

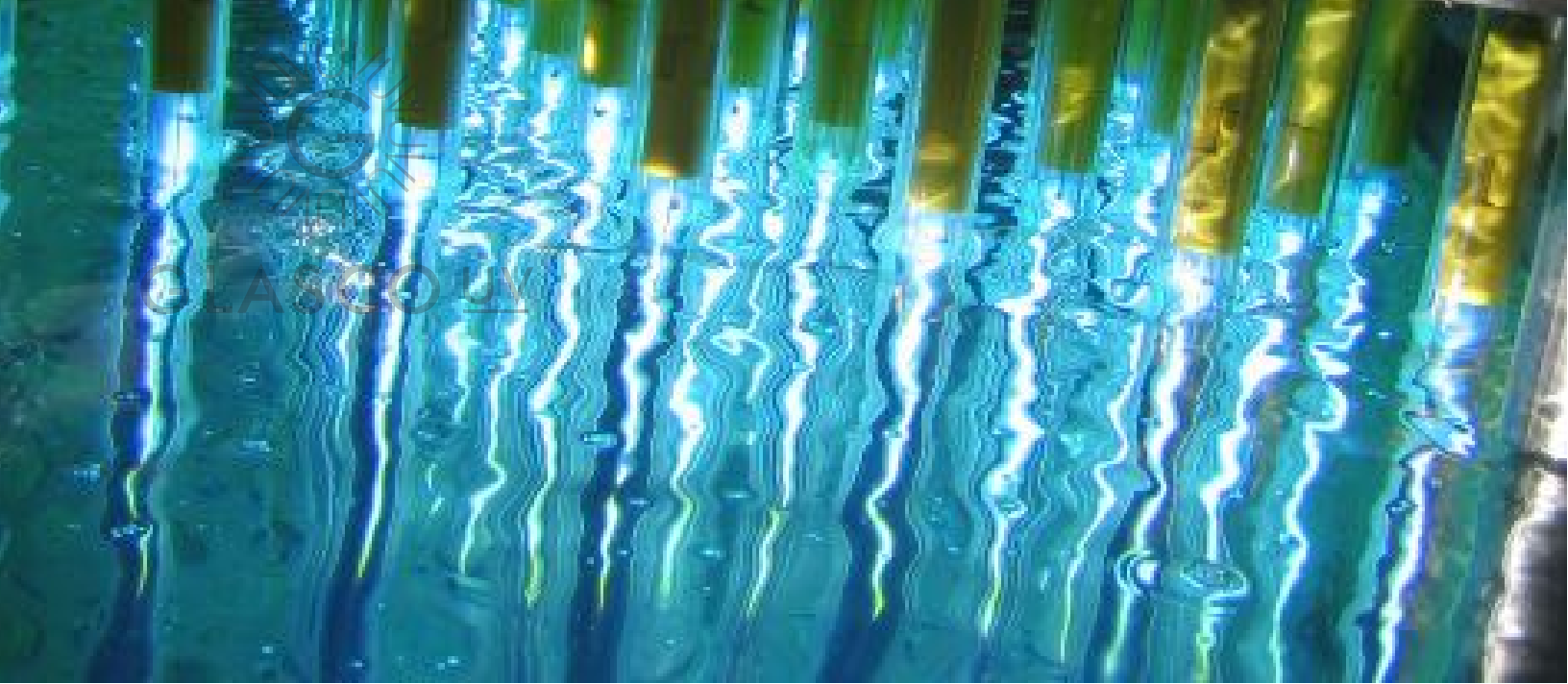
VC Series Wastewater



Vertical Open Channel
Ultraviolet Disinfection



GLASCO UV



VC Series

Our Company

Glasco has been manufacturing UV disinfection systems for over 50 years. Equipment is manufactured for a variety of markets, industries and applications in our NJ (USA) facility.

