to ensure interoperability. IoT will become as universal and as simple to utilise as smart phones, which have been through the same ITU process. A good way to grasp the potential is to think of the difference between fixed landlines of old and smart phones of today. Once GSM capability was combined with a standard mobile phone platform and wireless network, a plethora of manufacturers stepped in with greatly extended features and functions at affordable prices. Phone applications took off like a skyrocket as developers all around the world could participate.

Think of the capabilities of your smart phone, the price you paid and how it has changed your home and work life. Could you go back?

The same will happen with IoT. Probably more, much more.

The biggest impact that can be envisioned presently is the elimination of a great many manual processes that can be fully automated, removing the need for human intervention. A simple example is the cars we drive. Monitoring systems in the car can alert the manufacturer of either the need for a routine service or an intervention based on predictive techniques. This can result in a message on our phones requesting a service appointment and recommended time frame without any person being involved. A selection of presented service centres in the general location of the car and optional dates will result in the correct spares being dispatched to the service centre just in time. The car may be provisioned for self-communication, or our phones could be configured to serve as the means for providing the communication between the car and the manufacturer, as well as between the manufacturer or service centre and us.

Now if this concept is taken into a typical industrial environment where a vast array of sensing and data gathering devices can be installed, connected and set up at low cost by non-specialist staff with a standardised communication network and data analysis tools, the possibilities become almost endless.

This is a reliability engineer's dream come true. Not only does all the relevant information come direct to the desktop without the need to go onto site and collect data, but there is 24/7 monitoring and abnormal conditions automatically trigger work orders according to predetermined algorithms where maintenance intervention is required, with messages sent to relevant personnel either for action or information.

Proactive maintenance will be taken to

new levels that could not even be conceived of just a few years ago.

This is not to say that everything can be done in this way, but with an expected 50 billion devices by 2020, the anticipated drop in costs means that it will become economical for a very large percentage of what is presently manual work. There will be a similar impact on production process monitoring and control, raw material procurement and management, asset management, human resource management, health, safety and security, etc. In effect, almost every facet of a business is likely to be affected in one way or another. The benefits represent the rising sea levels that will make the incoming tide unstoppable.

Do you need to sit up and take notice?

Perhaps the best way to answer that question is look around you and see what is happening in the world of IoT as it relates to your present area of responsibility, then consider how you could use that knowledge to your advantage.

#### ISO Cat 1 Ultrasound Certification Training

Martec, a Pragma company, is introducing the ISO Cat 1 Certification Training course, which will be delivered at the Pragma Building in Midrand during the first quarter of 2018.

This four-day course will be presented by Tom Murphy from SDT International, a world leader in managed ultrasound. The course is conducted in accordance with ISO 18436-8 for Ultrasound.

This is the pinnacle of ultrasound training and as such participants should be ready for a closed book exam.

Anyone interested in attending can contact Kim Dare, on +2711 848-6940. *kim.dare@martec.co.za* 

What better place to start than the magazine you are reading?  $\hfill\square$ 

#### Reliable hose pump impresses Xstrata

"The pump so reliable – it's only downtime is for hose replacement and annual plant maintenance!" claims Xstrata Alloys Rhovan's acting HOD, Christelle van Vuuren, regarding the Verderflex pump installed at the operation's precipitation plant.

Located in Bethanie, North-West Province, Xstrata's Rhovan vanadium facility relies on the most appropriate and reliable equipment to run its impressive Ferrovanadium Plant constructed in 2002. Annual production capacity at Xstrata Alloys Rhovan vanadium operations' pentoxide production is 22 000 lbs and 6 000 kg of Ferrovanadium.

Verderflex (VF) peristaltic pumps are the first choice for mines around the world, offering unrivalled performance in a tough and uncompromising environment. All vanadium in the ore occurs in solid state in the titaniferous magnetite. After the first stage of processing, the magnetite concentrate is subjected to a conventional roast leach precipitation process for the recovery of vanadium. To achieve the desired final product quality, Silica (SiO<sub>2</sub>) is removed from the pregnant solution. Precipitation of Vanadium from the pregnant solution is achieved by the addition of ammonium sulphate ((NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>).

The vanadium recovery process makes use of an evaporation process to recover sodium sulphate salt from the barren solution after precipitation. This salt is recycled back to the kiln, displacing the need for a portion of the sodium carbonate flux requirement.

The VF40 pump is used to pump the barren slurry at the plant, at approximately 6.0 to  $8.0 \text{ m}^3$ /hr at 60% solids handling. Abrasive

mining slurries have sub-micron solid contents in excess of 80% with slurry SGs in excess of 2.0. Hose pumps can pump such dense fluids while maintaining high levels of plant availability, unlike centrifugal pumps that suffer from continuous downtime; an inability to pump high SG slurries; and lower plant performance.

Since the plant was commissioned, the operation has replaced other hose pumps for the easier-to-maintain VF pump, due to its quick maintenance capabilities. "With no gland water used by the operation, the pump can run dry, and the rotor design and flange arrangement makes the pump a hit at our plant for easy maintenance," says Harrison.

"It just runs and works when you need it to," confirms Van Vuuren. "The pump is only 'offline' for spare part replacement and planned plant maintenance. Quite simply: its a reliable pump!" she exclaims.





### **Balanced decision making required** for sustainable plant maintenance

Garth Jones, general manager SA Services at Multotec, explains the importance of balance when drawing up budgets for mine plant maintenance. For best results with minimal downtime, production targets must be balanced with the essential maintenance requirements and their cost to the mine.

dequate budgets for mine plant maintenance – to ensure minimal downtime and optimal performance – need to be based on a strategic management approach that can balance the mine's production targets with its maintenance requirements.

According to general manager SA Services at Multotec, Garth Jones, this balance is mainly about the relative authority of the production and maintenance functions within an organisation. "Where the power is unbalanced, and financial decisions unduly favour the production side of the business – to the detriment of the maintenance imperatives – then this can often spell trouble for the lifespan and reliability of plant and equipment," says Jones.

"The situation can be exacerbated by short term financial incentives that prioritise higher production, and have the unintended side effect of restricting budget to vital maintenance functions; where this happens, the operation will definitely suffer in the long term."

Jones acknowledges that there is huge pressure on mines in terms of operational budgets, and says this has put a strain on maintenance activities – as these are often seen as the 'low hanging fruit' when mines must cut costs. "It's important that decision makers understand the importance of allocating enough to the maintenance budget, to protect their assets for the long term, whilst at the same time maintaining current production capacity and efficiency," he says.

Larger, blue chip customers tend to manage the balance better, having the benefit of a longer-term outlook and, often, greater financial re-



Proper maintenance protects assets in the long term.

sources. With the cutbacks in capital expenditure budgets due to industry uncertainties and low commodity prices, which restrict the purchase of new equipment, there has been a renewed focus on maintaining older plant as an alternative to replacing these units. Jones says a closer relationship with the original equipment manufacturer (OEM) is the way to achieve the best results from such a focus.

"The prudent approach for most mines is to make use of a 'package' arrangement with the OEM, which includes the whole product life cycle from the concept and design, to the testing, commissioning, maintenance and refurbishment," he says. "The involvement of the OEM throughout the product life cycle is critical to achieving the lowest possible costs of ownership. To let go of the OEM and rely on sources that are not sustainable, can be suicide."

In addition to keeping equipment running in line with OEM specifications and standards, he highlights the value of continuous improvement – where even existing plant can be regularly upgraded to become more productive over its life span. OEMs are always developing their equipment's capacity and economy over time, based on substantial research and development efforts, which track and leverage the performance of their global installed base of units.

"The innovation and advancement of our products – especially in these days of fast moving technological change – makes it impractical for mines to try and keep their inhouse expertise up to speed with the evolving maintenance requirements of their various plants," says Jones. Rather, it is more realistic and more cost-effective to rely on the experience of the OEM, who has developed decades of best practice in the application of products to the globally installed base."

As most end users work in relative isolation from each other, they tend to see only what is done within their business, and may miss out on the experience of other users. This broader experience, when shared by the OEM among its customers, translates into cost savings and operational efficiencies – as well as quicker problem solving at site level.



The involvement of the OEM throughout the product life cycle is critical to achieving the lowest possible costs of ownership. Mulotec's support of a maintenance team offers broader experience and quicker problem solving at site level.

#### Monitoring mills' liner profiles aids efficiency

Unreliable and time-consuming methods of monitoring the condition of mill liners are now a thing of the past, as mines can now ensure higher efficiencies by tracking liner wear in real time. This is thanks to the use of MultoScan by Multotec Rubber, whereby milling plants are able to accurately measure a mill's liner profile and predict the point at which the mill will start becoming inefficient. The automatic measurement and display of the charge level confirms that the operation of the mill is correct.

According to Matthew Fitzsimons, technical manager at Multotec Rubber, wear rates of liners are not linear, as the increased slippage of the charge on worn liners tends to exponentially increase the wear rate.

Data generated by the MultoScan is analysed and interpreted by highly skilled technicians using Multotec's Hawkeye proprietary programme, so there is no time lag, allowing plants to respond much more quickly.

"When combined with critical mill operating parameters, this data can help predict the point where the liner becomes inefficient and hence when the mill itself will become inefficient," says Fitzsimons. "Customers can receive immediate feedback on the condition of the liners, so any urgent issues can also be timeously addressed."

Repeatability of the MultoScan results means that there is hardly any room for human error in this system. It also saves mines significantly in terms of the time value of mill stoppages for taking manual wear readings. Further savings can be harnessed by reducing the stockholding of liners that mines need to keep; this is because, having better information on the liner profile gives maintenance crews the ability to set the trigger point for the liner inventory as and when it is needed.

MultoScan allows key performance indicators from an individual mill to be mapped and linked to the liner profile condition. This extends the capability of the monitoring system by allowing mines to select and track specific criteria.

Field trials have proven how well the system works in some of Africa's most arduous milling conditions and, recently, the technology has even been exported to Australian customers.



MultoScan, from Multotec Rubber, can accurately measure a mill's liner profile and predict the point at which the mill will start becoming inefficient.

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# **Infinite flexibility** from total solutions maintenance packages

The key differentiator among mining competitors is a systematic approach to maintenance that can be applied irrespective of the prevailing economic climate. This is according to Kobus Fourie, regional services manager for Weir Minerals, a company which stresses that the most important focus for mining customers is on 'total solutions' that offer infinite flexibility in terms of maintenance.

o allow each mining customer to choose the most effective maintenance strategy for its conditions, Weir Minerals is offering 'infinite flexibility' in its range of solutions to keep clients' equipment operating at the lowest possible cost per ton over its full life cycle.

According to Kobus Fourie, global services manager for Weir Minerals, there is a refocus in the world of maintenance, as the mining industry gains a better understanding of the value of total asset management carried out by the original equipment manufacturer (OEM).

"The involvement of the OEM in ongoing plant maintenance can really make a difference to reliability while reducing maintenance costs in the long term," says Fourie. "So, to ensure that every customer can take advantage of these benefits, Weir Minerals is extremely flexible in how it structures its support to suit any environment."

These maintenance arrangements include a cost-per-ton model, which allows mines to budget a set premium for a pre-determined production rate. Another option is the repairand-exchange model, where the OEM keeps key stock related to the specific customer's requirements, so it can supply what would normally be long lead-time items in just a few hours.

He highlights that the OEM supplier is in the best position to understand and support its products optimally, and this is recognised by most mining companies, who will closely link their own maintenance programmes to the aftermarket services that the OEM can provide.

"Through our service capacity, OEMs are playing an increasingly important role in mining," he says. "We can do this because our knowledge base – earned through extensive and ongoing investment in research and development – is well established."

The OEM's focus is on the capabilities and lifecycle of its products, and customers can use this focus to their advantage. "The benefits of having an OEM maintain its own equipment far outweighs the costs, especially if one considers the indirect cost of downtime due to the more frequent breakdowns that



Weir Minerals Africa offers a variety of maintenance options focusing on total solutions.

often result from the use of non-OEM replacement parts, for example," he says.

He also emphasises the safety aspect of good maintenance strategies, reiterating the importance – for both the OEM and the customer – of a safe working environment in the plant. "If you start altering a product with non-OEM replacement parts, it can put not only the reliability and integrity of the equipment at risk, but also the safety of the people that work around the equipment," he says.

Fourie acknowledges that applying a longterm approach to maintenance is not always easy in the mining sector, because volatility in commodity prices creates uncertainty around the life-of-mine expectations at many operations.

"A more stable outlook allows mines to make better decisions about investing in the longevity of their critical-path plant and equipment," he says. "Nonetheless, the key differentiator among mining competitors is a systematic approach to maintenance that can be applied irrespective of the prevailing economic climate."

Weir Minerals pushes the envelope with maintenance options, placing the focus on total solutions. This, in Fourie's opinion, is what the mining industry needs. "Mines should be allowed to focus on their core business, which



The repair and exchange model offers customers key stock availability in just a few hours.



Weir Minerals Africa service personnel maintain customers' equipment to ensure lowest production costs.

is to process minerals, while OEMs should support that objective by maintaining and operating their equipment to ensure lowest-cost production," he concludes.  $\Box$ 

### Health monitoring eyes on the fleet

SKF has helped a shipping customer introduce condition monitoring to its vessel, with plans to extend it further across the fleet says Anders Welin, Business Engineer at SKF.

When you're out at sea, the last thing you need is a major breakdown. In such a case, it would mean being towed back to dry dock for expensive repairs - and that's something that hard-pressed shipping companies can do without.

One way around this



The compact SKF IMx-8 condition monitoring system along with the company's Cloud-based online monitoring service is being used to protect the gearboxes and generators of two ships, with a view to expanding its application to the entire fleet.

is to keep a constant watch over the condition of onboard assets, and SKF has helped one shipping customer to do this – introducing condition monitoring to its ship, with plans to extend the service to other vessels in the fleet.

