



- Commercial & Office Buildings
- Schools
- Daycare Centres
- Hospital & Clean Rooms
- Smoking Environment
- Manufacturing/Factories
- Government Buildings & Facilities
- Fire Department
- Police Departments

SOMA MEDICAL

Ultra Violet Germicidal Sterilization Systems

Indoor Air Quality Assurance (I.A.Q.A) protocol

www.somamedical.net

IAQ (Indoor Air Quality) Problems

What is IAQ ?

Indoor Air Quality as defined by OSHA Malaysia, OSHA Singapore and ASHRAE standard 62-1989, "Wherein it is stated that **air in which there are no known contaminants at harmful concentrations**". So **Quality air** is always related to **fresh air**.

IAQ problems are a combination of :-

- source of contamination
- susceptible occupants
- mechanism to transport the contaminants



Here's a short list of Human Indoor Airborne Virus Transmission Issues:

1. How can people eject Flu Viruses into the Air?
2. What different forms can airborne viruses take?
3. How far can those viruses travel & how can they circulate within buildings and inside their HVAC units?
4. What conditions increase Airborne Flu Viruses Survival?
5. What Systems are Available to Sterilize, Capture and/or Kill Airborne Flu Viruses?



Airborne Transmission depends on people to launch viruses into the air. People can shed this many Flu Viruses into the air:

1. Coughing	3,000+	
2. Sneezing	3,000+	
3. Breathing	Nose-None	Mouth-Varies
4. Talking/Singing	1,000+	
5. Vomiting	1,000+	
6. Diarrhea	*20,000+	

*As a Result of Toilet Water Aerosolization

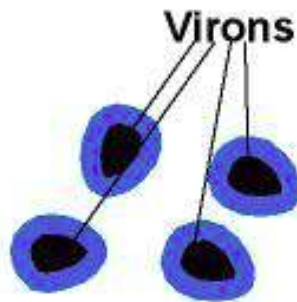
How far can Airborne Viruses Travel?

	Large/Small Droplets	Droplet Nuclei
1. Coughing	1-5 feet	160+ feet
2. Sneezing	8-15 feet	160+ feet
3. Singing, Talking	1-3 feet	160+ feet
4. Mouth Breathing	1-3 feet	160+ feet
5. Diarrhea*	5 feet+	160+ feet

*As a Result of Toilet Water Aerosolization and Mechanical Fan Dispersion into outdoor air (2003 Hong Kong SARS Virus Epidemic)

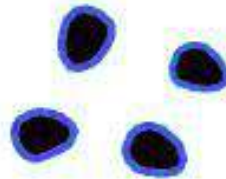
Stages of Infectious Droplets & Droplet Nuclei

Large Infectious droplets



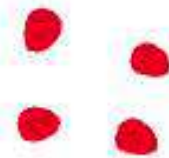
1. Mucus/water encased
Viruses are aerosolized by the infector or by toilet water. These quickly fall to the ground after traveling up to 1-3 feet.

Small Infectious droplets



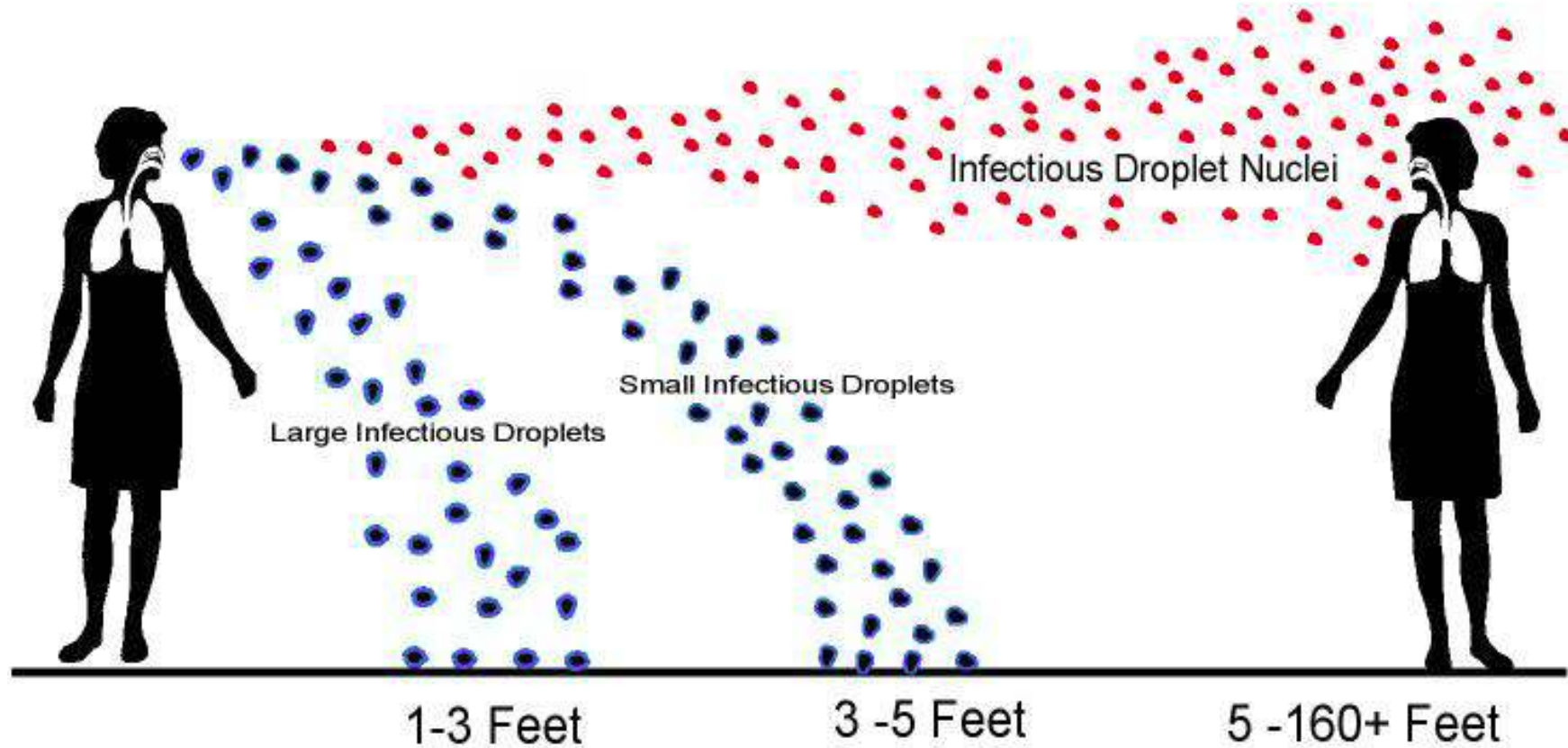
2. Mucus/water coating starts to evaporate. These will travel 3-5 feet before falling to the ground. These droplets can become droplet nuclei.

Infectious Droplet Nuclei

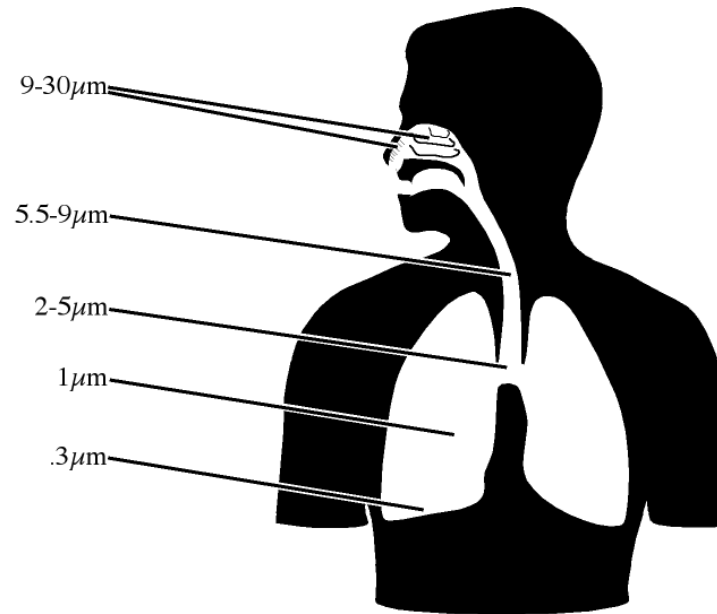


3. Mucus/water coating has totally evaporated leaving only the viron. This is a **Droplet Nuclei**. Droplet Nuclei are so microscopic that they can float in the air indefinitely.

