ClorDiSys

UV-C 101

An Introduction to Technology and its Process

CLORDISYS HISTORY

ClorDiSys Solutions, Inc was established in 2001 and has been providing decontamination equipment and services to the life science, pharmaceutical, food, healthcare, and government research industries ever since. The technology was developed by Johnson & Johnson. It has been used by most major pharmaceutical companies, 31 of the Top 100 food manufacturers, and many research institutions.

REQUIREMENTS for an EFFECTIVE DECONTAMINATION

Research and Development uncovered unique challenges within the healthcare industry and improved upon technology in order to provide the highest quality products and solutions.

- Drop ceilings
- Quick turnover times
- Cost restrictions
- Etc.

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REQUIREMENTS for an EFFECTIVE DECONTAMINATION

Best Solution:

Ultraviolet Light Disinfection

UV-C provides a dry, chemical-free, and residue-free method of disinfection effective against bacteria, viruses, fungi and spores. It offers extremely quick disinfection times against bacteria and viruses and can be used in a variety of applications.

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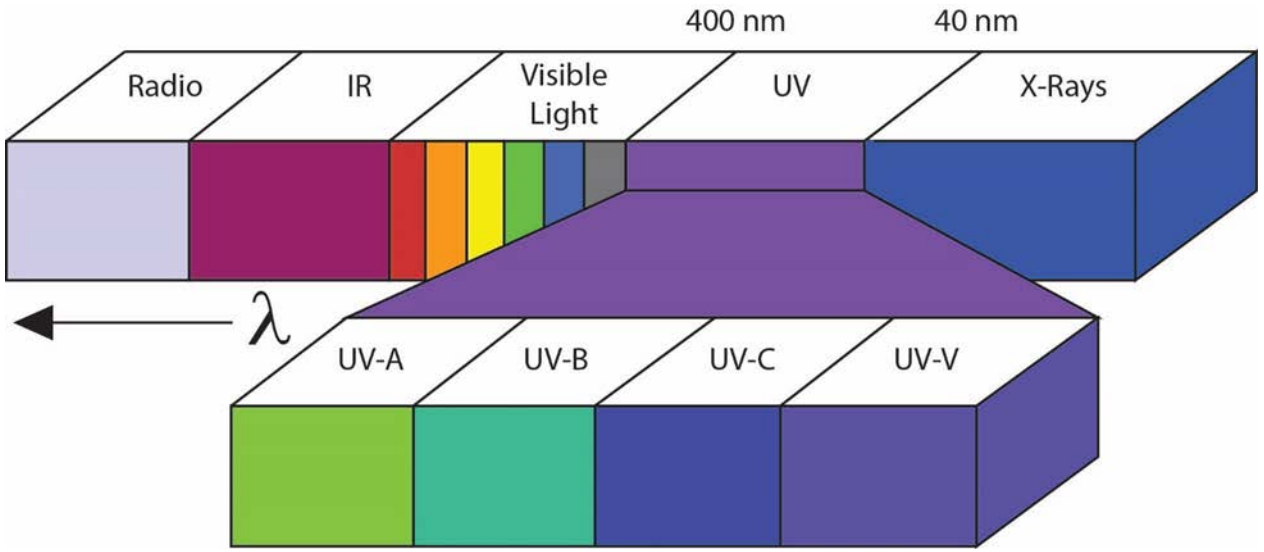
ULTRAVIOLET LIGHT SPECTRUM

Ultraviolet light is a specific part of the electromagnetic spectrum of light that offers bactericidal effects. Ultraviolet light is divided into UV-A, UV-B and UV-C rays. It is the wavelengths in the UV-C spectrum, specifically 265 nm, which offer the greatest germicidal potential.



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HISTORY OF UV-C

- Ultraviolet Disinfection was discovered in the 1801 by Johann Ritter
- In 1903 Niels Finsen won Nobel Peace prize for UV- C to control Tuberculosis (TB) in hospitals
- Used in Water/Waste Water treatment
- UV-C fell out of favor in 60s and 70s on account of medications & antibiotics
- HVAC applications in the 1990s
- Hospitals have embraced UV-C in recent years because of its ability to deactivate pathogens that have since become resistant to antibiotics such as so called "superbugs" MRSA, VRE and C. diff.

Dr. Niels Finsen treating tuberculosis with UV-C light

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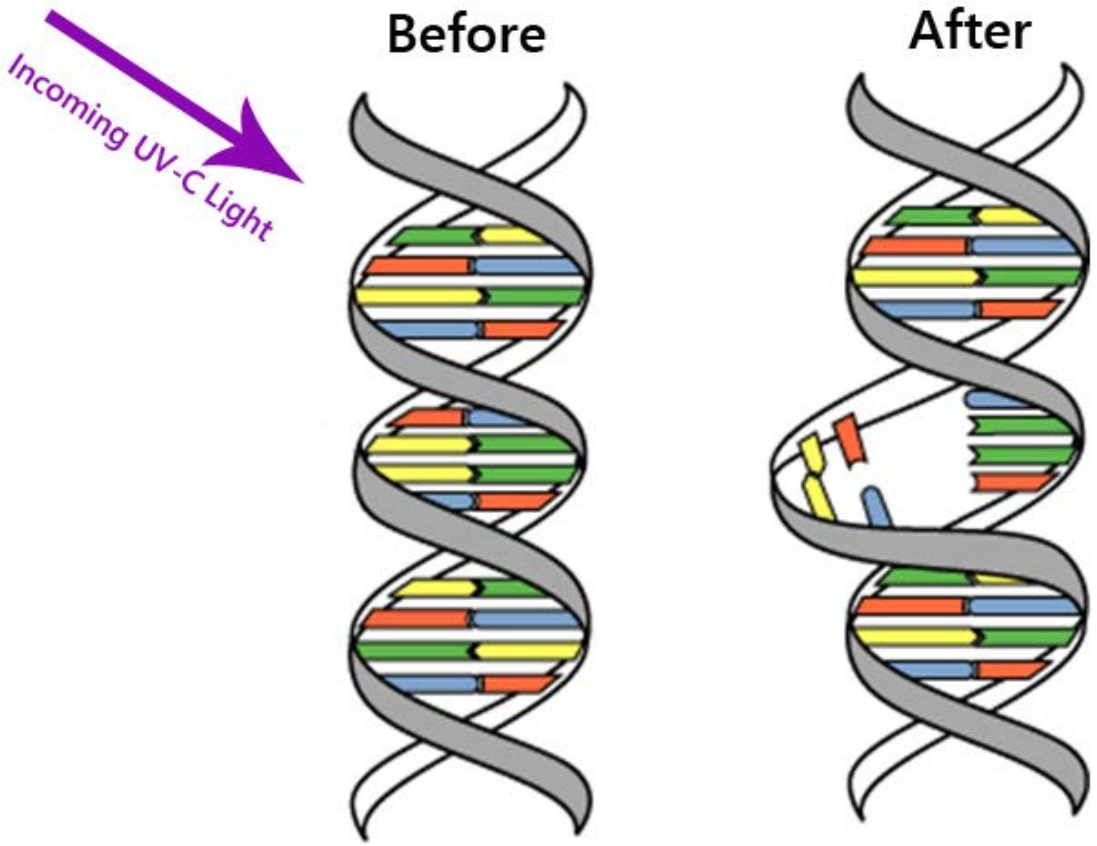
HOW UV-C WORKS



When a micro-organism is exposed to UV-C, the nuclei of the cells are altered due to photolytic processes. This process prevents further replication and causes cell death.

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UV-C DOSAGE

The degree of inactivation by ultraviolet radiation is directly related to the UV-C dose applied.

Intensity is typically expressed in $\mu W/cm^2$ and should be expressed at a particular distance from the light source.

The UV-C dose is the product of UV intensity [I] (expressed as energy per unit surface area) and exposure time [T].

Therefore: Dose=I*T and is typically in mJ/cm^2 ($\mu W\text{-}s/cm^2$)

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FEATURES OF UV-C

- Kills practically all organisms with the proper dosage
- Peak kill spectrum is 265 nm (UV-C)
- Effective only to objects that light is emitted on
- Dust and dirt dramatically reduce effectiveness
- Plain glass and most plastics block UV-C light
- Intensity falls quickly with distance
- UV-C can burn eyes and skin

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FEATURES OF UV-C

PROS:

- Nontoxic to humans, animals, or the environment
- Rapid microbicide
- Leaves no residues
- Simple to use
- Cost pennies per cycle

CONS:

- Shadow areas have no or little kill
- Affected by organic/inorganic soils or dust on surfaces
- Difficult to effectively use for large areas with many items in them

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MATERIAL PERMEABILITY

Material / Location / Position	Reading Mw-sec/cm2
Nothing Block Straight On	1032
Plexiglass	0
Glass Jar	0
Clear Ziplock Plastic Bag	800
Safety Glasses	0
Packing Tape	630
180 Degree Angle	9
180 Degree Angle Stainless Steel behind	87

180 Degree Angle Stainless Steel Behind

Plexiglass

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MATERIAL PERMEABILITY

Non-Reflective Surfaces (surfaces that mostly absorb UV-C)

- Glass- windows and mirrors
- Wood- finished or painted
- Traditional paint
- Vinyl- wall coverings or flooring
- Formica
- Ceiling Tiles
- Ceramic Floors
- Fabrics

Reflecting Materials

- High polished aluminum
- Some specialized paints

Unlike visible light,
93%-95% of UV-C radiation is absorbed
and is not reflected

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MATERIAL PERMEABILITY

ClorDiSys uses Quartz Glass for bulbs and shelving in UV decontamination units.

- Quartz glass shelving allows for items to be penetrated by UV-C light from all angles.
- Our bulbs offer the best electrical efficiency by converting up to 40% of electrical power into to UV-C power.
- Our LongLife+™ coating process, creates low pressure mercury lamps have an operating life of up to 16,000 hours, maintaining an end-of-life UVC output of >80%.

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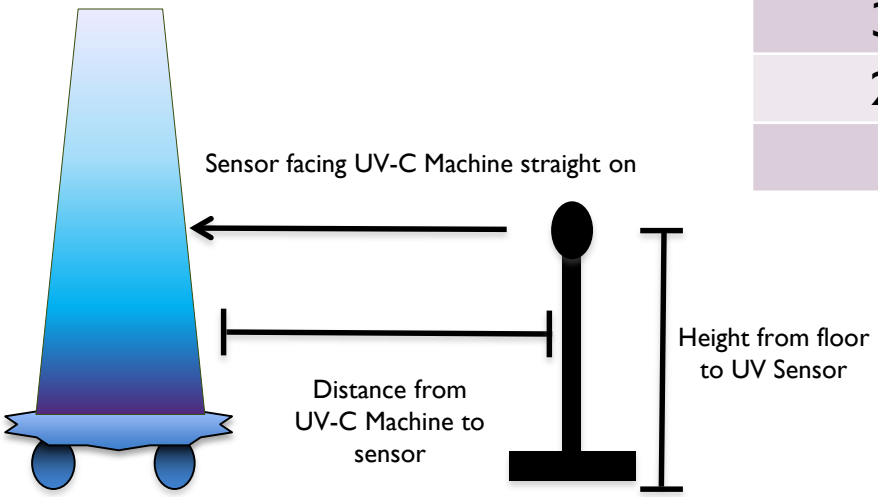
MATERIAL PERMEABILITY



Distance from Source (Ft)	Height from floor (in)	UV Intensity µw-sec/cm^2
10	47"	175
5	47"	705
3	47"	1653
2	47"	2000*
*Maximum reading on UV sensor		

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EXAMPLE OF UV-C KILL REQUIREMENTS

UV Dose (Fluence) (mj/cm2) for a given Log Reduction without photo-reactivation									
		Lamp Type	1	2	3	4	5	6	Reference
Spores	Bacillus subtilis spores	N/A	11.6	22					Light Sources Inc. 2014
Bacterium	Escherichia coli O157:H7 CCUG 29197	LP	2.5	3	4.6	5	5.5		Sommer et al.2000
	Escherichia coli O157:H7	LP	1.5	3	4.5	6			Tosa and Hirata 1999
	Legionella pneumophila ATCC33152	MP	1.9	3.8	5.8	7.7	9.6		Oguma et al. 2014
	Mycobacterium tuberculosis	N/A	6.2	10					Light Sources Inc. 2014
	Pseudomonas aeruginosa	N/A	5.5	10.5					Light Sources Inc. 2014
	Salmonella spp.	LP	<2	2	3.5	7	14	29	Yaun et al. 2003
	Staphylococcus aureas ATCC25923	N/A	3.9	5.4	6.5	10.4			Chang et al. 1985
Yeasts	Saccharomyces spores	N/A	8	17.6					Light Sources Inc. 2014
Molds	Aspergillus niger	N/A	132	330					Light Sources Inc. 2014
	Penicillium digitatum	N/A	44	88					Light Sources Inc. 2014
Protozoan	Cryptosporidium parvum	LP &MP	2.4	<5	5.2	9.5			Craik et al. 2001
	Giardia muris	MP	1	4.5	28+tailing				Craik et al. 2000

