Philips UV-C Disinfection

Applications and Offering in the NEW NORM

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Our new company name

Our global **product** brand

PHILIPS

Our IoT (Internet of Things) brand

interact

COLORKINETICS
Dynamic architecture lighting systems

dynalite

COOPER Lighting Solutions

once
A signify company

trulifi
by signify

hue personal wireless lighting
Smart home lighting systems

WiZ

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Signify is the world leader in lighting

We provide high-quality energy efficient lighting products, systems and services

Light sources	Luminaires	Systems and Services
		

No. 1 Connected, LED, Conventional	**€6.2bn** sales in 2019, ~ 75% professional	**38,000** people in 70 countries	**No. 1** Industry leader Dow Jones Sustainability Index

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Covid 19 Virus transmission occurs through:

1. Direct air-borne transmission **between people**
2. Indirect air-borne transmission through **air flows**
3. Indirect surface-borne transmission via **contaminated surfaces**

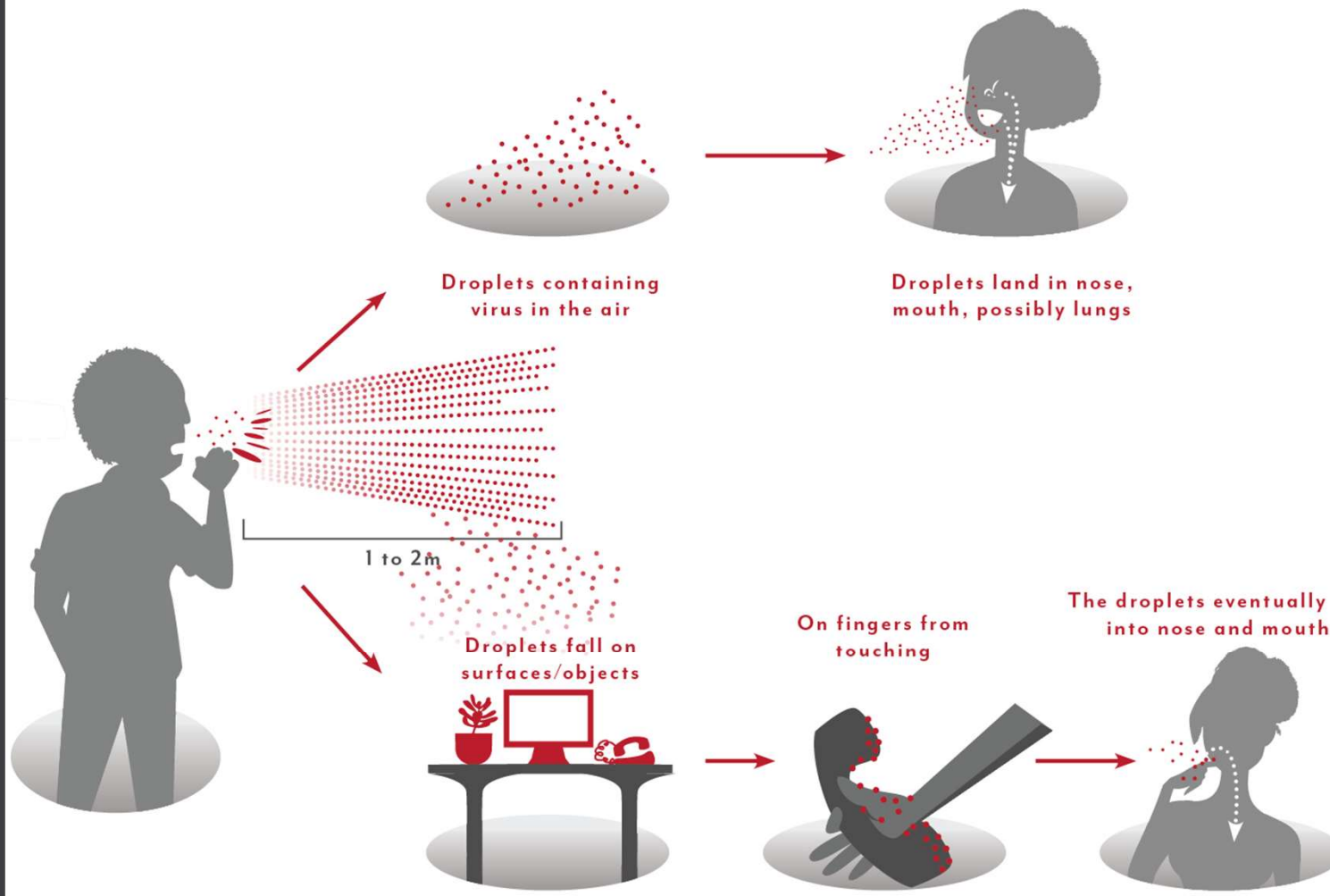


Image credit: WORLD HEART FEDERATION UNIVERSITY OF CAPE TOWN

LATEST NEWS

Proven effectiveness on inactivating the virus that caused COVID-19