Infectious Droplets & Droplet Nuclei travel lengths



Droplet Nuclei Viruses are 0.3μ or less, it can penetrate deeply into the human lungs

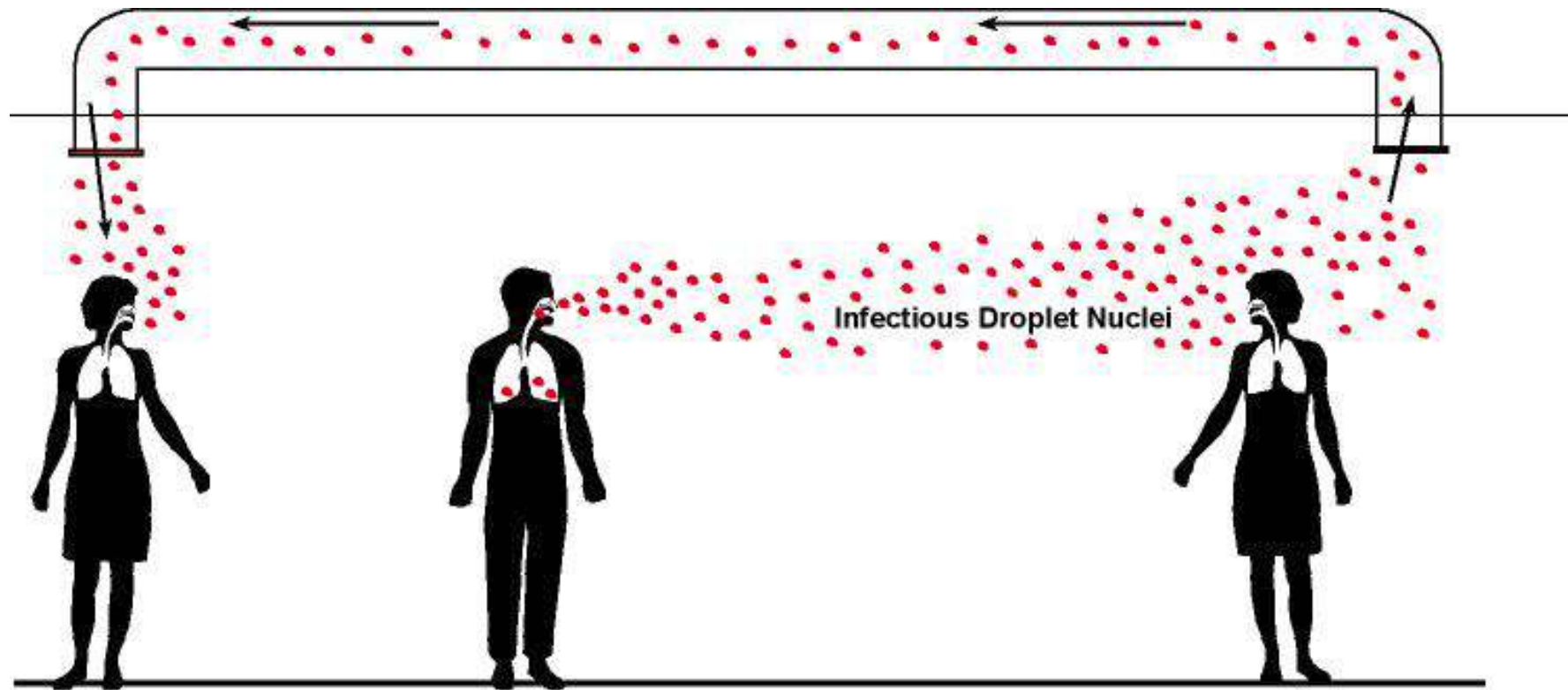


A μ m is a micron or 1/1,000,000 of a meter.
The smallest particle you can see is 30μ m.

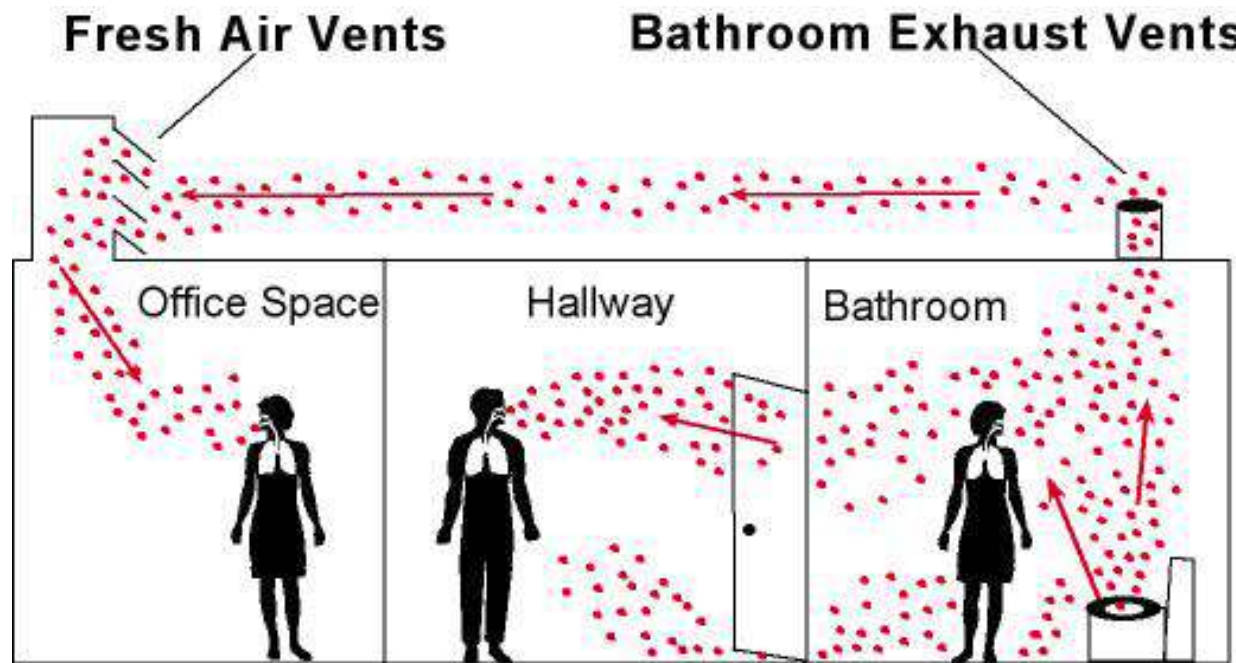
How do Occupant Droplet Nuclei Travel both within indoor spaces and then throughout a Building?



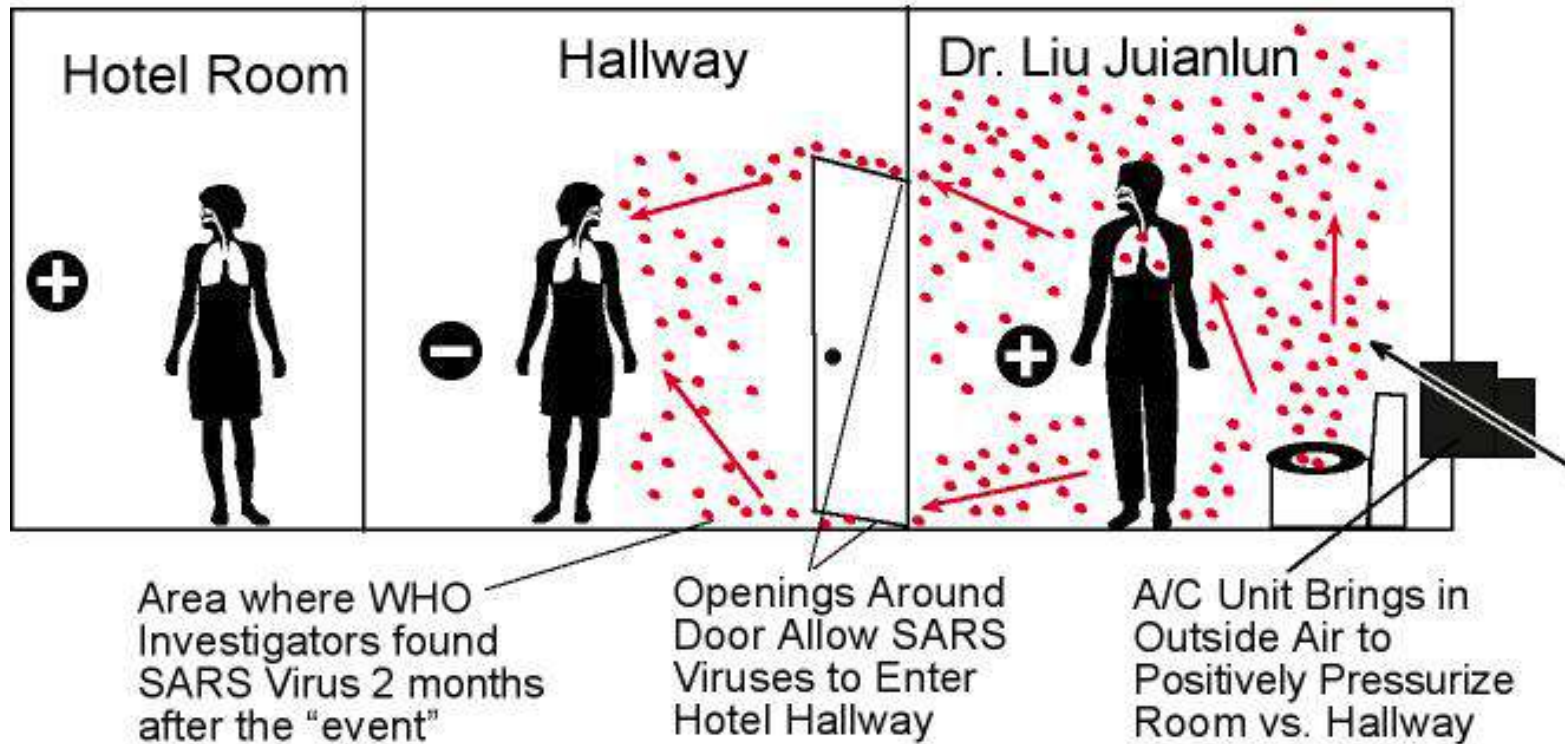
Droplet Nuclei traveling within buildings



