

A large industrial wastewater disinfection system, the Trojan UV4000PLUS, is shown in a grey-scale photograph. The machine features a complex metal frame with diagonal supports and a central processing unit. It is situated outdoors, with trees and foliage visible in the background. A prominent red diagonal graphic element cuts across the right side of the image. The text 'TROJANUV4000PLUS™' is overlaid in white on a red horizontal band at the top left.

TROJANUV4000PLUS™

Wastewater Disinfection

TROJAN ™

 Water
Confidence™



Proven UV Solutions for Low Quality Effluent & Large Flows

Selected for some of the world's largest & most challenging treatment applications

Trojan Technologies is an ISO 9001: 2000 registered company that has set the standard for proven UV technology and ongoing innovation for more than 25 years. With unmatched scientific and technical expertise, and a global network of water treatment specialists, representatives and technicians, Trojan is trusted more than any other firm as the best choice for municipal UV solutions. Trojan has the largest UV installation base – over 4,000 municipal installations worldwide. In North America alone, almost one in five wastewater

treatment plants rely on our proven, chemical-free disinfection solutions.

The TrojanUV4000Plus™ is one of the reasons why. This robust, high capacity system introduced the benefits of high intensity, medium-pressure lamp technology to wastewater treatment. It also redefined sleeve cleaning technology with Trojan's patented, dual-action, chemical/mechanical ActiClean™ system. With over 375 installations – including some of the largest wastewater treatment plants in the world – the TrojanUV4000Plus™ is allowing engineers and operators to

incorporate chemical-free, UV disinfection for large flows of 10 MGD (1,578 m³/hr) and greater in a minimal amount of space – with a fraction of the number of lamps required by low-pressure systems. The extremely compact system can be used for low UV transmittance applications previously unattainable with ultraviolet technology. It also offers the flexibility to treat a wide range of wastewater; from primary, secondary and blended effluents to combined and sanitary sewer overflows to water for reuse applications.

TROJAN UV4000 PLUS™

Providing high volume treatment effectively and reliably

System Control Center (SCC)