Founded in 1922, Glasco began as a New York City based metal equipment manufacturer for the food and beverage industries. In the 1940's, the company was committed to supporting other manufacturers during the war effort. Our stated mission was to *"build and design any handling equipment made of metal that will enable you to process or fabricate more expeditiously or more efficiently"*.

In the 1960's, Glasco introduced their first chambered UV system for an industrial application. Since then, we have manufactured tens of thousands of UV systems. Our UV business developed in the industrial markets and grew into the municipal market in the 1980s.

Today, Glasco manufactures a complete range of UV disinfection systems for treating both clean and waste water for residential, commercial, industrial and municipal marketplaces.

Systems integrate UV light to provide environmentally friendly disinfection. UVC light, defined as light emitted at wavelengths between 200 and 300 (254 is peak) nanometers (nm), is used as a means of disinfection by inactivating microorganisms, including waterborne pathogens. UV irradiation has been proven to be a fast, reliable, effective, economical, and green disinfection method and has been successfully applied worldwide for decades.

UVC lights targets the microorganisms' DNA. Exposure to UVC light prevents the microorganism from reproducing and cells that cannot reproduce cannot infect and are therefore harmless.



1. UV Disinfection

When wastewater pathogens are exposed to UV light, their cells become damaged and this damage inhibits reproduction. The UV light, produced by a special UV lamp, damages the cell's DNA and RNA and once damaged, they are unable to replicate. This physical process renders them harmless.

2. The Kill

The amount of damage is a result of the lamp's UVC intensity multiplied by residence time. The dosage is commonly referred to as microwatts and is often expressed as mJ/cm². Dosages of 30,000 uWs/cm² (30 mJ) are common for meeting a 200/100 ml discharge permit.

