

Xylem UV Disinfection Facility Protects New Zealand Coastal Waters

As part of an upgrade to a wastewater treatment plant near Auckland, New Zealand, an Ultraviolet (UV) disinfection facility from Xylem unit will be installed. The UV disinfection is part of a plan to improve effluent to an extent that will allow the local coastal waters to be open to the public for the first time in 40 years.

Watercare, Services Ltd (WSL), the New Zealand-based publicly owned water supply and wastewater treatment company, commissioned the construction of a UV Disinfection facility as a key process in the NZ \$450 million (US \$225 M) upgrade of the Mangere WTP, near Auckland, New Zealand. The plant upgrade included both construction of a new 'state-of-the-art' plant and full coastal restoration. Two of the four existing Oxidation Ponds, have already been demolished. They will eventually be replaced by a natural harbour foreshore. The improvement in water quality will allow swimming and shellfish gathering, in an area that has been off limits to the public for over 40 years.

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The overall project delivery is being carried out by Manukau Wastewater Services Ltd (MWS), under a design/build contract. MWS is a consortium of both local and international businesses; CH2M Beca, Bovis Lend Lease, Fletcher Construction and New Zealand Water Services.

The construction of new plant includes an upgraded screening facility, nine new combined reactor/clarifiers and a new tertiary treatment system using sand filtration in combination with UV Disinfection.



The 12 channels in the UV gallery contain a total of 7776 300-watt UV lamps. They achieve a 10,000 reduction in pathogens discharged into the harbor. It is one of the largest UV treatment installations in the world.

Basics of UV Disinfection

The UV disinfection facility is designed to reduce Enterococci and Fecal Coliform levels of filtered and biologically treated influent, to within specified microbiological requirements. This is achieved by using the physical effect of ultraviolet light. Within seconds of a water borne organism coming into contact with the UV radiation emitted from a UV Lamp, a photochemical reaction is triggered in the organism's DNA, preventing it from multiplying, therefore rendering it biologically inactive.

Equipment Selection

The UV disinfection process is the final treatment before effluent discharge. As the sole source of disinfection, it is critical to the effectiveness of the entire treatment plant. Therefore, in selecting a suitable supplier WSL completed extensive pilot plant trails, involving three separate proprietary systems. In June 1999, Xylem's WEDECO unit was awarded the contract to supply their TAK 55 series UV disinfection equipment. The completed UV Disinfection facility, with a maximum discharge rate of 16,000 l/s (365 MGD) and a total number of lamps close to 8,000, is now the largest and most sophisticated wastewater UV disinfection system in the world.

System Specifics

The Xylem UV disinfection facility is composed of 12 open channels, 17m (56ft) in length. Xylem installed three banks of UV lamps within each channel. Both the number of UV lamps in operation and the output power of each UV lamp is automatically varied, according to the influent flow conditions. Thus, the applied level of disinfection is constant regardless of influent flow rate or water quality. At the heart of Xylem's TAK series is the unique Spekthrotherm® UV lamp. This lamp was specifically designed by Xylem to generate 3 - 4 times more UV energy than standard low-pressure lamps. This enabled the entire UV facility to be installed with a total footprint of under 800m² (8,500sqft).

Advanced Control System

To ensure that the advanced properties of Xylem's Spekthrotherm® UV lamp were fully exploited, the development of a comprehensive system control philosophy was essential. Although Xylem could draw upon experiences gained in many previous installations, specific plant requirements were taken into consideration. Each UV Channel operates as a 'stand-alone' system, controlled by a dedicated Siemens PLC.

Supervisory control of each 'stand-alone' channel is achieved through a Distributed Control System (DCS). The use of the DCS allows the UV facility to be fully integrated into WSL's existing plantwide control system. Xylem's Electrical Engineering Manager, Jens Brede, states, "This form of control architecture ensures a high degree of operational flexibility and redundancy." He continues, "It also allows the plant operators to view the UV facility as part of the entire treatment process and not only as an isolated unit".

"Zero-Defect" Construction Philosophy

With the core design and manufacturing groups of Xylem's WECECO unit based in Herford, Germany, it was essential that there was an effective flow of information between Xylem, MWS and local contractors. As a means of assisting this, Xylem developed management plans in conjunction with MWS, covering all aspects of the design, fabrication, construction and testing. MWS Project Engineer, David Rose explains, "The Management Plans were used to define key tasks and allowed us to monitor and control those tasks within the overall construction program. Each phase was completed and checked on the basis of a 'zerodefekt philosophy' that ensured issues were resolved as they occurred."

This 'zero-defect philosophy' was applied across all disciplines; civil, mechanical, electrical and software. For example, each key task in the civil construction was inspected and signed off in accordance with agreed criteria. This further assisted the installation of the various pre-fabricated mechanical components. Another example can be seen in the development of the control software. Full software simulations of the process operation were carried out prior to installation, ensuring that all normal and abnormal operating conditions were known and accounted for.

During a recent meeting evaluating the completion of construction, Watercare Services Ltd described the Ultraviolet (UV) Disinfection facility, at the Mangere as "a world-class installation".

Coastal Waters Opened Again

The technology developed by Xylem has enabled them to provide a UV disinfection facility that offers a safe, reliable and economic solution to the safe discharge of effluent to coastal waters. The treated water that is discharged into the harbour is very clean by international standards. Fecal coliforms in the outflows from the plant have been cut by 99.8 per cent. Other pollutants, like nitrogen and ammonia, have been reduced heavily. There is a 10,000-fold reduction in viruses in water discharged from the plant.

The foreshore around the plant - for a distance of about 13 kilometres - has been restored to conditions comparable to those prevailing when the first wastewater treatment plant was opened in 1960. About 300,000 native trees and plants have been planted on the foreshore, and seven new beaches have been built. Bird roosts have been established and, in the summer of 2002-03, thousands of migratory seabirds returned to the restored foreshore around Mangere. Work is beginning on reopening Oruarangi Creek, which has special significance for local Maori, to the sea. The creek, which is just to the south of the plant, has been closed to the sea for almost a generation.

For more information: www.wedeco.com

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