

Chichester Harbour in West Sussex, U.K., is recognized as a water environment of national and international importance. Designated by Natural England as an Area of Outstanding Natural Beauty, it is a popular tourist destination visited by birdwatchers, surfers, families on vacation and nature and wildlife enthusiasts. Recognized by the Ramsar Convention as a Wetland of International Importance, its wetlands are home to a vast number of species and are an important stopover for migratory waterfowl. The harbor's designations also include being a Special Area of Conservation (EU), a Special Area of Protection (EU) and a Site of Special Scientific Interest (U.K.).



Storm Water Disinfection With UV

By Kirsten Meyer

UV system disinfects discharge to protect Chichester Harbour

Southern Water's Chichester wastewater treatment works (WWTW) discharges into these pristine waters. Significantly upgraded in 2008 to meet new consent standards for discharging into waters designated as sensitive under the Urban Wastewater Treatment Directive, Habitats Directive and EC Shellfish Waters Directive, its discharge requirements are stringent.

During storm events, the collection system experiences severe groundwater infiltration, and Chichester WWTW is unable to treat the increase in flow. Chichester receives ample rainfall, averaging more than 31.5 in. annually and ranging from an average of approximately 2 in. during the driest months to 3.5 in. or more during the wet winter months. While the 2008 upgrade increased treatment capacity and storm water storage capacity to over 30,000 cu meters (7.9 million gal), overflows of untreated storm water and wastewater from the storm tank still flowed into the harbor during severe storm events. Adding additional storm water storage is impractical and would not prevent spills, as the WWTW does not have adequate treatment capacity to empty the tank during extended rainfall periods.

Interim Treatment

The long-term solution to resolve the infiltration problem will require several years. To protect the harbor while the collection system is being upgraded, in 2012 the Environmental Agency (EA) agreed to allow the WWTW to treat the settled storm water with ultraviolet (UV) disinfection prior to discharge. In April 2013, the EA issued the WWTW an enforcement notice regarding the storm water tank discharge. At that time, Southern Water,

the EA, the design consultant and the contractor for the UV installation agreed to work through issues regarding permitting, design, construction and startup of the UV system to meet the March 31, 2014, compliance date. The process resulted in a permit based on a validated UV dose.

The project team selected Wedeco's Duron system to provide the UV disinfection for this installation in large part due to its validation and intelligent control. Duron's disinfection efficiency has been thoroughly assessed via biosimetric testing (validation) by an independent third-party engineer. Biosimetry is a process that determines the biological kill rate of a UV system under defined operating conditions and links these to surrogate specific UV dose values. Originally developed for potable water disinfection, this method of validating dosage is much more accurate for ensuring disinfection than the previous method of calculated dose, which only considers the output of the lamps, the UV transmittance (UVT) and the contact time.

The engineer, Montgomery Watson Harza (MWH), had to ensure that the chosen system would deliver the required dosage throughout the entire range of operating and water quality conditions, so validation—particularly at low UVT—was a prime concern. Depending on the intensity of the storm, the time of year and the time within the storm event, both the flow through the system and the water quality may vary drastically. The first flush from a high-intensity storm may combine very high flows with UVT of only 30%, while the final flow from the same event, as the rain tapers off, may produce much lower flow with a much higher UVT.

Duron's broad validation envelope includes all the conditions of Chichester's projected storm water flow and quality. Combined with the system's intelligent control protocols, this validation envelope assures an accurate dosage continuously, under all design conditions.

Meeting Dosage Requirements

To deliver the appropriate dosage over such a wide range of operating conditions, the Duron UV system uses 10 banks in sequence to treat flows up to 4,755 gal per minute.

To ensure the system meets dosage requirements efficiently and economically under all operating conditions, it must be able to adjust the output to match the flow and water quality. Equipped with intelligent protocols and automatic controls, it automatically turns on at the beginning of a storm event. The controls incorporate online sensors providing dual readings of real time UV intensity, plus the UVT of the water—and, of course, flow. The controls continuously adjust the number of banks in operation as well as the power level to the lamps to deliver the precise dose required without wasting energy and while minimizing lamp run time. As flow tapers off following the end of the storm event, the controls take banks out of operation, leaving two running at even very low flows to ensure treatment of all storm water prior to discharge.

Low maintenance requirements and minimal operator attention are other advantages to the system. Automatic on-off, as well as continual online monitoring and dosage adjustment, allow it to run itself, while operators attend to the wastewater treatment side of the operation. The system comes equipped with self-cleaning lamps, automatically activated when the measured UV intensity drops below a set point. Self-cleaning automatically restores the intensity of the lamps without the need for operator attention.

Ease of maintenance is another system feature. Lamp monitoring alerts operators when the system requires attention, such as lamp replacement. The push of a button activates the integrated lift system, lifting the inclined bank for maintenance.

Addressing Startup Challenges

Startup was not without challenges. The initial UVT sensors were prone to fouling and failure, particularly at low UVT conditions. The intermittent flow conditions, which included dry periods, allowed deposits to dry on the sensors, exacerbating these failures. Contacted by Southern Water, Wedeco changed the UVT sensors to advanced WTW sensors. These have demonstrated reliability even at very low UVT conditions and under all flow conditions, including no flow. Equipped with an automatic ultrasonic cleaning system, they are less prone to fouling and require minimal

maintenance. The WTW sensors have enabled the control system to deliver the proper dosage reliably, with little to no operator attention.

Validating Compliance

The Chichester project was the first end-of-pipe storm water discharge to receive UV disinfection permit conditions in the U.K. The EA developed new permitting protocols based on monitoring the UV dose to validate compliance. The Chichester WWTW project was the first disinfection system designed and operated based on this Validated Dose permit. The system

also demonstrated that properly designed low-pressure systems could be an alternative to the energy-intensive medium-pressure systems previously used in storm water applications.

Placed in service in 2014, the Duron system has proven reliable and effective, consistently meeting permit requirements for 1 log virus reduction and less than 1,000 E. coli at 85% ile. It is playing a role in preserving the beauty and health of an environmental gem, the Chichester Harbour. **w&wd**

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