

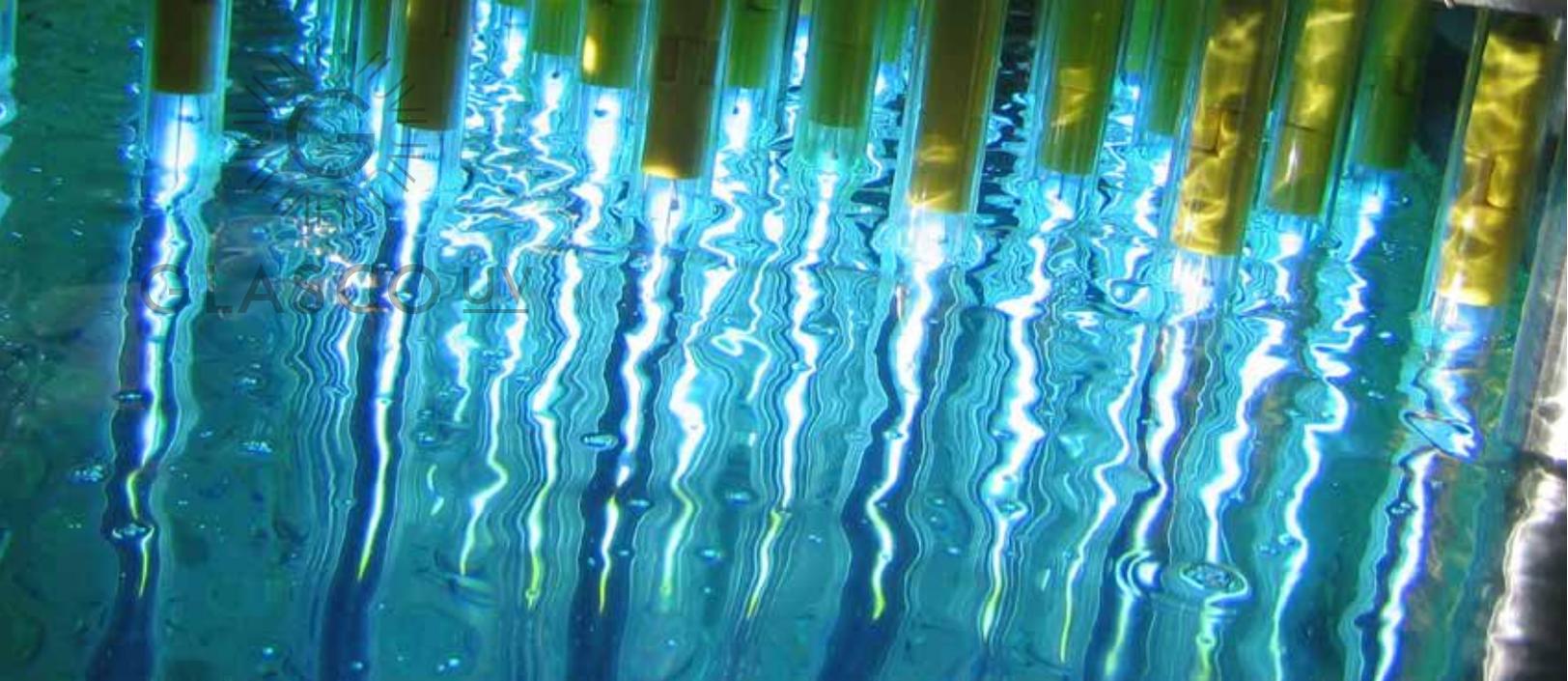


UV Wastewater

Vertical Open Channel
Ultraviolet Disinfection



GLASCO UV



GLOW VC Series

Our Company

Glasco Ultraviolet has been manufacturing UV water and wastewater disinfection systems for over 50 years. We manufacture equipment for a variety of markets, industries and applications at our Northern New Jersey (USA) facility.

From our early history as a New York City based process equipment manufacturer for the food industries, to our over fifty years of ultraviolet “UV” disinfection system fabrication, Glasco has been and will continue to be a high quality supplier for all of your project needs.

In the 1940’s, Glasco was committed to supporting manufacturers during the war effort. Even then, our 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”.

