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# ASYNBIO CASE STUDIES

THE WATERMARK OF DISTINCTION™

# CASE STUDY 1: COOLING TOWERS

## The Problem

Evaporative towers or “cooling towers” must be monitored periodically in order to avoid the risk of bacterial contamination *(Legionella)* and environmental damage.

Current water control and conditioning systems based on chemicals and biocides have a strong environmental impact and often do not completely eliminate the risk. The main contaminants of the evaporation towers are primarily of organic and microbiological origin (bacteria, algae, mud and fungi) and form a very resistant biofilm.

Furthermore, the temperatures of the exchangers favor the crystallization of the limestone, compromising the efficiency of the system. *(Cont.)*



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## The Problem *(Cont.)*

The biocidal products in use today are able to significantly reduce the number of organisms but are not able to guarantee their complete removal.

Pathogenic microorganisms, typically more resistant, are able to survive the disinfectants. At each cycle they reproduce more rapidly, colonizing more and more space on the surface or in the tank and increasing their colony and potential risks.

## Idea

Replace the biocides with a formulation based on probiotic bacteria capable of guaranteeing natural, stable and long-lasting microbiological protection and deep cleaning.

## Solution

AXEON has developed a new microbiological methodology that involves the insertion of live microorganisms into the process. Probiotics:

- Activate a natural mechanism that decomposes and metabolizes organic contaminants and biofilm
- Colonize the environment, preventing pathogenic bacteria from taking over
- Create a healthy and regenerative microbiotic environment
- Hinder the formation of new bad bacteria and germs

## Benefits

- Deeper and longer-lasting hygiene
- Recovery of system efficiency
- Sustainability and environmental protection
- Greater protection from contamination by pathogenic microorganisms

## Situation

Analysis and monitoring of the containment capacity of the proliferation of pathogenic bacteria in the water systems of evaporative towers following the use of probiotic products in place of chemical biocides.

The test is performed on evaporative towers under ordinary conditions of use. The microbiological aspects and the chemical-physical parameters of the water are monitored. Visual inspections are carried out to assess the cleanliness of the internal surfaces, heat exchange surfaces, and deposits (contamination due to mud, algae, mold, etc.). *(Cont.)*



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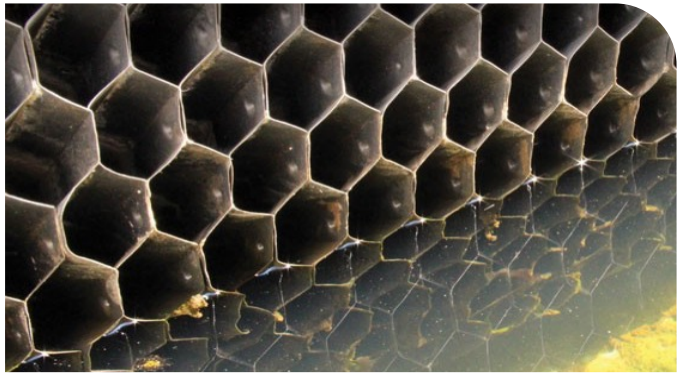
## Situation *(Cont.)*

The towers are powered by groundwater without softening or filtration systems. The makeup water is recalled from the evaporative towers by means of a float inside the individual towers. The makeup water was previously treated with a system of dosing pumps and a proportional dosage of antiscalant, dispersant solution, and a solution of biocide (hydrogen peroxide).

The process begins by verifying the effective disposal of biocides through colorimetric maps of the tower water. The metering pump previously used for the hydrogen peroxide, properly rinsed and cleaned, is fed with the probiotic-based formulation. The first quantity of Aqua Guard Pro is introduced directly into the tanks of the evaporative towers in order to accelerate the colonization process of the tanks. This is then proceeded by a proportional dosage of water for the first 3 weeks. A maintenance dosage is continued at the end of the 3-week period.