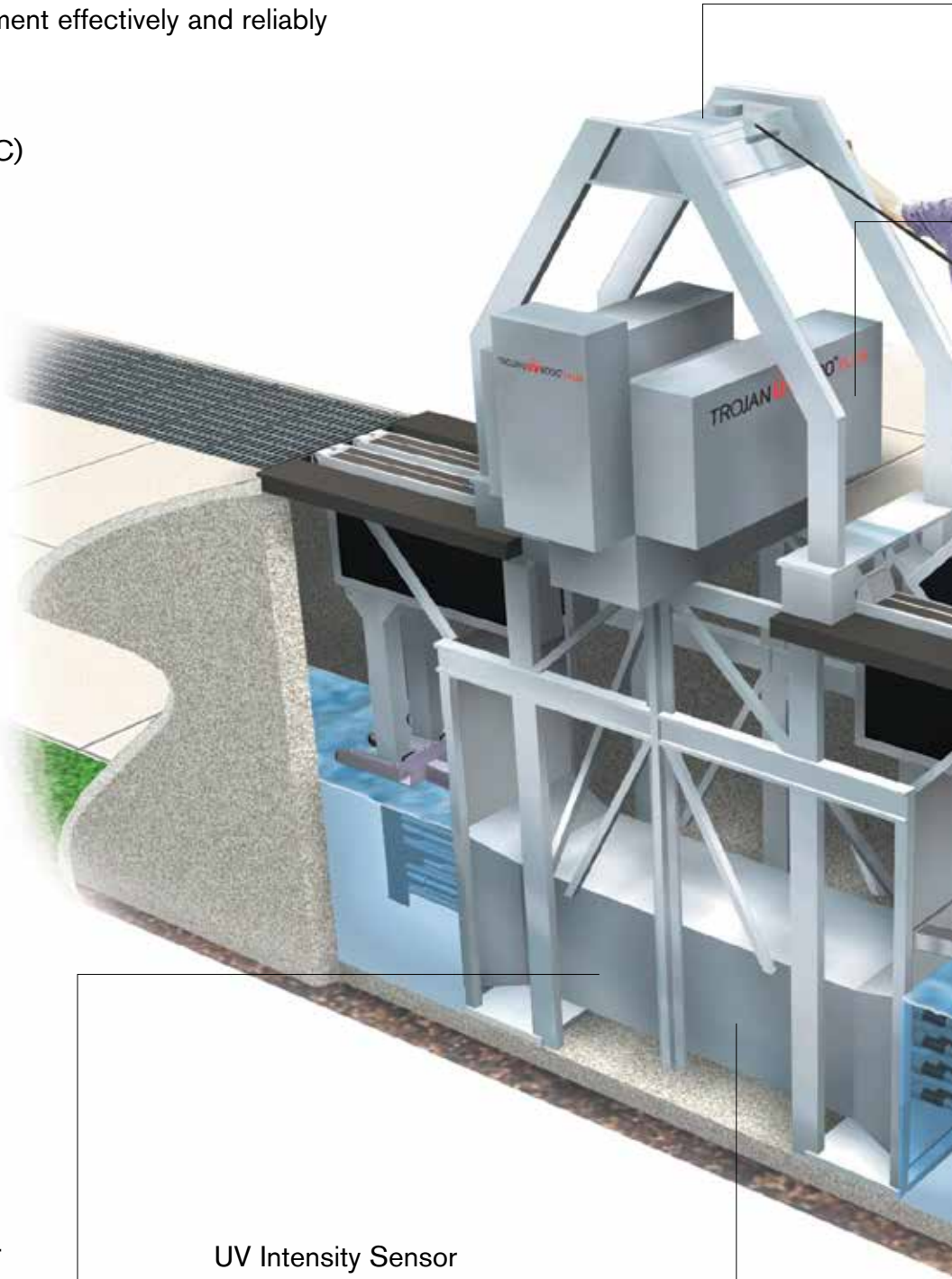
Continuously monitors and controls all UV functions and dose pacing. It incorporates a PLC and menu-driven, touch-screen interface for at-a-glance confirmation of system parameters, performance, and simple control of all system functions. The dose pacing program conserves power and extends lamp life by varying lamp intensity and controlling bank on/off status according to flow and water quality parameters. The SCC features discrete outputs and/or serial communication links to the plant SCADA system for full remote monitoring.

Submerged Effluent Reactor

All effluent in the channel flows by gravity through the fully submerged, open-ended reactor, where the effluent is exposed to high intensity UV light. The innovative, submerged design and contoured reactor interior ensures stringent control of the water layer around the lamps for consistent disinfection regardless of flow rate. Modules with UV lamps pivot into the reactor opening at both ends.

UV Intensity Sensor

Each bank of UV modules incorporates a UV intensity sensor that continually monitors UV lamp output.



Module Removal Mechanism (MRM)

The MRM lifts modules out of the channel to an optimal working height for maintenance. The device uses a reversible electric winch housed in a weather-proof, stainless steel case. The integrated safety hook allows multiple hook-up points for holding modules at different positions for maximum service convenience.

Power Distribution Center (PDC)

The PDC provides power to each bank of modules and monitors data from the module (including UV intensity signals), cleaning system control and status, hydraulic systems, and effluent level signals. PDCs are housed in TYPE 4X rated, stainless steel enclosures mounted directly on the system above the channel.

Electronic Ballast

High-efficiency, variable-output (30% - 100% power) electronic ballasts regulate the power to the UV lamps. The variable-output design permits the plant to dose pace based on flow rate and water quality. Ballasts (one per lamp) are inside the modules, and housed in weather-resistant, TYPE 6P rated enclosures. An integrated cooling system is contained within the ballast enclosure, eliminating the requirement for air conditioning and allows for the entire system to be installed outdoors.

UV Modules

UV lamps are mounted on stainless steel modules that are submerged in the effluent channel. The lamps are enclosed in quartz sleeves, positioned horizontally and parallel to the water flow. Modules consist of multiple lamps and are mounted in parallel to form a bank. Ballasts are mounted inside the modules, and all ballast and lamp wiring runs inside the stainless steel module frame to protect it from exposure to UV light and effluent.

