21st Century Healthy Hotels and Resorts

Facility Design and Construction Considerations to Enhance Consumer Confidence in Hotel and Resort Properties, thus Increasing the Business and Market Share Opportunities for Hotel Properties.

The Ritz-Carlton, St. Thomas, USVI

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Premise:

The rapid onset of the novel corona virus and resulting COVID-19 has stopped the world-wide economy, thus adversely affecting business and industry at large. Specifically, the hospitality industry has been hard hit as the vast majority of hotel and leisure properties have been forced to close to slow the widespread advance of this virus and limit the death and pain left in its wake. It significantly affects the consumers' confidence in travel due to concerns over individual health. This reduced confidence will likely influence hotel occupancy for many months and years into the future.

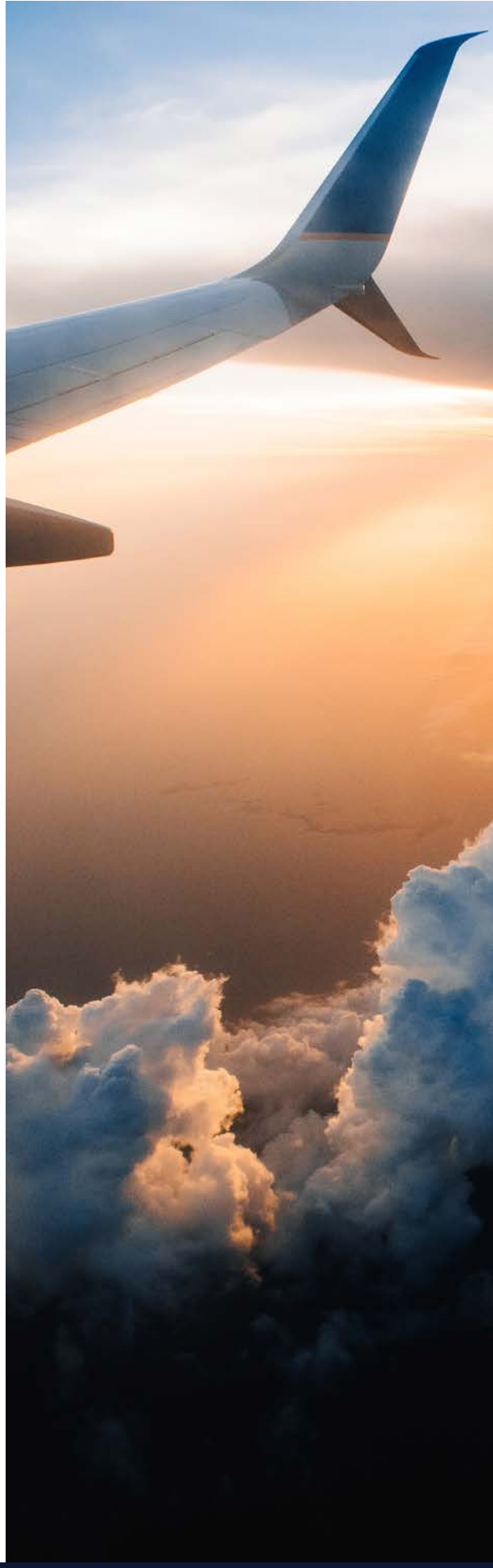
Initiative:

In light of the pandemic facing the world, it is paramount for hotel owners and operators to augment the physical and operational components of their hotels and resort properties to reestablish and increase occupancy and market share. It is important that the consumer has confidence in the facility, its cleanliness, and the quality of the hotel, thus selecting superior properties over that of traditional hoteliers. The implementation of modern systems, refined organizational planning metrics, and wellness components will not only make the hotel safer, but will contribute to provide a new level of wellness not currently present in hotels and resorts. The strategies identified below are applicable to not only hotels, but to many building types where people meet, work and live.

History:

Architecture and Design - A New Post-Pandemic Cultural Shift Based in History

The COVID-19 pandemic may be unique to the 21st century, but if history repeats itself, the social shifts will reverberate throughout the populations of the world and have a changing



effect on lifestyle, wellness, and the built environment. History informs that major health events have influenced the development of modern architecture. The bubonic plague of the 14th century wiped out one-third of the population of Europe and as a result, cities expanded space for housing and public activities. In the 18th century yellow fever caused pain and destruction around the world, and in the 19th-century cholera and smallpox, while wreaking havoc, influenced the development of modern planning innovations that included suburbs, wide boulevards, city sewers, indoor plumbing and a growing understanding of the importance of natural light and allowing breezes to reach inner sections of cities. The Spanish flu pandemic from 1918 to 1920 killed tens of millions across the globe. In the 1800s, a major percent of the urban population of Europe and America was infected with tuberculosis, and as many as seventy percent of those infected died of the disease. This gave rise to the sanatorium movement in Europe and the United States, designed to treat and isolate patients, these institutions emphasized strict hygiene and ample exposure to sunlight and air. Before the development of medications for tuberculosis, its treatment was environmental. These clinical environments inspired the development of healthy architecture and thus modern architecture was born.

The Swiss architect Le Corbusier stated, "A house is only habitable when it is full of light and air." Architects of the 19th and 20th centuries created Architectural Modernism which was the prevailing basis of architectural style from the 1920's through the 1970's. Architecture took on a curative basis in its organization with consideration to light, air, minimalism, and clean surfaces. The modern style with hard surfaces, expansive windows, and access to daylight was developed and flourishes to this day.

Le Corbusier photographed in 1953 by Willy Rizzo while describing the effects of light, air, and climate on a modern building.

Consideration of the Spread of COVID-19:

The COVID-19 pandemic rapidly swept across the globe leaving pain, suffering and economic ruin in its wake. Until a sustainable treatment and vaccine is developed, we must reconsider how we live and how we design facilities for human occupancy. As the global economy restarts, care must be taken to minimize the spread of this disease and transition to a sustainable model for increased human wellness.

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On May 22nd the Centers for Disease Control updated its statement regarding how the disease is transmitted to note:

"The virus is thought to spread mainly from person-to-person.

- Between people who are in close contact with one another (within about 6 feet).
- Through respiratory droplets produced when an infected person coughs, sneezes, or talks.
- These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs.
- COVID-19 may be spread by people who are not showing symptoms."

The CDC further states: "The virus may be spread in other ways—It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes. This is not thought to be the main way the virus spreads, but we are still learning more about how this virus spreads."

As such, primary design considerations in response to the COVID-19 pandemic should focus primarily on the transmission

of airborne pathogens transmitted from person to person and secondarily on the possibility of transmission by touching contaminated surfaces. The general dialogue in the hotel industry today revolves around the cleaning of surfaces and less on the sanitation of air. To solve the right problem, we must focus on the elimination of pathogens in the air we all breath. This article speaks to both areas of concern and proposes the integration of current mechanical technologies to improve the health of occupants of hotel facilities.

Improvements for the New Healthy Hotel and Resort:

The following is a summary of proposed improvements by space and type for development of the 21st century healthy hotel and resort.

As hotels begin to reopen for the summer 2020 season it is certain that changes in operational procedures will require facility modifications and enhancements to support new operational protocols. Facility and operational considerations will include:

- ***Getting to the Hotel:*** Hotel staff will be following new standards for guest interaction upon arrival to the hotel. Many hotels have advised that bell service could be reduced, that hotel employees will not be opening taxi or car doors, and luggage-bell service has been suspended in some hotels.

"Primary design considerations in response to the COVID-19 pandemic should focus primarily on the transmission of airborne pathogens transmitted from person to person and secondarily on the possibility of transmission by touching contaminated surfaces."

