BIOSTATIQ

Analytic Report

tests and analyzes of the

BioEraser System

Non-chemical water treatment

*Read more about sustainable development goals here: www.undp.org/sustainable-development-goals

Titel:
PowerPack Staticon BioEraser System – Analytic Report

Prepared by:
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In cooperation with:
Region Hovedstaden
Rigshospitalets – Department of spinal cord injuries
The plant host – Michael Madsen

BioTech Innovation
Owner – Lars Leth

Region Hovedstaden
Center For Ejendomme - Drift & Teknik
Subject Manager – Benny Søder

Limescale splitter water treatment
Project manager – Claus Jensen

Eurofins Denmark
Responsible for water analyses

In addition, involved persons:
Functional manager for the Cleaning Department Rigshospitalet – Ella Aagaard Petersen
Plumbing Installer – Niels Watson
Senior Researcher at The Danish Technical University of Denmark – Nikolaj Sorgenfrei Blom

Juli 2022

Author:
Carsten Petersen, Biostatiq ApS

Conclusion

The experiment was carried out at Rigshospitalet's department for spinal cord injuries, as there was an increased bacterial count in the existing domestic water installation due to the build-up of biofilm in the pipe system.

A chlorine system was installed which dosed chlorine into the water to keep the bacterial pressure at an acceptable level.

When those responsible for operations at the hospital become familiar with the BioEraser System, they choose to test the system, as the chlorine system has broken, and they were in the situation of having to replace it with a new one.

We dismantled this chlorine system and installed the BioEraser System to test what would happen to the water quality as well as the limescale problems.

The trial ran over 3 months.

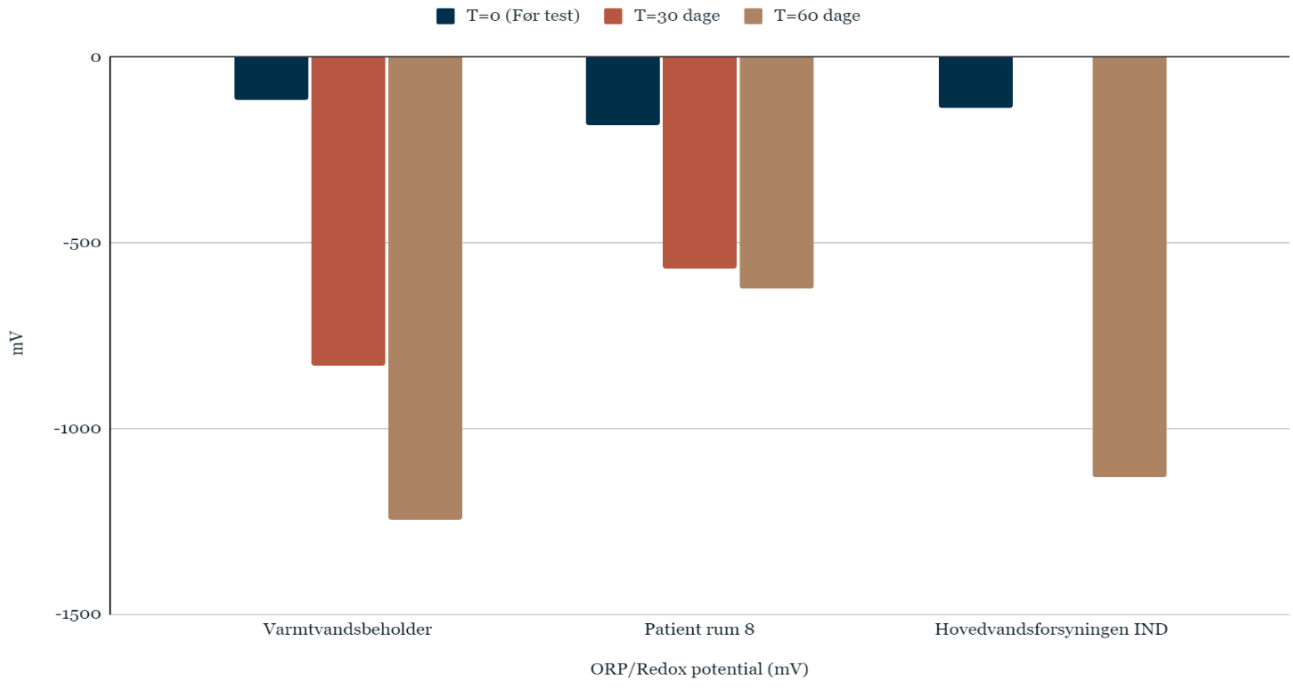
Below are the figures from the water analyzes carried out by the analysis laboratory Eurofins during the entire experiment. The columns with the text (Before test) are water analyzes that were taken immediately BEFORE the installation of the BioEraser System.

The redox potential increased negatively throughout the experiment as shown in Table 1 and Figure 1:

Tabel 1

ORP/Redox potential (mV)	**Whitout BioEraser** (Before test)	**With BioEraser** T=30 days	**With BioEraser** T=60 days
Boiler	-116.4	-830	-1246
Patient room 8	-184.9	-570	-623.4
Water entry	-136.8	n.d.	-1132

Figur 1

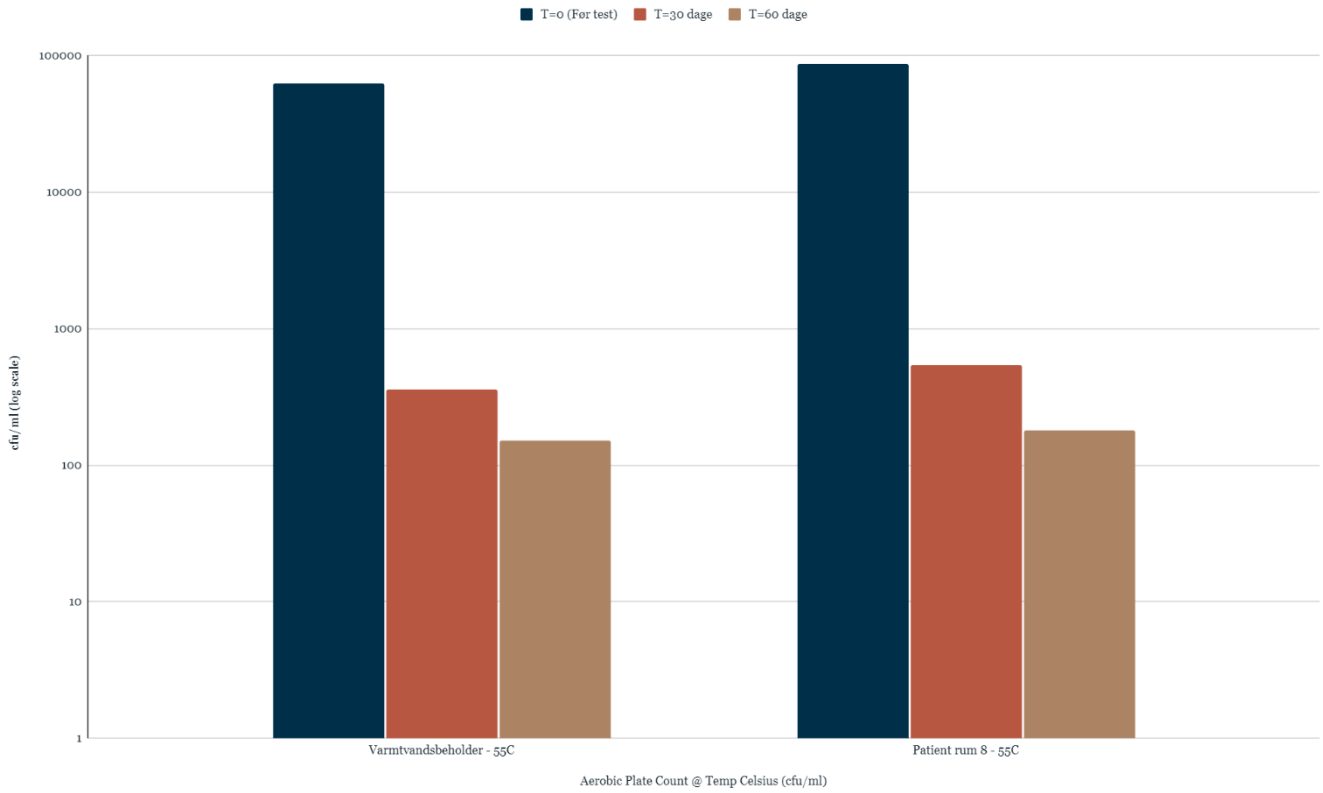


The Aerobic Plate Count dropped drastically during the test as shown in Table 2 and Figure 2:

Tabel 2

Aerobic Plate count (cfu/ml)	**Without BioEraser** T=0 (Bofore test)	**With BioEraser** T=30 days	**With BioEraser** T=60 days
Boiler - 55C	63000	360	150
Patient room 8 - 55C	86000	540	180

Figur 2



The Legionella level is roughly the status quo during the test (Table 3).

Tabel 3

Legionella	**Without BioEraser** T=0 (Before test)	**With BioEraser** T=30 days		**With BioEraser** T=60 days
Boiler	200	100		n.d.
Patient room 8	100	100		n.d.
Water entry	100	n.d.		100

Under maintenance, we find savings because of a significant reduction in stuck scale problems, in pipe installations and products that are directly affected by limescale, as well as the places where limescale is the cause of an increased energy demand, such as in heat exchangers, circulation pumps, etc.

Likewise, a strong reduction of bacteria in the water is seen. This is believed to have a connection with the negative ORP and thereby the opportunity for bacteria to colonize in the pipe system via the build-up of biofilm.

In this experiment, we can thereby conclude that the quality of the water has become much cleaner than it was, and we therefore claim, based on the results obtained, that you get better and cleaner water quality with lower bacteria content, as well as a higher antioxidant level where the lime's good properties are preserved when you install a BioEraser System.

Since we do not add chemicals to remove the scale and use a very small amount of electricity, we can confidently attribute this product as a system that brings us closer to achieving our global goals for sustainable development.

Introduction

A technology which was developed by BioTech Innovation more than 15 years ago, and which has been convincingly effective in reducing fat from e.g., suction from hoods and fat wells, has after many years of development been shown to influence many other areas such as in connection with water.

In general, in water installations, there is a high risk of the build-up of unwanted bacteria in the pipe system, as well as limescale accumulations throughout the water installation, which leads to increased service and operating costs (non-energy benefit, NEB).

The core of the technique is a BioEraser System which we describe in this report, and which can most easily be described as 2 different products, an advanced "Limescale splitting machine" and "PowerPack Staticon" and which put in connection with each other is called the BioEraser System.

The products each have their own function, as the name Limescale splitting machine indicates, this splits the lime in the water, and the PowerPack Staticon is a catalyst which, without the use of electricity or mechanical parts, influences the positive charge of static electricity in the water and the lime.

Since March 2022, the plant owner has been running trials with the BioEraser System with very promising results in connection with the removal of lime and biofilm that accumulates bacteria.

After the installation of the BioEraser System, the cleaning of limescale was significantly reduced as the limescale no longer stuck, the bacterial pressure also dropped considerably, to a level where it no longer poses a problem.

This means that the BioEraser System provides a greater financial gain in several places, and the Facility Owner has therefore chosen to keep the BioEraser System. Likewise, installation of the BioEraser System is now desired at several locations in the Capital Region's hospitals.