Condition monitoring is a vital resource in any industry, as it helps to protect assets from sudden failure. It uses an array of sensors to monitor machinery and detect potential problems at an early stage. One of the most widely used methods is to use vibration monitoring to assess the 'health' of the asset.

Serious problems with the bearings on a reduction gearbox on this vessel had caused extensive damage. With SKF's help, the customer introduced condition monitoring onto two ships in its fleet for early detection of emerging problems.

Condition monitoring is a good example of a technique that has many hidden layers. Beyond the visible hardware, there is a network of sensors gathering information. The information is collected and then transmitted to a central network in 'the Cloud' for storage, where it is analysed by SKF condition monitoring experts. Any findings are reported with clear recommended actions to the crew. In this case, bearing and gear mesh fault signals from the gearbox and generator were monitored.

The project made use of SKF's new SKF Multilog IMx-8 Online System as the 'gateway' to a full condition monitoring service. The system has been developed to compliment earlier SKF Multilog Online systems and boasts a number of improvements.

Firstly, it now has eight channels rather than 16 or 32. This may sound like a retrograde step, but it is actually more suited to this type of application: The Multilog Online Systems IMx-8 can be installed closer to the application being monitored, meaning less cabling and simpler installation.

It is also more compact – as it will fit into an existing cabinet rather than requiring one of its own. Furthermore, it is rugged for marine use, meeting the stringent environmental requirements set by the classification societies as part of type approval process.

Setting up the system is also much easier than before: rather than going via a serial connection, it is now done via a stylish App, which helps service engineers and crew to view data instantly.

SKF Multilog Online Systems IMx-8 is affordable and easy to use and an ideal way to help shipping companies take their first step into condition monitoring. And while it is initially targeted at the marine and offshore sectors, SKF expects it to find use in other industrial sectors as well.

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### Maintenance savings sweeten Zambia's sugar industry

Shesby Chabay, HOD of operations for WearCheck Zambia, describes the results of a case study on the 10-year and ongoing oil analysis programme being implemented at Zambia Sugar.

earCheck serves as a key stakeholder for Zambia Sugar's mission to be 'a worldclass and efficient, low-cost producer, whilst achieving balanced and integrated economic, social and environmental performance'.

Throughout WearCheck's decade-long partnership with the sugar producer, there has been a constant drive to instil best practice in the sugar producer's maintenance culture. This, complimented by Zambia Sugar's crusade for continuous improvement, has yielded very positive results in concrete key performance areas.

A general challenge facing the agricultural industry is the need to increase crop yields from the existing fleet, at the lowest possible operating cost. Zambia Sugar is no exception.

Hence the establishment of an oil analysis programme to improve the operating efficiency of the fleet and increase productivity – and positive returns on investment for the company are clearly demonstrated by savings of R2.8-million in the latest financial year.

The programme involves taking regular samples from the fleet's oil-lubricated components (engines, transmissions, hydraulic systems and axles). These are analysed, imminent problems are identified, corrective action is prescribed by WearCheck's diagnosticians and Zambia Sugar's maintenance workshop takes timely corrective action to addressing the root cause of identified problems, thus enhancing fleet availability and reliability throughout the agricultural season.

WearCheck's technical support team meets the agricultural workshop team every month to discuss critical issues and trends and to assist in the implementation of maintenance recommendations.

This case study examines sampling compliance, the findings for the season, actions and feedback, cost savings, as well as the recommendations for the next agricultural season.

Sampling compliance involves monthly targets being set at the start of the season to determine how many samples should be submitted from each member of the fleet. These targets are set based on the operating fleet in the season under review.

The main objective of monitoring sampling compliance is to ensure that all equipment on the oil analysis programme is sampled. The average sampling compliance level achieved during the 2016-2017 agricultural season was 91%, but a target of 100% has been set for the 2017-2018 season.

#### **Case study findings**

In order to analyse the findings from oil samples in his case study, the questions posed were: What is the ratio of alarms to total samples submitted? What is the trend in annual percentage alarms over the past five years? What is the picture per equipment type (cane



A cane loader at Zambia Sugar Estates. Where oil analysis discovers an imminent problem, the workshop responds by taking timely corrective action to avert the risk of catastrophic failure.



haulage, cane loaders, heavy plant and farm tractors)? And what are the major problem types and contaminants affecting the fleet?

The alarm percentage is calculated from the number of samples where the laboratory picks up problems, recommends corrective action and requests feedback from the customer. It is important for ongoing monitoring and as an indicator of general improvement or deterioration in equipment health and of the positive response by the maintenance team to identified equipment problems.

A general downward trend in percentage alarms is evident as the agricultural season progressed from May to October 2016. This may be due to the environmental impact and operational problems associated with wet weather harvesting, which mainly affected the tractor drive trains, especially at the beginning of the season. Bedding-in wear following component overhauls during the off-crop period and a progressive improvement (reduction) as the season progresses as a result the customer's continuous improvement system were also noted.

An average annual percentage alarms figure of 29% was achieved in the season under review. The trend for the five-year period from 2011 to 2016, however, illustrates a marginal increase in percentage alarms (1.0%) between 2015 and 2016, with the 25% (1:4) target set for that season being missed by 4%.

A sample to alarms ratio for equipment requiring corrective action of 1:3 (33%) was achieved in 2016. Repeat axle wear problems contributed to the upward movement in alarms by one percentage point, a ratio that will be improved if the repeat problems on the tractor axles are nipped in the bud.

The problem types and contaminants analysis examines the major problems affecting the fleet and the compartments which are most affected. The ranking of the major problems affecting the sampled oil of the fleet, in order of priority, were found to be: large metal particles, 42.8%; wear, 37.2%; silicon, 3.4%; and water 2.2%. This list outlines the highest risk areas for Zambia Sugar transport and forms the priority list for issues to focus on during the 2017-2018 agricultural season.

Problem types by component type were then evaluated. The differential wear problems are largely driven by axle wear as a result of operational problems being experienced on OEM tractor axles. The tractor fleet is the main production fleet and an early start to the season (wet weather harvesting) results in accelerated axle wear as the tractors get stuck in the muddy sugarcane fields and operators try to force the tractors out of the fields, resulting in axle damage. This clearly demonstrates the impact of the operating environment on equipment health.

Of the urgent and critical samples, 59% are attributed to axle problems (differential and final drive), mainly for tractors; 21% to engines; 13% to transmissions; while only 5% involved hydraulic systems.

Feedback reveals the actual findings following the diagnosis and also shows evidence of the resultant problem. It therefore assists in understanding problems and planning for future preventative measures. Average feedback compliance levels in his programme are sitting at 62% for the agricultural seasons under review.

#### Cost savings and maintenance culture improvements

Cost savings are the ultimate measure of the effectiveness and value of the WearCheck oil analysis programme. These are mainly driven by actions and feedback.

A cost avoidance approach was used to calculate cost savings. Over the past decade it has been noticed that a sudden component failure causes a failure to move sugarcane from the fields, resulting in lost productivity. It was also evident that oil analysis has been a useful tool in identifying imminent fleet problems, so that timely corrective action can be taken to reduce the risk of sudden catastrophic failures.

Therefore, where the laboratory has discovered an imminent problem and the workshop responds by taking timely corrective action, the risk of catastrophic failure and/or the resultant loss of production will be significantly reduced.

Repeat problems result in component failure if they go unattended. In calculating



the cost savings in Table 1, it is assumed that where corrective action was taken a potential failure is avoided.

Savings for the 2016-2017 agricultural season of US\$394 630 could have been even higher had it not been for the wet weather operations that affected the tractor axles. It is also important to note that, although the figure above gives an indication of the level of savings, the figure

is, in reality, much higher because downtime costs far more than the cost of replacing a component such as a failed differential.

Zambia Sugar has, over the years, implemented a continuous improvement (CI) programme in which WearCheck plays a significant role. Where problems are identified, best practice methods are implemented with the aim of addressing the root cause and preventing the problem from happening again.

WearCheck diagnostic reports and feedback are a way of documenting current improvements as well as potential opportunities for improvement. The WearCheck oil analysis programme has therefore provided a means of ensuring effective cost control, which is very important for improving operating margins. As a result, significant improvements have been noted over the last decade.

The programme has also improved the maintenance culture and general awareness of factors affecting the fleet health. The team is now better informed on the impact of the operating environment on equipment and of operational problems affecting equipment. They are now able to better avoid axle wear



A diagram summarising overall cost savings.

problems, for example. It is also evident that simple issues such as oil filler cap o-rings cause major dust contamination problems. This is a good example of the Pareto 80/20 principle: 80% of the effects come from 20% of the causes.

Zambia Sugar's agricultural workshop manager lists the key benefits his company is getting from the WearCheck oil analysis programme as: easier root cause failure analysis; preventing catastrophic failures before they occur; cost saving on very expensive vehicle/ machine components such as engines and transmissions; higher fleet performance; low downtime; higher fleet availability - at an average of above 95%; and higher fleet reliability.

As the leading oil analysis and condition monitoring company in Africa, WearCheck is proud to partner Zambia Sugar at a time when the company is expanding its operations by investing in the construction of a sugar refinery and an ethanol plant. WearCheck remains committed to offering the best service and savings to customers by offering a world-class service through its oil analysis and condition monitoring programmes.

	Cane haulage	Cane Ioaders	Farm tractors	Heavy plant	Total units	Typical repair cost (US\$)	Total savings (US\$)
Engine	11	2	2	-	15	8 600	129 000
Transmission	7	1	2	-	10	5 265	52 650
Differential	8	-	-	-	8	1000	8 000
Final drive: hub/tandem	11	8	1	-	20	10 160	203 200
Hydraulics	1	-	3	-	4	445	1780
Total estimate savings							\$394 630

Table 1: The total estimated savings that have accrued by using oil analysis to identify equipment problems and implanting timeous corrective action.





An overview of a 100 t/hour FLSmidth Modular RC<sup>™</sup> plant to be incorporated into the tailings treatment lines of two local UG2-based PGM producers for the recovery of chromite.



# Modular RCs for chromite tailings beneficiation

On October 23, FLSmidth held a product launch day at its Delmas Supercentre to showcase its modular Reflux<sup>™</sup> Classifier (RC<sup>™</sup>) solution for gravity separation of minerals and coal. *MechChem Africa* attends and takes the tour with Roy Hazell, FLSmidth's capital sales director for sub-Saharan Africa.

wo new modular Reflux<sup>™</sup> Classifier plants, built in a little over six month, were the focus of FLSmidth's day. Designed around ten interconnecting modules, each the size of a 20-foot container (excluding walkways, handrailing and product stacking arrangements), these plants are to be incorporated into the tailings treatment lines of two local UG2-based PGM producers for the recovery of chromite.

A typical UG2-platinum group metals (PGM) mine, explains Hazell, uses flotation cells to recover PGM concentrate. "The remaining material contains waste and chromites," he tells *MechChem Africa*. "Depending on the level of entrainment in the flotation process, chromite contaminant can still be in with the PGM concentrate when the product is sent to the smelter, which can lead to penalties being imposed on producers.

``If the flotation process is optimised, however, then the PGMs will go off to the smelter

and the chromite tailings will be left behind, as a waste product, albeit one that has considerable value," Hazell points out, adding that head grades of 23% chromite in waste streams are not uncommon.

"While for PGM producers, chromite is a contaminant, it is a saleable product in its own right. And with repressed platinum prices, PGM mine operators are realising that chromite represents a 'money-for-nothing' opportunity to improve the profitability and sustainability of their mining operations," Hazell notes.

Beneficiating the 'waste' chromite stream using spiral separation technology is not entirely new. Here, mixed slurries are separated into mineral streams of different densities due to the centrifugal force applied to each stream flowing down and around the spiral. "But spiral technology is inefficient in dealing with fine particles and can be unforgiving if the head grade composition changes for any reason.



The take-off points often miss the change in head grade and product is lost," he continues.

Compared to spirals, FLSmith's Reflux Classifiers offer far better recovery efficiency in separating bi-mineral slurries with different densities. "If the head grade goes up or down, the separation efficiency does not shift significantly and the set point is also easily adjusted," Hazell informs *MechChem Africa*.

Chromite producers in South Africa have long been dependant on spiral technology, but recognise that Reflux Classifier technology is far more effective: "For them, the Reflux Classifier is fast becoming the preferred solution. Many Chromite producers are already taking the output from their spirals and putting it directly into one of our Reflux Classifiers, which upgrades the product and raises its selling price. Metallurgical grade chromite might attract US\$160/t, with a chemical grade at around \$200/t. But if foundry sand chromite quality can be achieved, which takes both grade and size fraction onto account, the value can rise to as much as \$500/t," Hazell notes.

FLSmidth's modular RC2000 plant on show during the launch day is designed to process 100 t/h of minerals, and in particular, chromite tailings. "For chrome, iron ore or other hard rock minerals applications, we treat a -1.0 mm size fraction, with a preferred size distribution range of 4:1. So if we have a size range from -1.0 mm to 250  $\mu$ m, we can establish an optimum operating condition. The finest fractions that can be processed are in the range of -250  $\mu$ m to 40  $\mu$ m," he explains.

"For heavy ores, anything below 40  $\mu m$  is not really recoverable. For coal, however,

which is light and recovered from the overflow, we can recover the whole size fraction range, theoretically down to zero microns," he explains.

Describing how the Reflux Classifier works, Hazell says that, from the slurry inlet, the material first passes over an oversize screen to remove any tramp or debris and to establish the -1.0 mm cut size. It then passes through a cyclone, which removes the  $40 \,\mu$ m fines.

"The remaining slurry of between -1.0 mm to 40  $\mu$ m then enters a mixing chamber in the middle section of the classifier. Here, the heavier (more dense) particles sink quite quickly, while the lighter particles may rise, remain suspended, or become trapped by sinking heavier particles. A bed of dense material quickly collects in the mixing chamber forming an autogenous dense media zone.

