Atlantium
Illuminating Water Technologies

APPLICATION BRIEF

Hydro-Optic™ Technology
MACRO/MICRO BIOFOULING CONTROL

US Army Corp of Engineers Installs Hydro-Optic™ UV System for Aquatic Invasive Species Control at Gavins Point Dam

Gavins Point Dam is a hydroelectric facility with a nameplate capacity of approximately 120 megawatts that is managed by the US Army Corp of Engineers (COE) Omaha, NE district office. Following the invasion of Asian clams and then quagga mussels to the Missouri River supply and Lewis and Clark Lake, COE inquired about control options to protect their facilities while having little to no environmental or ecological impact. The Hydro-Optic™ (HOD) UV treatment system was selected for non-chemical control of aquatic invasive species.

Gavins Point Dam has three main turbines, each with eight heat exchangers (twenty four heat exchangers in total), requiring protection from Asian clams and mussels. Two HOD UV systems along with a new strainer and piping modifications will be installed during 2018. Each UV system (Model RZB300-14 with DPM) accommodates a flow rate of 1,091 m^3/hr (4,000 gpm) for water quality conditions with percent UV transmittance as low as 67.3 %UVT. The proprietary medium pressure UV systems will be supplied with a deposit control mechanism, %UVT monitor, UV dose monitor, and flow switch. To confirm water was flowing a flow meter will be installed by the facility on the discharge side of the HOD system. This feature will provide full control of all features of the HOD UV system to flow pace and control real time operator selected dose.

The HOD UV systems will be installed immediately after the cooling water line is supplied from Lewis & Clark Lake intakes on both ends of the powerhouse. Placement of one UV system on either end of the cooling water line enables the powerhouse to use either location to supply cooling water.

Footprint space is limited at the installation location. As a result, new 14" cast iron raw water piping will be incorporated. The HOD UV units will be installed immediately after the new strainer of the raw water, cooling water supply. The 14" piping will extend and loop back providing the additional footprint needed to accommodate each UV system. By extending the piping the UV systems will be placed horizontally with adequate spacing for maintenance (30" on each side for ease of UV bulb removal and located 3-4' above the floor). Additionally, a bypass will be installed so each unit can be taken out of service for annual maintenance while ensuring adequate flow to the cooling water for the generators. The slightly longer length of the inlet pipe as compared to the outlet pipe will allow for laminar flow so that air bubbles are not created inside the UV chamber. The flow meter will be used to detect when to signal the UV bulbs to shut down when no flow exists or fluid has drained out of the UV chamber. All electrical components (480V – 3 Phase) will be located in a weather-proof room, dry area, that does not exceed 100˚F. The system's communication is accomplished by MODBUS and signals are taken to a central location for monitoring the system alarms and operating parameters.

The Hydro-Optic UV system is an environmentally friendly, non-chemical disinfection method to minimize the risk of aquatic invasive species by preventing invasion and infestation at Gavins Point Dam.

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.

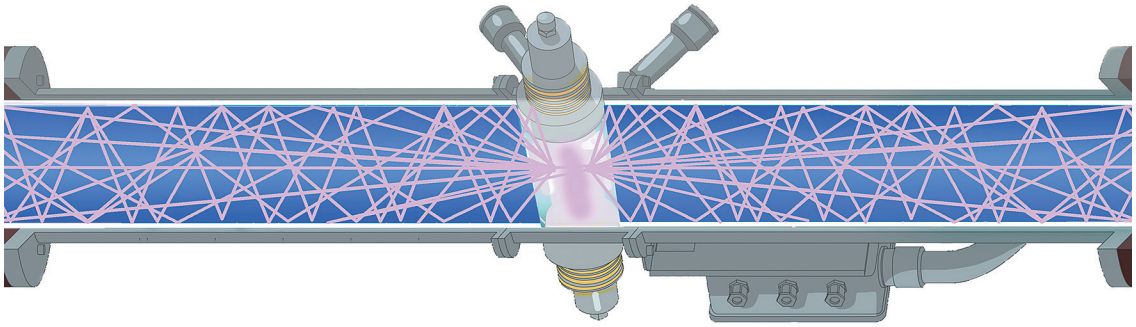

Figure 1: Atlantium Hydro-Optic™ UV Lamp and Chamber

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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