In subsequent water analyzes carried out by Eurofins Denmark, we have observed tendencies towards large fluctuations in the measurements of the Aerobic plant count, Legionella and in the redox potential.

It is estimated that this is probably due to the coatings of biofilm and lime which have started to loosen in the pipe installations and which will thereby result in these large fluctuations

Purpose of the test trial

The purpose of the trial is to document a new technology with the ability to reduce the amount of limescale as well as the reduction of Biofilm and the significance for energy consumption and operating costs.

Implementation and results of the test trial

Before starting the test, a building was carefully selected which was in such a condition that the BioEraser system would be loaded on all parameters.

On 16 March 2022, the test trial of the BioEraser System started, with the aim of reducing bacteria and limescale in water installations.

The entire experiment takes place over 60 days at The National Hospital, clinic for spinal cord injuries in Hornbæk. The choice of this location is due to the age of the building and thereby the condition of its water installation.

The building is 70 years old and there are therefore several challenges in keeping various bacteria, biofilm and lime at an acceptable level.

The building has several floors with a lot of toilets, kitchens, and patient rooms with bathrooms.

The entire water installation originates from the basement where the BioEraser System has been installed.

In this case, the BioEraser System is mounted as follows.
There is a limescale splitter and a PowerPack STATICON on the main water supply "Raw water inlet".
Likewise, there is a Limescale splitter on the recirculation of the hot water, on the return line just before the return into the boiler. This is done to ensure that we constantly split the lime in the water which recirculate.

The limescale splitter can keep the lime molecule split for up to 100 hours, and there may be a possibility for the water that "runs in a circle" exceeds the 100 hours, and it is therefore why we chose to install an extra Limescale Splitter on the recirculation.

Simplified in the picture below.

Figur 4

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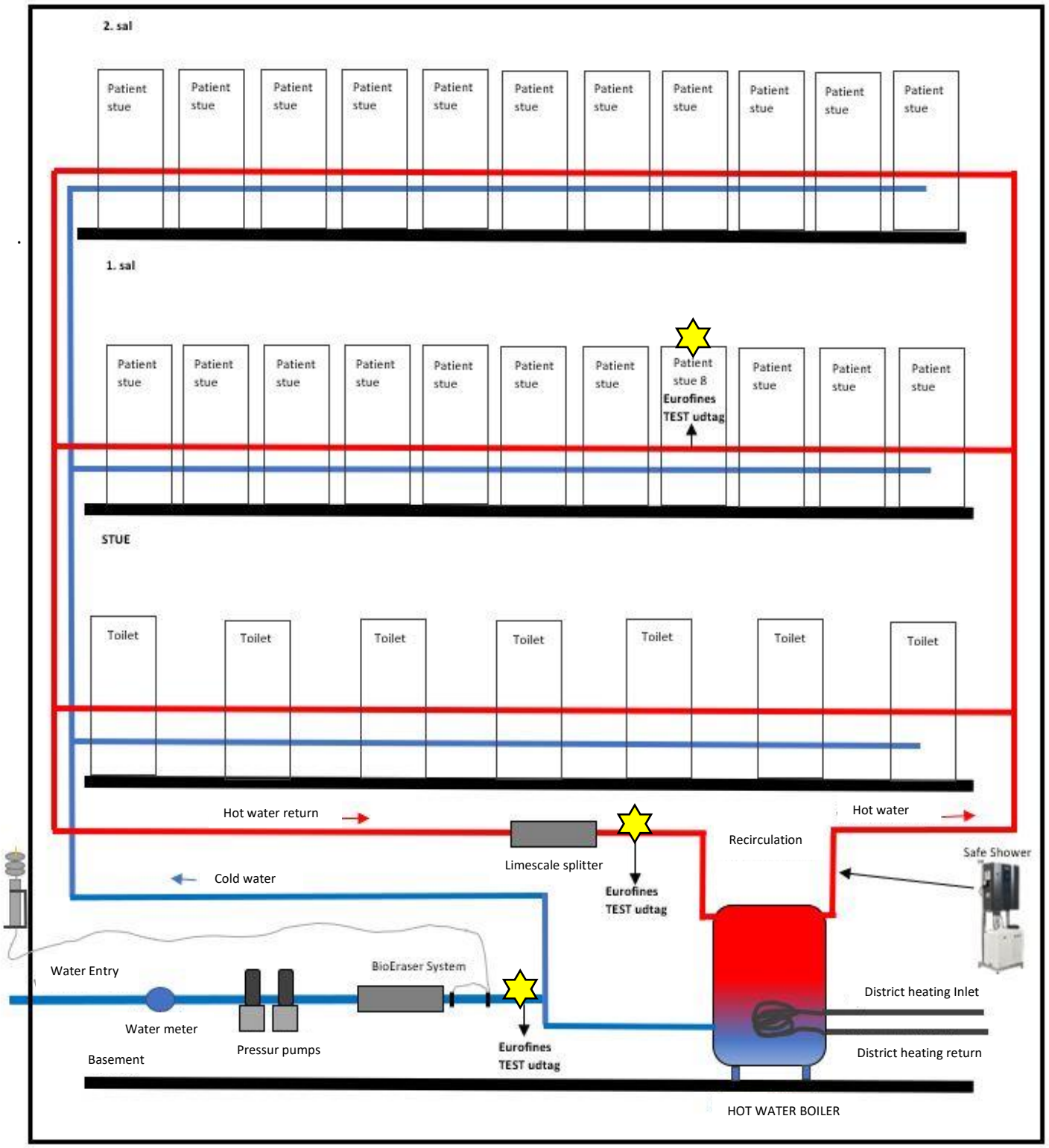


The installation seen in the picture has a main water supply to the hospital which enters the basement.

Right after is the water meter, and then two pressure pumps to provide enough water pressure for the water to reach the height of the 2nd. floor. The main water line is cold and is marked in blue in the picture.

The hot water tank is marked red, as well as the hot water line that circulates in the house between the hot water tank and the taps.

During the entire experiment, the water analysis company Eurofins Denmark continuously carried out water analyzes of the water in 3 different places in the house. This was done to ensure the water quality for the hospital and to ensure that the permitted values were not exceeded, but also to see which water parameters the BioEraser system has an influence on.

During the entire test period, 3 different sampling locations are used, which are at the main water supply into the house just after the water meter, in patient room 8, and on the service, water return line just before the hot water tank. All three outlets are shown in the drawing.

Which is:

Main water supplies IN (Entry water)

The hot water tank (Boiler)

Patient room 8 (Patient room 8)

As the test period takes place over 60 days, the water analysis samples are divided as follows:
Result before start (The day BEFORE installation of the BioEraser System)
Mid-term result (30 days into the test period)
Result at the end (60 days into the test period)

After cleaning the hot water tank, but before connecting the BioEraser System, Eurofins Denmark measures the water, and a water sample is also sent for analysis.

These first 3 Analytical Reports from Eurofins are all taken BEFORE the start of the test period, and thus BEFORE installation of the BioEraser system.

Microbiological parameters:

Kimtal (Aerobic Plate Count) expressed as CFU per ml and at different test temperatures (37, 44, 55, and 65 C.)

Legionella count (CFU per liter)

Of the microbiological measurements, large changes were seen during the test in bacterial counts, while Legionella counts remained persistently low.

Physico-chemical parameters:

pH
Water temperature
Redox potential/ORP (expressed in milliVolt/mV)
Conductivity

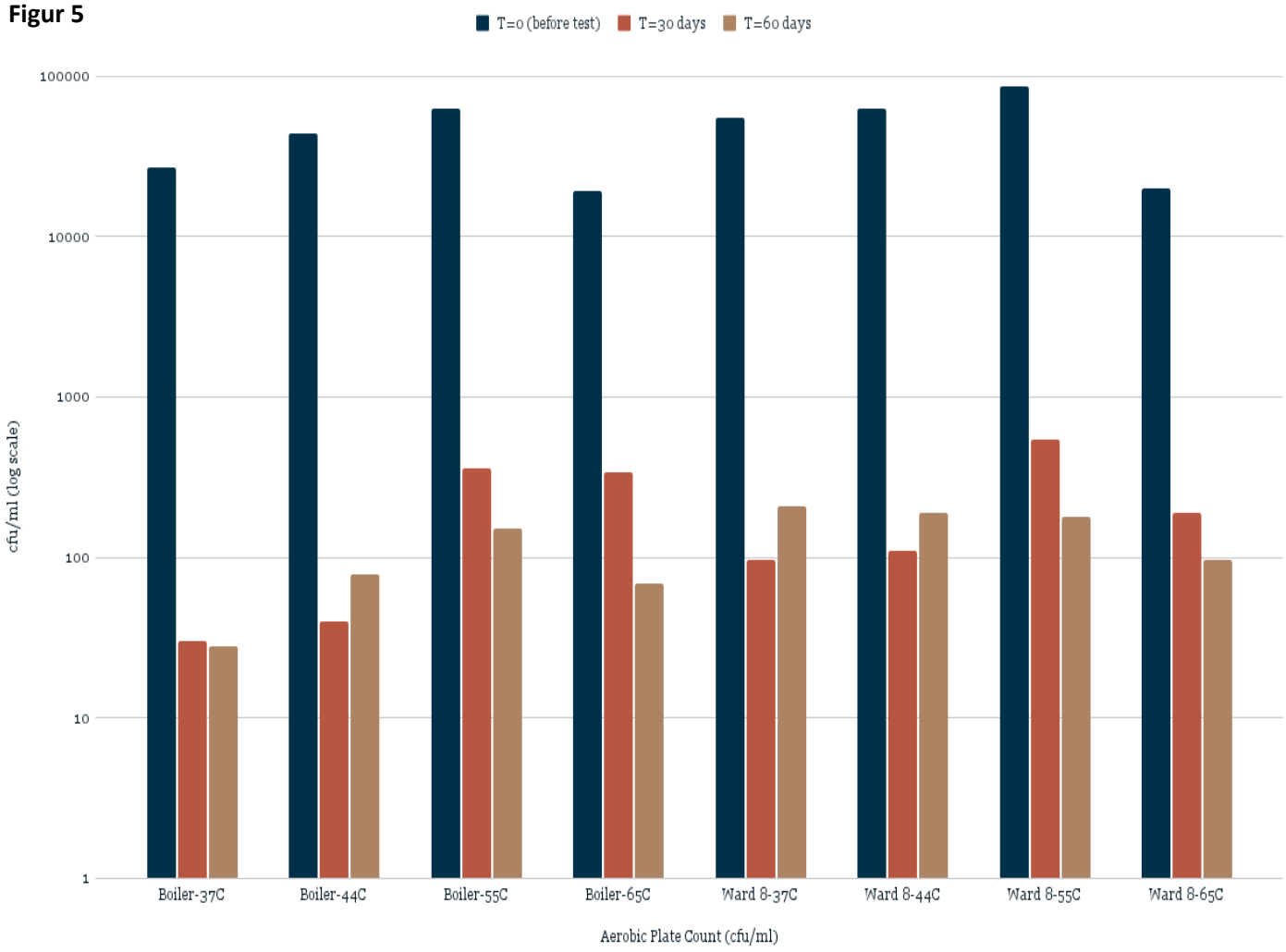
Of the physico-chemical parameters, a marked change in the Redox potential/ORP was seen during the course of the test. The other parameters were largely unchanged.

The Aerobic Plate Count numbers are shown in Table 5 and Figure 5 for all tested cultivation temperatures.