Water Level Control

Water level in the UV channel can be controlled using either a motorized weir gate or a fixed weir located downstream of the reactor. Trojan's engineering staff will assist to design and select the most appropriate device based on hydraulic and site-specific considerations.

ActiClean™ Cleaning System

A chemical/mechanical cleaning system prevents fouling of the UV lamp sleeves. Hydraulically driven wiper collars filled with ActiClean™-WW Gel surround the quartz sleeves. The gel is comprised of a non-corrosive, operator-friendly cleaning chemical that contacts the sleeves between the collar's two rubber wiper seals. Cleaning can be programmed to occur at preset intervals, and takes place online while the lamps are submerged and operating.



Key Benefits

TrojanUV4000Plus™

Increased operator, community and environmental safety. Uses environmentally-friendly ultraviolet light – the safest alternative for wastewater disinfection. No disinfection by-products are created, and no chlorine compounds must be transported, stored or handled.

Ideal for challenging wastewater applications. Treats a wide range of wastewater flows, including effluents with UV transmittance as low as 15%, combined & sanitary sewer overflows, and water for reuse applications.

Proven, regulatory-endorsed disinfection based on actual dose delivery testing (bioassay validation), and over 375 installations worldwide. Verified field performance data eliminates the sizing assumptions of theoretical dose calculations.

Reduced installation costs. Easily retrofitted into existing chlorine contact chambers, leaving the majority of the chamber available for storage, by-pass or emergency back-up – eliminating the expense and footprint associated with the construction of new structures.

Operator-friendly maintenance. Features significantly fewer lamps, modules that are electrically separate, and an integrated power winch to remove modules from the channel to a convenient working height.

Dual-action sleeve cleaning system improves performance and reduces labor costs. Unsurpassed chemical/mechanical cleaning system maintains maximum sleeve transmittance, and works online while disinfecting.

Optimized for efficient operation. Uses a fraction of the number of lamps required by conventional low-pressure systems, and features high efficiency, variable-output electronic ballasts and dose pacing to minimize power consumption.

Guaranteed performance and comprehensive warranty. Trojan systems include a Lifetime Disinfection Performance Guarantee. Ask for details.

Designed for Challenging & Large Scale Applications

System provides effective treatment of very low UVT effluent and large flows

Benefits:

- Use of high intensity lamps and chemical/mechanical sleeve cleaning overcomes operational limitations of low-pressure systems for low quality wastewater and large scale applications
- Capable of treating wastewater effluents with UV transmittance levels as low as 15% – eliminating the drawbacks and dangers of chemical disinfection
- Compact system designed for treatment of large wastewater flows of 10 MGD and greater
- Requires only 2.5 lamps per 1 MGD of secondary effluent
- Configurable in multiple channels, with single or multiple banks per channel, for optimal sizing based on upstream treatment processes & effluent quality

TrojanUV4000Plus™ Treatment Capabilities	
Disinfection Application	Capability
Primary Wastewater Effluent	Yes
Blended Wastewater Effluent	Yes
Secondary Wastewater Effluent	Yes
Fixed Film Processes	Yes
Tertiary Wastewater Effluent	Yes
Water Reuse Applications	Yes
Combined Sewer Overflows (CSO)	Yes
Sanitary Sewer Overflows (SSO)	Yes
Storm Sewer Overflows	Yes



The TrojanUV4000Plus™ has been optimized for disinfection of low quality wastewater using high intensity lamps, and vortex mixers (left) to increase flow turbulence around the lamps. Trojan's UV technology allowed the City of Honolulu, Hawaii to disinfect primary effluent at their Sand Island treatment facility (right), and thereby save hundreds of millions of dollars that would have been required to build secondary treatment facilities.

