AIR QUALITY SOLUTIONS

EVERYONE DESERVES BETTER AIR

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Contents

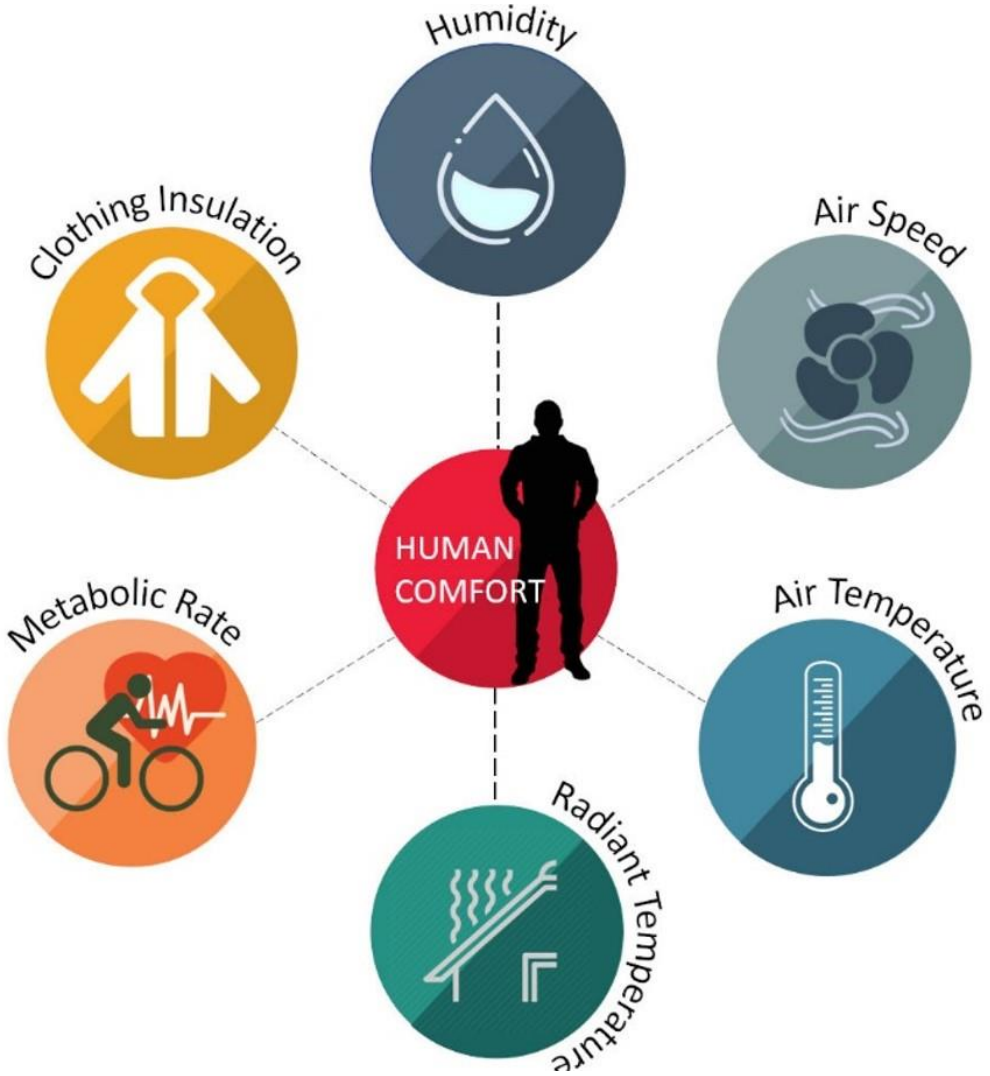
HUMAN COMFORT

Human comfort is defined as a condition of mind, which expresses satisfaction with the surrounding environment.