"A fluidisation system at the base of the mixing chamber, which consists of an array of water jets, keep the dense zone in continuous suspension. This enables any trapped low density particles to be liberated from the dense zone, allowing them to rise up the mixing chamber towards the Lamella Chamber at the top, which is the heart of our Reflux Classifier," Hazell explains.

The Lamella section is made up of sloping lamella channels, 6.0 mm apart –"although we can do 3,0 mm plates for finer materials".

The low-density particles rise up the through the lamella channels, with assistance from the fluidised water flow. The sloping channels cause a parabolic flow distribution, which carries the lightest particles through the faster flow midway between the channel walls until, at the top, they overflow and are directed to the discharge.

High-density particles tend to roll back against the underside surface of the channel wall, where the flow is low. They then slide down the slope back into the autogenous dense media zone.

"If separating coal, the overflow contains the product – and we can process coal to very high yields, 70% and above, which include the fine particles well below 40  $\mu$ m. We can typically produce metallurgical coal with less than 10% ash content from the unusable fines that accumulate at mines," says Hazell.

"With chromite, however, the product is in the underflow. The bed of material needs to be stable before a central underflow valve will discharges the product based on measuring the prevailing density in the mixing chamber, which ensures that the required grades are being accurately achieved," he adds.

"This technology ticks all of my boxes," Hazell tells *MechChem Africa*. "Everybody wins. Not only will these modular plants help to reduce the risk of UG2 miners being slapped with penalties for contaminants in the PGMs, they enable a waste product that would usually be dumped into the environment to generate income. These plants assist in creating more local community jobs and, in some cases, the chromite reserves are actually owned by the local community.

"But we at FLSmidth are masters of our own destiny. We are not simply saying this so that operators might buy our units. We have designed and build these systems at our own cost and we will be installing and operating them ourselves.

Left: The Lamella section is made up of sloping lamella channels, 6.0 mm apart. Low-density particles rise up the through the lamella channels, while high-density material slides down into the autogenous dense media zone. **Right:** A bank of FLSmidth Krebs pumps is used to distribute slurry and process water.



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# Shiploaders restored and configured on new quay

In line with upgrades at Maydon Wharf at Durban Harbour, two 850 tph shiploaders were recently refurbished as they were in good overall condition. This was a cost-effective solution, which incorporated new quayside railings into the reconfigured substructure. Bosch projects finished the job in a year, despite numerous challenges.

B osch Projects, part of Bosch Holdings, recently completed the upgrade of two shiploaders at the Durban Harbour, that have been used for over 50 years to load sugar onto vessels at the South African Sugar Association's iconic sugar terminal.

These two shiploaders, commissioned in 1965 by Moreland Technical & Engineering Consultants – the predecessor of Bosch Holdings – needed to be refurbished in line with Transnet's upgrade of the berths at Maydon Wharf.

"The original 850 tph shiploaders were designed to feed onto 35 000 t Handymax vessels, but with upgrades at the port, designed to allow for a deeper draft and the berthing of 80 000 t Panamax vessels, modernisation of these machines was critical if they were to remain in operation," explains Dave Chappelow, sector director: industrial, Bosch Projects. "Thorough inspections of these robust shiploaders indicated that despite many years of operation in aggressive seaside conditions, they were in good overall condition, with no excessive corrosion or evidence of fatigue.

"The most cost-effective solution was to restore the two existing shiploaders and to incorporate them into a new substructure that could utilise a new cope quayside rail. The reconfigured substructure provides the shiploaders' existing booms sufficient access and clearance to service Panamax type vessels, even at the highest tides.

"Bosch Projects, in conjunction with contractors, Bayside Engineering, commenced onsite modifications in August 2016 to coincide with construction of the quay modifications. In spite of numerous challenges, which included inclement coastal weather conditions and hot works restrictions imposed when vessels containing flammable goods were docked at the berth, timeous commissioning of the refurbished shiploaders took place a year later."

Each overhauled shiploader had a vertical lift of 1.32 m and a horizontal seaward shift of 4.0 m. Restoration entailed partial removal of existing legs of the structure, installation of new bogies and an advanced 33 t substructure, with a 14-m wheel-base between the landside and seaside legs. A rear 4.0 m extension allows for an extended feed conveyor and cable reeling drum.

This project also involved the replacement of two 9.0 t ballast boxes with new 21.4 t ballast boxes, to ensure stability of the machines under all load and wind conditions. A new motor control centre (MCC) panel was linked to the existing MCC panel; a new support platform was installed; and the original timber flooring was replaced with a grating and chequer plate structure.

Restoration also involved on and off-site conveyor belt splicing, surface preparation and painting of selected existing steelwork, as well as the replacement of the cladding where necessary.

These shiploaders were moved by Lovemore Mechanical Projects during the berth upgrade to allow Transnet access for construction. The shiploaders' 7.0 t chutes and 16 t booms were rigged down using a floating crane, for offloading at the stag-



Bosch Projects, part of Bosch Holdings, recently completed the upgrade of two shiploaders at Durban Harbour. These have been used for over 50 years to load sugar onto vessels at the South African Sugar Association's iconic sugar terminal.

ing area where they were reconditioned. The 112 t main structures, each 20 m high, were moved using a custom-made push and pull system, with the set-up of temporary railway lines.

Once the shipbuilders were back in place, four 50 t capacity hydraulic jacks, with a cumulative capacity of 200 t, were used to lift them to install temporary supports to allow for the building of the new substructure. Hydraulic jacks were used again to remove the supports and install the bogies.

Apart from providing specialist services to ports and terminals, Bosch Projects offers solutions to sugar and ethanol engineering, water and waste water, energy and industrial plants, roads, land and building developments.



Each overhauled shiploader had a vertical lift of 1.32 m and a horizontal seaward shift of 4.0 m.

# **Extra high and deep** cold storage solution

Mecalux Movirack<sup>®</sup> mobile storage solution, designed to enable increased storage by eliminating aisle space, was recently used in Durban's Idube Cold Storage facility for perishable goods. The facility, approximately 50% deeper than other similar local facilities and consisting of three cold chambers of varying temperatures, is now an 8 500 hi-cubed capacity mobile storage system, certified to carry 1.4 tonnes per pallet space.

outh African industrial storage solutions authority, APC Storage Solutions SA, recently completed a mobile storage system installation for a greenfield multi-temperature, multi-chamber cold storage facility for Durban-based company, Idube Cold Storage.

The internal height of the cold storage facility required some planned ingenuity from APC Storage Solutions SA, which resulted in elevating a casting wiring harness to conduct the roof installation. It is the first time in South Africa that a storage system has been installed in this way.

Situated in the Dube Trade Port at King Shaka International Airport in KwaZulu-Natal, Idube provides cold storage facilities for importers and exporters of perishable goods. To ensure adequate storage capacity across varying temperatures in the 4 700 m<sup>2</sup> cold store, the facility was divided into three cold chambers, in which the storage solution would be installed.

The contract included the complete design, supply and installation of storage systems for the three cold chambers and all associated electronics that facilitate mobile operations. APC Storage Solutions SA installed the Mecalux Movirack<sup>®</sup> mobile storage solution, designed to enable increased storage by eliminating aisle space. The cold storage facility is approximately 50% deeper than other similar facilities in South Africa, which means the number of bays usually used is almost doubled. The result is an 8 500 hi-cubed capacity mobile storage system across three chambers certified to carry 1.4 t per pallet space. This means the cold storage facility is now capable of storing 12 000 t of frozen product.

The 18 m high roof installation necessitated drilling from the bottom. Using specialised equipment, such as scissor jacks for example, APC Storage Solutions SA elevated a casting wiring harness, which enabled the installation to be conducted from the roof down. "This is the first time in South Africa that a storage system installation has been conducted in this way," says Fred Albrecht, managing director of APC Storage Solutions SA.

Using equipment for rigging in lieu of manual handling is one of APC Storage Solution SA's hallmarks, and the company is the only storage solutions company in South Africa to do so. "This is because the Mecalux brand we distribute and install requires us to adhere



Installation complete: One of the chambers inside ldube's 4 700 m<sup>2</sup> cold store. The installation of the storage system from APC Storage Solutions SA enables Idube to store 12 000 t of frozen product across all three chambers.

to European safety regulations, which necessitates minimal manual handling procedures," Albrecht explains.

One of the cold chambers is used specifically to handle drums for export and it is designed so that drum temperatures can be reduced in short times, similar to those of a blast freezer. To ensure the storage system could accommodate the export drums, it was specifically designed to contain 1.2×1.2 m type M pallets.

"APC Storage Solutions SA carried out its scope of work among some trying work-



An inside view. The 8 500 hi-cubed capacity mobile storage system is certified to carry 1.4 t per pallet space.



Aisle closed for now. One can clearly see the break between aisles 7A and 7B where racking will open to allow for aisle space when required.



ing conditions," says Idube's chief operating officer, Hoffie Rautenbach. "In addition to Idube being one of the highest storage facilities accommodating uniquely massive loads, other contractors were onsite restricting the movement usually required for an installation of this nature. Additionally, APC Storage Solutions SA began its scope of work in advance of the electrical lighting installations and still managed to complete the project in time and to spec."

APC Storage Solutions SA concluded the installation within the allocated two-month period, completing its scope of work well in advance of other contractors. To achieve this, the company's personnel worked throughout the December holiday period, closing only for the four religious holidays over the yearend break.

"We selected APC Storage Solutions SA after a rigorous tendering process," Rautenbach concludes, "with selection based on reputation, international experience, pricing and their high-quality storage solutions. As the purpose of our facility is to provide a world class service to importers, exporters and local producers of perishable products, which can only be achieved with world class facilities, we are now certain we made the correct choice in selecting APC Storage Solutions SA for our storage system requirements."

Training on the operations of systems for semi-automated storage solutions as well as maintenance training, incorporating the EU Harmonised Standards, was conducted for Idube personnel. In addition, APC Storage Solutions SA provides customer support throughout the year, 24 hours a day.

#### Drives and motors for reliable mining in Africa

BMG's integrated engineering solutions service to the mining sector in Africa encompasses a complete electromechanical capability, which includes a customised plant design, product selection, installation, commissioning and support service.

"BMG's energy efficient drive solutions are designed to meet the exact needs of mining and mineral processing, at the same time ensuring improved asset availability and the lowest possible cost of ownership. These robust drive systems can withstand heavy loading and operation in extreme conditions and are able to control equipment installed at great distances," says Ian Smith, country manager, BMG, Zambia. "By optimising ac-drive applications for every plant design, BMG provides dependable solutions that improve productivity, save energy costs, reduce maintenance requirements and extend service life of equipment.

"BMG's premium drives offering is through the Danfoss brand, which incorporates high power VLT® drives and the VACON® range. BMG is now able to deliver low voltage drive solutions up to 5 MW, in a variety of customisable configurations."

Danfoss drives are designed to operate in harsh, dusty environments and in high ambient temperature conditions, without de-rating. They can also be installed in environments containing relatively high levels of contaminants.

Standard VLT and VACON drives have a long motor cable capability on mines with a large-scale layout. They are fully compatible with all ac motors and integrate seamlessly into PLC fieldbus networks. These drives have built-in RFI filters, which ensure reliable operation of all other electrical equipment on the same installation. No additional RFI filters are required on the input of the drive – this saves space and installation time and costs, compared with conventional ac-drive solutions.

Danfoss drives, have a compact design and an intelligent heat management system for reduced project and operating costs. The back channel cooling concept for VLT high power drives reduces contamination of the drive electronics, resulting in increased lifespan of the unit. This cooling concept is also an optimal solution for reducing heat dissipation within the drives installation area. By removing the drives dissipated heat directly, mines are able to reduce cooling system requirements, thereby saving on capital and long-term energy costs.

VLT and VACON drives are used for

many applications in mining, including the control of mine ventilation fans, for smooth acceleration and deceleration of long conveyors, for electric driven dewater pumps skids and for the reliable operation of slurry pumps. These drives are also used for all mining and mineral processing equipment applications and bulk material handling facilities.

Danfoss variable speed drives are fully compatible with BMG's high power motors, which are available in an IP66 variant and in different power/frame size combinations. Motor life span is improved by winding all motors with Class H insulation and a Class B temperature rise.

Installation and changing out of the BMG high power motor range is made easy due to the oversized terminal box and removable gland plate. These motors, which are tested to stringent SABS and international standards, are SPM-ready to facilitate vibration monitoring and testing.

BMG's high power gearbox range incorporates the Sumitomo (Paramax and Hansen), Nord and Zollern brands.

Optimised gear tooth profiles reduce wear and noise levels, also extending the service life of the product. BMG is able to customise gearboxes for specialised applications.

BMG's two branches in Zambia – in Lusaka and on the Copperbelt in Kitwe – offer a 24/7 support-service for the full product range, through technically competent workshops and field service teams.



BMG's energy efficient drive solutions are designed to meet the exact needs of mining and mineral processing in Africa.

# **Oxygen:** an essential ingredient for stainless passivation

John Tarboton, executive director of Southern Africa's stainless development association, talks about stainless piping and the need to remember that stainless steel surfaces need oxygen in order to maintain their protective passivation layer.



hen stainless pipework is installed, it is usually pressure tested, which is generally done by pumping water into the pipework. If the water is left in the pipe after the successful completion of the test, it creates deaerated conditions, which starve the stainless of oxygen, preventing the formation of the passive layer on the inside surfaces. So the corrosion protection breaks down and, within months, pitting corrosion can destroy the pipe," begins Tarboton.

"I have seen this countless times," he continues, "with 3CR12 stainless steel in the mining industry and, most recently, in brand new 304L pasteurising holding pipes for a local dairy," he notes.

