Petrel Post

SANAE 58th Overwintering Team

Chapter 5

In this chapter you will meet our Mechanical Engineer and Technical Team Leader, Mr. Bongisipho Kuali. He will tell you more about himself and his responsibilities.

Further in this chapter you will learn about our waste water management, Karaoke here at the base, our sauna, the bar area and more…

"Lorenzen Piggen" Viewed from the SANAE IV Base (Zoomed), Antarctic Petrel in flight over the top of the mountain.

From left to right: Marvin, Jacques, Bongisipho, Jufter, Mpati, Travis, Sanele, Ewald and Salomé.

SANAE 58

Editor: Salomé Odendaal

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Did you know?

Antarctica is a desert.

Any region that receives very little annual precipitation or rainfall could be considered a desert. Antarctica may be covered in ice, but the average annual rainfall across the continent is low enough to classify Antarctica as a polar desert.

https://www.auroraexpeditions.com.au/blog/10-fun-facts-about-antarctica

MEET OUR MECHANICAL ENGINEER & TECHNICAL TEAM LEADER: BONGISIPHO

Bongisipho Kuali (DEA Mechanical Engineer)

Figure 1. Every day happy mood.

My name is Bongisipho Kuali, SANAE 58 Base Engineer and Technical Leader for the 2019 expedition. I am from Pietermaritzburg, KwaZulu-Natal. Before I tell you about what my role and responsibilities are, I will tell you briefly about my educational and employment history.

I studied mechanical engineering at Durban University of Technology. I then worked for a food manufacturing company as a maintenance technician where I got a bulk of my experience as a maintenance technician. I have also worked in the automotive industrial as a quality technician. While carrying out my in-service training, I was lucky enough to physically repair and carry-out maintenance work myself for two years before I got stuck behind a desk. I say lucky because this is not common in my field as our role in most of the working environments involves implementation and maintenance of processes and strategies. While this is not entirely a bad thing, it causes a disconnect between you and the machines you are trying to maintain.

I pride myself in my ability to work and carry-out repairs myself. The moment you are able to take a machine apart and access it, you immediately understand how it works and how it is most likely to fail. This also means I do not have to rely on a someone else's assessment on diagnosing a problem as I am more than capable of understanding the machine and what the problem might be. I believe that this is what has given me the edge as a maintenance technician and also allowed me to land this prestigious role.

As a government employee, I cannot think of a better place to work as an engineer than at an isolated Antarctic research base. If you can find a better location in government to work as an engineer, please let me know so I can tell you how wrong I think you are. This then means I have the best job as an engineer in government in the whole of South Africa! (I'm not bragging, it's true)

I feel incredibly blessed to be part of this program and be able to contribute my knowledge and skills to the betterment of this SANAP (South African National Antarctic Programme) program. My role and responsibility as Base Engineer is the maintenance and repairs of all mechanical equipment from the life sustaining generators to the sophisticated vacuum flushing toilets. I am also the leader of the technical team consisting of a mechanical engineer (myself), an electrician and two diesel mechanics. Our role is more of support staff, to keep the base functioning in order to allow the scientific work to continue.

I will not lie to you and say it's an easy job, even though I spent two months in Cape Town undergoing training. Like my manager once said to me: "There is nothing you can do in South Africa that can prepare you to work in Antarctica except being in Antarctica and experiencing it first-hand." Problems and breakdowns experienced here in Antarctica are like non other. Due to the constant below freezing temperature, machines, tools and materials behave differently. You are not only battling the mechanics of the machines themselves but also the environment which they are working under.

Much credit must go to my technical team; their passion and dedication to their roles have made my work much easier and life much more enjoyable. Together we look after the generators, HVAC (Heating, ventilation, and air conditioning) system, the snow smelter, vacuum system, waste water plant, diesel storage facilities and all the vehicles and snow mobiles. Most of the time they carry-out their work proactively and professionally without me having to stand over them. This is not a simple task as the technical team bears the responsibility of keeping everyone at base safe and comfortable.

My day-to-day work includes daily checks of the waste water plant and carrying out lab tests on waste water samples. I also write reports weekly and monthly on the well-being of all the machines and equipment at the base. In my free time I try and teach myself new skills like woodwork, metalwork, sawing and I even have aspiration of learning computer coding from the SANSA (South African National Space Program) engineers.

