

O&M Best Practices For UV Disinfection Of Wastewater

Insight and answers provided by:

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Ultraviolet radiation (UV) has become increasingly popular for disinfecting wastewater treatment plant effluent. UV provides safe, reliable, and cost-effective disinfection. However, proper operation and maintenance (O&M) is needed to ensure the best performance. In addition, using best O&M practices extends equipment life.

TrojanUV is a leader in ultraviolet disinfection technology with 10,000 installations worldwide. Water Online spoke with Wayne Lem, Market Manager, and Daemon Wilkinson, Technical Support Manager for TrojanUV to find out more about O&M best practices for UV disinfection systems.

How does a wastewater UV disinfection system basically work?

Unlike chemical approaches to disinfection, UV provides rapid, effective inactivation of microorganisms through a physical process. When microorganisms are exposed to the specific wavelengths of UV light, they are disinfecting and rendered incapable of reproducing and infecting.

UV disinfection systems provide municipalities with a safe, effective, and environmentally friendly method of disinfecting wastewater.

Thousands of municipalities have converted from chemical-based wastewater disinfection (such as chlorine



Core components of a wastewater UV system include lamps and drivers, quartz sleeves and the sleeve cleaning system.

gas) to UV. This is due to the significant safety advantages for their communities, plant employees, and local water bodies.

What are the major mechanical, electrical, and electronic components in a wastewater UV disinfection system?

Core components include UV lamps and drivers or ballasts, quartz sleeves and the sleeve cleaning system. Over the past 40 years, as UV wastewater disinfection has evolved and become more widespread, system suppliers have dedicated a lot of R&D to these components. At TrojanUV,

for example, we are proud to have led the innovation and introduction of many advancements associated with UV lamps. These include TrojanUV Solo Lamp™ Technology and the ActiClean™ sleeve cleaning system.

System power and communication is centralized in the Power Distribution Center (PDC). As UV lamp and driver technologies have advanced in terms of efficiency, PDCs have become much more compact.

When it comes to water level and flow

management, key components include Automatic Level Controllers (ALCs) and Modulating Weir Gates (MWGs). One of these options would be installed in the UV channel to maintain the appropriate water level. ALCs and MWGs ensure that no portion of the lamp arc is exposed to air.

Two additional key pieces of a wastewater UV system are the System Control Center (SCC) and Hydraulic System Center (HSC). The SCC monitors and controls all UV functions to ensure optimal disinfection performance. The HSC actuates system sequences, such as the sleeve cleaning system and the raising/lowering of UV banks in and out of the channel.

There are also numerous other complementary devices that enable the UV system to operate as effectively and efficiently as possible. Some of these devices, for example, measure real-time values of UV Transmittance (UVT), UV Intensity (UVI), and flow rate. At TrojanUV, we customize our systems based on specific customer requirements, so these complementary devices vary depending on the application.

How does the effectiveness of the upstream process affect wastewater UV disinfection, and are there any specific substances that inhibit UV disinfection performance?

When properly designed and sized, UV has been proven effective on virtually all treated effluent, including primary, secondary, and tertiary. However, it's critical to consider the correlation between upstream effluent quality and the desired microbiologic inactivation and to size the UV system accordingly.

Generally, UV is more amenable to the effluent of suspended growth biological process – such as activated sludge – versus fixed-film processes (e.g., trickling filters). Reason being that the slough of biomass from fixed-film processes can harbor and shield pathogens from the UV light. Primary considerations for effective UV



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disinfection are Total Suspended Solids (TSS) and UVT. There are numerous organic and inorganic UV absorbing compounds. Take ferric (iron), for example. It is a chemical that is sometimes used at wastewater treatment plants. When used at high concentration, it can have a detrimental effect on UV efficacy. Furthermore, organic compounds, such as coloring agents and organic dyes, can absorb UV and inhibit UV disinfection performance. Each of these parameters is easy to test and measure, so it's important to do that up-front testing.

What are the most important process controls used to ensure the wastewater UV system provides adequate disinfection?

The controls that are critical to UV disinfection performance include:

- Flow rate monitoring
- UVT
- Lamp on/off status
- Lamp output through the use of UVI sensors

These parameters allow calculation of real-time UV dose and enable automatic adjustment of lamp power to deliver the required dose.

What process checks should operators make on a wastewater UV system, and how frequently?

We recommend that our customers take a daily walk around the equipment and do a visual inspection. In many cases, the UV SCC will be connected to a plant SCADA system, so system status and any alarms will be available remotely. However, we still recommend a local visual inspection for UV dose, lamp status, and any alarms.

Furthermore, it's imperative that the system is maintained as per the manufacturer's guidelines and O&M manual instructions. We also recommend only using genuine replacement parts. Doing so gives our customers a lifetime disinfection performance guarantee, fully validated equipment and components, and maintains safety certifications.

What electrical/electronic inspections should be done on a regular basis?

Operators should routinely inspect electrical enclosures, conduits, and wiring. When maintained and kept dry, this equipment will have a longer life span.

Recommended inspection and service intervals should be listed in the O&M

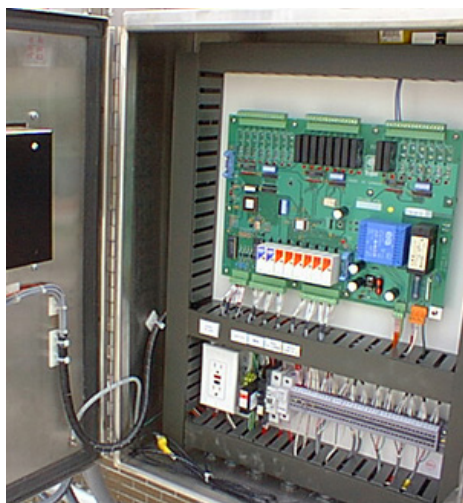
manual provided by the UV system supplier.

What mechanical checks should be made on the system regularly?

Visual cues go a long way in identifying mechanical concerns. Operators should routinely inspect for system alarms and take the necessary measures to rectify non-conforming conditions.

For UV equipment with cleaning systems, it's important to visually inspect sleeves to ensure they are being evenly and effectively cleaned.

The O&M manual will also outline consumable parts. These parts should be checked for wear on a periodic basis and replaced as needed.



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What are some of the common troubleshooting inquiries associated with wastewater UV systems?

Issues are often related to improper maintenance, changing of site conditions (e.g., UVT, TSS), or the use of knockoff replacement parts. We can't stress enough the importance of using only the parts specified by the UV system supplier. Doing so will help avoid unnecessary problems.

Just like any other sophisticated piece



of equipment, a UV system will perform more reliably if proactively maintained and serviced.

What troubleshooting techniques or tips can you give operators when it comes to working with a wastewater UV disinfection system?

Here are seven tips to help operators.

1. Keep the system in automatic mode for efficiency purposes.
2. For systems equipped with automatic lamp sleeve cleaning (i.e., a dual-action cleaning system that uses mechanical wiping in conjunction with a cleaning solution), ensure that the cleaning solution is replaced at predetermined intervals. For products without automatic lamp sleeve cleaning, manual sleeve cleaning – again at predetermined intervals – is imperative.
3. Maintain the system as per the O&M manual provided by the system supplier.
4. Be observant of changing influent and site conditions. It's not uncommon for sites to receive industrial waste which can upset the treatment operation.
5. Know and understand the safety precautions associated with working with a UV system (e.g., high voltage and the impact of UV exposure).
6. Licensed wastewater treatment plant operators can perform most of the work. But some work – specifically related to electrical – may need to be completed by licensed electricians.
7. If in doubt, contact your UV equipment supplier for technical support. ■