



The Critical Factors

Ultraviolet Technology of Australasia

ultraviolet disinfection systems

This brochure is part of an occasional series of information sheets designed by Ultraviolet Technology of Australasia to help you select the right water disinfection unit for your needs.

This information sheet focuses on the critical factors of water disinfection systems that use ultraviolet light as their germicidal agent.

How does it operate?

Ultraviolet light water disinfection systems aim to eliminate pathogenic bacteria and viruses from water supplies and secondary wastewater treatment systems in an efficient and cost-effective way.

To do this, water passes a mercury vapour lamp, which emits ultraviolet light at a wavelength of 253.7 nanometers, killing any pathogens that are present.

The Critical Factors

- UV Lamp Skin temperature
- Air temperature
- Water temperature
- Flow rate
- Water colour and turbidity
- UV transmission of the fluid being disinfected at a wavelength of 254 nm.

Why are these factors critical?

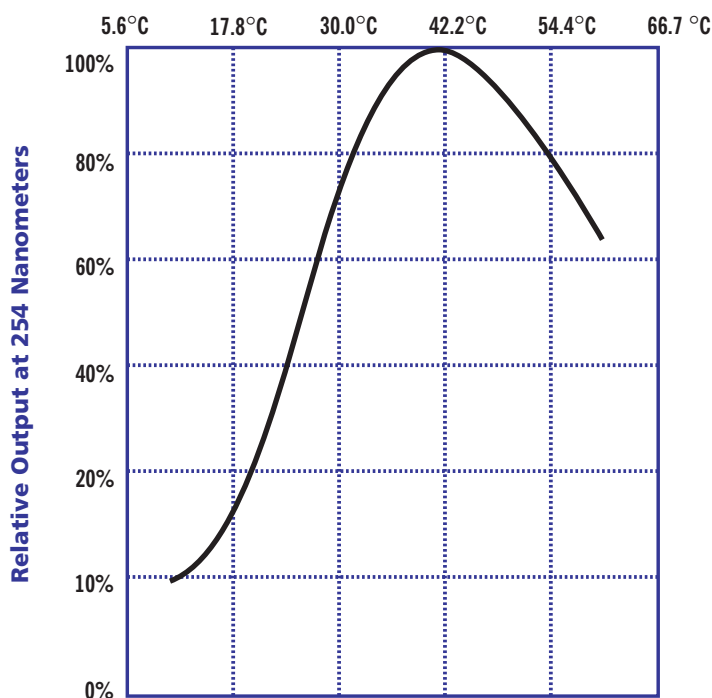
When the lamp skin temperature is maintained at about 42°C, maximum lightwave emission occurs and the "kill rate" in UVTA units is maintained at more than 99.9 percent for all common pathogens.

Any fluctuations in lamp temperature can reduce the efficiency of ultraviolet light emissions by more than 40 percent, thus dramatically reducing the "kill rate".

To destroy the pathogens, the water must be exposed to the ultraviolet light for a certain amount of time. This amount of time is calculated for each unit and expressed as a flow rate. Any pressure fluctuations can cause increased flow rates, which means the water is exposed to the ultraviolet light for less time, and this decreases the "kill rate".

How effectively ultra violet light disinfects water is also affected by the colour and turbidity of the water. For drinking water, the colour rating must be less than 10 hazen units and the turbidity must be less than 10 nephelometric turbidity units (NTU). The World Health Organisation recommends a turbidity level of one NTU (see 'Guidelines for drinking water quality'). UVTA has easily achieved this by installing carbon and media filters and, where necessary, flocculation tanks.

Lamp Output at Various Bulb Wall Temperatures



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Why Do These Problems Occur?

In most systems, the mercury vapour lamp is enveloped in a quartz sleeve, the water flows over the quartz tube and, when the quartz is clean and the temperature is right, the water becomes disinfected.

This design creates a major problem as the temperature of the water flowing over the quartz sleeve affects the air temperature surrounding the lamp. For example, in a quartz tube system in the Snowy Mountains, the cold water flowing through the system would cause an immediate drop in the lamp skin temperature by cooling the air around the lamp. The drop in temperature would then lower the emission rate of ultraviolet light, reducing the system's "kill rate" and its efficiency.

If the water is too hot, the same problem will occur but due to an increase, rather than a decrease, in the lamp's skin temperature.

Quartz tubes also require constant cleaning and are extremely brittle, unlike AFP, which is a non-fouling and unbreakable*.

*If used within recommended pressure specifications.

The UVTA Advantage - The Answer to these Problems

With a UVTA unit you don't have to worry about these problems. By using AFP to carry water past freestanding lamps, the water temperature has little effect on the air temperature surrounding the lamps. This means the lamp's operating temperature is easily maintained at about 42 °C and the maximum "kill rates" of more than 99.9 percent are constantly achieved.

In areas where air and water temperatures are a problem, strip heaters or fans can be installed within the unit to maintain the correct temperature.

In large installations, a flow meter can monitor flow rates. This is linked to a programmable logic controller, which can also activate additional lamps to maintain the "kill rate".

Units that disinfect treated effluent at more than 18 litres per second can justify having an ultraviolet light intensity meter installed to monitor UV emissions and transmission, enabling the PLC to control and maintain the highest level of disinfection.

Getting the most out of your unit

To ensure the unit is efficient, uses power economically and has a very long life, it is important to house it correctly. A simple tool shed or garage is all that is required (check with your local council regarding building regulations) and means you will be protecting your equipment.

UVTA considers occupational health and safety to be a high priority and takes OH&S provisions into its operational safety policies. By simply placing the UV equipment inside a building, you are automatically protecting the unit and its operators from the elements.



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