## Monitoring

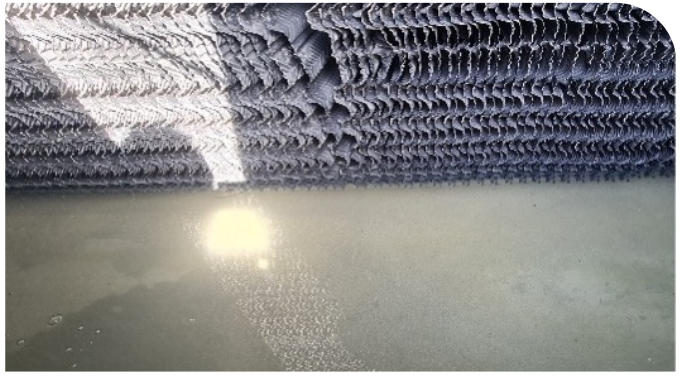
During the start-up phase of the plant, a weekly visual inspection and monitoring of the chemical and physical parameters were carried out to ensure the correct functioning of the evaporative tower. Monitoring and microbiological analyses were then carried out monthly. *(Cont.)*



Tower 1: Presence of algae and organic biofilm in the lower part of the tower

# Monitoring *(Cont.)*

Tube Bundles: Strong encrustation of limestone and organic material that can't be removed mechanically



Tower 2: Presence of algae and organic biofilm in the lower part of the tower



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## Results

Probiotics begin colonizing and producing specific enzymes for the type of biofilm and organic material they encountered. The biofilm is composed of several layers of organic and inorganic materials, such as calcium carbonate, which makes it adhere to surfaces. The probiotics progressively break the bonds of the biofilm, starting from the outermost layers and progressing towards the innermost ones. The organic matter contained in the biofilm becomes nourishment for the probiotics, which multiply and continue their cleansing action. *(Cont.)*

Detachment of encrustations and dissolution of the biofilm

## Results *(Cont.)*

The water is more turbid and there are more deposits due to the progressive detachment of encrustations.

Based on the degree of encrustations and biofilm present in the system, it may be necessary to carry out a programmed control of the filters. If the detached material is so abundant that it prevents the probiotics from disposing it in a short time, intervention is possible with washing and mechanical removal of the deposits. *(Cont.)*

Detachment of encrustations and dissolution of the biofilm



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## Results *(Cont.)*

The duration of this phase depends on the degree of contamination and dirt accumulated on the walls, tube bundles, and inside of the pipes. The bacterial load grows due to the multiplication of probiotic bacteria (desired effect) and a greater presence of non-probiotic bacteria and fungi due to the biofilm breaking down.

**The increase in probiotics accelerates cleaning and the process of dissolving the biofilm/detaching the matter in which it is nested.**

Detachment of encrustations and dissolution of the biofilm



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## Maintenance

The water becomes clear again and the surfaces of the tank, walls and tube bundles appear clean and without biofilm or encrustations. The organic material, loose deposits and silt have been removed mechanically to accelerate the effect of probiotic digestion (in the case of new or clean towers, this mechanical phase is not necessary).

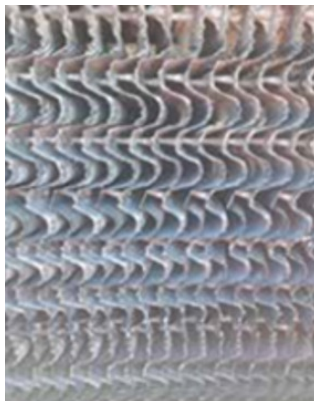
There is a reduction of unwanted bacterial loads and fungi. Algae is no longer present and even organic nourishment is scarce. The effect of cleaning and eliminating nutrients leads to the death of microorganisms due to lack of sustenance and the reduction of all monitored microbiological parameters. *(Cont.)*

## Maintenance *(Cont.)*

This process is continued with a maintenance dosage in the makeup water in order to maintain the presence of a probiotic colony (although dormant or reduced in number due to the absence of nutrients).

The elimination of biofilm and organic contaminants (nutrients) prevents the proliferation of pathogenic organisms. The probiotics introduced in this phase will remain inactive (in the form of spores) until new nutrients arrive.



# CASE STUDY 2: PAPER INDUSTRY

## Overview—Applications in Paper Industry

- DIP plants:
  - Large scale DIP plant
  - Medium scale DIP plant
- Paper machines or similar:
  - Packaging paper mill with 2 PMs
  - Small tissue paper mill with 2 PMs
  - Large tissue paper mill with 4 PMs
  - Wet laid production mill with 2 forming machines (just started) *(Cont.)*

