

# | GEORGE EKAMA |

## TOP THREE AWARDS

- National Order of Mapungubwe (Silver), 2013
- International Water Association Project Innovation Award, 2012
- Water Institute of South Africa/Water Research Commission/Council of Scientific and Industrial Research Stander Memorial Lecture, 2004

## DEFINING MOMENT

Learning the basics of engineering from my father as he was 'tinkering' in our family garage.

## WHAT PEOPLE DO NOT KNOW

I don't do social media and I don't like emails. It's such a weak form of communication. A real discussion requires being there in person. For deep information exchange (and doing good research) you need to spend face-to-face time with other people.



## SAVING SA'S PRECIOUS WATER

Clean water is a basic human requirement, but in an arid country like South Africa keeping it flowing, can be a challenge. Professor George Ekama has made it his life's work to keep the country's taps running and clean.

From tackling algal blooms in dams and rivers by preventing pollution from municipal and industrial wastewater to biological sulphate reduction in acid mine drainage, Ekama has been at the forefront of global technological innovation in the water sector.

His specialty is using biological processes to remove and recover waste products from water, including the water itself. Over the years, he has published over 170 research papers on these subjects and contributed to several International Water Association reports on sludge management and wastewater treatment. His advice is sought-after internationally, and he collaborates with international colleagues on solutions, such as using seawater to flush toilets, in water-stressed cities.

So valuable are Ekama's insights that his employer of 40 years, the University of Cape Town (UCT), does not want him to leave despite him having reached retirement age in 2014. In 2015, he has been busy setting up a new laboratory in his department.

He enjoys the work, but he hankers for more time to think. Modern communications technologies that mean that you can keep in touch with anyone, from anywhere, at any time, are a nuisance and a distraction, he says. "I miss the days when messages came in brown paper envelopes, and no one expected a reply for a month afterwards – there was time to think."

## EARLY LIFE AND TRAINING

An engineer by training, Ekama's entry into academia was somewhat accidental. Before joining UCT as a researcher, he worked in the Cape Town harbour. Even after joining the university on a contract basis it took him more than a decade to get a permanent position.

He was born in the Netherlands in 1949, but his family moved to South Africa (SA) when he was six years old to escape Europe's post-war economic slump. In the Netherlands there were also great floods in the early 50s that led the Ekama family to seek a better life elsewhere.

From the start, engineering was in Ekama's blood. His father was an engineer, as was his grandfather, uncle and brother. As a child, Ekama learnt the tricks of the trade from his dad in the family garage where Ekama Sr, a mechanical engineer, would take things apart to see if he could put them back together again – things like the family car, for example.

Ekama enrolled at the University of Cape Town (UCT) for a Bachelor's degree in engineering in the late 1960s. He chose civil engineering because it was the easiest course to get a bursary for. At the time, there were massive intakes on the course to train engineers for the apartheid government's major infrastructure projects, including airports, roads, dams and harbours. At school, he hadn't been a star pupil by any stretch. In fact, with his grades – a couple of As and Ds, and an E – he wouldn't be accepted into UCT today, he admits.

However, he loved Cape Town, which was far from where he'd grown up on the other side of the country, both geographically and culturally. "For me coming to Cape Town was like going to San Francisco. Everyone was a hippy."

After graduating with honours in 1972 he got a job on the container quay in the Cape Town harbour. But he didn't enjoy the job. "We worked ridiculous hours in order to match the tides, and we didn't get paid overtime. I also didn't like the monotony of the work, so I thought that in order to keep my neurons from dying out I should enrol in some evening classes."

## ACADEMIC BEGINNINGS

It was at the postgraduate evening classes that Ekama first met Professor Gerrit van Rooyen Marais, who was the Chair of Water Resources and Public Health Engineering at UCT's Department of Civil Engineering. Marais'

main research interests at the time were in municipal water and wastewater treatment. This caught Ekama's interest. When his contract was up with the contractor at the harbour, Ekama resigned and came to work at Marais' laboratory at the Professor's invitation to do a Masters degree.

The laboratory was at the time wrestling with a major problem facing wastewater treatment in SA. The country's new sewage systems, the activated sludge process, was using design criteria from the United States, which were not appropriate for SA where people use much less water leading to more concentrated wastewater flows.

Another huge and related problem was eutrophication – algal blooms in SA's rivers, lakes and dams driven by the release of nutrients like phosphates and nitrogen from wastewater, emerged in the late 1960s. The Water Act of 1956 required that all water taken from a river had to be put back to safeguard the supply downstream. But up until the mid-70s the workhorse of wastewater treatment was the trickling filter which was unable to remove the nutrients except by chemical means. Chemical removal of phosphorus could not be contemplated in SA due to its exacerbation of the growing salinity problem from acid mine drainage, unless one is going to completely reclaim the water. Finding biological nitrogen and phosphorus removal methods with the activated sludge process became a national priority.

For his PhD and throughout his early career Ekama worked with Marais on developing models of biological processes for removing nitrogen and phosphorous from wastewater. Their work fed into an international modelling effort that resulted in the international standard models known as "Activated Sludge Model Nos 1 and 2".

