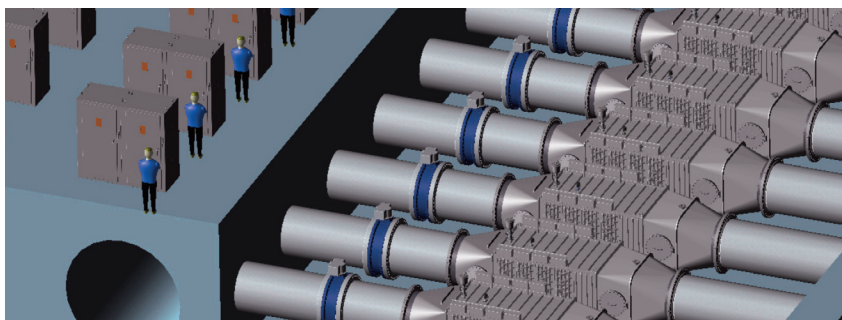


TROJAN UV™

CASE STUDIES

Municipal Drinking Water



Trojan UV Solutions: Disinfecting with UV in Drinking Water

UV-Disinfection – NEW YORK CITY Drinking Water Facilities

PROJECT BACKGROUND

New York City, is made up of five boroughs: the Bronx, Manhattan, Queens, Brooklyn and Staten Island and is home to more than eight million people, making it the most populous city in the United States.

The City draws its drinking water from two protected surface water systems: the Catskill/Delaware and Croton watersheds. The majority of New York City's (NYC) drinking water is supplied by the Catskill/Delaware watershed, located approximately 100 miles outside the city. Historically, NYC has not filtered the water from this system nor did they require any additional barriers to microbial contaminants due to the pristine nature of the watershed. The total area of both watersheds is approximately 1,972 square miles and contains 19 reservoirs and three controlled lakes.

In 2006, the United States Environmental Protection Agency released the Long Term Enhanced Surface Water Treatment Rule

(LT2ESWTR). This new rule requires surface water treatment facilities to either filter their water or install an additional barrier for microorganisms as a multi-barrier disinfection strategy. The city of New York needed to comply with the LT2ESWTR by 2011. Engineers working on the Catskill/Delaware project evaluated a new filtration plant but the cost of installing a 2.2 billion gallon per day (BGD) filtration facility was significantly greater than other alternatives. After evaluation of available technologies, it was decided that UV was the most practical and cost-effective solution.

THE TROJAN SOLUTION

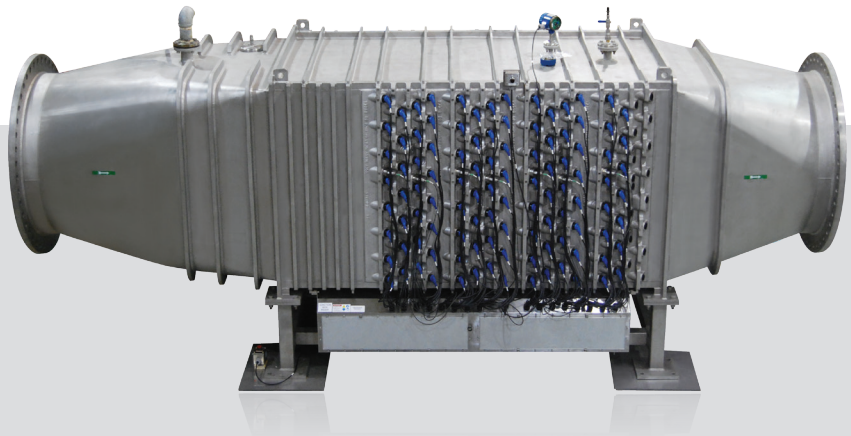
When completed in 2011, NYC will operate the largest drinking water UV installation in the world – the Catskill/Delaware UV Facility – with a capacity to treat 2.24 billion gallons per day (BGD). Combined, the Catskill/Delaware and Croton water plants will supply residents of NYC with over 2.8 BGD of high quality drinking water.