## Overview—Applications in Paper Industry *(Cont.)*

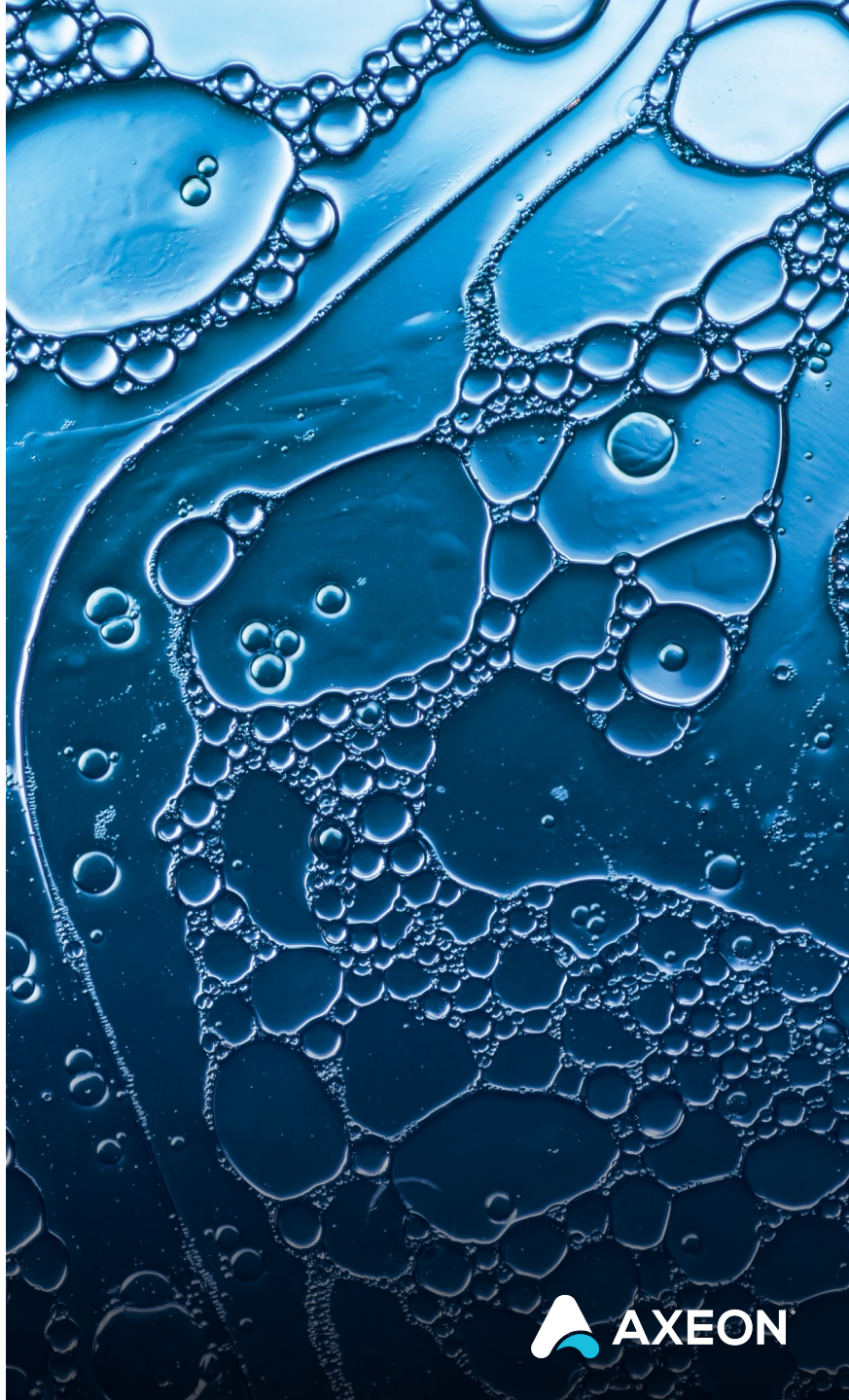
- Secondary water systems:
  - Airwasher in specialty paper mill
  - Wastewater treatment plant (just started)
- In preparation:
  - Packaging paper mill
  - Large graphical paper mill