High Intensity UV Lamps

Medium-pressure lamp technology reduces number of lamps significantly

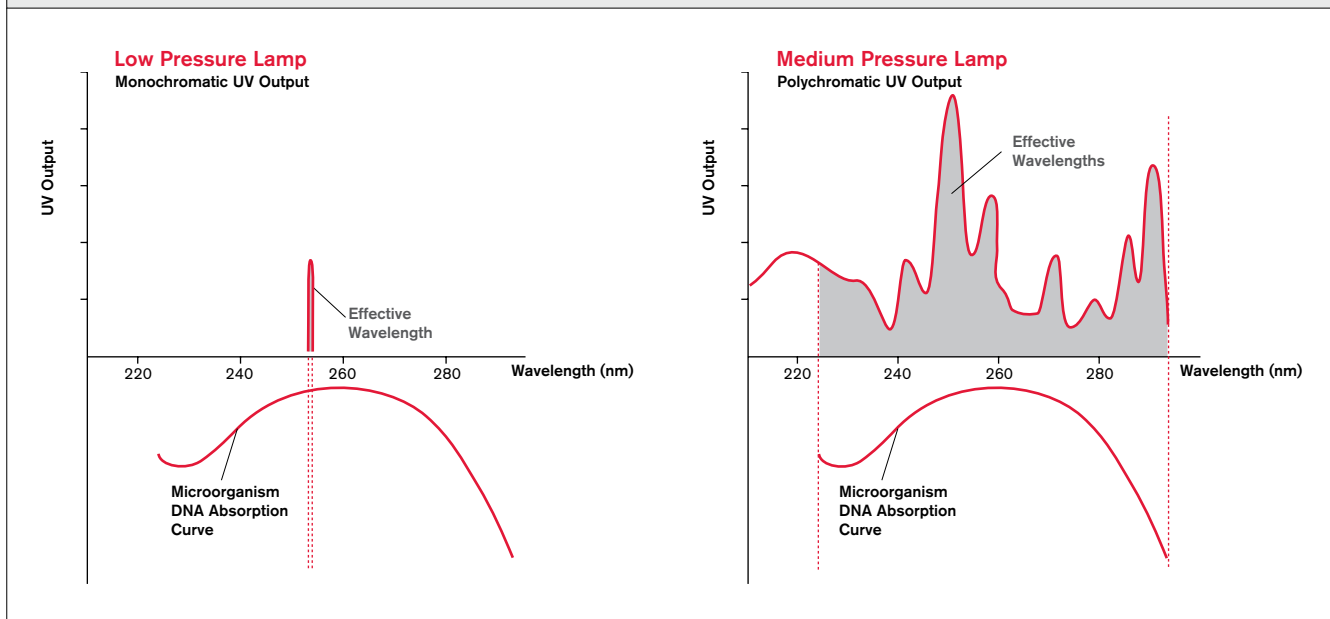
Benefits:

- High intensity, medium-pressure lamps produce significantly more UV energy than low-pressure lamps
- Reduced number of lamps – the TrojanUV4000Plus™ uses a fraction of the lamps required by conventional low-pressure UV systems
- Medium-pressure lamps are polychromatic, and produce a broad range of wavelengths – the majority of which are effective against microorganisms (see below)
- Fewer lamps allow the system to be located in compact spaces, reducing installation costs
- Minimize number of related components (sleeves, seals, wipers, ballasts, etc.), reducing O&M costs



Trojan pioneered the use of high intensity, medium-pressure ultraviolet lamps for wastewater disinfection. The technology minimizes the system footprint, and offers the capability of treating high flow rates, and low quality effluents with UVT levels as low as 15%.

Comparison of Low-Pressure and Medium-Pressure Lamp Technologies



The intensity and breadth of UV wavelengths delivered by medium-pressure lamps are significantly greater than low-pressure lamps. A larger portion of the ultraviolet light that medium-pressure lamps emit is absorbed by the DNA of microorganisms, which results in effective disinfection with fewer lamps.

