WHITEPAPER: UV DISINFECTION FOR

Boil Water Alerts

SINCE 1963 ATLANTIC ULTRAVIOLET CORPORATION®

The Root Issues

From 2012–2014, over 20,000 boil water advisories were issued in the United States.[1] Most American water systems are over 100 years old, and many in other countries are much older. Time and environmental changes allow dirt and gravel around the pipes to settle, causing them to develop small fissures and cracks. Shifting pipes then lead to water main bursts, pipe corrosion, and fitting disintegration—all of which provide contaminants a path into the water source.

Cause	Percentage
Water Main Break or Leak	53.06%
Low Pressure	14.11%
Confirmed Microorganisms	13.87%
Unknown Cause	11.92%
Scheduled Maintenance	7.05%

Table 1: Causes of Boil Water Alerts in U.S. (2012–2014)[2]

"Waterborne diseases affect over 7 million people in the U.S. every year and cost our healthcare system over $3 billion."

CDC, "Waterborne Disease in the United States" [3]

During a Boil Water Alert

Boil water alerts complicate daily tasks of families, businesses, and healthcare facilities. At home, personal hygiene practices, food and beverage preparation, and washing dishes are no longer simple. Businesses risk closing their doors and losing valuable sales. In the medical field, safe water is a matter of life and death.

If boiling your water, the EPA and CDC recommend you bring the water to a rolling boil for 1 minute (3 minutes at elevations greater than 1,000 meters or 5,000 feet).[4] Then, allow the water to cool thoroughly before use. If choosing chemical disinfection, use unscented, plain household chlorine bleach. Proper precautions must be taken to avoid overdosing and chemical mishaps. Refer to the EPA guidelines for appropriate dosage.

How UV Disinfection Helps

UV light is made up of three wavelength ranges (UV-A, UV-B, and UV-C). UV-C lamps produce rays at 254 nanometers, which are very effective at destroying the DNA of harmful microorganisms. Unlike boiling and chemical disinfection, UV water disinfection allows daily tasks to take place as usual during boil water advisories.

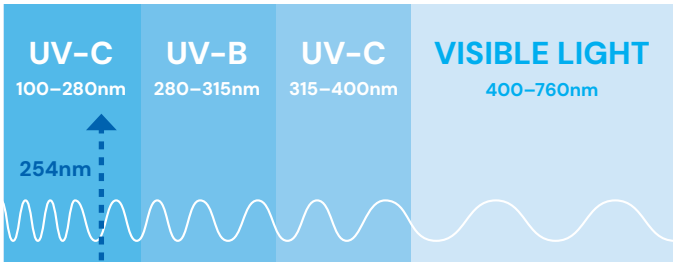

Figure 1: A Portion of the Electromagnetic Spectrum

Water Quality

UV purifiers are intended for use with water that is visually clear—not colored, cloudy, or turbid. 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 2: 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. Contact our UV specialists at (631) 273-0500 for help.

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 3: 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, for an ice maker, or a coffee machine. 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. 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 4: Comparison of UV Water Purifier Models

Feature	Bio-Logic®	Minipure®	Mighty Pure®	Sanitron®	Megatron®
Flow Rate (GPM)	1.5 or 3	1–9	3–20	3–40	90–450
Min. Clearance (Lamp/Quartz)	13⅞–19½"	10⅜–29"	16–49"	17–50"	71"
Min. Clearance (Gland Access)	6"	6"	6"	6"	12–24"
Lamp Indicators	✓	✓			✓
Point of Use Models	✓	✓	✓	✓	
Point of Entry Models		✓	✓	✓	✓
Sight Port		✓	✓	✓	✓
Drain Fitting			✓	✓	✓
HMI Touchscreen					✓
Dual-Action Wiper				✓	Manual or Auto
UV Monitor			Optional	Optional	Standard
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.

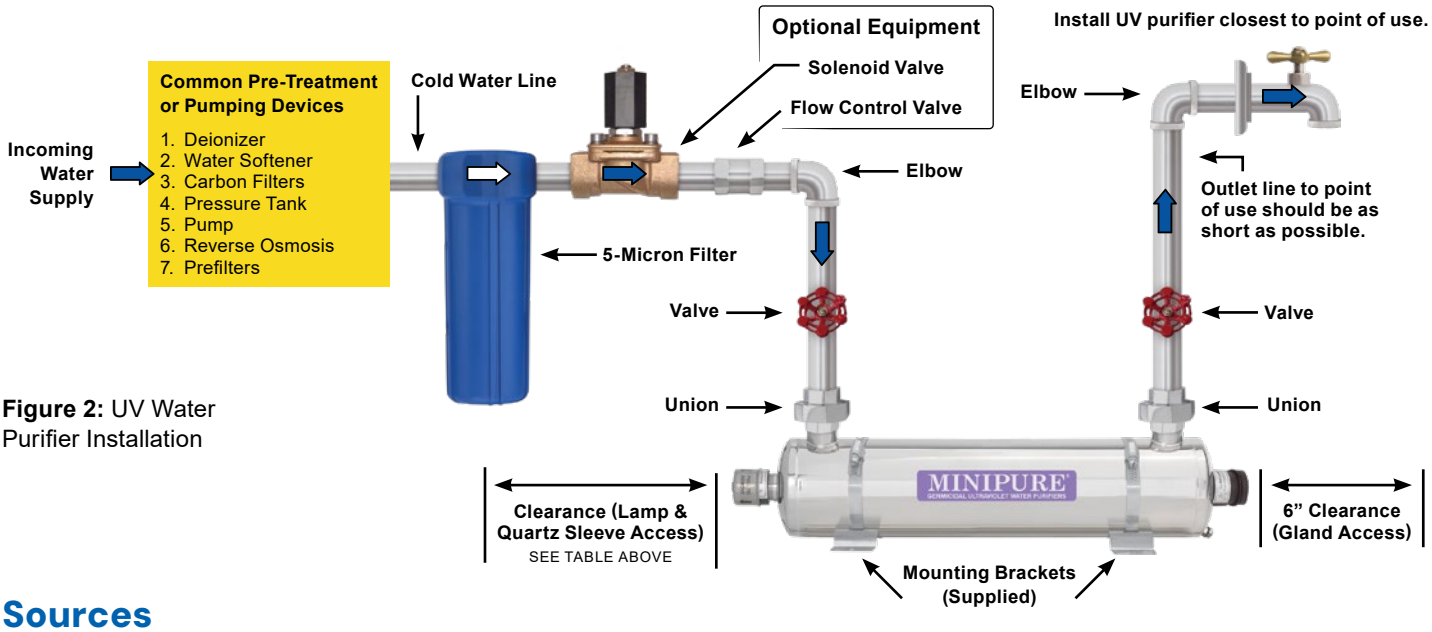

Figure 2: UV Water Purifier Installation

Sources

1. WQRF. "Boil Water Notices in the U.S., 2012-2014." https://www.vettersculliganwater.com/content/documents/vetters/boil-water-alerts.pdf
2. WQRF. "Boil Water Notices: What are they, why are they issued and what are you supposed to do if you receive one?" https://wqa.org/wp-content/uploads/2022/09/Boil_Water_Notice_Study_Brochure.pdf
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4. EPA. "Emergency Disinfection of Drinking Water." https://www.epa.gov/ground-water-and-drinking-water/emergency-disinfection-drinking-water

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