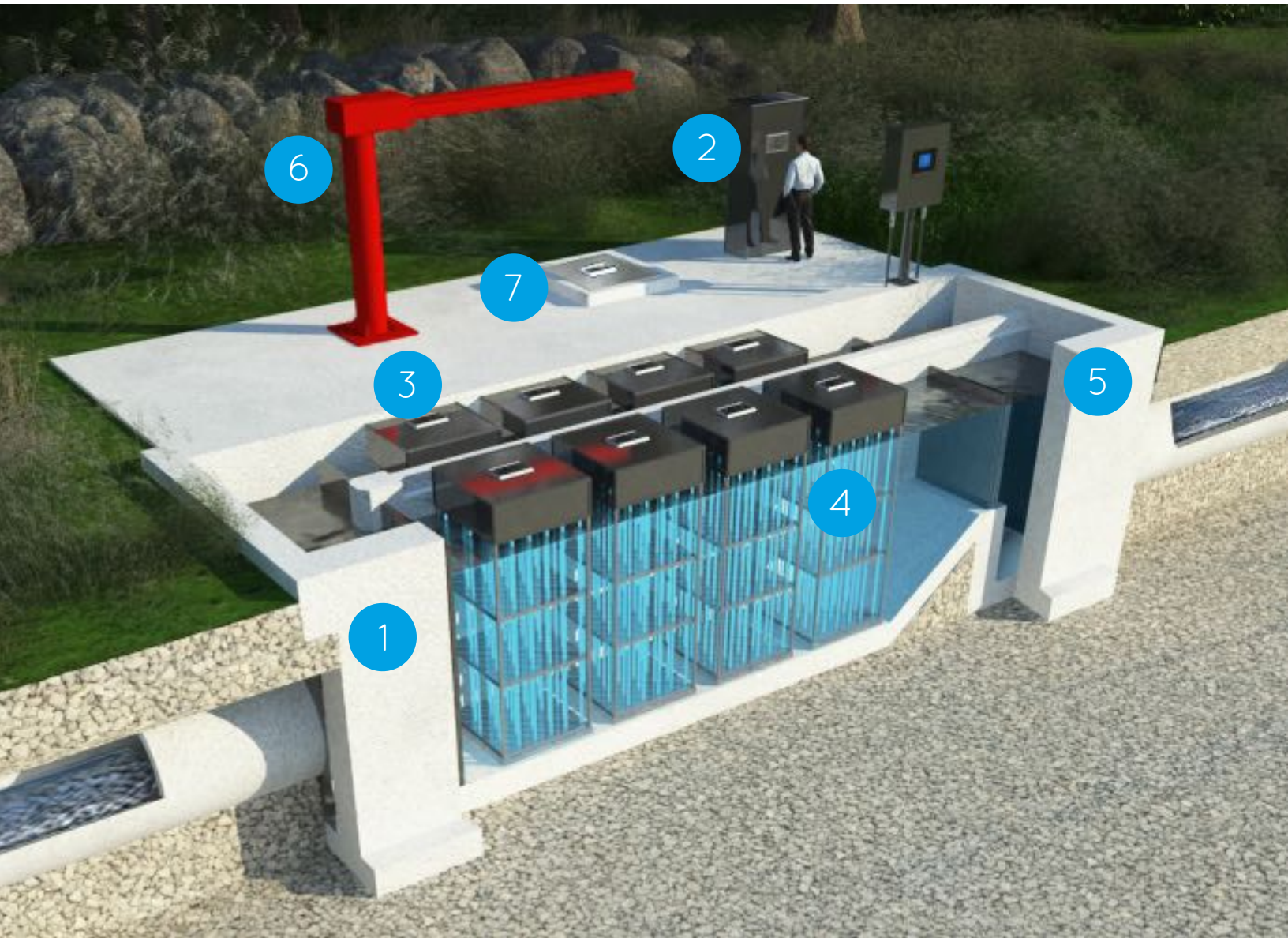
3. Calculating Dose

The two primary methods to calculate dose are biological testing (bioassay) and mathematical calculations using light physics (Point Source Summation Method aka UVDIS). Both offer end-users with information that is important in system sizing. Each method takes into account flow rate, water transmission, lamp type and # of lamps.

4. Why use UV?

UV disinfection is a well accepted method for treating wastewater. The main benefits: a green technology (no chemicals), short residence time and the technology has matured over the last 40 years. UV disinfection produces no harmful by-products and will work on a wide range of effluent quality.

Vertical Plant Overview



UV plant layout and level control

Open channel UV systems need to be designed with level control systems. Level control is necessary to keep the UV lamps submerged regardless of flow (from 0 to peak). There are three (3) types of level control systems: finger weir, counter-balanced level gate and downward opening gate.

There are pros and cons for the three (3) options. The most basic and economical is a fixed serpentine finger weir. For higher flow rates, a counter-balanced gate can be considered for its smaller footprint and lower headloss. A downward opening gate requires a level sensing system and is the more complicated of the control systems.

- 1 Concrete Channel
- 2 PDC-BCC / SCC
- 3 Modules
- 4 Automatic Clean
- 5 Level Control
- 6 Hoist
- 7 Dip Tank

About UV lamp technology

Not all lamps or UV systems are created equal. Manufacturers will tout the benefits of their lamp type.

The main UV lamps being used are low pressure (standard, high output and amalgam) and medium pressure.

The difference between low pressure and medium pressure is one of efficiency. Low pressure UV lamps produce the majority (90%+) of their output in 254 nm range. Medium pressure UV lamps produce a significant amount less (15%).

Low pressure lamps are rated by their watts. Standard output is 65 W, High Output is 155 W and Amalgam lamps come in various outputs ranging from 150 to 1200 Watts.

Lamps produce 35% of their output in UVC watts and will typically last 12,000+ hours.

Vertical Operation

Once in the concrete channel, the module's utilities (power, data and air) are connected to the Ballast Control Center (BCC) / Power Distribution Center (PDC) and System Control Center (SCC).

As wastewater enters the channel, portions of the modules (segments or rows of lamps) will turn on in relationship to a flow signal. This allows the plant to use only the required lamps which saves energy and costs associated with lamp replacements.

The staggered vertical lamp array provides for mixing and redundancy. The level control weir insures that the water is properly exposed to lethal doses of UV light.