Factors affecting Human affecting Comfort

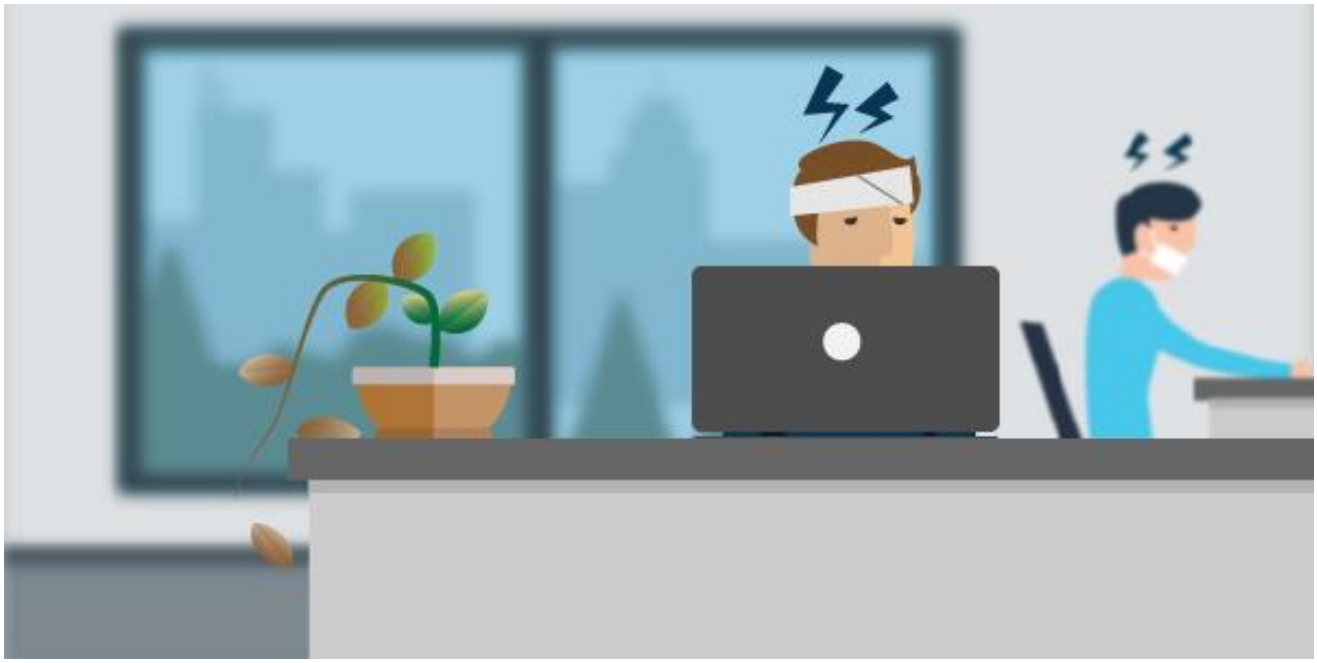
There are lot of factors affecting human comfort, however following are the major factors.

1. Temperature of surrounding air
2. Humidity of air
3. Air motion
4. Aesthetics
5. Acoustics and lighting
6. Indoor air quality



INDOOR AIR QUALITY

Indoor air quality (IAQ) is one of many factors that determine building functionality and economics. A building with good IAQ is more desirable place to work, learn and conduct business as it affects building occupants and their ability to conduct their activities and creates positive or negative impressions on them. IAQ directly affects occupant health, comfort, and productivity. Serious health impacts resulting from poor IAQ include -Legionnaires' disease, lung cancer from radon exposure, and carbon monoxide (CO) poisoning. More widespread health impacts include increased allergy and asthma from exposure to indoor pollutants, molds and other infectious diseases that are transmitted through the air, and **"sick building syndrome"** symptoms due to elevated indoor pollutant levels as well as other indoor environmental conditions. These more widespread impacts have the potential to affect large number of building occupants and are associated with significant costs due to health-care expenses, sick leave, and lost productivity.