- ***Valet Services:*** Luxury hotels and resorts have always emphasized personal service. This has become an expectation for many travelers, and we do not see this expectation diminishing in the future. Sanitation and cleanliness extend to valet and bell services, and hotels should provide extra care in this regard including fog sanitation in cars as well as coverings for steering wheels and shifters. This added touch could combine with other hotel features to make the hotel brand a must-stay for the savvy wellness-oriented traveler.
- ***Wellness Checks:*** Many hotels are planning the addition of staff host/hostess to greet guests, perform temperature checks, review social distancing/PPE rules, and determine a general wellness assessment.
- ***Hotel Entrance/Registration:*** Concerns over surface touch points are important for the public. According to the U.S. Centers for Disease Control and Prevention and the World Health Organization, the novel coronavirus is primarily spread by droplets from someone who is coughing, sneezing or even talking and by virus particles that drop onto surfaces from the air or that are transmitted to surfaces directly by infected people. For this reason, hotels are minimizing the number of touch points throughout the hotel. Door handles should be removed and replaced by electronic operators where possible. Guest registration will more often be facilitated via touchless electronic registration with smart phones, thus eliminating personal contact and minimizing surface contact.
- ***Concierge and enhanced guest services:*** The tradition of hospitality in the hotel industry is important and a radical reduction in services and amenities would be a long-term mistake. Hotel operations need to integrate current and new technologies into traditional guest

services to provide a new level of 21st century service. Many hotels are eliminating traditional concierge services or placing the concierge staff behind a plastic shield. This is counter to the tradition of hospitality, and care must be taken to provide a new level of one-on-one guest service via an electronic medium. This can extend service beyond the hotel property and enhance guest service. An off-property facility could be established that provides this service for several hotels as an amenity for guests, perhaps a paid amenity, thus enhancing service, not eliminating traditional services.

UV light treatment is a non-thermal, non-chemical technology to inactivate microorganisms. Campden BRI's UVI light tunnel can treat products from both above and below.

- ***Sterilization of guest luggage can be accomplished with UVC light conveyors:*** A UV light conveyor box is used to disinfect luggage and items carried by guests, similar to an airport x-ray machine. This is currently being utilized in the food industry.
- ***Public Corridors and Public Areas:*** Hotels are minimizing furniture and replacing finishes with hard surfaces that are easily cleanable. In addition, sanitizing UV lighting at 405 nm in the visible spectrum or Far UV light at 222 nm can be placed within these areas for continuous natural sanitization of surfaces, furniture and fixtures. Doors can be removed to further reduce touch points; rooms and spaces can be designed allowing guest access by screen walls. When screen walls are not practical, then smart phone access points with automated openers could be used, thus minimizing personal interaction and touch points.

Sunseeker Resort, Port Charlotte, FL

- ***Hotel Guest Room:*** The guest room is the heart of the guest experience and physical/operational considerations to guest rooms in this post pandemic era are many. Considerations with regards to guest rooms include:
    - ***Cleaning and Sanitation*** – Hotels have developed a cleaning protocol that will elevate the cleanliness and wellness of the guest room to new levels previously unseen in the industry. Cleaning and sanitation will occur from topical surface cleaning with cleaning chemicals and surface sterilization. Cleaning and sanitation will take on a technological advantage with the implementation of UV technology for continuous sanitation and wellness.
    - ***Electronic Access*** – Smart phone access systems for touchless entry.
    - ***Entry Door Seal*** – Many hotel brands are developing a door seal to be applied by housekeeping staff upon completion of the room cleaning protocol. It is important to the guest that access to their personal guest room is limited. The door seal allows an increased level of confidence in room cleanliness and helps certify that no one has entered the room after cleaning and sterilization.
    - ***PPE Closet and Service Access to Guest Room*** – Guests have always desired to limit access to their personal guest room space by hotel staff and outsiders. This will be more important in this post pandemic era, and to this regard hotels can borrow a feature common in hospital rooms—the pass-through closet. Redesign of the guest room entry allows the addition of a small closet accessible through a door from the outside corridor. The small

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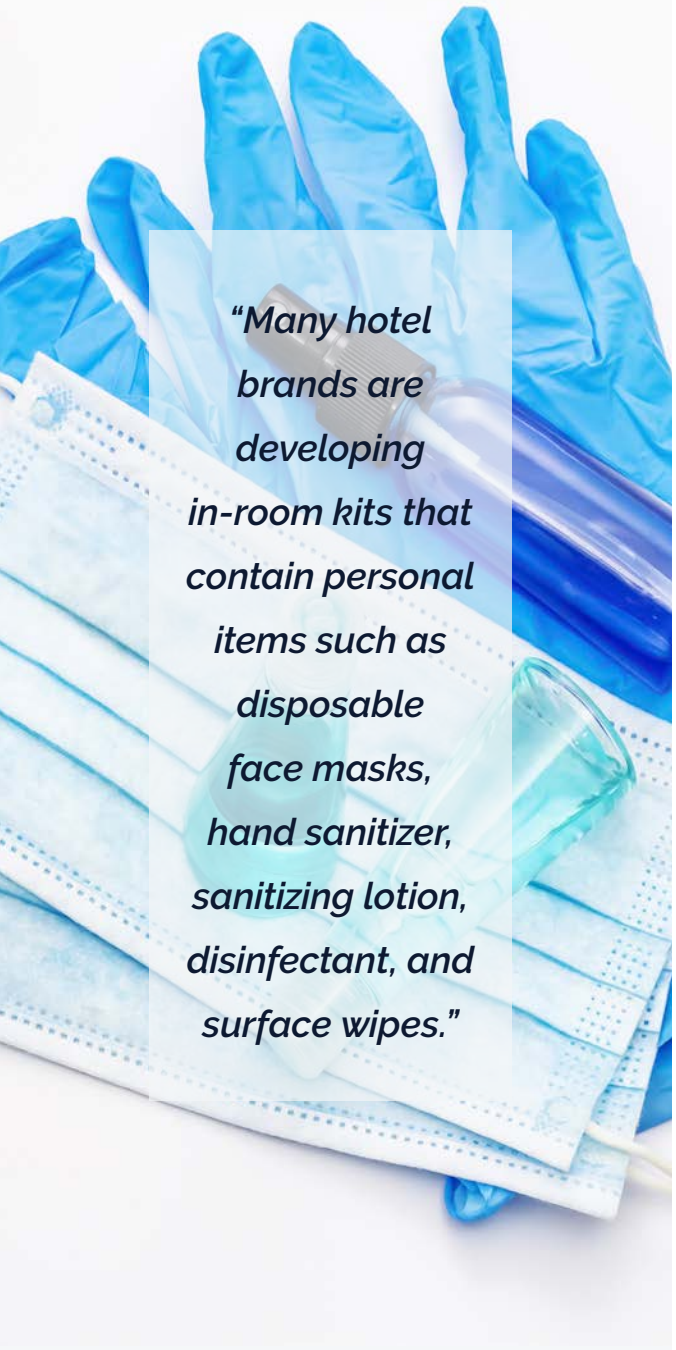


"Many hotel brands are developing in-room kits that contain personal items such as disposable face masks, hand sanitizer, sanitizing lotion, disinfectant, and surface wipes."

closet space can be accessed from inside the guest room through a locked door. The guest can then retrieve the items provided, such as clean towels, linens, sundries or even room service food and beverage items.

- ***Room Amenities*** – Many hotel brands are developing plans to limit in-room amenities due to difficulty with cleaning and sanitation. These include mini bars, in-room coffee, decorative pillows, bed scarves, enclosed closets, magazines, pamphlets and even TV remote controls (utilizing smart phone access through the hotel app). This radical approach can be offset with continuous in-room sanitation lighting. As a replacement to the traditional in-room amenities,the retail facility at the front desk or in the lobby will be expanded as a new guest amenity.
- ***In-Room Personal Safety (PPE) Amenity*** - Many hotel brands are developing in-room kits that contain personal items such as disposable face masks, hand sanitizer, sanitizing lotion, disinfectant, and surface wipes. This could be provided in the lobby at the time of greeting, left in the room as an amenity, or provided for guest use through the guest room entry closet.
- ***Newspapers and Resort Schedules*** – The traditional amenity of a delivered newspaper, daily activities program or daily menus have become a thing of the past to be replaced by electronic media integrated into the hotel app..
- ***Separated Quarantine Guest Rooms*** - It is likely that, guests infected with COVID-19 will be identified in the hotel. It is assumed that hotel management will

facilitate the transfer of the guests to a health care facility. If that is not possible, it may be necessary to accommodate the sick guests within the hotel. The establishment of several isolated guest rooms with advanced features such as advanced air quality, negative air pressure, antimicrobial furnishings, accessible restroom facilities, and an airlock entrance with PPE closet to allow separation of the sick guest during the quarantine period would be beneficial.