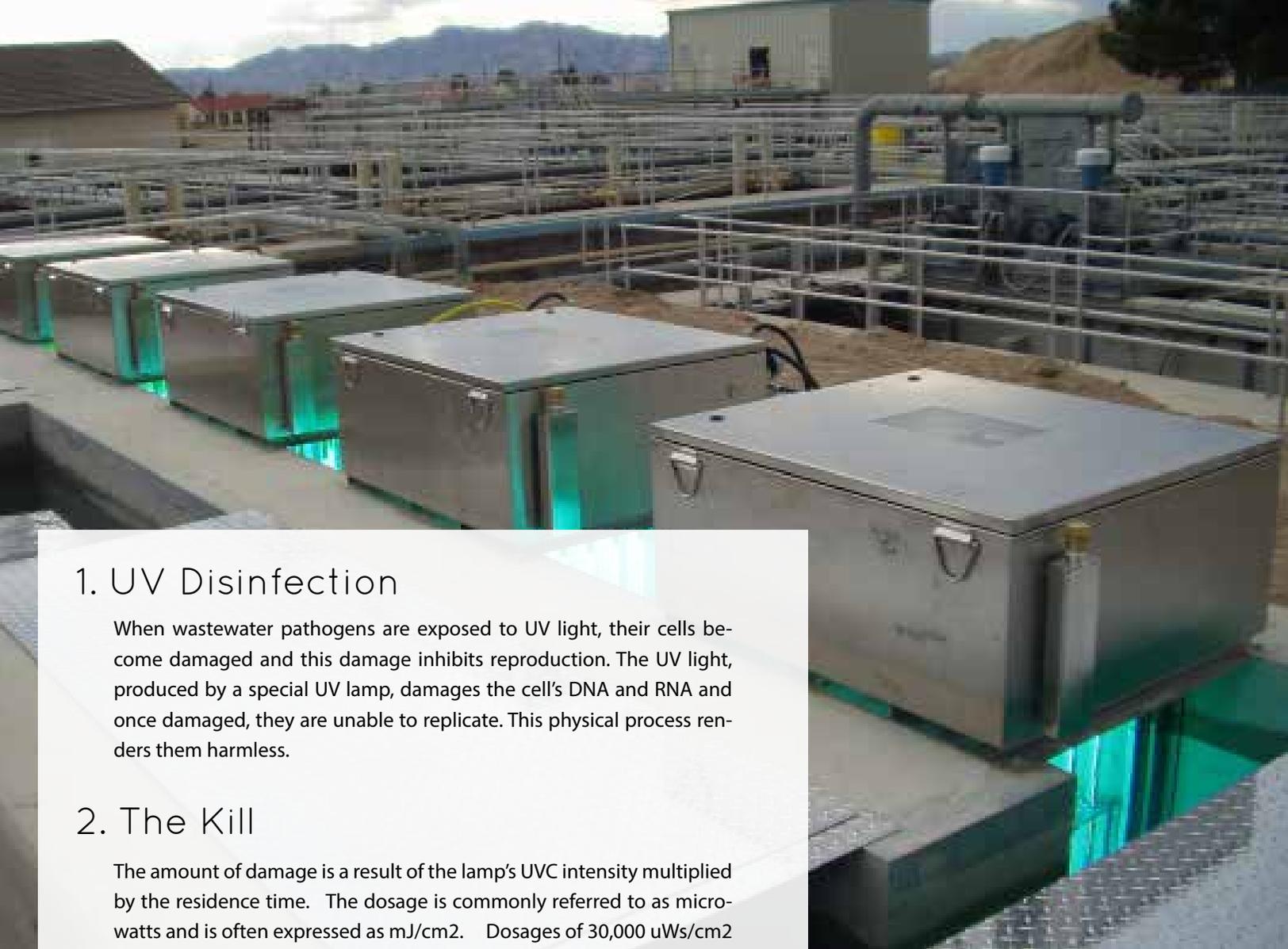
Since the 1960’s, Glasco has manufactured tens of thousands of systems that use UV light to disinfect water, air and surfaces. The UV business originally developed in the industrial marketplace as a direct result of our ability to manufacture high-grade stainless steel material handling equipment and vessels that were food and beverage grade.