- COVID-19 infections can be caused by contact with contaminated surfaces and then touching facial areas; additionally it can also be transmitted through air
- The National Emerging Infectious Diseases Laboratories (NEIDL)[1] at Boston University in the US have conducted research that validates the effectiveness of Signify's UV-C light sources on the inactivation of SARS-CoV-2, the virus that causes COVID-19.
- During their research they have treated inoculated material with different doses of UV-C radiation coming from a Signify light source and assessed the inactivation capacity under various conditions.
- The team applied a dose of 5mJ/cm2, resulting in a reduction of the SARS-CoV-2 virus of 99% in 6 seconds. Based on the data, it was determined that a dose of 22mJ/cm2 will result in a reduction of 99.9999% in 25 seconds.[2]

[1] The NEIDL is a state-of-the-art research facility that encompasses significant containment laboratories at Biosafety Level -2, -3, and -4

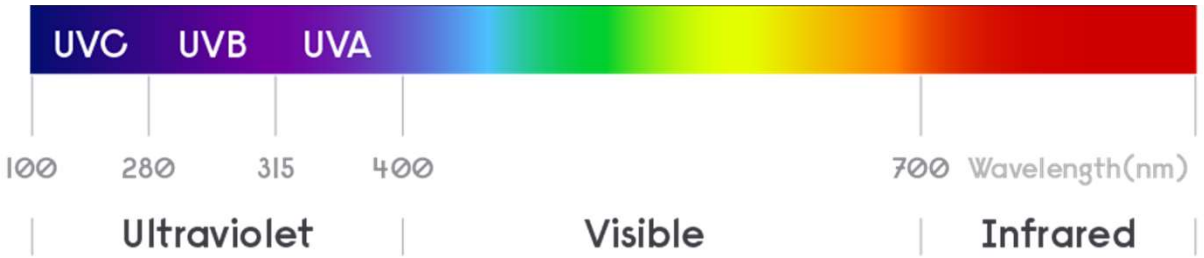
[2] Research variables are available upon request

What is UV-C and how does it work?

What is UV radiation?

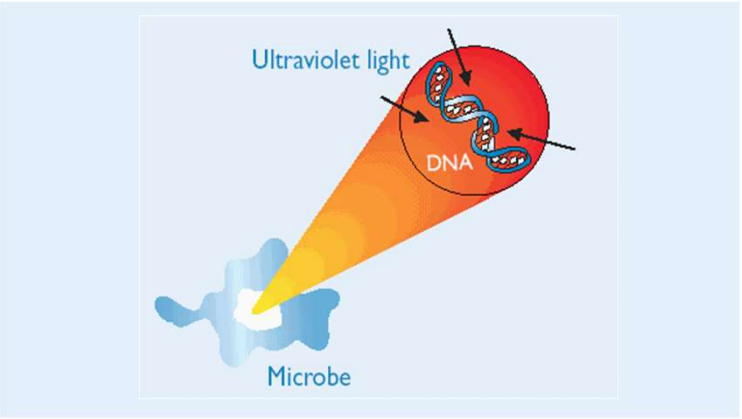
Ultraviolet (UV) light is invisible to human eyes. It can be subdivided into three categories:

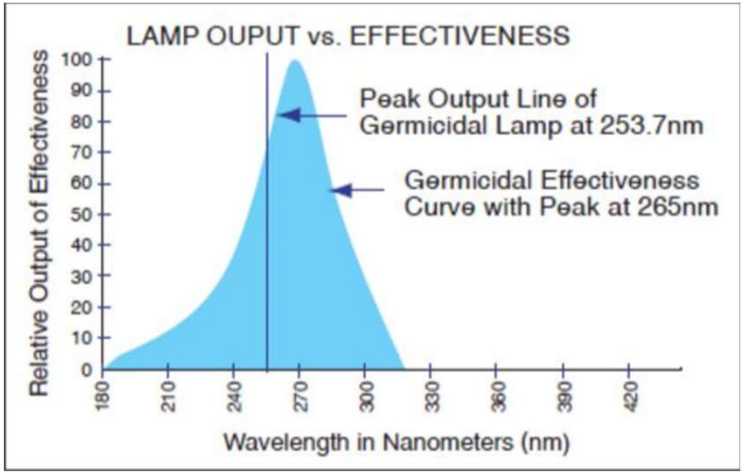
UV-C from 200 to 280 nm	UV-B from 280 to 315 nm	UV-A from 315 to 400 nm
• For disinfection purposes and germicidal application	• For medical use (i.e. phototherapy to treat skin conditions, including psoriasis)	• For use with curing, suntanning and insect traps.



How does it work?

- UV-C radiation can **break the DNA and RNA** of bacteria, viruses and spores, meaning that they leave them harmless. There are **no known micro-organisms resistant** to UVC.[1]
- UV-C technology has been used **safely and effectively** in hospitals and governmental buildings for more than **40 years**[2]
- Most UV-C solutions **utilize conventional lighting**, with LED now improving in efficiency
- The **peak output of our germicidal lamps (253.7nm)** is close (80-85%) to the maximum effectiveness of UV-C (265nm)
- Smaller UV-C wavelengths (222nm) are being explored as less harmful alternatives





[1] Fluence (UV Dose) Required to Achieve Incremental Log Inactivation of Bacteria, Protozoa, Viruses and Algae Revised, updated and expanded by Adel Haji Malayeri, Madjid Mohseni, Bill Cairns and James R. Bolton. With earlier contributions by Gabriel Chevrefils (2006) and Eric Caron (2006) With peer review by Benoit Barbeau, Harold Wright (1999) and Karl G. Linden

[2] EPA Report, "Building Retrofits for Increased Protection Against Airborne Chemical and Biological Releases" Pg. 56

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Effectiveness of disinfection with UV-C determined by two main factors: dosage and environment

Inactivation dose (log1) for various pathogens			
Pathogen	**Dose (log1)**	**Pathogen**	**Dose (log1)**
Bacillus anthracis	45.2	Streptococcus faecalis	44
B. megatherium sp. (spores)	27.3	Streptococcus hemoluticus	21.6
B. megatherium sp. (veg.)	13	Streptococcus lactus	61.5
B. parathyphosus	32	Streptococcus viridans	20
B. suptilis	71	Sentertidis	40
B. suptilis spores	120	Vibrio chlolerae (V.comma)	35
Campylobacter jejuni	11	Yersinia enterocolitica	11
Clostridium tetani	120	Bakers' yeast	39
Corynebacterium diphteriae	33.7	Brewers' yeast	33
Dysentery bacilli	22	Common yeast cake	60
Eberthella typhosa	21.4	Saccharomyces cerevisiae	60
Escherichia coli	30	Saccharomyces ellipsoideus	60
Klebsiella terrifani	26	Saccharomyces sp.	80
Legionella pneumophila	9	Aspergillus flavus	600
Micrococcus candidus	60.5	Aspergillus glaucus	440
Micrococcus sphaeroides	100	Aspergillus niger	1320
Mycobacterium tuberculosis	60	Mucor racemosus A	170
Neisseria catarrhalis	44	Mucor racemosus B	170
Phytomonas tumefaciens	44	Oospora lactis	50
Pseudomonas aeruginosa	55	Penicillium digitatum	440
Pseudomonas fluorescens	35	Penicillium expansum	130
Proteus vulgaris	26.4	Penicillium roqueforti	130
Salmonella enteritidis	40	Rhizopus nigricans	1110
Salmonella paratyphi	32	Hepatitis A	73
Salmonella typhimurium	80	Influenza virus	36
Sarcina lutea	197	MS-2 Coliphase	186
SARS-Cov-2	18	Polio virus	58
Seratia marcescens	24.2	Rotavirus	81
Shigella paradysenteriae	16.3	Cryptosporidium parvum	25
Shigella sonnei	30	Giardia lamblia	11
Spirillum rubrum	44	Blue Green	3000
Staphylococcus albus	18.4	Chlorella vulgaris	120
Staphylococcus aureus	26		

Reduction for SARS-Cov-2[2]		Dose [J/m²]	Dose [mJ/cm²]
log6	99.9999%	370	37
log5	99.999%	290	29
log4	99.99%	220	22
log3	99.9%	140	14
log2	99.0%	65	6.5
log1	90.0%	18	1.8