Tabel 5

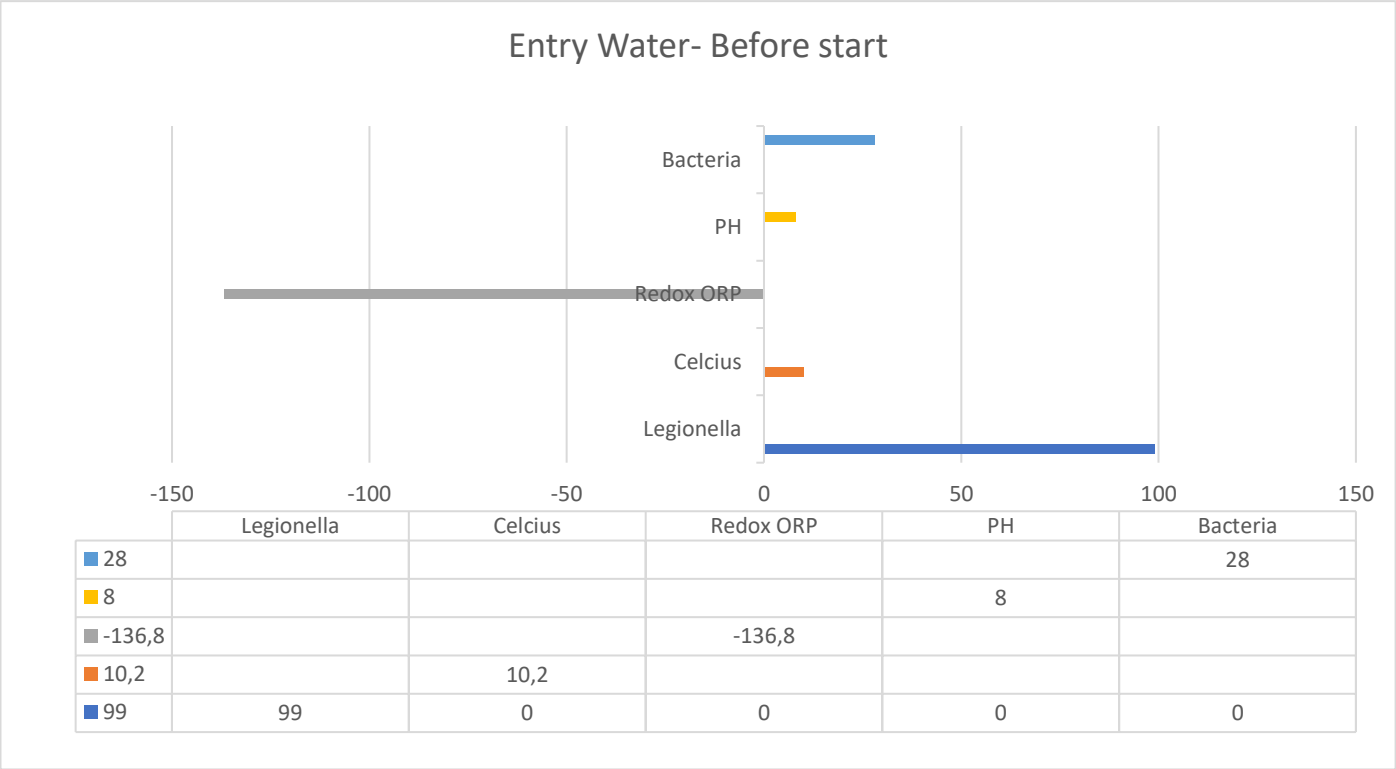
Aerobic Plate Count (cfu/ml)	**Without BioEraser** T=0 (Before test)	**With BioEraser** T=30 days	**With BioEraser** T=60 days
Boiler - 37C	27.000	30	28
Boiler - 44C	44.000	40	78
Boiler - 55C	63.000	360	150
Boiler - 65C	19.000	340	69
Ward 8 - 37C	55.000	97	210
Ward 8 - 44C	62.000	110	190
Ward 8 - 55C	86.000	540	180
Ward 8 - 65C	20.000	190	96

Figur 5



The first sample is from Entry water IN (before starting the test period)

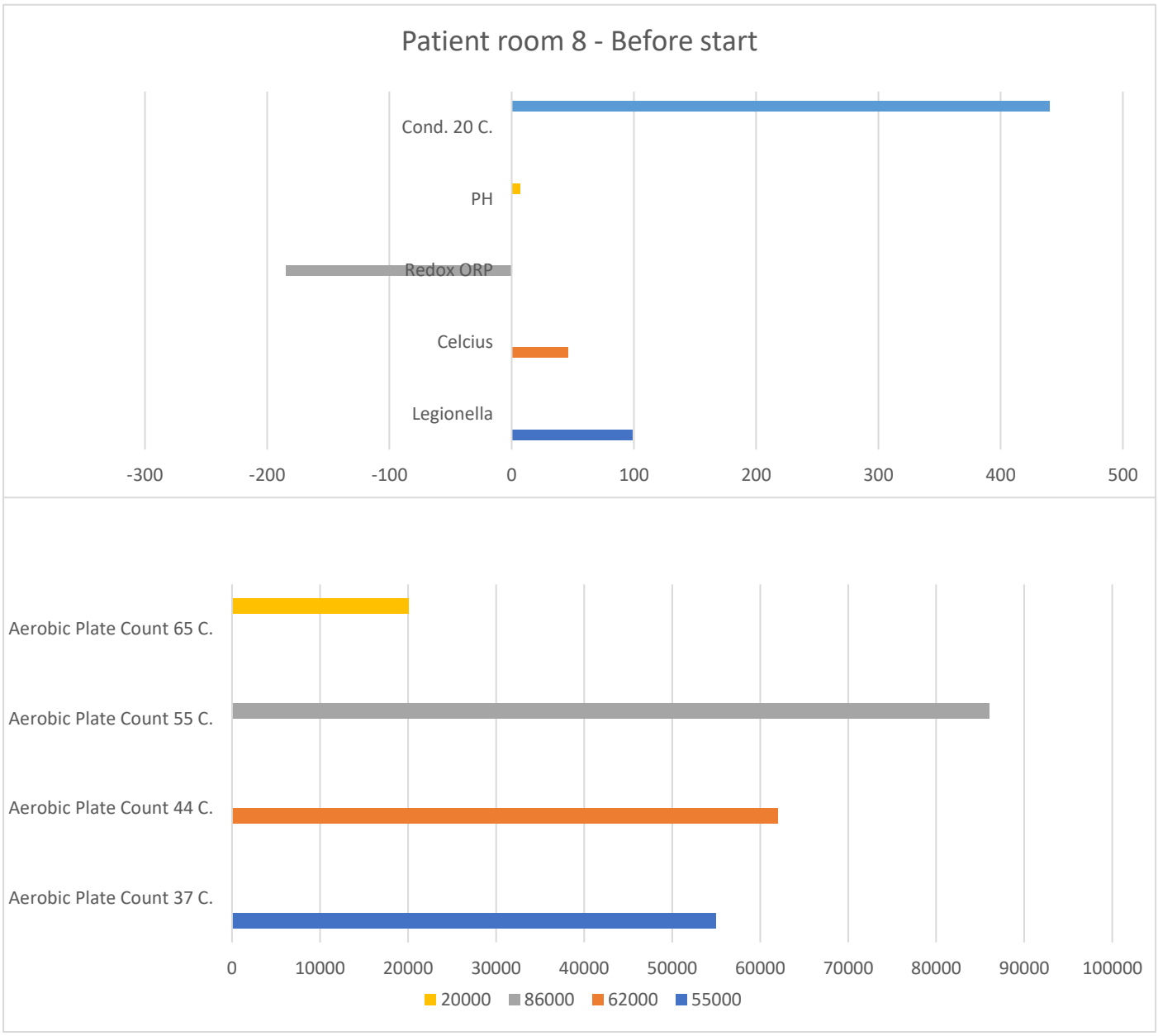
(Eurofin's Annex 1)



	Legionella	Celcius	Redox ORP	PH	Bacteria
28					28
8				8	
-136,8			-136,8		
10,2		10,2			
99	99	0	0	0	0

The second sample is from Patient Room 8 (before starting the test period)

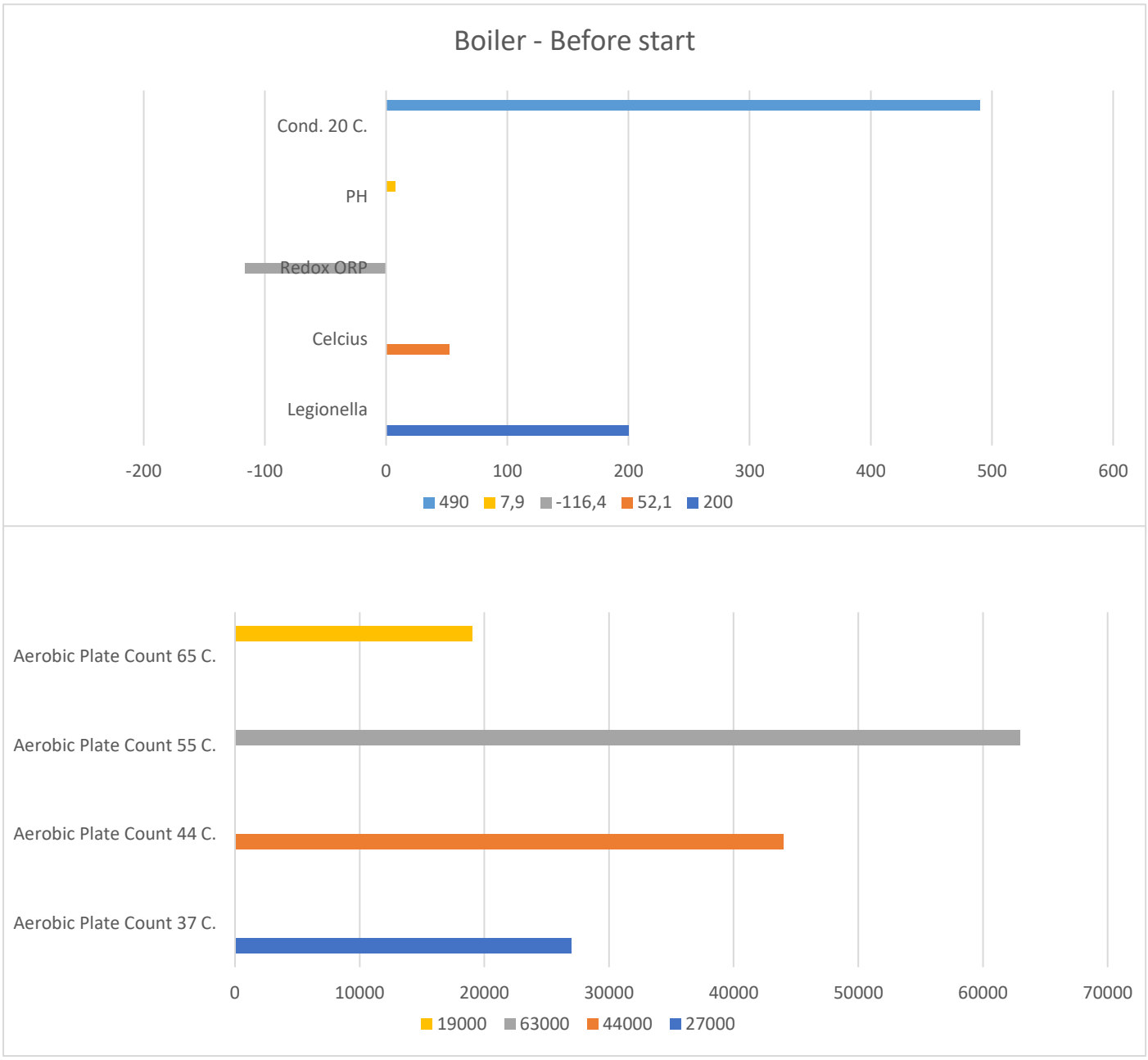
(Eurofin's Annex 2)



Unlike the first sample where the main water supply is a cold line, this one is a hot water line from the hot water tank, and with that you can now also see the Aerobic Plate Count, which is the number of accumulated bacteria in the hot water line. Most of it, is from the pipes as this is where the water temperature drops to a level where there is fertile ground for these. You can see in the diagram above, that the bacteria grow best at 55 C.

