WHITEPAPER: UV DISINFECTION FOR

Well Water Contamination

SINCE 1963 ATLANTIC ULTRAVIOLET CORPORATION®

The Issue: Groundwater Quality

As of 2021, more than 23 million U.S. households use private water wells.[1] Since EPA regulations protecting public drinking water sources do not apply to private wells, homeowners are responsible for overseeing the quality of their drinking water. The U.S. Geological Survey studied the water quality of over 2,000 private wells and found that about 23 percent had at least one contaminant at a level of potential concern.[2]

The EPA and Cornell University determined that bacterial contamination from septic tank effluent is the most common drinking water quality issue.[3] Animal waste can also seep into the groundwater from a nearby livestock farm, sometimes finding its way into your well. Because there are so many potential contaminants in your well at any given time, there is not one single water treatment to eliminate all the risks.

3 Essential Routines

Testing. Experts recommend that you have your water tested by a certified laboratory at least once a year. This procedure will indicate if your well water tests positive for coliform bacteria, nitrates, and dissolved solids—while monitoring water pH levels.

"Several sources of pollution are easy to spot by sight, taste, or smell … however many serious problems can only be found by testing your water."

EPA, "Drinking Water From Household Wells"[4]

Maintenance. Periodic inspection by a well water specialist is also recommended to rule out any physical issues near or with your well. Areas of concern that the investigation can reveal are bad or corroded fittings, casings, and pipes, abandoned wells nearby, and reduced water pressure.

Treatment. Whenever possible, remove the contamination source. However, removal of many natural and unnatural causes is not always feasible. Continuous ultraviolet disinfection, when used along with proper pre-treatment devices (see next page), ensures your water is safe from harmful bacteria, viruses, and fungi.

How UV-C Works

UV light is made up of three wavelength ranges (UV-A, UV-B, and UV-C). UV-C lamps produce rays at 254 nanometers, making harmful microorganisms unable to reproduce, and hence inactive. Unwanted microbes eventually die off, making water safer and healthier.

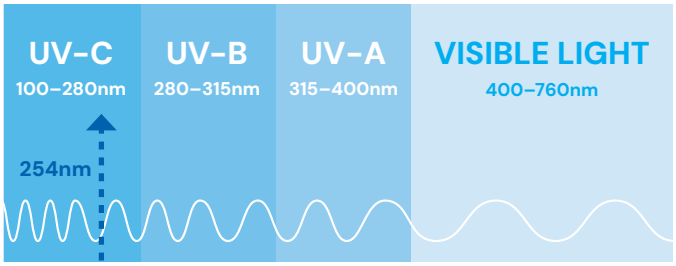

Figure 1: A Portion of the Electromagnetic Spectrum

Water Quality

UV purifiers are intended for use with water that is visually clear—not colored, cloudy, turbid, or having an obvious contamination source. Water quality plays a major role in the transmission of UV-C rays. In order to achieve the minimum UV transmission level of 85% per centimeter, do not exceed these maximum concentration levels:

Characteristic	Maximum Level
Turbidity	5 NTU
Manganese	0.05 mg/L
Total Suspended Solids	30 mg/L
Biological Oxygen Demand	30 mg/L
pH	6.5–9.5
Color	None
Hardness	6 gpg or 102.6 ppm
Iron	0.3 mg/L
Tannins	< 0.1 ppm (0.1 mg/L)

Table 1: Maximum Concentration Levels for UV Treatment

Effectively treating water with higher concentration levels (or a lower UV transmission) can be accomplished, but will require added measures to improve water quality to treatable levels. Contact our UV specialists at (631) 273-0500 for assistance with your well water.

UV-C Doses

A proper UV transmission level will ensure your water purifier delivers a UV-C dose of 30 mJ/cm^2, which is high enough to neutralize many harmful microorganisms commonly found in contaminated water supplies. Millijoules per square centimeter (mJ/cm^2) is the measurement of energy produced by germicidal UV lamps over a certain amount of time.