After completing his PhD in 1978, Ekama remained a soft-funded staff member of the UCT Department of Civil Engineering until he finally got a permanent position in 1992 when his PhD supervisor and mentor Professor Marais retired.

The lack of job security throughout the 80s and early 90s (soft-funded staff depend on external project income to pay their salaries) didn't really bother him. Marais' group had dependable funders in the South African Water Research Commission, established in 1972 and the forerunner of the National Research Foundation. In fact, Ekama enjoyed being on a temporary contract as it allowed him to focus on research since he was spared from having to spend a lot of his time teaching undergraduates and dealing with departmental administration.

From 1992, Ekama's duties changed. His teaching load was increased and he was suddenly head of the small research group. Having been part of a national effort that developed the biological nitrogen and phosphorus removal activated sludge system (there is a nutrient removal configuration called the UCT process) he joined the national effort on dealing with the salinity problem: how to reduce sulphate in acid mine drainage, but by biological means. This problem opened his work on biological sulphate reduction using sewage sludge as the energy source, which has brought him full circle back to municipal wastewater treatment arising from seawater toilet flushing, a project he is working on with colleagues in Hong Kong, where seawater toilet flushing has been practised since 1957.

## MAJOR WORKS

Ekama co-edited and co-authored a seminal book on biological wastewater treatment that was published in 2008 by the International Water Association. The book became a best-selling work of reference, and it has been translated into Korean, Spanish, Arabic and Chinese. The book was written during a challenging time in Ekama's career. In 2006, his group shrunk from five to one: his long-time colleague Dick Loewenthal retired; resignation of a research officer; former PhD student Sven Sötteman left to start his own consultancy; PhD student Ashley Muller was killed in a car accident at the Rondebosch Common a month before submission; and long-standing research officer Professor Mark Wentzel was permanently medically boarded. With Ekama being Head of the Department of Civil Engineering from 2003 to 2007, and with more undergraduate teaching

duties, he had very little time for research – a time during which his wife Janet and daughter Katie renamed him ‘absent professor’. “It was a very difficult time. I am extremely grateful for their patience and understanding – whenever more time had to be found, they were the ones who were short-changed. Any success is also thanks to them and is also theirs.”

In 2008, Ekama stepped down as head of his department and was able to concentrate more on research again. In 2010, his laboratory at UCT was demolished to make way for a new building. This further freed up Ekama’s time as he no longer had to deal with the administration and fundraising for his own lab. Instead, he used colleagues’ labs in Padua, Delft and Hong Kong, where he has spent some productive research leave periods.

In Hong Kong, Ekama got to work on an intriguing new problem. The city, which is severely water-constrained, had been using seawater to flush toilets since 1957. But seawater corrodes the sewerage pipes, a problem called crown corrosion. In Hong Kong, scientists have pioneered the use of urine separation toilets to ameliorate the problem of crown corrosion in the seawater-flushed system. Small urine-treatment plants can be used to remove micro-pollutants such as pharmaceutical residues, which are not recovered in conventional treatment plants. The system also saves energy. Urine separation toilets are among the technologies that Ekama thinks can help SA as it faces its next big water-related crisis. “The problem is that our population is growing, not just in number but economically. When people earn more they will use more water. So economic growth as a result of empowerment will result in greater water consumption.”

The challenge, he says, is not technology – it is changing people’s mind sets and how they engage with water and their waste. At the moment, he says, waterborne sanitation and water supply systems have been designed purely for the comfort of the user. Any change from the current system is likely to cause some form of discomfort. All of us need to become more aware of our environmental impact and learn to embrace greater com-

plexity and some discomfort to minimise it. However, the benefit would be a cleaner and more sustainable society for all to enjoy.

Over his career, Ekama has received several recognitions and prizes. He is one of only a few environmental engineering professors listed on Thomson’s 2002 – 2013 ISI Highly Cited website, listing the scientists whose work has attracted the most citations from colleagues worldwide.

A devout Christian, he believes it is his duty to use his competency and skills to serve society and future generations. He attributes his success to providence and hard work, to being in the right place at the right time. “As environmental engineering grew explosively from the 1960s, I grew with it. I did not plan to be successful; that I have become so is a surprise to me also – it grew out of going to work every day, paying attention to detail, meeting deadlines, doing one’s best and serving others.”

Personally he says it does not bother him a lot whether he succeeds or fails. “I do what I do as best as I can because I believe that’s the responsible way of employing my gifts and talents,” he says. However, an engineer to the core, he gets a kick out of problem-solving. Problems engineers try to solve are real, it brings a focus and urgency to the work.

He sees himself as a steward for the skills and knowledge he has amassed throughout his career, and he believes one of his most important duties has been to pass this on to future generations.

While he has been offered jobs abroad that he has turned down, he believes it has had little to do with how his life turned out. The best of me and the worst of me follow me wherever I go, he says. “I’ve loved it. It’s been amazing. If you said to me, George, why didn’t you take the job overseas? I don’t think I would have done any better there, and the need is greater here.”