Today, Glasco manufactures a complete product range of UV disinfection systems for treating both clean and wastewater for the residential, commercial, industrial and various municipal marketplaces.

Our systems integrate ultraviolet lamps to provide environmentally friendly disinfection. UVC light, defined as UV 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 environmentally friendly 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.

Glasco has integrated today’s best tested technologies into our current offerings of vertically oriented open channel wastewater treatment equipment. The GLOW VC Series.



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 the residence time. The dosage is commonly referred to as micro-watts and is often expressed as mJ/cm^2 . Dosages of $30,000 \text{ uWs}/\text{cm}^2$ (30 mJ) are common for meeting a 200/100 ml discharge permit.

3. Calculating Dose

There are a number of ways that the industry calculates dosage. The two primary methods 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 number of lamps.

4. Why use UV?

UV disinfection is a well accepted method for treating wastewater. The main benefits of UV are that it is a green technology (no chemicals), that it does not require a long residence time and the technology has matured over the last 25 years. UV disinfection produces no by harmful by-products and will work on a wide range of effluent quality.

1

VCS-40-HO-30"

VCS-40-HO is designed to treat wastewater flows between 500,000 to 1,500,000 US GPD. Each module treats 750,000 GPD 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"

VCS-40-A150 is designed to treat wastewater flows between 750,000 to 4,000,000 US GPD. The VCS-40-A150 is biologically validated to disinfect 1.5 MGD and operates in a 30" water level channel. Lamp: Low pressure high intensity amalgam 150 watts.

2

VC-40-HO-60"

VC-40-HO is designed to treat wastewater flows between 1.0 to unlimited MGD. Each module treats 2+ 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-40 & 48-A300-60"

VC-40-A300 & 48-A300 treat unlimited wastewater flows. The VC-40-A300 treats 4.0 MGD, while the VC-48-A300 treats 4.5 MGD and has been biologically validated. Both operate in a 60" water level channel. Lamp: Low pressure high intensity amalgam 320 watts.

Many Vertical Choices

Traditionally, vertical systems were only installed at large plants treating millions of gallons per day. These plants realized the many advantages that the vertical orientation had over traditional horizontal open channel systems. These include small footprint, efficient flow pacing, lamp life savings and easier lamp and quartz maintenance.

Seeing that a major market segment (plants operating under 1 MGD) was not able to appreciate the benefits of a vertical oriented installation, Glasco UV designed the **VCS** line of products to work in plants that can integrate the system with 30" water.

Today, plants treating 500,000 GPD can integrate a vertical UV disinfection system.

Key Benefits

- Compact installation footprint
- All lamp seals above the water
- Easy lamp change
- Flow paced by turning lamps on and off - saving energy and lamp life.
- Staggered lamp design provides mixing
- Multi-lamp UV monitoring
- Automatic quartz 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 United States Environmental Protection Agency (EPA)

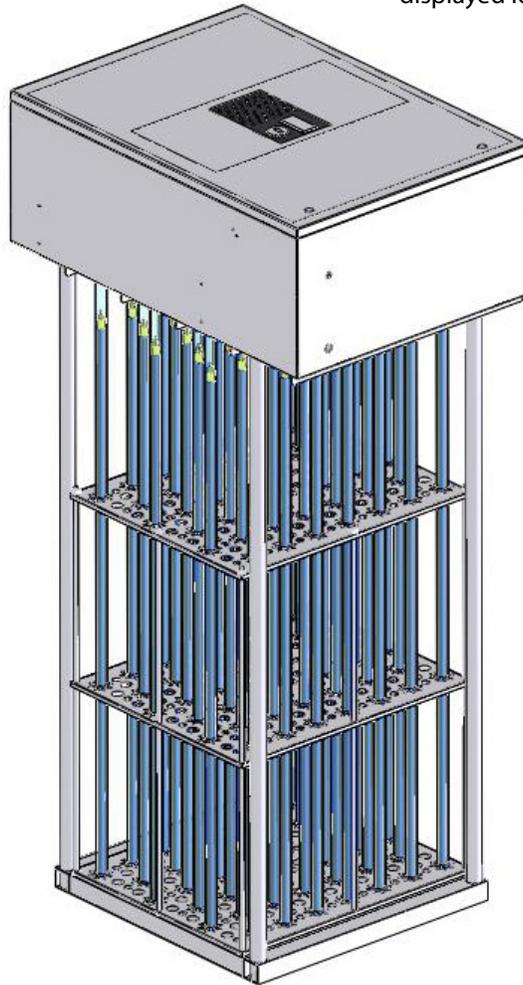
3

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 have air supplied by the plant.

