Genano Healthcare Concept Solutions & Technology

Advanced & easy-to-install solutions for nanoscale air decontamination

The patented Genano®
cold plasma technology eliminates bacteria and viruses effectively.

HEPA filters are commonly utilized to filter supply air flow in a cleanroom. However, it can only collect particles of 0.3 µm and larger in diameter, which renders a need for additional air decontamination technologies such as air purifier units in the room. Majority of nanoparticles in cleanrooms are process-related and must be effectively removed at the source. While most particles in cleanrooms can be related to human activity, ultra-fine particles are also generated by electrostatic discharge, chemical reactions such as oxidation, and gas phase nucleation. These contaminants cannot be removed with fixed HVAC interfaced HEPA filtering systems.

Our air purifiers do not contain any easily clogged, regularly replaceable filters, so their performance remains constantly high and they are easy to use – and no replaceable parts means low running costs. The system does not suffer from increase in pressure drop due to accumulation of particle mass, nor does it provide substrate for microbes to grow.

Building cleanrooms with Genano is highly cost-efficient and fast compared to traditional HEPA systems. Only minor piping work is needed to connect the Genano air purifier to central ventilation. All of the supply air enters the room through the unit, while air flow is controlled to create positive pressure difference to outside environment. A second unit is utilized to constantly circulate and purify the air from any process and human-related contaminants.

With Genano Air Purifiers, you can remove even Nano-size particles, gaseous compounds (VOC’s) and microbes; such as bacteria, viruses and mold spores from indoor air

Our unique electric filtration technology removes even the most dangerous ultra-fine particles that cause harm to our bodies by penetrating to the blood circulation through lungs. When traditional fiber filter can collect particles about up to 300 nanometer (=0.3 µm) size, Genano® Non-thermal Plasma filtering technology collects particles even 3 nanometer (=0.0003 µm) of size.

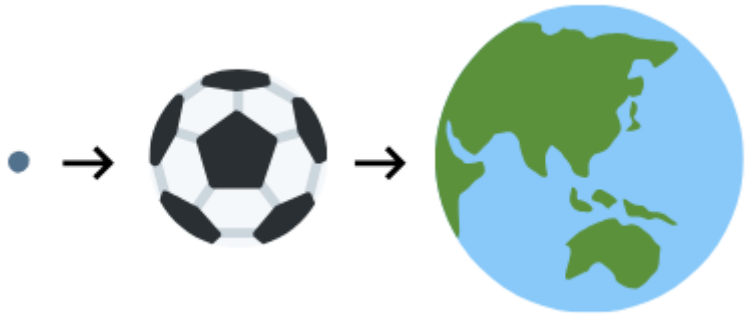
Genano Intelligent Indoor Air Quality secures the whole property's healthy indoor air as a service.

What is a Nano particle?

With Genano® technology, we manufacture air purification devices that can filter 3–100 nm sized nanoparticles from indoor air. Nano is a measuring range (nanometer, micrometer, millimeter, and centimeter).

1 nanometer is a billionth of a meter, i.e. $1 \cdot 10^{-9}$ m.

Nano particles are classified as ultra-small particles, that according to WHO are the most dangerous for the human body.



The size of a Nano particle is proportionally the same with respect to football than the size of football with respect to the globe.

Removes gaseous compounds and smells from indoor air

The largest active carbon filter on the market, placed on the upper part of the device, removes gaseous compounds, VOC's (volatile organic compounds), that usually originate from building and interior materials, cleaning detergents, smells and at some cases microflora.

The emissions from building materials are, for example, solvents and raw material residues, as well as reaction and dissolution products from manufacturing processes, such as furniture adhesives, varnishes, fire retardants or plastics.

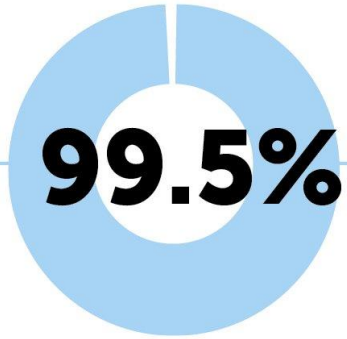
This is how to get rid of airborne microbes, such as viruses, bacteria and mold spores

Genano’s air purifiers could be called indoor air disinfection equipment, as they eliminate organic microbes, such as mold spores, viruses and bacteria. There is nothing organic in the device's collection tray, so there is no risk of microbes spreading back into the indoor air. Genano’s Air Decontamination devices are ideal for premises, where there are large numbers of people, and the risk of airborne contamination, such as flu, is high.

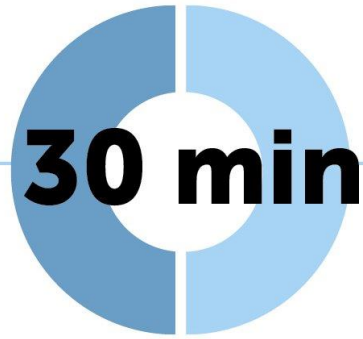
Patented Finnish Genano® technology is originally developed for isolation rooms in hospitals, cleanrooms and laboratories; to prevent cross-contamination, nosocomial infections from spreading in critical areas, and for the safety of immunocompromised patients.

Genano technology is also used in prevention of airborne contamination in laboratories and cleanrooms, such as process food manufacturing, pharma and petrochemical production premises, and to ensure the safety of staff from process-originated impurities, such as dust particles, gaseous compounds or microbes.

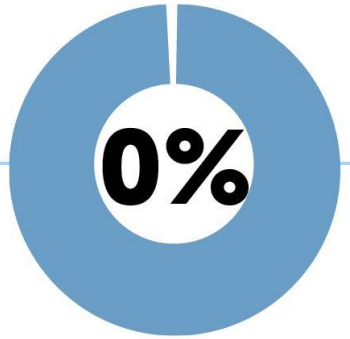
Genano® Non-thermal Technology has been tested in several research institutes:



Finnish Institute of Occupational Health, Finland: PURIFYING PERFORMANCE for particle size 0.003 – 10 µm



Laboratoire National d'Essai, France: 100% OF MICROBES DESTROYED after the device was turned on



MetropoliLab, Finland: NUMBER OF LIVING MICROBES in output air or cleaning tank

Genano sensors: only through measuring can you verify, what is the quality of indoor air

With Genano sensors, you can see the invisible or odorless. Indoor Air measurement offers you information about the condition of building structures, as well as about the quality and purity of indoor air – in real time. This enables the painless and right kind of up keeping of the property, while extending the property's lifetime. Awareness of indoor air quality allows relatively painless adjustments and corrective actions before problems begin to appear.

Real-time monitoring of indoor air quality is here and now. And what is best, the system does the monitoring on behalf of you. The system alerts you of changes that exceed or fall below the set limits. Genano iNtelligent IoT sensors use wireless, worldwide Sigfox network, and you will have access to Cloud Service through easy-to-use application, that can be operated from laptop or mobile phone.

Indoor air quality provides the data for you to control your property's life cycle

Measurement and real-time monitoring of measurement results provide a solid basis for site maintenance. The purpose of measurement is to reduce uncertainty in decisions, and that way eliminate the possibility of mistakes in corrective actions, as well as to help adjusting the air ventilation.