- ***Hotel Food Service and Restaurants:*** As with many normal activities and amenities post pandemic, there will be a radical shift to safety that will soften over time and return to a new normal. Success can be achieved through the design of facilities, procedures and systems that enhance safety and wellness while maintaining and enhancing guest service and satisfaction.

  Leisure and business travel share a commonality, and that is relaxation and personal pampering at the end of a busy travel day or stressful workday—this is often satisfied by a quality dining experience. Elimination of superior dining facilities degrades the travel experience and should not be undertaken lightly; rather redesign to provide a safe experience while maintaining quality hospitality experiences.

  The following are changes contemplated by hotels as they reopen and move forward.

  - Elimination of buffets or replace with staff-served buffets
  - Closing restaurants or limiting F&B outlets
  - Limit seating at hotel restaurants
  - Installation of partitions between seating
  - Removal of traditional menus and replacement

Luminary Hotel, Marriott Autograph Collection, Ft. Myers, FL

with disposable paper menus or digital menus accessed from guests smart devices

- Use of disposable paper and plastic service items

The following are changes that could be implemented to enhance the guest dining experience.

- Increased room service offerings with augmented in-room dining surfaces
- Organization of dining rooms to allow greater separation of seated guests
- Integration of natural separation barriers to provide separation while maintaining social integration
- Mechanical systems improvement/ integration for increased air quality
- Addition of anti-microbial coatings on dining tables and seating
- Design of additional outdoor dining areas with natural light, natural ventilation and separation of diners on exterior patios, pool decks and roof-top open-air facilities
- Integration of UV light technology for continuous sanitation

- ***Back of House Operational Changes:*** There will be significant operational changes that the guests will not see. These include training and procedural changes for the staff with additional managerial and supervisory staff. These changes will necessitate physical upgrades to the back of house areas. The following represents a partial list of changes and facility modifications needed to accommodate the operational adjustments:
  - Additional training/meeting conference facilities
  - Administrative space for newly deployed hygiene managers and inspectors—similar to registered sanitarians currently utilized in F&B operations, this activity will be expanded to overall hotel facility cleaning and sanitation.


Fontainebleau Hotel, Miami Beach, FL

Semiprivate seating to allow distance separation while allowing for social connection, augmented by enhanced air cleaning and sterilization

- Staff arrival zone for well checks and temperature checks
- Augmented uniform storage and laundry facilities as many hotels will no longer allow associates to take their uniforms and wear while traveling to the hotel—with uniforms laundered on property and maintained for staff use
- Storage for additional cleaning supplies and equipment including staff and guest PPE

- ***Design:*** The traditional requirements for hotel and public area design and planning must now include adequate space for the new standards of public separation. The use of semi-private area is more important to allow greater separation of large numbers of people. Dividing elements and screening will allow an increased level of separation while reestablishing the human need for public connection. This will become common in all building types and will simply become an expectation of the public. A design that intelligently incorporates these elements will support the new public expectation and will create a greater level of wellness.

Current architectural expressions have taken a turn back toward modernism with the onset of the Global Wellness Economy. The desire for healthy buildings and spaces, to align with the growing understanding of wellness, will inform how we design buildings of all types including hotels, schools, offices, residences, and healthcare facilities. A return to Mid Century Modern planning and design principals provides segregation of gathering areas with more distance, while providing easily cleanable

Expansive public areas with readily cleanable surfaces that allow natural daylighting, and continuous air cleaning and sterilization


Fontainebleau Hotel, Miami Beach, FL

Hotel Valley Ho, Scottsdale, AZ

surfaces and materials. This aligns with a current design trend to more traditional modern design.

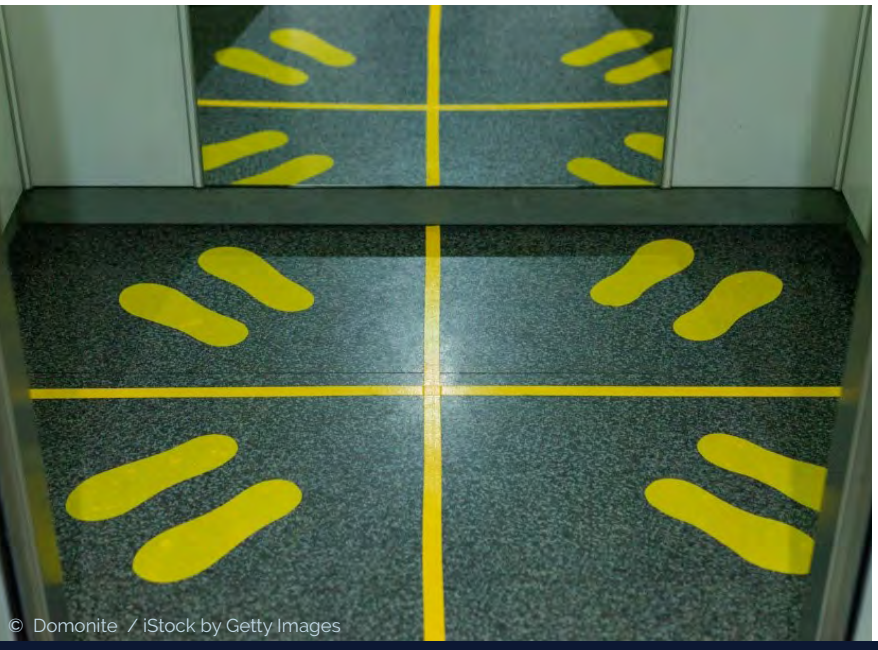
- ***Existing Public Restrooms:*** Public restrooms in existing hotels can be renovated with minimally invasive features to increase the health and wellness of the space. The following are steps that can be taken to increase the safety of guests and the public:
  - Remove entrance doors and provide access with screening walls
  - Coat existing surfaces with anti-microbial coatings
  - Separate and minimize lavatories
  - Improve air quality by redirecting air flow and increasing negative pressure within the restroom by increasing exhaust capacity
- ***New Design and Construction of Public Restrooms:*** How do we design safer public restrooms post-pandemic? The items described above also apply to new restroom facilities with the addition of the following items:
  - Redirected air flow with the addition of air filtration systems
  - Installation of continuous UV sanitization lighting systems
  - Incorporation of touch-free access to toilet stalls
  - Positive separation between stalls with solid partitions
  - Incorporation of negative air exhaust within stalls to remove airborne contaminants from occupants

There is a shift in society to gender-neutral restrooms. The international

Code Council has approved a change to restroom standards recommended by the National Center for Transgender Equality, and these changes will take place in two phases in future code updates. Primarily the individual stalls will provide privacy separation, and the public area will require shared lavatory areas. Consideration of changes to new restroom facilities should include the upcoming gender-neutral requirements.

- ***Vertical Circulation:*** Given the fact that COVID-19 and other viruses are spread via airborne transmission, the elevator is the most difficult area of a multi-story building to design for safe occupancy. The elevator is the most expensive part of a building by square footage, and the ability to provide multiple elevators for limited occupancy is likely cost prohibitive. So how do we improve the wellness of the elevator in multi-story buildings and hotels? The following is a list of improvements that when undertaken should significantly improve the wellness equation of traveling in traditional modern elevators:
  - Requirement for all occupants within an elevator to wear masks as face coverings
  - Limited occupancy whereby the occupants face away from other occupants toward walls or mirrors that are surfaced with antimicrobial coatings
  - Modernization of elevator controls allowing for touch-free access controls

"Elevator renovation includes a stand-alone mechanical system on each cab that provides negative pressure and air change for every elevator trip."



