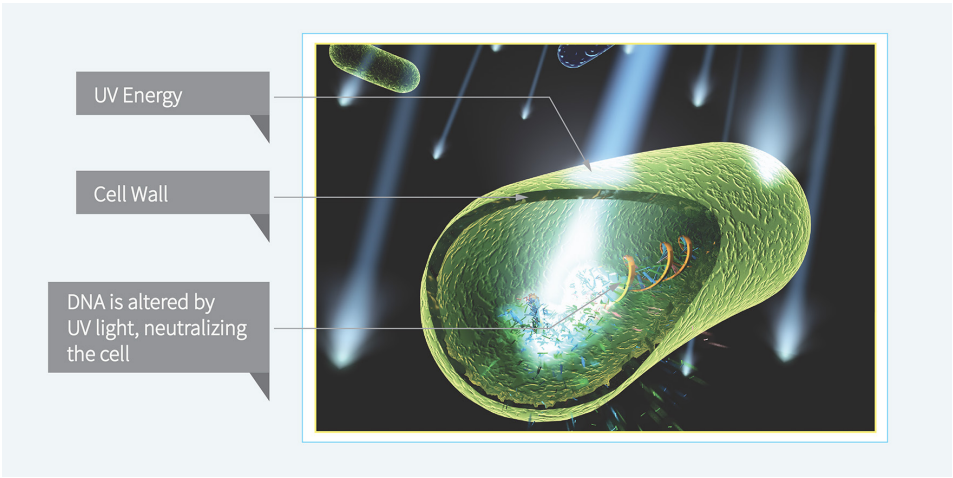
Use The Power Of Ultraviolet Light For Reuse Disinfection

Reclaimed water system managers must provide their customers with water that is safe to use — free of pathogens and other contaminants. In addition, utilities face constant pressure to protect workers and the public from chemical hazards while reducing costs and increasing sustainability.

TrojanUV has been a leader in the development of innovative ultraviolet (UV) light solutions for disinfecting water for over 35 years. Water Online spoke with Jennifer Muller, Vice President of Marketing at TrojanUV, to find out how UV technology is being used in reclaimed water systems.



UV light alters the DNA of pathogens, so they can no longer reproduce or infect those coming into contact with the water.

How do ultraviolet disinfection systems work to reduce or eliminate pathogens?

UV disinfection is a physical process whereby ultraviolet lamps emit UV-C energy into the wastewater to directly attack pathogens. The UV light penetrates the cell wall of the pathogen and is absorbed by the pathogen's DNA. Upon absorption, the DNA strand (and pathogen) is damaged and unable to replicate or cause an infection.

As water demands increase and supplies decrease, reuse of treated wastewater is becoming more important. How does UV compare with other disinfection methods for reuse, such as chlorine gas or sodium hypochlorite?

There are a few key differences between UV disinfection and chemical methods. UV does not add anything to the water except light. As such, there is no balancing act between dosing and residuals, so there is no risk of exceeding THM (trihalomethanes) limits or chlorine residual requirements.

The UV disinfection process takes place in seconds, so the footprint required for disinfection is significantly smaller with UV. Large concrete contact basins are not required; UV systems are installed in a pipe network or in an open flow-through channel.

Indirect potable reuse (IPR) projects are getting more attention lately. How can UV disinfection systems be utilized for IPR?

TrojanUV systems have been used for IPR for a number of years, producing recycled water suitable for groundwater recharge, aquifer augmentation, and seawater intrusion prevention. UV disinfection augmented with an oxidation process (UV-oxidation) targets environmental and chemical contaminants that are not removed by upstream treatment processes. Nitrosodimethylamine (NDMA), for example, is a carcinogenic compound commonly found in wastewater that can pass through microfiltration and reverse osmosis processes but is destroyed by UV. The Groundwater Replenishment System (GWRS) in Orange County, CA, is the largest IPR system in the world and uses our UV technology for the treatment of NDMA and other contaminants, such as pharmaceuticals and industrial chemicals. Operating since January 2008, it currently treats 100 MGD (millions of gallons per day) of wastewater for recharging local

Operating since 2008, the Groundwater Replenishment System is the largest indirect potable reuse system in the world, treating 100 MGD.