Accurate monitoring and maintenance enable the well-being of people in the building, and the long life span of the sites. This, in turn, reduces costs, in terms of reduced sick leaves in office buildings, as well as reduced energy costs.

Easy set-up

The sensors are easy to install and easy to set-up. Wires or electricity is not required. Sensors with extremely long battery life can be attached directly to the desired room, where the system immediately starts monitoring the indoor air quality. The data is available within half an hour.

Why Genano Clean Indoor Air service?

Genano service saves money, as temporary evacuation to other premises is not needed. Air Quality Measurement Service in combination with Air Purification prevents the pollutants from entering into the indoor air and ensures a healthy indoor environment.

Easy to install iNtelligent Air Quality Service protects people from out coming air pollutants that can be a significant problem in industrial cities or nearby roads with heavy traffic.

Genano electric filtration: an energy-efficient way to remove ultra-fine particles from incoming air

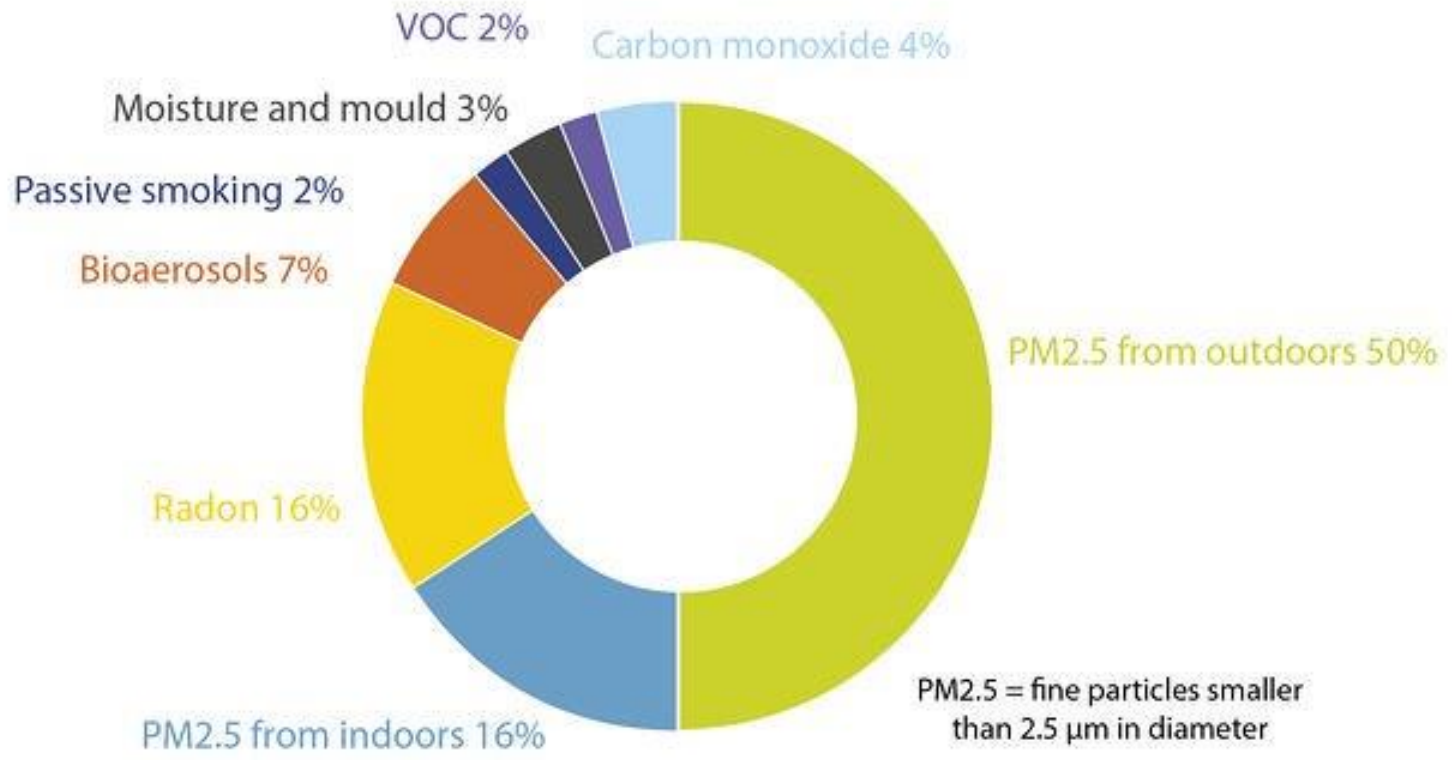
Exposure to traffic exhaust emissions occurs mainly indoors, where we spend most of our time. Outdoor air pollutants such as asphalt dust, traffic pollutants, pollen, and particulate emissions from combustion processes are spread indoors within ventilation.

Electric filtration is the most effective way to collect also ultra-fine particles, as the technology collects particles of all sizes, to the collection surfaces by a powerful corona discharge. As outdoor air pollution increases, the need for purifying the incoming replacement air is also increasing. That is why in the planning of new buildings, the purification of outdoor inlet air should be taken into account in order to prevent indoor air problems in the property.

Electric filtration does not cause pressure drop, unlike clogged fiber filter does, and therefore it decreases the energy consumption in the building.

Savings are also be achieved by the fact, that there are no changeable fiber filters. It is enough to clean the collecting surface in the electric air purifier, after washing it can be placed back to its place and the purifier is back in use again. This ensures that the performance of the purifier remains high at all times, the usage is ecologically friendly and supports sustainable development.

Indoor Air Pollutants



**Hänninen O. & Asikainen A. THL Report, 2013*

Indoor air problems originate from different sources

Indoor air problems have various causes - not always mould. Impurities in indoor air cause symptoms such as colds, coughs, fatigue, eye irritation, blocked sinuses, headaches, allergies, asthma and skin symptoms, as well as respiratory infections and sinusitis. All factors in buildings that increase the risk of allergic symptoms can be alleviated by good real estate management.

Indoor air problems incur considerable costs through, for example, a lowered ability to work, sick leaves and even disability.

Modular solutions fit any hospital specific needs
Isolation Room Concept – Genano has a turnkey solution for hospitals

Prevention

Bio risk reduction combines expertise and advice on high-consequence pathogens with guidance and training on safe handling and control of disease agents that pose significant health risks, with potential for adverse economic impact and public concern.

The goal of bio risk reduction is to ensure that current scientific knowledge regarding viral hemorrhagic fevers, epidemic-prone orthopoxviruses, and emerging severe zoonotic diseases affecting humans, is maintained in order to apply the most appropriate guidance for treatment, control, and safety to mitigate the risks regardless of the source of the disease event.

Experience is gained through outbreak response, managing clinical and laboratory environments, networking with subject matter experts and developing partnerships with stakeholders.

As part of bio risk prevention procedures, one of the main concerns is the ability to isolate the disease or the infected patients. This can be achieved by having Isolation Rooms, where the exhausted air is not recirculated but instead first filtered and then directed outside the premises.