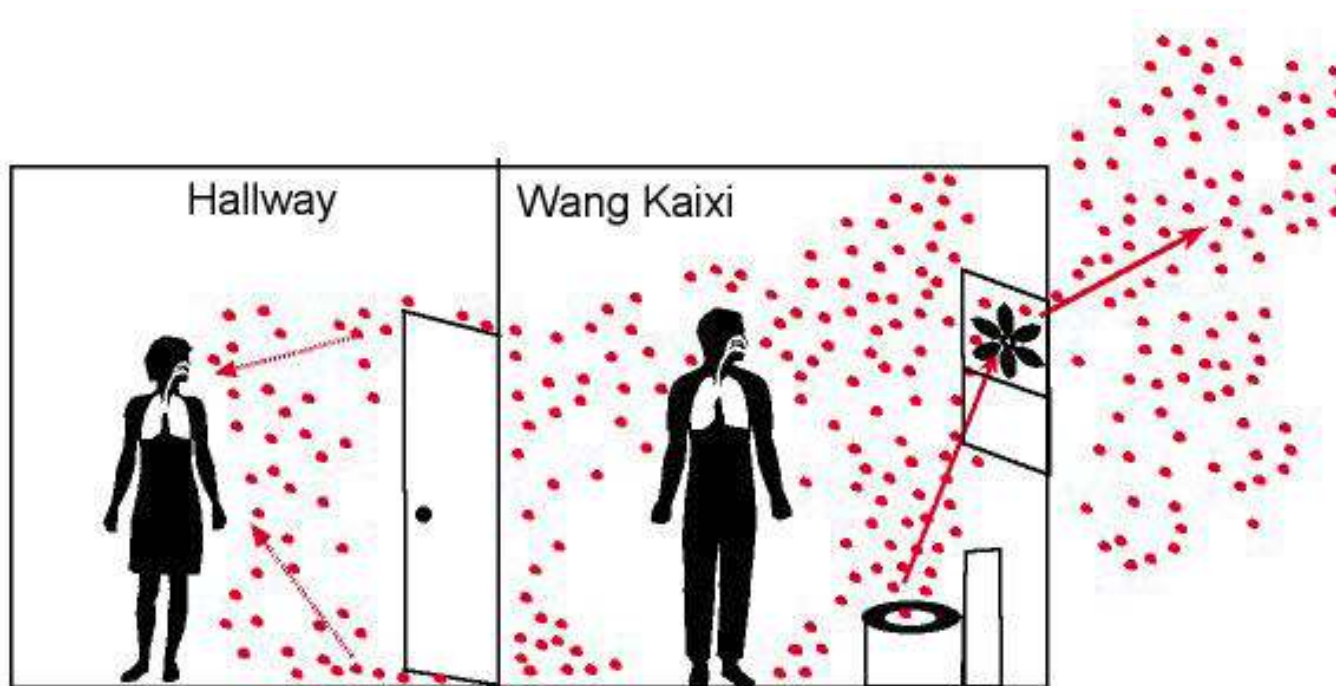
Infectious Droplet Nuclei Recirculation in buildings



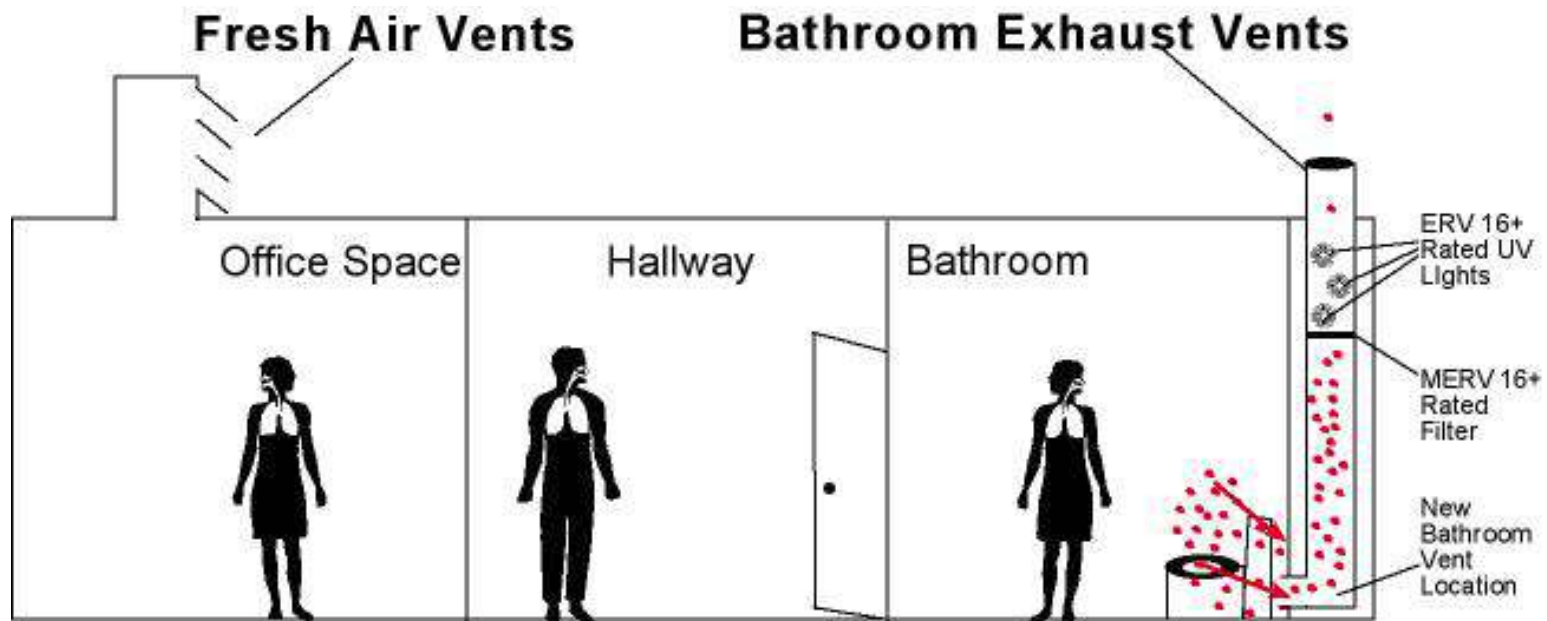
Airborne SARS Transmission at The Metropole Hotel 22.02.2003



Airborne SARS Transmission at Amoy Gardens Apartments 19-20.03.2003



Proactive Droplet Nuclei Infection Prevention





**Why is there a Flu Season?
Does Flu take a vacation?
Are there Flu epidemics ?**

**THE ANSWER IS FOUND IN
HUMIDITY LEVELS**

Low Indoor Humidity Increases Droplet Nuclei Levels

- Viruses evaporate faster in low humidity levels thus creating **More** Droplet Nuclei.
- Low humidity allows droplet nuclei to stay airborne longer as the droplets do not absorb water weight which would cause them to fall to the ground.
- Indoor Air currents both created by HVAC systems and people movement assure that droplet nuclei will remain airborne *Indefinitely*.
- This allows HVAC systems to remove and redistribute droplet nuclei throughout the building to infect more occupants.