## Situation 1: Virgin Pulp Using Paper Machine

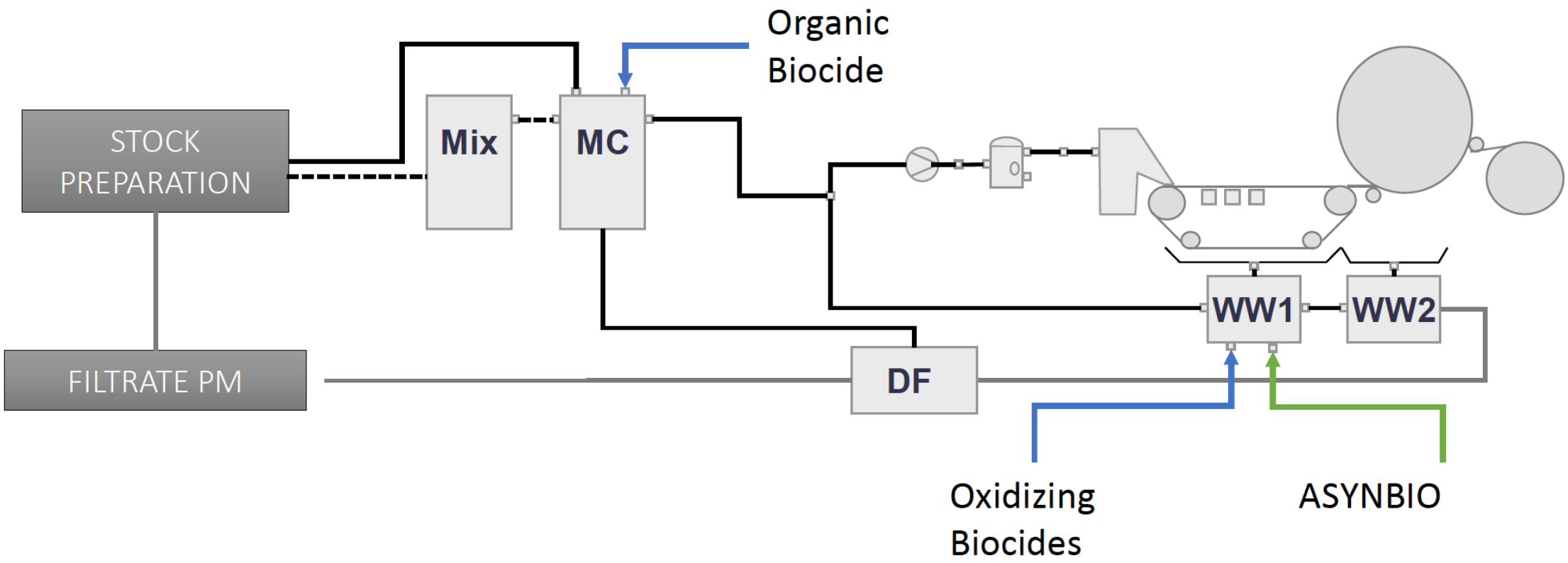
- PM is using a combined treatment of oxidizing and classical organic biocides
- Due to reclassification, the organic biocide formulation's Water Hazard Class increased from 2 to 3

### Target:

- Substitute the organic biocide, or better, all biocides due to storage limitations and risk assessments
- Good hygiene status should be maintained



## Schematic Dosage at the PM



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Spray bar beneath forming wire

## Results

- No change in the microbiological baseline of the system
- Stable conditions of the wet end
- Strong evidence indicating probiotic establishment
- Reduction of deposits like slime in the periphery (spray zone) and other places on the machine, such as the frame or the spray pipes
- Customer reported improved cleanness in the white water tank and the approach flow system compared to biocidal treatments

## Situation 2: Graphical Paper Mill With Deinking Plant

- Graphical paper mill was treating its deinking process lines with glutaraldehyde ($C_5H_8O_2$) to reduce catalase activity
- Trial with oxidizing biocide systems as well as formaldehyde releasers did not show sufficient effectiveness

### Target:

- The customer was looking for an economic and eco-friendly alternative, as at this time glutaraldehyde was being considered for the SVHC-candidate list

## Results

- Aqua Guard Pro can substitute glutaraldehyde
- The amount of residual peroxide was on a similar or even higher level than it was with a conventional treatment
- Aqua Guard Pro stabilized the redox potential and pH values in the process
- The deinking cells were easier to clean, as deposits adhered less to the surfaces




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## Situation 3: Air Scrubber in Specialty Paper Mill

- Specialty paper mill is operating 3 airwashers to remove dust from the production and converting halls
- Oxidizing biocide (peroxide) and conventional biocides were used as biocidal treatment

### Target:

- The customer was looking for an eco-friendly alternative to improve the work safety of the employees

## Alternative Treatment: Impressions Air Scrubber

Directly after cleaning

Siltation within the first two weeks

After optimization



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Together, let's leave our mark on the right water treatment solutions.