

IAQ Health and Safety Solutions

Associated with COVID-19

WFI 2020 Annual Virtual Conference

December 15-16, 2020, 8a-12p, EST

Meet leading experts online for the latest update
of air filtration and facemasks to fight COVID-19



Welcome Message from WFI 2020 Chairs

On behalf of the WFI 2020 organizing committee, it is our pleasure to invite you to join the Waterloo Filtration Institute 2020 Annual Conference, December 15-16, 2020, 8:00 am -12:00 pm EST. The theme of this conference is "IAQ Health and Safety Solutions Associated with COVID-19". It will address the critical roles of facemasks and air filtration during the current pandemic for public health and safety. The virtual conference will feature the following four sessions (4 speakers per session):

- 1. Emerging Challenges and Responses***
- 2. IAQ and the Built Environment***
- 3. Facemask Technologies and Latest Developments***
- 4. Facemask/Air Filter Test Methods and Standards***

We are excited to have 16 distinguished speakers from academia and the industry to share their latest developments and trends on IAQ health and safety solutions in response to the pandemic. WFI is dedicated to supporting the growth of the global filtration industry and the advancement of filtration and separation processes for a clean, healthy, and sustainable world. We thank all the committee members, volunteers, and speakers for helping us put this fantastic program together.

As the conference chairs, we would like to encourage you to join us at WFI 2020 to meet the experts and speakers online for an informative and interactive conference discussing the most current topics and the continuing critical issues associated with IAQ Health and Safety Solutions.

Look forward to seeing you at WFI 2020.



Conference Chair
Christine Sun, President
Waterloo Filtration Institute



Conference Co-Chair
Jay Forcucci, Vice President
Cerex Advanced Fabrics

IAQ Health and Safety Solutions Associated with COVID-19

Conference Schedule

Tuesday, December 15, 2020, 8:00a – 12:00p, EST

8:00-8:10a Welcome and Introduction

Session 1: Emerging Challenges and Responses

8:10-8:35a Cleaning Air during A Global Pandemic, Dr. Thomas Caesar, Freudenberg Filtration Technologies

8:35-9:00a Recent advances in assessing the role of respiratory droplets in spreading of COVID-19, Dr. Abhishek Saha, University of California San Diego

9:00-9:25a Impact of COVID 2019 on the Air filtration Industry, Bob Mcilvaine, The Mcilvaine Company

9:25-9:50a Center of Excellence in Protective Equipment and Materials, Dr. Ravi Selvaganapathy, McMaster University

9:50-10:00a Bio Break

Session 2: IAQ and The Built Environment

10:00-10:25a Shifting Paradigms for the Future of Air Filtration, Hunter Most, AAF Flanders

10:25-10:50a How the onset of the Coronavirus Pandemic has forever influenced the air filtration industry, Joe, Gorman, Camfil

10:50-11:15a A Closer Look at Air Filtration, Indoor Air Quality and Covid-19, Jim Rosenthal, Tex-Air Filters

11:15-11:40a The Digital Transformation of Clean Air Management, Dr. Ellie Amirasr, qlair

11:40a-12:00p Product of Year Award Ceremony

Wednesday, December 16, 2020 , 8:00a – 12:00p, EST

8:00-8:10a Welcome and Introduction

Session 3: Facemask Technologies and Latest Developments

8:10-8:35a Specifications and Ideal Performance of Masks for Protection against COVID-19, Dr. Peter Tsai, Univ of Tenn.

8:35-9:00a Respiratory Filtration using Nanofibers, Dr. Jayesh Doshi, eSpin

9:00-9:25a Functionalized Filtration Media, Joseph L Menner, Ascend

9:25-9:50a Pandem-trepreneurship, Mike Atkinson, T3Gear

9:50-10:00a Bio Break

Session 4: Facemask/Air Filter Test Methods and Standards

10:00-10:25a Latest Update of HVAC Air Cleaner Testing, Kathleen Owen, ASHRAE Fellow and 52.2 Chair

10:25-10:50a Comparing test methods for respirators, medical masks and barrier face covering to improvised methods used during COVID-19, Tim Johnson, TSI

10:50-11:15a An outline of current medical face mask performance requirements and testing, Janelle R. Bentz, Nelson Labs

11:15-11:40a In-Place Measure, Monitor and Manage Air Filtration System Associated with COVID-19, Stephen Nicholas, Past President of National Air Filtration Association , Life Member of ASHRAE

11:40a-12:00p CFSS Certification Ceremony

IAQ Health and Safety Solutions Associated with COVID-19

Conference Abstracts

Tuesday, December 15, 2020, 8:00a – 12:00p, EST

8:00-8:10a Welcome and Introduction

Session 1: Emerging Challenges and Responses

8:10-8:35a Cleaning Air during A Global Pandemic, Dr. Thomas Caesar, Freudenberg Filtration Technologies



Air filtration has never been under such a high public focus than it is today, during the Covid19 pandemic, especially as there is strong indication that the SARS-CoV2 virus can spread as aerosols via the air. As the virus may attach to smaller or larger particles (solid or liquid), a large range of particles sizes has to be considered from some micrometers down to the nano scale. Air handling units using high quality and efficient fine filters and by regarding specific advice given for the pandemic times do reduce the virus concentration in buildings. Together with other measures like keeping distance and wearing face masks this can reduce the infection risk significantly.