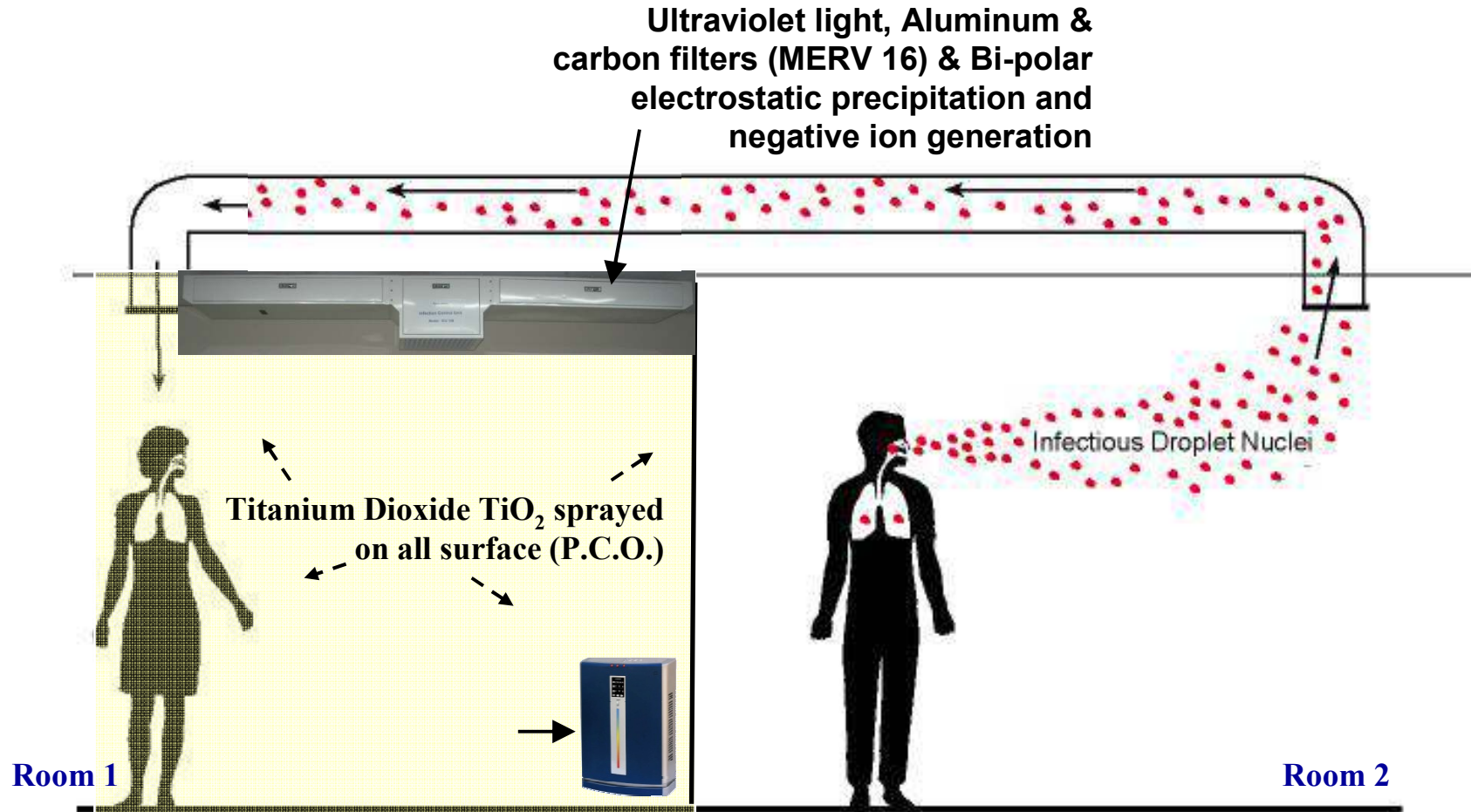


What Systems are Available to Sterilize, Capture and/or Kill Airborne Flu Viruses? (According to EPA guidelines)

- 1. MERV (Minimum Efficiency Reporting Value) Rated Filters. (H.E.P.A).**
- 2. Germicidal UV Lights (UV-C)**
- 3. Magnetized Air Media Filtration (ELECTROSTATIC FILTERS)**
- 4. Bi-Polar Ionization (GERMICIDAL MEDICAL LAMP)**
- 5. Photo-Catalytic Oxidation (NANO TiO₂)**

Option 'A'

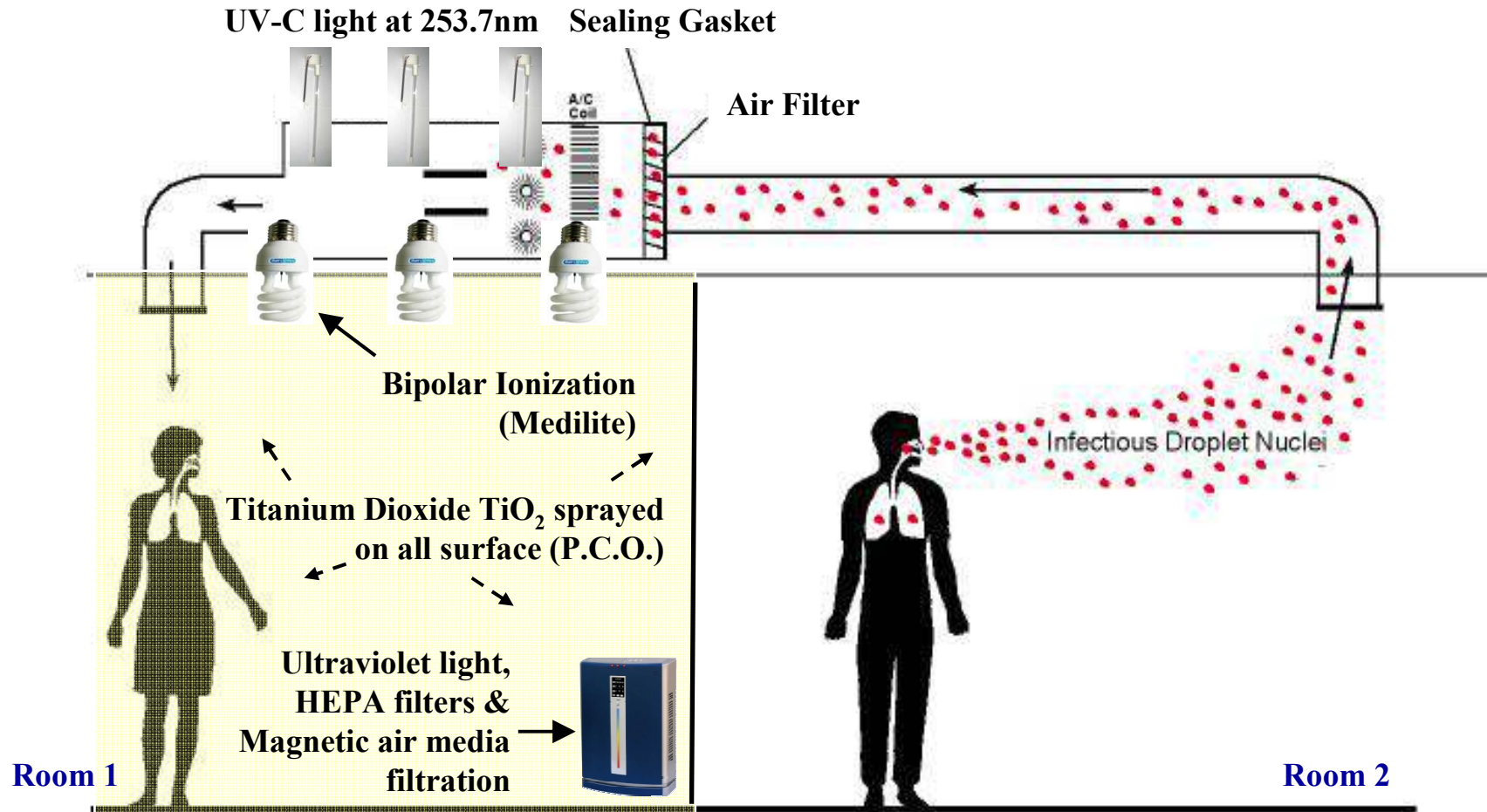
Air Filters, UV-C Lights, P.C.O. and Bi-Polar Ionization Can Kill, Sterilize & Capture Viral Droplet Nuclei



The % of Influenza captured, sterilized or killed will depend upon the Air Filter's MERV rating, intensity of Ultraviolet Output, the total surface area coated with Titanium Dioxide and the Bi-Polar Ionization Output.