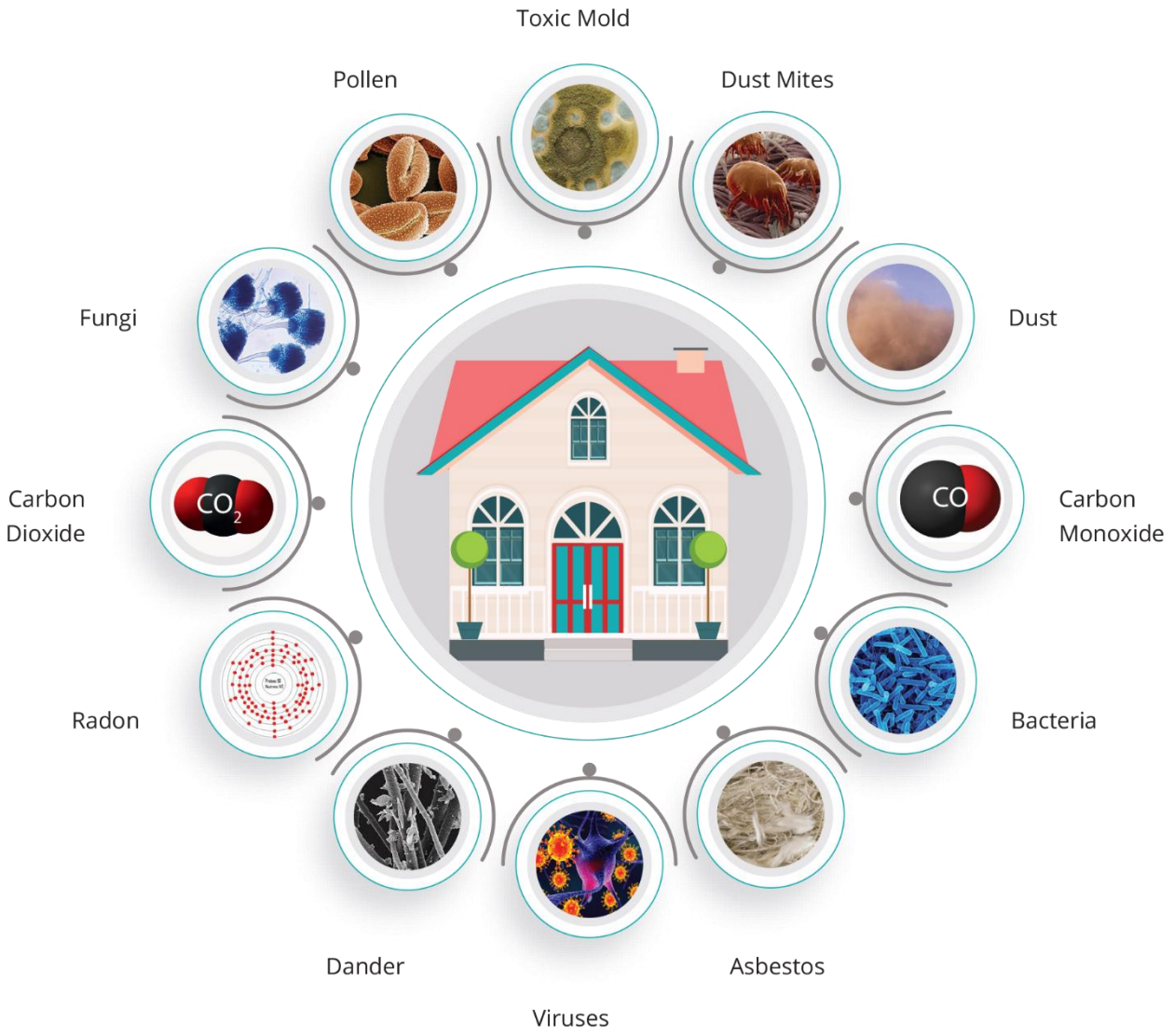


Benefits of Good Indoor Air Quality

1. Cleaner air with reduced odours
2. Lower energy costs
3. Improved performance and productivity
4. Reduced risk of health concerns
5. Increased comfort

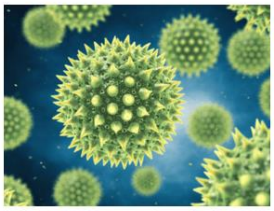
A study from the technical university of Denmark (2013) revealed that the indoor environment can influence work productivity by up to 10%. Tasks requiring concentration, memory and original thought are particularly susceptible to poor indoor air quality.

Contaminants Affecting the Indoor Air Quality



The major source of these pollutants inside an office could be pollution in the ambient air, dirty or dusty supply air ducts and air terminal devises in the air conditioning devices, construction and furnishing materials or particulate matter emerging from the printers.






SOLUTIONS FOR INDUSTRIES

Each project has special air quality needs and challenges; hence we offer a comprehensive solution that is customizable, scalable, effective, and robust.

Importance of IAQ test

In order to understand the level of quality inside and office or a workspace it is important to do the indoor air quality test. The quality of air inside buildings as represented by concentrations of pollutants and thermal (Temperature and Relative Humidity) conditions that affect the health, comfort, and performance of occupants.

Scope of work shall comprise of measuring the following:

1. Temperature
2. Humidity (RH %)
3. Carbon Dioxide (CO2 PPM)
4. Oxygen
5. Carbon monoxide (CO PPM)
6. Ozone (O3 PPM)
7. Hydrogen Sulphide (H2S PPM)
8. Sulphur Dioxide (SO2 PPM)
9. Nitrogen Dioxide (NO2 PPM)
10. Ammonia (NH3 PPM)
11. Formaldehyde
12. Suspended particulate matter
13. Total Volatile Organic compound (TVOC)

Following table shows the permissible limits of different contaminants.

Sl No	Parameter	Permissible Limit	Standard	Effects
1	Temperature (ºc)	24 +/- 2 ºc	ASHRAE	Temperature above or below the comfort requirements will leads to uneasiness by way of too cold or hot condition.
2	Relative humidity (%)	20% to 60%	ASHRAE	Excessive humidity will lead to sweating, Low humidity will lead to dryness.
3	Carbon dioxide - CO2 (PPM)	1000 PPM	ASHRAE	Acute health effect: difficulty concentrating, drowsiness, increased respiration rate.
4	Oxygen (%)	21%	OSHA	Lack of oxygen will lead to dizziness and chronic lack of oxygen may leads to death.
5	Carbon monoxide - CO (PPM)	50 PPM	OSHA	Acute health effect: dizziness, headache, nausea, cyanosis, cardiovascular effects.
6	Oxone - O3 (PPM)	0.1 PPM	OSHA	Acute health effect: Irritation of eye, respiratory tract, mucous membrane, aggravation of chronic diseases.

7	Ammonia- NH3 (PPM)	50 PPM	OSHA	Acute health effect: Irritation of eye, respiratory tract, and skin.
8	Sulphur dioxide - SO2 (PPM)	5 PPM	OSHA	Acute health effect: cough, irritation and feeling of chest tightness.
9	Nitrogen dioxide – NO2 (PPM)	5 PPM	OSHA	Acute health effect: Irritation of eye, respiratory tract, and mucous membrane.
10	Formaldehyde	16PPB	EPA	Acute health effect: Irritation of eye, respiratory tract, and skin.
11	PM2.5	65µg/m3 (24-hr)	EPA	Particulate matter is associated with a variety of serious health effects, including lung disease, asthma, and other respiratory problems.
12	VOCs	200 µg/m3	EPA	Acute health effect: Irritation of eye, nose, and throat. Fatigue, Loss of coordination and Dizziness

Sampling and Testing

1. Every 2000 to 5000 sqft, require one sample.
2. Measuring the parameters in morning, afternoon & evening.
3. Compact & modern equipment for measuring.
4. Evaluating parameters and comparing with reference to international standards.
5. Identifies the pollutants which is above permissible limits.
6. Recommendation in the form of technical solutions.