What I miss the most is my son, who I had to leave at home when he was only 19 months old. Now, 8 months later, he is talking and singing to me over the phone. I cannot wait to spend endless days playing with him. For what it's worth I am incredibly happy with being here and time for me seems to be flying by quickly. Soon this experience will be nothing but fond memories and pictures on a screen. Early 2020 will be my last time at SANAE and I will have no regrets but I will look forward to the next 'big adventure' that life has in store for me.

'But those who wait on the Lord shall renew their strength; They shall mount up with wings like eagles, they shall run and not be weary, they shall walk and not faint.'

Isaiah 40:31

Figure 2. First ever wood-work project.

EFFLUENT / WASTE WATER TREATMENT PLANT

Bongisipho Kuali (DEA Mechanical Engineer)

The question of what happens to all sewage waste in an isolated Antarctic base; I must admit was the last thing I would have thought to ask the first time I heard of about SANAE. Fortunately, I did not have to wait long to learn about the treatment of sewage waste water as I would be in-charge of it. What has then transpired between me and the sewage waste plant can only be describes as 'love at first sight' and earned me the name of 'poop-plant' technician.

Figure 3. Nitrification process.

Before I get into the details of SANAE's treatment plant, let me explain in simple terms what the process of treating sewage waste water entails, (Sewage in this context is separated into two types, waste water from toilets is called black water; shower, wash basins and kitchen water is called grey water). The process is called nitrification and it's a natural occurring process. The simplest illustration of where nitrification takes place is in our rivers. This is a biochemical process where waste water in the presence of oxygen and micro-organisms convert organic matter (sewage in our case) into Carbon dioxide, Ammonia and new micro-organisms, or to be a bit more technical it converts Ammonia to Nitrite then to Nitrate. This process allows the clear water (filtrate) to run above the river bed and the mud (sludge) to settle at the bottom. This is the basis of all waste water treatment plants.

Conventional sewage treatment plants use settlement tanks to separate the water from the sludge. This means the tanks where the sewage waste water is treated are open to the environment (will not work well in an enclosed building, the smell will not be so good ☹). Most of these plants are not automated which means constant monitoring and adjustments to the process (which is a full-time job) to ensure success. This becomes especially difficult when you include the long list of factors that go into maintaining and running a treatment plant, examples being oxygen supply, correct temperatures, alkalinity, pH and sludge.

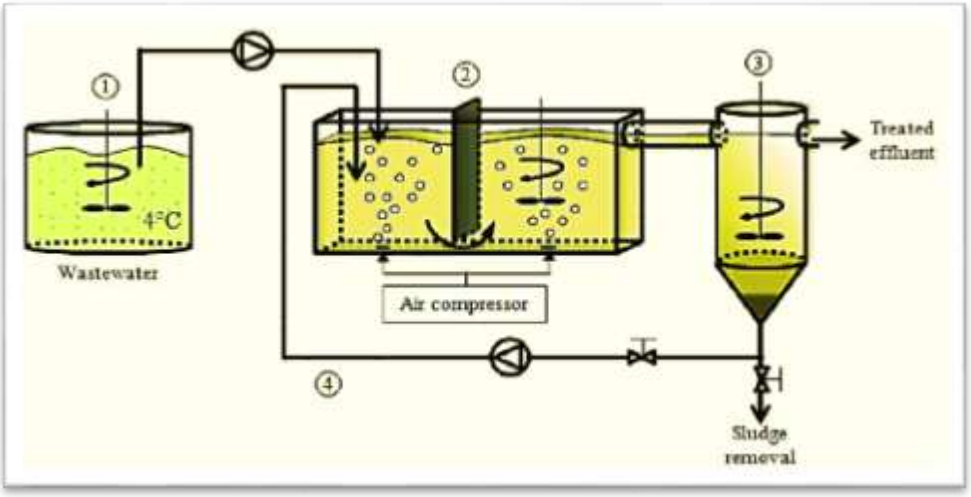

Figure 4. Description of the conventional activated sludge process. ① Raw sewage tank, ② Anoxic plus Aeration tank, ③ Settlement tank, ④ Return sludge line.