Option 'B'

Air Filters, UV-C Lights, P.C.O. and Bi-Polar Ionization Can Kill, Sterilize & Capture Viral Droplet Nuclei



The % of Influenza captured, sterilized or killed will depend upon the Air Filter's MERV rating, intensity of Ultraviolet Output, the total surface area coated with Titanium Dioxide and the Bi-Polar Ionization Output.



Ultraviolet light, Aluminum & carbon filters (MERV 16) & Bi-polar electrostatic precipitation and negative ion generation

Designation of product:	IAQA Infection Control Unit
Model:	ICU 100
Physical dimension:	2600 x 420 x 320 mm
Input voltage	AC220V \pm 15% (187V~253V) ; 50Hz \pm 10% (45 Hz~55 Hz)
Operating power:	200 W
Working voltage of ionizer:	DC8200V, \pm 1.5%
Working voltage of dust collector:	DC4100V, \pm 1.5%
Temp range of working environment:	0~45 $^{\circ}$ C
Humidity of working environment:	<90% RH (40 $^{\circ}$ C)
Synchronous control voltage:	AC25V~AC300V
Audible noise:	<25dB
Purification efficiency:	96.2% (test condition) 85.3% (actual measured condition)
Sterilization efficiency:	99.90%
Dust removal efficiency:	95%
Product description:	

1. Installation location: ceiling mounted
2. Product size: 2600*420*320 mm Weight: 45 kg
3. UVC: 80 watts X 4 pieces working @ 60,000 microwatts intensity each
4. Air exchange speed: Low- 500 m³/hour High- 700 m³/hour **Coverage Area: 1,200 ft²**
5. Features:
 - A. Multi-purification and sterilization system
 - B. High efficiency aluminum filter size 38.5 cm x 40 cm filtrating E6 + 4R6AL filtrating efficiency L5 ASHRAE 52.2-1999. Rated MERV 16 and coated with SM Nano 1152 TiO₂ solution
 - C. 254 Nm UVC (4 pieces 80 watts working at 253.7 nanometers)
 - D. LED display
 - E. Remote control
 - F. Bi-polar negative ion generation @ 9 million ions per cm³
6. Application:

Hospitals, hotels, office buildings, schools, shopping malls, supermarkets, etc.



**IAQA Infection control
Unit: ICU 100**

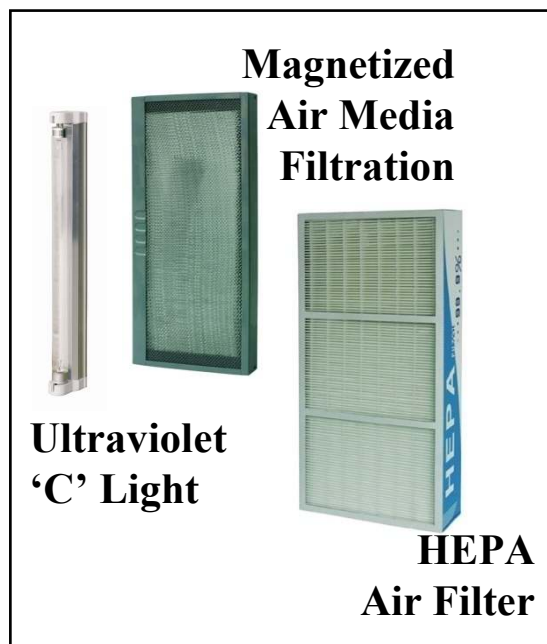
Air Filters (HEPA), UV-C Lights & Magnetized Air Media Filtration



**Cleanature
SM767B**



Filters & Bulb inside



**Magnetized
Air Media
Filtration**

**Ultraviolet
'C' Light**

**HEPA
Air Filter**

Specifications	
Model	Cleanature SM767B
Filter	Electrostatic + HEPA + Activate carbon + photo catalyst
Negative Ion generation rate	Static plasma: with honeycomb type of aluminum 5×10^6 ions / s
Ultraviolet light	Yes (2 on both sides) intensity 23,000 $\mu\text{W}/\text{cm}^2$ (Quartz Lamp)
Air Sensor	Dust, odor, air hydrogen, ammonia, hydrogen sulfide, ethane, toluena, air methane, butane and carbon
Ozone application	Yes (≤ 0.05 ppm)
Purification rate	$\geq 99.997\%$
Anti-bacteria rate	$\geq 90\%$
Airflow rate	400 cfm/70m ³ /H (low) 450 cfm/150m ³ /H (medium) 500 cfm/210m ³ /h (high)
Air exchange rate	2 hours (low) 1 hour (medium) 0.6 hour (high)
Recommended room use	60 m ² (650 ft ²)
Power supply	110 – 230V, 50-60Hz ($\leq 55\text{W}$)
Product dimension	580 x 450 x 240 mm

What is Photocatalytic Oxidation (PCO) and Bi-Polar Ionization & How do they work?

- **Photocatalytic Oxidation** is created when Ultraviolet light photons strike Titanium Di-Oxide (TiO_2) to create Hydroxyl radicals. These newly liberated airborne Hydroxyl radicals can rupture and destroy the cellular material of any germs which they encounter.
- **Bi-Polar Ionization** creates positively and negatively charged oxygen molecules which act like hydroxyl radicals and destroy the cell wall and inner cellular material.

Bi-Polar Ionization



Medilite Germicidal Medical Lamp

Specifications			
Model	Medilite (GML)		
Negative Ions	> 800,000 ions/cm ³		
Colour Temperature	2700 warm	and	4100 cool
Light Output (Lumens)	1350	and	1680
Total Length	15 cm		
Anti-bacteria rate	≥ 90%		
Average Lifespan	8,000 operational hrs		
Coverage area	70 sq ft		
Power supply	220 – 240V, 50/60Hz (≤ 25W)		
Fitting	E27 Medium Base		

medilite™

Photocatalytic Oxidation SM NANO TiO₂



**SM 1152
Nano TiO₂
coating
agent**

Specifications	
Product Series	SM1152 Sol Coating Agent
Main Compositions	Nano Titanium Dioxide
Crystallite Structure	Anatase
Average Primary Particle Size	<4nm
Coagulation Index	2-4
Executing Criterion	Q /TDIT-01-2004 GB/T 19591-2004 GB/T 19619-2004
Appearance	Transparent liquid
Smell	Odorless
Skin Touch	Harmless
Dispersant	Water-based
Origin	Malaysia
Storage Condition	Sealed/Avoid light/Room temperature
Packaging	Plastic / Metal Barrel 10L, 25L, 30L, 200L

How does UV-C Work?

UV-C light emits germicidal wavelengths between 200-300nm. This reacts with the DNA and permanently alters the structure and the molecular bonds of microbiological contaminants such as *bacterias, viruses, germs, molds* and *mildews*.