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EXAMPLE OF UV-C KILL REQUIREMENTS

UV Dose (Fluence) (mj/cm2) for a given Log Reduction without photo-reactivation									
		Host	Lamp Type	1	2	3	4	5	Reference
Viruses	Adenovirus type 15	A549 cell line (ATCC CCL-185)	LP	40	80	122	165	210	Thompson et al. 2003
	Hepatitis A	HAV/HFS/GBM	N/A	5.5	9.8	15	21		Wiedenmann et al. 1993
	Influenza	N/A	N/A	3.4	6.6				Light Sources 2014
	Poliovirus 1	BGM cell line	N/A	5	11	18	27		Tree et al. 2005
	Rotavirus	MA104 cells	LP	20	80	140	200		Caballero et al. 2004

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CASE STUDY:
ANIMAL RESOURCES CENTRE

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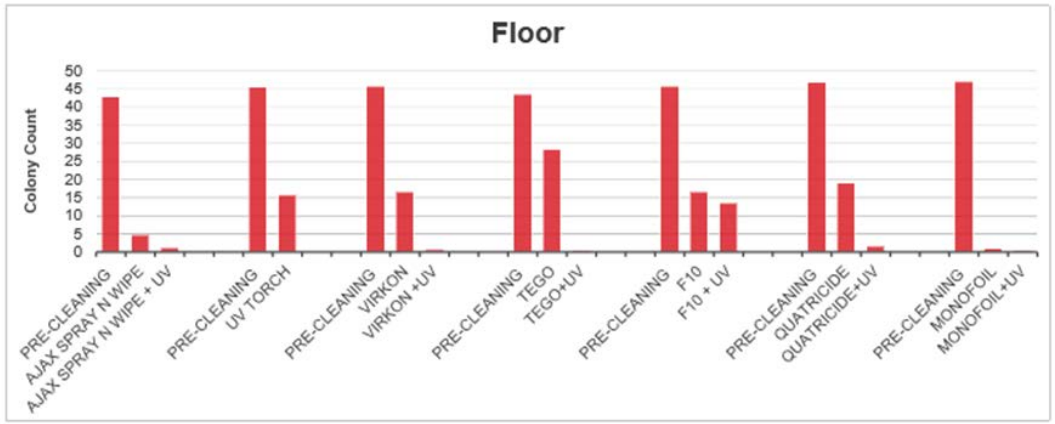
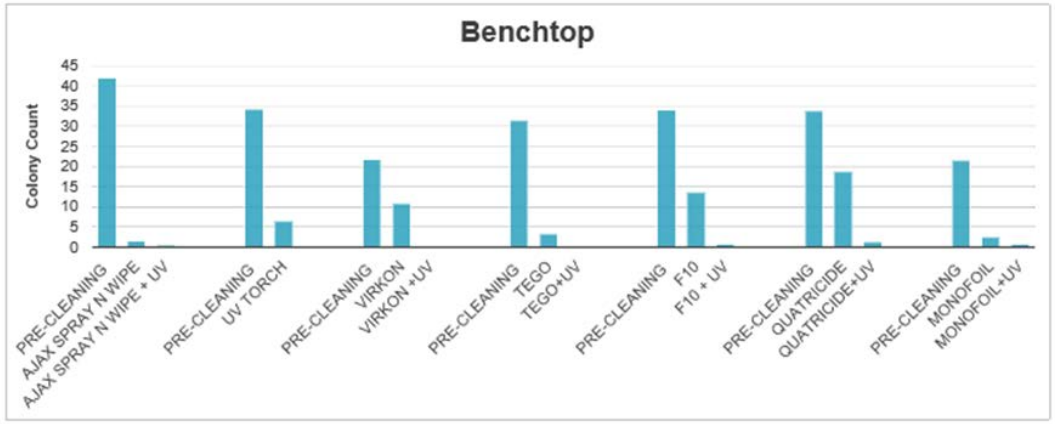
ANIMAL RESOURCES CENTRE





Animal Resources Centre

Southern Hemispheres largest rat/mouse supplier

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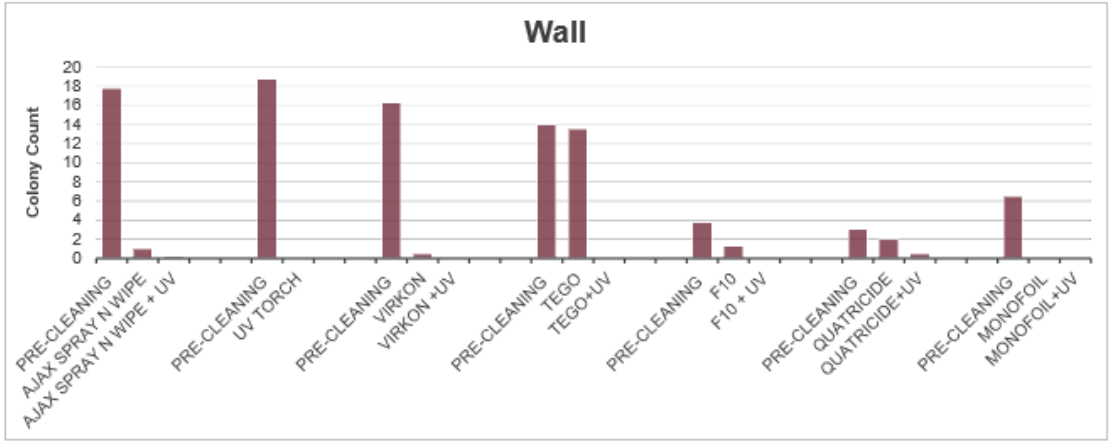
CASE STUDY:
ANIMAL RESOURCES CENTRE



Animal Resources Centre

South Hemispheres
largest rat/mouse supplier

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CASE STUDY:
ROWAN UNIVERSITY

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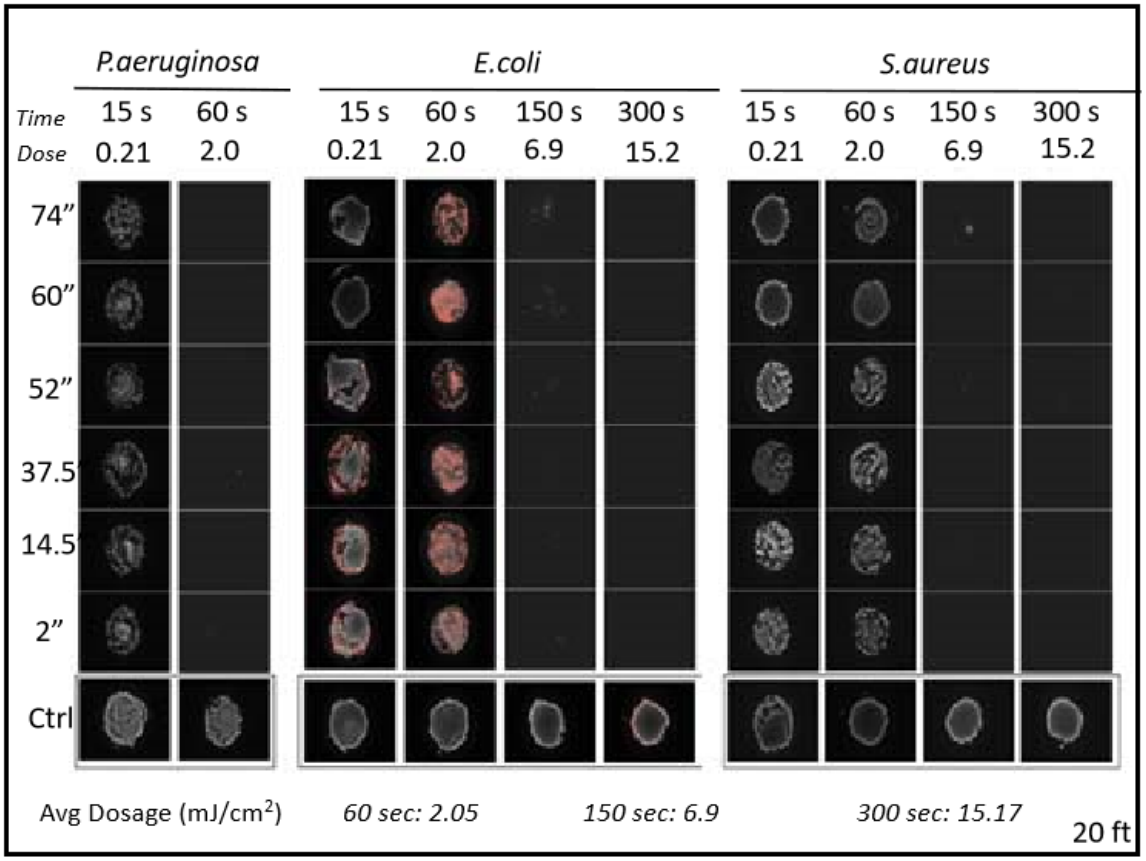
Rowan University

Research University in New Jersey

CASE STUDY:
ROWAN UNIVERSITY



Rowan University

Torch testing at varying intervals

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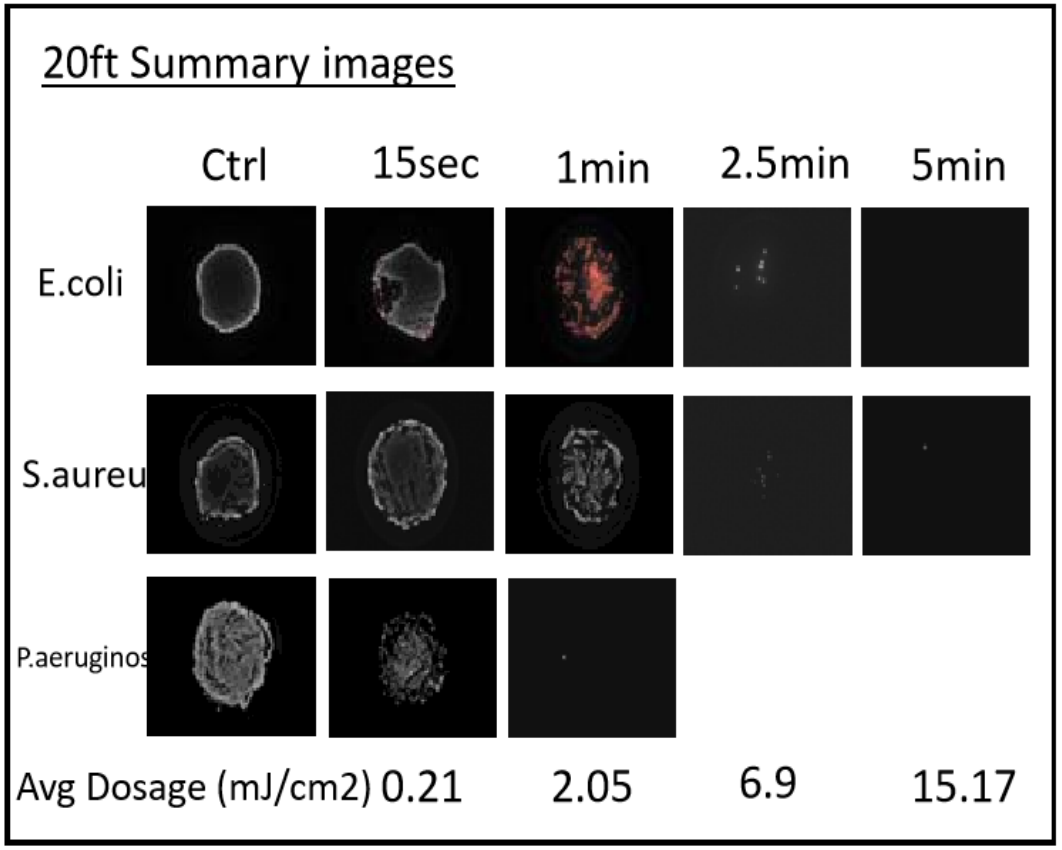
CASE STUDY:
ROWAN UNIVERSITY