Explaining why, he says that, "we often find that the problem is caused by microbiologically influenced corrosion (MIC). In stagnant water conditions, bacteria grow on the stainless surfaces, initiating corrosive conditions underneath the patches of bacteria.

"But in the case of the dairy, this was not the case. The water used for the pressure test had been treated with chlorine and the cleaning agent, peracetic acid, to ensure sterile conditions were maintained inside the tube.

"Unfortunately, in an effort to save water – the drought was on at the time – the dairy did not drain the pipe after the test," Tarboton says.

#### The consequences

In the dairy industry, pasteurisation is achieved by raising the temperature of the milk and holding that temperature for a predetermined length of time: for continuousflow pasteurisation, 72°C for a minimum of 15 seconds is common, for example. "At this dairy, after heating, the milk is pumped through about 500 m of holding tube at a controlled rate so that, by the time the milk exits the tube, it will have been pasteurised," Tarboton explains.

The new holding tube was part of an expansion project and its installation was being done before the Christmas break last year. "Pressure testing was successfully completed just before closing for the holiday and the treated water was left inside the pipe over break," he continues.

"When the dairy was reopened four weeks later, the holding pipe was leaking. It was full of pinholes caused by pitting corrosion, which had penetrated through the 2.0 mm wall thickness in just a few weeks," Tarboton relates.

On investigation, it was discovered that the holes had occurred around the welds of the holding tube. Pointing out some of the weld photos, Tarboton says that there was some evidence of lack of penetration and, due to poor purging, oxidation and cauliflowering of the welds had occurred.

"The weld quality wasn't good, mostly

because of access difficulties at the U-bends. And this is a food and beverage application, where pickling after welding is avoided, where possible," he says, adding that passivation actually occurs naturally on stainless steels that have been properly pickled.

"Instead, the industry relies on properly managed internal pipe purging to protect the inside surfaces during welding. A number of things went wrong with this project, however."

First of these is the above-mentioned poor quality welding. "Second, however, the purging was clearly inadequate, with clear evidence of discolouration around the heat affected zones of the internal root seams. They did purge the pipe during welding, but simply by blocking off the tube, connecting an argon gas pipe at the other end, and setting the gas flow rate. This was assumed to be adequate," he says.

"My advice to clients is that they have a choice: either purge properly and monitor the results or spend the money on getting the pipe pickled after welding. Any weld discoloration on the inside of a weld will have to be removed, anyway, so poor purging is pointless," he suggests.

"The discoloured oxide layer or the heat tint that is formed around a stainless steel weld is not the chromium-rich passivating layer formed under normal oxidation conditions, so the material's corrosion resistance

From left to right: Lack of weld penetration, weld seam misalignment as well as poor purging was evident on the pipe samples examined. The welds show surface oxidation in the HAZ and cauliflowering (roughness) of the weld metal itself.







Left: From the outside of the pipe, the weld may look acceptable, even if no purging has been done on the inside. Right: The inside root seam of an unpurged weld. Cauliflowering/crevice formation and HAZ oxidation destroys the chromium-rich passivated layer that protects stainless steel from corrosion.

is immediately compromised," he adds.

"The higher the chromium to iron ratio in the oxide layer, the better the pitting resistance. At low oxidation temperatures (300 to 600 °C) in the HAZ, the diffusion rate of iron is faster than chromium, resulting in an iron-rich oxide, which is susceptible to pitting. At higher temperatures, up to about 900 °C, the chromium diffusion rate becomes faster than that of iron and the heat tint in the HAZ becomes chromium-rich with associated good pitting resistance.

"At temperatures above 1 000°C, however, the oxide layer becomes depleted in chromium owing to the volatisation of  $CrO_3$ , with resulting lower pitting resistance. Thus, to ensure that a chromium-rich pitting resistant surface is maintained during welding, oxidation of the HAZ must be avoided by eliminating oxygen through effective purging with argon," Tarboton stresses.

"And if stagnant conditions with low oxygen content and lots of time are added, rapid corrosion will occur. The lack of oxygen prevents the formation of any new protective film and, if left for several weeks in a slightly acidic environment in a pipe with inadequate welds, corrosive attack is inevitable," Tarboton tells *MechChem Africa*.

The peracetic acid sterilant, he continues,





The transparent and adherent passive film on stainless steel requires oxygen in order to self repair.

has a relatively low pH (4.4). "So it should not have been harmful to the 304 stainless, which would normally resist low pH. But in its compromised unpassivated state, acidic conditions will contribute to making pitting more likely.

"The water also contained about 70 ppm of chlorides and about of 0.5 ppm of dissolved chlorine, which are also both well below the recommended maxima for passivated stainless steel of 250 ppm for chloride and 2.0 ppm of chlorine, respectively," he adds.

Tarboton suggests that chromium depletion was more prevalent around the grain boundaries because chromium can diffuse faster along the boundaries. "In this case, the chromium depletion was due selective grain boundary oxidation," he says.

So what should have been done?

The problem starts with the holding tube design. The U-bends of the tube were not designed with enough access for welding, so achieving acceptable weld quality was impossible. "It is likely that, even if the pipe had been purged and/or pickled properly, hygiene and cleanability problems would have eventually have occurred in areas where cauliflowering and lack of fusion defects allow bacteria to 'hide' from the sterilisation fluids," he predicts.

Inadequate purging was the second contributing factor. "Breweries that don't do pickling make 100% sure that the purging is done effectively – and borescopes are used to check inside the pipes for any discolouration," Tarboton says.

Third, though: "Following pressure testing, it is essential to make sure that the pipe is drained and dried, immediately, even if this means blowing hot air through the pipe.

"Deaerated conditions inside stainless tubes or vessels are a no-no. Continuous flow velocities of above 2.0 m/min, are thought to be sufficient to stop the formation of biofilms and microbiologically influenced corrosion. It also ensures that enough dissolved oxygen is entering the flow to maintain the passivation. But if the flow stops for any length of time, MIC or other problems are likely," he warns.

Leaving standing liquid in stainless steel tanks is also a problem. "In the US, stainless tanks were filled for use as ballast during one of the recent hurricanes. The water was then left to evaporate out of the tanks, completely destroying the stainless material.

"Also, municipal water tanks are often designed with a conical underside to enable sludge to be regularly drained. This reduces areas of low oxygen content and enables fresh aerated water to reach the entire tank surface," he tells *MechChem Africa*.

"Stainless is a wonderful material that offers excellent corrosion resistance in the right conditions. The most routinely forgotten among these is access to oxygen, which is an essential ingredient of the material's corrosion protection system," Tarboton concludes.

### MechCaL expands sub-Saharan reach



Luther Erasmus, Group MD for TLT MechCaL & TLT ACTOM.

his expansion strategy follows the announcement of TLT MechCaL and TLT ACTOM working in collaboration with their majority shareholder, German-based TLT-Turbo to provide a total ventilation solution to sub-Sahara Africa (SSA).

TLT MechCaL and TLT ACTOM will collaborate closely as they expand their reach to develop the SSA market, offering a complete range of fans – from auxiliary, axial and radial fans to large surface fans – for applications in the mining industry, as well as a broad range of industrial ventilation and process solutions. This offering will also include custom-designed ventilation solutions to suit any specific requirements and to meet specialised challenges.

These ventilation solutions have a broad range of applications including mining, power generation, industrial processes, construction, oil and gas, as well as rail and off-highway vehicles. TLT ACTOM will sell and support the full range of TLT-Turbo fans in the sub-Saharan market, including the new high performance and efficient 1 400 mm and 1 600 mm TLT MechCaL fans.

TLT MechCaL will sell and support its

Under the TLT-Turbo umbrella, local ventilation firms, TLT MechCaL and TLT ACTOM have embarked on an ambitious expansion strategy for sub-Saharan Africa. Their collaboration will enable an offering of a complete range of fans, from auxiliary, axial and radial fans to large surface fans, for applications in the mining industry, as well as a broad range of industrial ventilation and process solutions.

> 1 200 mm and smaller auxiliary fan products in the region, as well as its large composites blades and radial composite fans.

"As TLT-Turbo has been present in this market for some time, it has been simultaneously showcasing our products. Firms in the region have expressed interest by wanting to see how our products work and the ways in which our innovations can improve their operations," says Luther Erasmus, group MD for TLT MechCaL and TLT ACTOM.

"We believe that we have a lot to offer because of the specific research, developments and innovations that have gone into our product offering. Efficiency with less energy use will, in my view, be the biggest selling point in a region where power usage is a major concern for any operation, the cost per kilowatt hour being quite high in some countries." Erasmus notes that a fan that is a mere 4% to 5% more energy-efficient can drastically reduce the total cost of ownership.

Clients in sub-Saharan African countries will also be able to benefit from the full range of additional services offered by both TLT MechCaL and TLT ACTOM. This includes maintenance and refurbishment of process, power and primary and secondary mining



The larger mine ventilation systems and fans of 1 400 mm in diameter and upwards will be supplied to the SSA market through TLT ACTOM.

fans, as well as other value-added services as part of a ventilation-on-demand solution. This venture combines the global resources and expertise of TLT-Turbo with the client base, distribution network and product innovation of TLT MechCaL and TLT ACTOM.

Product availability in line with precise requirements and on-the-spot costing will be managed by means of a central product configuration system that the TLT MechCaL and TLT ACTOM sales teams will be utilising



TLT MechCaL's innovative auxiliary fan products of up to 1 200 mm in diameter will be marketed to the sub-Saharan African industry.



The fans will be manufactured locally in South Africa before being transported to clients across Africa for installation.



to provide clients with up-to-date information and optimal delivery turnaround times.

"We are currently moving towards becoming compliant with the relevant legislation applicable to the various countries we are targeting. This includes making the necessary amendments to fan components such as motor types, fan sizes, safety specs, performance specs and operating frequencies," Erasmus explains.

This is not the first time that either company has supplied ventilation solutions to clients in this region but the move places emphasis on a focused approach with more efficient distribution models and solutions tailored for the market – both in terms of product design and delivery.

"We have already shipped and installed both surface fan and auxiliary fan solutions for the mining industry in Zambia and Zimbabwe. We are now aggressively targeting expansion into the West African markets, including new mining projects in Ghana, Sierra Leone and Mali, as well as mining ventilation opportunities in the DRC. In addition to these we are also pursuing services and refurbishment opportunities in the power, cement and processing industries in the above countries. This is very encouraging as together both companies seek to offer a complete product range from the smallest fan to the largest ventilation solution," concludes Erasmus.

This move forms part of a larger company objective to be shipping 80% of all products internationally by 2020. □

#### Call for move to fourth generation refrigerants

While the bulk of the mining industry uses HFCs (hydrofluorocarbons) in their refrigerant systems, these are on the cards to be phased-out in accordance with the Montreal Protocol and Kigali Agreement to minimise the use of ozone-depleting substances.

While chlorofluorocarbons (CFCs) were used the past, these were phased-out by the Montreal Protocol in the late 1990s, paving the way for the advent of HFCs. Now the Kigali Agreement is looking to the future phase-out of HFCs, too, and their replacement with HFOs (hydrofluoro-olefins), the fourth generation fluorine-based refrigerant gases.

"When mines' reach the stage of needing to invest in new refrigerant systems, or to refurbish existing ones, our suggestion is to opt for the latest technology and move straight to HFOs, rather than go through the interim HFC stage, as this will prove much more cost-effective and environmentally friendly in the long run," says A-Gas South Africa national sales manager Michael Labacher.

A-Gas South Africa's role in ensuring compliance in major industrial sectors such as mining encompasses a range of services and product offerings. A-Gas Health Check is an easy-to-use test kit that can be supplied, consisting of a refrigerant sample cylinder, an oil sample bottle, and all of the necessary hoses in order to take the samples, all packaged in a robust box. A Certificate of Analysis is then supplied in compliance with AHRI 700 standards, which reveals the maximum contaminant levels permissible for re-use, without causing system damage.

"Mining is an arduous environment

and application, especially in underground conditions. For example, a pipe may burst, resulting in the refrigerant being contaminated with water. A high moisture level will increase the acidity, which in turn, will corrode the copper elements of the system leading to the failure of motors and pumps followed by the equipment in its entirety," Labacher warns.

Therefore, it is recommended that mines conduct a refrigerant analysis at least once or twice a year. This is critical in terms of preventative maintenance, which will prevent safety-critical equipment breaking down and impacting on mine productivity.

Since the establishment of A-Gas South Africa in 1996, the company has seen a steady increase in its involvement with the mining industry. "Especially with shafts being closed and mines decommissioned once they reach their end-of-life, it is imperative that systems be purged of all refrigerant, cleaned and rendered safe." This refrigerant can then be returned to A-Gas South Africa and restored to specification for reuse.

In terms of future developments, Labacher reveals that the company is looking to launch a new product to recover refrigerant out of systems far more quickly in order to reduce downtime and boost the recovery rate. "What we are looking at it is vacuum-sucking system for evacuating refrigerant out of a system directly into drums, which will eliminate the danger of any blow-off to atmosphere. This will be far more environment-friendly, our mining customers will receive an improved service, and we will be able to more efficiently recycle the refrigerant in question."



Lennox Ngeshe at A-Gas South Africa, a leader in the supply and lifecycle management of speciality chemicals. When mines need to invest in new refrigerant systems, A-Gas South Africa recommends moving directly to HFOs.



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### Latest in water-heating solutions

HydraTherm's Llewellyn Ward talks about HVAC products that ensure payback periods are minimised, and returns maximised.

new South African company is providing high-tech, energy-efficient water-heating solutions to the residential, commercial and industrial markets. Their units have been shown to produce savings of around 70% of total hot water costs, a significant contributor to lower electricity bills. Since they use less than a third of the energy of an ordinary geyser, these units qualify for installation in terms of SANS 10400XA and XA2.