Microorganism	UV Dose (mJ/cm^2)
Giardia	100.0
Shigella	7.0
Cryptosporidium	5.8
Hepatitis A	8.0
E. coli	6.6
Salmonella	7.6
Rotavirus	24.0

Table 2: UV-C Doses to Neutralize Waterborne Microbes

Sizing a UV Purifier

First, find your maximum flow rate in gallons per minute (GPM). Flow rates will depend on your water pressure, the size of your water lines, and the number and type of water outlets. A home with 3/4″ water pipes will generally have a maximum flow rate of about 7 GPM. Larger homes with 1″ pipes could reach 15 GPM or higher.

We recommend a 6 GPM purifier for homes with 1 bathroom, 12 GPM for 2–4 bathrooms, and 20 GPM for 5 bathrooms. If your flow rate is in between two models, purchase the larger size.

Point of use purifiers will be installed directly at the site of use, such as under a sink. Point of entry models will be installed where the water enters your home or facility, providing continuous disinfection to all water plumbed downstream of the UV purifier. UV models designed for higher flow rates (such as an entire building) will generally be larger, while point of use purifiers will be able to fit in small spaces.

Installation

Location

Install the water purifier in a dry, well-lit area which provides enough room for routine maintenance. This includes a minimum distance of one chamber length from the chamber end, to allow for cleaning and/or changing of the lamp and quartz sleeve, as well as a minimum of 6” on the opposite end of the water purifier. Minimum clearance to the floor is usually between 18 and 30 inches.

Pre-Treatment Devices

As shown in the diagram on the next page, your water purifier should always be installed after any other treatment devices such as deionizers, water softeners, carbon/sediment filters, pressure tanks, pumps, and reverse osmosis systems (whether installing at the point of use or point of entry). This practice eliminates the possibility of the purified water being re-contaminated by bacteria in any of these units.

Additional Considerations

- Use of metal pipe is recommended for connecting to both the purifier inlet and outlet 12” past the first elbow (to avoid degradation of exposed plastic pipe).
- Always use a mounting bracket and never leave a UV water purifier’s plumbing connections to support its weight. Atlantic Ultraviolet water purifiers are designed to mount horizontally.
- Install a drain pan under the water purifier for added protection against leaks.
- Always connect the purifier to the cold water line, with the water temperature between 50 and 100°F (10–37°C).

Disinfecting the “Downstream” Plumbing

Before completing the plumbing connections to the water purifier, it is a good practice to disinfect the plumbing between the purifier and point of use. This is done by introducing chlorine or other disinfectant solution into the purifier chamber; 100 ppm of chlorine is suggested. With the disinfectant in the purifier chamber, turn the germicidal ultraviolet purifier on. Open the “downstream” outlet until a chlorine or disinfectant solution odor is noticed. Close the outlet and allow the disinfectant to remain in the plumbing for three (3) hours. Flush the plumbing with germicidal ultraviolet purified water; allow the water to run for a minimum of 5 minutes prior to use (to ensure no chlorine or disinfectant smell can be detected). This will allow the chlorine or disinfectant solution to be flushed from the pipes.

Table 3: Comparison of UV Water Purifier Models

Feature	Bio-Logic®	Minipure®	Mighty Pure®	Sanitron®
Flow Rate (GPM)	1.5 or 3	1–9	3–20	3–40
Min. Clearance (Lamp/Quartz)	13⅞–19½"	10⅜–29"	16–49"	17–50"
Min. Clearance (Gland Access)	6"	6"	6"	6"
Lamp Indicator LEDs	✓	✓		
Point of Use Models	✓	✓	✓	✓
Point of Entry Models		✓	✓	✓
Sight Port		✓	✓	✓
Drain Fitting			✓	✓
Dual-Action Wiper				✓
UV Monitor			Optional	Optional
Audio Alarm	Standard	Standard	Optional	Optional
Solenoid Valve		Optional*	Optional	Optional
Flow Control Valve	Optional	Optional	Optional	Optional

*Available for Models MIN-3, MIN-6, and MIN-9 only.