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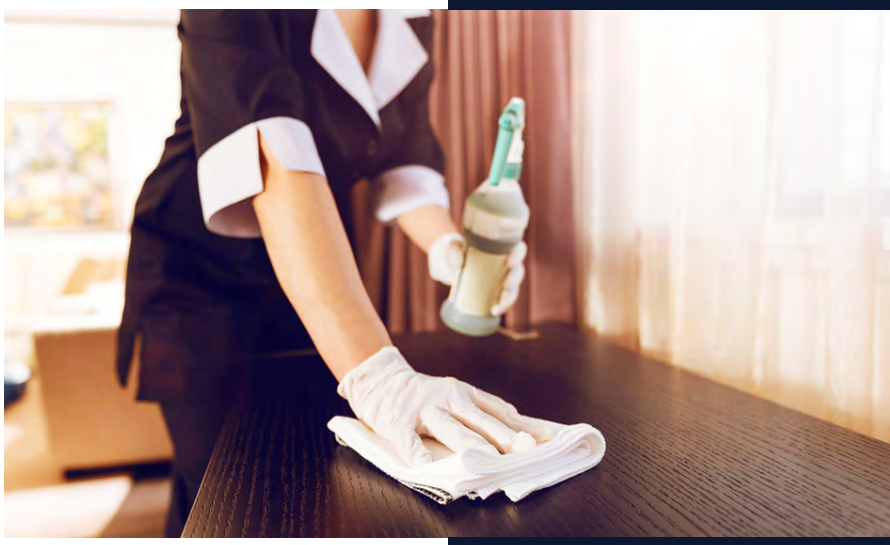
  - Integration of a stand-alone mechanical system that exhausts the air from the individual elevator cab through HEPA filtration media and UVC light sanitation allowing negative pressure and a complete air change for every elevator trip
  - In new multi-story buildings, United Technologies and Otis Elevator have developed a smart elevator that allows users to schedule trips and operate the elevator via their smart phone

device. This will allow increased efficiency for parties in limited occupancy

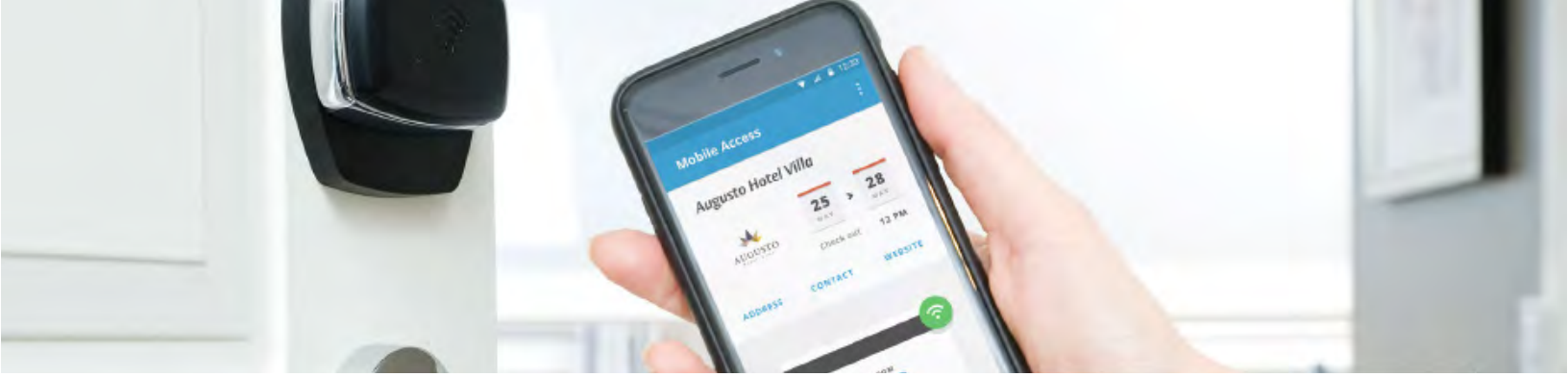
- ***Clean and Disinfected:*** Although hotel guests have always desired a standard of cleanliness in the hotels they select, this expectation will increase in the future as we all have a greater expectation that the facilities must not only be clean but also disinfected to minimize contact with harmful bacteria and viruses.



  General cleaning of all areas of the hotel must be upgraded to maintain a healthy hotel standard. The current pandemic has raised the awareness and understanding of the importance of a sanitary environment to maintain health and wellness. The days of a quick pass with a used rag and a spray of window cleaner are gone forever to be replaced with a new standard of hospital-grade cleaning and sanitation. The Center for Disease Control and Prevention has developed a Best Practices Document for Environmental Cleaning in Healthcare Facilities and this document is available at https://www.cdc.gov/hai/pdfs/resource-limited/environmental-cleaning-RLS-H.pdf

- ***PPD – Personal Protection Devices***

  Personal protection devices are now a familiar component in everyday life and for some time into the future they will be common and needed. Just as hotels in the past would provide a spare toothbrush to a guest that left his at home, so too hotels now should make personal protection devices available to guests for their use—this would include disposable masks, gloves, and shoe coverings being readily available to guests.



- ***Hand Sanitation and Hand Washing***

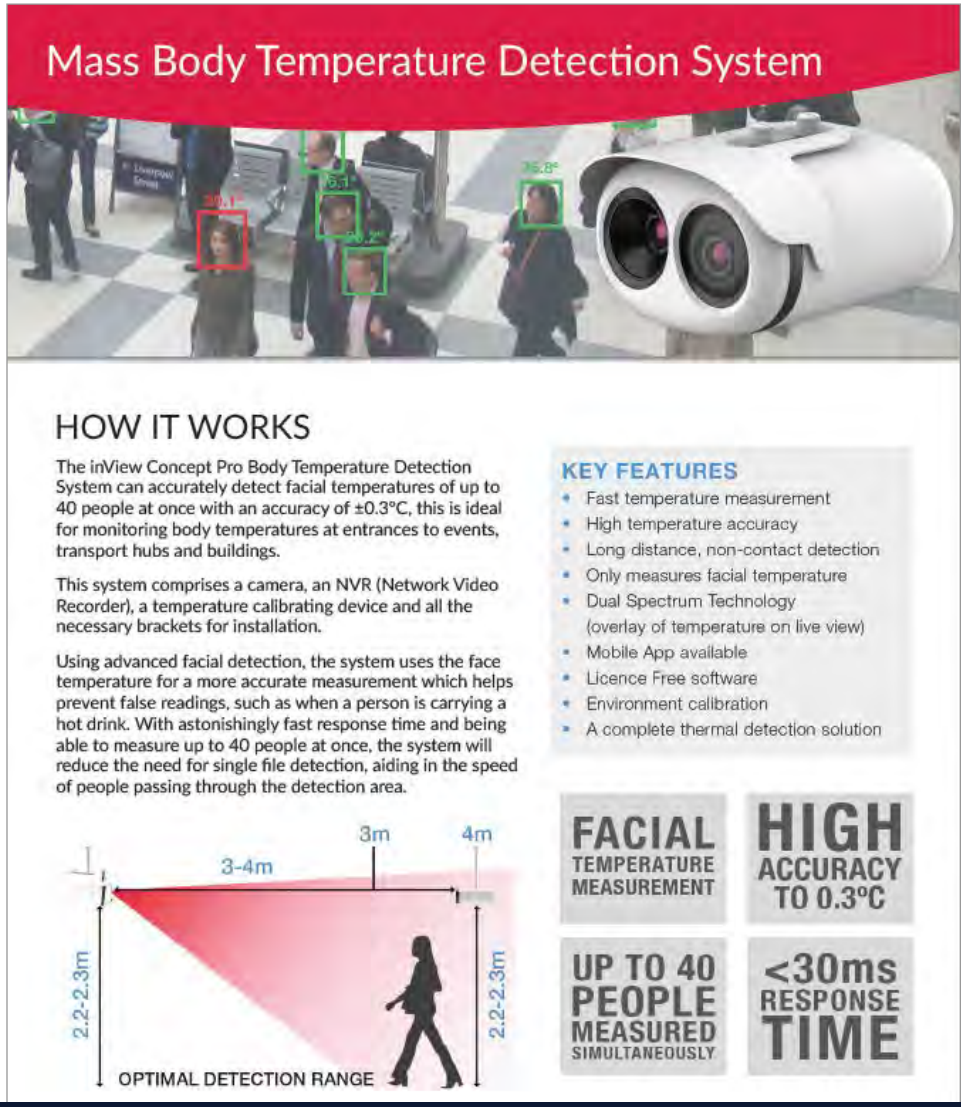
  The hotel should place hand sanitizer stations throughout the hotel at all entry points and provide small personal bottles in the guest rooms to augment the traditional bathroom toiletries. L2 recommends the stations have two types of sanitizer, an alcohol-based hand sanitizer and sanitizing hand lotion that could be procured with a branded scent that relates to the hotel or location.