The quartz sleeves and UV sensor are automatically cleaned on a periodic basis. The protective sleeves are wiped to prevent build up from adhering to the quartz.

Operators inspect the system to ensure that the lamps are functioning and producing actual UV light. Lamp Out and Low UV output indicators and alarms will direct operators to the service issue.

Service



UV Lamp and Ballast Technology

UV lamps are powered and controlled by electronic ballasts. Ballasts regulate the current to the lamps and also provide the initial voltage to start the lamp. Ballasts monitor operational status, detect when lamp has failed and provides other shut down protections for voltage fluctuations.

Energy and Lamp Conservation

Modules, module-segments and individual lamp rows can be turned On & Off in relation to a flow signal. This insures that only the required number of lamps are on. This saves energy and reduces the number of lamps that need to be replaced. All other systems are always ON and in some cases only dimmed.

Automatic Quartz Cleaning System

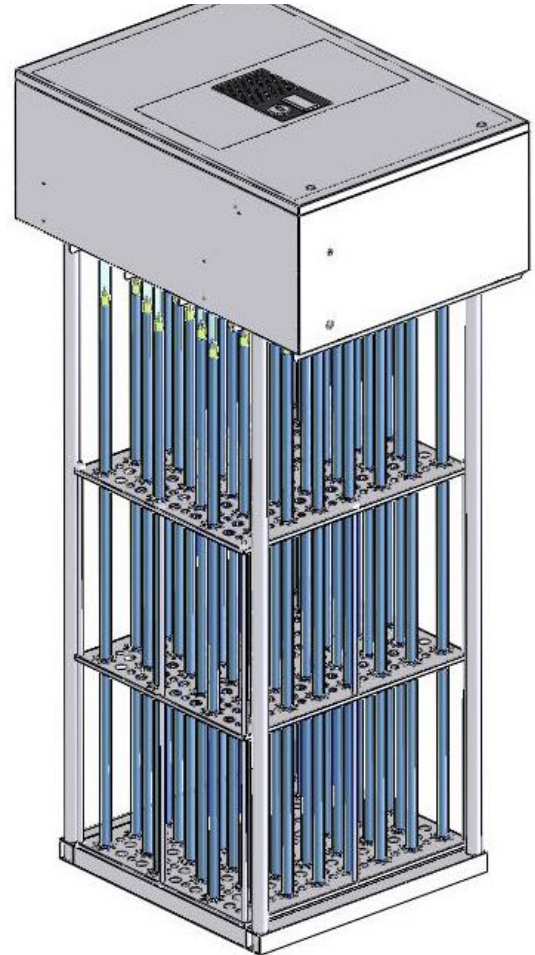
Modules come standard with an automatic quartz cleaning system. The pneumatically driven piston uses a quick stroke approach to remove materials from the sleeves before they have the ability to build up and foul. System can use a standalone air compressor or plant supplied air.

Lamp and System Maintenance

The ability to change lamps without removing the module or undoing any underwater seals, is one of the biggest benefits of the vertical installation. Operators open the module, unplug the lamps, pull them out, install the new lamps and close lid. This procedure is much easier and many times faster than re-lamping horizontal systems.

Ultraviolet Monitoring

Modules incorporate a UV light sensor and monitoring system. The sensor is placed in its own dedicated quartz sleeve, which is cleaned as part of the automatic quartz wiping system. The sensor reads 360 degrees of UVC light and provides an output from 0-100% or $\mu\text{W}/\text{cm}^2$.



Controls and Displays

Vertical module displays lamp status, run time and UVC output. PLC can be provided for remote monitoring and operation. Flow pacing based on a 4-20 mA signal from plant flow meter, allows the system to use only the required amount of UV.

1

VCS-40-HO (30" - 80 Watts)

Treats wastewater flows up to 2 MGD. Each module disinfects 1.0 MGD and has been engineered to operate in a channel that maintains a 30" water level. Lamp: Low pressure high output 80 watts.

