



AquaWorker reduces Legionella and biocides in cooling system at Epiroc, Sweden

There are multiple challenges associated with the operation of an open recirculating cooling system. These systems comprise conditions, warm and humid, ideal for pathogenic reproduction. This includes different types of Legionella bacteria which is the cause of Legionnaires disease and Pontiac fever. Sources of contamination into the system can be several; make-up water quality, air quality and intrusion from the process. The problems are chemically and biologically oriented and are accelerated due to accumulation because of vast evaporation. Common practice to address issues with corrosion, scaling and biological fouling is to add chemicals which leads to another dilemma. More stringent waste regulations and requirements from recipients of waste streams put demands on industries to monitor less chemicals in waste streams.

Epiroc in Fagersta chose AquaWorker, an industrial UV solution developed for tough conditions, to address these challenges.

Strong focus on sustainability

At Epiroc Drilling Tools, Fagersta part of the continuous environmental work is to reduce the use of chemicals. For the cooling system, the objective was to replace the use of biocides with UV treatment to control microbiological activity. The benefits are multiple; biological control, reduced OPEX, reduced health hazard risks of personnel and environment and waste stream compliance.

Pre-conditions of the cooling system

The cooling system is in operation continuously, supporting the multi-shift production lines every day of the week which is advantageous for an effective water treatment. However, the system volume is large compared to the cooling capacity, that potentially can promote uncontrolled bacteria growth. Biocides have been used historically to control biological activity in the cooling system.

Despite these conditions Epiroc have experienced problems on several occasions during the years with bacteria levels ($>10^6$ CFU/ml) exceeding EWGLIs corrective action limits ($>10^5$ CFU/ml) that required extraordinary handling. Efforts involving manual handling of chemicals, components and sanitation.

On some occasions, levels of Legionella have also exceeded the limits. In these cases, production have been maintained using large volumes of tap water as flow-through cooling with high costs as a result. These situations have occurred even though biocide dosing have increased during the years.

AquaWorker at Epiroc Fagersta

For the cooling system at Epiroc Drilling Tools, Wallenius Water Innovation made a system analysis based on cooling capacity, system volume and water analysis. In addition, factors such as operational parameters and installation point with presumed greatest effect was considered.

One AquaWorker was installed and in full operation end of August 2022. During September 2022 to May 2023, the biocide dosing was continuously reduced while the systems bacteria levels were monitored.

Operational expenses, OPEX

– Total annual savings EUR 31 000

The operational cost calculations include costs for biocides, electricity, spare parts, and maintenance hours by personnel. The main savings are due to reduced consumption of biocides.

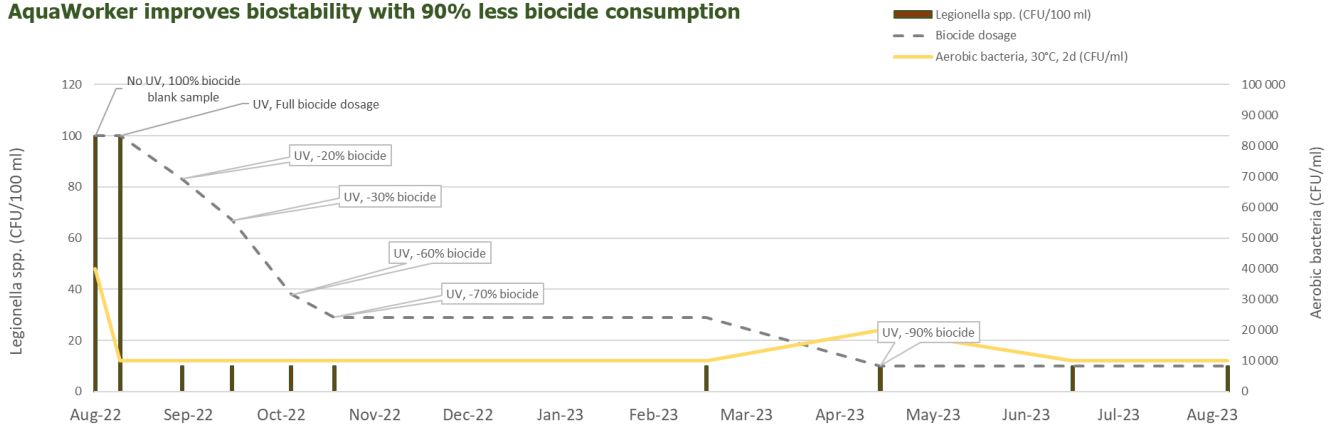
Costs related to uncontrolled bacteria levels have not been included in the saving calculations, but additional advantages of the upgraded Epiroc cooling system are:

- Waste stream compliance
- Improved biostability and operational reliability
- Reduced health risks of personnel
- Preventing Legionella spreading to the surroundings
- No risk of antimicrobial resistance
- Less risk of corrosion due to biofouling
- Equalizing bacterial fluctuations in case of issues with dosage of biocides

Elin Ståhl, Safety & Health Coordinator at Epiroc concludes:

"We wanted to feel sure of not getting legionella growth in our system, but at the same time we wanted to reduce the biocide addition. This product has helped us, and we see the possibility of being able to completely exclude biocide additives and ensure low water consumption"

AquaWorker improves biostability with 90% less biocide consumption



Return of investment - ROI

Considering the investment of AquaWorker and related installation costs, the annual savings for Epiroc results in a ROI of less than 2 years using an interest rate of 5%. This doesn't include the additional advantages which are difficult to evaluate.

Bacterial control

During the ramp-up period, water samples were taken regularly at different points in the system. Also, bacteria assessments were done using several methods to detect differences and count trends: dip slide, ATP and laboratory plate count (ISO 6222). Specifically, Legionella spp. were isolated and analyzed according to ISO 11731 using an external accredited laboratory.

Confirmation of biostability was defined through conformity between the methods and when low bacteria concentrations were measured. Only when biostability was confirmed, the biocide dosage was reduced.

After one year of operation, biostability with a reduced biocide consumption of more than 90% has been validated.

Summary & Conclusions

The operation of AquaWorker at Epiroc in Fagersta has been successful. During the first year of operation, the following can be concluded:

- **Reduced biocide consumption and operational costs** with approx. 90%
- **Less** handling of chemicals and related risks
- **Low and stable** bacteria levels **beneath** recommended action levels
- **Reduced risk** of Legionella outbreaks to the surrounding
- **Less downtime** for cleaning the system
- **Less** chemicals in waste streams to meet environmental legislations

EWGLI bacteria levels and guidelines

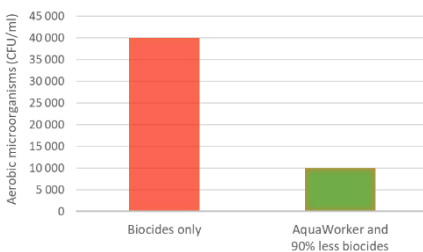
European Working Group for Legionella Infections guidelines published by ECDC, European Centre for Disease Control give rules for management and maintenance for open cooling systems.

Specifically, the guideline defines bacteria concentration limits when actions are needed to prevent outbreaks.

	Aerobic bacteria (CFU/ml)	Legionella (CFU/100 ml)
Control	< 10 ⁴	< 100
Preventive	10 ⁴ -10 ⁵	100-1000
Corrective	> 10 ⁵	> 1000

These limits have been used in the monitoring of the upgraded system as well.

Bacterial colony count - overall results



Biocides only

AquaWorker in operation

System data	Total volume=150 m ³ , Cooling flow rate=176 m ³ /h, Operation=360 days, 24h	
Water treatment	Biocides 100%	UV treatment, biocides < 10%
Biocide dosage	90 min/day, 7 days/week	60 min/day, 1 day/week
Bacteria levels	Fluctuating, bacteria levels, above 10 ⁶ CFU/ml	Stable, bacteria levels below 10 ⁴ CFU/ml
Transmittance of water	24%	45%
Water/system appearance	Fluctuating, foam	Stable, much less foam, clearer water Less system cleaning required

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