AYMAR DE LICHTERVELDE ON IMPROVING PEA'S WATER PRODUCTION AND TREATMENT SYSTEMS

Aymar de Lichtervelde, a process engineer who is in charge of the water treatment system of the Princess Elisabeth Antarctica (PEA) Research Station, spent 21 days in Antarctica with the BELARE team during the 2020 - 2021 season.

While only in Antarctica a short time, he was able to make a lot of progress in his continuing mission to improve the water production and treatment systems at the station.

What were your primary objectives at the Princess Elisabeth this year? Did you manage to accomplish them?

Due to a weather delay keeping us from arriving in Antarctica on schedule, it was not possible to do everything I had planned, but I was able to complete all of the essential tasks I needed to accomplish.

Firstly, we had to do maintenance and repair work on the station's water treatment system. After more than ten years of operation, some sensors had started to malfunction or break down from natural wear and tear,

and needed to be replaced.

The next most important order of business was further automating both the drinking water production and wastewater treatment systems.

For the drinking water, we installed an automatic mineralisation system. During previous seasons, minerals had to be added by hand. We add essential minerals such as calcium and magnesium to the drinking water to make it healthy drinking water, like we have back home. The water we obtain from melting the Antarctic snow is too pure to drink. If you drink water without minerals, it can keep your body from getting the nutrients it needs and create health problems.

As for the bioreactor, which treats the station's wastewater, we had planned to do some work to further improve its aeration system. Although we faced strict space constraints at the station, the system we designed works very well. I have already noticed an improvement in the water treatment process compared to the previous season.

However, starting up the bioreactor is the one thing that is still difficult to automate, and one of the reasons why my return to Princess Elisabeth Antarctica was necessary. When starting up the system, someone must do chemical analyses in the lab to assess the viability and activity of the bacteria we use to treat the wastewater.

Why was it necessary to improve the aeration of the station's bioreactor?

Managing wastewater at a polar research station is a challenge. The wastewater treatment system at PEA was originally designed over a decade ago to handle only about 15 people staying at the station.

But over the years, more and more people have been staying at the station at a time. So eventually it became necessary to find a way to increase the capacity of the water treatment system while respecting the space constraints we had at the station.

During last season, we learned that the oxygenation of the bioreactor could be a major bottleneck in the overall treatment process. Hence, improving aeration was thought to be an effective way to improve the system's overall performance. More oxygen means the bacteria that treat the wastewater can do their job more effectively.

Before leaving for Antarctica, we built and tested a prototype of an external aeration column, based on the airlift principle. This was very useful as it allowed us to carefully select and pre-assemble the materials to bring to Antarctica, saving us time on-site.

Thanks to the help of the station's two plumbers, Bernard Polet and Paul Herman, we were able to get the job done. I am really grateful for their technical support, which was a key ingredient in this mission's success. We ended up installing the aeration column with a static mixer inside to efficiently mix air and water without taking up too much extra space in the core of the station, which is densely packed with the station's systems.

Did you do anything besides work on the water treatment system while you were at PEA?

The Antarctic air is very dry. Any water quickly evaporates, which allows aerosols to disperse more easily in the air. Consequently, particles from coughing, sneezing, and even speaking can linger in the air for quite a long time, which can favour airborne virus transmission indoors.

Although we went through a very strict quarantine and submitted to several tests prior to leaving for Antarctica, as an extra preventive measure against COVID-19, we installed air purifiers that monitor the indoor air quality and filter fine particles and aerosols inside the station.

The system we installed is also very energy efficient, which is in line with the environmentally-friendly concept of the Princess Elisabeth Antarctica.

Will you be heading back to the PEA Station next season?

At this point, I cannot give a clear answer. There are still decisions to be taken that will happen at the end of the 2020-2021 season vis-à-vis current projects. If any additional work is required, I will probably be asked to go on-site to carry out more work.

This year was my shortest mission of the three seasons I have been to the Princess Elisabeth Antarctica so far. It was especially challenging this season, not only because of the COVID-19 pandemic, but because unfavourable weather postponed our departure by nine days. My time at the station ended up being reduced by a third, which is significant. It tightened our planning and required us to prioritise our objectives this season.

While I was a bit frustrated to have to leave the station with a few tasks remaining on my to-do list, I was able to hand over water treatment operations to the station's two plumbers, Bernard and Paul, who are certainly the most experienced and polyvalent technicians in their field.

The most important objective of my mission was to leave the water treatment system in such a way that it can be operated without requiring an engineer to stay on-site each season, and this is an objective we reached. We want to reduce to a strict minimum the number of engineers and technical crew needed at the Princess Elisabeth Antarctica each season, although, as an evolving prototype of sustainable living and a technical showcase, the presence of engineers will be required from time to time at the station.

What have you been doing since your return to Belgium?

Since my return, I have been monitoring and supporting operations remotely from Belgium. Bernard has been able to operate the water treatment system on his own in addition to other jobs he has at the station such as operating the snow melter, fixing any plumbing issues, performing general maintenance tasks, doing the laundry, etc. Being able to manage the water treatment system on his own was something he had wanted to do for a while, so now he has the chance to do it.

As my presence was not required for as long compared with previous seasons, I was able to come back to Belgium in time to celebrate Christmas with my family for the first time in three years. This was very important for me.