Cells Exposed to UV-C

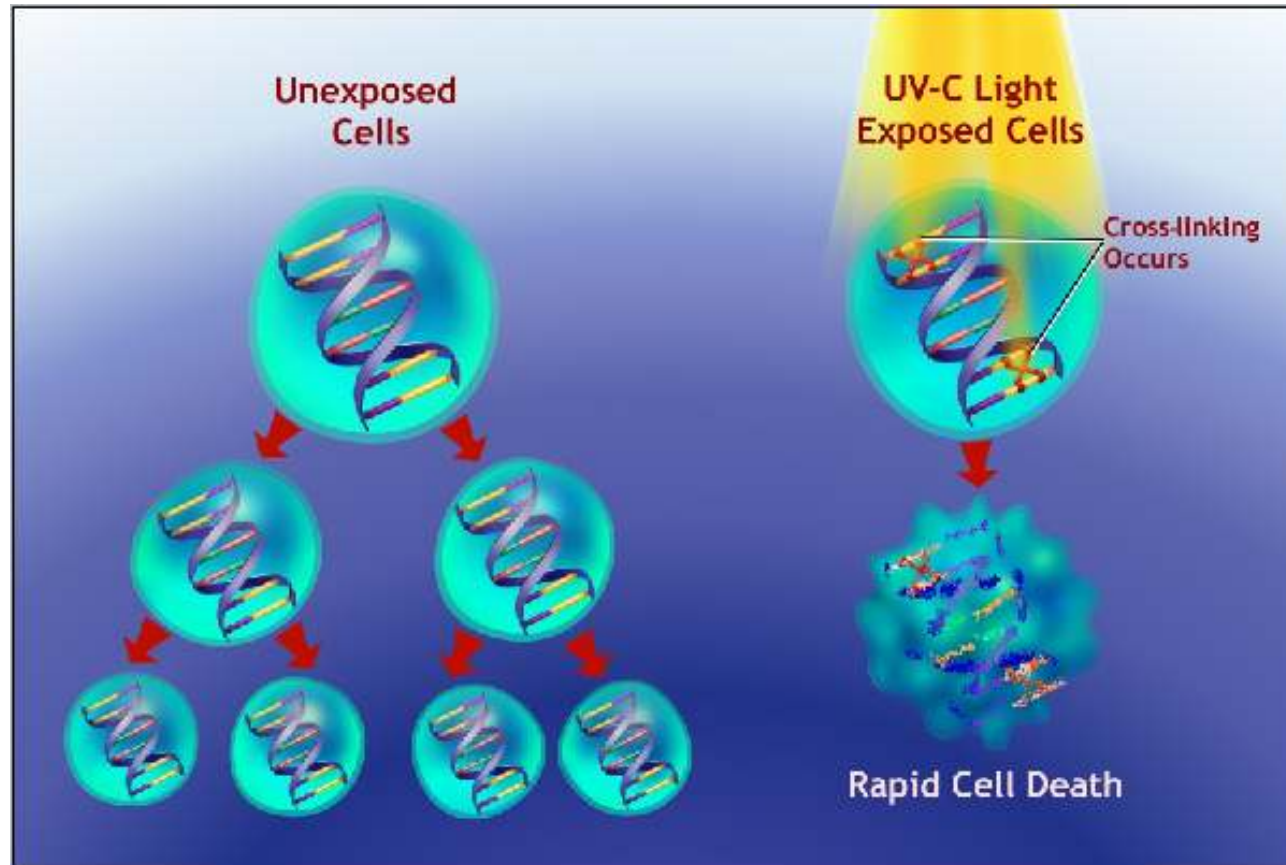


Fig 1 : The picture above explains how UV-C breaks down the DNA of living airborne particles like bacteria, virus and fungus.

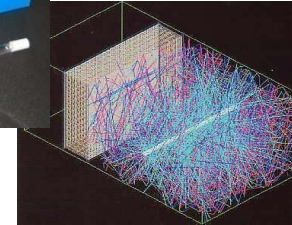
UVC Lights



UVMax™ SM 212



UVMax™ SM 313

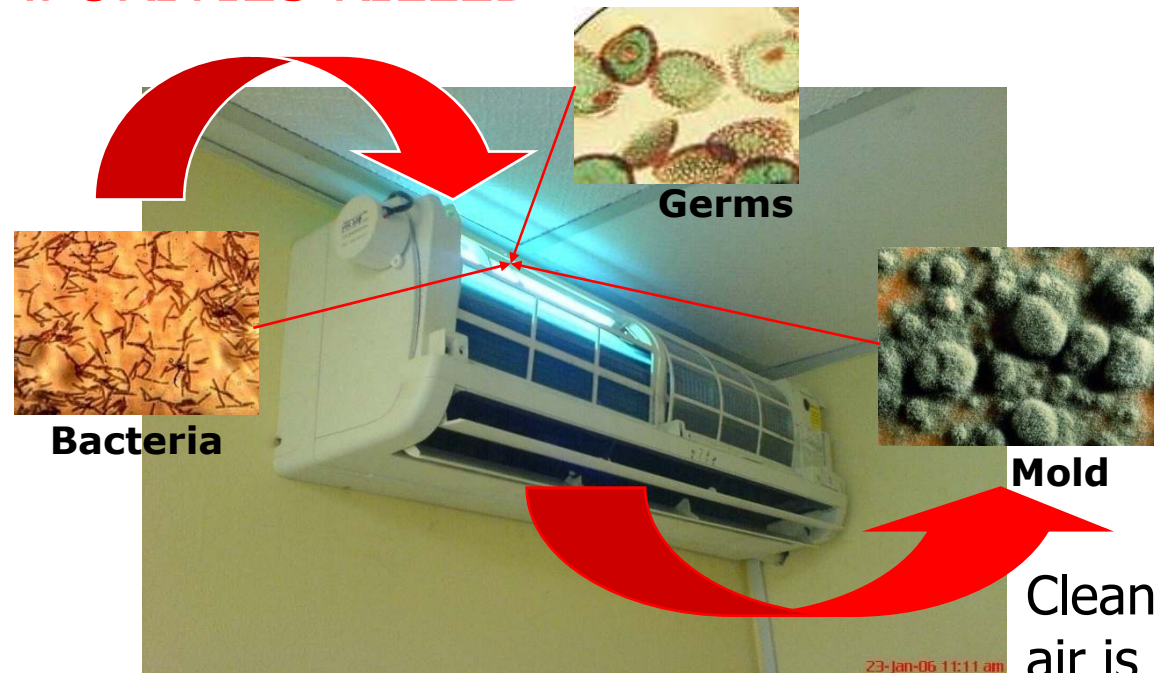


Specifications	
Model	SM 212 cassette unit for 1hp air conditioning system
Ultraviolet light	Yes Intensity 18,000 $\mu\text{W}/\text{cm}^2$
Bulb lifespan	12,000 hours operational
Energy used	$\geq 90\%$
Power supply	220-230 V 50 Hz (6 W)
Product dimension	9"

Specifications	
Model	UVMax™ 313 socket unit for 1.5hp and above air conditioning system & ducting
Ultraviolet light	Yes Intensity 24,000 $\mu\text{W}/\text{cm}^2$
Bulb lifespan	12,000 hours operational
Energy used	$\geq 90\%$
Power supply	220-240 V 50 Hz (9 W)
Product dimension	9"

How UVMax™ Works?

ALL IMPURITIES KILLED



Clean and sterilized
air is released into
the premises

All germs, bacteria and mold that are floating and breeding in your air cond has to pass through UVMax Germicidal Light before it is released.

Types of UVMax™ Germicidal System

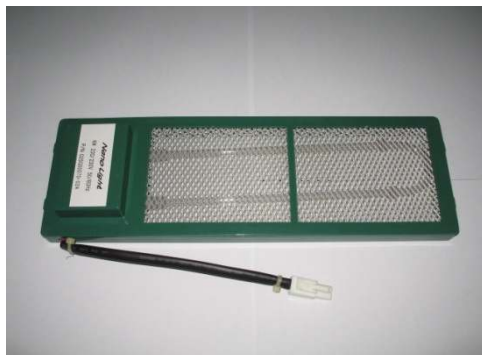


UVMax 313

Specifications : (9watts,
intensity = 24,000 $\mu\text{w}/\text{cm}^2$)



Working in a 2hp Split Unit or centralized air conditioning systems.



UVMax 212

Specifications : (6watts,
intensity = 16,000 $\mu\text{w}/\text{cm}^2$)



Working in a 1.5hp Split Unit

(Installed in the Ministry Of Health, Malaysia)

Why is Microwatts important in UV-C?



Microwatts are actually the main dosage calculation that determines the kill rate for every type of disease causing agents.