Rowan University

Torch testing at 20ft at varying intervals



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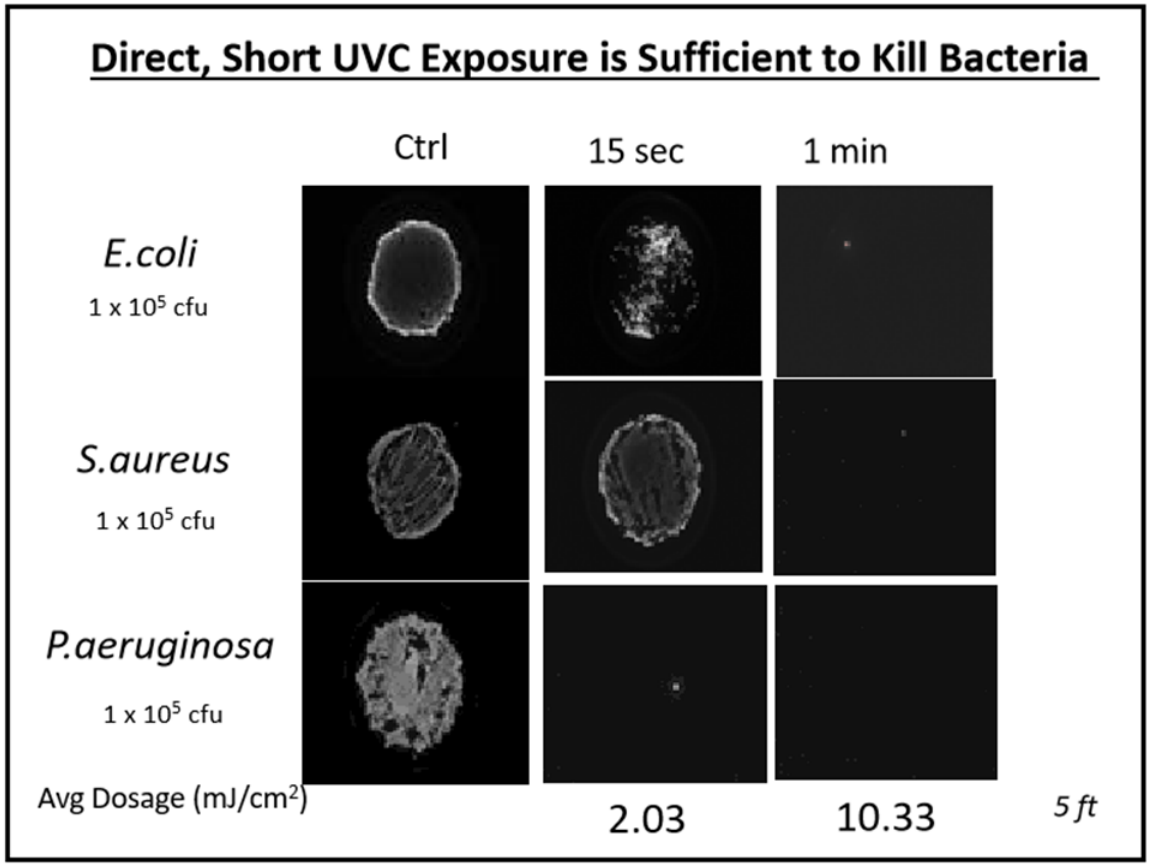
CASE STUDY:
ROWAN UNIVERSITY



Rowan University

Torch testing at 5ft at varying intervals

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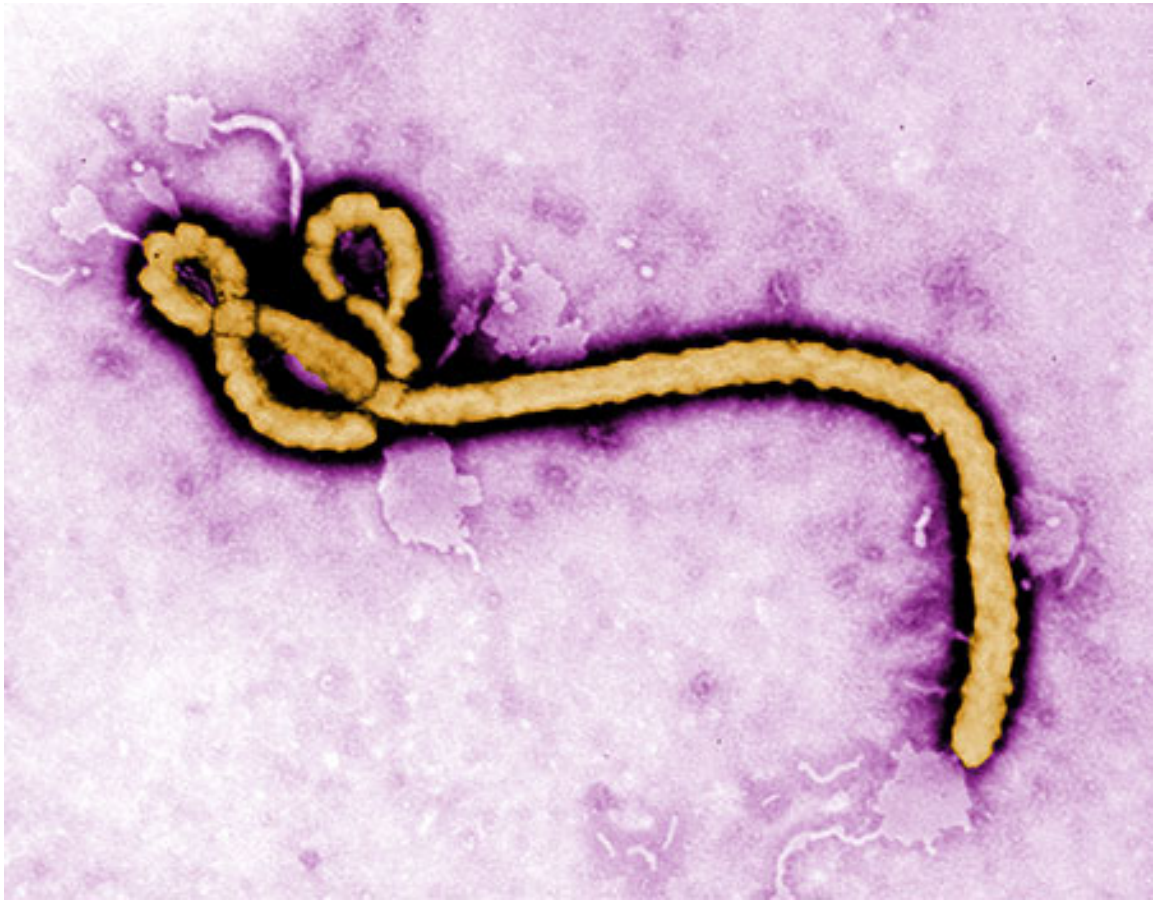
CASE STUDY: EBOLA



The 2014 Ebola Crisis caused public outcry and the need for our aid in preventing further spread of disease.

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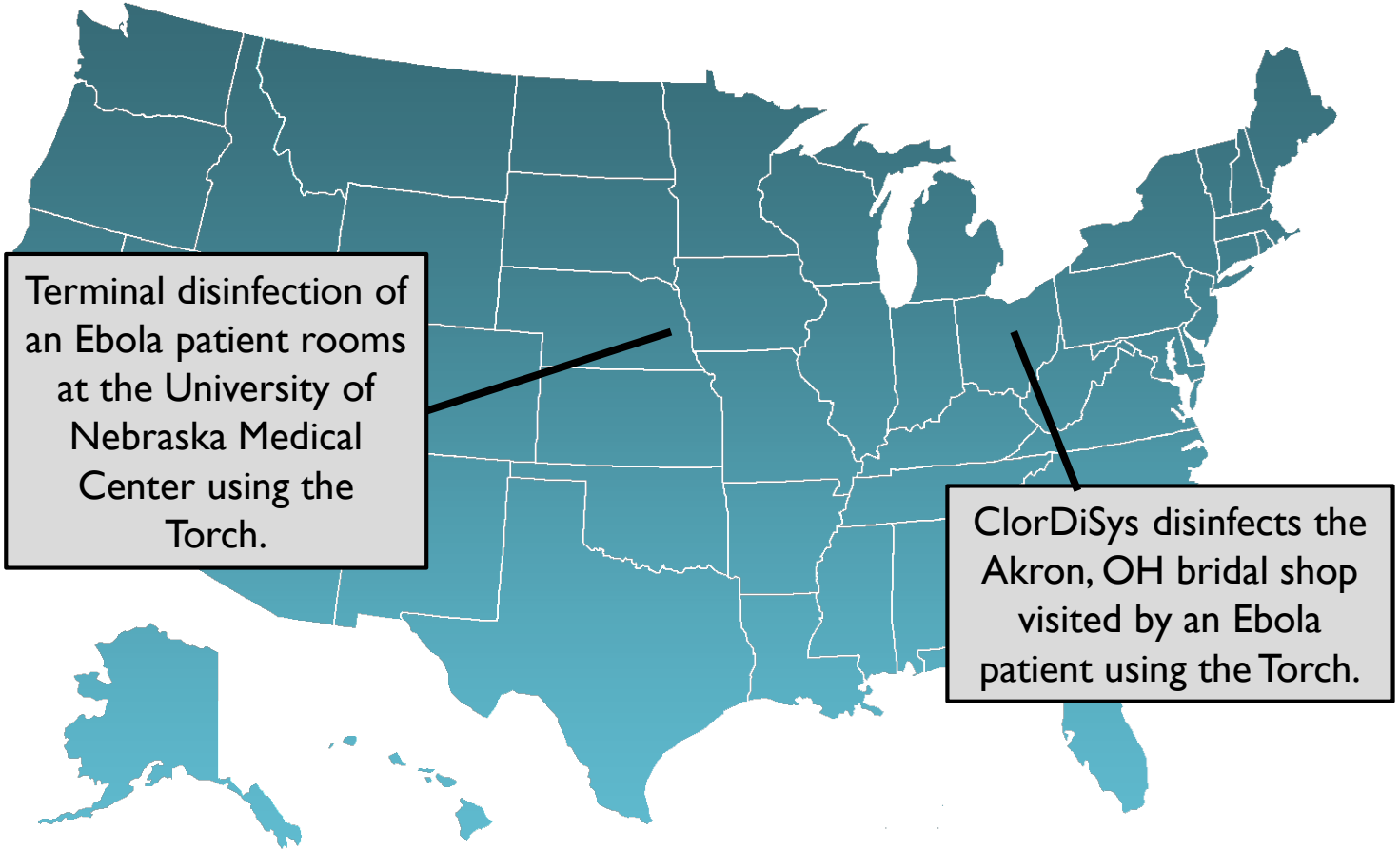
CASE STUDY: EBOLA



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CASE STUDY: EBOLA

Nebraska Biocontainment Unit patient discharge and environmental decontamination after Ebola care

Katelyn C. Jelden BS[a], Shawn G. Gibbs PhD[a,b], Philip W. Smith MD[b,c], Michelle M. Schwedhelm MSN[b,d], Peter C. Iwen PhD[e], Elizabeth L. Beam MSN[b,f], A. Kim Hayes RN[g], Nedra Marion MPA[g], Christopher J. Kratochvil MD[h], Kathleen C. Boulter BA[b], Angela L. Hewlett MD[b,c], John J. Lowe PhD[a,b,*]

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[b] *Nebraska Biocontainment Unit, Nebraska Medicine, Omaha, NE*
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[g] *Division of Infection Control and Epidemiology, Nebraska Medicine, Omaha, NE*
[h] *Office of the Vice Chancellor for Research, University of Nebraska Medical Center, Omaha, NE*

University of Nebraska Medical Center℠

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ENVIRONMENTAL DECONTAMINATION OF ISOLATION UNIT

After patient dismissal, PPE protocols used for cleaning the NBU are consistent with patient care PPE protocols.[6] The patient room is cleared of linen and solid waste, and personnel in full PPE (gown, booties, triple gloves, head covering, face shield, and mask) continue processing waste and linen out of the NBU with a pass-through autoclave.[3] Once all infectious waste is sterilized, the remaining HCWs left in the unit follow standard doffing procedures to exit. The NBU is sealed and left undisturbed for 48 hours to allow high air flows of 15–19 high-efficiency particulate absorption–filtered air exchanges per hour within the NBU to promote desiccation of the remaining virus.[9]

After 48 hours, NBU staff decontaminate the unit through manual disinfection and ultraviolet germicidal irradiation (UVGI). Unit HCWs and nonclinical supervisors perform decontamination instead of environmental service workers to avoid exposure of additional individuals, to ensure competency with PPE, and to maximize understanding of the risks and hazards. Infection control personnel observe and provide quality assurance throughout the terminal cleaning. Decontamination procedures were developed by the NBU's leadership team and were then evaluated and approved by hospital infection control personnel to provide a check and balance system to maximize safety. Infection control personnel intentionally do not participate in the decontamination but observe that all items on the cleaning checklist are decontaminated properly.