Okay! So let me tell you why I fell in love with this SANAE sewage treatment plant. It's called the Membrane bioreactor waste water treatment plant or MBR plant for short, which is largely used on ships (such as the S.A. Agulhas II) and cruise-liners due to its compact size and the large volume of waste water it can process at a time. During take-over where the population in the base is around 90 people, the plant successfully processes 5 000 Litres (L) of waste water per day.

During take-over, where the population in the base is around 90 people, the plant successfully processes 5 000 Litres of waste water per day!

Figure. 5 Membrane waste water treatment plant.

The complete system is almost entirely compressed into the size of a shipping container (space saver). This MBR plant has the ability to control the entire treatment process. It has the ability to read and control its own pH and temperature. It can detect the amount of sludge in the process and remove old sludge that is no longer effective. All it requires from me is monitoring and fine tuning the setting to optimise the process.

Figure 6. Inside of MBR plant plus sludge tank on the right.

Three external tanks, two buffer tanks and a sludge tank also form part of the MBR plant. The first one of these is a 4 000 litre buffer tank into which black and grey water are pumped directly, where it is then periodically pumped into the Anoxic tank. This is where nitrification begins. The second buffer tank is for kitchen food waste water (also referred to as the galley tank) which is ± 200L. This tank holds all the waste water from the kitchen sinks and this water many time contains fats and oils generated from the cooking processes. These fats and oils are not good for the plant in many ways, so a pre-treatment Floatation Unit is installed to eliminate them. The Unit Has two small tanks built into it, a floatation tank and a grease tank.

It removes fats and oils by creating bubbles via an air blower which bring the fats and oils to the top where they are then blown from the surface of the floatation tank into the grease tank. When the grease tank is full, the fats and oil are automatically pump into a waste drum via an outlet. This drum, when it is full, is then sealed and sent back via ship to South Africa for proper disposal at a landfill site. The remaining water is then transferred into the Anoxic tank, where nitrification begins. The third and last tank is called the sludge tank (which's function I will explain a bit later).

Inside the MBR plant is three tanks, which are constantly circulating water and sludge between themselves. The Anoxic tank (3 000L), which is first to be supplied with waste water from the 4 000L buffer tank containing black and grey water and the kitchen waste water from the Floatation Unit. The Anoxic tank also serves another objective because it is starved of oxygen and this removes nitrates (which are harmful to the environment) from the whole system and this process, which only happens in the Anoxic tank, is called de-nitrification. The Anoxic tank then supplies this mixture of raw sewage and the sludge that is already in the system to the Aeration tank. The Aeration tank also serves two objectives: It is the tank where nitrification takes place first but it also serves as a buffer tank to aid nitrification when the plant is processing a large volume of waste water (during take-over period). During winter months when the base is only manned by the over-wintering team (9 people), this tank is bypassed.

Perhaps what makes this machine so brilliant and also allows for it to be so compact is the set of filters that are housed on the inside of the filtration tank. The Aeration tank supplies the semi-processed waste water to the Filtration tank. These filters inside the Filtration tank are membranes made of a synthetic polymer with 35 nanometre pores (100 000 x smaller than the human hair). The biologically treated water (filtrate) is sucked through the membranes and the sludge remains behind, ensuring that no solid particles are present in the filtrate. The quality of the filtrate is then tested and if found to be compliant with South African waste management standards; is disposed of via an outlet over the cliff. This treated water does not harm the environment and carries no bad odours. As these tanks are all enclosed, there is no raw sewage odours anywhere in the base, plus the system is so efficient that even samples taken from any of the three tanks for testing carry no foul odour. The container itself is also fitted with a high tech odour eliminator which makes working with this 'poop-plant' a fresh breeze.

Figure 7. 'Poop plant' and 'Poop plant' technician.

Inside is also a fine-screen machine which prevents objects larger than 1mm from going through the Anoxic tank, which is first to be supplied with the raw sewage. Also housed inside the container is the electrical distribution box (BD) with the control user interface (screen and buttons, for the less technically inclined).

Figure 8. Filtrate water sample testing in the wet-lab.