Isolation facilities include the following types

- Negative pressure room, where others are protected from any airborne transmission from a patient who may be an infection risk, Class N
- Negative pressure room with additional barriers including an anteroom, also known as Class Q for quarantine isolation.
- Normal rooms can also be transformed into Isolation rooms if the air is duly filtered and dispatched outdoors.

Most common parameters to be monitored in these rooms

- Differential Pressure (0.03 WC) – between the isolation room and the area to be protected (ex.: corridor)
- ACH – Air Changes per Hour inside the room (isolation ACH 12)

Critical points when creating an Isolation Room

1. Installing a Filtering Unit on the extract
2. Be certain that the air is being extracted to the outdoors and not recirculated
3. Air Balancing – create negative pressure inside the room
4. Room Pressure and ACH monitor

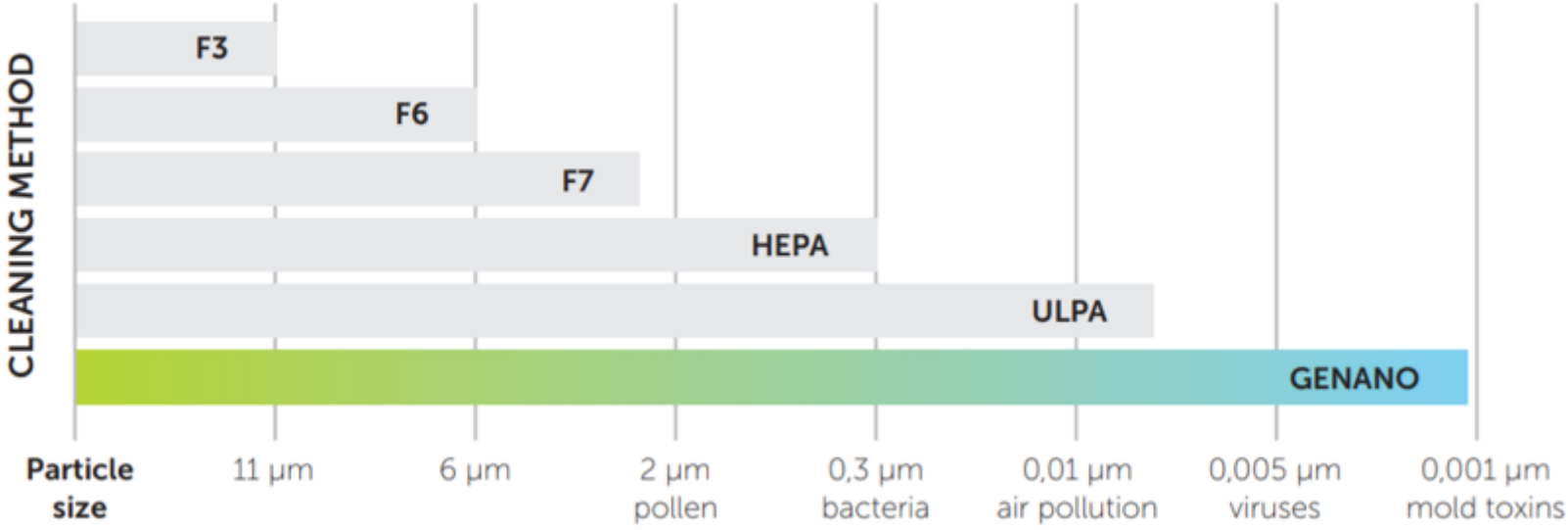
Turn-key solution for Isolation Rooms

Installing a Filtering Unit on the extract:

1. Genano 5250 – 500 m3/h (all rooms)
2. Genano Tube XS – 300 m3/h (option for small rooms up to 100m2 or 250 m3)

Genano's patented electric air purification method purifies indoor air even of nanoscale impurities. The method eliminates organic microbes, such as viruses, bacteria and mold. In addition, the method removes dangerous VOCs and smells.

All the units have an extremely low-cost maintenance compared to HEPA filtration units. Efficiency is their biggest advantage as seen below:



Genano air decontamination unit

- A Genano 5250 air decontamination unit is part of the Isolation Room Concept.
- Be certain that the air is being extracted to the outdoors and not recirculated.
- Exhaust will be done with the Genano unit.
- The air outlet of the unit has to be connected to a duct, from where the “decontaminated” air will be delivered 100% outdoors. This duct should not be connected to any recirculating system or duct.

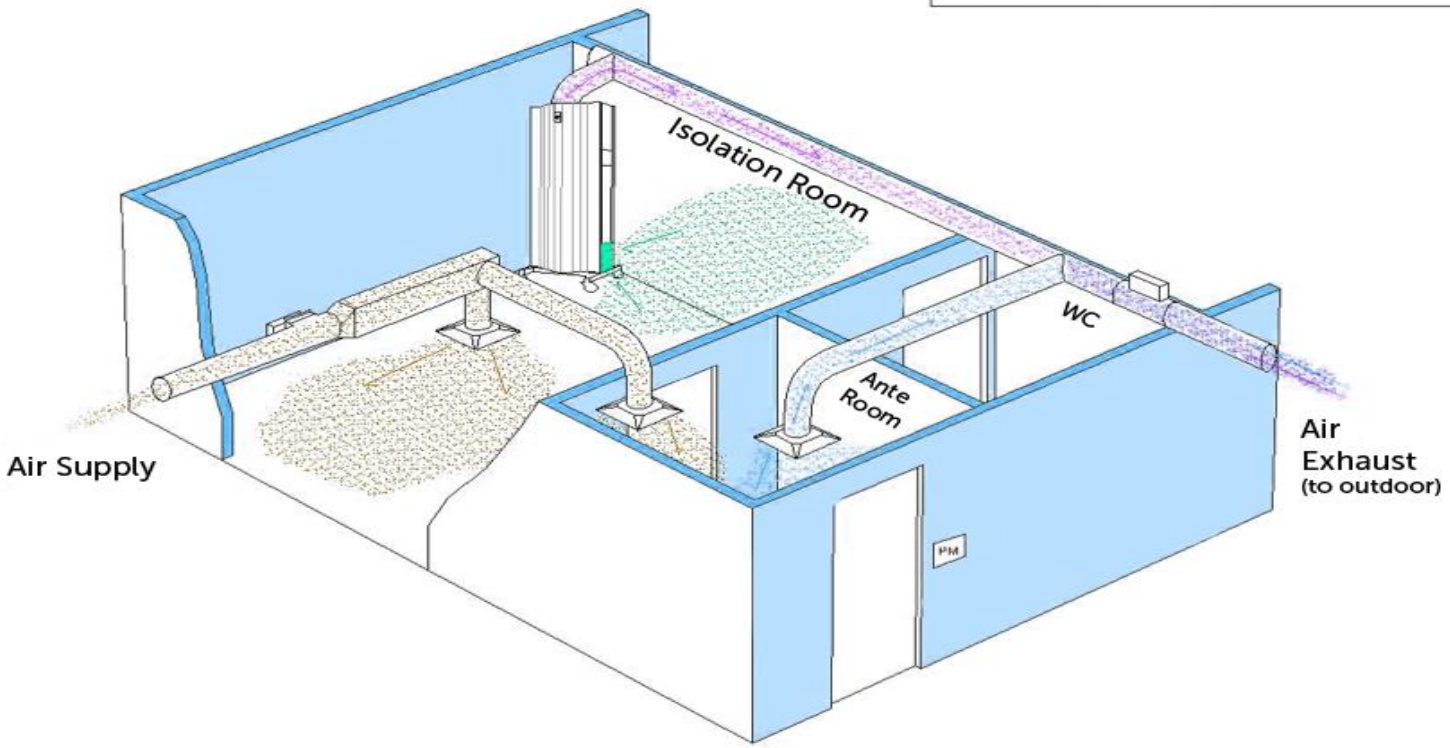
Air Balancing – create negative pressure inside the room

Differential Pressure
Air Changes per Hour (ACH)

Air balancing is done on the air supply of the room, either by the manual control of the air valves or by the building management system (BMS).

