

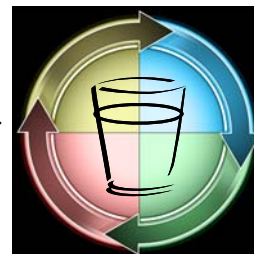
PRIVATE DRINKING WATER IN CONNECTICUT

Publication Date: May 2009

Publication No. 25: Ultraviolet Radiation Treatment of Private Drinking Water Systems

Effective Against: Efficient at inactivating low concentrations of bacteria, viruses, *Giardia lamblia*, *Cryptosporidium* cysts, and other pathogenic microorganisms.

Not Effective Against: Not recommended if the untreated water contains high levels of total coliform (or confirmed E-Coli or fecal coliform), substantial color or suspended solids. Does not improve the taste, odor, or clarity of water.



How Ultraviolet Radiation Works

Ultraviolet (UV) systems expose water to the light from a special lamp. The light is at a specific wavelength capable of killing common bacteria. The percentage of organisms killed depends on the intensity of the UV light, the contact time that the water has with the light, and the amount of suspended solid particles in the water. The system adds nothing to the water, produces no tastes or odors, and typically requires only a few seconds of exposure to be effective. No residual is produced because UV radiation quickly dissipates into water. Therefore, treatment of the water occurs as the water passes into the light. The light penetration into water is shallow, usually only 2-3 inches.



Suspended solid particles in the water can shield organisms from the light. Therefore, UV devices are often combined with other technologies such as particle filters, carbon filters, ion exchange units, or reverse osmosis systems to remove particles prior to UV disinfection. UV is often the last device in the “treatment train” (a series of treatment devices), following reverse osmosis, water softening, or filtration. The UV unit can either be a point-of-entry system, treating all the water entering the house, or a point-of-use device, treating water from a single tap, as a final disinfection method.

The typical UV treatment device consists of a cylindrical chamber housing the UV bulb along its central axis. A quartz glass sleeve encases the bulb; water flow is parallel to the bulb, not passing too quickly past the bulb. Assuring appropriate radiation contact time with the flowing water is essential. It has been reported that turbulent (agitated) water flow provides more complete exposure of the organism to UV radiation.

Maintenance

Regardless of the quality of the equipment purchased, it will not perform satisfactorily unless maintained in accordance with the manufacturer’s recommendations for maintenance, cleaning, and part replacement. Keep a logbook to record equipment maintenance and repairs.



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Since UV radiation must reach the bacteria to kill them, the housing for the light source must be kept clean. Commercial products are available for rinsing the unit to remove any film on the light source. An overnight cleaning with a solution of 0.15 percent sodium hydrosulfite or citric acid effectively removes such films. Some units have wipers to aid the cleaning process. The Connecticut Department of Public Health (DPH) suggests that you purchase a unit with manual wipers to aid the cleaning process.



UV Systems are designed for continuous operation and should be shut down only if treatment is not needed for several days. The lamp needs a few minutes to warm up before the system is used again following the shutdown. Check manufacturer's recommendation, you may need to run water to waste to ensure it has been treated properly. In addition, the plumbing system of the house should be thoroughly flushed following a period of no use. Whenever the system is serviced, the entire plumbing system should be disinfected with a chemical such as chlorine, prior to relying on the UV system for disinfection.

UV lamps gradually lose effectiveness with use; therefore the lamp should be cleaned on a regular basis and replaced at least once a year. It is common for a new lamp to lose 20 percent of its intensity within the first 100 hours of operation, although that level is maintained for the next several thousand hours. Units equipped with properly calibrated UV emission detectors alert the owner when the light intensity falls below a certain level.

The treated water should be monitored for coliform bacteria on a monthly basis for at least the first 6 months of the device's use. If these organisms are present in the treated water, the lamp intensity should be checked, and the entire plumbing system should be disinfected with a chemical such as chlorine. After power outages or fluctuations in power you may need to run water to waste until the lamp has reached its full intensity.

Other Considerations

Ensure the system you choose is installed and operated according to the manufacturer's instructions. After installation, retest both the raw water (prior to treatment) and the treated water at a state certified laboratory to ensure it is working properly and removing the contaminants. You should continue to test the quality of both the untreated and treated water annually. This annual test will also help you determine how well your treatment system is working and whether maintenance or replacement of components may be necessary. This treatment is not a substitute for correcting physical deficiencies in the well and/or distributions.

The following affect the disinfection efficiency of a UV system:

- Contact time and flow rate
- Depth of water being treated
- Chemical and biological films that develop on the surface of UV lamps
- Dissolved organic and inorganic compounds
- Clumping or aggregation of microorganisms
- Any Turbidity
- Any Color
- Short-circuiting in the water flowing though the UV contactor
- Accumulation of solids on the surface of the UV sleeves



Questions to Ask Before You Buy

Before purchasing a water treatment device, have your water tested at a state certified laboratory to determine the contaminants present. This will help you determine if UV is an effective treatment method for your situation.



See Publication #19: *Questions to Ask When Purchasing Water Treatment Equipment* for more information.

- Has the treatment system been tested and certified by a third party to ensure that it meets manufacturer's claim?
- What are the maintenance requirements for the system?
- Are there any special installation requirements that may add to the equipment costs, for instance changes to your household plumbing?
- Purchase National Sanitation Foundation's (NSF) certified products

Product Certification



NSF, International is a non-profit organization that sets performance standards for water treatment devices. Because companies can make unsubstantiated statements regarding product effectiveness, the consumer must evaluate test results of the device to determine if claims are realistic. Products that have been tested or evaluated by NSF and meet their minimum requirements are entitled to display the NSF listing mark on the products or in advertising literature for products. Manufacturers and models that meet NSF's standard are included in a listing published twice a year. For more information contact NSF at: 800-NSF-MARK or http://www.nsf.org/business/drinking_water_treatment/index.asp?program=DrinkingWatTre

For more information please click on the following links:

EPA Office of Groundwater and Drinking Water

<http://www.epa.gov/ogwdw/>

EPA New England

<http://www.epa.gov/region01/>

Adapted from *Healthy Drinking Waters for Rhode Islanders*, University of Rhode Island Cooperative Extension, April 2003.