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 wiping system. The sensor reads 360 degrees of UV light and provides an output from 0-100%. Information is displayed locally and remotely.



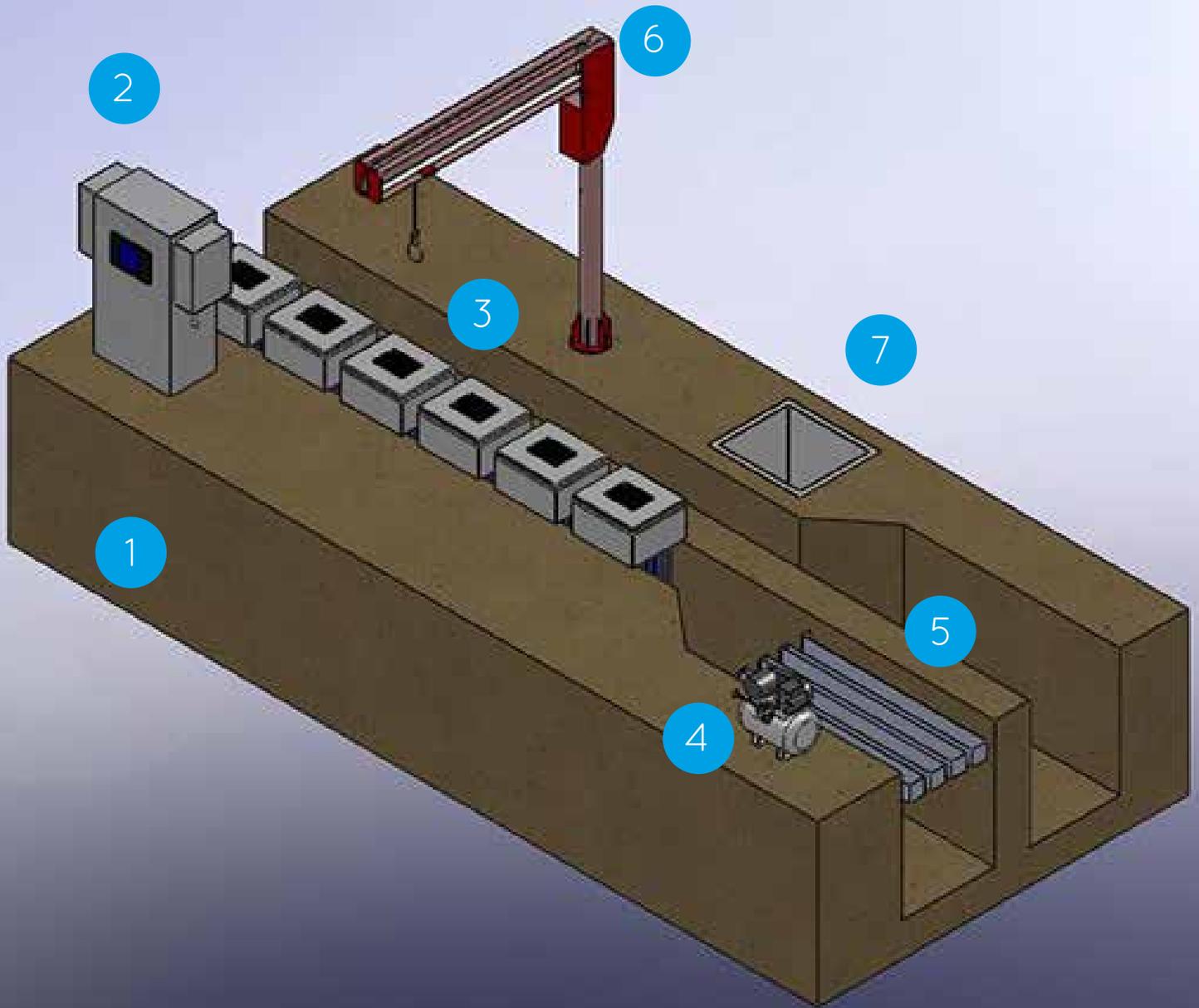
Lamp and System Maintenance

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 have to simply 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.