ENGINEERING CONTROLS

The goal of air purification is to remove contaminants from the air we breathe. Considering we breathe 23,000 times a day and move around 435 cubic feet of air, this is a major concern. In this age of globalization, the smarter and healthier buildings require high-performance engineering solutions.

Filter Cleaning

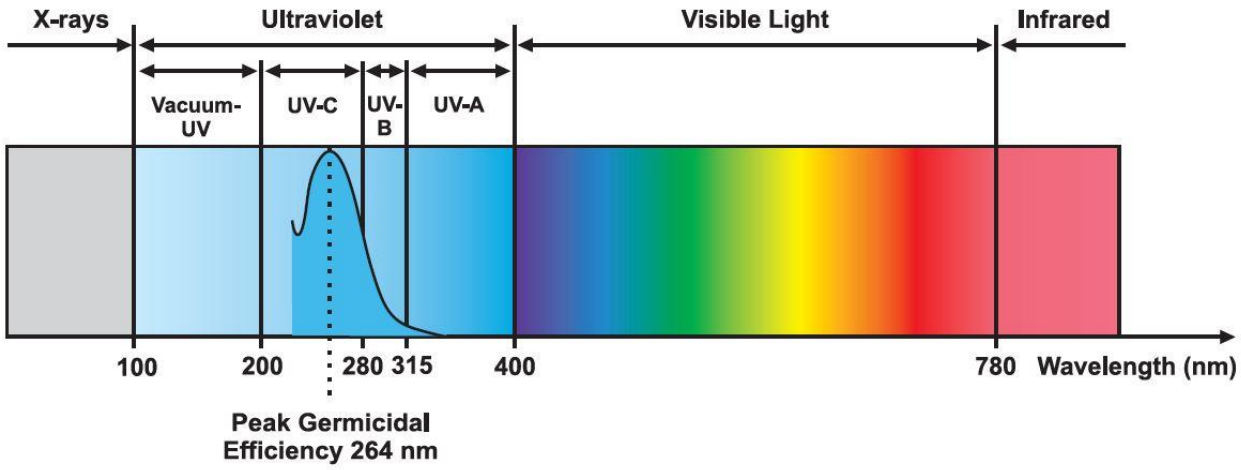
- Air filter prevent larger airborne particles (up to 40 microns)
- Dirty filter will affect pressure drop and air flow
- A dirty filter can lead to mold growth that can be spread throughout the occupied area by the HVAC system

Robotic Duct Cleaning

In today's times HVAC Air Duct is the most common form of air supply, cooling, air-conditioning as also air quality maintenance. It is but common knowledge that over a period considering the air quality – dust, minute organisms, even pests including small birds, rodents thus suffering the air quality of the office, hospital, home premises that it serves. Robots – operated by machines that clean the inside of these ducts – by scrubbing, polishing, sucking, scraping and removal of the above said contaminants and provides the Ozone treatment to the ducts from the inside and thus sanitizes it for a long period.

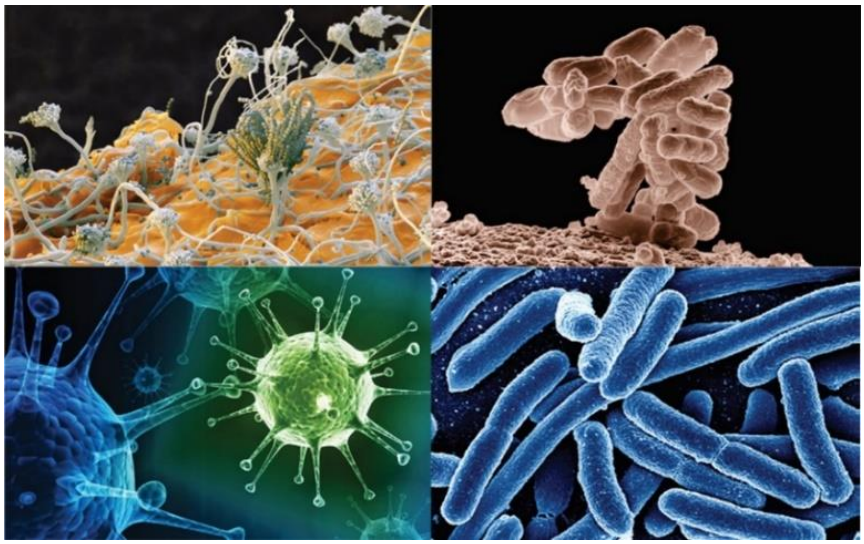
Ultraviolet Solutions

Ultraviolet Germicidal Irradiation (UVGI) is the use of ultraviolet (UV) energy to kill or inactivate microbes (viral, bacterial and fungal species). UV energy attacks the DNA of a living cell, penetrating the cell membrane, breaking the DNA structure of the micro-organism, inhibiting reproduction. UVC is effective in destroying biological contaminants and odours such as mold, bacteria and viruses. The Centre for Disease Control (CDC) recommends this method for destroying viruses such as tuberculosis. The sun delivers specific UV wavelengths that destroy and deactivate chemical contaminants that are introduced into the atmosphere.