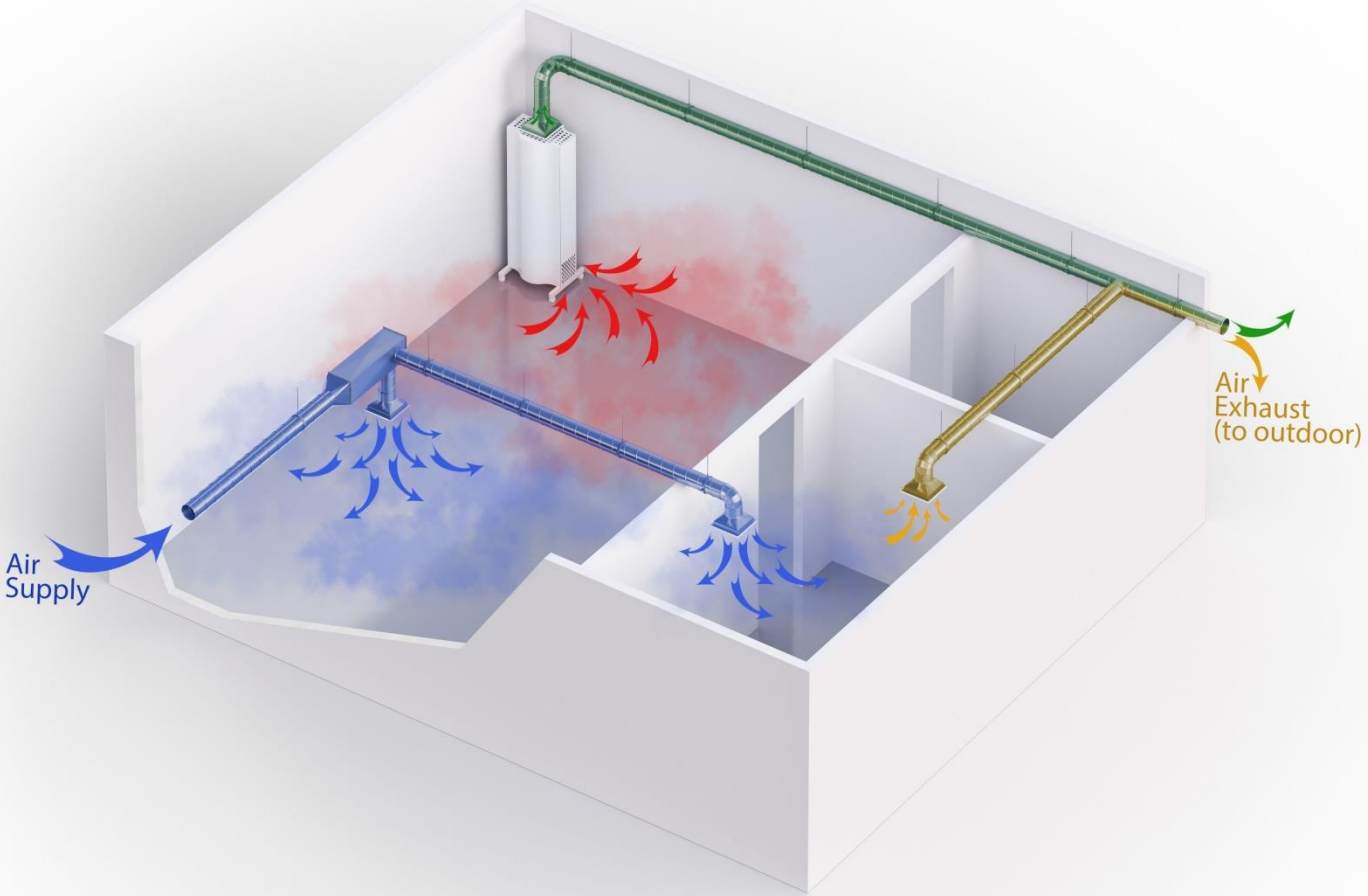
It is extremely important that the room is airtight, the ceiling, doors and walls have to be completely sealed. Having leakages will affect the performance and the differential pressure readings.

Genano Isolation Room Solution

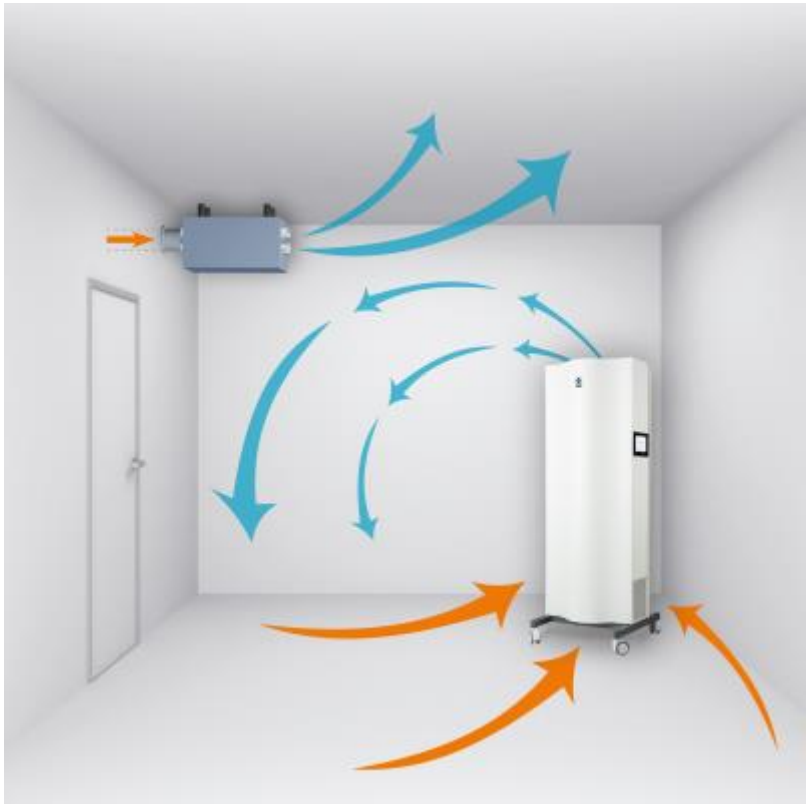


- Air Supply
- Clean Air
- Air Exhaust
- PM - Room Differential Pressure Monitor
- Contaminated Air