Floors are mopped twice with hospital-grade disinfectant, starting from the NBU's entrance and ending with areas likely to be most contaminated in the patient room. Disposable items from the patient room are autoclaved and discarded into the existing NBU's waste stream. Medical equipment is manually disinfected according to manufacturer recommendations by HCWs cleaning in tandem to wipe all surfaces while being observed by infection control personnel.

Four UVGI generators (Torch, ClorDiSys Solutions, Lebanon, NJ) are used as a final disinfection step after all surfaces have been bleach wiped. Each unit emits 254 nm ultraviolet C spectrum light from low-pressure, mercury-arc lamps. All 4 units are used in tandem to ensure an exposure level >17 mJ/cm^2, which has been previously found to inactivate Ebola virus.[10] All surfaces in the unit, including the equipment in the unit, are exposed to a minimum of 100 mJ/cm^2. This is accomplished by using multiple UVGI units simultaneously surrounding equipment or within rooms and by strategically placing the UVGI monitor in areas to ensure readings are lower than actual exposure of many surfaces. Large medical equipment is exposed by arranging 4 UVGI units around each individual machine, with a UVGI monitor under the equipment. Areas with a higher likelihood of contamination, such as the patient room and bathroom, are treated for longer exposures, with the patient room receiving an exposure >800 mJ/cm^2 and the bathroom

CASE STUDY: EBOLA

Considerations for Safe EMS Transport of Patients Infected with Ebola Virus

John J. Lowe, PhD, Katelyn C. Jelden, BS, Paul J. Schenarts, MD, Lloyd E. Rupp, Jr., EMT-P, Kingdon J. Hawes, NREMT-P, Benjamin M. Tysor, NREMT-P, Raymond G. Swansiger, PA-C, MPAS, Shelly S. Schwedhelm, RN, MSN, Philip W. Smith, MD, Shawn G. Gibbs, PhD, CIH

University of Nebraska Medical Center℠

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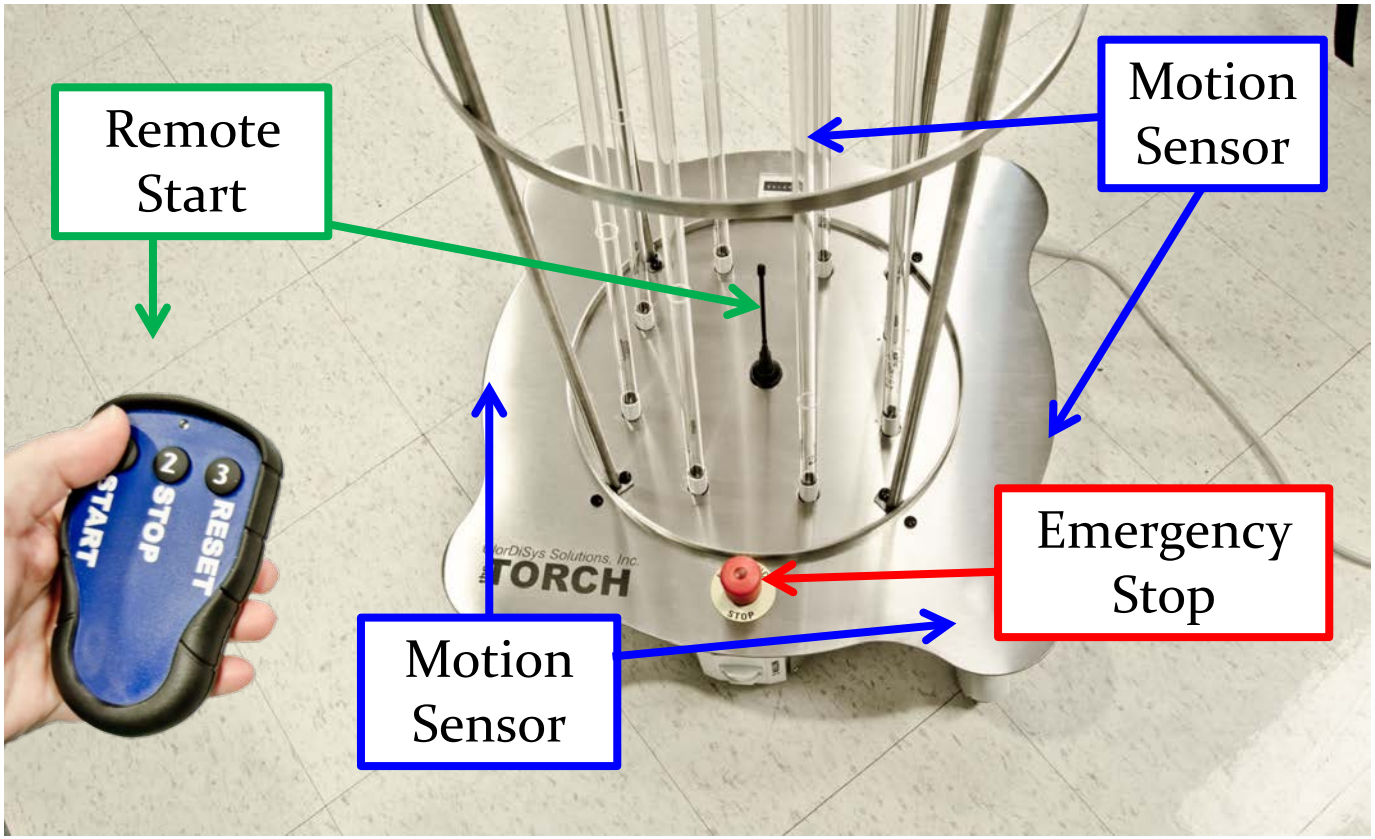
Decontamination

Following patient admission into the biocontainment unit, a biocontainment staff member donned in Tyvek suit, N-95 respirator, face shield, and gloves mopped the hospital hallway and elevator route with hospital-grade disinfectant. The elevator was wiped down with disinfectant bleach wipes. The through-hospital transportation route was held by security until cleaning was complete and four times the manufacturer recommended contact time had elapsed.

The contaminated ambulance was relocated to an isolated, controlled-access area for decontamination as recommended.[1] Decontamination was performed by two biocontainment unit staff donned in Tyvek suits, gloves, boot covers, and full-face respirators with (F)OV/AG/P95 organic vapor/acid gas cartridges. The full-face respirator was used to minimize exposure to disinfection chemicals, and to reduce the likelihood of splash exposures. The plastic sheeting covering the patient compartment was removed by folding it in onto itself, similar to how one doffs a Tyvek suit; it was contained within autoclave waste disposal bags, which were processed in a pass-through autoclave before ultimate disposal.[6] All surfaces of the ambulance (cab and patient compartment), including walls, ceiling, and floor, were thoroughly wiped with bleach solution. In a final decontamination step, the back of the ambulance was exposed to over 500 mJ/cm^2 ultraviolet germicidal irradiation. The ambulance remained out of service for 48 hours in the isolated area for decontamination.

TORCH SAFETY FEATURES



Torch Safety Features

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TORCH SENSOR MODULE

The Torch Sensor Module can measure and document the UV disinfection process.

- Logs run data: room name/number, time & date, and UV intensity and dosage data to document disinfection efforts.
- Run data can be downloaded for archival purposes.
- Can be utilized to periodically verify output.

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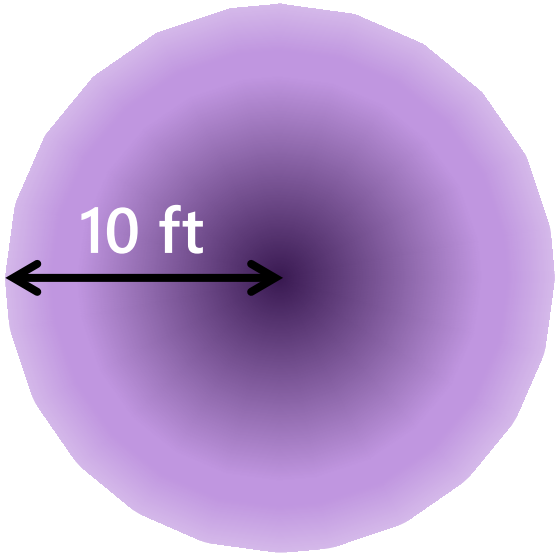
TORCH SENSOR MODULE

UV-C Dosing



10.8 mJ/cm^2

Typical calculated dosage for a 2 log (99%) reduction of bacterial organisms is about 5 mJ/cm^2 (mW-s/cm^2).

Typical calculated dosage for a 2 log (99%) reduction of spores is about 40 mJ/cm^2 (mW-s/cm^2).

The Torch produces an intensity of approximately 10.80 mJ/cm^2 per minute at a 10 ft distance which achieves:

2 log bacterial kill in under 1 minute

and a

2 log reduction of spores like C-Diff in under 5 mins

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TORCH+

The Torch+ incorporates data collection and reporting systems in addition to the features of the Torch:

- Controlled via iPad™
- Measure and report on actual UV dosage
- Document the Operator Name, Room #, actual intensity & treatment dosage, time & date
- Run records automatically emailed for report generation and data storage
- Only pennies per cycle to use and 16,000 hour bulb life

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TORCH+

Connect your supplied sensor to the Torch+. Point the sensor at the unit at the distance you wish to measure intensity at. You can also control the unit based on dosage instead of time.

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TORCH+

On the Settings page you can enter your location, Time and Date, Dosage Fail Timer and Enable/Disable email functionality. Delay Start and UV Sensor Max Scale are non-editable to ensure your safety and proper functionality of the machine. Provide an email address that you want the run information sent to if email is enabled.

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TORCH+

To start a run, navigate back to the Home page. Make sure no one is present in the room and that the door(s) are closed and press the Start Torch + button. When the run begins, the Main screen will change to show the process parameters.

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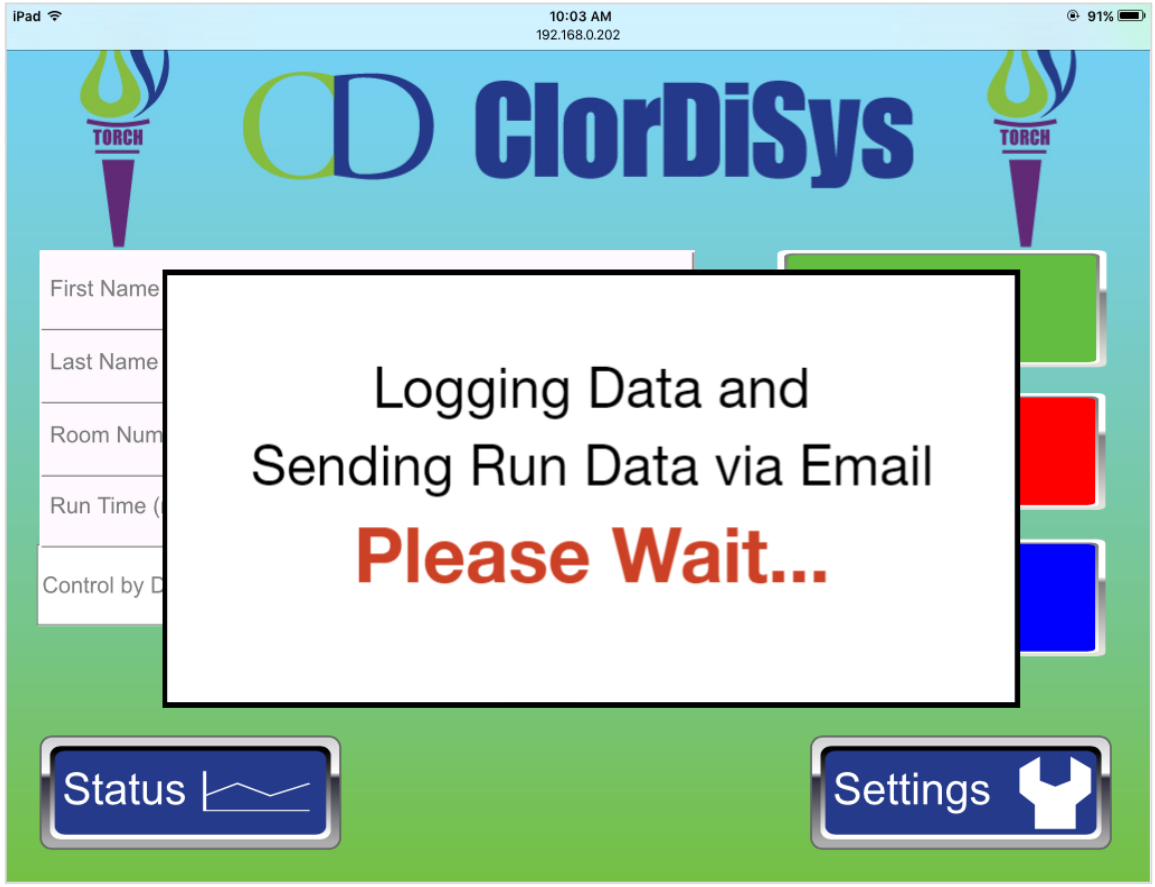
TORCH+



Upon run completion, a pop-up will appear as the Torch+ logs data and sends your run data to your email address if enabled.