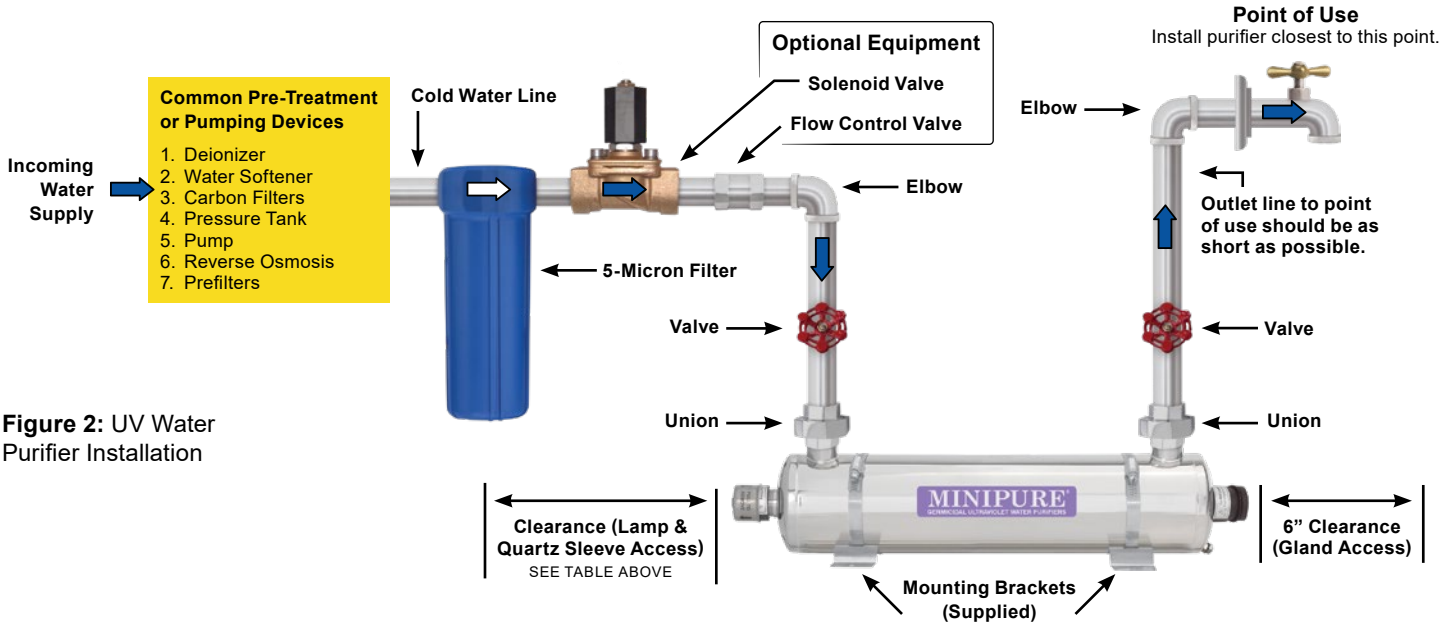

Figure 2: UV Water Purifier Installation

Sources

1. NGWA, *"Groundwater facts."* https://www.ngwa.org/what-is-groundwater/About-groundwater/groundwater-facts
2. USGS, *"Contamination in U.S. Private Wells."* https://www.usgs.gov/special-topics/water-science-school/science/contamination-us-private-wells
3. USGS, *"Ground Water and the Rural Homeowner."* https://pubs.usgs.gov/gip/gw_ruralhomeowner
4. EPA, *"Drinking Water From Household Wells."* https://19january2017snapshot.epa.gov/sites/production/files/2015-05/documents/epa816k02003.pdf

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