Air balancing to be done on the VAV's, to achieve a minimum of 2.5 Pa differential pressure between the outside corridor (reference) and the inside of the Room.
Contaminated air is cleaned through the Genano unit and exhausted outdoors of the building.
The only exhaust to be installed inside the room is the Genano unit.
. No exhaust diffusers
. Ceiling to be completely sealed (no tiles)
. Doors between the corridor and the room to be completely sealed

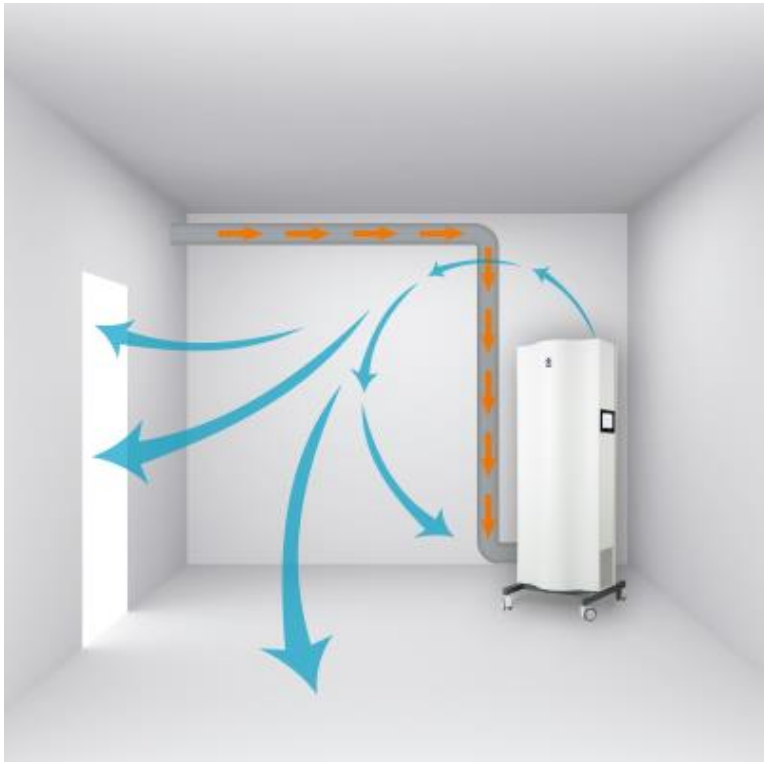

Air
Supply
Air
Exhaust
(to outdoor)

Prevention of surgical site infections, by total air decontamination



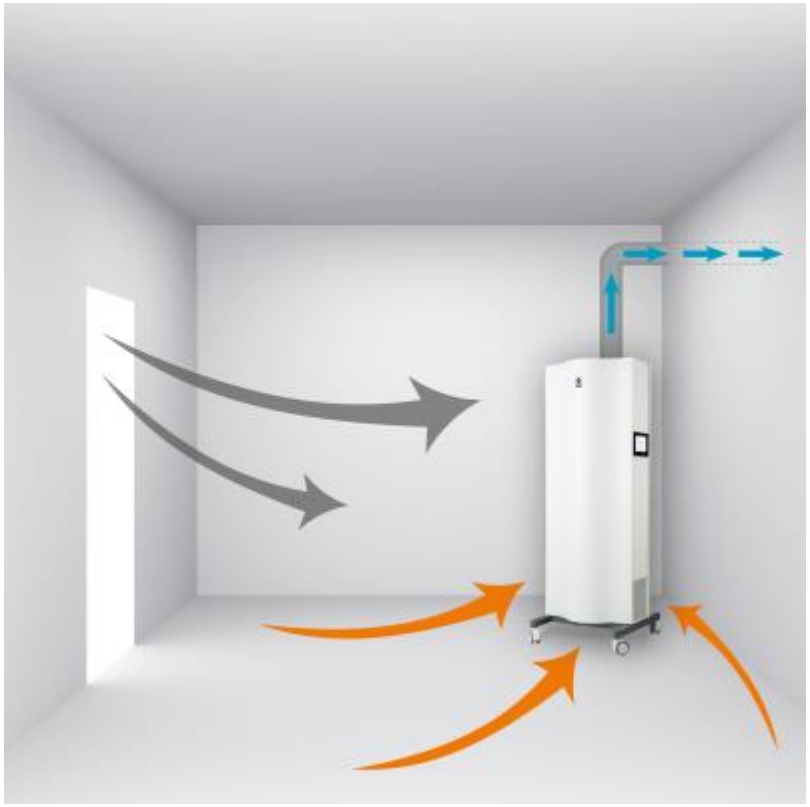
Electric Duct Filter cleans impurities of all sizes from the incoming air.
Genano stand-alone air decontamination unit ensures contaminants within the room will be eliminated by capturing particles from the room air.

Positive pressure installation, to prevent contaminated air from entering the room

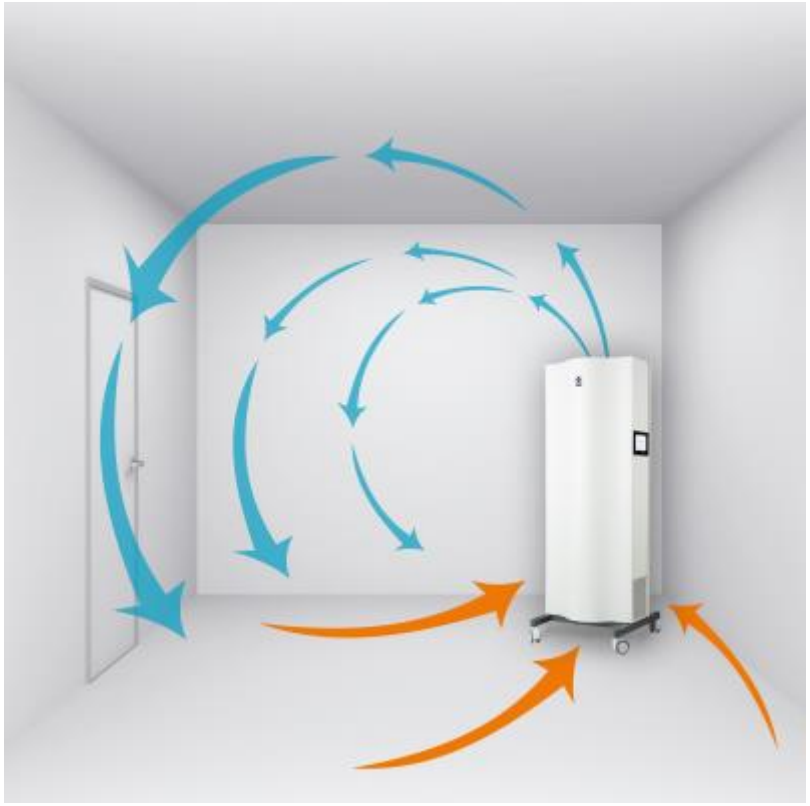


The supply air of the central ventilation is led into the room through the Genano air purifier
The device is capable of controlling the positive pressure difference, which should be 5–10 Pa relative to adjacent spaces. To obtain maximal results, the supply air should be at least 20 % more than the exhaust air and the air leakage should be under control.