Controls and Displays

At a minimum, each vertical module will display lamp operating status, run time and UV output. For larger projects, a PLC can be provided for remote monitoring on a lamp by lamp basis, flow pacing based on a 4-20 mA signal from plant flow meter and automatic operation.

GLOW Vertical Plant Overview



- 1 Concrete Channel
- 2 PDC / 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 270 to 1000 Watts.

Lamps produce 35% of their output in UVC watts and will typically last between 9,000 - 12,000 hours.

Vertical Operation

Modules are lowered into their stainless steel support systems via a hoist. Once in place, the module's utilities (power, data and air) are connected to the Power Distribution Center (PDC) and System Control Center (SCC).

As the wastewater enters the channel, portions of the modules 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 system insures that the wastewater 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 that they are still producing actual UV light. Lamp out and low UV output indicators and alarms will direct operators to the service issue.

Modules are removed from the channel for seasonal storage or for supplemental hosing or citric acid dipping.

Service





VCS-40-HO	
Number of lamps	40 x 80 Watts
Power	3.4 kW
Voltage	120-277 50/60 Hz
Flow rate	750,000 GPD
Dosage	30 mJ @ 65% UVT
Headloss	1/4" (1" at 1.5 MGD with 2 modules)
Water level	30"
Channel width	22.5"
Channel height	30"
Module weight	250 lbs

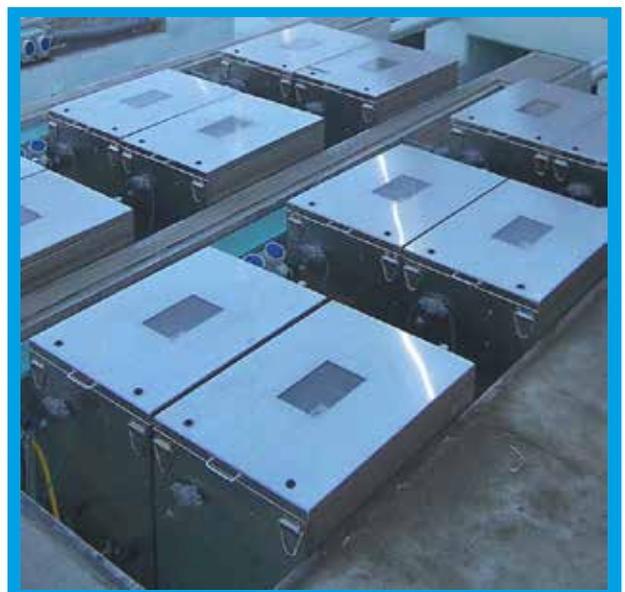
The **VCS-40-HO** is our offering for lower flow rates (<750,000 per module) and is designed to treat a 30" water level. The system has been designed for wastewater plants that would normally only have the option for horizontal installations.

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

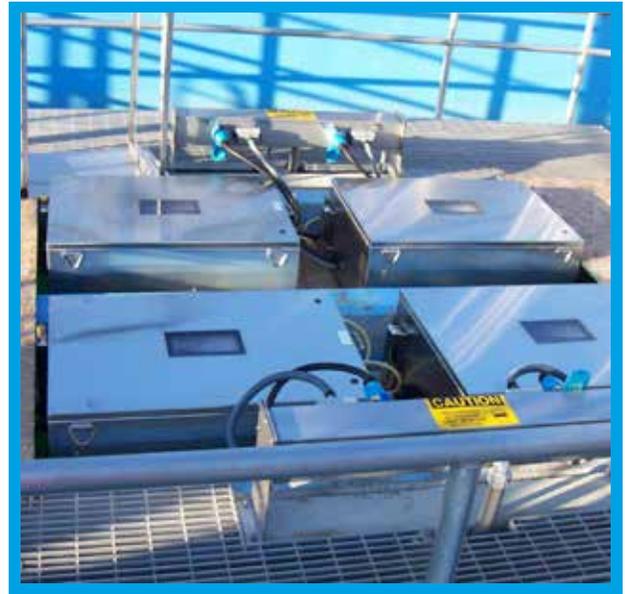
The **VC-40-HO** is our offering for plants exceeding 1.0 MGD and is designed to treat a 60" water level. The system has been designed for wastewater plants that have the ability to use a deeper channel.