User-Friendly Controls & Operation

Intuitive, touch-screen controller allows at-a-glance system monitoring and control

Benefits:

- PLC-based system monitors and controls all UV functions via an operator-friendly, touch-screen display on the System Control Center (SCC)
- Menu-driven interface simplifies access to all system functions, set points, and alarm reporting for fast accurate diagnostics of process or maintenance issues
- Automated dose delivery is based on lamp age, and other water parameters from optional sensors, including flow rate, UV transmittance, turbidity, etc.
- Discrete outputs and/or serial communication links to the plant SCADA system enable full remote monitoring



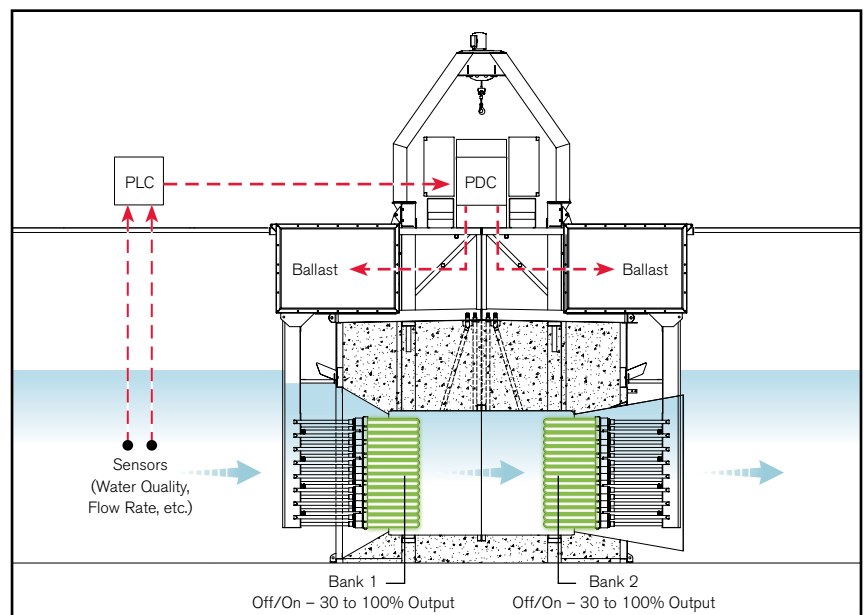
The PLC-based controller combines sophisticated system operation and reporting with an operator-friendly, touch-screen display.

Dose Pacing Reduces O&M Costs

System accurately matches UV output to disinfection requirements

Benefits:

- High efficiency ballasts vary output from 30 – 100% per bank in order to match UV dose with effluent quality and flow rate
- UV lamps are “dimmed” to optimize UV dose, and banks can be turned off during periods of no or low flow
- Multiple sensor inputs allow maximum efficiency so disinfection requirements are fully met using the minimum amount of power
- Dose pacing increases the operating life of UV lamps, thereby reducing the frequency, expense and labor required for lamp replacement



The dose pacing system of the TrojanUV4000Plus™ uses a PLC-based controller that monitors lamp age and water quality (e.g. flow rate, UVT, turbidity) and adjusts lamp output to ensure full disinfection is achieved using minimal power.

Design Flexibility Reduces Installation Costs

Compact system minimizes footprint and allows easy retrofit into existing facilities

Benefits:

- High intensity, medium-pressure lamps and unparalleled sleeve cleaning allow maximum disinfection in minimal space – over 100 MGD (15,780 m³/hr) in a single effluent channel
- Requires only 1/8th to 1/15th the amount of space of chlorine disinfection, reducing construction and capital costs substantially
- System is designed for simplified retrofit into existing chlorine contact tank infrastructure, minimizing construction costs – and leaving the majority of the contact tank available for storage, by-pass or emergency back-up
- Electronic ballasts are inside the modules, eliminating the need for large ballast panels mounted beside the UV channel
- All system components can be installed outdoors



In this retrofit installation, each reactor was installed in one pass of the existing chlorine contact basin with only minor modifications to the channels. This allows the majority of the basin to be used for storage, by-pass or emergency back-up.