- UV-A — the most abundant in sunlight; responsible for skin tanning and wrinkles
- UV-B — primarily responsible for skin reddening and skin cancer; also used for medical treatments
- UV-C — naturally blocked by the earth's ozone layer and is the germicidal wavelength

UV lamp produces the same UV wavelength the sun produces. UVC (Germicidal 254nm) and UVV (Oxidizing 187nm) are produced using quartz glass. UVV (Vacuum UV) is used for oxidization; this is the portion of the lamp that destroys chemicals and odours, such as cigarette smoke, VOC's, diesel fumes, formaldehyde, amongst others. Both UV wavelengths work together to destroy thousands of biological and chemical contaminants that continually circulate within the building. Depending on the application, we use UVC, UVV, or a combination of both wave lengths to achieve the desired results.



Surface Disinfection

AHU Coil Cleaning

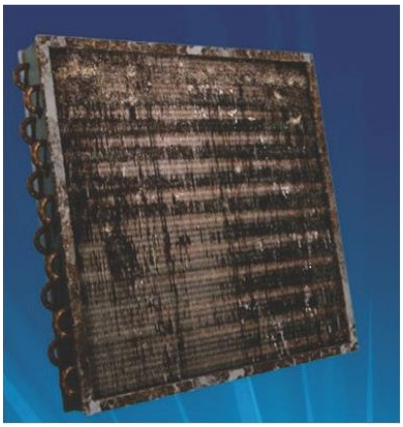
This UVGI (Ultraviolet Germicidal irradiation) System is installed in Air Handling Units of HVAC. The reason for installing this is to overcome the following usual problems encountered with air conditioning and refrigeration systems commissioned without any UVGI.

Usual Problems Encountered

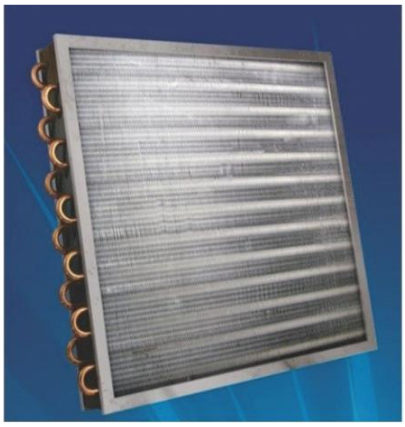
1. Increasing Electricity Consumption
2. Deteriorating Indoor Air Quality (IAQ)
3. Increased Operation & Maintenance Cost
4. Improved Cleanliness, Eliminated Maintenance and Cleaning of Cooling Coils
5. For Retrofit and New Projects

Helps in Following Ways

1. Energy Saving
2. Improved Indoor Air Quality
3. Reduced Operation & Maintenance Cost
4. Increased Coil Life



Coil Before UVC

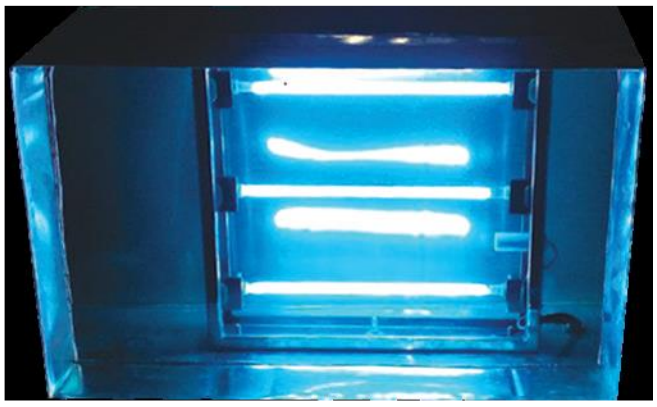


Coil After UVC

Air Disinfection

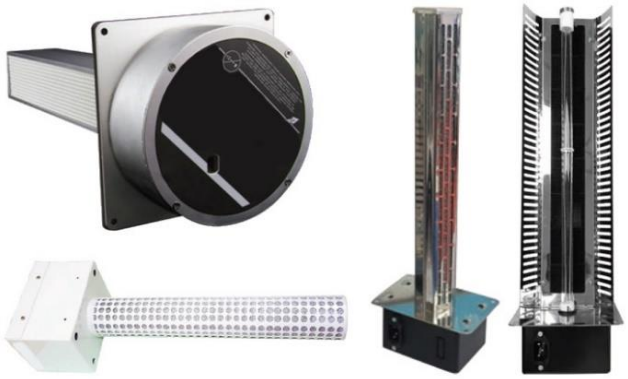
In-Duct Cleaning

Air Disinfection and Stench Removal: A duct mounted Ultraviolet (UV) based product designed for original fitment or retrofitting in ducts usually for the purpose of eliminating bad odours of kitchen exhaust, toilet exhaust, sewage treatment plant etc. This product finds wide application and acceptance in hotels and hospitality industry as well as for hospitals and industrial canteens, public toilets etc.