In 2003, after evaluation of available lamp technologies, NYC chose to design a low pressure, high output (LPHO) lamp based UV system over a medium pressure (MP) lamp-based system. The LPHO units are capable of disinfecting the water utilizing approximately one-third the power of MP lamp units. Trojan Technologies offered a high-flow capacity LPHO lamp solution – the TrojanUVTorrent™ – which minimizes electrical costs while maximizing disinfection efficiency.

CATSKILL/DELAWARE UV FACILITY

In 2005, Trojan Technologies was selected as the manufacturer for the UV portion of NYC drinking water project. In 2009 and 2010, Trojan delivered 56 TrojanUVTorrent™ UV units to the Catskill/Delaware UV Facility. Each unit is capable of delivering a 40 mJ/cm² dose to 40 million gallons of water per day (MGD). This disinfection requirement, set by the NYC

CASE STUDIES



Department of Environmental Protection, delivers greater than 3-log reduction of microorganisms such as *Cryptosporidium* and *Giardia*. The TrojanUVTorrent™ was custom-designed by Trojan's engineers and scientists in order to meet the challenging design parameters of this unique project.

The Catskill/Delaware UV Facility is located in Valhalla, New York. The treatment train consists of screening, UV treatment, and chlorination (for a residual disinfectant in the distribution system).

CROTON WATER TREATMENT FACILITY

In 2006, Trojan Technologies was selected to supply the UV equipment for the new Croton Water Treatment Facility. This facility has the capacity to treat up to 600 MGD of high quality drinking water. Trojan is supplying 20 TrojanUVTorrent™ UV units. Each unit is capable of producing a dose of 40 mJ/cm² to treat a flow of 30 MGD.

LIFE CYCLE ASSESSMENT

In separate work, Trojan assessed the relative carbon dioxide (CO₂) emissions associated with both MP and LPHO solutions through a joint project with the University of Western Ontario. It was estimated that for the Catskill-Delaware Facility, the low pressure solution would lead to the release of approximately 13,700 fewer tons of carbon dioxide (CO₂) annually than a medium pressure option (assuming that for typical conditions, the system operates at

70% of its peak capacity). Over 20 years, this equates to 274,000 fewer tons of carbon dioxide, making the TrojanUVTorrent™ the most environmentally-friendly solution for NYC. (see Figure 1)

FULL SCALE SYSTEM

SYSTEM DESIGN PARAMETERS

- **CATSKILL/DELAWARE UV SYSTEM PEAK FLOW CAPACITY:** 2.24 billion gallons per day
- **CROTON UV SYSTEM PEAK FLOW CAPACITY:** 600 million gallons per day
- **TOTAL FLOW:** >2.8 billion gallons per day
- **DISINFECTION REQUIREMENT:** Minimum dose of 40 mJ/cm²
- **TARGET REDUCTION OF CRYPTOSPORIDIUM:** 3-log
- **NUMBER OF UV UNITS:** 56 Units (Catskill/Delaware), 20 Units (Croton)

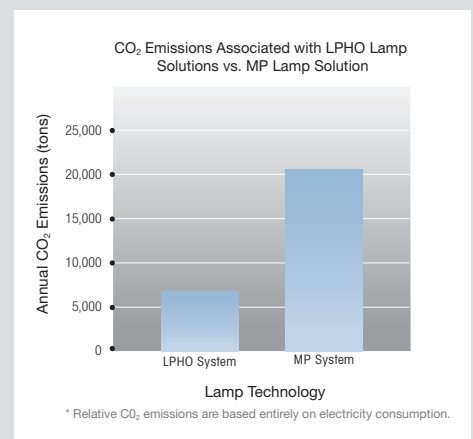


Figure 1.

TROJAN TESTIMONIAL

"The innovative equipment that Trojan developed and provided to the [Catskill/Delaware] project is impressive. This equipment will be installed in the new disinfection facility and will provide better quality drinking water to nearly 9 million people with a significant capital and operating cost savings to the City"

Matthew Valade, P.E., Senior Associate, Hazen and Sawyer, P.C.

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Products in this case study may be covered by one or more of the following patents:
CA 2,383,686; US 6,830,697; US 6,818,900; US 7,282,720; US 7,368,725; US 7,390,225; US 7,408,174.
Other patents pending.