  In addition to hand sanitizer, L2 would integrate public hand washing stations throughout the public areas of the hotel. This would consist of modern integrated sinks designed in the hotel to be seamless while providing easy access at all entry points and proximate to restaurants and food and beverage facilities.

Technology:

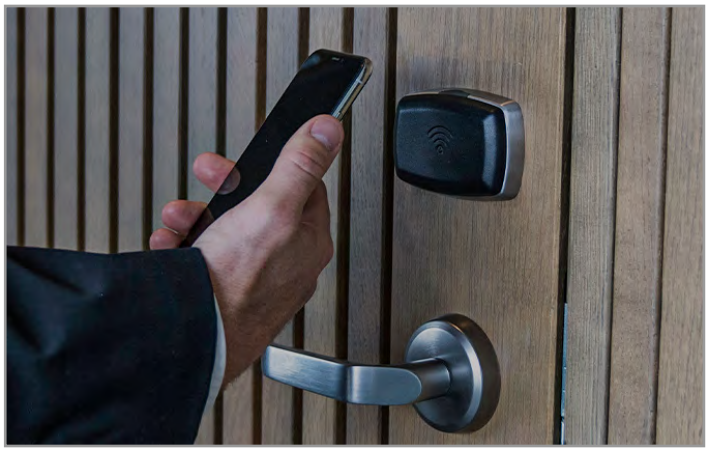
- ***Guest Wellness Monitoring:*** Remote mass testing with a Body Temperature Detection System should be considered at the primary entry points of the hotel and public facilities. The Body Temperature Detection System, described here by Clearway Company, comprises a thermal imaging camera that instantly and remotely displays the face temperature of up to 40 individuals simultaneously from

Clearway Environmental Services (UK) Ltd.



a single, standalone camera. The System will constantly scan a moving flow of people, and will detect, visually highlight, and alert operations instantly when a high body temperature is detected, even when the individual is completely unaware of their symptoms, allowing personnel to approach and isolate the individual quickly and efficiently until testing can be completed.

- ***Touchless Systems Integration:*** All areas of the hotel experience should be analyzed with consideration to a touchless experience, to include doors, check-in and service, restrooms, valet, and entertainment. In the past, consideration for voice-activated and automated entertainment, access and lighting was considered a convenience. In a post-COVID-19 world this may now be considered a necessity and will rapidly become an expectation and business advantage.

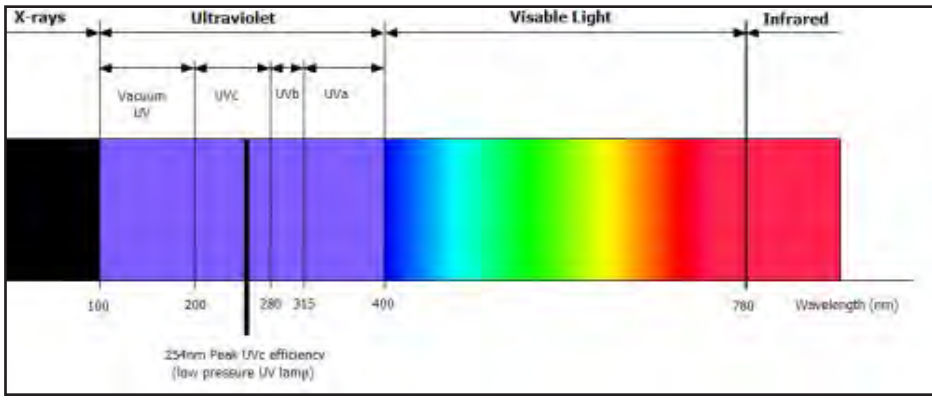


  Companies such as Assa Abloy with their "Global Solutions Mobile Access" have developed mobile access solutions that allow guests to check-in remote and receive access to hotel facilities via their electronic smart device. Originally conceived as a convenience for tech-minded travelers this technology now offers an additional level of wellness by minimizing person-to-person contact and touch points for hotel guests.

- ***Light Sanitation Technology:*** In recent weeks and months there has been extensive discussion and press regarding UV light and light sanitation. The use of UV light has been around for well over a hundred years. Dr. Niels Finsen won the "Nobel Prize in Physiology or Medicine" in 1903 for his use of UV light in the treatment of Smallpox. UV light is an important element presently used in disease prevention and in making buildings safer. The CDC, WHO and ASHRE (American Society of Heating & Refrigeration Engineers), along with numerous private companies are actively researching the advancement of UV light applications. It certainly has an application in hotels and other building types just as it is currently used in hospitals.

To understand the benefits and risks of using light for sanitation we should understand the types of UV and visible light along with current uses and recent advances. Inappropriate application of UV light can cause harm to guests and staff. Below is a description of types of light by frequency:

- ***Ultraviolet Light Sanitation***:
  - **UV-C – 100 to 315 nm** - Sanitizing UV Light – Dangerous and carcinogenic, damages skin and eyes, kills pathogens, has beneficial effect when properly used and controlled, deep tissue penetration.

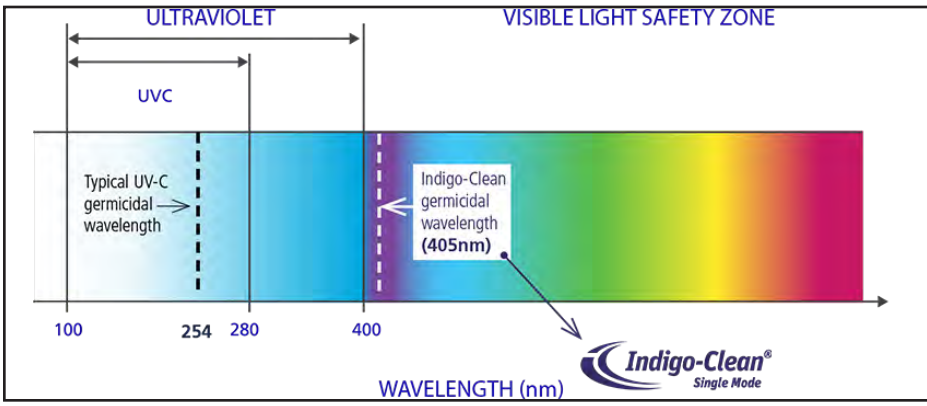


  - **UV-C – 100 to 280 nm (Ozone Production Zone)** - Ozone Production – Ozone is the natural element that protects earth from damaging solar radiation. It is naturally generated in the upper atmosphere when solar generated UVV light meets oxygen, thus generating atomic oxygen forming O3 (Ozone). Ozone is created with artificially generated 185 nm UV light and it is highly effective for sanitation. This is typically utilized for sanitation of drinking water. The downside of Ozone is that it damages human lungs and can be dangerous. For that reason, care must be taken when utilizing UVC light for sanitation, as the generation of ozone at certain light frequencies can be harmful.
  - **FAR UV-C – 200 to 230 nm** - Sanitizing UV Light – Current research indicates that when utilized in controlled exposure with light dosage, this type of UVC light can provide a continuous sanitation with no adverse effects to humans. Products/research is currently underway and Healthe has developed lighting for hotels, offices and schools that provide light at controlled dosage in this light frequency for sanitizing effects.
  - **UV-B – 280 to 315 nm** - 5% of natural UV-B light reaches the earth. It is carcinogenic, causes sunburn and damage to skin and eyes, negatively

effects photosynthesis, moderate tissue penetration.