The last test, is from the hot water tank (before starting the test period)

(Eurofin's Annex 3)



Here you can also see germs (the Aerobic Plate Count) and Legionella.

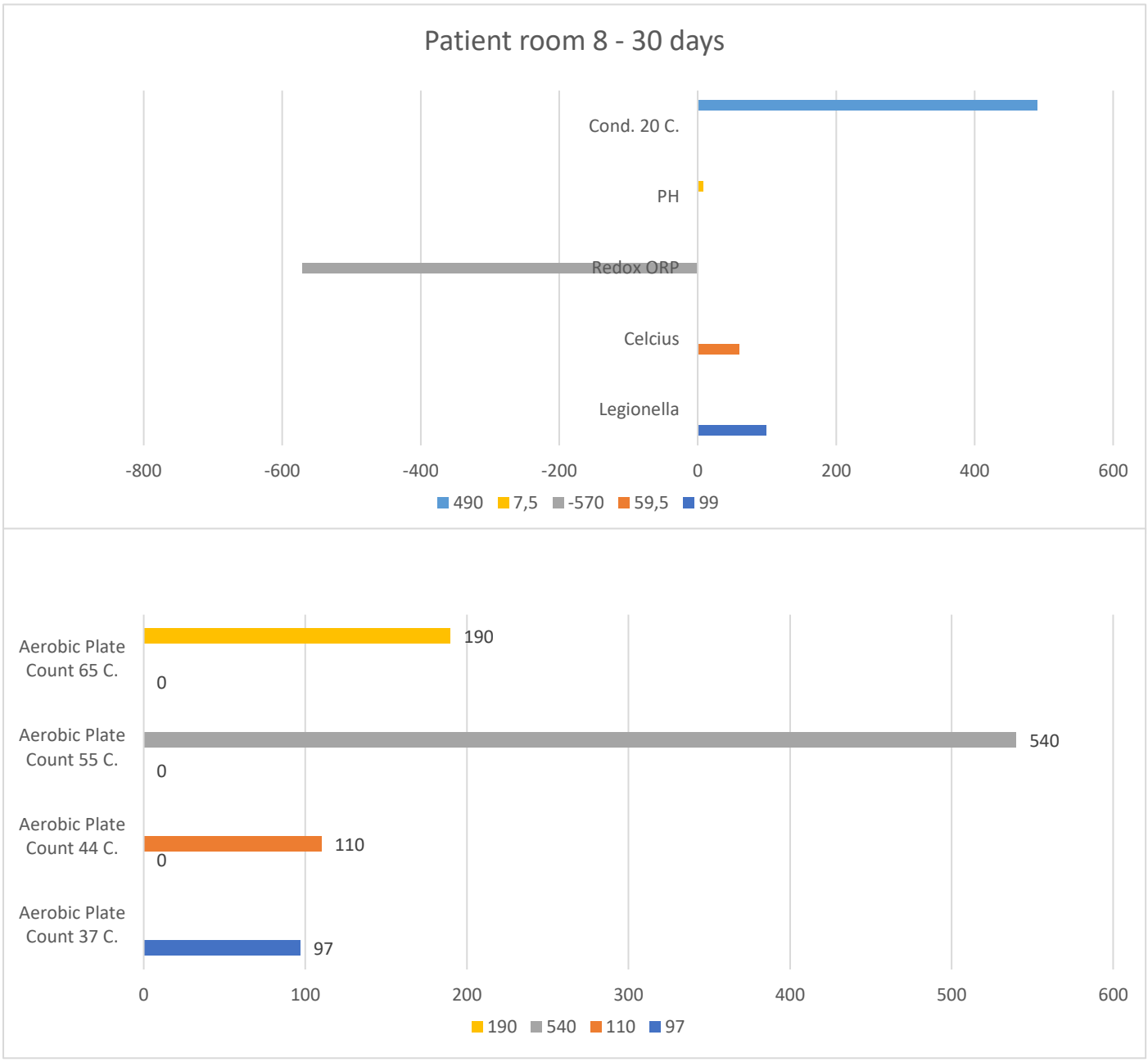
These 3 first water analyzes from Eurofins Denmark were taken the day before installation of the BioEraser system, and thus the measurements with which they are compared, throughout the rest of the test period.

The subsequent water analyzes were thus carried out by Eurofins Denmark with the BioEraser System installed and functioning.

After 30 days with the BioEraser System installed and functioning, Eurofins Denmark carries out new water analyzes in 2 places which are:

The first test, is from Patient Room 8 (30 days into the test period), i.e., halfway through

(Eurofin's Annex 4)



After the first 30 days midway through the test period, we can now see major changes in the water parameters.

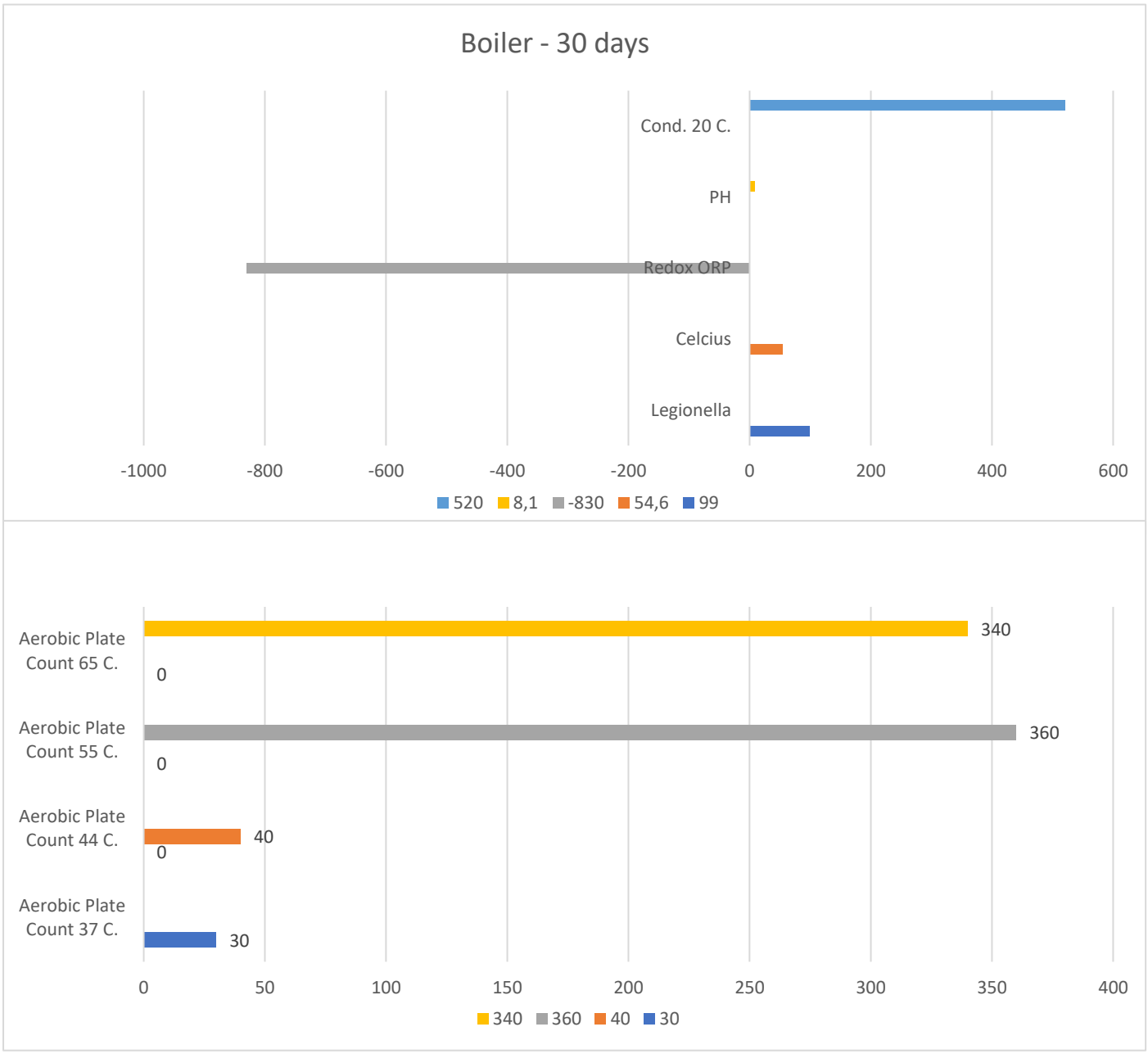
The redox potential has increased from -184.9 to -570, which means that the water is more antioxidant.

There is a huge drop in the number of germs (Aerobic Plate Count), which means that bacteria no longer accumulate in the pipes.

You can expect a period of large fluctuations in the water analyzes after this, as the coatings that may have remained in the pipes will slowly loosen and be washed out.

The last test, is from the hot water tank (30 days into the test period), i.e., halfway through

(Eurofin's Annex 5)



Here, the aerobic plate count is also reduced to almost nothing and no longer pose a problem for water quality.

Likewise, the Legionella number has fallen to below 100 from the first water analysis, where the Legionella number was 200.

Based on this observation, it can be established that when the aerobic plate count is reduced, i.e., the biofilm in the pipes, this also has an impact on the amount of Legionella present.