HydraTherm's expertise lies in the design and specification of centralised hot water plants for large commercial projects, as well as in offering premium solutions for smaller projects and domestic homes. Water heating products can also be supplied on demand, to meet exact specifications, where specialised solutions are required.

"Our full-service solutions are ideal for hotels, laundries, dairies and hospitals, the retail and manufacturing industries, and private homes at a highly competitive level of investment," says managing director Llewellyn Ward. "We aim to ensure payback periods are minimised, and returns maximised."

The HydraTherm range of high quality, efficient hot water heat pumps includes 'traditional' split pump technology, where an external heat pump is piped to a separate water storage vessel, and an integrated unit where the heat pump is mounted on top of the water tank. Heat pumps are proven to use roughly a third of the electricity required to heat the same amount of water in a conventional geyser element.

The range includes two 60 °C integrated heat pumps for residential use, 55 °C and 60 °C split hot water heat pumps for residential, hotel and commercial use, 70 °C split hot water heat pumps for hotel and commercial use and 80 °C split hot water heat pumps for laundry, dairy and medical use.

#### **Technology and materials**

HydraTherm heat pumps are manufactured using the latest technology and best possible materials. All parts and components are carefully selected and tested to ensure ultimate efficiency, reliability and durability. Vapour injection (EVI) technology combined with highly efficient air-to-water heat exchangers results in improved efficiencies in a wide range of ambient temperature conditions and



The HydraTherm range of high quality, efficient hot water heat pumps includes 'traditional' split pump technology, where an external heat pump is piped to a separate water storage vessel, and an integrated unit where the heat pump is mounted on top of the water tank.

nominal co-efficient of performance figures of up to 4.5:1.

High quality Saginomya four-way reversing valves provide defrost functionality and ensure that low ambient temperature operation is possible. Hydrophilic coated fin evaporator coils improve efficiency and reduce corrosion, while the patented C&S tube-in-shell heat exchangers with counterflow design, improve heat exchange efficiency and reliability.

The water tank is made from SUS316L 'low carbon' stainless steel, and incorporates two electric impressed current anodes in addition to a magnesium sacrificial anode. This ensures corrosion is virtually eliminated, even in the harshest of environments.

"We supply only SABS approved T/P safety valves and drain cocks. In terms of our product warranty, installation compliance with SANS10254 and SANS10142-1 is mandatory," notes Ward.

Units for large-scale commercial use are designed to be space-efficient. The integrated heat pump resembles an ultramodern domestic appliance and will complement the architecture and aesthetics of any home. The product features a smart control panel, with intuitive on/off push button, and temperature and operating mode controls. Installation is as straightforward as that of an ordinary geyser. Another advantage of the HydraTherm's integrated heat pump is the centrifugal fan assembly and egg carton-style sponge noisedamping material. This reduces the overall sound level to just 45 dBa, which translates to less than the sound of normal human speech or domestic refrigerators.

Whether working with a hospital, dairy, factory or private residence, the company strives to supply only the highest quality products, workmanship and service. Every project taken on – no matter how big or small – is carried out with precision, and completed to the exact specification of the client, architect or engineer.

HydraTherm's three principal members have been in the plumbing industry for over ten years, with he senior director having been in the industry longer than 25 years. This combined experience allows for flexibility. "Where unique solutions are required, we also design heating products on demand to meet exact specifications," Ward confirms.

"We are very excited to launch these sophisticated products and look forward to revolutionising this sector. As impressive as our products are, we are not merely in the business of supply. We provide the full spectrum of services, from initial consultation, all the way through to personal after-sales service and our revolutionary 'cloud' support," he concludes.

### Advanced local solutions for mine and seawater desalination

*MechChem Africa* talks to Martin Pryor, process manager for South African water and wastewater specialist, Prentec, along with Peter Günther, managing director of Prentec's sister company, Prentec Technical Services.



rentec (Process Engineering Technology) has been active in South Africa since 1974, mostly in the water and wastewater space. "We developed the IP for sequencing batch reactor (SBR) technology, modular wastewater treatment plants that are ideal for farms estates and small municipalities," says Günther adding that there are now hundreds of these plants around the country.

"SBRs are single units that are designed to manage all of the processing steps involved in wastewater treatment in one reactor," continues Pryor. "Conventional activated sludge (sewage treatment) requires aeration for oxidation of organics and nitrogen, as well as provision for anaerobic and anoxic conditions for the removal of nitrate and phosphate for complete biological nutrient removal. Then, the solids are settled in a clarifier or thickener, with some activated sludge being recycled, before the clear supernatant water is discharged into the dams or river systems," he explains.

Prentec SBRs do all of these processes using single modular chambers: an aerator on the top mixes the sludge when needed. When it stops, the activated sludge settles to the bottom of the tank and, after a short period, the clear water can be removed from the top.

"So one piece of process equipment can do the job of a multi-stage treatment facility: and larger processing needs can be accommodated by combining different numbers of modules – our largest plant can treat 6.0 Ml/day from eight units," Pryor tells *MechChem Africa*.

Smaller units have proved practical for residential estates, small towns, and industrial applications, with SBRs being cost competi-

tive due to short construction periods, innovative construction methods and low operating costs. "Also, the use of local labour makes these particularly attractive in the South African context," notes Günther.

"We have a number of our own in-house designs for different treatment technologies and we offer turnkey fabrication, building and commissioning of water plants of any size. In addition, though, Prentec offers fabrication services for a host of other process applications: filter presses; clarifiers; thickeners and specialised process equipment such as rotary coal breakers, which we manufacture for a local OEM," says Pryor.

Prentec Technical Services was established in 1988 to cater to the increasing need for servicing of the company's plants in operation. "We view our offering as an end-to-end engineering service that cuts right across the lifecycle of water and wastewater treatment plants as well as the many peripheral installations and units we fabricate," Günther informs *MechChem Africa*.

"Additional value accrues due to our ability to improve designs through observations made on the operations and thereby adapt to the ever-changing operational needs of clients," he adds.

#### Mine water desalination

"Acid mine drainage is only one aspect of the minewater problem," Pryor explains. "There are certainly some places where the water has become acidic but minewater can be polluted in many different ways, so we prefer to talk about mine-affected water," he reveals.

Günther tells of his previous involvement in building the first minewater desalination plant ever built in South Africa to treat coal-affected waters, the eMalahleni Water Reclamation Plant. "This was groundbreaking work. Today there are probably six or seven similar plants and, particularly in coal mining, at least R4-billion has already been invested in overcoming minewater pollution problems," he says adding that the majority of the key people involved in these developments are now employees of Prentec.

"The eMalahleni minewater desalination plant has changed the mining industry," he notes. "Some might argue that desalination



is energy-intensive, but we believe it is as competitive as any technology available – and we have to treat the water anyway to ensure environmental compliance," continues Pryor.

The technology? "Essentially, it is based on two or three stages of reverse osmosis," responds Günther. "Unlike seawater desalination where the discharge can be fed back into the sea, minewater desalination is complicated by the requirements to deal with the extracted contaminants."

"The concentrate from minewater desalination cannot be discharged. This means that, first, as much water as possible has to be recovered from it, and second, the concentrate has to be safely stored, typically in large triple plastic-lined evaporation ponds," he explains.

Pryor continues: "What to do with the concentrate or brine has been the hot topic for the desalination industry for many years. Inland, the only viable solution has been to store it in lined surface ponds and allow the water to evaporate off. A zero liquid solution was investigated in the early to mid 2000s but evaporative crytallisers were the only commercial available solution, which are very expensive and energy-intensive. Hence, evaporation ponds were selected with the mindset that over the next 5-10 years a more cost effective solution for brine treatment would be sought," he says.

"The essence of minewater desalination is to minimise the amount of brine produced from the plant. The original design at eMalahleni was for 97% recovery as fresh water, with only 3% brine. This compared to common reverse osmosis practice at the time, where a single stage produced recovery rates of 70 to 80%, leaving 20 to 30% as brine concentrate.

### affected water





**Above:** Prentec's first commercial scale eutectic freeze crystallisation (EFC) plant. **Left:** Prentec's sequencing batch reactor (SBR) technology for sewage treatment is modular. **Below:** Typical skid-type reverse osmosis (RO) units for minewater desalination.

"Our modern systems take the brine from the first stage and, following a precipitation step, pass it through a second and a third processing stage to squeeze out as much water as possible," Pryor tells *MechChem Africa*.

Günther adds: "The eMalahleni plant has been operating at recovery efficiencies of greater than 99% for over 10 years now. This plant has the ability to treat 50 M $\ell$ /day, producing potable water for the local municipality to supplement its natural sources – and the minewater comes from 19 different contaminated sources.

"This plant proves that mine-affected water problems can be solved. It simply needs the investment. Prentec has installed similar plants for Exxaro and Glencore mines, and many other mines are also adopting these solutions," he adds.

Prentec plants such as these generally also contract Prentec Technical Services to ensure long-term reliability. "Glencore and Exxaro, for example, have taken up maintenance and operations contracts. We have our own staff operating the plant and we keep a maintenance team onsite, with additional on-demand support from our technical specialists here in Chloorkop. Most current tenders, however, are for build-own-operate (BOO) plants, and we are more than happy to invest in our technologies and tender for services on this basis," Günther says.

#### **Seawater desalination**

Pryor adds that BOO contracts are currently being negotiated for seawater desalination projects in water-distressed areas such as the Western Cape. "Seawater desalination is far simpler. There is a massive single water source in the ocean with a consistent chemistry and 40 to 45% of the water can be economically extracted in a single reverse osmosis stage. A higher pressure is required (50 to 70 bar) due to higher salinity levels, but these plants are much easier to design and control.

"The only perceived down side is the power cost, and these days energy recovery systems are included in the designs, which reduce desalination power needs to around 3.0 kWh/m<sup>3</sup> of water. The perception that seawater desalination is expensive is no longer true," he argues. "We can currently tender for short term BOO contracts at R20 to R25/m<sup>3</sup>, which is not significantly more than current municipal tariffs – and it is far cheaper than the punitive water tariffs of greater than R35/m<sup>3</sup> that are sure to kick in more often if we rely only on rainfall," Pryor predicts.

#### **Eutectic freeze crystallisation**

In order to more economically overcome brine management and disposal issues from reverse osmosis plants treating mine-affected water, Prentec is at the forefront of a new freeze crystallisation technology for extracting pure water from solutions with high concentrations of dissolved salts.

This reduces the very high costs associated with evaporation ponds. "When eMalahleni was built, 3.9 Ha of solar evaporation ponds for brine were estimated to be needed to cover the 20-year life of the plant, at a total cost of R300-million.

We have now begun to install a new brine treatment technology that will enable us to eliminate the use of ponds and significantly lower the costs," he reveals.

"Eutectic Freeze Crystallisation is the exact opposite of evaporative crystallisation. Instead of boiling the water to create steam



and leaving the crystals behind, we chill the brine to produce ice, which, when remelted, is close to potable water," explains Pryor.

On chilling the brine, the ice floats up as it begins to solidify. The dissolved salts, on the other hand, crystallise and sink in the solution. "Evaporative crystallisers need high temperature and exotic stainless steel, but when freezing, the corrosion problem goes away and cheaper materials can be used. fFrom a plant- and energy-cost perspective, this technology can be much more cost effective," says Pryor.

The first commercial units – engineered by Prentec – have now been installed and their performance is being carefully monitored.

"We are well positioned in the current market to provide water and wastewater treatment services, and we are continuing to do and support research to advance our technologies," Pryor says.

"We have the engineering experience, the fabrication facilities and the service networks to provide significantly more efficient and cost-effective water services for mines, municipalities and communities – and we are willing to invest in these ourselves through BOO contracts," he assures *MechChem Africa*.

# **Veolia projects** at Global Water Awards 2017

Veolia Water Technologies continues to deliver landmark water treatment solutions the world over, and this was confirmed at the recent Global Water Awards 2017 in Madrid, where three of the company's plants were distinguished in their categories.

he Global Water Awards are presented annually at the Global Water Summit, the major business conference for the worldwide water industry. The Awards acknowledge the most important achievements in the international water industry within several categories.

At this year's awards in Madrid, Veolia was distinguished for the following: the Marafiq project in Saudi Arabia in the Industrial Desalination Plant of the Year category; the Antarctica Reuse project in the Water/ Wastewater Project of the Year category; and, in the Municipal Desalination Plant of the Year category, for the Az Zour North 1 project in Kuwait.

For the Water/Wastewater Project of the Year category, Veolia's new MBR plant was recognised as the critical component of the multi-year programme to clean up contamination in the Antarctic. The plant will be complemented by a seven-barrier advanced water treatment plant at the Davis research station, allowing world-class potable water to be produced from secondary effluent within a closed-loop system. On top of the unique construction, engineering and logistical challenges associated with working in one of the world's harshest yet most ecologically sensitive and precious environments, Antarctica presents difficult contaminant dispersal challenges. Yet, in supplying cutting-edge, low-footprint Veolia technologies, it is also a leading example of how scientific solutions by industry leaders are solving critical environmental challenges through reconceptualising the role of waste within the gamut of circular economics.

Veolia's Marafiq reverse osmosis plant was distinguished in the Industrial Desalination Plant of the Year category. Built to supply the water required for Sadara Chemical Company's massive manufacturing facility in the industrial city of Jubail on the Gulf coast of Saudi Arabia, the plant supplies up to 178 000 m<sup>3</sup>/day through reverse osmosis seawater desalination.

The plant uses an array of high-end pretreatment technologies – dissolved air flotation followed by self-cleaning microfiltration and ultrafiltration – to allow large volumes of water to be treated from a feed source at the



Veolia's MBR plant is helping reduce historic pollution in Antarctica by using cutting edge technology to provide fresh water to the continent's research community.