PHI Cell

Powerful light wave lengths are generated that energize the gaseous contents of the passing air, producing purifying plasma that destroys bacteria, virus, fungi, VOC's, and other organic as well as neutralizing unpleasant odours. Highly effective in removing VOCs, odour, dust particles bacteria and virus from passing air and inside air duct and AHU. Employs the most advance nanotechnology to coat TiO2 on patented metallic surface (304 Stainless Steel) and UV lamp for outstanding (PCO) performance.



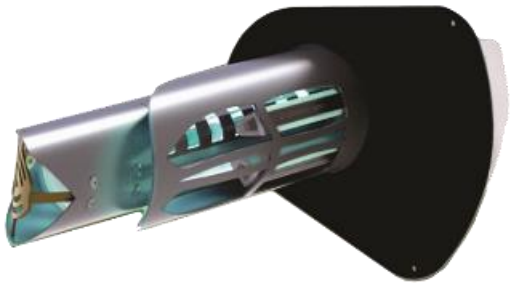
Features

1. Available in three sizes (5", 9", 14") to accommodate blower sizes from 300-18,000 CFM
2. Reduces bacteria, mold, viruses, and odours.
3. Unlike portable units that are limited to the room in which they are placed, the PHI Cells provides whole home and building purification.
4. Easily integrated with your existing HVAC system, the unit does not take away living space and operates silently.
5. PHI can reduce sneeze germs by 99% by the time the sneeze has reached three feet.
6. Low maintenance.

REME Cell

Designed to eliminate sick building syndrome risks by reducing odours and air pollutants, the REME cell is an in-duct air purifier which is the best solution for whole house and building air purification. Invented to recreate nature's process of purifying the air, it is like bringing fresh outdoor air inside without ever having to open your windows. And it is effective against all three categories of indoor air pollutants: Particulates, Microbial and Gases.

You can now reduce common allergy triggers from particulates such as pollen, mold spores, dander, and dust. Thoroughly tested on airborne and surface bacteria & viruses, such as MRSA, e-coli, and Norwalk, to name a few. Say goodbye to odours from cooking, pets, dirty socks, diaper pails, and musty rooms



Features

1. Dual ionizers to reduce airborne particulates (dust, dander, pollen, mold spores)
2. Kills up to 99% of bacteria, mold and viruses
3. REME® reduces sneeze germs by 99% in the time a sneeze can reach three feet.
4. New zinc ions kill 99% of viruses on surfaces
5. Easily integrated with your existing HVAC system. The unit does not take away living space and operates silently.

Catalytic Air Purification

PCO with Gas Phase Filtration : It is an advanced process by which volatile organic compounds (VOCs), bacteria, olds and fungus are destroyed by incorporating photon and ultraviolet (UV) energy activating a catalyst thereby creating the photo catalytic oxidation (PCO) process. UVPCO often utilizes a honeycomb configured, reactor coated with titanium dioxide (TiO2 or Titania) as the photooxidative catalyst. This design potentially can have high conversion rates with low pressure drop making it suitable for use in building HVAC systems. The coated screen is irradiated with UV light near 254 nm UVC. Air containing organic pollutants flows through the screen, where the VOCs adsorb on the catalyst. The UV light interacting with the catalyst in the presence of oxygen and water vapor, produces hydroxyl radicals. Hydroxyl radicals are highly chemically reactive and, in-turn, breakdown the adsorbed VOCs, ideally producing only carbon dioxide and water as bye products. Gas Phase Filtration with Photo-Catalyst Oxidation systems are tailored precisely to your needs and operate with the highest efficiency. The multistage design allows for selection of the required filters in a specific sequence to meet the requirements of each application.

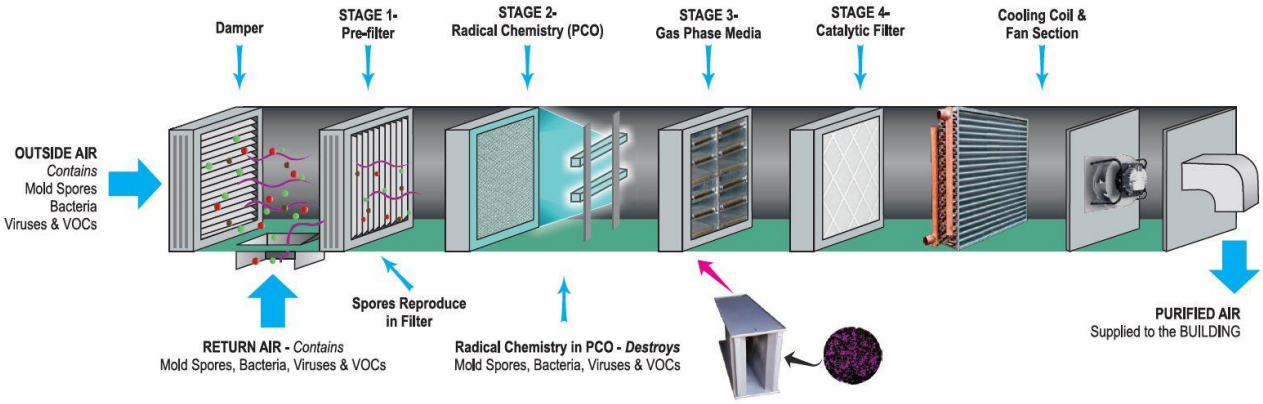
- Destroys molds, viruses, bacteria, and allergens etc.
- Maintains desired levels of particulate matter
- Efficient regeneration of media
- Flexible design, Easy to retrofit
- Adequate controls for safety
- No harmful emissions
- Reduces all odorous and hazardous air pollutants
- Provides extremely high single-pass efficiency of gas removal
- Prevents corrosion / breakdown of electronic equipment