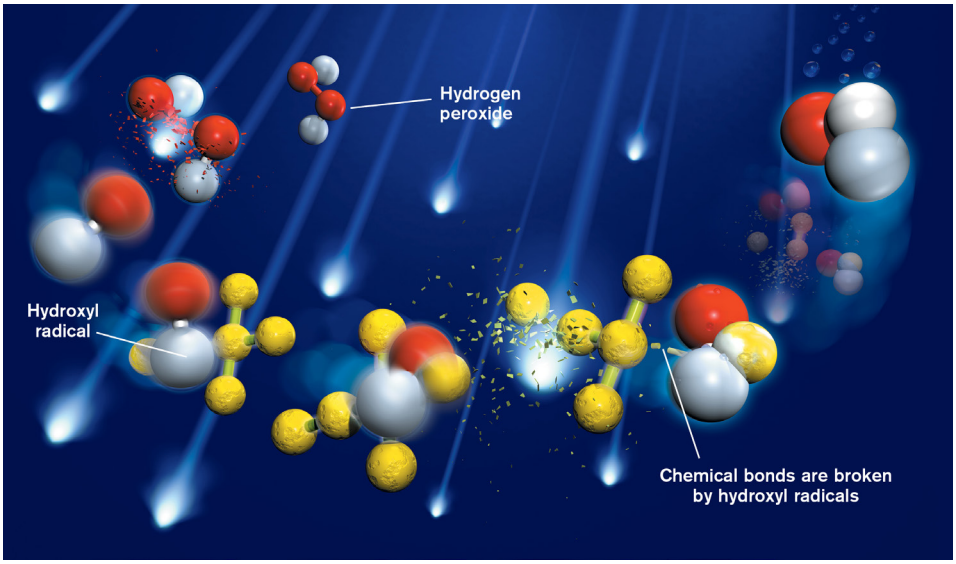
groundwater through spreading basins and injection wells.

Can UV help to reduce other contaminants in addition to pathogens?

Yes, the UV-photolysis/UV-oxidation processes target and destroy harmful contaminants such as 1,4-dioxane, nitrosamines (e.g. NDMA), pesticides and herbicides, and contaminants of emerging concern such as endocrine-disruptor chemicals and pharmaceuticals and personal care products.

Utilities are always pressured to save costs and improve sustainability. How can energy usage for UV disinfection be optimized?

UV system efficiency is a function of the UV lamp characteristics as well as the overall chamber design (e.g., lamp spacing, placement, inlet/outlet).



UV light in combination with hydrogen peroxide creates hydroxyl radicals that break the bonds of chemical contaminants, reducing them to their safe, elemental components.

After selecting the appropriate lamp, Trojan's engineers optimize the chamber design using sophisticated modeling software including computational fluid dynamics. Real-world bioassay testing is subsequently completed to ensure field results match theoretical predictions. An optimized and validated UV system helps save money by using only the power and lamps needed to meet specific disinfection objectives. UV is considered a sustainable disinfection technology since it doesn't use chemicals and has a small physical footprint and reduced construction effort compared to the alternatives.