At the pinnacle of multiple effect distillation (MED) technology, the Veolia-supplied seawater desalination plant in Kuwait, provides 486 400 m<sup>3</sup>/day.

extreme reaches of salinity and temperature for a desalination plant. Through a unique dual-train seawater then brackish water reverse osmosis process, water recovery level reaches almost 50%, while a rotary isobaric pressure exchanger uses just 5.1 kWh/m<sup>3</sup>, an impressive achievement for a plant of this scale dealing with hostile feed water conditions.

The 486 400 m<sup>3</sup>/day multiple effect distillation plant (MED) supplied to Az-Zour North in Kuwait is the first privately owned desalination plant in the country. This plant combines low operations and maintenance costs with a limited requirement for scaling treatment, which pushes the margins of performance and profitability in this pathfinder public-private partnership in the water space.

With an ultra-low energy consumption of around 1.0 kWh/m<sup>3</sup> and a low-pressure stream, the plant showcases the pinnacle of MED technology. The successful treatment of extreme levels of salinity with a wide range of feed water temperature, from 13° to 38° C, is a stunning example of cutting-edge seawater desalination technology.

#### The state of reuse and desalination in South Africa

As water security becomes more and more difficult to guarantee through an increasingly strained supply of surface water in South Africa, water reuse and seawater desalination continue to grow in importance.

Desalination, especially, is seen as the best avenue to invest in future water infrastructural builds, and while it remains the most expensive per-unit cost of treatment for a potable water supply, in many cases there are few other options available. Veolia has been responsible for seven seawater desalination plants in South Africa, including the biggest: the 15 Mℓ/day Mossel Bay plant.

"However, while desalination plays an everincreasing role in meeting our fresh water supply requirements, the need to invest in more sustainable, more environmentally friendly

#### Water and wastewater processing



In hostile feedwater conditions, the Marafiq reverse osmosis plant delivers water recovery levels approaching 50% to supply 178 000 m<sup>3</sup>/day to the Sadara Chemical Company's facility in Saudi Arabia.

and less wasteful water use practices is becoming more blatant," argues Chris Braybrooke, marketing manager for Veolia Water Technologies South Africa. "That is why, more and more, we will see water reuse and recycling being a critical part of municipalities and industry meeting their water requirements in the not-too-distant future."

Veolia can provide water reuse solutions for full potable reuse from applications including: facility cooling; boiler feed water; industrial process water; irrigation in agriculture and urban green space; as well as ground water storage and recovery.

The largest of the plants provided by Veolia to date are the landmark Goreangab Water Reclamation Plant in Windhoek, Namibia, which treats wastewater and semi-purified sewage to directly supply 21 Mℓ/day of potable water, and the Durban Water Recycling (DWR) Plant, which recycles 47.5 Mℓ/day of domestic and industrial wastewater for reuse by industrial users such as Mondi Paper and SAPREF. □

#### Truck-mounted treatment plants for Lesotho

Veolia has designed, built and delivered four generator-powered, potable water treatment plants (WTP), mounted on the back of 4×4 trucks, for use by communities in Lesotho.

River water is pumped into the mobile WTPs to undergo clarification, ultra filtration (UF) and disinfection. The plants contain ceramic membrane UF units designed for their ruggedness and their ability to accept varying water qualities.

"While these truck-mounted mobile WTPs are a first for Veolia in South Africa, the engineering of the units has allowed for ease of assembly because we used our expertise in packaged plants to modularise the system and reduce manufacturing time and costs," explains Victoria Tutubala, project engineer at Veolia.

Process equipment for each plant consists of a raw water feed pump, basket strainer, clarifier, ceramic membrane UF unit, chemical dosing unit, compressor, backwash and air receiver tanks and the power generator. Additionally, each mobile unit has its own UF clean-in place (CIP) skid for use when required.

From order to delivery took only between 12 and 13 weeks, with all equipment design, manufacture, construction and mounting carried out at Veolia's Sebenza facilities in Johannesburg East. □

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#### **Tracking industrial trends**

### Water on the mind

In his Tracking Industrial Trends column this month, Gary i. Crawford of Crawford Strategic Consulting talks about the precious nature of water and some of the latest steps being taken to protect this limited resource.

.....

ike most students of the brain, I'm convinced of the value of drinking enough water, although, quite frankly, I'm more of a water 'derivative' fan. A fine wine or beautifully crafted beer have much more appeal than H<sub>2</sub>O.

During my working life I've been lucky to consult with several blue-chip clients in whose businesses water played a significant role, from Rand Water and its large diameter spiral-weld pipeline manufacturing facility – I recall that its CEO had the delightfully appropriate surname of Bath – to SAB which at that time used one tenth of its water in actual brewing and nine tenths in maintaining sterile conditions. From them I learned about reducing waste and correct storage and handling of water.

From a more recent client, I learned the value of a 'natural' approach to sediment control and treatment equipment 'conditioning.' From my involvement with the stainless steel industry, I learned that water authorities around the world were losing unprecedented volumes of water through leaking pipelines.

In the past week, I've come the closest I've been to living near water. Now, officially residents of 'Harties,' we availed ourselves of 'Oewerklub' membership and immediately went down to the shore to enjoy the vast sweep of water and the village of Kosmos nes $tled at the foot of the Magalies berg {\it monocline}.$ 

Reality was a little different from what was in our mind's eye. A visual sweep, yes, not of water but of dense Water Hyacinth from shore to shore!

#### The scourge of Hartbeespoort – Water Hyacinth

Water Hyacinth (*Eichhornia crassipes*) has once again invaded Hartbeespoort Dam. This aquatic plant is Africa's biggest aquatic invader. Dense water hyacinth infestations impact negatively on sport and recreational activities, but are potentially far more serious.

The plant is also widespread throughout many waterways in the Western Cape, KwaZulu-Natal, Gauteng, Free State and Mpumalanga. It is particularly problematic along vast stretches of the Vaal River. A native species in the Amazon Basin, water hyacinth was introduced in South Africa as an ornamental plant. This plant is regarded as the world's worst waterweed by the IUNC (World Conservation Union) and GISP (Global Invasive Species Programme).

Water hyacinth forms floating mats on top of the water, clogging waterways and killing indigenous species by cutting off the sunlight and oxygen.

By July this year 600 ha of the Hartbeespoort Dam, 30% of the dam's surface of



The resilient and invasive water hyacinth weed is again taking over Hartbeespoort Dam.



the micro-economy of the area. For a decade the Department of Water and Sanitation ran a programme to keep the hyacinth and algae at bay on the dam. However, the Department terminated this successful programme.

The Department's Metsi a Me project was a biological remediation programme called the Hartbeespoort Dam Integrated Biological Remediation Programme (HDRP). The approach was basically to remove the bad things present in excess – algae, hyacinths, undesired fish species, litter and debris – restore natural filters via wetlands and regulate water use.

From a public meeting on 18 April 2016 it became clear that most of the 19 projects had been stopped and that the creation of a Resource Management Agency combining public and private stakeholders was needed. It also became clear that the meeting covered a very broad range of subjects, including the allocating of foreshore management leases to private parties.

At that stage it was envisaged that the proposed water hyacinth control programme could include the following components:

- Chemical Control: A chemical (or herbicidal) control component where the bulk of the hyacinth biomass would be treated with a suitable herbicide.
- Biological Control: A biological component where bio-agent reservations will be demarcated for control of hyacinth with their natural biological enemies, such as beetles and mites.
- Mechanical Control: The mechanical control programme at the dam wall could be re-activated and maintained to remove biomass drifting towards the sluices.
- **Physical Control:** the removal of water hyacinth by hand from the shoreline around the reservoir, which would provide work for unskilled labourers.

In its contemplation of chemical control it is apparent that the Department wanted to



be seen by the public as 'doing something' to get rid of the water hyacinth problem. But little thought had been given to the problem it would create by 'dumping' an enormous biomass to rot on the dam floor?

To me, we should be viewing water hyacinth as a usable input material rather than just waste.

In many countries people have been able to find useful applications for the plant. Composed of more than 95% water, it has a fibrous tissue and a high energy and protein content, which can be used for a variety of useful applications.

For paper in Bangladesh, for example, experiments have shown that when the fibre is blended with waste paper or jute the resulting paper is good. Similar papermaking projects have been successful in the Philippines, Indonesia, and India. Another related application of water hyacinth is the production of fibreboard for a variety of uses such as dry-walling, ceilings and bitumised board for roofing. The stalk from the plant can also be shredded lengthways to expose the fibres. After being left to dry for several days, these fibres are ideal for making yarn and rope.

From a fuel perspective, charcoal briquetting of charcoal dust following pyrolysis has been proposed in Kenya to deal with the rapidly expanding carpets of water hyacinth on Lake Victoria. And in India, biogas in quantities of up to 4 000 litres of gas per tonne of semi dried water hyacinth have been produced with a methane content of up to 64%.

Animal feed studies have also shown that the nutrients in water hyacinth are available to ruminant mammals such as cows and in Southeast Asia, some other domestic animals are fed rations containing water hyacinth. In China pig farmers boil chopped water hyacinth with vegetable waste, rice bran, copra cake and salt to make a suitable feed and in Malaysia fresh water hyacinth is cooked with rice bran and fishmeal and mixed with copra meal as feed for pigs, ducks and pondfarmed fish.

Water hyacinth is also used on farmland as green manure or compost, either ploughed into the ground or used as mulch. Mixed with ash, soil and some animal manure, the mixture In many countries people have been able to find useful applications for the plant. Composed of more than 95% water, it has a fibrous tissue and a high energy and protein content, which can be used for a variety of useful applications.

can be left in piles to compost. Particularly in the warmer climate of tropical countries, this process accelerates and a rich pathogen free compost is produced that can be applied directly to the soil.

So think Department, think!

#### Water wastage: stainless steel to the rescue

While consulting with Rand Water, I discovered that approximately half of all water supplied to municipalities did not reach the ultimate consumer. Local authorities could invoice for only half of the water they had purchased. No wonder so many were 'crying poverty.'

It is believed that approximately one third of treated water is lost to leaking pipes and that more than 90% of the leaks are in the small diameter service pipes connecting to users' water meters. These leaks are difficult to detect because they don't register on the meter and water loss is relatively low. So leaks can go undetected for years.

According to an article in the current issue of Stainless Steel magazine, approximately 40% of Johannesburg's supply is non-revenue water, with a value of R1.1-billion per year, of which more than 70% is lost through pipe leaks.

High density polyethylene (HDPE) is the material of choice for water pipes. The International Stainless Steel Forum (ISSF), however, states that HDPE is not the best solution as its lifespan can be as low as 20 years. With stainless steel, a lifespan of at least 60 years can be anticipated.

This year the ISSF launched an initiative to use stainless steel water pipes. From three case studies, it presented conclusive evidence that stainless steel is the best material when taking both economic and environmental considerations into account.

Tokyo started investigating a solution to its dwindling water supply in the 70s and between 1980 and 2012 it replaced all service pipes with stainless steel pipes – some being corrugated pipes. From a water loss of 17% in 1980, losses were reduced to 2.0% by 2012.

The results speak for themselves.

#### The natural approach, take one and call me in the morning

A recent survey of wastewater treatment plants in Gauteng showed that 43% of its 84 plants are operating at capacities higher than those for which they were designed. This precarious situation is made more dangerous by the substantial sludge build-up occurring in virtually every area of South Africa's wastewater treatment systems.

Current sludge removal methods are time-consuming and expensive in the case of mechanical removal, and ineffective in the case of treatment with inorganic additives and chlorine. In any event, most of South Africa's dams and waterways now have unacceptably high levels of coliforms, which poses medical risks.

There is a single tablet-based product that can eliminate bottom sludge. Through bacterial and aerobic action, it oxygenates water; neutralises pH; reduces coliform levels; prevents corrosion of metal, concrete and pumping equipment; and reduces the need for frequent clearing of water pumps and lift stations.

Sounds like snake oil? It did to me too, until I saw it at work.

The reduction of solids increases the ability to handle more incoming wastewater and in so doing restores the sewage plant to operational efficiency, further extending its active life span.

The secret lies in the 16 different bacteria used to dissolve sludge. Worth looking up? The product is available in several countries, including South Africa, under the brand name, Eco-Tabs.

Well, I think that's enough water for now. I'm going to pour myself a Scotch and check whose winning in the water hyacinth war.



#### When less really means more

Atlas Copco Compressor Technique, a global specialist in quality compressed air technology, equipment and systems, offers the OSC range of condensate separators for compressed air systems, for the delivery of high performance, versatility and low maintenance.

Consisting of eight models, the OSC range can accommodate compressed air systems from 35  $\ell$ /s up to 2 360  $\ell$ /s.

Atlas Copco incorporated advanced technology into the design of the OSC range in the form of a revolutionary and patented oleophilic active filtration process. This technology enables almost all condensate mixtures to be separated,



The Atlas Copco OSC 145-600 range.

including most emulsions. Unlike with many of such systems, over-sizing is unnecessary when faced with synthetic oil based condensates. This also ensures that the condensate separators meet strict environmental regulations.

According to Charl Ackerman, business line manager of Atlas Copco Compressor Technique's Industrial Air division, simplicity is a key feature of the product. "Installation requires only a roughly flat surface, the set-up is uncomplicated and there are no restrictions on the drain type used upstream of the unit, making this a simple, no-fuss and extremely userfriendly unit."

The OSC range offers a series of practical and tangible advantages compared with traditional gravity-based systems:

 A very stable separation performance throughout filter lifetime.

- No standing stagnant water, which eliminates health risks.
- Large capacity chambers reduce the risk of spillage through blockage or any sudden increases in condensate flow.
- No oil collection bottle which means already separated condensate cannot be ruined in the event of a malfunction and multiple oil condensate can be separated, along with condensate from multiple sources.

Ackerman also points out that compulsory regular testing is a thing of the past as the maintenance indicator conveniently tells the customer exactly when to change the filters, which is completed in a quick, easy and clean operation.