Optional Equipment

- Differential Pressure Monitoring System
- VOC Sensors
- Lab Analytical Services

Stage 1 – Pre-Filtration

- Air entering the system passes first through a MERV 8 high-efficiency particulate filter, which captures many of the larger biological contaminants and small airborne particles such as mold spores and pollen.
- Bag Pre-Filters are provided with 95% efficiency (MERV 14, EU 8), bag filter made of 100% dual layer synthetic fibres to capture finer particulates.



Stage 2 – Radical Chemistry (PCO)

- Viruses, odours, VOCs, and micro-organisms are exposed to a high-intensity ultraviolet light. This UV radiation penetrates micro-organisms such as fungi, bacteria and viruses and damages their DNA bonds, sterilizing them.
- This air passing through a panel coated with titanium dioxide (TiO2), when subjected to ultraviolet photons, creates hydroxyl radicals. The radicals oxidize gaseous organic compounds, e.g. odours and VOCs

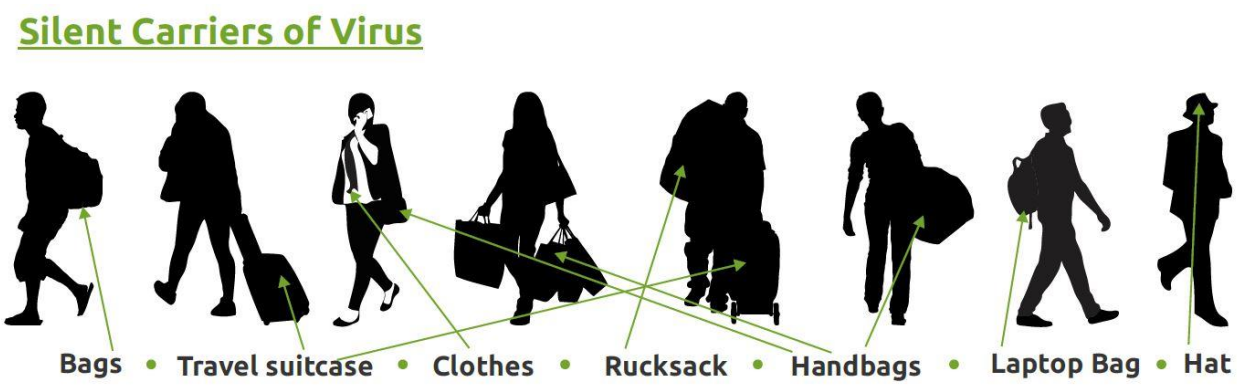
Stage 3 – Gas Phase Media

- The system media panel is uniquely designed to continually renew itself and has an exceptionally long life, under normal use.
- Media is in the form of granular pellets that are made of binders and activated alumina or other elements. Potassium permanganate is used as media, as it boosts the adsorption rate for a longer duration. The filtration media generally targets contaminants such as sulphur oxides, hydrocarbons, formaldehyde, organic acids, hydrogen sulphide, nitric oxide, and VOC's.