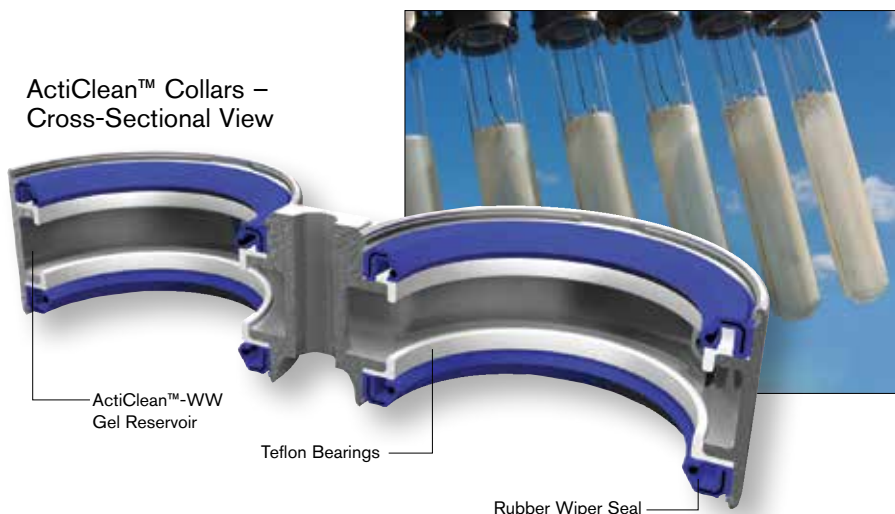
The eight TrojanUV4000Plus™ reactors used to disinfect 600 MGD (94,680 m³/hr) at this large wastewater treatment facility require a footprint measuring only 80' x 120' (24 x 36 m) – a fraction of the space needed for chlorine disinfection.

Unsurpassed Chemical/Mechanical Sleeve Cleaning

ActiClean™ dual-action cleaning system eliminates fouling and reduces maintenance costs

Benefits:

- Unsurpassed chemical/mechanical cleaning system ensures optimal sleeve transmittance so maximum UV energy is delivered to the effluent
- Cleans automatically at preset intervals without disrupting disinfection, thereby reducing downtime and O&M costs of manual cleaning



Operator Comments About the TrojanUV4000Plus™

"It does the job and it's simple to operate."

"It's user-friendly and low maintenance."

"We're getting a better kill than we expected. We've always dealt with chlorine and sulphur dioxide, but this does every bit as well. It doesn't seem to need as much maintenance – there's no dangerous chemicals, and it's cleaner."

System Specifications	
System Characteristics	TrojanUV4000Plus™
Typical Applications	10 MGD and greater; primary, secondary, blended, and tertiary wastewater, CSO, SSO, and water reuse applications
Lamp Type	Medium-pressure, polychromatic UV output
Ballast Type	Electronic; variable-output (30 – 100%)
Input Power Per Lamp	3,200 Watts
Lamp Configuration	Horizontal, parallel to flow
Lamps Per Module	6 to 24
Modules Per Bank	2 to 7
Level Control Device Options	Fixed weir or motorized weir gate
Enclosure Ratings	
Module Ballast Enclosure	TYPE 6P (IP67)
All Other Enclosures	TYPE 4, 4X or 3R (IP56, IP65 or IP14)
Ballast Cooling Method	Closed loop system; no air conditioning or forced air required
Structural Materials	Wetted parts: 316 SST; Non-wetted parts: 304 SST
Maximum Ambient Temperature	122° F (50°C)
Sleeve Cleaning System	
ActiClean™ Cleaning System	Dual-action; chemical/mechanical; programmable for automated cleaning at defined intervals; manual override
ActiClean™-WW Gel	Non-corrosive, operator-friendly
System Control Center	
Controller	Various PLC options; Ask your Trojan Representative for details
UV Intensity Monitoring	1 sensor per bank
Inputs Required / Optional	4-20 mA flow signal / 4-20 mA UVT signal
Typical Outputs Provided	Bank status, common alarms and SCADA communication
Maximum Distance from UV Channel	500 ft. (152 m)
Electrical Requirements	
Power Distribution Centers	50/60 Hz, 277/480V, 3 phase, 4 wire + ground or 50/60 Hz, 230/400V, 3 phase, 4 wire + ground
Hydraulic System Center	50/60 Hz, 120V, single phase, 2 wire + ground or 50/60 Hz, 230V, single phase, 2 wire + ground
System Control Center	50/60 Hz, 120V, single phase, 2 wire + ground or 50/60 Hz, 230V, single phase, 2 wire + ground