Dosage = Irradiance x time* (J/m²)

Each pathogen has its own characteristic.
Some pathogens need higher dosage to be inactivated than others

SARS-Cov-2* needs dose
> 290 J/m² to inactivate with 99.999% (5-log reduction)
> 220 J/m² to inactivate with 99.99% (4-log reduction)

Other pathogens need higher or lower dose (see table)
SARS-Cov-2 needs relatively low dose to be inactivated

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Philips UV-C Solutions

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Surface disinfection	Air Disinfection	Object disinfection
		
UVCT200 140W 02 **UVCT100 70W 02**	**WL345W 1xTUV T5 25W HFS**	**UVCC100 68W 02**
UVC trolley	**UVC upper air wall mount**	**UVC chamber**

Surface disinfection	Air Disinfection	Object disinfection
		
TMS160C 1X36W TUV SLV/6 R Sensor	**SM345C C 4xTUV PLS 9W HFM**	**UVCC200 80W 02**
UVC batten with sensor	**UVC upper air ceiling mount**	**UVC chamber**

Surface disinfection	Air Disinfection	Object disinfection
		
TMS160C 2X36W TUV SLV/6 R **TMS160C 2X36W TUV SLV/6** **TMS160C 1X36W TUV SLV/6 R** **TMS160C 1X36W TUV SLV/6**	**UVCA100 84W 02** **UVCA200 120W 02**	**UVCC090 36W 02**
UVC batten	**UVC portable air disinfection**	**UVC mini chamber**

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Surface disinfection	Air Disinfection	Object disinfection
 **PDUVCC-30 UV-C controller + 30 Sensors** **PDUVCC-20 UV-C controller + 20 Sensors** **PDUVCC-10 UV-C controller + 10 Sensors** **UVC batten dynalite controller**	 **UVGI**	 **UVC tunnel**

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Sample of Applications

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Applications: Looking at just surface and air, there are numerous real-world segments where UV-C lighting is a viable disinfection solution

Retail	Work surfaces	Restrooms	Food	Transportation
				
Labs	**Offices**	**Hospitality**	**Entertainment**	**Custom chambers**
				

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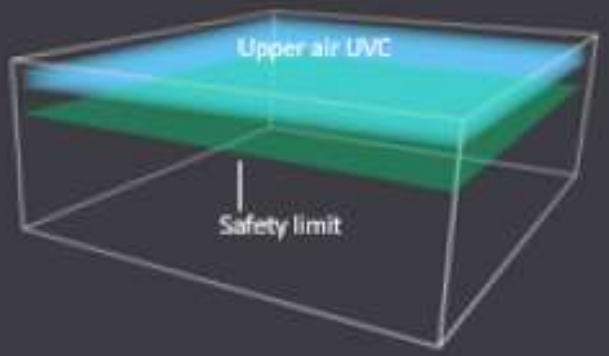
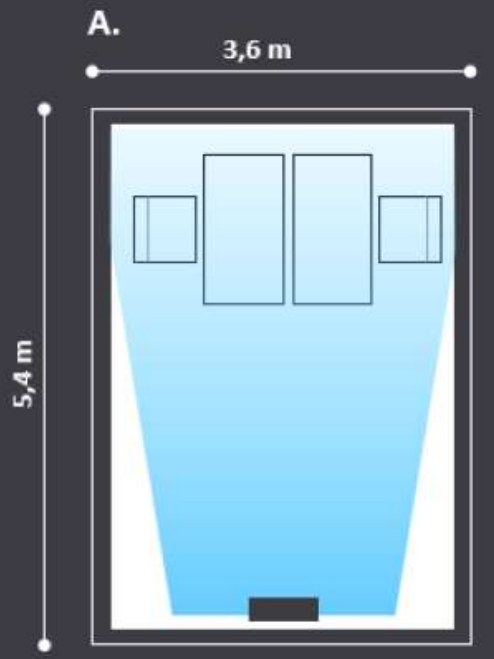
UV-C Solutions
Air Disinfection