UV dosage for the inactivation of various microbes.			
Bacteria	UV Dose	Bacteria	UV Dose
<i>Agrobacterium lumentorum</i> 5	8,500	<i>Pseudomonas aeruginosa</i> (Environ. Strain) 1,2,3,4,5,9	10,500
<i>Bacillus anthracis</i> 1,4,5,7,9 (anthrax veg.)	8,700	<i>Pseudomonas aeruginosa</i> (Lab. Strain) 5,7	3,900
<i>Bacillus anthracis</i> Spores (anthrax spores)*	46,200	<i>Pseudomonas fluorescens</i> 4,9	6,600
<i>Bacillus megatherium</i> Sp. (veg) 4,5,9	2,500	<i>Rhodospirillum rubrum</i> 5	6,200
<i>Bacillus megatherium</i> Sp. (spores) 4,9	5,200	<i>Salmonella enteritidis</i> 3,4,5,9	7,600
<i>Bacillus paratyphosus</i> 4,9	6,100	<i>Salmonella paratyphi</i> (Enteric Fever) 5,7	6,100
<i>Bacillus subtilis</i> 3,4,5,6,9	11,000	<i>Salmonella</i> Species 4,7,9	15,200
<i>Bacillus subtilis</i> Spores 2,3,4,6,9	22,000	<i>Salmonella typhimurium</i> 4,5,9	15,200
<i>Clostridium tetani</i>	23,100	<i>Salmonella typhi</i> (Typhoid Fever) 7	7,000
<i>Clostridium botulinum</i>	11,200	<i>Salmonella</i>	10,500
<i>Corynebacterium diphtheriae</i> 1,4,5,7,8,9	6,500	<i>Sarcina lutea</i> 1,4,5,6,9	26,400
Dysentery bacilli 3,4,7,9	4,200	<i>Serratia marcescens</i> 1,4,6,9	6,160
<i>Eberthella typhosa</i> 1,4,9	4,100	<i>Shigella dysenteriae</i> - Dysentery 1,5,7,9	4,200
<i>Escherichia coli</i> 1,2,3,4,9	6,600	<i>Shigella flexneri</i> - Dysentery 5,7	3,400
<i>Legionella bozemanii</i> 5	3,500	<i>Shigella paradysenteriae</i> 4,9	3,400
<i>Legionella dumoffii</i> 5	5,500	<i>Shigella sonnei</i> 5	7,000
<i>Legionella gormanii</i> 5	4,900	<i>Spirillum rubrum</i> 1,4,6,9	6,160
<i>Legionella micdadei</i> 5	3,100	<i>Staphylococcus albus</i> 1,6,9	5,720
<i>Legionella longbeachae</i> 5	2,900	<i>Staphylococcus aureus</i> (incl. MRSA) 3,4,6,9	6,600
<i>Legionella pneumophila</i> (Legionnaire's Disease)	12,300	<i>Staphylococcus epidermidis</i> 5,7	5,800
<i>Leptospira canicola</i> -Infectious Jaundice 1,9	6,000	<i>Streptococcus faecalis</i> 5,7,8	10,000
<i>Leptospira interrogans</i> 1,5,9	6,000	<i>Streptococcus hemolyticus</i> 1,3,4,5,6,9	5,500

<i>Micrococcus candidus</i> 4,9	12,300	<i>Streptococcus lactis</i> 1,3,4,5,6	8,800
<i>Micrococcus sphaeroides</i> 1,4,6,9	15,400	<i>Streptococcus pyrogenes</i>	4,200
<i>Mycobacterium tuberculosis</i> 1,3,4,5,7,8,9	10,000	<i>Streptococcus salivarius</i>	4,200
<i>Neisseria catarrhalis</i> 1,4,5,9	8,500	<i>Streptococcus viridans</i> 3,4,5,9	3,800
<i>Phytomonas tumefaciens</i> 1,4,9	8,500	<i>Vibrio comma</i> (Cholera) 3,7	6,500
<i>Proteus vulgaris</i> 1,4,5,9	6,600	<i>Vibrio cholerae</i> 1,5,8,9	6,500
Molds	UV Dose	Molds	UV Dose
<i>Penicillium expansum</i> 1,4,5,6,9	22,000	<i>Oospora lactis</i> 1,3,4,6,9	11,000
<i>Penicillium roqueforti</i> 1,2,3,4,5,6	26,400	<i>Penicillium chrysogenum</i>	56,000
<i>Mucor racemosus</i> (A & B) 1,3,4,6,9	35,200		
Protozoa	UV Dose	Protozoa	UV Dose
<i>Chlorella vulgaris</i> (algae) 1,2,3,4,5,9	22,000	Nematode Eggs 6	40,000
Virus	UV Dose	Virus	UV Dose
Adeno Virus Type III 3	4,500	Influenza 1,2,3,4,5,7,9	6,600
Bacteriophage 1,3,4,5,6,9	6,600	Rotavirus 5	24,000
Coxsackie	6,300	Infectious Hepatitis 1,5,7,9	8,000
Yeasts	UV Dose	Yeasts	UV Dose
Baker's Yeast 1,3,4,5,6,7,9	8,800	<i>Saccharomyces cerevisiae</i> 4,6,9	13,200
Brewer's Yeast 1,2,3,4,5,6,9	6,600	<i>Saccharomyces ellipsoideus</i> 4,5,6,9	13,200
Common Yeast Cake 1,4,5,6,9	13,200	<i>Saccharomyces sp.</i> 2,3,4,5,6,9	17,600

Why are Hospitals, Schools & Offices Conducive environments for Flu and Viral Transmission?

- **Dry environments!** Many hospitals, schools & offices have 15-25% relative humidity levels indoors! This is the **PERFECT** environment for airborne Viral transmission and contagion.
- **Low MERV Filter Ratings!** Many hospitals, schools & offices have low MERV rated filters like MERV 4-6. You need a MERV 13 or higher to have any real effect on airborne viral capture.
- **No Ultraviolet Lights or TiO₂ Photocatalyst!** Relatively no hospitals, schools & offices use ultraviolet lights or the TiO₂ photocatalyst . Hospitals, schools & offices with UV-C lights combined with TiO₂ photocatalyst have enjoyed lower airborne viral transmission rates and higher indoor air quality.
- **Bathrooms with ceiling exhaust fans!** No public bathroom design which incorporates floor level exhaust vents. Scientist Wang Kaixi demonstrated the efficiency of toilet aerosolization and dissemination.



Recommendations by USA Environmental Protection Agency (EPA)

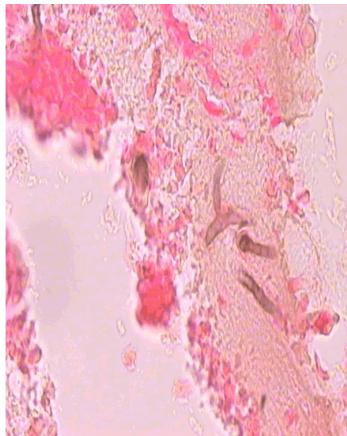
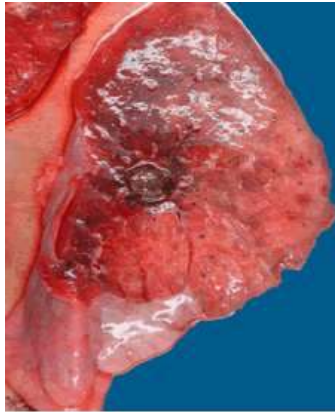
1. **Seal** your filter rack & HVAC system.
2. Get the **highest MERV** rated filter that your filter rack and air handling fan can tolerate.
3. Put as much **UV light** within your coil plenum to achieve a **99.9% single pass kill rate**.
4. Consider **Bi-Polar Ionization, Photocatalytic Oxidation and Magnetized Filtration Media Technologies** for additional viral sterilization.
5. Install **bathroom exhausts 1-12" above the floor**.
6. **Coughing/sneezing occupants stay at home or wear a mask.**

What are the other benefits of Photocatalytic Oxidation, Bi-Polar Ionization & Ultraviolet C Germicidal Lamps?



It's a good preventive measure against

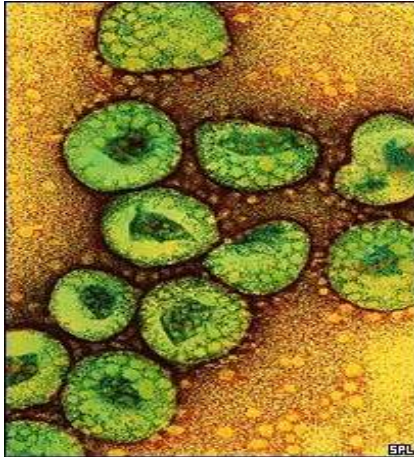
Aspergillosis Niger



Aspergillosis Strain

Aspergillosis Niger is a type of fungal spore that breeds in the air-conditioning system and spreads through the air flow. It infects humans by entering the lungs and creating lumps of black mold as seen in the picture. Causes difficulty in breathing due to fungal growth in the nasal cavity.

SARS (*Severe Acute Respiratory Syndrome*)



SARS Strain



SARS Patient Treatment

Severe Acute Respiratory Syndrome or widely known as SARS spreads easily through the air conditioning system. Light droplets of infected mucus or saliva passes through air conditioners and reaches victims at close proximity.