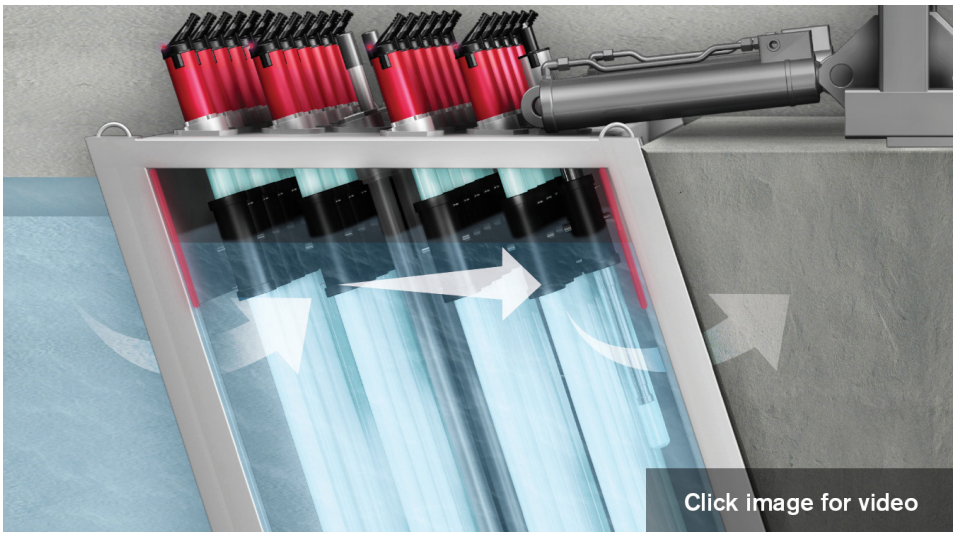
What are typical maintenance requirements for UV disinfection systems?

For proper performance, it is critical to ensure that UV lamps are emitting the right amount of light *and* that the light is reaching the pathogens. As such, typical maintenance activities will include checking intensity sensor calibration, replacing aged lamps, and ensuring that quartz sleeves housing the lamps are clean. A daily inspection for alarms and general system health and cleanliness is also recommended.

Lamps are easy to access and can be replaced in minutes by a single operator without disrupting disinfection.

Are there options for using UV disinfection without breaking head in the treatment process?

Absolutely. This is a common request from facilities that use pressurized membranes upstream of UV and virtually all IPR and DPR (direct potable reuse) applications. UV systems configured in a closed chamber for installation in a pipe network are designed for those applications.



Light Locks work with downstream water level control to help ensure lamps are fully submerged, maximizing disinfection and preventing sleeve fouling.

The Whittier Narrows Water Reclamation Plant in Los Angeles County converted their disinfection process from sodium hypochlorite to UV technology.

How does a UV system accommodate the fluctuating flow levels at water reclamation plants?

UV systems are designed for flexible operation, both in terms of the control system and the equipment itself. TrojanUV systems use variable output lamp drivers, so lamp intensity automatically ramps down when flow rates drop in order to save power and money. In addition, entire units and trains of equipment will shut on/off in response to flow rates (and water quality) to optimize the amount of equipment in use. Lastly, in open-channel systems, level control devices are key to ensuring that lamps are submerged at the appropriate depth at all times.

At what size facilities is UV disinfection most appropriate?

For municipal reuse applications, the size of the facility is not a limiting factor. UV has been applied to very small plants, such as those found in a development/gated community, up to large municipal plants disinfecting more than 100 million gallons per day. Each must be carefully sized and planned, but the technology exists to enable plants of virtually any size to recycle and reuse their wastewater.

How can UV technology be retrofitted into an existing reclaimed water plant?

UV is often added to an existing reclaimed water plant when the municipality decides to move away from chlorine and its operational challenges. The Whittier Narrows Water Reclamation Plant in Los Angeles County did just that in 2008. They converted their disinfection process from sodium hypochlorite to UV technology and are using 100% of the recycled water within the facility at Upper San Gabriel Valley Water District and for groundwater recharge.

When incorporating UV into an existing facility, it is important to look at the hydraulic profile, water quality, available space, and power/control systems. It is very rare that a UV system doesn't fit into existing chlorine contact tanks. However, some plants decide to build new channels for UV and reserve the chlorine basins for storage or other uses. Trojan engineers are experienced in UV retrofits and work through each of these important design considerations, as each site is different. Our goal is to help municipalities recycle their valuable resource and ensure the reuse water is properly disinfected and suitable for potable and non-potable uses. ■