Recommended dosage

Boundary conditions used

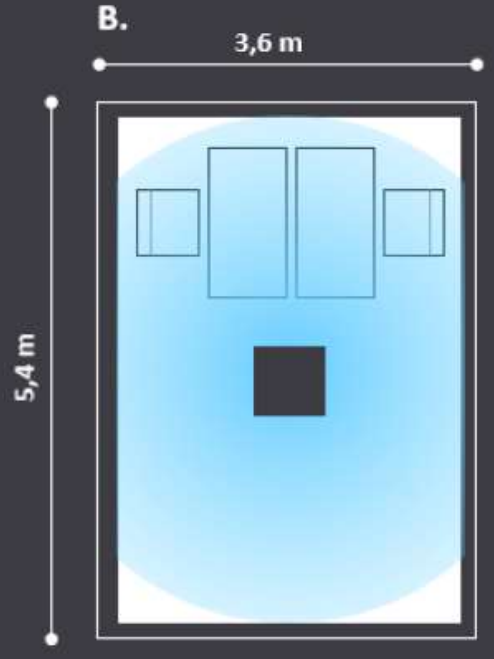
- Reflection factors
  - Ceiling: 10%
  - Walls: 5%
  - Floor: 5%
- Maintenance factor safety limits: 1.0 (i.e. max output)
- Maintenance factor fluence rate: 0.80 *
- Ceiling height: 2.80 m





WL345W 1xTUV T5 25W HFS

UVC upper air wall mount



SM345C C 4xTUV PLS 9W HFM

UVC upper air ceiling mount

UVC Upper Air

The effectiveness of Upper-Room UVGI and it has become an important and effective addition to other infection control measures.

Well planned and maintained Upper-Room UVGI will help prevent transmission of airborne diseases.

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UV-C Appliances

UV-C Trolley

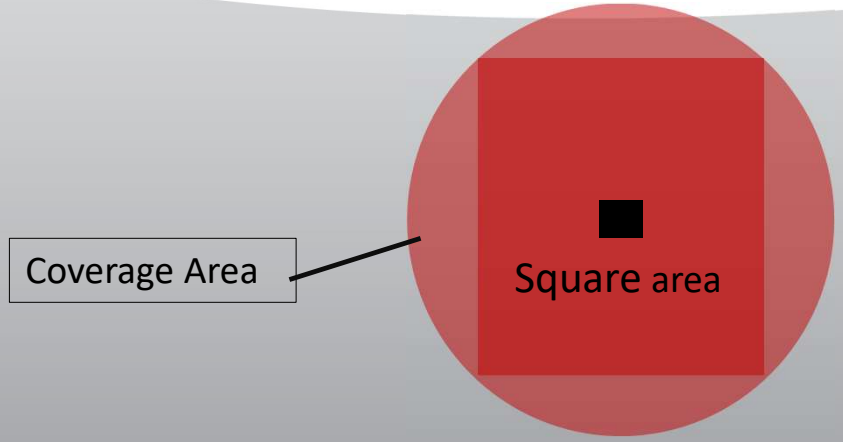
Recommended dosage

1 arm Trolley

Calculation result for SARS - CoV-2 (causes COVID-19):DOSE 4log					
disinfection duration (mins)	15min	30mins	60mins	90mins	120mins
circular area (m2)	18	36	70	105	140
square area (m2)	10	20	40	65	90

2-arm Trolley

Calculation result for SARS - CoV-2 (causes COVID-19):DOSE 4log					
disinfection duration (mins)	15min	30mins	60mins	90mins	120mins
circular area (m2)	36	70	140	215	290
square area (m2)	20	40	90	135	185



PHILIPS

UV-C Appliances

UV-C Batten

Recommended dosage

Reduction for SARS-Cov-2[2]		Dose [J/m²]	Dose [mJ/cm²]
log6	99.9999%	370	37
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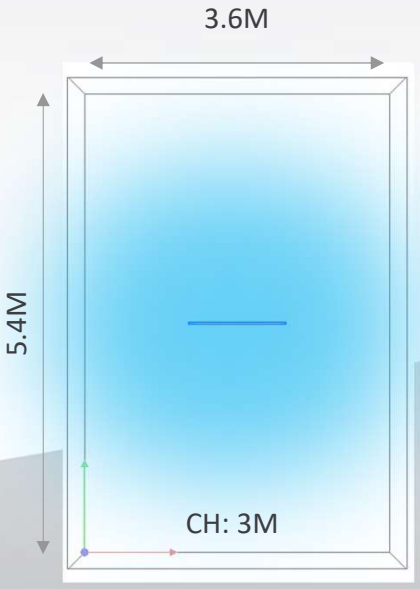