» **UV-A – 315 to 400 nm** - 95% of natural UV-A light reaches the earth, can be carcinogenic and causes Sunburn and damage to skin and eyes, shallow tissue penetration

- ***Visible Light Radiation***



» **405 nm Visible Light** - Sanitizing Visible Light – It has been discovered and perfected by Indigo-Clean, manufactured by Kenall company, that longer exposure to 405 nm blue light provides a safe sanitizing effect. They have developed fixtures that are currently utilized in hospital operating rooms and patient rooms with no adverse effects on occupants.

» **400 to 500 nm Visible (Blue) Light** - Through research into the human body's natural circadian rhythms it has been discovered that blue light retards the production of serotonin in the human body and can cause a stimulating effect increasing energy and alertness. This is often referred to as the natural waking cycle.

» **Above 500 nm absence of Blue Light** - Conversely it has been shown that the elimination of blue light in frequencies at or above 500 nm (2,000 degree K color), stimulates the production of melatonin and begins the sleep cycle. Healthe has developed lighting for hotels, offices and schools that provide beneficial circadian rhythm effects.

ARTZ 2.0 Mobile Room UVC Germicidal Solution

- ***Light Sanitation Fixtures:*** An example of a mobile UV-C germicidal light system is the American Ultraviolet Light shown here, this product was developed for hospital use for operating rooms and patient rooms. This is a good product for hotels and could be used in guest rooms for deep sanitation of all surfaces in the room. The housekeeper would clean the room, afterward and upon leaving, the housekeeper would place this unit in the guest room and cycle the device. When the housekeeper finishes the next room, this

unit would be moved to the next clean room and the process repeated. Thus, creating a sanitary room environment that is unique to the specific hotel, a significant benefit over competing hotels.

The second type of light used for sanitation utilizes 405 nm in the visible light spectrum and is manufactured by Indigo-Clean. These permanently installed ceiling fixtures able to be operated with people present, developed initially for hospital use, could easily be installed in guest rooms, public corridors, kitchens, dining rooms and housekeeping spaces to provide continuous disinfection of the hotel. This type of light is not as intense as UV-C light and takes longer to achieve the desired effect, in many cases as much as 8 hours. The manufacturer states: Indigo-Clean, a continuous disinfection technology, is patented and proven to kill harmful bacteria linked to hospital acquired infections (HAIs). Using a combination of 405nm Indigo and White LEDs, Indigo-Clean emits narrow-spectrum light that kills bacteria while providing ambient illumination for the space.

Below is information for Indigo Clean Fixtures:

How it works

1. The 405nm emitted from Indigo-Clean reflects off of walls and surfaces, penetrating harmful micro-organisms
2. The light targets naturally occurring molecules called porphyrins that exist inside bacteria. The light is absorbed and the excited molecules produce Reactive Oxygen Species (ROS) inside the cell
3. 405nm creates a chemical reaction inside the cell, similar to the effects of bleach
4. The Reactive Oxygen Species inactivates the bacteria, preventing it from re-populating the space

MEIC
for Procedure Rooms

MDLIC
for Patient Bathroom

The third type of light used for sanitation utilizes Far UV-C light at 222 nm. The following fixtures are manufactured by Healthe Lighting Science.

- Unique 2-in-1 solution that not only provides high-quality illumination, but cleans and sanitizes surfaces
- Features Far-UVC technology that effectively penetrates and inactivates >90% of bacteria and viruses without harm to exposed human body
- UV dosage requirement can be low due to effectiveness of Far-UVC light source*
- Integrated general illumination available in various CCT choices including Healthe's GoodDay engineered spectrum
- Motion-controlled mode activates Far-UVC light via built-in PIR motion sensor and can preserve longevity of Far-UVC module during periods of inactivity
- 6" downlight form factor can be retrofitted to conventional recessed can fixture for easy installation
- Available in 120V or 220V input voltage with a power consumption of 20W

- Cleanse® Retrofit Troffer utilizes a combination of air filtration with UV (A+C) light to sanitize air, inactivate pathogens, and decrease contamination while providing comfortable healthy light to illuminate the work space.
- Easily retrofit any existing standard 2 ft x 4 ft luminaire in as little as 15 minutes to an air sanitizing LED luminaire with the Cleanse Retrofit Troffer without breaching the plenum keeping facility disruptions and installation cost at a minimum.
- Ultra efficient multi-stage air sanitization process that utilizes easy to replace HEPA/ Charcoal filter and UV LED (A+C) module. Recommended to replace filter every 6 months and UV LED module every 24 months. *
- Achieves 99.9% removal rate among four common airborne pathogens responsible for most hospital acquired infections.
- UV LED have four times the life expectancy (24-month) without the safety concerns of hazardous material exposure or waste disposal in comparison to traditional mercury based bulbs.
- Features Healthe's patented True Circadian spectrum technology with a choice of GoodDay (5000K or 4000K) suitable for daytime intensive environments or GoodNight (2700K) ideal for evening applications.
- Recessed Housing Kit (ACC-07010) can be purchased separately for installation due to incompatibility with existing troffer housing or in new construction settings.

- ***Individual Items Sanitation in Guest Rooms:*** In addition to utilizing light to disinfect rooms, UV-C light sources can be used in a limited capacity to sanitize common items such as remote controls, cell phones, keys, shoes, etc. L2 recommends small sanitation boxes for guests to use to sanitize these items.

- ***Using Disinfecting, Sanitizing Fog Systems in Guest Rooms and Public Spaces:*** In addition to light systems, the hotel could utilize a sanitizing fog system like that currently being implemented by airlines worldwide. Altapure is a healthcare product company that has developed a mobile cart that can be placed in the guest rooms and utilized to sanitize the room.

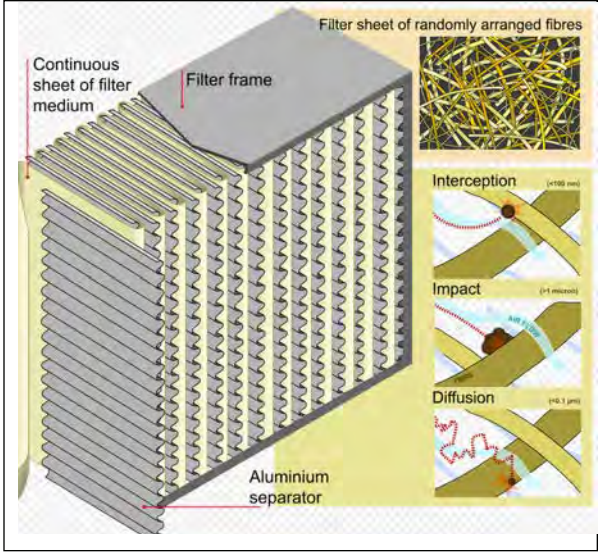
  "The AP-4 ™ High Level Disinfection System (HLDS) is an enhanced ultrasonic product that will consistently kill 100% of pathogens such as: C. difficile spores, VRE, CRE, MRSA, C. auris, & viruses in a treated space. The AP-4 ™ delivers a dense cloud of sub-micron droplets for the high-level disinfection of large spaces such as those found in medical facilities, clean rooms, pharmaceutical facilities, biotechnology facilities, hospitals - including patient rooms, ICUs, and operating rooms. The dense sub-micron aerosol delivers gas-like performance that offers three-dimensional coverage in large areas. Rooms are ready for reoccupation in less than 50 minutes leaving no residue and ending green. No other option can match this performance!"