Earlier I mentioned a third tank, which is called the sludge tank (not housed within the container). From time-to-time, old sludge is taken out of the system to allow new, younger and better performing sludge to continue the micro-biological process of nitrification. This process is called wasting where all the old sludge is pumped to the sludge tank. In the sludge tank the sludge is mixed with water. This machine is called the decanter. The process of decanting allows us to separate the sludge from the water by spinning the water and sludge very fast in a centrifugal drum. The sludge sticks to the lining of the drum due to the difference in mass and is separated from the water. The sludge is then disposed of into drums, which are then sealed and also sent back via ship to South Africa for proper disposal. The water is then pumped back into the Anoxic tank.

Two weeks ago, while changing a grease canister of one of the pumps inside the plant, I neglected to close a valve and through that grease pipe came raw sewage spewing out at a high pressure while I was trying to grab the swaying pipe. I got the good old taste of raw sewage in my mouth... not nice!

BAR, KARAOKE & SAUNA

Written and edited by Ewald Ferreira (DEA Communications Engineer). No additional editing by editor.

So, what do we know about being recreational, or how much of it one needs to feel socially inclined, or catch a hint in your daily thought process that you have had enough of the usual daily grind? Why do we need recreational facilities and why do we feel the urge to be social more often than not?

We are social beings, of course yes; we like to work together, wherever, laugh together and complain together, always looking for an accomplice of sorts or a partner-by-association, and a natural phenomenon this is indeed for most, in any capacity. Yet during these times, while we are in this mindset, we like to familiarize ourselves with a place or location that forces the mind to act and respond differently, in order to wind down and veer off from the day to day activities that we are usually obligated to do. We need something to distract us enough to really be able to forget about even the littlest obstacles in life that bother us.

Well now, lot of garble this is believed to be by some - but there is an undeniable truth about needing to forcibly veer off from the day to day and that is why we have some areas in Base, familiar territories where we can do exactly that. We have a Games Room that has a pool table, dart board, table tennis and whatever else we introduce there, provided we can find the furniture to stage it: right now, we have a chess set in that area too and some extra seating for spectators; a powerful medium chess is, trying to watch the game at our pace is not easy. The Games Room has also been known to sustain or accommodate activities like bowling, beer pong, penny can and even badminton, yip, and with a roof of no more than two and a half meters high! Anything you can put your mind to, I am sure has happened there before. Right next to the Games Room, we have an indoor braai area with TV and sound system; this is also the smokers' lounge, as we have to accommodate the more unfortunate habits amongst us also, don't say a word…

Right across from the Games Room, we have a bar with a door that seals it from regular activities and gives you a bit of privacy if you need it. A pub in the true sense of the word, called "Sastrugi Inn" with a railway sleeper wood counter of nice thick, strong wood, and an overhead compartment where you can leave your favorite stuff for another day - provided you remember that you put it there; plus couches, a coffee table that we once managed to fit around 16 people on, a fridge and an ice machine.

Now, we are definitely not the first expedition to have introduced such an area in Antarctica. Many Bases around and many nations alike have had such a facility amongst the superstructures and dry walls of their living quarters for decades already, and it is really not difficult to understand just why it is such an important asset to have. If you look at what the teams endure periodically in isolated areas like Vesles Karvet for instance (Nunatak on which SANAE IV Base is built), and the pressures they face at these Bases, being technologically and electro-technologically very sophisticated, and you consider that it is only a handful of professionals that manage and run all technical, scientific and medical equipment inside such a Base, with a very limited support structure, how in the name of science can they *not* have such a dedicated spot, or not yearn to shut down from time to time. With a vast diversity of cultures and religions and backgrounds amongst team members plus the odd weird or temperamental personality, it becomes actually very apparent why such an area is of the utmost importance. And further, seeing that our lovely Base had to be built from the ground up, can you even imagine what the construction teams went through? Staying onsite in tents and containers before 1997 when the SANAE IV Base

was commissioned and opened officially, and miles away from SANAE III or civilization in fact: the conditions were very treacherous and frighteningly challenging.

So they also had a pub on the construction site called “The Jackhammer Inn” and before, in the SANAE III Base closer to the coast, which was under the ice still, the teams had a pub called “The 90 Knotter”, a tradition that has been kept alive for years and years and a rich history that you can feel the moment you set foot into our pub here. The signs have been brought across from the other expeditions and now hang on the walls inside the “Sastrugi Inn”, something really to be immensely proud of, to say the least.