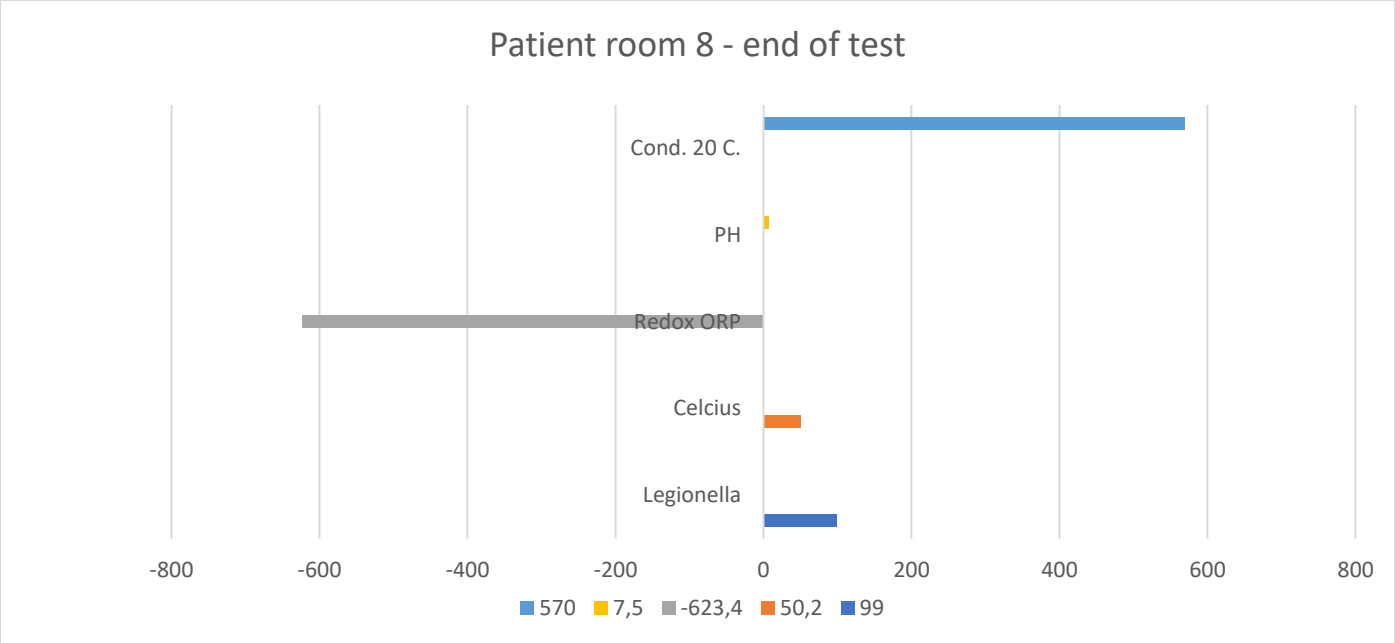
You can expect a period of large fluctuations in the water analyzes after this, as the coatings that may have remained in the pipes will slowly loosen and be washed out.

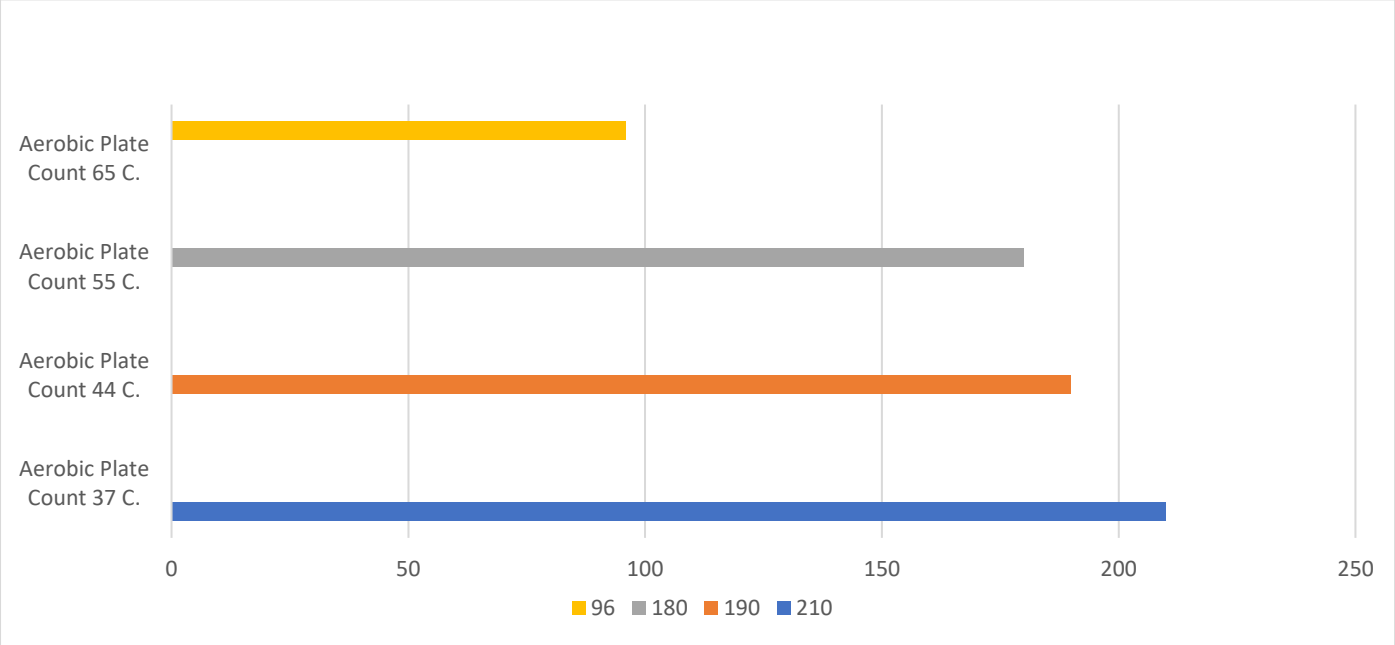
A water analysis is not taken at the entry water at this time, as this is a cold-water line and therefore does not contain germ counts "Biofilm" and Legionella, which is what we mainly testing for.

After 60 days with the BioEraser System installed and functioning, Eurofins Denmark carries out new water analyzes in 3 places which are:

The first sample is from Patient Room 8 (60 days into the test period), i.e., End of the test period

(Eurofin's Annex 6)





60 days and the end of the test period, the changes are small, but the redox potential has further increased since the last measurement.

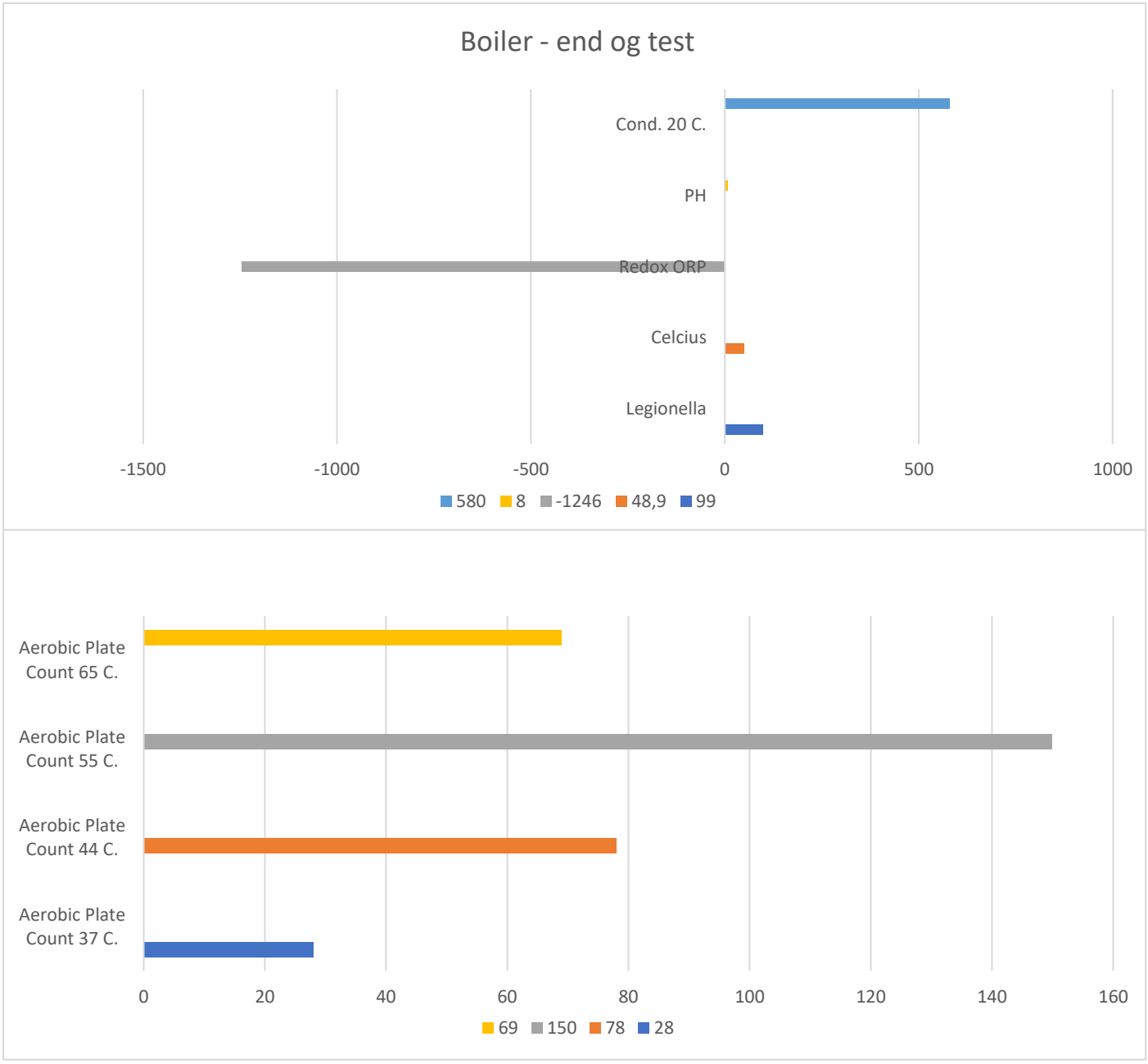
The redox potential has increased from -570 to -623.4, which again indicates that the water is more antioxidant.

Likewise, the amount of aerobic plate count is still greatly reduced.

You can expect a period of large fluctuations in the water analyzes after this, as the coatings that may have remained in the pipes will slowly loosen and be washed out.

The second sample is from the hot water tank (60 days into the test period), i.e. end of the test period

(Eurofin's Annex 7)



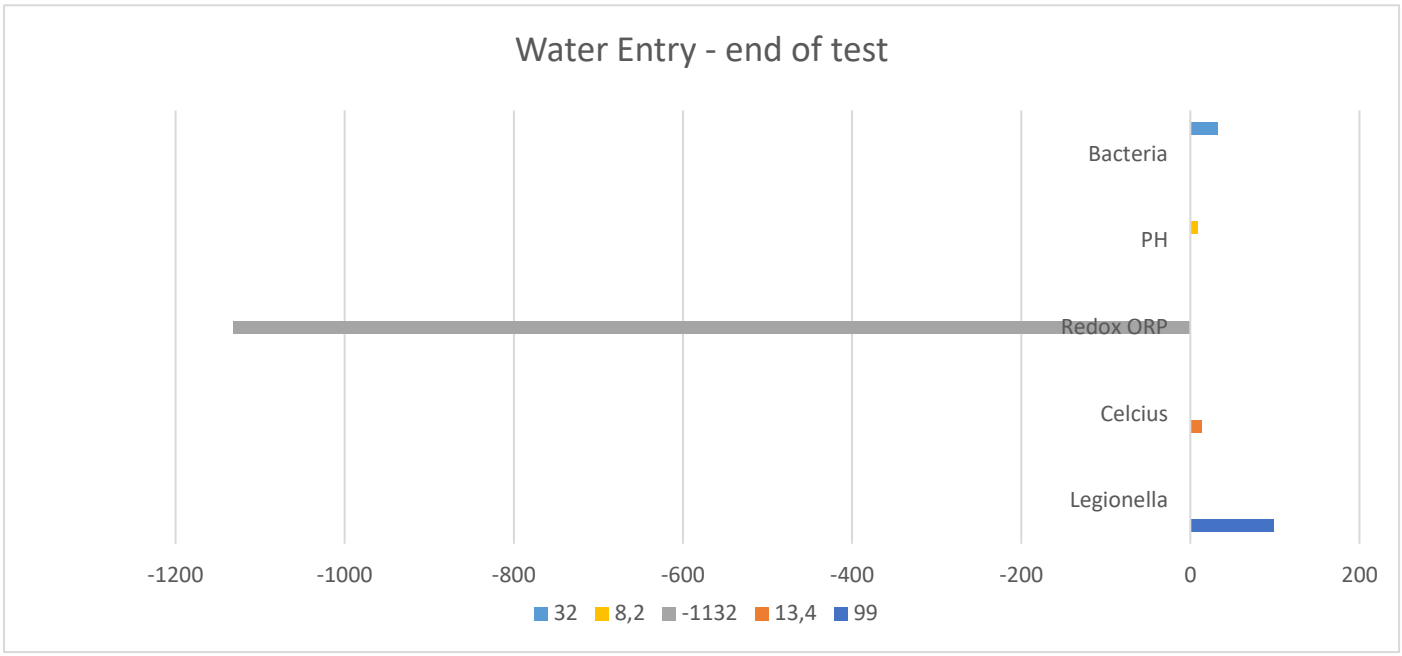
The aerobic plate count (germ count) is still greatly reduced to almost nothing.