Mechanical Systems – Indoor Air Quality:

- ***Mechanical Systems – Air Change, Fresh Air, Positive Pressure, Exhaust and Humidity Control:*** The air pressure within a building has a significant effect on air quality and the health of the building and its occupants. A building that is under positive pressure has a greater pressure inside the building than outside, therefore air from within the building is forced out through cracks and openings in the building envelope and thus humid outside air is not drawn into the building and its concealed spaces.

  In a healthy hotel it is necessary to balance fresh air through air changes and purification/filtration of the air. Guests are looking for healthy hotels and understand that indoor air quality is a very important component of a healthy hotel room and public space. Rooms and areas within the hotel can have negative pressure zones where the air within the room is pulled through a filtration and sterilization system thus significantly improving the health of the rooms within the hotel.

Sunseeker Resort, Port Charlotte, FL

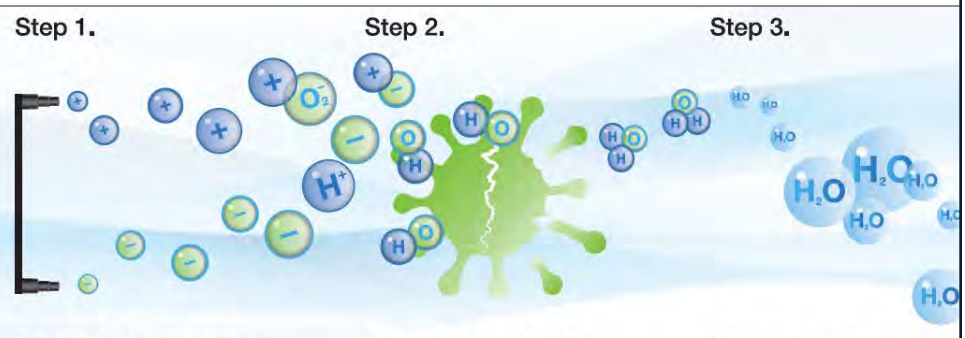


Indoor air quality can be improved and provided in hotel public spaces and guest rooms with the following technology:

- ***HEPA Filtration:*** Improved air filters added to the mechanical systems of hotels and guest rooms improve air quality. HEPA filters or high-efficiency particulate air (HEPA) filters, is an efficiency standard for mechanical air filtration. Common standards require that a HEPA air filter must remove—from the air that passes through—at least 99.97% (ASME, U.S. DOE) of particles whose diameter is equal to 0.3 µm; with the filtration efficiency increasing for particle diameters both less than and greater than 0.3 µm. Therefore HEPA filtrations does not immediately kill pathogen, but they remove pathogens from the air.

IONIZATION SYSTEMS BY AIR OASIS:

Electrically Generated Ions:



Positive & Negative Ions are Dispersed

Positive and negative ions are created by splitting water vapor present in the air. Our purifiers are **proactively** dispersing ions throughout the ambient air.

Bacteria, Viruses, VOCs & Other Pollutants are Destroyed

Polarized ions **actively** seek out pollutants and break them down. They are neutralized as the contaminants are destroyed. A clustering effect causes contaminants to become heavy and drop out of the air.

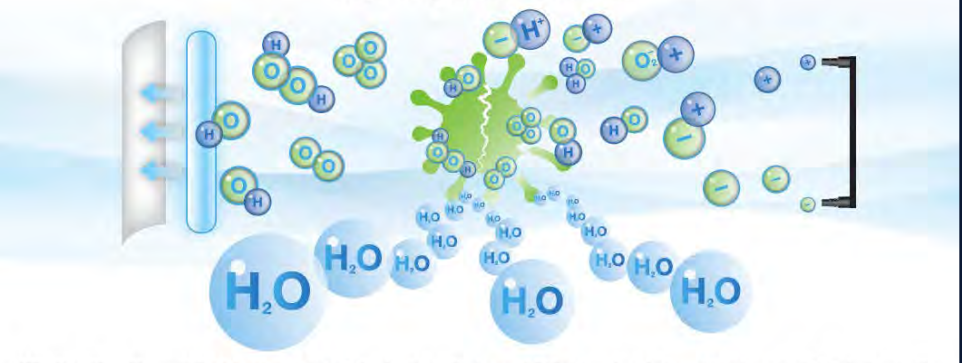
Harmless By-products of Water Vapor

Polarized ions revert back to harmless water vapor and the cycle repeats, thereby reducing additional contaminants.

UVC Light Generated Ions:

AHPCO & Bi-Polar Ionization Technology

Replicating Nature and The Sun



Whether it's with our NASA-backed AHPCO technology that uses UV light and a photo catalyst, or our Bi-Polar Ionization technology that utilizes electricity to produce positive and negative ions…our purifiers work by creating ions that actively attack pollutants in the air and on surfaces and break them down. These ions then revert back to harmless water vapor, resulting in nothing but pure, clean air, free of nearly all odor- and illness-causing bacteria and particles.

- ***HVAC Air Ionizer System:*** Air Ionization systems are added to mechanical systems to improve air quality and kill pathogens. An air ionizer (negative ion generator or Chizhevsky's chandelier) is a device that uses high voltage to ionize (electrically charge) air molecules. Negative ions, or anions, are particles with one or more extra electrons, conferring a net negative charge to the particle. Cations are positive ions missing one or more electrons, resulting in a net positive charge.

  Modern systems utilize high voltage electrical charge or light energy to disperse ions through the air, then polarized ions seek out pollutants and break them down. They are neutralized as the contaminants are destroyed.

Mechanical Improvements:

For remodel of existing buildings, a supplemental system could be added within the guest rooms and public areas that provide HEPA filtered air with UVC light sterilization and ionization purification. This provides quality air with the additional benefit of user awareness, as they can see and touch this technology integration.

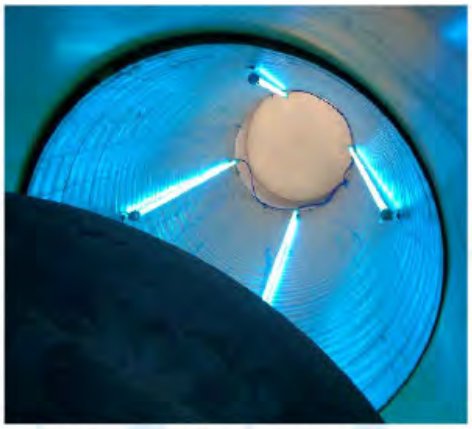
Given the fact that existing buildings contain current mechanical systems that still have usable life, the use of supplemental systems to improve air quality while maintaining the existing HVAC equipment is an effective solution with a good cost-to-benefit ratio. The following are renovations for consideration.

- Cleaning the existing mechanical equipment, coils, ductwork, and grilles
- Redirecting the supply air flow from above high to low (traditional), to low to high (directing contaminated air away from occupants to the central filtration/sanitation system where possible given cost constraints.
- Add UVC lights at the air coils to allow continuous sanitation of the lower and upper surfaces of the air coils. This eliminates mechanical sludge that contains pathogens including mold, bacteria, and virus.

HVAC UVC Light:

Air Handler Disinfection

AHU / RTU & Airstream Disinfection



Make-Up Air & Exhaust Disinfection

- Add UVC lights within the air stream, (Ducts) to allow continuous sanitation of the supply air.
- In the event modifications of the existing equipment is not possible or it proves too invasive, we recommend a supplemental system that consists of a central duct with fan to create internal negative pressure that draws contaminated air away from the occupants. The air is then filtered through a HEPA filter, sanitized with high-intensity UVC light and returned across an ion generator back to the room. The result is sanitized air that is free of airborne pathogens. This can be added to common areas, ballrooms, dining rooms and business office areas.

