
ENVIRONMENTAL Fact Sheet



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Ultraviolet Drinking Water Disinfection

Disinfecting Drinking Water. Drinking water can be made bacterially safe by a number of treatment methods. Chemicals can be added such as chlorination, silver and ozone; the water can be boiled; and the water can be exposed to a physical killing agent, such as ultraviolet radiation. Favorable characteristics of a disinfectant include: acts quickly, has low capital cost, leaves a disinfectant residual to maintain the killing action, produces no hazardous by-products, is safe for children and pets, minimizes consequences if there is accidental over-treatment, and has low operational cost.

UV Introduction. Ultraviolet disinfection, often abbreviated UV, provides rapid disinfection of water with no chemical addition and no residual taste or odor. UV destroys common bacteria by disrupting their ability to reproduce. The killing action is the same as that provided by sunlight in open streams and ponds. UV devices are small and cost effective. UV does not provide a disinfectant residual in the treated water after the device.

How Ultraviolet Disinfection Works. UV disinfection devices expose the raw water to light from a special lamp, which produces UV radiation at a wavelength of 254 nanometers. A typical UV device consists of a UV lamp, a sleeve to protect the lamp, an enclosure to contain the pressurized water and UV radiation, an electrical supply to power the UV lamp, appropriate controls, devices to assess proper operation, and plumbing connections to facilitate installation of the device to the water system.

Ultraviolet Design Suitability. The UV light must come in contact with each microorganism to achieve effective kill. Therefore, suspended particles, such as turbidity or iron and manganese precipitates, would potentially prevent the UV from achieving total kill of some organisms and must be removed.

Pre-filtration is necessary when there are sediments or cloudiness in the water and is typically installed whether turbidity is expected or not. Pre-filtration is accomplished by a cartridge sediment filter.

Features of an Ultraviolet Device. UV devices typically will have a “run” light on the outside of the device to note that the UV lamp is operating. This “run” function can be connected to a solenoid valve that will prevent water flow if the UV lamp is not operating. The UV system can also be equipped with a device that will read the intensity of the lamp light. This device can interconnect with the solenoid valve and stop the flow if the lamp is not generating adequate UV radiation strength. The UV housing is usually stainless steel.

Although the UV lamp can be wired to start and stop with your well pump, the industry generally recommends that the UV lamp run continuously. This will kill any organisms that might migrate forward through the device when the well pump is off. Mineral and biofilm deposits can build up on the outside of the UV lamp sleeve. Some devices have an automated wiper to clean the outside of the UV sleeves. Most home devices use a manual cleaning mode. Typical cleaning frequency is twice per year. For home use, a UV strength sensor and alarm are appropriate. These options increase the cost of the UV device.

Standards for UV Devices. The National Sanitation Foundation (NSF) is a third party certifier of many types of health and food processing equipment. NSF standard 55 pertains to UV water treatment devices used to disinfect water. This standard lists two categories of devices. Class A devices are those designed to treat bacterially unsafe or unknown waters, and Class B are those devices designed to provide supplemental treatment to water supplies that have high bacterial reliability (water such as public drinking water supplies). Principal design criteria for Class A and B devices are shown below.

Class A

Dose: 40,000 joules /cm²
Performance Indicator
Flow Controller
Lamp on Verification Indicator
Accessible for Cleaning
Housing that Prevents UV Exposure

Class B

Dose: 16,000 joules /cm²
No Performance Indicator
Flow Controller
Lamp on Verification Indicator
Accessible for Cleaning
Housing that Prevents UV Exposure

For a private well with a sustained record of **excellent bacteria** results, a Class B device could be used. Otherwise, a Class A device is recommended for disinfection of a private well.

Design of UV Devices. To select the proper size of a UV treatment device, you must know the flow of your water's well source. The highest flow must be known to assure there is enough residence time in the device for complete kill of the target organisms. For submersible pumps, this would be the maximum flow when the pump first starts after a long period of rest. This can often be a much higher flow rate than the long-term sustained flow. This flow can be determined by opening multiple faucets, measuring the flow rate of each, and adding the results. Discuss this measurement approach with your equipment supplier before conducting the test. The UV dosage is measured by multiplying the flow rate times the residence time of the water within the housing. Typical cost of a home UV device is \$1,000-\$1,200.

Operational Maintenance. UV bulbs are normally rated for a certain number of total hours of operation, typically 9,000 hours (i.e., one year). During this operational period, the lamps lose some of their disinfection strength. Bulbs should always be replaced at the end of this period even if they still appear to be functioning properly. Have a spare lamp on hand, and never look directly at a lit UV lamp.

As mentioned, dissolved minerals and biofilm in the water may accumulate on the sleeve that holds the UV lamp. A maintenance schedule should be adopted to ensure that the lamp sleeve is periodically cleaned. DES suggests beginning with a quarterly cleaning frequency. The pre-sediment filter cartridge should also be inspected and changed out as necessary. DES suggests beginning with quarterly inspections and evaluating the reduction in frictional loss with the new cartridge. Operational cost is approximately \$100 annually for electricity, \$5 each for a sediment cartridge and \$100 plus for a replacement UV lamp.

Bacteria Samples. DES recommends taking a bacteria sample every 3-6 months to evaluate the UV.

FOR MORE INFORMATION

Please contact the Drinking Water and Groundwater Bureau and the New Hampshire Water Well Board at (603) 271-2513 or dwgbinfo@des.nh.gov or visit our website at www.des.nh.gov/organization/divisions/water/-dwgb/index.htm. All of the bureau's fact sheets are on-line at www.des.nh.gov/organization/commissioner/pip/-factsheets/dwgb/index.htm

Note: This fact sheet is accurate as of August 2008. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.