The redox potential has increased further from -830 to -1246, which again indicates that the water is more antioxidant.

You can expect a period of large fluctuations in the water analyzes after this, as the coatings that may have remained in the pipes will slowly loosen and be washed out.

The last test is from the main water supply IN (60 days into the test period), i.e., End of the test period

(Eurofin's Annex 8)



The last water analysis carried out by Eurofins Denmark are on the main water supply (Entry water), as the test period is now ending. This is done to see if the BioEraser system has an influence already at this point when the water enters the house.

Since the BioEraser system is installed on the main water supply line right after the water meter, the limescale will be split and therefore no longer cause problems further in the installation, but you can also read from the water analysis that the redox potential has already at this point increased from -136 .8 to -1132.

The water is already at this point more antioxidant than it was before the installation of the BioEraser system.

Antioxidants are molecules in the body that fight free radicals. Free radicals are substances which, if accumulated, are harmful to the body. Antioxidants are important for the human organism. Without protective substances or systems like them, we would not actually be able to live.

Netdoktor.dk

According to Research Specialist Trevor V. Suslow, a negative Oxidation-Reduction Potential (ORP) has a correlation with fewer bacteria in the water and therefore cleaner water.

Below is a clipping from his Publication 8149 regarding ORP measurements in water.

PUBLICATION 8149

Oxidation-Reduction Potential (ORP) for Water Disinfection Monitoring, Control, and Documentation

TREVOR V. SUSLOW, Extension Research Specialist, Department of Vegetable Crops, University of California, Davis

TREVOR V. SUSLOW, Extension Research Specialist, Department of Vegetable Crops, University of California, Davis

Accurate monitoring and recording of disinfection procedures is an important component of a sound postharvest quality and safety program during product cooling and processing. Many packers of raw produce, as well as many processors of fresh cut products, now use sensors to determine the oxidation-reduction potential (ORP) status of their water systems. ORP, measured in millivolts (mV) has increasingly become a primary approach to standardizing water disinfection parameters. Rather than exclusively monitoring dose (for instance, in parts per million, or ppm), postharvest handlers now monitor activity, since ORP reflects the antimicrobial potential of the water, irrespective of the water quality.

A primary advantage of using ORP for water system monitoring is that it provides the operator with a rapid and single-value assessment of the disinfection potential of water in a postharvest system. The operator is able to assess the activity of the applied disinfectant rather than the applied dose. Research has shown that at an ORP value of 650 to 700 mV, free-floating decay and spoilage bacteria as well as pathogenic bacteria such as *E. coli* O157:H7 or *Salmonella* species are killed within 30 seconds (see table 1). Spoilage yeast and the more-sensitive types of spore-forming fungi are also killed at this level after a contact time of a few minutes or less.

Table 1. Summary of results from various lab simulation and commercial hydrocooler survey studies

	Survival in seconds (s) or hours (h) at ORP (mV)		
Pathogen/Indicator	< 485	550 < × < 620	> 665
E. coli O157:H7	> 300 s	< 60 s	< 10 s
Salmonella spp.	> 300 s	> 300 s	< 20 s
Listeria monocytogenes	> 300 s	> 300 s	< 30 s
thermotolerant coliform	> 48 h	> 48 h	< 30 s

This is how pure your Water becomes when it get ORP – negative to the extent of -500

Conclusion of the analysis

Estimated savings that can be achieved by using the BioEraser System:
If we divide the savings into 2 areas, which are maintenance and operation costs.

During maintenance, we find savings because of a significant reduction in limescale problems. In other words, pipe installations and products that are directly affected by limescale, as well as places where limescale is the cause of an increased energy need, such as heat exchangers, circulation pumps, etc.

Here we mention the following places where we found savings:
Palletizers – Shouldn't be changed so often.
Mixer taps – Didn't have to be changed as often, but also didn't have to be descaled and were easier to clean.
Sinks - no need to descale, which means the surface treatment is maintained for longer and easier to clean.
Toilets – No longer had to be descaled and was much easier to clean.
Coffee machines did not have to be descaled as before.
Valves and fittings are no longer stuck in the same way, and therefore last longer.
Circulation pumps, pump better and do not become filled with limescale and biofilm, thereby more energy saving.
Heat exchangers do not get limescale deposits, and thereby become more energy-saving.
Hot water tanks do not get lime deposits on the heating element and are therefore energy-saving.
Less coating on tiles and joints, which resulted in less cleaning.
The most powerful lime removal detergent became redundant, which is good for people and nature.
Generally easier and faster cleaning – Savings in working hours

Likewise, a strong reduction of bacteria in the water is seen. This is believed to have a connection with the negative ORP and thereby the opportunity for bacteria to colonize in the pipe system via the build-up of biofilm.

A video has also been produced following the entire project and includes excerpts from e.g.
Nikolaj Sorgenfrei Blom, Senior Researcher at the Danish Technical University "DTU"
Ella Aagaard Petersen, functional manager for the cleaning department at The National Hospital

The days before the start of the test period the hot water tank was cleaned as well as possible for limescale and the anode was also changed, this is done once a year. Since the installation is of an older date, it is not chosen to remove all limescale from the hot water tank, and this is also clearly seen in the picture below.

The picture below shows the amount of lime that was removed from the hot water tank.

The image below shows the hot water tank cleaned for limescale as possible.

The picture below shows the inside of the hot water tank after 5 months with the BioEraser system installed

The image below shows the heater, and there are no additional lime coatings here either.

As can be seen in the pictures of the hot water tank, there have been no further significant lime deposits over the 5 months our BioEraser System has been installed. Which provides a considerable energy saving, since lime coatings on e.g., the heater acts as an insulator between the water to be heated and the heater itself.

Subsequently, the water analysis reports were carried out by Eurofins Denmark during the entire test period.

Analytical Report no. 1 Before test of test

Eurofins Miljø Vand A/S
Ladelundvej 85
6600 Vejen
Danmark
Telefon: 7022 4256
CVR/VAT: DK-29822980

Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Report code: AR-22-CG-22029774-01
Batch code: EUDKVE-22029774
Client code: CA0000805
Received on: 16.03.2022

Analytical Report

Sampling Point	Klinik for Rygmarvsskader - Cold water,entry point - / 4217100501
Sampling address:	Havnevej 25, 3100 Hornbæk
Sample type:	Drinking water - Other
Sampling:	16.03.2022 . 10:15
Sampler:	Eurofins Miljø Vand A/S WWM8
Test period:	16.03.2022 - 31.03.2022

Sample description: Entry point

Lab sample No.:	836-2021-80831091	Unit	Limit values ** Min.	Limit values ** Max.	LOQ	Method	*)	Urel (%)
Microbiology								
Culturable Microorganisms 22°C	28	cfu/ml		200	1	ISO 6222	A	0.15[a]
Legionella species	< 100	cfu/l			100	ISO 11731	A	
Information from sampler								
Accredited sampling	Yes					DS ISO 5667-5,MST-Drikkevand. Mar		
pH	8.0	pH	7	8.5		DS/EN ISO 10523:2012		
Sampling with flush	Done					DS ISO 19458,DS ISO 5667-5,MST-D		
Water temperature	10.2	°C				DS/EN ISO 19458:2006		
Redoxpotential	136.8	mV				-		
Conductivity at 20°C	510	µS/cm		2500	15	DS/EN 27888:2003 (by 20°C)		
Oxygen content	10.8	mg/l			0.1	DS/EN ISO 5814		15

Subcontractors:
A: Eurofins Environment A/S (DS EN ISO/IEC 17025 DANAK 168)

The specified limit values are a guideline only as the sampling is done following flushing of the tap.

Results meet the limits requirements from Miljøministeriets bek.nr. 2361 af 26. november 2021 (Drikkevandsbekendtgørelsen).

Copy to:
BioStatiQ ApS, Carsten Petersen, Solgården 15, 3250 Gilleleje

31.03.2022

Customer center
Tel 70224256
Rentvand@eurofins.dk

Ulla Bøgedal
Costumer Advisor

Legend:
< less than
>: greater than
#: none of the parameters are detected
LOQ: Limit of quantification
*): Not included in the accreditation
n.d: not detected
NM: non-measurable
=): subcontractors

Urel (%): The expanded relative measurement uncertainty, with a coverage factor 2. For results at the level of detection limit the uncertainty might be higher than reported.
[a]: Uncertainties of microbiological parameters are given as a logarithmical standard deviation
**): Miljøministeriets bek.nr. 2361 af 26. november 2021 (Drikkevandsbekendtgørelsen).

Eurofins Miljø Vand A/S
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6600 Vejen
Danmark
Telefon: 7022 4256
CVR/VAT: DK-29822980

Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Report code: AR-22-CG-22029759-01
Batch code: EUDKVE-22029759
Client code: CA0000805
Received on: 16.03.2022

Analytical Report

Sample type: Hot utility water - Other
Sampling Point Klinik for Rygmarvsskader - Hot water, ward#8 - / 4217100503
Sampling address: Havnevej 25, 3100 Hornbæk
Sampler: Eurofins Miljø Vand A/S WWM8
Sampling: 16.03.2022 . 10:50
Test period: 16.03.2022 - 31.03.2022

Sample description: ward#8, shower

Lab sample No.:	835-2021-80831089	Unit	LOQ	Method	*) Urel (%)
Microbiology					
Aerobic Plate Count 37°C	55000	cfu/ml	1	DS 2402	A 0.15*)
Aerobic Plate Count 44°C	62000	cfu/ml	1	DS 2402	A 0.15*)
Aerobic Plate Count 55°C	86000	cfu/ml	1	DS 2402	A 0.15*)
Aerobic Plate Count 65°C	20000	cfu/ml	1	DS 2402	A 0.15*)
Legionella species	< 100	cfu/l	100	ISO 11731	A
Information from sampler					
Accredited sampling	Yes			SSI guidance	
pH	7.1	pH		DS/EN ISO 10523:2012	
Sampling method	Normal			SSI 1 ed. 2000	
Water temperature	45.8	°C		DS/EN ISO 19458:2006	
Redoxpotential	184.9	mV		*	
Conductivity at 20°C	440	µS/cm	15	* DS/EN 27888:2003 (by 20°C)	

Subcontractors:
A: Eurofins Environment A/S (DS EN ISO/IEC 17025 DANAK 168)

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31.03.2022

Customer center
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Rentvand@eurofins.dk

