



Water recycling: a solution to scarcity and quality challenges

MechChem Africa talks to Louis Koen, a Cape Town-based process engineer and technical director at Zutari (Pty) Ltd, about the advantages of adopting direct potable water reuse to overcome water scarcity and quality challenges.

To address South Africa's water challenges, Louis Koen says it is important to distinguish between the problems in coastal areas such as the Western and Eastern Cape and those inland around the mining and key industrial areas of South Africa. "I don't think water scarcity is the same everywhere. Some areas of our country have been blessed with an abundance of rain with frequent flooding occurring in Gauteng, the north coast of KZN and inland from the Northern Cape to the Northwest Province.

"In direct contrast to this, other areas of our country are extremely dry, such as the coastal areas in the Eastern Cape. I think global warming is largely responsible for the unusual weather patterns we are seeing.

"Here, in the City of Cape Town, we have had good rains since 2018, but we know that there will again be years when the rains fail, and we must be better prepared for these years than we were in 2018," Koen tells *MechChem Africa*. "We are already concerned that last year we had a lower rainfall than the previous year, so our dam levels are lower than we had hoped. If we have another low winter rainfall season in 2023, we could be back where we were a few years ago. Changing weather patterns due to global warming are a reality, but it is very difficult to predict how they will impact us," he says.

Another critical issue affecting future water security is the power crisis. "It is challenging to operate water and wastewater treatment plants with intermittent power. For the City of Cape Town, we are installing massive diesel generators to allow their wastewater treatment plants to continue running during a power outage, but this is expensive and not all municipalities can afford it," says Koen.

Without backup power, power outages affect the treatment efficiency of our already ailing wastewater plants. "Most wastewater treatment plants are unable to produce quality wastewater during a power outage and this affects the surface water discharged into our rivers and dams," he says.

This is a particular concern in inland areas where wastewater treatment plants discharge to a river or dam that feeds a

downstream potable water treatment plant abstracting water from the same source. This is referred to as *de facto* reuse.

"An additional challenge is that most of our drinking water treatment plants are not designed to deal with contaminants of emerging concern (CECs), and we rely on the environmental buffer to reduce the impact of these contaminants via dilution," says Koen.

To remove the contaminants, advanced purification processes are required. Although technology to address these CECs is available and mature, it is too pricy to apply in a normal potable water treatment plant. The technologies are rather reserved for projects that specifically target potable water reuse.

"Our federal water laws are also not really

designed to protect users from CECs, which include pharmaceuticals; herbicides and pesticides; hormones; endocrine disruptors; micro plastics; forever chemicals and many other chemicals in low concentrations that, if unaddressed, are likely to cause long-term health issues for whole communities. Very few of these chemicals are regulated by our drinking water guidelines and we must rely on internationally published guidelines," Koen explains.

"In the City of Cape Town catchment area, we are fortunate that our traditional raw water supply is sourced from high mountain catchment areas that are unaffected by wastewater discharge. Our raw water is thus pristine, but this is not the case for inland



The control room at the end of the treatment process overlooks the UV-based advanced oxidation process (AOP) that breaks down any remaining organic chains into CO₂ and water.



A view of the ultrafiltration plant that removes any particles, pollutants and pathogens/germs smaller than 10 µm.

facilities that source water from a river or dam impacted by wastewater. This is where potable water reuse is critical, whether it is *de facto* reuse, direct potable reuse or indirect potable reuse.

"Potable water reuse is not uncommon, and the pioneers are without doubt our neighbouring country Namibia, which has been running the internationally renowned WINGOC advanced water treatment plant for the past 50 years. The WINGOC plant has long proved the potential and safety of direct potable water reuse," he adds.

The Faure New Water Scheme

The current flagship direct potable water reuse project – for Zutari and for South Africa – is the Faure New Water Scheme (FNWS). The City of Cape Town initiated this project after the Day Zero scare in 2018. The FNWS will treat wastewater from the Zandvliet WWTP (Wastewater Treatment Plant) to potable water quality. The FNWS plant will produce up to 100-million litres of clean drinking water per day. Although the water quality would be drinkable, the intention is to blend the reclaimed water with surface water from local dams, with a maximum blending ratio of 20% reuse water and 80% natural freshwater.

One of the reasons for the success of this scheme is that the wastewater feeding the Zandvliet WWTP does not contain any contaminants from heavy industry, which would make it more challenging to treat. The Zandvliet WWTP predominantly receives residential wastewater.

Koen tells *MechChem Africa* that the FNWS makes use of advanced purification technologies to remove all CECs and other contaminants identified in the wastewater. "The water quality produced will be of a very high standard, complying with international best practices," he says. To ensure this, the City of Cape Town has appointed an International Advisory Panel (IAP) to review the FNWS design and provide guidance and recommendations to the Zutari design team.

"Direct water recycling plants are using advanced oxidation processes to remove complex organics, including the CECs. These can be in our water in concentrations of nanograms per litre. And they are now also being found in the seawater around Cape Town because screened sewage is still being discharged into the oceans. So direct recycling, while delivering superior quality water, can also help to clean up our oceans," Koen argues.

He adds that the cost of producing high quality water through potable water reuse is significantly lower than any other treatment options available to the City of Cape Town. The 'Water Reuse for Cape Town' booklet (CCT_Water_Reuse_Booklet.pdf) reports that the estimated cost of direct potable water reuse is 60% of the cost of – or 40% less expensive than – seawater desalination. It also has fewer environmental impacts than seawater desalination and other surface water options.

At a Water Reuse Symposium in San Diego in the USA about two years ago, Koen says the Environmental Protection Agency (EPA) announced it would no longer support any

large water diversion schemes where water is transferred from a source over hundreds of kilometres to where it is needed. "In almost all cases, it makes much more sense, in terms of cost and the environment, to invest in direct potable water reuse," he points out.

In addition to the FNWS in Cape Town, he says there are already other smaller direct water reuse plants highlighting the viability and practicality of the technology. There is a small direct potable water reuse scheme in Beaufort West that has been operating for quite some time now, and in eThekweni (Durban), there is a pilot plant that combines wastewater treatment and seawater desalination.

"As a water scarce country facing a climate and power crisis, we need to protect every water source available to us, now more than ever before. We need to become shepherds of every drop of water we have. There are too many wastewater plants that are discharging poor quality water and polluting our fresh water sources," says Koen.

"Zutari is very proud of what we have achieved so far with the FNWS project, which is being seen as a global flagship project for direct potable water reuse.

We are creating a state-of-the-art direct potable water reuse treatment plant that, while building on the local WINGOC legacy, takes water quality to a new high, without having to resort to costly or energy intensive alternative technologies," Louis Koen concludes.

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An aerial view of the Zutari-designed Faure New Water Scheme, a new flagship direct potable water reuse project.