Systems are good for mid to large size wastewater treatment plants.

VC-40-HO	
Number of lamps	40 x 155 Watts
Power	6.2 kW
Voltage	120-277 50/60 Hz
Flow rate	2.0 MGD
Dosage	30 mJ @ 65% UVT
Headloss	1/4" (1.5" at 4.0 MGD with 2 modules)
Water level	60"
Channel width	22.5"
Channel height	68"
Module weight	350 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	22.5"
Channel height	30"
Module weight	250 lbs



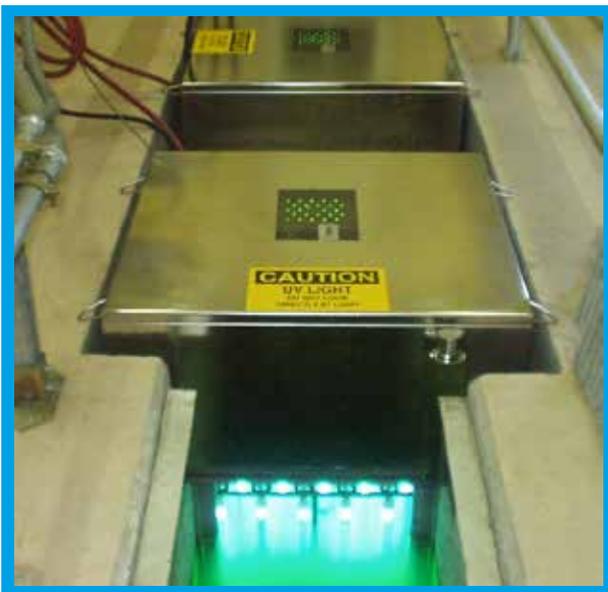
The **VCS-40-A150** is our biologically validated vertical amalgam based offering exceeding 1.0 MGD and is designed to treat a 30" water level .

The **VCS-40-A150** has been validated in cooperation with the NSF and the US EPA's Environmental Technology Verification Program (ETV). This program allows performance verification of innovative environmental technologies.



The **VC-48-A300** large flow vertical amalgam disinfection system was validated in conformance with current UV validation protocols, including NWRI/AwwaRF UV guidelines for Drinking Water and Water Reuse (2003) by HydroQual at the Johnstown NY Validation Center.

The results of the T1 and MS2 Reduction Equivalent Dose (RED) was established over an operating range of 50% to 80% UVT and flow rates from 0.4 to 8 MGD.



VC-48-A300	
Number of lamps	48 x 320 Watts
Power	15.4 kW
Voltage	230 50/60 Hz
Flow rate	4.5 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



Installations and Design

Experience

Today, Glasco supports hundreds of our wastewater plants around the world from our NJ USA based manufacturing facility.

We constantly strive to improve our technologies and have been at the forefront of the technology for the last 10 years.

We constantly test and integrate the best components from around the world to manufacture our vertical UV disinfection systems.

Our vertical amalgam based systems have been biologically validated to the most current standards by HydroQual at the Johnstown NY UV Validation Center.

- 2001 installed the first vertical 30" high output system
- 2003 installed the first vertical amalgam installation in US - 10 years of succesful operation on a water re-use plant. USA.
- Designed, installed and currently support a 60 US MGD (227,000 m3/day) vertical amalgam system in Massachusetts.
- Worldwide installation base with vertical modules installed in North and South America, Europe and Asia.



Environmental Considerations

Most UV 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 special electronics that need protection from fluctuating voltage, power spikes and brown out conditons. 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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