Ulla Bøgedal
Costumer Advisor

Legend:
<: less than
>: greater than
#: none of the parameters are detected
LOQ: Limit of quantification
*): Not included in the accreditation
n.d: not detected
NM: non-measurable
n): subcontractors

Urel (%): The expanded relative measurement uncertainty, with a coverage factor 2. For results at the level of detection limit the uncertainty might be higher than reported.
*): Uncertainties of microbiological parameters are given as a logarithmical standard deviation

Eurofins Miljø Vand A/S
Ladelundvej 85
6600 Vejen
Danmark
Telefon: 7022 4256
CVR/VAT: DK-29822980

Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Report code:	AR-22-CG-22029758-02
Batch code:	EUDKVE-22029758
Client code:	CA0000605
Received on:	16.03.2022

Analytical Report

Sample type:	Hot utility water - Other
Sampling Point	Klinik for Rygmarvsskader - Hot water, boiler - / 4217100502
Sampling address:	Havnevej 25, 3100 Hornbæk
Sampler:	Eurofins Miljø Vand A/S WWM8
Sampling:	16.03.2022 . 10:30
Test period:	16.03.2022 - 27.05.2022

Sample description: Boiler

Lab sample No.:	835-2021-80931090	Unit	LOQ	Method	*)	Urel (%)
Microbiology						
Aerobic Plate Count 37°C	27000	cfu/ml	1	DS 2402	A	0.15[1]
Aerobic Plate Count 44°C	44000	cfu/ml	1	DS 2402	A	0.15[1]
Aerobic Plate Count 55°C	63000	cfu/ml	1	DS 2402	A	0.15[1]
Aerobic Plate Count 65°C	19000	cfu/ml	1	DS 2402	A	0.15[1]
Legionella species	200	cfu/l	100	ISO 11731	A	
Information from sampler						
Accredited sampling	Yes			SSI guidance		
pH	7.9	pH		DS/EN ISO 10523:2012		
Sampling method	Normal			SSI 1 ed. 2000		
Water temperature	52.1	°C		DS/EN ISO 19458:2006		
Redoxpotential	-116.4	mV		*		
Conductivity at 20°C	490	µS/cm	15	* DS/EN 27888:2003 (by 20°C)		

Subcontractors:
A: Eurofins Environment A/S (DS EN ISO/IEC 17025 DANAK 168)

835-2021-80931090 Sample comment:
The sample contains a small amount of Legionella bacteria - Legionella might be able to grow to a higher concentration in the water system.
Reference: Legionella i varmt brugsvand, 2000. Statens Seruminstitut, Den centrale afdeling for sygehushygiejne.

Batch comments:
Revised analytical report supersedes the former. Operational sign for redox potential changed from postive (+) to negative (-).

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27.05.2022

Peter Møller
Customer Advisor /Teamlead

Customer center
Tel 70224256
Rentvand@eurofins.dk

Legend:

<: less than	*): Not included in the accreditation
>: greater than	n.d: not detected
#: none of the parameters are detected	NM: non-measurable
LOQ: Limit of quantification	#): subcontractors

Urel (%): The expended relative measurement uncertainty, with a coverage factor 2. For results at the level of detection limit the uncertainty might be higher than reported.
[1]): Uncertainties of microbiological parameters are given as a logarithmical standard deviation

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Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Report code: AR-22-CG-22041286-02
Batch code: EUDKVE-22041286
Client code: CA0000805
Received on: 12.04.2022

Analytical Report

Sample type: Hot utility water - Other
Sampling Point Klinik for Rygmarvsskader - Hot water, ward#8 - / 4217100503
Sampling address: Havnevej 25, 3100 Hornbæk
Sampler: Eurofins Miljø Vand A/S B9VH
Sampling: 12.04.2022 . 08:15
Test period: 12.04.2022 - 27.05.2022

Sample description: Patient room 8

Lab sample No.:	835-2022-81080370	Unit	LOQ	Method	¤) Urel (%)
Microbiology					
Aerobic Plate Count 37°C	97	cfu/ml	1	DS 2402	A 0.15[a)]
Aerobic Plate Count 44°C	110	cfu/ml	1	DS 2402	A 0.15[a)]
Aerobic Plate Count 55°C	540	cfu/ml	1	DS 2402	A 0.15[a)]
Aerobic Plate Count 65°C	190	cfu/ml	1	DS 2402	A 0.15[a)]
Legionella species	< 100	cfu/l	100	ISO 11731	A
Information from sampler					
Accredited sampling	Yes			SSI guidance	
pH	7.5	pH		DS/EN ISO 10523:2012	
Sampling method	Normal			SSI 1 ed. 2000	
Water temperature	59.5	°C		DS/EN ISO 19458:2006	
Redoxpotential	-570.0	mV		*	
Conductivity at 20°C	490	µS/cm	15	* DS/EN 27888:2003 (by 20°C)	

Subcontractors:
A: Eurofins Environment A/S (DS EN ISO/IEC 17025 DANAK 168)

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27.05.2022

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Peter Møller
Customer Advisor /Teamlea

Legend:

<: less than
>: greater than
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LOQ: Limit of quantification
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n.d.: not detected
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[a)]: Uncertainties of microbiological parameters are given as a logarithmical standard deviation

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Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Report code:	AR-22-CG-22041263-02
Batch code:	EUDKVE-22041263
Client code:	CA0000605
Received on:	12.04.2022

Analytical Report

Sample type:	Hot utility water - Other
Sampling Point	Klinik for Rygmarvsskader - Hot water, boiler - / 4217100502
Sampling address:	Havnevej 25, 3100 Hornbæk
Sampler:	Eurofins Miljø Vand A/S B9VH
Sampling:	12.04.2022 . 08:25
Test period:	12.04.2022 - 27.05.2022
Sample description:	Boiler

Lab sample No.:	836-2022-81080388	Unit	LOQ	Method	*)	Urel (%)
Microbiology						
Aerobic Plate Count 37°C	30	cfu/ml	1	DS 2402	A	0.15°
Aerobic Plate Count 44°C	40	cfu/ml	1	DS 2402	A	0.15°
Aerobic Plate Count 55°C	360	cfu/ml	1	DS 2402	A	0.15°
Aerobic Plate Count 65°C	340	cfu/ml	1	DS 2402	A	0.15°
Legionella species	< 100	cfu/l	100	ISO 11731	A	
Information from sampler						
Accredited sampling	Yes			SSI guidance		
pH	8.1	pH		DS/EN ISO 10523:2012		
Sampling method	Normal			SSI 1 ed. 2000		
Water temperature	54.6	°C		DS/EN ISO 19458:2006		
Redoxpotential	-830.0	mV		*		
Conductivity at 20°C	520	µS/cm	15	* DS/EN 27888:2003 (by 20°C)		

Subcontractors:
A: Eurofins Environment A/S (DS EN ISO/IEC 17025 DANAK 168)

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27.05.2022

Customer center
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Peter Møller
Customer Advisor /Teamlea

Legend:

<: less than	*): Not included in the accreditation
>: greater than	n.d: not detected
#: none of the parameters are detected	NM: non-measurable
LOQ: Limit of quantification	n): subcontractors

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Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Report code: PR-22-CG-22053659-01
Batch code: EUDKVE-22053659
Client code: CA0000805
Received on: 16.05.2022

Preliminary report

Sample type: Hot utility water - Other
Sampling Point Klinik for Rygmarvsskader - Hot water, ward#8 - / 4217100503
Sampling address: Havnevej 25, 3100 Hornbæk
Sampler: Eurofins Miljø Vand A/S WWM8
Sampling: 16.05.2022 . 09:45
Test period: 16.05.2022 - 27.05.2022

Sample description: Patient room 8

Lab sample No.:	835-2022-81094148	Unit	LOQ	Method	*) Urel (%)
Microbiology					
Aerobic Plate Count 37°C	210	cfu/ml	1	DS 2402	[A] 0.15[*]
Aerobic Plate Count 44°C	190	cfu/ml	1	DS 2402	[A] 0.15[*]
Aerobic Plate Count 55°C	180	cfu/ml	1	DS 2402	[A] 0.15[*]
Aerobic Plate Count 65°C	96	cfu/ml	1	DS 2402	[A] 0.15[*]
Information from sampler					
Accredited sampling	Yes			SSI guidance	
pH	7.5	pH		DS/EN ISO 10523:2012	
Sampling method	Normal			SSI 1 ed. 2000	
Water temperature	50.2	°C		DS/EN ISO 19458:2006	
Redoxpotential	-623.4	mV		*	
Conductivity at 20°C	570	µS/cm	15	* DS/EN 27888:2003 (by 20°C)	

Subcontractors:
A: Eurofins Environment A/S (DS EN ISO/IEC 17025 DANAK 169)

Batch comments:
Preliminary report - the final version will be issued when a result Legionella is ready.

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Legend:
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#: none of the parameters are detected
LOQ: Limit of quantification
*): Not included in the accreditation
n.d.: not detected
NM: non-measurable
n): subcontractors

Urel (%): The expanded relative measurement uncertainty, with a coverage factor 2. For results at the level of detection limit the uncertainty might be higher than reported.
*): Uncertainties of microbiological parameters are given as a logarithmical standard deviation

The test results relate only to the items tested.

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Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Report code: PR-22-CG-22053664-01
Batch code: EUDKVE-22053664
Client code: CA0000805
Received on: 16.05.2022

Preliminary report

Sample type: Hot utility water - Other
Sampling Point Klinik for Rygmarvsskader - Hot water, boiler - / 4217100502
Sampling address: Havnevej 25, 3100 Hornbæk
Sampler: Eurofins Miljø Vand A/S WWM8
Sampling: 16.05.2022 10:10
Test period: 16.05.2022 - 27.05.2022

Sample description: Boiler

Lab sample No.:	836-2022-01001252	Unit	LOQ	Method	*)	Urel (%)
Microbiology						
Aerobic Plate Count 37°C	28	cfu/ml	1	DS 2402	A	0.15*
Aerobic Plate Count 44°C	78	cfu/ml	1	DS 2402	A	0.15*
Aerobic Plate Count 55°C	150	cfu/ml	1	DS 2402	A	0.15*
Aerobic Plate Count 65°C	69	cfu/ml	1	DS 2402	A	0.15*
Information from sampler						
Accredited sampling	Yes			SSI guidance		
pH	8.0	pH		DS/EN ISO 10523:2012		
Sampling method	Normal			SSI 1 ed. 2000		
Water temperature	48.9	°C		DS/EN ISO 19458:2006		
Redoxpotential	-1246	mV		*		
Conductivity at 20°C	580	µS/cm	15	* DS/EN 27888:2003 (by 20°C)		

Subcontractors:
A: Eurofins Environment A/S (DS EN ISO/IEC 17025 DANAK 168)

Batch comments:
Preliminary report - the final version will be issued when a result Legionella is ready.