Negative pressure installation, to prevent contaminated air spreading out of the room



With a negative pressure kit, the stand-alone air contamination unit can be connected to the existing ventilation system, for creating a negative pressure into the room, while removing the airborne contaminants from the air.



Genano stand-alone air decontamination unit ensures contaminants within the room will be eliminated by capturing particles from the room air

Benefits of our Healthcare Technology

Genano is a cost efficient way to improve air hygiene in healthcare facilities by preventing transmission of airborne pathogens. The solution is easy to set up a cleanroom in healthcare facilities where HEPA is not enough.

Removes particles down to the Nano-size / Removes gases and odors

Easy plug & play installation

Offers an immediate air decontamination

No substrate for microbes to grow

No filter media

Complements existing ventilation / does not produce ozone

Immediate effect

by easy plug and play installation

Easy maintenance

by automatic washing

Prevents from airborne infections from spreading

By collecting and eliminating all living microbes.

Low lifetime running costs

No disposable filters, no changeable parts

WHO Report: “A World At Risk” – an increased risk of global pandemic?

Author: Petri Vaulo

In the following article, some worrying highlights from the current WHO report: “A World At Risk” are collected and further analyzed.

If it is true to say “what’s past is prologue”, then there is a very real threat of a rapidly moving, highly lethal pandemic of a respiratory pathogen killing 50 to 80 million people and wiping out nearly 5% of the world’s economy. A global pandemic on that scale would be catastrophic, creating widespread havoc, instability and insecurity. The world is not prepared.

For too long, we have allowed a cycle of panic and neglect when it comes to pandemics: we ramp up efforts when there is a serious threat, then quickly forget about them when the threat subsides. It is well past time to act.

The world is confronted by increasing infectious disease outbreaks. Between 2011 and 2018, WHO tracked 1483 epidemic events in 172 countries (3). Epidemic-prone diseases such as influenza, severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), Ebola, Zika, plague, yellow fever and others, are harbingers of a new era of high-impact, potentially fast-spreading outbreaks that are more frequently detected and increasingly difficult to manage.

The chances of a global pandemic are growing. Taken together, naturally occurring, accidental, or deliberate events caused by high-impact respiratory pathogens pose “global catastrophic biological risks”

The world is not prepared for a fast-moving, virulent respiratory pathogen pandemic. In addition to tragic levels of mortality, such a pandemic could cause panic, destabilize national security and seriously impact the global economy and trade.

The great majority of national health systems would be unable to handle a large influx of patients infected with a respiratory pathogen capable of easy transmissibility and high mortality.

High-impact respiratory pathogens, such as an especially deadly strain of influenza, pose particular global risks in the modern age. The pathogens are spread via respiratory droplets; they can infect a large number of people very quickly and, with today's transportation infrastructure, move rapidly across multiple geographies.

In addition to a greater risk of pandemics from natural pathogens, scientific developments allow for disease-causing microorganisms to be engineered or recreated in laboratories. Should countries, terrorist groups, or scientifically advanced individuals create or obtain and then use biological weapons that have the characteristics of a novel, high-impact respiratory pathogen, the consequences could be as severe as, or even greater, than those of a natural epidemic, as could an accidental release of epidemic-prone microorganisms.

Tiny pathogens behind respiratory infections

Reading the above makes you scared. Thinking what could be done to be better prepared. There are of course several things from vaccinations and medications to infrastructure and political determination, so huge things that have to be dealt with. However with my 20+ years of experience with air decontamination in hospital critical surroundings makes me think why reacting is so slow. In the following I will give one example in an area I know well.

The report pinpoints high-impact respiratory pathogens as the main risk of lethal pandemia. We have known for a while that the amount of respiratory infections from airborne droplet nuclei has increased. We are typically talking about very small pathogens –the insidious invisible element.

Fighting viruses in hospitals is based on outdated technology

What do we do? The most used technology in hospitals still relies on fiber filters invented in 1950s. They do not catch viruses and they serve as growth platform for bacteria and fungus. There are also innovative technologies available that can catch the ultra-fine particles and kill all microbes in the process.

The problem is that the traditional guidelines demand HEPA-filtration and they are designed for HEPA-filtration. That leads to a situation, where even when the staff working in the infectious isolation rooms is scared of the possible release of pathogens from the fiber filters, and the amount of negative pressure is not stable due to constant pressure drop creating risk factors.

We have a solution for all this if only the guidelines and regulations would follow the technology development. Faster reacting is needed!

Source: **Global Preparedness Monitoring Board. A world at risk: annual report on global preparedness for health emergencies. Geneva: World Health Organization; 2019. License: CC BY-NC-SA 3.0 IGO.**
Complete report: https://apps.who.int/gpmb/assets/annual_report/GPMB_annualreport_2019.pdf

Are you aware of the transmission routes of hospital acquired infections in your healthcare facilities?

Author: Riikka Niemi

Nosocomial infections, that develops as a result of a stay in hospital or is produced by micro-organisms and viruses acquired during hospitalization may have several different transmission routes: contact, droplet, air, water, food, or disease vector carrying and transmitting an infectious pathogen, or blood.

The transmission routes are divided into two: direct or indirect transmissions. The direct transmission route of an infectious agent present within a patient's body, through skin contact or mucous membrane is a human to human transmission. In addition to patient-to-patient spread, other sources for contaminants may be involved, including hospital staff, medical students, or visitors.

In indirect transmission, where the contaminant is transmitted from another source within the hospital, is transferred to patient. The source can be contaminated water, food or poorly disinfected structures, furniture or supplies & accessories that are used from patient to patient. One source of contamination can also be a vehicle that is a carrier transmitting the contaminant to a patient. One of these is the contaminated indoor air. Contaminants can origin from humans within the premises, or even from the structures of building, such as poorly cleaned air ventilation shafts.

Contacts between patients, patients and health care workers and among healthcare workers represent one of the important routes of transmission of hospital-acquired infections (HAI). The other, not so recognized transmission route is the air. A detailed description and quantification of transmission routes in hospitals provides key information for HAIs epidemiology.

Nano size particles can stay in the air for a long time, resulting significant nosocomial problems

In airborne contamination, microbes are transmitted in small droplets – especially when coughing, or sneezing, dust or dandruff particles. By air circulation small-particle-size micro-organisms remain suspended in the air for long periods of time, and they can spread quickly. Microbes can spread within air circulation for long distances, ending up into people's mucous membranes. Respiratory viruses are increasingly recognized as significant pathogens, as their transmission routes are not based on contact transmission, and they are readily transmitted over considerable distances. Long distance transmission occurs via spread of small (median diameter, <5μm) droplets.
Given the relative ease, with which they spread, and their relatively short incubation times, these viruses can result in significant nosocomial problems.

A patient with a known or suspected infection that spreads within air may present a potential risk to other patients and staff and could serve as the point source of a nosocomial outbreak, as the micro particles can stay in the air for a long time, and can travel long distances. Awareness of the potential risk and knowledge of the nature of the contaminant concerned and its likely transmissibility may lead to the need for immediate single-room isolation. While nosocomial outbreaks being rather impossible to forecast, causes the suspected infections varying needs for isolation rooms. In these cases, it is essential, that a vacuum room with a negative pressure is available, so that the microbes can be stopped from spreading, and eliminated.