Log5

Irradiance x Exposure time = Dosage

Irradiance x Exposure time = 290J/m^2

UVC Batten	Irradiance @ 0.76m	Time to achieve 290J/msq
TMS160C 1X36W TUV SLV/6 R Sensor	91mW/m^2	55min
TMS160C 1X36W TUV SLV/6	66mW/m^2	75min
TMS160C 1X36W TUV SLV/6 R	91mW/m^2	55min
TMS160C 2X36W TUV SLV/6	106mW/m^2	46min
TMS160C 2X36W TUV SLV/6 R	163mW/m^2	30min

Effectiveness credentials

Signify

Press Release

June 16, 2020

Signify and Boston University validate effectiveness of Signify's UV-C light sources on inactivating the virus that causes COVID-19

- Test results show that the virus could no longer be detected after seconds of exposure
- Signify to make its UV-C lighting technology widely available to other lighting companies
- Signify has been at the forefront of UV technology for more than 35 years

Eindhoven, the Netherlands – Signify (Euronext: LIGHT), the world leader in lighting, together with the National Emerging Infectious Diseases Laboratories (NEIDL)[1] at Boston University in the US have conducted research that validates the effectiveness of Signify's UV-C light sources on the inactivation of SARS-CoV-2, the virus that causes COVID-19.

Since the start of the SARS CoV-2 pandemic, Dr. Anthony Griffiths, Associate Professor of Microbiology at Boston University School of Medicine and his team have been working on developing tools to support scientific advancement in this field.[2] During their research they have treated inoculated material with different doses of UV-C radiation coming from a Signify light source and assessed the inactivation capacity under various conditions. The team applied a dose of 5mJ/cm^2, resulting in a reduction of the SARS-CoV-2 virus of 99% in 6 seconds. Based on the data, it was determined that a dose of 22mJ/cm^2 will result in a reduction of 99.9999% in 25 seconds.[3]

"Our test results show that above a specific dose of UV-C radiation, viruses were completely inactivated: in a matter of seconds we could no longer detect any virus," said Dr. Anthony Griffiths. "We're very excited about these findings and hope that this will accelerate the development of products that can help limit the spread of COVID-19."

Signify is the leader in UV-C light sources and has been at the forefront of UV technology for more than 35 years. It has a proven track record of innovation in UV-C lighting, which is designed, manufactured and installed in line with the highest safety standards.

"I'm very happy about the fruitful cooperation with Boston University in the fight against the coronavirus. Boston University has validated the effectiveness of our light sources as a preventive measure for companies and institutions as they seek ways to provide virus-free environments," said Eric Rondolat, CEO of Signify. "Given the potential of the technology to aid the fight against the coronavirus, Signify will not keep the technology for its exclusive use but make it available to other lighting companies. To service the growing need for disinfection we will increase our production capacity multifold in the coming months."

— END —

[1] The NEIDL is a state-of-the-art research facility that encompasses significant containment laboratories at Biosafety Level -2, -3, and -4

[2] Dr. Griffiths' team develops vaccines and therapeutics for Risk Group 3 and 4 viruses, which include organisms that can cause serious or deadly diseases in humans

[3] Research variables are available upon request

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INNOVATIVE BIOANALYSIS
creating solutions | getting results

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SARS-CoV-2USA-CA1/2020

CLIENT: SIGNIFY
PROJECT: UV WALL SYSTEM AEROSOL
PRODUCT: WL345W UV WALL MOUNT
CAP LIC NO: 886029801
CLIA LIC NO: 05D0955926
STATE ID: CLF 00324630

CHALLENGE VIRUS: SARS-CoV-2 USA-CA1/2020

intertek
Total Quality. Assured.

SIGNIFY NETHERLANDS B.V.
EFFICACY TEST REPORT

SCOPE OF WORK
Non-standardized Test Method: Microbial Reduction Rate Test

PRODUCT – Germicidal UV Light

MODEL – -1. Philips UV-C disinfection upper air luminaire, ceiling mount, Philips PL-S TUV lamp included: 4x9W
2. Philips UV-C disinfection upper air luminaire, wall mount, Philips T5 TUV lamp included: 25W

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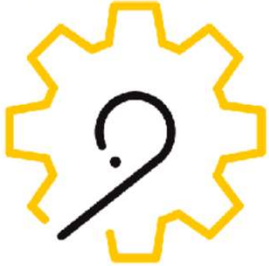

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