

WHITEPAPER: UV DISINFECTION FOR Wastewater & Gray Water



The Issue: Contaminated Water

In the course of everyday water use, homes, businesses, and industrial processes yield *wastewater*. It originates in toilets, washing machines, bathtubs, sinks, and showers, and may consist of human waste, food scraps, oils, soaps, and chemicals.

Another classification called *gray water* is still far from potable, containing fats, oils, grease, and other organic matter that have washed off of clothes or resulted from baths and showers. The reuse of gray water for non-drinking purposes such as irrigation is very helpful to urban water systems as a means of reducing the demand for fresh water. Global population and industry has put pressure on available clean water sources. The proper treatment and reuse of wastewater is essential in alleviating this water stress.

Nature, on its own, can cope with small amounts of water waste. But for the billions of gallons of sewage people generate every single day, it is imperative that we have water treatment facilities to reduce wastewater pollutants to a level the environment can handle.¹

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.

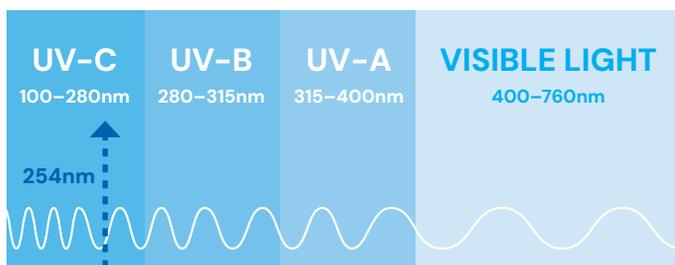


Figure 1: A Portion of the Electromagnetic Spectrum

Treating Wastewater

Water that is piped to a sewage plant undergoes a five step purification process that mimics that of nature²:

1. Removal of large objects
2. Sludge removal
3. Aeration
4. Disinfection
5. Release back into waterways

Wastewater discharge regulations require an efficient cleaning and disinfecting process. UV-C disinfection is an effective means to eliminate contaminants, thereby fulfilling this mandate.



UV disinfection is effective at inactivating most viruses, spores, and cysts. [It] is a physical process rather than a chemical disinfectant, which eliminates the need to generate, handle, transport, or store toxic/hazardous or corrosive chemicals.

The US Environmental Protection Agency³



Water Quality

UV water purifiers are intended for use with water that is visually clear—not colored, cloudy, turbid, or having an obvious contamination source. Nor is the purifier intended to convert wastewater to microbiologically safe drinking water. Water quality plays a major role in the transmission of UV-C rays. In order to achieve the minimum UV transmission level of 65% per centimeter, do not exceed these maximum concentration levels:

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

Table 1: Maximum Concentration Levels

Effectively treating water with higher concentration levels (or a lower UV transmission) than listed above 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 regarding your application.

UV-C Doses

The UV-C doses below will inactivate bacteria and viruses that have been found in wastewater and gray water³. Millijoules per square centimeter (mJ/cm²) describe energy produced by germicidal lamps over a certain amount of time.

Microorganism	UV Dose (mJ/cm ²)
<i>Clostridium difficile</i> (C. diff)	16.0
<i>Giardia</i>	100.0
<i>Clostridium perfringens</i>	95.0
<i>Yersinia enterocolitica</i>	4.20
<i>Toxoplasma gondii</i>	13.0
<i>Salmonella</i>	7.60
<i>Vibrio cholerae</i>	6.50
<i>Escherichia coli</i> (E. coli)	6.60
<i>Cryptosporidium</i>	5.80

Table 2: UV-C Doses to Neutralize Waterborne Microbes

At Atlantic Ultraviolet Corporation®, we offer made-in-the-USA UV solutions to meet wide-ranging water volume scenarios. We manufacture industrial-sized units which meet the disinfection needs of municipal water and wastewater applications. Please see our recommended product lines below and contact a UV application specialist for help determining the properly-sized system for your needs.

UV Disinfection Models for Wastewater and Gray Water

Our **SANITRON**® models treat 3–416 gallons per minute (GPM). They are well-featured and can be easily monitored with the use of several accessories. A sight port, patented dual-action wiper, drain plug, and Easy-Off™ end cap are just some of its features. Models S37C, S50C, and S2400C are NSF® Certified. Model S2400C can be combined to handle larger water flow requirements.

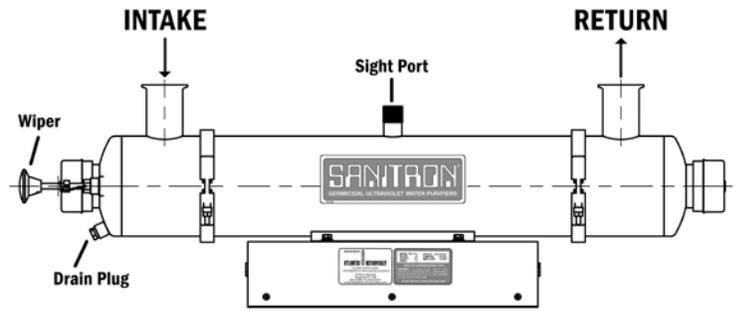


Figure 2: SANITRON® UV Water Purifier Operation

The **MEGATRON**® product line treats 90–450 GPM. Each model contains multiple germicidal UV lamps and provides wastewater disinfection for large facilities. Multiple chambers can be combined to handle larger water flows. All MEGATRON® R Series models feature a remote electrical enclosure with an HMI touchscreen, water temperature monitoring, and UV-C intensity

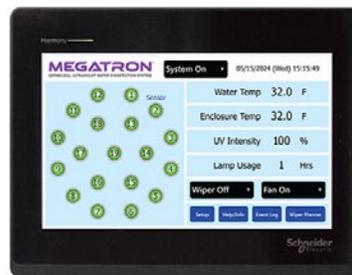


Figure 3: MEGATRON® R Series HMI touchscreen

monitoring. This line also features a manual or automatic wiper system for cleaning quartz sleeves around each lamp, a sight port for viewing lamp operation, digital lamp operation indicators, an elapsed time indicator, and removable chamber heads.

Sources

1. The U.S. Geological Survey. Water Science School, “Wastewater Treatment Water Use.” 2018. <https://www.usgs.gov/special-topics/water-science-school/science/wastewater-treatment-water-use>
2. Journal of Water & Health. “Household greywater treatment methods using natural materials and their hybrid system.” July 28, 2016. <https://iwaponline.com/jwh/article/14/6/914/28393/Household-greywater-treatment-methods-using>
3. The U.S. Environmental Protection Agency. “Wastewater Technology Fact Sheet: Ultraviolet Disinfection.” 1999. <https://www.epa.gov/sites/default/files/2015-06/documents/uv.pdf>



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