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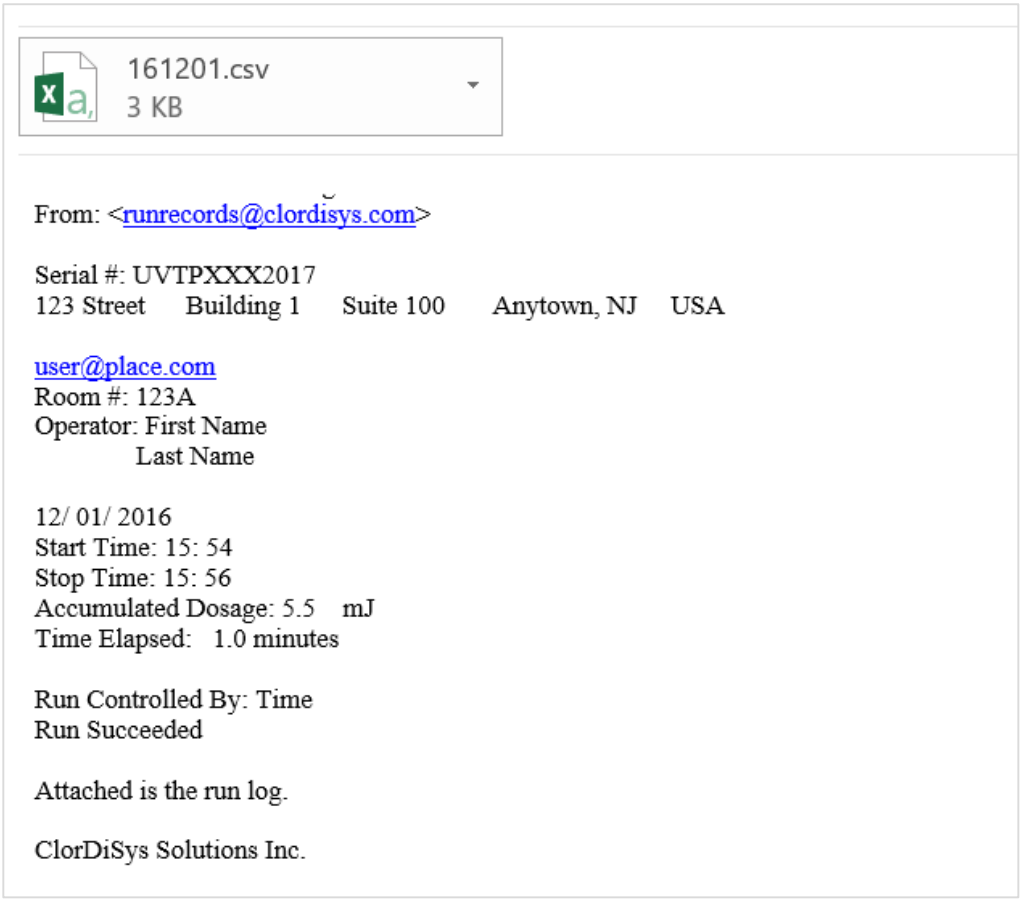
TORCH+



161201.csv
3 KB

From: <runrecords@clordisys.com>

Serial #: UVTPXXX2017
123 Street Building 1 Suite 100 Anytown, NJ USA

user@place.com
Room #: 123A
Operator: First Name
Last Name

12/ 01/ 2016
Start Time: 15: 54
Stop Time: 15: 56
Accumulated Dosage: 5.5 mJ
Time Elapsed: 1.0 minutes

Run Controlled By: Time
Run Succeeded

Attached is the run log.

ClorDiSys Solutions Inc.

When a run ends, you will get an automatic email showing all the run parameters as well as an attached Datalog file. The Datalog files will contain previous runs of the day in addition to the most current run. If email functionality is disabled, the data can be downloaded from the external USB drive.

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LANTERN

- Only pennies to operate
- Seconds to set up
- Operates on 115 VAC
- Adjustable start timer
- Adjustable exposure timer
- Hangs Upside Down for top-down disinfection
- Sits Upright for small rooms

The Lantern is a small, low cost UV-C generator designed to disinfect small areas, tanks/vessels, parts, supplies, tools, etc.

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FLASHBOX MINI

Tabletop device designed to disinfect small items such as tablets, remote controls, cell phones, pens, etc. in a minute or less.

Usable Space for items:

4”H x 8.5”D x 9.75”W

Overall Dimensions:

8.25”H x 11”D x 14.5”W

Power:

115 VAC, 60 Hz, 2 Amps

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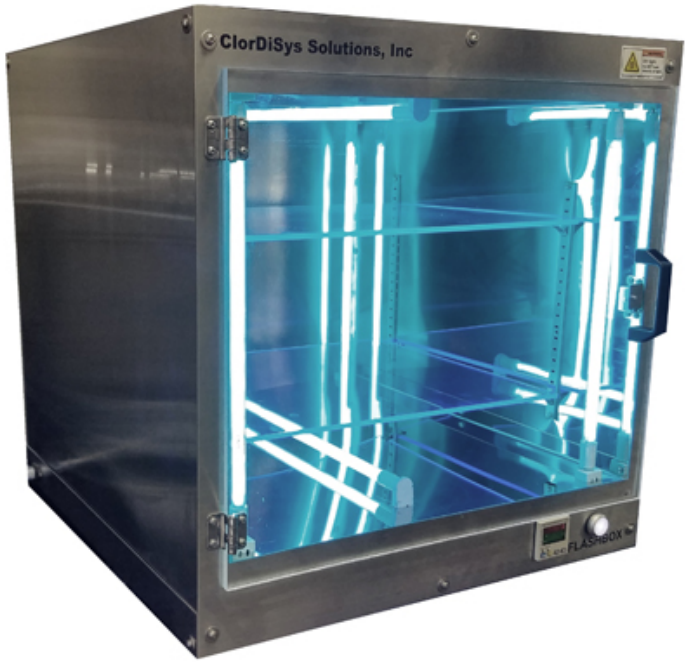
FLASHBOX

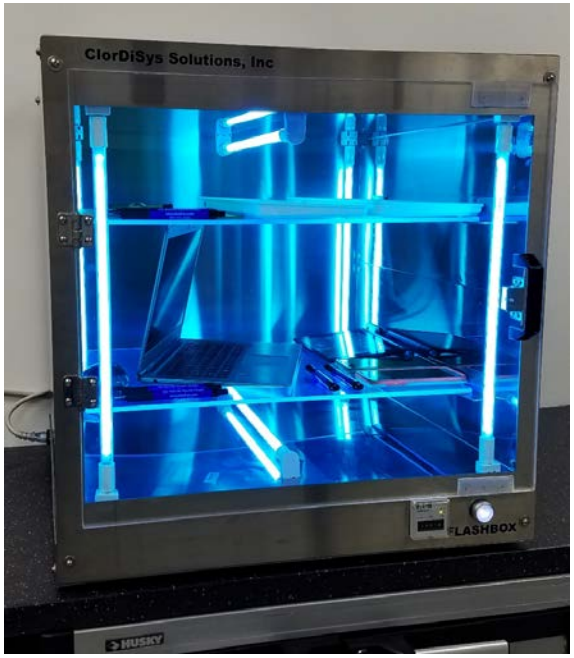
Designed to disinfect small items such as
tablets, remote controls, keyboards, laptops, components,
supplies, pens, tools, glasses, shoes, test equipment,
electronics, etc. in a minute.



Usable Space for items:
14”H x 17.5”D x 17.5”W

Overall Dimensions:
23.5”H x 22.5”D x 22.5”W

Power:
115 VAC, 60 Hz, 3 Amps



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TORCH FLEX

The Torch Flex is a low cost UV-C generator designed to disinfect harder-to-reach areas

- 200 degree bend radius
- 40” Bulb Length
- Adjustable exposure timer
- 10.8 mJ/cm^2 per minute at 4 feet

to achieve:

2 log bacterial kill in under 1 min

and a

2 log reduction of spores in under 5 mins

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TORCH DOUBLE FLEX

The Torch Double Flex is designed for multiple difficult to reach areas to be flooded with UV-C light at once.

- Two flexible arms each with two quartz glass UV bulbs
- 180 degree bend radius
- 36” Bulb Length
- Adjustable exposure timer
- Approx. 21 mJ/cm^2 per minute at 4 feet; 3 mJ/cm^2 per minute at 10 feet

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TORCH AIRE-RECESSED

- Torch Aire-Recessed™ is an ultraviolet light room air disinfection unit to eliminate airborne microbes.
- The Torch Aire-Recessed™ is easily mounted in a ceiling and fits especially well within a drop ceiling format.
- Torch Aire-Recessed™ pulls air inward and allows for enclosed UV-C bulbs to disinfect the air that passes over the bulbs.
- Torch Aire-Recessed™ is constructed of stainless steel with a reflective aluminum exposure chamber.

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TORCH AIRE-MEGA

- Torch Aire-Mega™ is a portable room air disinfection system with enclosed UV-C bulbs so it can be utilized in an occupied area.
- When in operation, air is drawn into the fixture through the four louvered filter panels which are located around the base of the fixture. The air passes then into the exposure chamber where it flows over twelve UV-C bulbs and is disinfected. The air then leaves the fixture through the louvered exhaust panel that is located on the top of the fixture.
- Torch Aire-Mega™ is constructed of stainless steel and has a high polished interior for optimal reflectivity.
- The maximum treatment capacity is 120,000 cubic feet per hour, allowing for large spaces to have a sufficient amount of air exchanges to have continual disinfected air.

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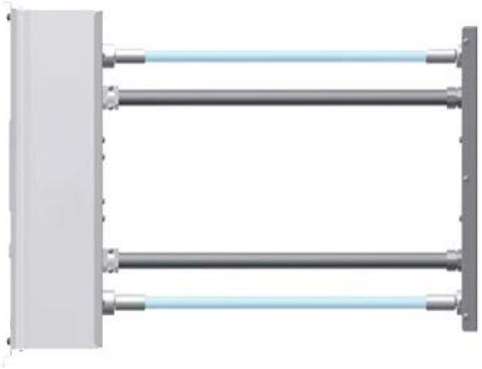
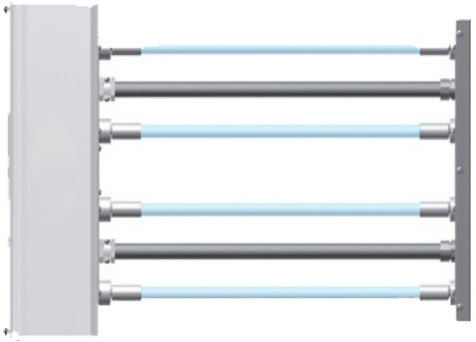
AIRGLOW

- UV-C Ultraviolet lamps reduce or eliminate the growth of bacteria, mold and spores and also prevent the spread of airborne cold and flu viruses, as well as other airborne transmitted diseases.