In an ideal world, the infected patients would be accommodated in separate rooms, with own dedicated nursing staff. In reality, shortage of beds and staff usually necessitates compromise. This may involve selecting different sections of a single ward for use, causing the situation where ensuring that infection control protocols are strictly adhered to, is difficult. Especially, what comes to airborne pathogens?

The importance of prevention strategies and guidelines for precautions of airborne infections

The control of hospital-acquired infections (HAI) is largely based on preventive procedures derived from the best available knowledge of potential transmission routes. The accurate description of contact patterns and possible sources of infections is crucial to recognize, as it can help to understand the possible transmission dynamics and the design principles for appropriate control measures.

Therefore, environmental infection control measures are primary methods to protect the patient from transmission of airborne micro-organisms and viruses. The importance of an approach to reduce transmission of contaminants through airborne spread with detailed guidelines in hospitals should not be ignored. The use of personal protective equipment protects the healthcare workers from exposure to micro-organisms in the healthcare settings, but it is not adequate, as it does not protect the immunocompromised patients from airborne infections.

Air decontamination is the most effective way for airborne infection control, to stop the transmission and nosocomial outbreak. If a comprehensive approach is adapted, both modes of operations should be considered when creating preventive procedures for precautions of airborne infections in critical areas.

Usage of electric filtration to reduce the transmission of airborne infections in hospitals

Author: Riikka Niemi

Ventilation plays an important role in maintaining a steady exchange of clean air in hospitals. However, when a large number of people move through open spaces in hospitals, with their infectious status unknown, a normal airflow approach to aerosol infection control is not sufficient to control airborne contaminants from spreading.

Cold plasma technology = advanced electric filtration technology

In order to stop the contaminants from spreading, the route of transmissions has to be known

Nosocomial disease can be transmitted by air, over large distances, by direct or indirect contact, or a combination of both routes. The transmission pathways for hospital acquired infections are generally divided into three categories: personal measures, administrative controls and engineering controls.

Personal and administrative controls are intertwined as the former cannot be controlled without the latter. Personal measures are instructed to patients, visitors and staff, and can include a variety of measures, including hand washing, the wearing of masks, removal of jewelry, reduced physical contact (such as hand shaking). **Engineering control methods** include building ventilation, use of HEPA and other air cleaning methods. Ventilation refers to the supply of outdoor air into a building, and its circulation in the building.

The effectiveness of ventilation is important for controlling airborne diseases

If a disease can be shown to be airborne, the importance of filtration becomes obvious. While contact transmission of disease forms the majority of HAI cases, transmission through the air is harder to control, but it is the problem, where effective air decontamination plays an important role in limiting the spread.

There are two basic physical principles behind the roles of ventilation in infection control. The first is through **dilution of airborne pathogens**, and the second is the **control of movement of airborne pathogens from one space to another**.

Building ventilation has three basic elements:

- **ventilation rate;** the amount and the quality of outdoor air that is provided into the space
- **airflow direction;** the overall airflow direction in a building, which should be from clean zones to dirty zones
- **air distribution or airflow pattern;** the external air should be delivered to each part of the space in an efficient manner and the airborne pollutants generated in each part of the space should also be removed

The benefit of electric filtration is the ability to collect and eliminate living microbes – unlike HEPA.

Additional air contamination control by corona discharge – to remove particles from an aerosol

Varying standards define what qualifies as a HEPA filter. The two most common standards require that an air filter must remove (from the air that passes through) 99.95% (European Standard) or 99.97% (ASME standard) of particles that have a size greater than or equal to 0.3 µm. **HEPA standard** was commercialized in the 1950's. Nowadays, much smaller particles can be measured, and the need for additional air decontamination has been identified.
Advanced Electric Filtration Technology (=Cold Plasma Technology) can be used to complement ventilation for airborne infection control in hospitals. The benefit of electric filtration is the ability to collect and eliminate living microbes – unlike HEPA. The technology has the ability to collect contaminants of all sizes. It is usually a flexible and mobile additional solution for hospitals, where a varying amount of clean rooms are needed, as the ISO-class 5–7 can be reached within 10 minutes.

Reducing the cost of hospital acquired infections

It becomes obvious, that it should be defined, what are the roles of ventilation methods in hospitals. It doesn't only save lives but can also remarkably reduce the cost of patient care. Linked to that conversation, it should be understood, how the ventilation requirements for infection control differ from comfort and general health requirements. What should be the ventilation requirements for airborne infection control, and what other measures should be collectively applied to remediate transmission of nosocomial infections. More research is needed over the next years, to understand better the sources of contaminants, and their pathways through large open spaces carried around by people.

The global effect of tuberculosis and prevention in hospitals

Author: Petri Vaulo

WHO Annual report on global preparedness for health emergencies:

The world is at acute risk for devastating regional or global disease epidemics or pandemics that not only cause loss of life but upend economies and create social chaos.

Many financial, human, infrastructure, surveillance and laboratory health resources already exist in countries that can directly support preparedness efforts. However, resources for disease-specific programs, such as those for HIV, tuberculosis, malaria and polio eradication, often do not include or sustainably support preparedness.

High-impact respiratory pathogens, such as an especially deadly strain of influenza, pose particular global risks in the modern age. The pathogens are spread via respiratory droplets; they can infect a large number of people very quickly and, with today's transportation infrastructure, move rapidly across multiple geographies.

Tuberculosis (TB) is one of the top 10 causes of death worldwide.

In 2016, 10.4 million people fell ill with TB, and 1.7 million died from the disease

The HICPAC guidance defines airborne transmission as dissemination of either airborne droplet nuclei or small particles in the respirable size range containing infectious agents that remain infective over time and distance. It states that microorganisms carried in this manner may be dispersed over long distances by air currents and may be inhaled by susceptible individuals who have not had face-to-face contact with (or been in the same room with) the infectious individual.

Furthermore, preventing the spread of pathogens by the airborne route requires the use of special air handling and ventilation systems, such as airborne infection isolation rooms (AIIRs) to contain and then safely remove the infectious agents. Mycobacterium tuberculosis is cited as an example of a pathogen transmitted by the airborne route.

Guidelines for Preventing the Transmission of M. tuberculosis in Health-Care Settings:

Transmission of M. tuberculosis

Spread by airborne route; droplet nuclei.

