Atlantium
Illuminating Water Technologies

APPLICATION BRIEF

UV Water Treatment
Hydro-Optic™ Technology

Bielefeld, Germany Installs Hydro-Optic™ UV System for Cooling Tower Water Disinfection

The City of Bielefeld, Germany provides municipal utilities including electricity, natural gas, district heating, and water needs for a population of approximately 330,000. The municipality operates three gas-fired boilers with tapping turbines to feed into the district heating system that has a thermal peak load of 300 MW. Cooling water from generators, oil coolers, and sampling coolers are recooled via two open evaporation cooling towers with a total capacity of 2,500 m^3. Historically the municipality has used chlorine dioxide to manage Legionella and algae blooms in their cooling water; unfortunately, a sustainable genetic content of less than 100 cfu has not been consistently maintained especially in autumn and winter when cooling tower swaths pull through the factory internal road.

With the new stringent regulations governing the control of microbiology (42. BImSchV, the inspection requirements for evaporative cooling systems, cooling towers and wet separators) and guidelines for plant operation (VDI Guideline 2047-2, securing the hygienically sound operation of evaporative cooling systems), the municipality required a new disinfection method to minimize biofilm growth, biofouling and Legionella in their cooling water. The Hydro-Optic™ (HOD) UV treatment system, an environmentally friendly disinfection method that reduces the use of chemicals and chlorination cycles, was installed in February 2018 as a cost-effective and efficient method of reducing biofilm and providing effective treatment for inactivating Legionella.

The Hydro-Optic UV system (Model RZB300-12 with DPM), installed as a bypass on the existing 300 mm (12") piping and returned to the cooling towers, accommodates a flow rate of 250–400 m^3/h (1,100–1,761 gpm). Initial disinfection results for the HOD UV technology are very promising, bacteria counts have drastically reduced and Legionella is non-detectable following the use of the HOD UV technology (Table 1). Additionally Legionella levels are reducing in time due to the "cleaning" effect of the HOD UV technology. Microbiological results, sampling and analysis for Legionella and Pseudomonas Aeruginosa are being performed by an accredited laboratory.

Table 1: Microbiological results from City of Bielefeld, Germany open evaporation cooling towers

		19 Feb 18	26 Feb 18	5 Mar 18
Legionella [/100ml]	**Before HOD UV**	550	100	15
	After HOD UV	0	0	0
	% Reduction	100	100	100
Pseudomonas Aeruginosa [/100ml]	**Before HOD UV**	0	50	0
	After HOD UV	0	0	0

The municipality is pleased with the excellent microbiological results and believes the HOD UV system is an effective and sustainable solution for Legionella control.

Hydro-Optic™ UV Technology: Principles of Operation

Unlike chemical treatment approaches, UV systems employ a physical process for disinfection. When bacteria, viruses and protozoa are exposed to the germicidal wavelengths of UV light, they are rendered incapable of reproducing.

Medium pressure (MP) UV lamps provide polychromatic UV light (200–415nm), while low pressure (LP) lamps provide monochromatic light (254nm). MP lamps produce a high-density broad-spectrum UV light inclusive of wavelengths responsible for disinfecting certain resistant viruses.

Since different microorganisms are sensitive to different UV wavelengths, MP lamps can easily inactivate more microorganisms, such as algae, adenovirus, and IPN, through their broad UV germicidal spectrum.

When a microorganism has been inactivated by a LP UV system, it can still repair using its own cell-repair mechanism or by summoning host repair mechanisms. In a MP UV system, the various wavelengths work together to disable cell repair mechanisms. MP lamps disable the proteins and enzymes needed to trigger repair, achieving permanent microbial inactivation at a lower dose than LP systems.

The Hydro-Optic UV technology measures four critical parameters including %UVT, flow rate, UV lamp intensity (kW) and UV apparatus (consisting of Total Internal Reflection and Dose Pacing) in real time to maintain the minimum required UV dose.

The system uses a proprietary Total Internal Reflection (TIR) based design that when coupled with the comprehensive monitoring of critical parameters allows the system to achieve and maintain the specified UV dose.

The system's patented TIR technology, which is similar to fiber optic science, recycles UV light energy within the HOD UV chamber. The core of the technology is its water disinfection chamber made of high-quality quartz surrounded by an air block instead of traditional stainless steel (Figure 1). This is especially important given that in traditional UV systems metal adsorbs or "detracts" the UV dose the closer it gets to metal, whereas the TIR enhances the UV dose.

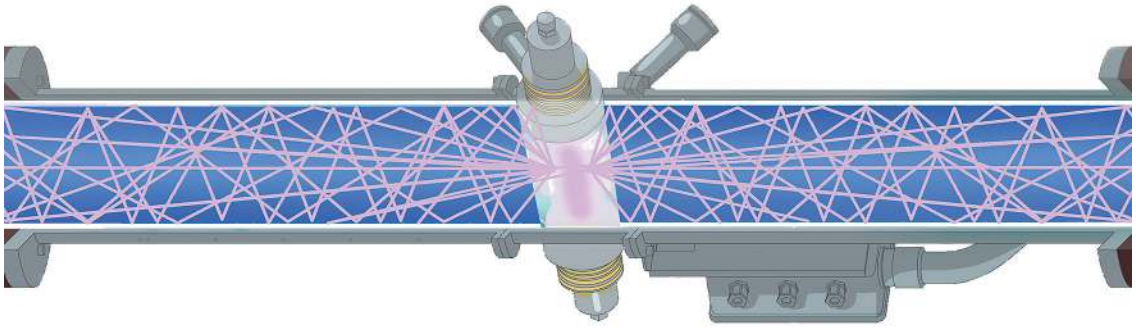

Figure 1: Atlantium Hydro-Optic™ UV Lamp and Chamber

This configuration uses fiber optic principles to trap the UV light photons and recycle their light energy. The photons repeatedly bounce through the quartz surface back into the chamber, effectively increasing their paths and their opportunities to inactivate microbes.

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www.atlantium.com
info@atlantium.com

For more information, contact your Atlantium representative