- Continuous disinfection without special attention or risk of exposure to people in room

- 120 volts or 230 volts, 50/60 Hz



- Constructed of corrosion-resistant Stainless Steel
- 13,000hrs bulb lifetime
- Low maintenance

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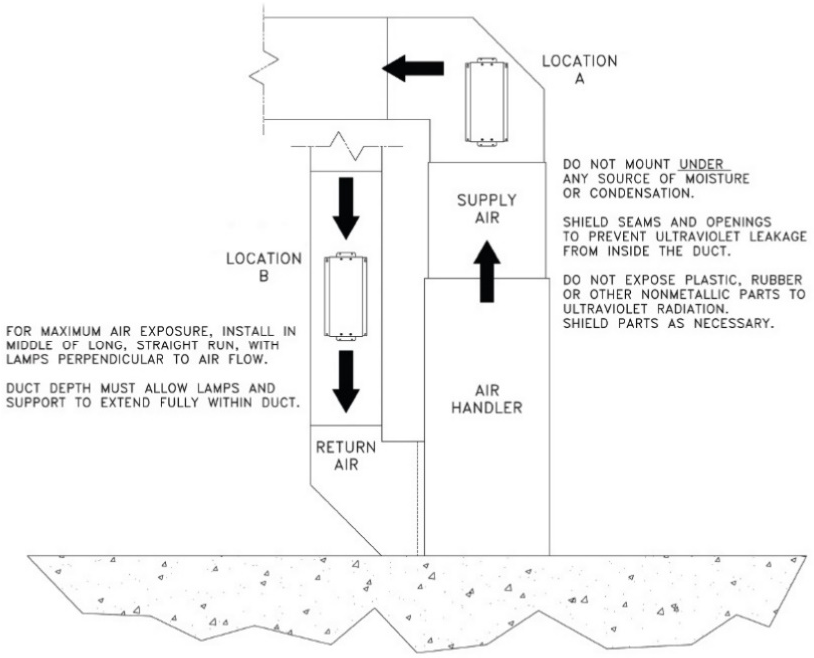
AIRGLOW

- UV-C light system designs can treat both supply and return airflow with in-duct mounting.
- In-duct lamps are positioned perpendicular to the duct run, allowing for mold and other pathogens to have a longer exposure to the UV-C light as they pass through the ducts.
- UV-C lights mounted in the return air ducts are beneficial because of the slower air velocity which increases exposure time even further.



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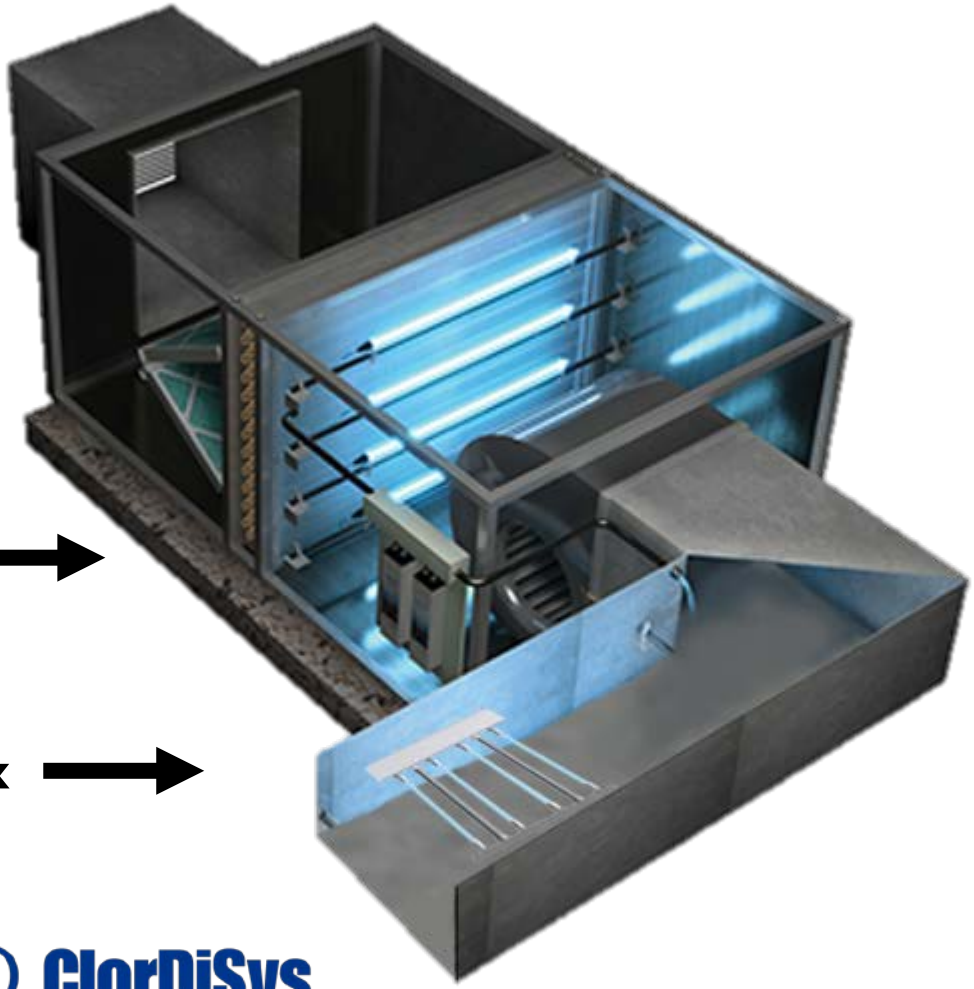
AIRGLOW

UV-C lights in coiling coils →

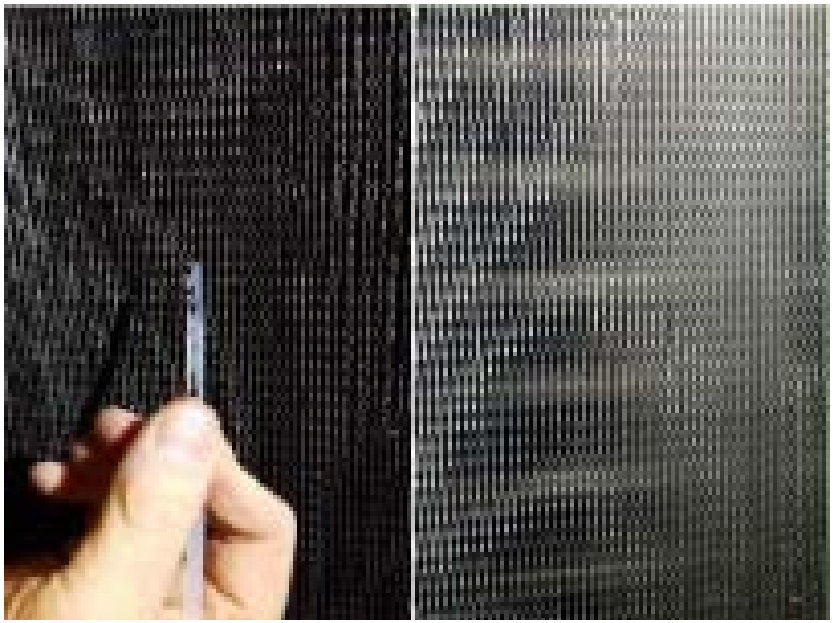
UV-C lights in ductwork →



ClorDiSys

AIRGLOW

- UV-C lights mounted on coils reduce biofilms.
- Biofilms create friction and increase static pressure which case the blower and HVAC system to work harder and less efficient.
- Clean coils can deliver a 30% increase more in cooling capacity, even 1.5 thousands of an inch can have a dramatic loss in energy efficiency.



Mold Growth on Coils before installing UV-C fixtures (left)
Clean coils after UV-C fixture installation (right)

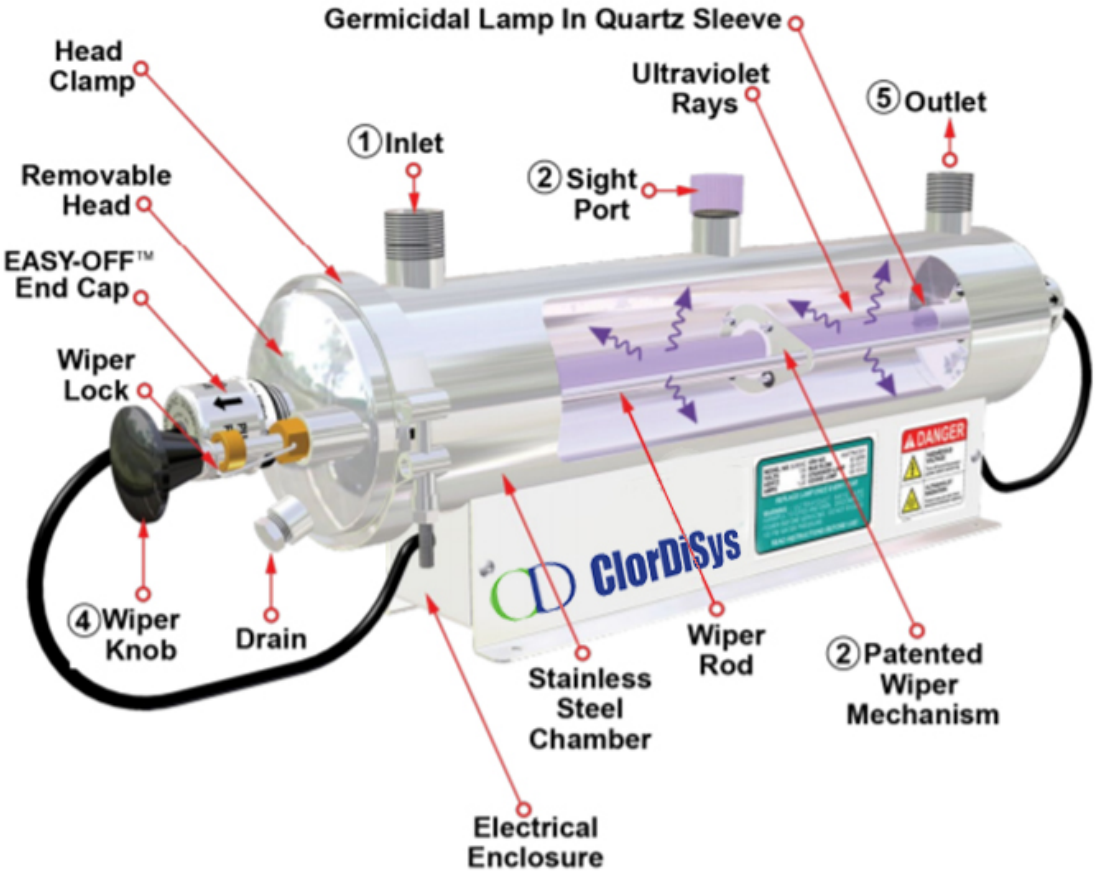
ClorDiSys

FLASH FLOOD

- The Flash Flood utilizes UV-C disinfection that can kill almost all harmful organisms.
- Hundreds of gallons of water are purified for a penny of operating cost.
- No chemicals are needed.
- The Flash Flood offers continuous disinfection without the need for special attention.
- Simple installation and maintenance.
- The Flash Flood ranges in capacity from 3 to 416 gallons per minute depending on use requirements.

ClorDiSys

FLASH FLOOD



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CLORDISYS HISTORY

The Flash Tunnel is a UV Disinfection system providing a quick, chemical-free, liquid-free method of aseptically bringing equipment and supplies into a barrier facility.

ClorDiSys

FLASHBAR

Flashbar is a UV-C generating light fixture that can be configured to create a UV Disinfection Pass-Through room designed to safely disinfect components entering a clean area without risk of contamination. This provides a more consistent approach compared to spray and wipe methods.

ClorDiSys

CLORDISYS HISTORY

The Flash-Thru UV Disinfection Pass-Through chamber is designed to safely transport materials into a clean room without risk of contamination.

Place an item inside dual-door chamber, and after 1 minute UV-C exposure time has elapsed, it can safely be brought inside the clean room.