The design simplicity of Atlas Copco's OSC range adds value through the delivery of optimum performance, low operational costs, and long life for total convenience and customer peace of mind.

www.atlascopco.co.za

#### Workplace demarcation made easier

Workplace demarcation in manufacturing facilities has become more important as companies streamline processes and implement best practice policies.

Wim Dessing, managing director of Apex Strip Curtains & Doors, says the company has seen a marked increase in the use of specialised PVC strip curtaining to cordon off areas and clearly identify the flow of work.

"Floor markings are something we

#### thyssenkrupp and Tata Steel in 50/50 JV

thyssenkrupp and Tata Steel recently signed a memorandum of understanding to combine their European steel activities in a 50/50 joint venture. Their aim is to create a leading European flat steel player positioned as a quality and technology leader. The new entity is set to have pro-forma sales of about €15 billion and a workforce of about 48 000, currently at 34 locations. Shipments are envisioned to be about 21 million tons a year.

Dr Heinrich Hiesinger, CEO of thyssenkrupp AG comments: "Under the planned joint venture, we are giving the European steel activities of thyssenkrupp and Tata a lasting future. We are tackling the structural challenges of the European steel industry and creating a strong No 2. In Tata, we have found a partner with a very good strategic and cultural fit. Not only do we share a clear performance orientation, but also the same understanding of entrepreneurial responsibility toward workforce and society."

Natarajan Chandrasekaran, chairman of Tata Steel, adds: "The Tata Group and thyssenkrupp have a strong heritage in the global steel industry and share similar culture and values. This partnership is a momentous occasion for both partners, who will focus on building a strong European steel enterprise. The strategic logic of the proposed joint venture in Europe is based on very strong fundamentals and I am confident that thyssenkrupp Tata Steel will have a great future."

To be named thyssenkrupp Tata Steel, the planned joint venture will be managed through a lean holding company based in the Netherlands. It is to have a two-tier management structure comprising a management board and a supervisory board with both boards having equal representation from thyssenkrupp and Tata.

www.thyssenkrupp.com

encounter in some way every day. This method of demarcating areas where people are able to walk within a facility allows for quick visual identification, but there is also the need to cordon off various sections for quality control or safety reasons," Dessing says. "And this is where the Apex General Purpose Strip Curtains play such an important role."

This locally manufactured product has been available in South Africa for more than 45 years and apart from its high quality boasts the unique patented Balledge® on both sides of individual strips. "The Balledge is a major differentiator that customers recognise," Dessing says. The reinforced rounded edge on the strip ensures the perfect thermal close, but just as importantly it allows the strips to part easily to allow access to pedestrians as well as pallet trucks, forklifts and other motorised equipment.

Apex General Purpose Strip Curtains are manufactured at the company's facility in Founder's View, Modderfontein.

www.apexstrip.co.za



Apex Strip Curtains are used to cordon off sections for quality control purposes.

#### BMG Fenner transmission belts

BMG's portfolio of Fenner power transmission components includes a range of high-strength friction transmission belts that offers longer service life, higher drive efficiency and reduced downtime compared with conventional V-belts.

Fenner PowerTwist Drive V-belts, which are manufactured from a high strength polyurethane elastomer reinforced with multiple plies of polyester fabric, offer excellent resistance to abrasion, oils and greases, water and steam, as well as industrial solvents and chemicals.

"These flexible PowerTwist Drive V-belts are the ideal solution for permanent replacement and fitment into inaccessible locations. The friction transmission belts can be custom-sized for each sheave groove, reducing wear and providing a perfect matched set of belts when mounted on a drive," says Carlo Beukes, general manager, power transmission, BMG. "PowerTwist Drive belts combine extremely high strength with low stretch and have the same power ratings as conventional V-belts. The elasticity of woven polyurethane fabric enables these belts to be stretched over a pulley drive without any damage.

"Once the required length of belt is



BMG's Fenner PowerTwist Drive V-belts and Quatro Plus TW heavy-duty drive belts offer high performance, maximum drive efficiency and extended service life in tough conditions.

determined, the V-belt is simply twisted and the end links are interlocked by hand, without the need for tools. An important advantage is that these durable belts operate efficiently at elevated temperatures up to 110 °C in harsh environments, for up to 15 times longer than standard rubber and other link V-belts. These flexible belts are also designed for easy installation as a permanent replacement, with minimal downtime. No dismantling of equipment is necessary."

For user convenience and inventory reduction, the PowerTwist Drive range is available in different speciality profiles and constructions for efficient power transmission and material handling applications. www.bmgworld.net

#### IE3-compliant DRN motors WWTP

A major upgrade to a wastewater treatment plant in the Eastern Cape is taking advantage of the energy-saving and cost-efficiency features of the latest IE3-compliant DRN motors from SEW-EURODRIVE.

An important feature of these motors for wastewater treatment applications is their IP 65 rating, SEW-EURODRIVE South Africa head of projects, Rudi Swanepoel comments. A total of six units are being supplied, with two gearboxes fitted with 75 kW DRN motors, two with 45 kW DRN motors, and the remaining two with 37 kW DRN motors.

These specific units will be used for aerator applications. "With aerator and mixing applications, our projects and engineering teams have to double check all of the loads and bending moments. These loads are supplied to us by the client, based on their designs. We then have to ensure that the gearboxes that have been selected are suited to the application at hand," Swanepoel explains.

SEW-EURODRIVE employs a special program designed specifically to determine if the gearbox selection is adequate,

based on the loads and bending moments. This is particularly important when it comes to aerators and mixers.

Wastewater treatment plants represent a particularly arduous application for these DRN motors, which means auxiliary instrumentation such as PT100s to measure temperature, and thermistors, which are a cut-out failsafe measure when the motor temperature reaches a set high point, are often required. Accessories included strip heaters for colder conditions, and rain canopies.

www.sew-eurodrive.co.za



SEW-EURODRIVE South Africa is supplying its latest IE3-compliant DRN motors to a wastewater treatment plant in the Eastern Cape.

### WEG W22Xd motors now Ex-certified

The WEG W22Xd flameproof electric motor, available from Zest WEG Group, meets worldwide standards for use in hazardous applications including the mining, chemical and oil and gas sectors. The W22Xd motor is certified in line with European ATEX and International IEC Ex standards.

ATEX/IEC Ex certified, WEG W22Xd flameproof motors are designed to cope with the rigours and aggressiveness of explosive atmospheres, while delivering the added benefits of high efficiency. Motors available with the IE2 or IE3 energy-efficiency rating offer minimised noise, vibration, and low operating temperature for increased reliability and safety.

The W22Xd motor is classified for Group I (mines susceptible to firedamp) and Group II (surface industries); for gases Group IIB and IIC, suitable for use in hazardous area defined as Zone 1 and Zone 2 – Gases and Vapours; and Zone 21 and Zone 22 – Combustible or Ignitable Fibres.

The advantage of one motor carrying dual certification for gas and dust facilitates a reduction in inventory costs for users as a common motor frame can be used with different types and sizes of terminal boxes.

Developed in 2002, the initial range of WEG flameproof motors covered the larger power output segment for low, medium and high voltage supplies up to 11 kV. Following the introduction of motors in frame sizes 315 to 500, the range was extended in 2014 to include larger sizes through to a 710 frame.

Complying with the latest editions of IEC/EN 60079 standards, the WEG W22Xd range allows Zest WEG Group to provide a comprehensive range of hazardous area motor products from IEC frame sizes 71 to 710.

Features of the WEG W22Xd 560 to 710 frame design include a stainless steel tube array, which provides air ducts allowing both axial and radial flow paths, which optimise cooling of the rotor, stator and critical components such as the bearings. The motor is fitted with an aerodynamic fan and cover for efficient airflow with minimum noise.

Designed using finite element analysis (FEA) software, the cooling system on the WEG W22Xd flameproof motor provides outstanding heat dissipation. This reduces thermal stress on the insulating materials facilitating longer life. It also eliminates hot spots by providing a uniform temperature distribution throughout the frame. www.zestweg.com

#### Choose your rubber lining with care

The choice of rubber lining in any mining or quarrying application remains complex and experience-based; one certainty, however, is that hardness and price per kilogram are insufficient factors to consider when making that choice.

According to Yatheen Budhu, product manager rubber products at Weir Minerals Africa, the mining industry has fallen into the habit of specifying rubber by hardness alone. Budhu says: "Other



Weir Minerals produces custom rubber linings including Linatex at its plant in Alrode.

important factors, including resilience, tensile strength, tear strength, cutting resistance and dry/wet abrasion resistance index (ARI), need to be considered to ensure that the option selected is fit for the application.

"The quality of rubber sheeting varies widely within the industry. Moreover, rubbers which are formulated for dry abrasive applications may not be suitable for wet abrasion applications," he says. "An essential primary step is to assess the application requirement when selecting the type of rubber sheeting."

Rubber sheeting has had to compete increasingly with synthetic elastomers, polymers, ceramics and other abrasion resistant metals, he says. Nonetheless, rubber has retained its position as the preferred wear material for fine slurry abrasion resistance, as well as impact and chemical resistance in the mining industry.

Most processes used in the mining sector to recover base and precious metals, coal, diamonds and other minerals involve the suspensions of solids in water. Budhu explains that natural rubber is considered the most suitable wear material in such applications where wet abrasion is found, for example in the pumping and separation of fine particle slurries

Equipment used in these processes is frequently lined with pre-cured rubber sheet. Where mines, fabricators and applicators have access to an autoclave or open steam facility, steam cured rubber sheet could be used.

Linatex<sup>®</sup> premium rubber has superior physical properties, and this Budhu says is due to the unique manufacturing process used by Weir Minerals. The manufacturing process to make Linatex incorporates 'liquid phase processing' and ensures that the original molecular structure of natural rubber is retained. Budhu says this is critical to the performance characteristics of the product because, Linatex premium rubber has an even dispersion throughout the rubber sheet.

"The combination of a high wet ARI (Abrasion Resistance Index), high resilience and tensile strength with a bimodal molecular weight distribution, gives Linatex rubber its superior performance in fine slurry applications," he says.

www.minerals.weir

#### RTS Africa spin filters do away with dust damage

"Many industrial air compressors work in very dusty conditions, particularly in the mining industry, where dust from newly broken rock is particularly abrasive," explains managing director of RTS Africa Engineering, Ian Fraser. "If you get dust into the cylinders of a compressor, it combines with the oil to form a highly corrosive

### Cummins Africa relocates to Allandale Building

Cummins Africa and the Middle East (AME) has announced that it has relocated to new premises in the Allandale Building in Waterfall City, Midrand, close to the Mall of Africa development. The relocation became necessary because of the company's success on the continent; a healthy and growing organisation now requires expanded facilities.

"We would like to welcome Cummins to Waterfall City," said Morné Wilken, CEO of developer, Attacq. "We are confident that Cummins, a global energy and power leader, will benefit from its new office's strategic location and facilities, which make Waterfall City the ideal site for the company's Middle East and Africa headquarters."

africa.cummins.com

grinding paste, which will accelerate wear dramatically," he adds.

All compressors have their own air intake filters, which are, in the main, designed to filter out tiny low-mass particles. However, if a compressor is exposed to excessive dust from manufacturing or mining where the particles are larger than three microns (µm), the compressor's air filters block up rapidly.

In this circumstance, one of two things will happen: either, the compressor owner has to spend a lot of money more frequently changing proprietary air filters; or the filters suffer from total neglect.

"With a blocked air filter, the compressor is increasingly starved of air and its efficiency levels drop. Ultimately, this leads to compressor failure. With large industrial compressors costing anything upwards of

half a million rand, an unscheduled and urgent capital requirement for a replacement and the cost of lost production time can have serious consequences for a company," Fraser says.

RTS Africa spin filters will remove 98% of 15  $\mu$ m particles and above, 93% of 10  $\mu$ m particles, and 80% of 5.0  $\mu$ m particles. By using an RTS Africa inertial spin

filter to remove most of coarser particles from the air entering a compressor room, the compressor's own filters will need to be replaced far less often.

"A spin filter consists of a cycloneshaped tube, through which air is propelled or drawn. On entering the tube, the air is induced to spin using vanes. Particles in the tube move to the outside of the vortex, and the clean air in the vortex centre exits through a central orifice at the end of the tube. A secondary stream of air is used to evacuate the dust-laden air back to where it came from," he explains.

Spin filters are also useful in the direct ventilation of the variable speed drives (VSDs) that are used on many compressors. RTS Africa Engineering has developed a technique it calls 'back-channel cooling' of VSDs. www.rtsafrica.co.za



Spin filters for use in back-channel cooling of VSDs.

#### Flexicon explosion-proof bag dump station

A new Flexicon bag dump station with an explosion-proof electrical system, contains dust emitted from manual dumping activities, compacts empty bags and conveys the material to an elevated destination.

Bags are staged on the bag tray and transferred through a plastic strip curtain into a hooded glove box and onto a grate, which supports the bag and prevents unintended operator contact with moving parts.

The hood is equipped with a polycarbonate skylight that illuminates the interior of the enclosure for improved bag slitting, dumping and disposal.

A bag infeed chute through the sidewall of the glove box permits the operator to pass empty bags directly into an integral bag compactor, causing dust generated from compaction as well as dumping activities to be drawn onto the system's two filter cartridges.

The automatic reverse-pulse filter cleaning system employs timer-activated solenoid valves to release short blasts of compressed plant air inside the cartridges, causing dust build-up on the outer filter surfaces to fall into the hopper, conserving useable product. Filters are readily accessed by removing the interior baffle, and replaced rapidly using quick-disconnect fittings.

The compactor employs a pneumatic air cylinder that compresses bags into a removable polybag-lined bin that accommodates 50 to 80 bags. The main waste access door and a flapper door within the bag infeed chute are safety interlocked to prevent operation of the compactor unless both doors are closed.