On a “lighter” note though, we also have a gym to work off the extra pounds gained in the “Sastrugi Inn”, and a Sauna to assist if the results aren’t that clear to you at “hindsight” (post workout). Now in order to utilize the “Sastrugi Inn” and games room, plus braai room and Gym/Sauna areas - not necessarily in that order! - we often host small events to get together as a team; thus far, these have been some of the most memorable events in my lifetime and, I am sure, have had a special place in the memories of many teams before us, as well.

With this team, we do Karaoke!! Once a month we have a Karaoke evening and also once a month we have a punch night. I have brought my music system with me specifically for this sort of thing, and seeing that there are a few big screen TVs around in Base, we managed to facilitate the complete setup, like you would see on TV, with two cordless microphones plus effects and what not, to have the best fun possible to be had by a “9-man” team. Also, lots of songs to choose from and I must say, there might be some true talent in our midst, but probably not that apparent right at this moment

This is us, we love to have fun but we keep it professional; and for all practical purposes, we are a happy team. All professional and dedicated designations on these teams are of equal importance and by making this small gesture, we would probably keep on talking to each other, still for many months to come. The reason for this common ground, equal potential, manageable differences and universal understanding of course? You’ve guessed it: our mutual enjoyment in commendable recreation, the extended laughter and suggestive moments that goes along with these social spaces, where you sometimes cannot here a word that is said from under a powerful melody and sing-along lyrics and among all the little tendencies to sometimes get irritated with nonsense, the latter is easily forgotten with the common language of music and a whole lot of harmoniously smiling faces.

OUR WEATHER

Marvin Rankudu (Senior Meteorological Technician)

Table 1. SANAE IV weather statistics, as recorded for the month of July 2019.

Weather Statistics: June 2019								
SANAE IV - VESLESKARVET								
	Minimum		Q1	Median	Average	Q3	Maximum	
Temperature (°C)	-34.8	(31st)	-26	-24	-24	-21	-10.2	(4th)
Humidity (%)	18	(27th)	48	64	61	74	91	(3rd)
Wind Speed (m/s)	0	(1st)	7	11.3	10.8	14.2	42.7	(22nd)
Pressure (hPa)	866	(31st)	882	886	886	890	896	(9th)

°C, degrees Celsius; Q1, first quartile or 25th percentile; Q3, third quartile or 75th percentile; %, percentage; m/s, meter per second; hPa, hectopascal

ANTARCTICA MATTERS

Salomé Odendaal (Team Medical Doctor)

Antarctica is the earth's 5th largest continent and covered in ice. A glacier is defined as a large body of ice moving slowly down a slope or valley or spreading outward on a land surface. A crevasse is a deep, wedge-shaped opening in a glacier.

Crevasses form when brittle failure occurs due to the elasticity threshold of ice being exceeded. Crevasses usually form in the top 50 meters of a glacier where the ice is brittle. Below 50 meters, a glacier is less brittle and can slide over an uneven surface without cracking. The inflexible upper portion may split as it moves over the changing landscape. The tensile strength of ice depends on the water content, the temperature of the ice, the ice density and the ice structure.

Crevasses also form when different parts of a glacier move at different speeds. For example, when the ice mass is traveling down a valley, its speed in the middle is faster as the sides of the glacier are slowed down as they scrape against valley walls. As different sections move at different speeds, crevasses open in the ice. There are three kinds of crevasses; tensile, opening stresses, fracturing and sliding, and tearing.

Crevasses may stretch across a glacier, run along its length, or even crisscross it. Some crevasses have measured up to 20 meters wide and 45 meters deep.

Sometimes, a thin layer of snow may form over a crevasse, creating a snow bridge. These snow bridges blend in very well with the surrounding landscape, thereby hiding the crevasse. Thin snow bridges usually cannot hold a person's weight and are therefore a danger for somebody to fall into it.

With regards to the SANAE expedition teams, all efforts are made to avoid the dangers of crevasses by means of determining safe routes, saving it on the GPS systems and avoiding unsafe areas. The safe routes are regularly reviewed and determined through means of Ground Penetrating Radar (GPR), route markers, helicopter photogrammetry and the collaboration of Norwegian Polar Institute and the South African National Antarctic Programme (SANAP).

Figure 15. Photo taken by Janneman Erasmus 2011/12 of the Jutulstraumen Glacier in Antarctica.

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