Transmission affected by:

- **Infectiousness of patient**
- **Environmental conditions**
- **Duration of exposure**

Persons at High Risk for TB Disease

- **Persons co-infected with HIV and M. tuberculosis (highest risk)**
- **Those with recent M. tuberculosis infection (within 2 years)**
- **Children under 4 years of age**
- **Persons with certain clinical conditions or other conditions of compromised immunity**
- **Those with a history of untreated or poorly treated TB**

Environmental Factors That Increase Risk for Transmission

- **Exposure in small, enclosed spaces**
- **Inadequate ventilation**
- **Recirculating air containing infectious droplets**
- **Inadequate cleaning and disinfection of equipment**
- **Improper specimen-handling procedures**

Risk for Health-care–Associated Transmission of M. tuberculosis

- **Linked to close contact with infectious TB patients during procedures generating aerosols**
- **Bronchoscopy**
- **Endotracheal intubation or suctioning**
- **Open abscess irrigation**
- **Autopsy**
- **Sputum induction**
- **Aerosol treatments**

Environmental Controls

- **Control source of infection**
- **Dilute and remove contaminated air**
- **Control airflow (clean air to less-clean air)**
- **Relevance to Biologic Terrorism Preparedness**
- **Multidrug-resistant M. tuberculosis is classified as a category C agent of biologic terrorism**

“Airborne infection isolation” (AII)

- **AII rooms should be single-patient rooms with a private bathroom**

AII Room Policies and Practices

- **Keep doors closed as much as possible**
- **Maintain adequate number of AII rooms**
- **Check room for negative pressure daily when in use**
- **Group AII rooms together**

Environmental Controls

- **Prevent spread, reduce concentration of infectious droplet nuclei**
- **In AII rooms, these systems control airflow direction to minimize spread of infectious droplet nuclei to adjacent areas**
- **Technologies for removing or inactivating M. tuberculosis consist of**

- Local exhaust ventilation
- General ventilation
- Air-cleaning methods

Genano Technology: Destruction of TB (Mycobacterium tuberculosis)

Mycobacterium tuberculosis: Characteristics: the rods are 2-4 µm in length and 0.2-0.5 µm in width. M. tuberculosis is more related to Gram-negative than to Gram-positive bacteria; its double layer structure is more related to Bacillus subtilis.

Risk factors and causes: Mycobacterium tuberculosis, the bacterium that causes tuberculosis (TB), spreads in microscopic droplets that are released into the air when someone with the untreated active form of the disease coughs, speaks, laughs, sings, sneezes, talks or spits, etc.

Destruction of TB (Mycobacterium tuberculosis): With reference to LNE microbiological tests where Gram + bacteria (Bacillus subtilis) were exposed to the Genano air decontamination process, experience shows that for similar bacterium such as Mycobacterium tuberculosis, the structure would also undergo the same neutralization process. Residues would be in the form of water vapor, carbon, O_3 and CO_2 gases.

The process:

1) Irreversible electroporation
2) Oxidation by O_3, generated by UV and electrostatic capture
3) Capture of molecules by van der Walls forces.
4) Conversion of and adsorption of gases by active carbon

Infection transmission prevention and control of Coronavirus (2019-nCoV) made possible through Genano Air Decontamination Units

Infection control procedures including work practices, protocols and controls, environmental hygiene, air filtration and appropriate use of Personal Protective Equipment (PPE) are all necessary to prevent infections from spreading during healthcare service delivery. But in the case of the recent **Coronavirus (2019-nCoV) outbreak** early detection and isolation of potentially infectious patients is essential to prevent unnecessary exposures among patients, healthcare personnel, and visitors to a healthcare facility.

According to CDC and WHO, besides other infection prevention protocols/precautions the following important steps need to be adapted for patient care in healthcare facilities.

- Place the patient suspected or infected with Coronavirus (2019-nCoV) in a single patient isolation room (with negative pressure relative to the surrounding areas), with a minimum of 6 air changes per hour. Air from these rooms should be exhausted directly to the outside or be cleaned through filtration units before recirculation.
- Healthcare facilities should have one isolation unit per 20 beds (5% of beds) to be prepared for an outbreak such as Coronavirus (2019-nCoV).
- Room doors should be kept closed except when entering or leaving the room, and entry and exit should be minimized.
- Examination room doors should be properly closed when interacting with a suspected person or patient.
- Patients should wear a proper facemask to contain secretions.
- Healthcare professionals entering the room should use PPE (gloves, gown, eye goggles, facemasks etc.) and maintain entries of the visit in a log book.
- Healthcare facility should use dedicated or disposable noncritical patient-care equipment (e.g., blood pressure cuffs). If equipment is to be used for more than one patient, clean and disinfect such equipment before use.
- Healthcare professionals entering the room soon after a patient vacates the room should use respiratory protection.

- Healthcare facilities should ensure that hand hygiene supplies are readily available in every location and are used properly.
- Healthcare professionals should be regularly trained to handle infective patients and pass through periodic screening for the virus.
- Dedicated medical air purifying equipment should be used for patient care and environmental infection control.

The Chinese authorities combating the outbreak of **Coronavirus (2019-nCoV)** have built hospitals in the crisis areas and upgraded their medical infrastructure as traditional air purification methods are not enough to contain microorganisms in the air. Most commonly used fiber **HEPA** filters are powerless against the microbes **that are less than 0.3 µm size**. Unfortunately, the **Coronavirus (2019-nCoV) is slightly larger than 0.1 µm size.**

This Finnish company **Genano** has developed a unique air decontamination method that **kills and removes** even Nano-sized particles **up to 0.003 µm (3nm) size** from the indoor air.

Genano has recently delivered over 200 air decontamination units for hospitals in Jiangsu, Hubei and Guangdong provinces in China who needed to develop isolation rooms for Coronavirus (2019-nCoV) infected patients urgently.

Previously, Genano air decontamination units were used in Saudi Arabian hospitals for isolation rooms and other healthcare facilities in the MERS outbreak (2012), where they were able to treat patients safely and without the risk of contamination.

Genano air purifier is an advanced technology that ensures that all airborne microbes such as viruses and bacteria, up to **0.003 µm (3nm) size,** are eliminated in a contained space. The air purifying unit may be equipped with a negative pressure kit to exhaust clean air from isolation rooms and comes in stand-alone units for isolation rooms, patient rooms and hospital areas.

Genano has proved to be a viable solution for a healthcare facility (purpose or non-purpose built).

Genano Medical air purifier benefits

- 99.5% air decontamination for all types of microbes, particles and gases
- Are easy to install and use (plug and play)
- Are mobile (using casters)
- Low running and maintenance costs (low electricity consumption and requirement of consumables)
- Improves quality, efficiency of work and prevents infection transmission.

Application areas of Genano Medical

- *Isolation Rooms and Intensive Care Units (Positive / Negative pressure patient rooms)*
- *Operation Rooms/Theatres (OR)*
- *Transplant Centers*
- *Burn & Cancer centers*
- *Areas for protection of immune-compromised patients*

Genano Certifications

- Medical device certified (MDD 93/42/EEC Class 1 Medical Devices)
- CE Marked
- ISO Certified

International Media Hits ENG Genano – Coronavirus

1) Radio Dubai Eye, Business Breakfast show, UAE
https://omny.fm/shows/businessbreakfast/fight-against-coronavirus-in-china-genano-27-01-20

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https://www.goodnewsfinland.com/genano-delivers-decontamination-units-to-china/

4) Yle English
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https://www.foreigner.fi/articulo/business/chinese-hospitals-need-finnish-purifiers-for-freecoronavirus-air/20200128160423004106.html

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https://www.iaqe.fi/post/iaqe-partner-genano-delivering-clean-air-to-fight-against-the-coronavirusin-china

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