The hopper discharges into an enclosed Flexicon flexible screw conveyor for dust-free transfer of free- and non-free-flowing materials to an elevated destination with no separation of blended products.

www.flexicon.co.za



### Radar products from E+H's e-direct online shop!

The new free space radar Micropilot FMR10 from Endress+Hauser offers various significant product features regarding innovation and efficiency. It is a radar measuring device with Bluetooth wireless technology whose commissioning, operation and maintenance are carried out via the SmartBlue App.

The full PVDF body guarantees a long sensor lifetime. Wireless remote access and its most compact design make it eminently suitable for installation in areas difficult to reach or in places with limited space. The new Micropilot FMR10 is especially designed for the requirements of the water and wastewater industry as well as for utility applications in all industries. It is of particular use for measurement in storage tanks, open basins, pump shafts and canal systems.

Notable features include: up to 5.0 measuring range; process temperature from -40 to +60 °C; process pressures from -1.0 to 3.0 bar; accuracy of up to  $\pm 5.0$  mm; and IP66 ingress protection.

The Micropilot FMR10's best price-performance-ratio in radar measurement is available via Endress+Hauser's e-direct product portal. www.e-direct.endress.com

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### **Keyless access for better protection** of equipment enclosures

*MechChem Africa* talks to Gavin Coetzer, managing director of KAG Technical Solutions about its proudly South African "Bluelock" Keyless Access Solution, an innovative approach to managing access to deployed network infrastructure such as telecommunication and electricity substation enclosures, while overcoming physical key management challenges.

B ased on experiences of installing and testing fuel-cell and cooling technology in cell phone towers, Coetzer noticed that key management was a critical element in the telecoms space. "This, we believe, is an industry wide problem. It affects every cellphone tower, electricity substation or lamppost cabinet where critical network assets are deployed for the delivery of essential and connectivity services. Keys are routinely issued to contractors or staff, for example, but the management and recovery of those keys is seldom effective," he says.

"Also, traditional locks, even modern electronic versions such as keypads or biometric readers for example, invite vandals or thieves to break in. Wherever there are visible security features, these elements are targeted by people convinced that the enclosed equipment has value, which is often the case. Given enough time and unguarded access, even the best physical locks can be broken and removed, giving easy access to the site, which is certain to be damaged or completely destroyed, disrupting local services and triggering the need for expensive repairs – usually after hours," Coetzer tells *MechChem Africa*.

Having realised the problem, Coetzer went looking for solutions. "In Europe and the US, all sort of modern USB- and remote-based locking systems are available, but these all still require a key-like device to be handed over to the person requiring access, in the hope that it can be easily retrieved before

being duplicated. "What we wanted

to achieve was an invisible and keyless site access solution, which we found locally being implemented for home security and garage

access by a company called BlueLock. Based on the use of Bluetooth technology, this system replaces remotes and enables gate motors and locking actuators to be

triggered from a phone.

#### KAG "Bluelock" keyless access solution

KAG Technical Solutions has now incorporated BlueLock's receiver technology into a new Keyless Access system specifically designed for infrastructure enclosures. "This is all built around the Smartphone, which can be temporarily assigned 'secure tokens' to activate the locking systems

The "Bluelock" keyless access solution does not offer any visible clues as to how the cabinet is secured. Instead, it uses Bluetooth technology, triggered from a Smartphone App and an authorised access token (inset), to lock and unlock the cabinet via actuators.

![](_page_43_Picture_13.jpeg)

Given enough time and unguarded access, even the best physical locks can be broken and removed, giving easy access to the site.

at particular enclosures," Coetzer explains. "When close to the locking device in question, hidden locks are triggered from the phone via the BlueLock App. The signal sent via Bluetooth is picked up by the receivers, which are also hidden behind the enclosure's doors and fully incorporated into the secure space.

"Bluetooth is a short distance – 20 to 30 m – communication system, but it can penetrate steel, so it is possible to also hide and secure the receiver. This also makes it very difficult for a hacker to intercept the code, since they would have to be within 5.0 m of the person activating the locks," he adds.

Describing the advantages, he says "If I am in Europe and my geyser bursts at home, I can issue a token and an access code to anyone with a Smartphone, my neighbours for example. First, they will need to download the Bluelock App. Then I can send a single use time- or date-limited secure token. When they are near my front door, they simply unlock the doors by touching the App's activate icon. Then, when done, they lock the doors again in the same way.

For industry players in the telecoms space,

![](_page_44_Picture_1.jpeg)

Vandalism and the theft of batteries and other equipment from these cabinets causes the disruption of local services and triggers the need for expensive repairs – often after hours.

KAG Technical Solutions has created an environment where "we can remove all of the physical evidence of a locking system from a cell phone tower enclosure or lamppost cabinet leaving the steel door completely plain. This makes it very difficult for a vandal or thief to determine how the system is locked and, therefore, much more difficult for them to break in," he says

"The electrical/electronic locking system and its Bluetooth receiver sits behind the locked steel-cage door. In addition to this invisibility, we no longer need any physical keys for the equipment shelters and all access management – for any telecoms shelter or City/Eskom substation or distribution site – can be managed via centralised databases built into the access system," he continues.

The database monitors and records every person authorised to access the site along with every individual access event. "By allocating a secure token for every authorised person, every trigger access by that specific person can be monitored and recorded, along with the exact time. In addition to the security advantages, this makes for much tighter accountability of authorised staff," Coetzer explains.

It is also ideal for managing contractors, who are often unknown to the network operators. "Each contractor first needs to be registered on the clients authorised personnel database, and this immediately enables checks to be carried out against the contracting company's database.

Also, though, access can be easily limited to exactly what is necessary. "A time limited access entry and secure token can be sent, for example, which will become useless after having been used in the defined period." he tells *MechChem Africa*.

The locks themselves? "The physical locks can be solenoid, any linear actuator or electromagnetic lock that can be electronically triggered. The system needs power and battery back-up power to function, but the infrastructure being protected usually has these systems anyway, to maintain services when the power goes down – and we can keep a lock alive for several months after a power outage, which the operator will know about immediately, anyway," he responds.

"Reliability wise, the actuators are not used every day, so they will never reach their rated life cycles. They are housed in clean and dry environments and, because only battery-backed dc power is used, the power supplied to them is very stable," he assures.

"We have been focusing, very successfully, on the telecoms space, initially securing the lowprofile high-security lamppost cabinets, being installed for improved GSM, LTE and HSDPA data networks. These 2.0×1.5×1.0 m cabinets with cellphone masts that are less than 15 m tall are being installed in cities all over the world to fill the network connectivity gaps and raise signal density in urban areas. It's the modern trend in cities," suggests Coetzer.

"We see our keyless access solution as ideal for anyone who has accessible infrastructure providing essential services that needs to be protected, particularly if key management challenges are being experienced," Coetzer concludes. SMC Pneumatics – Leaders in Innovation

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![](_page_44_Picture_16.jpeg)

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Join the conversation

- in SMC Pneumatics (South Africa)
- SMC Pneumatics South Africa

### Remote AR offers real-time expert assistance

RE'FLEKT has launched REFLEKT Remote, a first enterprise augmented reality suite with real-time assistance and content automation.

n October 19, 2017 in Munich at the Augmented World Expo, RE'FLEKT launched the latest member of its leading Enterprise AR Suite: REFLEKT Remote for real-time expert assistance with Augmented Reality. REFLEKT Remote provides instant access to expert knowledge and connects to a cloudbased incident management system as well as to AR applications created using the REFLEKT One content creation platform.

REFLEKT Remote's state-of-the-art remote video collaboration solution and incident management system can connect to Android, iOS and Windows operating systems as well as to smart VR glasses. The system connects to artificial reality (AR) applications from the REFLEKT One content platform.

Using the remote video collaboration tool, employees and customers can now choose between real-time assistance and on-site guidance with AR-powered instructions in mobile apps, tablets or smart VR systems such as Microsoft Hololens. The fusion of remote expert assistance and highly automated experiences provides enterprises with the most comprehensive AR solution to improve maintenance, operations and training for complex machinery.

"Traditional documentation no longer

meets the needs of companies for simple work instructions and quick help. Our Enterprise AR Suite enables industrial companies to replace or enhance traditional manuals with guided instructions where they are needed most, for complex machinery. No programming is required and no external experts are needed, which means increased reliability and revenue for industrial companies," says RE'FLEKT CEO, Wolfgang Stelzle.

"In addition, ARKit and ARCore support will provide users and customers access to a new generation of interactive product manuals, troubleshooting guides, and service tools for smartphones and smart glasses," he continues.

The Enterprise AR Suite will support ARKit and ARCore to expand the reach of enterprise AR applications to millions of devices. A new demonstration application, Augmented Repair, is now available on iOS and Android, showing the potential of Augmented Realitypowered documentation and applications.

"In the past, recurring inspections of

![](_page_45_Picture_12.jpeg)

#### The Africa Energy Indaba: for Africans and by Africans

The Africa Energy Indaba on 20 and 21 February 2018 at the Sandton Convention Centre will discuss, debate and seek solutions to enable adequate energy generation across the continent. Delegates, drawn from all continents, represent an unrivalled combination of industry experts, project developers, financiers, energy users, government officials and manufacturers.

Again and again, the Africa Energy Indaba has proved an invaluable forum for advancing projects and opportunities that are vitally important in keeping the lights on, industry producing, and fuelling continued economic growth in Africa.

www.africaenergyindaba.com

![](_page_45_Picture_18.jpeg)

our vacuum pumps were performed by our service technicians with varying levels of quality and without any reference to the actual pump. Our Augmented Reality applications now provide our service technicians with a visual toolkit to maintain a high level of quality. This will help us to reduce our maintenance costs significantly in the future," says Carl Brockmeyer, general manager of Leybold USA, on the benefits of using RE'FLEKT's platform solutions.

The Enterprise AR Suite provides a powerful content creation platform and a remote expert solution to empower workers with flexible and customisable smart instructions on mobile devices and smart glasses - for increased efficiency and reduced errors.

The content creation platform integrates into existing enterprise software and enables companies to easily convert existing CAD data and media content into mixed reality (MR) applications for maintenance, training and operations. The Remote Expert tool connects workers to immediate augmented reality (AR) support with dedicated experts in one simple click. www.re-flekt.com

#### Industry diary

#### December 2017

Risk Based Asset Management

4-5 December 2017, Melkbosstrand, Cape Town Joan Bloom +2711 053 8189

#### Energy from Waste 2017

6-7 December 2017, London, UK Andrew Gibbons +4420 7827 6168 agibbons@smionline.co.uk

#### January 2018

MTE Show 25 January 2018, Cullinan Diamond Mine Sheldon +2784 569 3516 sheldonG@interactmedia.co.za

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#### Centralise the health of your critical machines

Imagine a world where you have the ability to know the health of your critical machines at any time no matter where you are.

The Industrial Internet of Things (IIoT) is changing our world and enabling the plant owner with this knowledge. Martec partnering with Motornostix is able to offer just such a service which includes report interpretation from reliability specialists, providing health check advice and support. Knowledge is only a click away on your PC or mobile device.

Pumps • Agitator • Motor • Fan • Gearbox • Bearings • Archimedes screw pumps

### Cpragma

![](_page_46_Picture_8.jpeg)

Principal partner to Motornostix for the water and waste water sector

www.pragmaworld.net

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Email info1@martec.co.za

### **READY-MADE SOLUTIONS**

To Your Specific Bulk Bag Handling Problem

![](_page_47_Picture_2.jpeg)

### FILL

#### Fill one bulk bag per week or 20 per hour with REAR-POST, TWIN-CENTREPOST<sup>™</sup>, and SWING-DOWN<sup>™</sup> Bulk Bag Fillers

Flexicon's extra-broad model range, patented innovations and performance enhancements let you exact-match a filler to your specific cost and capacity requirements. Patented TWIN-CENTREPOST<sup>™</sup> models maximise strength, accessibility to bag loops and economy. Cantilevered REAR-POST models allow pass-through roller conveyors. SWING-DOWN<sup>™</sup> models pivot the fill-head to the operator at floor level for quick, easy and safe spout connections. Optional mechanical and pneumatic conveyors.

### CONDITION

Loosen material solidified in bulk bags during storage and shipment with BLOCK-BUSTER<sup>™</sup> Bulk Bag Conditioners

Opposing hydraulic rams drive contoured conditioning plates to crush and loosen solidified bulk material safely and easily. Bulk bags can be raised, lowered and rotated to allow complete conditioning of the entire bag through the use of automated turntables and scissor lifts, or electric hoist and trolley assemblies. Offered as standalone units for loading with forklift or electric hoist and trolley, or integrated with bulk bag dischargers for reduced cost, footprint and loading time.

### UNLOAD

Save time, money and space with BULK-OUT<sup>™</sup> Multi-Function Bulk Bag Dischargers and Weigh Batching Stations

Condition, de-lump, screen, feed, weigh batch, combine with liquids, and convey as you discharge, with a custom-integrated, performance-guaranteed, dust-free discharger system. Offered as stand-alone units for loading with forklift or electric hoist and trolley, split frames for low headroom areas, economical half frames and mobile frames. All available with mechanical and pneumatic conveyors, flow promotion devices, bag dump access, automated weigh batching packages, and much more.

Stand-alone units to complete, automated systems integrated with mechanical and pneumatic conveyors

![](_page_47_Picture_13.jpeg)

See the full range of fast-payback equipment at flexicon.co.za- Flexible Screw Conveyors, Tubular Cable Conveyors, Pneumatic Conveying Systems, Bulk Bag Unicaders, Bulk Bag Conditioners, Bulk Bag Fillers, Bag Dump Stations, Drum/Box/Container Tippers, Weigh Balching and Blending Systems, and Automated Plant-Wide Bulk Handling Systems

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![](_page_47_Picture_16.jpeg)

![](_page_47_Picture_17.jpeg)