3

VCS-40-A150 (30" - 150 Watts)

Treats wastewater flows up to 4 MGD. Each module is biologically validated to disinfect 1.5 MGD and operates in a 30" water level channel. Lamp: Low pressure high intensity amalgam 150 watts.

Validated under US EPA ETV
Environmental Tech Verification



2

VC-40-HO (60" - 155 Watts)

Treats wastewater flows up to 15 MGD. Each module disinfects 2.5 MGD and has been engineered to operate in a channel that maintains a 60" water level. Lamp technology: Low pressure high output 155 watts.

4

VC-A300 (60" - 320 Watts)

Treats wastewater flows up to 30 MGD. Each module is biologically validated to disinfect 5 MGD and operates in a 60" water level channel. Lamp: Low pressure high intensity amalgam 320 watts.

Validated to NWRI Standards by
HDR/HydroQual

5

VC-A600 (60" - 600 Watts)

Treats unlimited wastewater flows. Modules can be configured with 12 or 24 lamps and operates in a 60" water level channel. Lamp: Low pressure high intensity dimmable amalgam 600 watts.

Vertical Models 30" & 60"

Horizontal open channel systems had dominated the market since the 1980's. While the change from chlorine to UV was a positive, there were issues relating to UV system operation that made some aspects difficult and expensive. Horizontal modules are always on and modules need to be removed and underwater seals undone to change lamps.

Seeing that plants wanted easier maintenance, lower lamp and energy costs, Glasco launched our Vertical program in the 1980s. In 2003, we installed the industry's first vertical amalgam system.

Vertical installations have the lowest operational costs due to lamp/energy management systems that turns off rows of lamps that are not required.

Key Benefits

- Compact installation footprint
- All lamp seals above the water
- Easy lamp change
- Flow paced - turning lamp rows/segments (on/off) and dimming
- Staggered lamp design provides mixing
- Multi-lamp UV monitoring with auto clean
- Automatic quartz sleeve cleaning
- Select models bioassayed at UV Validation and Research Center of New York, Johnstown, NY
- Hydraulically tested and profiled
- Environmental Technology Verification (ETV) test performed for NSF International (NSF) and the Environmental Protection Agency (US-EPA)

6



VCS-40-HO	
Number of lamps	40 x 80 Watts
Power	3.4 kW
Voltage	120-277 50/60 Hz
Flow rate	750,000 to 1 MGD
Dosage	30 mJ @ 65% UVT
Headloss	1/4" (1" at 1.5 MGD with 2 modules)
Water level	30"
Channel width	23 1/4"
Channel height	40"
Module weight	250 lbs

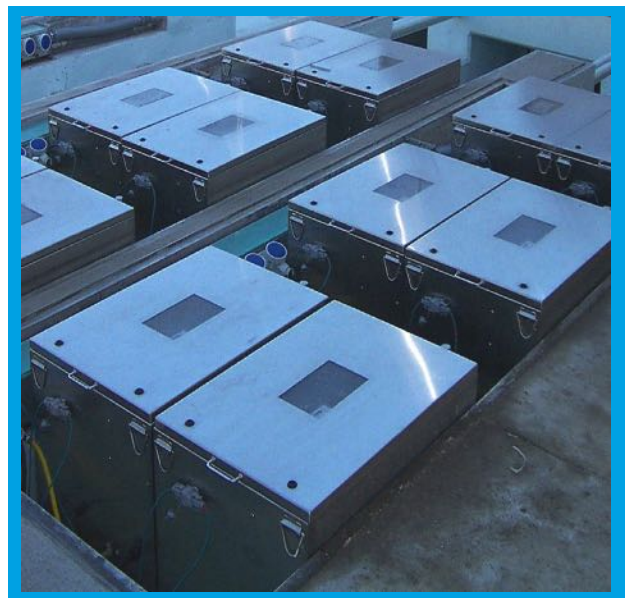
The **VCS-40-HO** is our offering for lower flow rates (<1 MGD per module) and is designed to treat a 30" water level. System has been designed for wastewater plants that would normally only consider a horizontal type installations.

