

UV TRANSMITTANCE 101:

Everything you need to know about UVT for UV Disinfection

About UVT

UV transmittance, UV transmission or UVT is a measurement of the amount of ultraviolet light (commonly at 254 nm due to its germicidal effect) that passes through a water sample compared to the amount of light that passes through a pure water sample. To measure UVT, ultraviolet light at 254 nm is passed through a 10 mm quartz cell containing the sample water. The intensity of attenuated light is measured with a sensor and compared to that of a pure water sample. UVT is a relative measurement expressed as a percentage %UVT.

Why is UVT Important for UV Disinfection?

Measurement of UV Transmittance is important for ultraviolet (UV) disinfection of drinking water, wastewater, and process water. Low-pressure UV disinfection systems disinfect water using monochromatic UV light at the 254 nm wavelength. The effectiveness of a UV disinfection system is determined by the dose that the system is able to deliver to the target microorganisms in the water. The effective UV dose is dependent primarily on the combined effects of the UV light intensity, the exposure time, and the water quality or UVT.

UV Transmission varies over time and from site to site as it is related to the quantity of organics, colloidal solids and other material in the water which absorb and scatter the UV light as it passes through the water column. In a UV disinfection system, if the UVT of the water is low, then the UV light is not able to penetrate the water as effectively, thereby reducing the potency of the dose. For this reason, it is very important to monitor UVT and ensure its levels are maintained above the manufacturer's minimum for proper disinfection to occur.

6 Applications for UVT Monitoring & Testing

UVT is one of the most important operational parameters related to a UV disinfection system's performance. UV disinfection system manufacturers, operational personnel, and government agencies rely on this water quality measurement for a variety of applications, including:

1

Drinking Water/Process Water Dose Control

Large drinking water and process water UV disinfection systems are often also designed with a method that allows the UV dose delivery to be calculated based on UV intensity, flow rate, and UVT, such as the USEPA UVDGM calculated dose approach method. Online UVT measurement is required for a calculated UV dose strategy to make accurate adjustments that result in proper disinfection.

2

Wastewater Dose Control

Large wastewater UV disinfection systems are typically designed with a method that allows the delivered UV dose to be calculated based on UV intensity, flow rate and UVT. Accurate and reliable real-time analysis of UVT is therefore essential to ensure an effective UV dose is applied and adequate disinfection is achieved.

3

Dose Monitoring

The USEPA UVDGM, DVGW, and ÖNORM UV intensity set-point approach is common for small UV disinfection systems. While this approach does not enable calculated dosing, UVT monitoring is often still incorporated into the system as UVT is a valuable tool for quickly diagnosing operational problems, thus saving the operator time. Investing in a low cost UVT instrument will also help ensure that the water quality meets the minimum design criteria at all times, alarming for off specification performance, giving the operator peace of mind and ensuring water quality.

4

Designing and Sizing a UV Disinfection System

UVT data is essential whether designing a new construction UV facility or adding to an existing chlorination system for a multi-barrier strategy. In many cases, a UVT monitor will be installed 6 months to a year before the UV system to better understand the water quality conditions and the expect range. This information greatly helps the UV manufacturer to size the system adequately, ensuring that over-design or frequent off-specification operation is avoided.

5

Servicing a UV Disinfection System

When a UV reactor goes into alarm or poor microbiological counts are found, service is needed. The cause could be related to fouling of the quartz sleeve, UV lamp failure, fouling of the UV sensor, condensation on the sensor window or low UV transmittance. The first step, and often simplest, for an operator or service technician to diagnose the failure is to test the UVT of the water. If results indicate UVT is below the validated conditions, action can be taken to enhance pre-treatment. If results prove the UVT is within the validated range, the technician can proceed to troubleshoot further. This initial step to test UVT is quick and simple and will save a technician or operator time and user expense.

6

For Assessing the Overall Water Quality

In addition to being critical for UV disinfection performance, UVT is also a catchall indicator of water quality and performance of treatment that precedes the disinfection process. As UVT relates to the presence of organics in the water, the UVT levels are closely associated with the performance of coagulation-flocculation-sedimentation-filtration processes, as well as activated carbon adsorption. Furthermore, UVT of the water is indicative of the potential for formation of disinfection by-products. For these reasons, monitoring UVT provides a quick and reliable way to screen water quality for potential source water related problems as well as treatment process related issues.

3 Ways to Measure UVT

UVT can be measured in a variety of ways, enabling the users to select a method that best meets their application, water type and site-specific environment. Below are three common ways UVT is measured:



Grab Samples

UVT meters are an invaluable tool for UV disinfection to spot check water quality, aid with troubleshooting, and to validate the performance of an online UVT monitor. A cuvette containing the sample is inserted into a UVT meter and the UVT result is output within seconds. The UVT test can be performed on the spot in less than 2 minutes. Some meters can also be equipped with battery power, making them portable and much more practical than lab UVT analysis.



Online in an Open-Channel

For online UVT monitoring in an open channel, a submersible UVT probe is commonly used. The UVT probe is connected to an arm that is mounted to the channel wall or railing. Water in the channel continuously flows through the measurement opening on the probe and relays the measurement to a controller mounted nearby. The UVT measurement is displayed on the controller and often output via 4-20mA directly to the UV system control panel and/or the local SCADA. The measurement windows are cleaned periodically with compressed air to remove any buildup on the quartz windows, keeping the UVT measurements accurate and the maintenance low.



Online from a Pressurized Pipe

For online UVT monitoring in a pressurized system, a bypass cabinet style analyzer is often favored. A side stream is taken from a pressurized pipe and flows through a cabinet analyzer. Inside the cabinet, a quartz flow cell enables continuous UVT measurement of the water flowing through the analyzer. The display on the outside of the cabinet provides the current UVT value. Measurement can also be output via 4-20mA directly to the UV systems control panel and/or to the local SCADA. For this style of UVT instrument, chemical cleaning is favorable, where the sample water stream is stopped periodically and a chemical cleaning agent is pumped into the internal flow cell, held, and then discharged to drain. The automatic configurable process maintains accuracy for UVT measurements and lower maintenance for operations staff.

To learn more about Real Tech's complete line of UVT solutions, visit our [products page](https://realtechwater.com/products) or contact us directly.

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