Bacillus Anthracis



Anthrax found in bottle



Anthrax strain



Anthrax Lesions

Bacillus Anthracis is a world renowned bacteria that kills human beings, minimum 3 days after coming into contact. It is a white powdery substance that spreads easily through any air-conditioning system and this bacteria is active at cold temperature.

Dust Mites



Dust Mite on the prowl (greatly enlarged)

What are Dust Mites?

Dust mites are microscopic creatures that belong to the family of eight-legged creatures called arachnids. This family also includes spiders, chiggers and ticks. Dust mites prefer warm, moist surroundings such as the inside of a mattress, pillow or fabric cushion on your sofa. They feed on dander (human and animal skin flakes), so they thrive in places where there are people and animals.

How does UVC kill dust mites?

The UVC spectrum at 253.7 nm which is also called the germicidal wavelength is able to eliminate dust mites. It does this by deactivating the DNA of the dust mite and prevents reproduction. UV-C light at 253.7 nm causes cell death in the dust mite and prevents the DNA from being unzipped for replication. A quartz lamp transmits more than 94% of the crucial 253.7 nm UVC wavelength. The quartz lamp produce more UVC because of higher transmission and thus be more effective in killing mites.

Allergy & Sinusitis



Victims suffer **headaches, fatigue, trouble concentrating and irritation of skin and mucus membranes.**

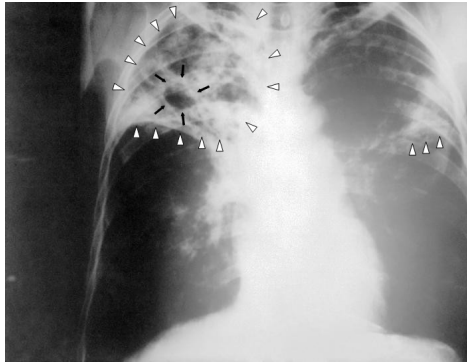
Allergy is caused by an oversensitive immune system, which leads to a misdirected immune response. The immune system normally protects the body against harmful substances, such as bacteria and viruses.

Sinusitis occurs when there is infection, or inflammation due to allergies, in one or more of the sinuses. Acute sinusitis is often associated with upper respiratory infections, as inflammation of the nasal passages prevents drainage of fluid from the sinuses, which allows infection of the sinuses to occur.

The Role of UVC on Allergy & Sinusitis

Destroys micro-organisms. UV (ultraviolet) light is scientifically proven to destroy a large variety of contaminants, including disease-causing viruses, bacteria and fungi (including mold). Ultraviolet light air purification has been used for years by the medical field (including hospitals) to sanitize rooms and equipment, in order to prevent the spread of illness and disease.

Tuberculosis



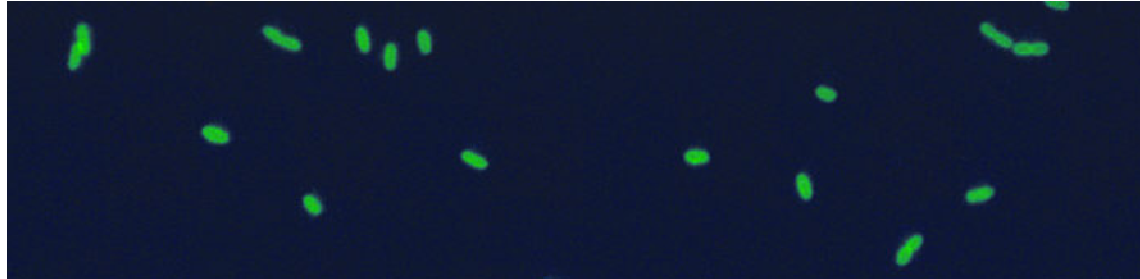
An anteroposterior X-ray of a patient diagnosed with advanced bilateral pulmonary tuberculosis. This AP X-ray of the chest reveals the presence of bilateral pulmonary infiltrate (white triangles), and "caving formation" (black arrows) present in the right apical region. The diagnosis is far-advanced tuberculosis.

Tuberculosis (abbreviated as **TB** for Tubercle Bacillus) is a common and deadly infectious disease caused by the mycobacterium *Mycobacterium tuberculosis* or *Mycobacterium bovis*. Tuberculosis most commonly affects the lungs (as pulmonary TB) but can also affect the central nervous system, the lymphatic system, the circulatory system, the genitourinary system, bones, joints and even the skin.

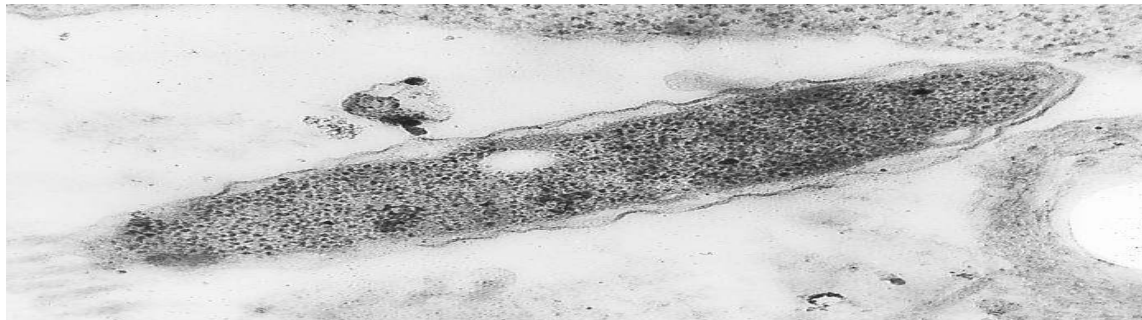
The Effects of UVC on Tuberculosis

Airborne transmission of Mycobacterium Tuberculosis and other infectious agents within indoor environment has been a recognized hazard for decades. Increasing cost associated with providing ventilation has prompted renewed interest in other means to remove airborne infectious agents from room air, such as the application of ultraviolet germicidal irradiation (UVGI). One application of UVGI is to irradiate the upper part of a room while minimizing radiation exposure to person in the lower part of the room. UVGI has the potential to be a useful engineering control for TB. The 1994 CDC TB Guidelines (Center for Disease Control and Prevention 1994) relied primarily on upper-room air UVGI studies for over 30 years. UVGI was very effective at inactivating airborne bacteria.

Legionnaires Disease



Transmission may occur via inhalation or aspiration. Disease transmission is most likely to occur via inhalation of aerosols, fine sprays, mists or other microscopic droplets of water contaminated with LDB, providing direct access into the lungs.



References :-

1. **M. Tavini, editor. "UV-B Radiation and Ozone Depletion Effects on humans, animals, plants, microorganisms and materials" Lewis Pulishers, Boca Raton (1993).**
2. **United States Environmental Protection Agency, "Ozone Generators That Are Sold as Air Cleaners", <http://www.epa.gov/iedweb00/pubs/ozonegen.html>**
3. **The Nobel Foundation, "Biography of Niels Ryberg Finsen", <http://www.nobel.se/laurates/medicine-1903-1-bio.html>**
4. **ASHRAE, "Ventilation for Acceptable Indoor Air Quality" American Society of Heating, Ventilating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, Ga.**
5. **Kowalski, W.J. & Bahnfleth, W., "Airborne Respiratory Diseases and Mechanical Systems for Control of Microbes." HPAC Heating/Piping/Air Conditioning (July 1998).**
6. **Ultraviolet Germicidal Irradiation, Aerobiological Engineering, The Pennsylvania State University, <http://www.engr.psu.edu/ae/wjk/wjluvgi.html>**
7. **Scheir, R & Fencl, Forrest, "Using UVC Technology to Enhance IAQ", HPAC Heating/Piping/Air Conditioning (February 1996).**
8. **Luckiesh, M., Application of Germicidal, Ethyemal and Infrared Energy, D. Van Nostrand, New York, N.Y. (1946).**
9. **Hallaender, A. & Oplihant, J.W., Journal of Bacteriology, Volume 48, (1948).**
10. **Disinfection by UV-Radiation, Phillips Lighting Corporation (undated) and cited reference therein.**
11. **First, M.W., Nardell, E.A., Chaisoon, W., & Riley, R., ASHRAE Transactions, Volume 105, Part 1, (Chapter 99-12-1, 99-12-3)**
12. **The use of UVC for De-Activation of Various Microbes – <http://www.ultraviolet.com/microorgan.htm>**
13. **Use of UV on Dust Mites – <http://www.predator.hitech.com/html/questions.html>**



Thank You

SOMA MEDICAL SDN BHD

Website: www.somamedical.net

Email: info@somamedical.net