Systems are good for smaller towns, industries, mobile home parks and new developments.

The **VC-40-HO** is our offering for plants exceeding 1.0 MGD and is designed to treat a 60" water level. The system has been designed for wastewater plants that have the ability to use a deeper channel.

Systems are good for mid to large size wastewater treatment plants up to 15 MGD. Larger plants will require the A300 or A600 modules.

VC-40-HO	
Number of lamps	40 x 155 Watts
Power	6.2 kW
Voltage	120-277 50/60 Hz
Flow rate	2.5 MGD
Dosage	30 mJ @ 65% UVT
Headloss	1/4" (1.5" at 4.0 MGD with 2 modules)
Water level	60"
Channel width	23 1/4"
Channel height	66.5"
Module weight	400 lbs



VCS-40-A150	
Number of lamps	40 x 150 Watts
Power	7.0 kW
Voltage	230 50/60 Hz
Flow rate	1.5 US MGD
Dosage	30 mJ @ 65% UVT
Headloss	1/2" (3" at 3 MGD with 2 modules)
Water level	30"
Channel width	23 1/4"
Channel height	40"
Module weight	250 lbs

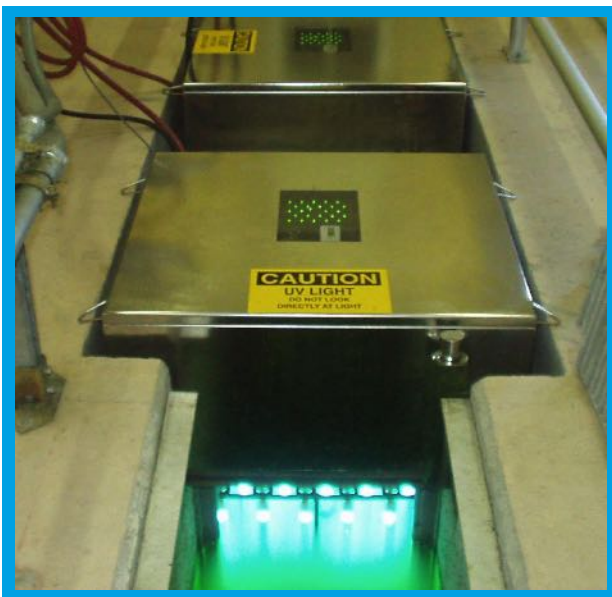
VC-A300	
Number of lamps	24, 30, 40 & 48 x 320 Watts
Power	7.7 to 15.4 kW
Voltage	230 50/60 Hz
Flow rate	2 - 5 MGD
Dosage	30 mJ @ 65% UVT
Headloss	1/4" (1.5" at 4.0 MGD with 2 modules)
Water level	60"
Channel width	30"-33"
Channel height	68"
Module weight	450 lbs

The **VCS-40-A150** is our 30" amalgam system. It has been validated with the NSF and the US EPA's Environmental Technology Verification Program (ETV).