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Legend:
< less than
> greater than
#: none of the parameters are detected
LOQ Limit of quantification
*): Not included in the accreditation
n.d: not detected
NM: non-measurable
n): subcontractors
Urel (%): The expanded relative measurement uncertainty, with a coverage factor 2. For results at the level of detection limit the uncertainty might be higher than reported.
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Eurofins Miljø Vand A/S
Ladelundvej 85
6600 Vejen
Danmark
Telefon: 70224256
CVR/VAT: DK-29922980

Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Report code: AR-22-CG-22053663-01
Batch code: EUDK/E-22053663
Client code: CA0000805
Received on: 16.05.2022

Analytical Report

Sampling Point	Klinik for Rygmarvsskader - Cold water,entry point - / 4217100501
Sampling address:	Havnevej 25, 3100 Hornbæk
Sample type:	Drinking water - Other
Sampling:	16.05.2022 . 10:00
Sampler:	Eurofins Miljø Vand A/S WWM8
Test period:	16.05.2022 - 27.05.2022

Sample description: Entry point

Lab sample No.:	835-2022-81081253	Unit	Limit values ** Min.	Limit values ** Max.	LOQ	Method	a)	Urel (%)
Microbiology								
Culturable Microorganisms 22°C	32	cfu/ml		200	1	ISO 6222	A	0.15*)
Legionella species	< 100	cfu/l			100	ISO 11731	A	
Information from sampler								
Accredited sampling	Yes					DS ISO 5667-5,MST-Drikkevand, Mar		
pH	8.2	pH	7	8.5		DS/EN ISO 10523:2012		
Sampling with flush	Done					DS ISO 19458,DS ISO 5667-5,MST-C		
Water temperature	13.4	°C				DS/EN ISO 19458:2006		
Redoxpotential	-1132	mV				*		
Conductivity at 20°C	570	µS/cm		2500	15	DS/EN 27888:2003 (by 20°C)		
Oxygen content	10.4	mg/l			0.1	DS/EN ISO 5814		15

Subcontractors:
A: Eurofins Environment A/S (DS EN ISO/IEC 17025 DANAK 168)

The specified limit values are a guideline only as the sampling is done following flushing of the tap.

Results meet the limits requirements from Miljøministeriets bek.nr. 2361 af 26. november 2021 (Drikkevandsbekendtgørelsen).

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27.05.2022

Customer center
Tel 70224256
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Peter Møller
Customer Advisor /Teamlea

Legend:
<: less than
>: greater than
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n.d.: not detected
NM: non-measurable
a): subcontractors

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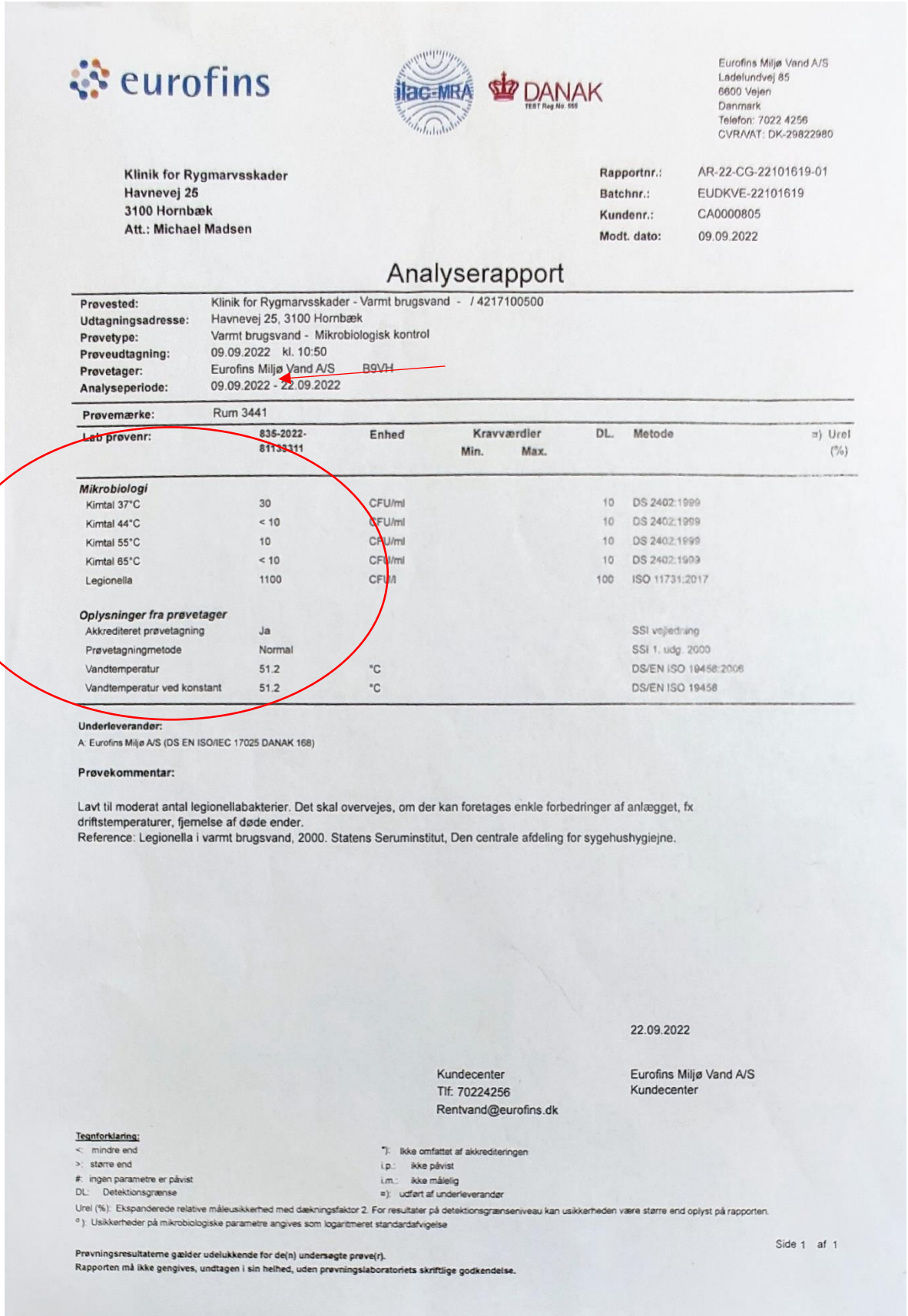
*): Uncertainties of microbiological parameters are given as a logarithmical standard deviation
**): Miljøministeriets bek.nr. 2361 af 26. november 2021 (Drikkevandsbekendtgørelsen).

This Analysis Report (no. 9) from Eurofins was taken on September the 9th. 2022.

The BioEraser system has now been installed for 6 (six) months, and we want to determine whether the system can maintain the water parameters without the use of chemistry.

Analytical Report no. 9



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ilac-MRA DANAK TEST Reg.No. 155

Eurofins Miljø Vand A/S
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6600 Vejen
Danmark
Telefon: 7022 4256
CVR/VAT: DK-29822980

Klinik for Rygmarvsskader
Havnevej 25
3100 Hornbæk
Att.: Michael Madsen

Rapportnr.: AR-22-CG-22101619-01
Batchnr.: EUDKVE-22101619
Kundenr.: CA0000805
Modt. dato: 09.09.2022

Analyserapport

Prøvested:	Klinik for Rygmarvsskader - Varmt brugsvand - / 4217100500
Udtagningsadresse:	Havnevej 25, 3100 Hornbæk
Prøvetype:	Varmt brugsvand - Mikrobiologisk kontrol
Prøveudtagning:	09.09.2022 kl. 10:50
Prøvetager:	Eurofins Miljø Vand A/S B9VH
Analyseperiode:	09.09.2022 - 22.09.2022
Prøvemærke:	Rum 3441

Løb prøvenr:	835-2022-81133311	Enhed	Kravværdier Min.	Kravværdier Max.	DL.	Metode	¤) Urel (%)
Mikrobiologi							
Kimtal 37°C	30	CFU/ml			10	DS 2402:1999	
Kimtal 44°C	< 10	CFU/ml			10	DS 2402:1999	
Kimtal 55°C	10	CFU/ml			10	DS 2402:1999	
Kimtal 65°C	< 10	CFU/ml			10	DS 2402:1999	
Legionella	1100	CFU/l			100	ISO 11731:2017	
Oplysninger fra prøvetager							
Akkrediteret prøvetagning	Ja					SSI vejledning	
Prøvetagningmetode	Normal					SSI 1. udg. 2000	
Vandtemperatur	51.2	°C				DS/EN ISO 19458:2006	
Vandtemperatur ved konstant	51.2	°C				DS/EN ISO 19458	

Underleverandør:
A: Eurofins Miljø A/S (DS EN ISO/IEC 17025 DANAK 168)

Prøvekommentar:

Lavt til moderat antal legionellabakterier. Det skal overvejes, om der kan foretages enkle forbedringer af anlægget, fx driftstemperaturer, fjernelse af døde ender.
Reference: Legionella i varmt brugsvand, 2000. Statens Seruminstitut, Den centrale afdeling for sygehushygiejne.

22.09.2022

Kundecenter
Tlf: 70224256
Rentvand@eurofins.dk

Eurofins Miljø Vand A/S
Kundecenter

Tegnforklaring:
<: mindre end
>: større end
#: ingen parametre er påvist
DL: Detektionsgrænse
*): Ikke omfattet af akkrediteringen
i.p.: ikke påvist
i.m.: ikke målelig
¤): udført af underleverandør

Urel (%): Ekspanderede relative måleusikkerhed med dækningsfaktor 2. For resultater på detektionsgrænseniveau kan usikkerheden være større end oplyst på rapporten.
°): Usikkerheder på mikrobiologiske parametre angives som logaritmeret standardafvigelse

It can be observed that the Aerobic Plate Count (kimtal) are still beneath the acceptable threshold, the Legionella count has increased slightly, but is also still well beneath the official acceptable level according to the Statens Serums Institut (SSI).

The slight increase in Legionella count is potentially related to the age of the plumbing installation, the lack of sufficient cleaning of the water boiler from the start, as well as the amount of old lime and rust which is still to be found in the old pipes.

As the Aerobic Plate Count and the biofilm will slowly degrade and disappear, it is expected the numbers to drop further.

The Green Transition

Measures and products such as the BioEraser system help organizations reduce their impact on the environment and the climate. By reducing the amount of cleaning agents, removing the need for machinery that uses high amounts of energy, and extending the life of components in the water system, a BioEraser system can positively help an organization one step closer to its green goals.

Nikolaj Sorgenfrei Blom, Senior Researcher at the Danish Technical University DTU states "It is a no-brainer to bring on the green agenda", after he had gone through the project and the closely studied water analyzes carried out by Eurofins Denmark.

Addressing problems with lime, high bacterial counts, and ORP in the water, will provide a better work environment, protect patients and other vulnerable individuals, and greatly reduce nuisance and degeneration of the components in the building's water circuit.

Ella Aagaard Petersen, functional manager for the cleaning department at Rigshospitalet was interviewed after the test period and joined the group of people who only experienced positive improvements after the BioEraser system was installed on their water systems. Ella states ”..I would like to have this in all new places..”. This must be seen in connection with Ella’s understanding that it is easier to prevent problems with lime, ORP, and high germ counts than it is to be affected by them and try to treat the problems ongoing. As she concluded in the end, “..even when the system is installed on an old water system, we can achieve a much faster and more efficient cleaning”.

Components such as faucets, sinks, toilets, coffee machines, valves, fittings, circulation pumps, hot water tanks, and all the other units that are part of the water circuit will all benefit from the lack of lime and limescale and the problems it causes.

Resources used by one organization are different from another organization. A company that needs frequent cleaning will have a much higher financial benefit from the BioEraser system. But by taking measures that improve water quality without having a negative impact on the environment and climate will provide any organization to achieve a greener profile and will impact expenses used in relation to water treatment, maintenance and service.

*Read more about the Sustainable Development Goals here: undp.org/sustainable-development-goals

BioEraser System

Non-chemical water treatment

BIOSTATIQ