CLORDISYS HISTORY

- Portable, enclosed UV-C bulbs with reflective metal linings
- Disinfect personnel with PPE prior to removal of clothing
- Stand in front of 8 UV-C bulbs and be completely disinfected from head to toe, turn around to treat backside

ClorDiSys

APPLICATIONS

- Room disinfection with portable units
- Small item (Tablet, phone, PPE, tool, devices, etc.) disinfection within chamber
- Pass-through Rooms/Chambers (supplement Spray & Pray)
- Transport Vans and Processing Vessels/Tanks
- Disinfection Tunnels
- Reduction of airborne organisms –
  - Continuous run supply duct disinfection
  - Continuous run room air disinfection

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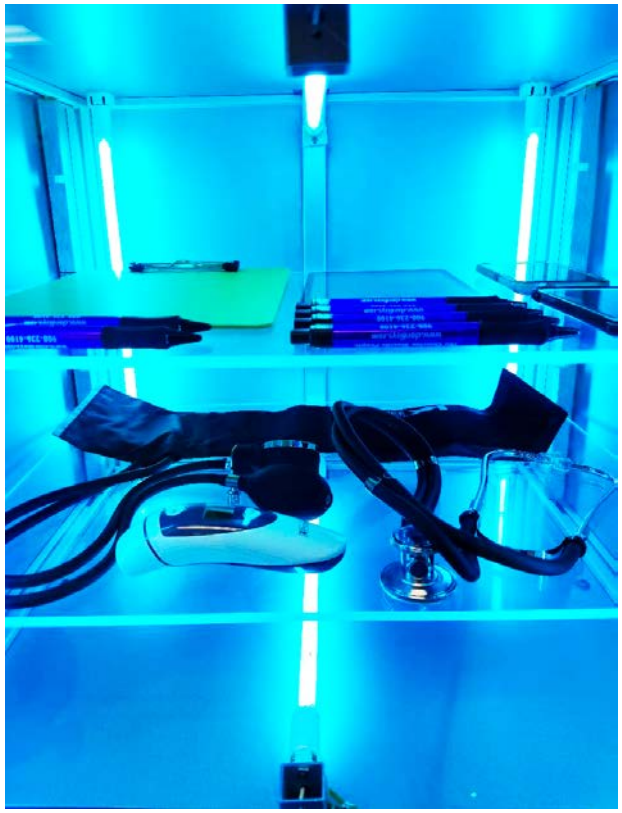
APPLICATIONS



Tools Including:

- Blood Pressure Cuffs
- Stethoscopes
- Cell Phones
- RFID Tags
- Pagers
- Keyboards
- Tablets
- Pens
- Etc.

ClorDiSys

APPLICATIONS

Ultraviolet Light Disinfection of Safety Glasses

- Safety glasses are many of times immediately thrown out after use, increasing costs
- If sanitized, most methods are insufficient

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APPLICATIONS

Tools

- Tools by placing them in the large, enclosed, flat space.
- The lid lifts up and stays up by itself for easy working ability
- The lights are on the ceiling of the unit, so there is no is of exposure for people in room. Clear window indicates when on.

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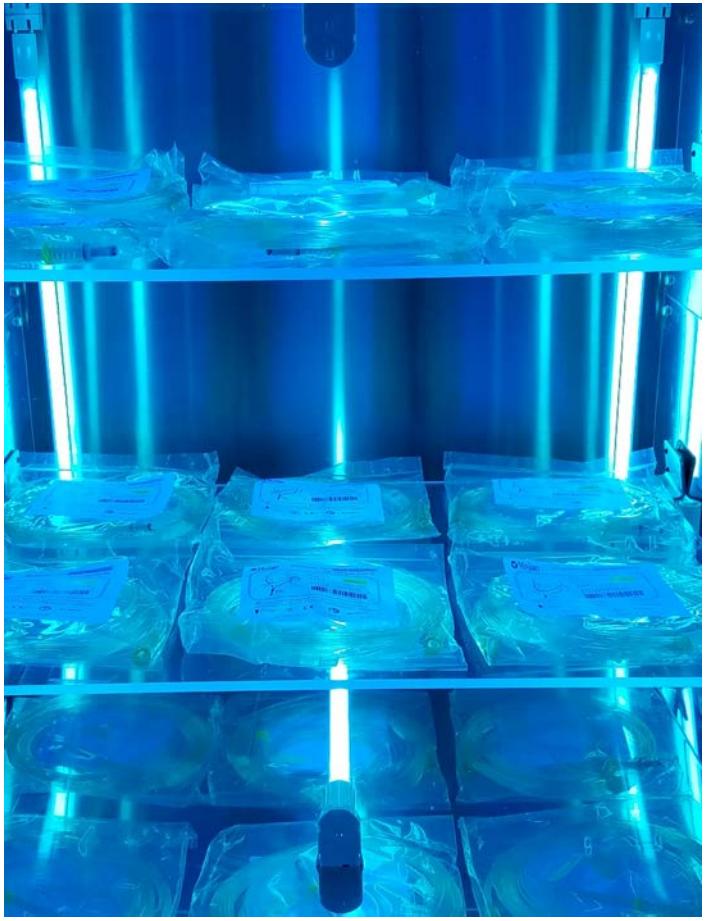
APPLICATIONS



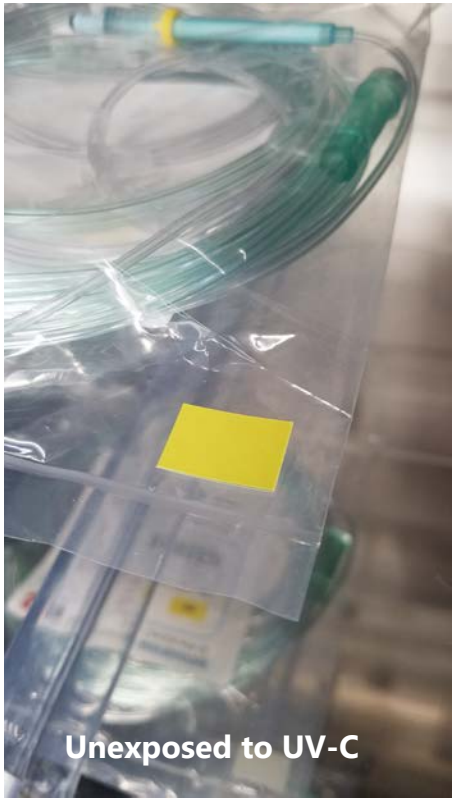
Packaging and Components

- Eliminate harmful organisms on packaging before entering clean room
- Treat completed product once packaged to expose to ultraviolet light and ensure that there are no organisms on surface

ClorDiSys

APPLICATIONS

Outer Finished
Product
Packaging
Disinfection



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APPLICATIONS

- Quartz tubing can allow small components to slide down and be exposed to light from outside
- Tube width can be adjusted depending on size of items
- UV-C exposure would only need to be very short as long as bulbs were positioned close to tubes (high intensity)

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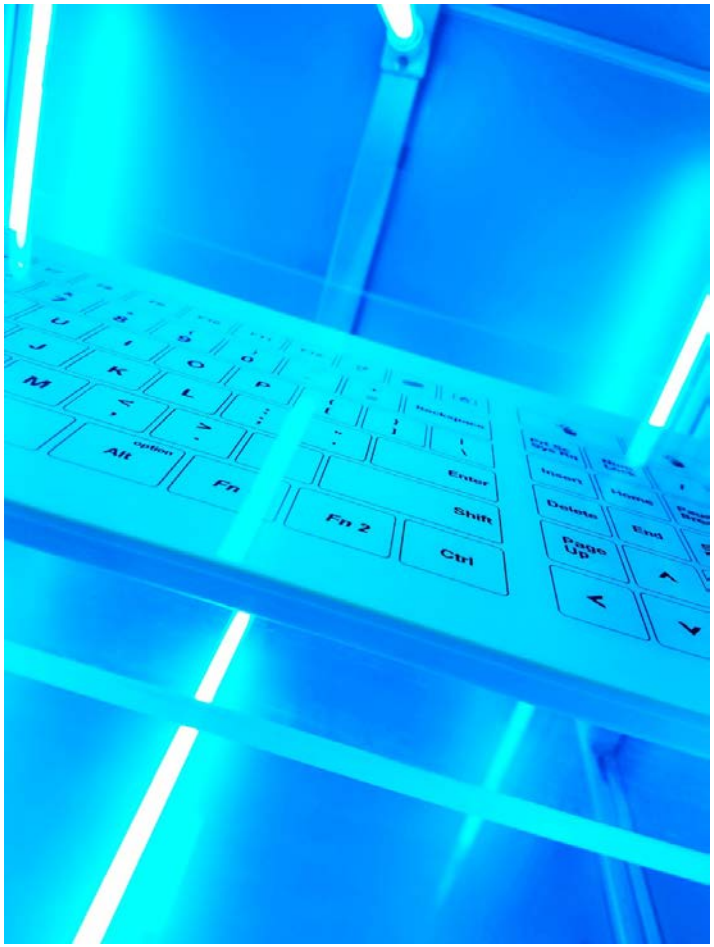
APPLICATIONS

Electronics

- UV-C will not damage electronics
- Flashbox is ideal for phones, tablets, laptops, keyboards, remotes, RFID tags, etc. Basically any electronics that can be damaged by a thorough liquid disinfection.



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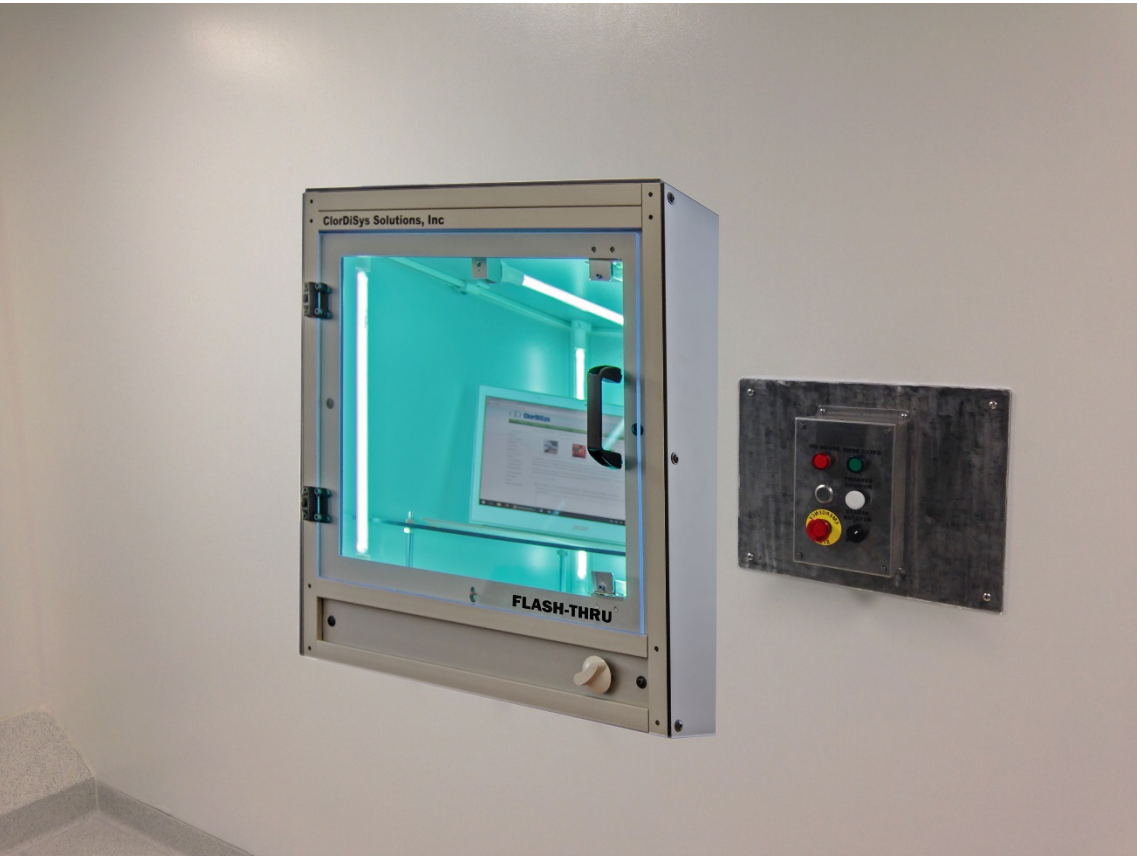
APPLICATIONS



Pass-Through

- Introduce tools or supplies into a clean room via a disinfection chamber pass-through
- UV-C indication stickers can be added to prove exposure

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APPLICATIONS

Animal Cages

- Place animal cages in Flashbox as a chamber, a Flash Tunnel if a conveyor system is desired, or within a disinfection room using the Flashbar

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APPLICATIONS

Custom Disinfection Room

- Transform a space to become a disinfection room
- Any quantity of Flashbar units can be utilized, it depends on preferred speed and the size of the space
- Any item that can fit in the room can be disinfected, this can allow large items to be disinfected and to treat multiple items at once.

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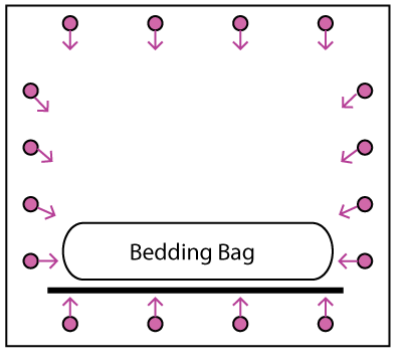
APPLICATIONS

Custom Conveyor System

- Transport bags or other containers into a clean room
- Can be connected to an automated system
- Speed of conveyor can be adjusted to ensure proper dosage is being applied



UV Dosage

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APPLICATIONS

Food Conveyors

- UV-C Lights can be added overhead to disinfect conveyor surfaces.
- This can be done at any location on the conveyor and can be shielded to prevent human exposure.
- Portable units can be moved from conveyor to conveyor.