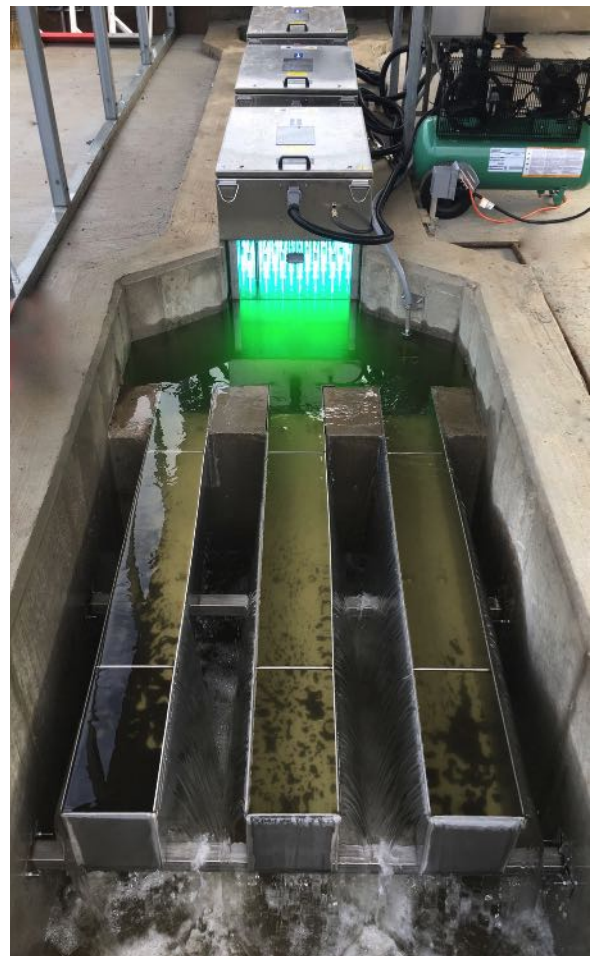
The **VC-A300** is our 320 watt vertical amalgam lamp system. It has been validated to NWRI/AwwaRF UV guidelines for Drinking Water and Water Reuse at the Johnstown NY Validation Center.

The **VC-A600** vertical amalgam disinfection system integrates 600 watt lamps. System has been designed for larger plants > 5.0 MGD.

The UV lamps will dim in relationship to the flow and other operating parameters. Electronics are housed in remote Ballast Control Centers with air conditioning. System Control Center comes standard with Allen Bradley PLC.



VC-A600	
Number of lamps	12 and 24 x 600 Watts
Power	7.7 to 15.6 kW
Voltage	230 50/60 Hz
Flow rate	2.5 - 5 MGD
Dosage	30 mJ @ 65% UVT
Headloss	1.5" at 5.0 MGD
Water level	60"
Channel width	30"-33"
Channel height	68"
Module weight	450 lbs



Installation

Depending on the Vertical model, the modules will either have the primary electronics (ballasts) in the module or have them remotely located.

For the higher powered amalgam systems, the sophisticated electronics are maintained in remote stainless steel air conditioned enclosures. For the high output systems, ballasts are located in the module and cooled through heat exchange with the effluent. For projects that are concerned about flooding, remote ballasts can be provided.

A dedicated air conditioner will be provided to run the automatic quartz cleaning. A hoist may be incorporated to remove the modules for seasonal disinfection or for servicing.

Experience

- 1980's installed first low pressure vertical systems
- 1999 installed first vertical 60" high output module
- 2001 installed first vertical 30" high output module
- 2003 installed the first vertical 320 watt amalgam
- 2007 installed and currently support a 60 US MGD vertical amalgam system (10+ years)
- 2016 released 600 watt vertical amalgam system
- Worldwide installation base with vertical modules installed in North and South America, Europe and



Remote Ballast Control Center with Air Conditioning



20 MGD vertical amalgam system

Environmental Considerations

Most systems are designed for outdoor installation. Ideally, a structure should be constructed above the UV system and the electrical cabinets to prolong system life and make operation and maintenance easier.

UV systems, especially the UV lamp ballasts, are susceptible to both heat and freezing conditions.

Many operators have indicated that their jobs would be easier if a simple pole structure had been placed over the channel. These type of structures allow the operators to work in inclement weather and prevents them from dealing with issues like snow build up or extreme heat conditions.

UV disinfection systems incorporate sophisticated electronics that need protection from fluctuating voltage, power spikes and brown-out conditions. Engineers should be aware of these issues when contemplating the electrical design.

The other issue that needs to be carefully considered is the installation height of the level control system. The UV lamps need to be submerged regardless of the flow. This means that at both no flow and at peak flow, the lamp's electrodes need to be covered by the effluent. This not only ensures that the wastewater is being disinfected, but also provides needed cooling for the UV lamp.



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