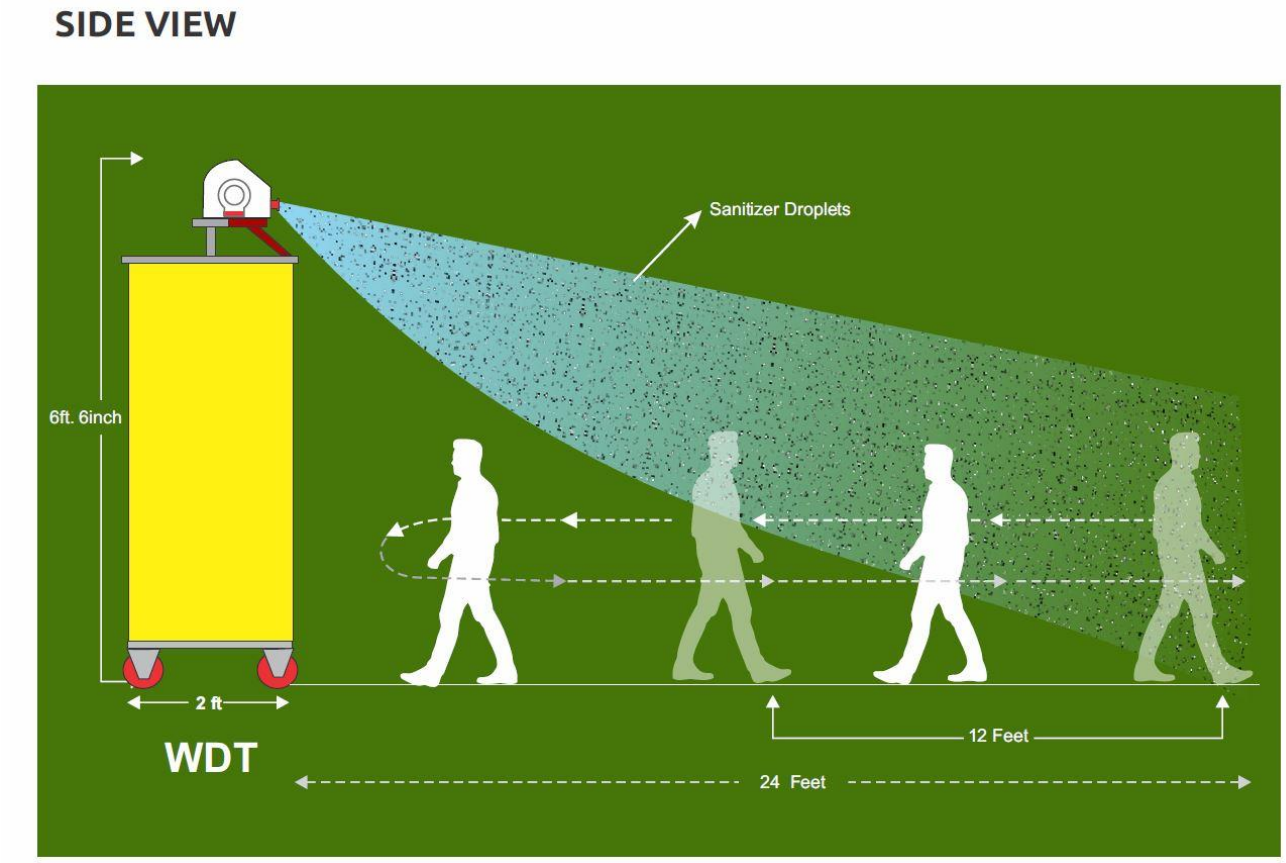
Stage 4 – Final Filters

- Final set of pleated disposable fibre matrix filters are provided with 30% efficiency (MERV 8, EU 4), to capture any leftover elements.

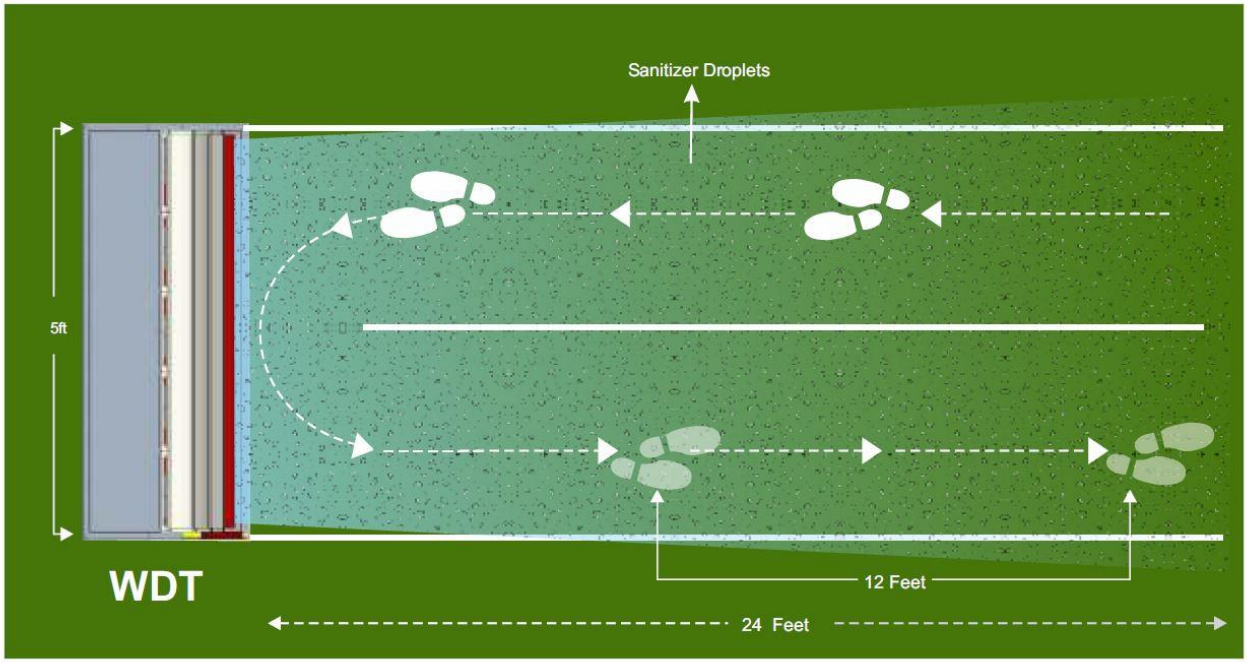
Disinfectant Walk Through (DWT)



- No need of a Chamber
- Can Disinfect up to 900 people / Hour
- Low consumption of Disinfectant
- Dual function - Disinfecting and Misting
- Movable Trolley modules
- Available in 2, 3, 5, 6& 10 feet



TOP VIEW



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