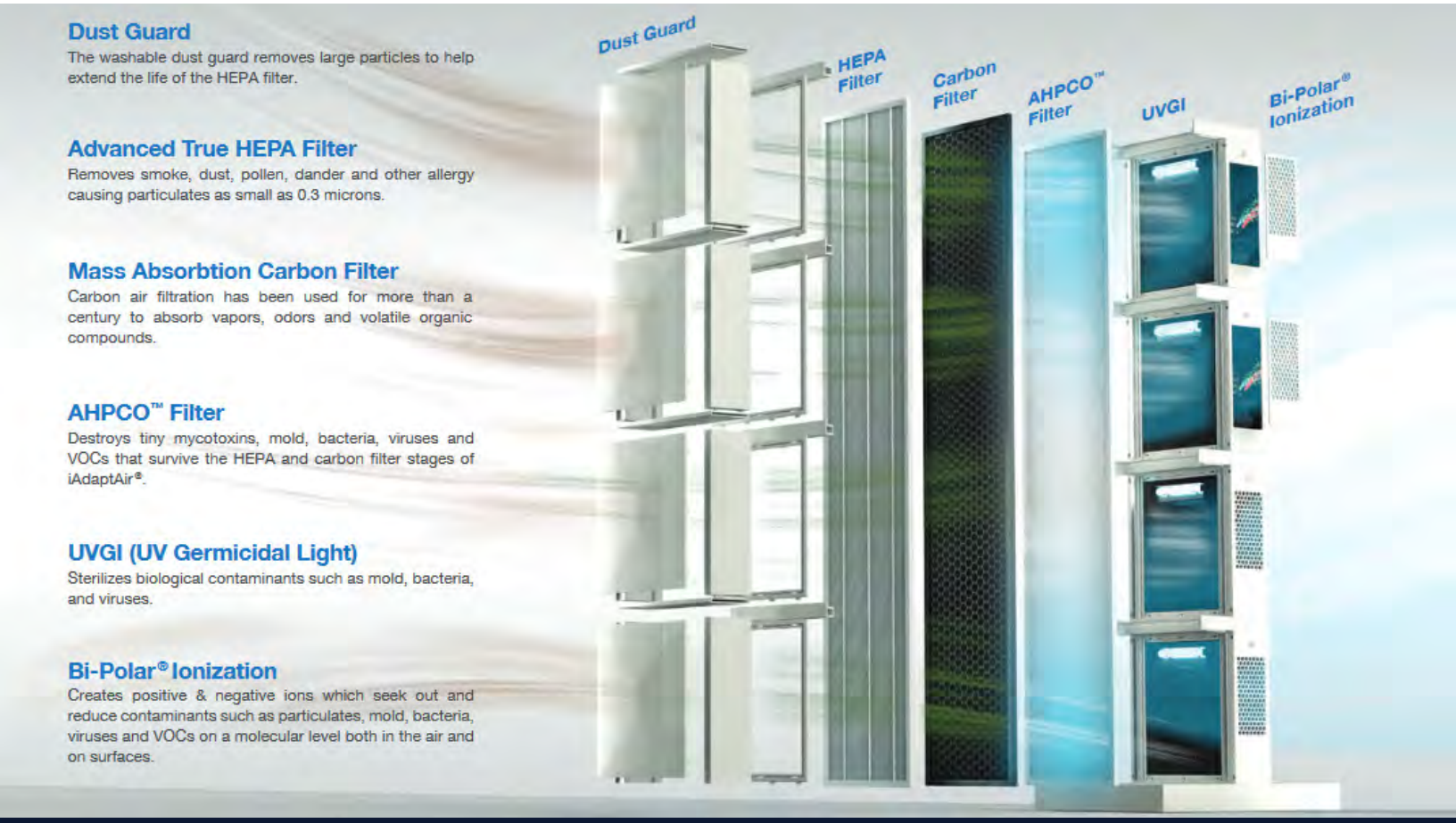
For new construction, installation of these mechanical components will provide quality clean air within all areas of the hotel by scrubbing and sterilizing the air with a combination of the systems described above. This application becomes integral to the building and will not stand out as supplemental equipment.

In general the secondary (supplemental) system will create negative pressure zones and then treat the air with a combination of current technologies that could include multiple components from the following list:

- HEPA filters
- Carbon air filtration
- AHPCO – (Photocatalytic oxidation) air purification
- UVC Sterilization (mechanical equipment containment)
- Bi-Polar Ionization
- Far UVC sterilization daylighting – 222 nm
- 480 nm visible spectrum continuous daylighting (LED – Indigo-Clean patent) .

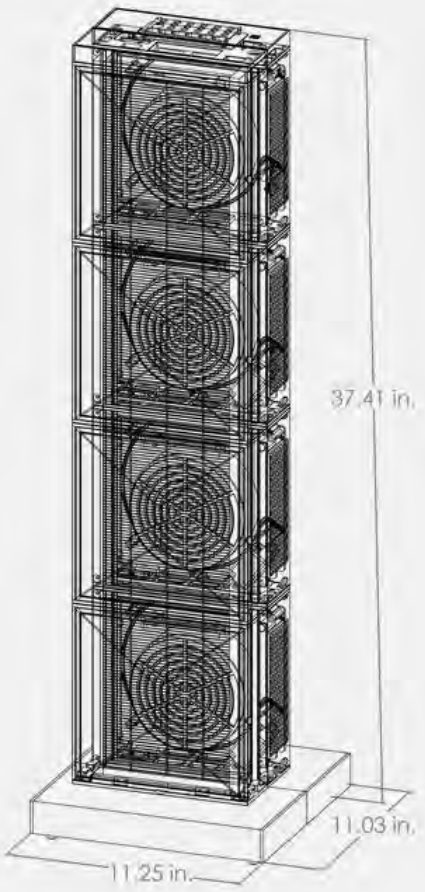
Redirecting the HVAC air in the room for controlled conditioning and then scrub and sterilize the air within the room will minimize the guests exposure to airborne pathogens.

- Self-Contained Air Purification Systems that provide the benefits described above in compact contemporary containers:
  iAdaptAir Modular In-Room Clean Air System



Specifications

	IADAPTAIR L (UP TO 850 SQFT)	IADAPTAIR M (UP TO 550 SQFT)	IADAPTAIR S (UP TO 250 SQFT)
Warranty:	Lifetime		
Voltage:	100-240VAC		
Rated Power:	32 WATTS		
WiFi:	On/Off With Mobile App		
Dimensions:	11.2in x 11.2in x 37in		
Weight:	20 lbs.		
Fan Speed:	Low 700rpm, Medium 1000rpm, High 1200rpm		
Timer Settings:	2hr, 4hr, 8hr		
Coverage:	850 sq. ft.		
PM 2.5 CADR:	Low 79 CFM, Medium 149 CFM, High 237 CFM		
Total VOC CADR:	Low 29 CFM, Medium 44 CFM, High 57 CFM		
Ozone:	0.00 PPM		
Replacement Filter Cartridge:	Model: AOIA-LF, HEPA, Carbon and AHPCO		
Universal Broad-Spectrum UV Replacement Lamp:	Model: AOIA-UV		
Ion Output:	40,000,000 positive and negative		
Noise Level:	25dB low speed to 52dB high speed		



The Current Hotel, Marriott Autograph Collection, Tampa, FL

The resumption of travel for both business and leisure has begun, and consideration must be given to the health and safety of the traveling public. Fear and apprehension could stall the restart of the travel industry. The healthy hotel will have a significant advantage over traditional hotels, and the confidence gained by the traveling public will serve to expedite travel and return of a prosperous hospitality economy.

The effects of the COVID-19 pandemic should not be considered a bump in the road, rather a catalyst for the design of healthy buildings. The integration of wellness features in our buildings will help us to deal with future pandemics and will allow our buildings to align with the 4.2 billion dollar global wellness economy.

Tim Lemons is a Hospitality Architect registered in 24 US states, and his firm L2 Studios specializes in the design of hotels and resorts. They are available to assist hoteliers with the renovation of and the design of new hotels and look forward to the prosperous time ahead.

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