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European Respiratory Cluster Antwerp

Point of View

Patients suffer from construction activities in and near hospitals, due to bad air quality.

Many hospitals are in some kind of construction or renovation phase. The resulting emissions of dust and particulate matter can have several negative impacts on the hospital environment and air quality affecting the well-being of patients, staff, and visitors. In this "point of view", we have enlisted the key impacts of dust in a hospital environment.

Dust can contain various harmful particles, including allergens, pathogens, pollutants, and even toxic substances. As vectors for transmission, they can carry over viruses, bacteria, and spores amongst other potential pathogens. These particles can exacerbate respiratory conditions, trigger allergies, and lead to infections. Patients with compromised immune systems, such as those undergoing surgery or chemotherapy, are particularly vulnerable to these health risks.

The impact of dust on HAI (Hospital Acquired Infections)

Dust particles can be inhaled by patients, staff, and visitors, leading to respiratory problems such as coughing, sneezing, and worsening of conditions like asthma and chronic obstructive pulmonary disease (COPD). These may seem like minor ailments, but in recently operated patients they can cause very serious problems. **Construction activities can cause substantial dust contamination and scatter large amounts of fungal spores**. An analysis conducted during a period of excavation at a hospital campus showed a significant association between excavation activities and hospital-acquired mold infections.

Amongst the microorganisms suspended in the air, fungi are present in vast amounts as part of the air-biological ecosystem. Aspergillus species have been the organisms most involved in hospital-acquired mold infection. The risks to inpatients during hospital construction projects and their effect can at times be detrimental, especially to the immunocompromised. Hospitals should adhere to infection control risk assessment protocols during construction events.

Dust accumulation on medical equipment, machinery, and ventilation systems can hinder their proper functioning. This can lead to equipment breakdowns, malfunctions, or inaccurate readings, impacting patient care and safety. Regular dust accumulation requires increased cleaning efforts and maintenance, which can incur additional costs for the hospital. It may also lead to the need for more frequent replacements of air filters and other equipment.

Certain measures have been shown to significantly decrease the risk of mold infections and other nosocomial infections during construction projects, but dust control through the c**onsistent use of high-efficiency particulate air decontamination has proven to be insufficient in these circumstances. There is no diffusion process which is crucial**

for HEPA's performance. HEPA 14 filters capture 99.995 % of particles starting from 0.3 um size. But, as measured, they show 80/90 % capture rate. The reason is simply too high air speed; instead of using 1...2 cm/s, as defined in the HEPA qualification standard, air cleaning processes with HEPA use 1...4 m/s. When larger quantities of dust are spread in the environment, HEPA filters gradually lose their efficiency and need to be removed and replaced frequently. Therefore it is recommended to install ESP in hospital units that care for immunocompromised and critically ill patients. Contrary to HEPA, the ESP doesn't get clogged and shows a constant performance.

Aspergillosis as a nosocomial infection hazard in dusty conditions

Hospitals undergoing construction work provide an environment where Aspergillus can potentially thrive, especially in areas with poor ventilation, high humidity, and dusty conditions. Airborne spores of the fungus can be inhaled by susceptible individuals, leading to infections. Dust can be easily transported from one area to another through air currents, foot traffic, or cleaning activities. This can lead to cross-contamination between different parts of the hospital, increasing the risk of spreading infections.

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***Aspergillus* can cause opportunistic infections, primarily affecting individuals with compromised immune systems, such as transplant recipients, cancer patients, and those with HIV/AIDS.**

These infections can range from mild allergic reactions to severe and life-threatening invasive infections. The most common form of Aspergillus infection in hospitals is invasive pulmonary aspergillosis, which affects the lungs. It can lead to symptoms such as fever, cough, chest pain, and difficulty breathing. In severe cases, it can spread to other parts of the body and become life-threatening.

We can notice that a HEPA filter collects but does not kill viruses, bacteria or fungi like Aspergillus. As such it does not decontaminate but 'filter' the air.

ESP will collect the dust, capture and destroy the viruses, bacteria and fungi in the internal high voltage process inside the ESP decontamination unit.

Conclusion:

The particular focus on air quality in the surroundings of renovation sites or units is paramount for infection prevention protocols to prevent the spread of diseases. Dust can harbor microorganisms and pathogens such as Aspergillus, potentially compromising the effectiveness of these protocols and leading to hospital-acquired infections (HAIs).

To mitigate the impact of dust and the potential presence of Aspergillus and other pathogens, in a hospital environment, it's crucial to implement good cleaning practices, robust ventilation, and air quality management including regular air filtration and decontamination. Proper ventilation systems and air purification technologies can also help minimize dust levels and maintain a clean and healthy environment for patients, staff, and visitors.

In these circumstances, ESP decontamination units, such as those provided by Genano OY or VFA Solutions, will provide the best solution to protect patients, hospital staff and visitors. In hospital areas the air quality is depending on correct pressure differences between facilities requiring various stages of cleanliness, adequate ventilation and continuous air circulation inside the room preventing human generated particles and pathogens spreading around the room. Adjusting the first two balance is crucial and the most difficult. The third one only requires good room air purifiers that must be suitable for various kinds of hospital use: waiting areas need more CADR (Clean Air Delivery Rate is a metric used to measure the effectiveness of an air purifier in removing specific airborne pollutants from the indoor air.) Operation theatres need less CADR, but must meet low leakage current requirements. Some hospital areas require good dust control, or particles reduction, while some need adsorption of gaseous contaminants and aerosols.

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The European Respiratory Cluster Antwerp (eu.reca) is a dynamic knowledge platform with a focus on the lung. In order to improve therapies and quality of life of patients, develop new products, reduce societal costs and deal with the challenge of air pollution, we believe it is necessary to connect and unite all stakeholders in an expert community.

"As a catalyst for innovation, we want to bring promising start-ups into contact with leading companies, pharma with product designers, academics with entrepreneurs, and investors with patients. That is why our approach is based on interaction. Our extensive network ensures a quality pool of participants. Our workshops and symposia encourage in-depth dialogue." Frank Pieters, Founder and Chairman of the Board.

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