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APPLICATIONS

Components, Raw Materials/Finished Products

- Components can be tumbled in mixer with UV-C bulbs to help disinfect potentially contaminated product
- In Process or Finished Goods can be exposed to UV-C light directly to eliminated contaminants
- Studies show UV-C rays actively mitigate microorganisms, bacteria, and mold. UV-C rays, emitted at 254 nanometers, are lethal to pathogenic bacteria such as E. coli, Salmonella, L. monocytogens (Listeria), spoilage bacteria, virus, and mold.

APPLICATIONS

UV-C Cabinet

- UV-C lights are internally mounted to ensure complete exposure of light onto surfaces of items.
- Possible applications include, mops, brooms, tools, etc.
- Kill switch ensures that UV-C light will turn off if door is opened during disinfection.
- Customization options can be added to include pegs or magnets to allow mixing equipment, blades, knives, or other tools to be disinfected.

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APPLICATIONS

Cooling and Sub Zero Storage

- UV-C lights can be placed on cooling coils to dramatically reduce biofilms and increase energy efficiency

- UV-C lights are capable of excelling even in sub zero climates
- Air disinfection units can reduce the amount of microbes in the air which can keep products safer as well as fresher for longer

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APPLICATIONS

Packaging

- UV-C can be exposed to packaging to disinfect outside to eliminate potential contamination
- If packaging is thin film, UV-C may penetrate packaging to improve shelf life of food and food safety.

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APPLICATIONS

Studies have found UV-C to be effective on:

- Water
- Milk
- Liquid Sweetener
- Fruits
- Fruit Juices
- Vegetables
- Meat
- Finished goods
- and more…

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APPLICATIONS

Evaluation of the effects of ultraviolet light on bacterial contaminants inoculated into whole milk and colostrum, and on colostrum immunoglobulin G

R.V. Pereira, M. L. Bicalho, V. S. Machado, S. Lima, A. G. Teixeira, L. D. Warnick, and R. C. Bicalho[1]

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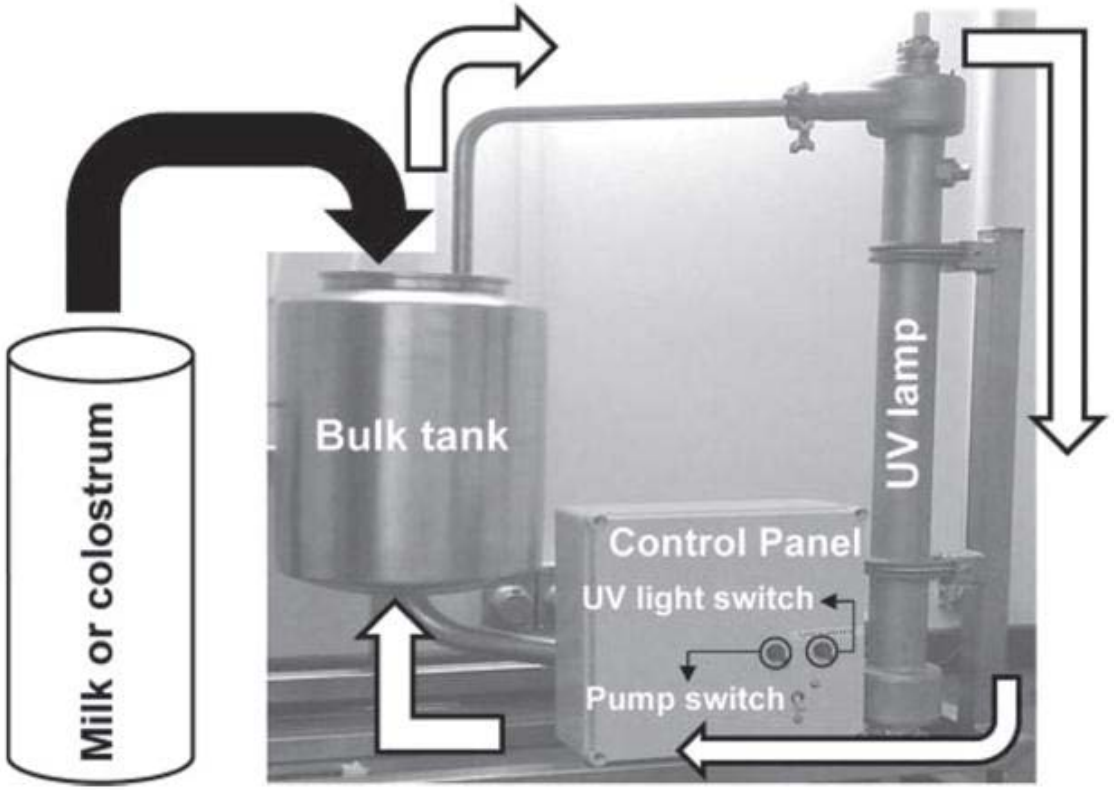
APPLICATIONS

Flow-through UV light unit used for trials. White arrows indicate the continuous flow trajectory of fluids through the UV lamp and returning to the bulk tank when the pump was switched on.



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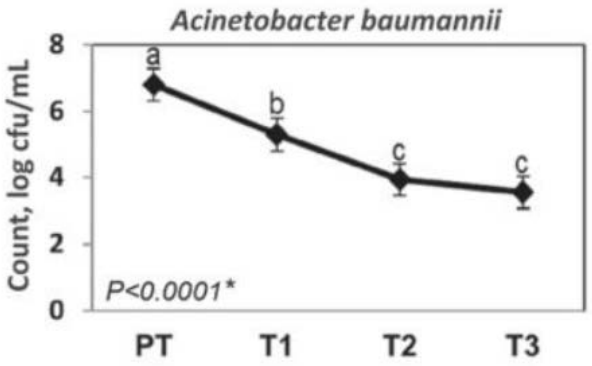
APPLICATIONS

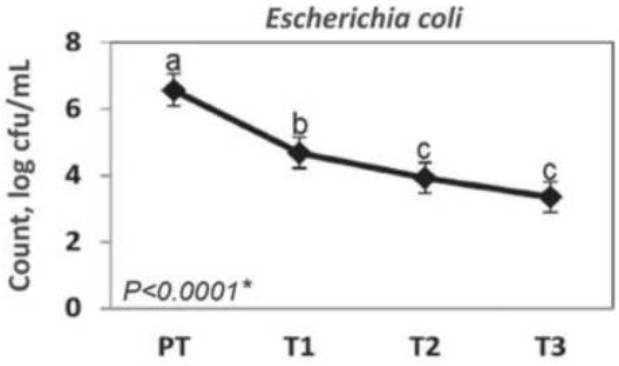
Counts (mean log cfu/mL) for milk samples after UV light continuous (UVC) treatment

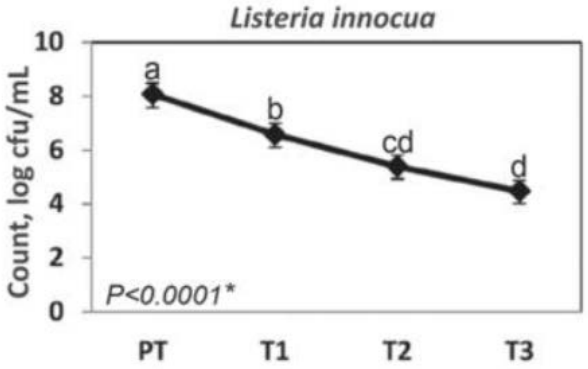
T1 = UV lamp on and after the pump had been on for 2 min and 30 s

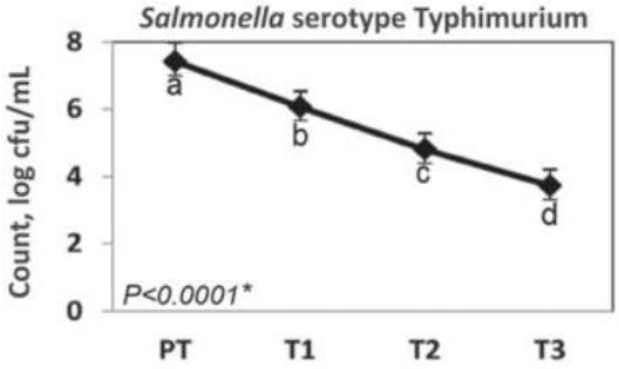
T2 = UV lamp on and after the pump had been on for 5 min

T3 = UV lamp on and after the pump had been on for 7 min and 30 s









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APPLICATIONS

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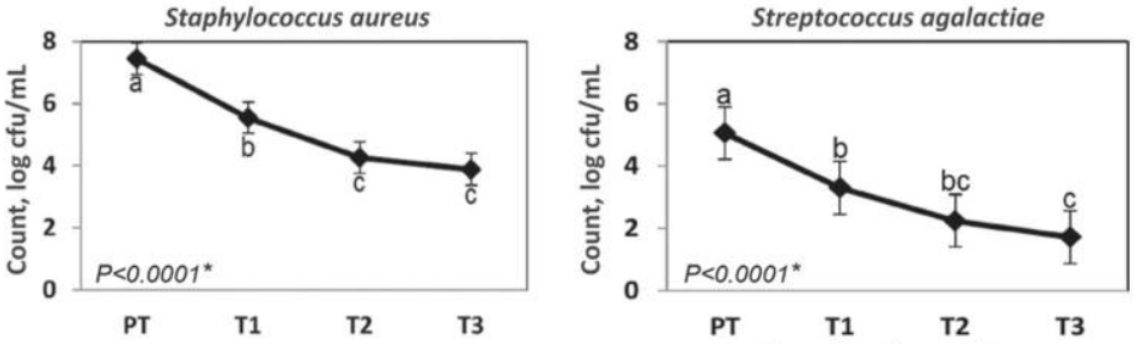

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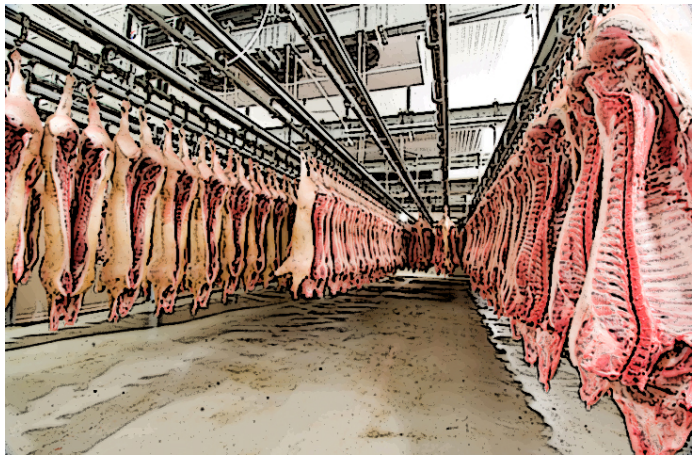
APPLICATIONS



- Air treatment of meat processing facilities with Torch Aire
- UV-C exposure of meat products directly, including ready to eat meats with Flashbar or Flash Tunnel
- Flashbars to treat cooling rooms with the necessary protection against airborne slime and mold-producing organisms.
- Water usage is high, Flash Flood is necessary for water line disinfection and surfaces after rinsing

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APPLICATIONS

- Study indicates that low levels of UV-C produce a reduction in postharvest decay of strawberries

- A University of Washington study determined UV-C kill up to 99.9 percent of pathogens on apples and pears.

- UV-C treatment has no or minimal effect on the sensory quality of fruit, Sablani reports. After the experiments, sensory panels consisting of 30 to 40 people were unable to detect a difference between treated and untreated pears.

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APPLICATIONS

Ultraviolet Light Disinfection:

- Chemical free
- 99% kill of harmful organisms in minutes
- Easy to use
- Affordable
- Portable

APPLICATIONS

WEBINARS

January 16- 1:00pm EST

CD vs. VPHP

January 16- 2:00pm EST

Clean Break for Food and Pharma

WORKSHOPS

March 24

Frederick, MD

March 31

Harrisburg, PA

April 21

St. Louis, MO

4th ANNUAL FOOD SAFETY AND MICROBIOLOGY CONFERENCE

March 1-4

San Antonio, TX

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THANK YOU!

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