8 :35-9:00a Recent advances in assessing the role of respiratory droplets in spreading of COVID-19, Dr. Abhishek Saha, University of California San Diego



Respiratory droplets play a critical role in the transmission of the SARS-CoV2 virus, responsible for the current COVID-19 pandemic. Hence, it is important to understand and analyze the mechanisms of evaporation, precipitation, and transport of these droplets ejected from our oral or nasal cavities during respiratory events such as sneezing, coughing, talking, or breathing. In this talk, we will highlight some key aspects which control the lifetime of these droplets and connect it to a pandemic model in an effort to assess the growth in the infected population. We will also discuss the relative probabilistic contributions from droplets vs aerosol in the transmission of this virus at given ambient climate conditions. We will conclude the presentation with a note on the importance of masks in restricting the transmission of respiratory droplets and show how improperly designed masks can have severely opposite effects.

9:00-9:25a Impact of COVID 2019 on the Air filtration Industry, Bob Mcilvaine, The Mcilvaine Company



The Coronavirus is not disappearing. As school has started in Europe, new outbreaks have arisen. Experts now warn that the deaths in the U.S. will range from 300,000 to 600,000 by the end of the year. India is registering 90,000 new cases per day. A vaccine is not going to be 100% effective. There is increasing evidence that much of the transmission is through small aerosols. MERV 8 filters will not remove a high percentage of the virus and are likely to be aerosol generators for larger droplets. These conditions create a very large market opportunity for the filtration industry. The market will not experience a sharp peak as the benefits of cleaner indoor air become permanently established.

IAQ Health and Safety Solutions Associated with COVID-19

Conference Abstracts

Session 1 Continued

9:25-9:50a Center of Excellence in Protective Equipment and Materials, Dr. Ravi Selvaganapathy, McMaster University, Canada



The current COVID-19 pandemic caught Canada on a flat foot. The country did not have sufficient local manufacturing capability nor testing and validation facilities to respond quickly when supply chains across the world shut down. In this talk, I will describe one of Canada's most comprehensive responses in assisting local manufacturing and establishment of a test facility that has enabled local manufacturers of apparel, automotive components, and construction to pivot to the manufacture of personnel protective equipment (PPE). In assisting these companies, broad outlines of an integrated research and development program were realized, which led to the establishment of the Center of Excellence in Protective Equipment and Materials (CEPEM) as a one-of-a-kind facility in Canada. The COVID pandemic and its aftermath have significantly changed how PPEs are used. These changes in use call for a significant redesign of PPEs as well as the development of new materials and manufacturing processes suited for further use cases. There is also a need for the development of specific and custom standards for the evaluation of PPEs in these settings. Finally, natural and sustainable materials need to be incorporated into PPEs instead of fossil fuel-derived materials in order to reduce the impact of their increased use. All of these considerations are interrelated, and a comprehensive research program is required to address all aspects of this problem. In this talk, I will provide some examples of such an integrated approach to the development of PPEs.

9:50-10:00a **Bio Break**

Session 2: IAQ and The Built Environment

10:00-10:25a Shifting Paradigms for the Future of Air Filtration, Hunter Most, AAF Flanders



Indoor air quality is at the forefront of the public consciousness more than ever as facilities of all types continue to be reoccupied after pausing operations due to Covid-19. Once a passing thought for many facility managers, air filtration is now extremely important as they strive to address the concerns of occupants. Thinking of air quality as a matter of safety, as opposed to simply comfort, has dramatically changed the way that consumers make decisions regarding the products and services used to attain clean air. The approach to solving air quality problems has fundamentally changed as decisions have been informed by shifting paradigms with respect to almost every aspect of the technology. A previously common view of filtration as a commodity product has given way to a highly engineered, value-driven selection process. Facilities have a renewed level of focus on materials, performance verification, and cost optimization as they explore new use cases for filtration technologies. These paradigm shifts affect multiple professional disciplines. It is critical that these factors are prioritized as the filtration and HVAC industries mobilize to rise meet these new challenges with novel and innovative solutions. A comprehensive grasp of this information is also essential across facility management, life safety, and academia. Cooperation from such a cross-sectional shared understanding will provide the best possible built environments today and ensure that the environments of tomorrow are even better.

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Conference Program

Session 2 Continued

10:25-10:50a How the onset of the Coronavirus Pandemic has forever influenced the air filtration industry,

Joe, Gorman, Camfil



On March 11, 2020, the World Health Organization announced publicly that COVID-19 disease was officially a global pandemic. During the proceeding months, and as COVID-19 cases grew across the globe, a lot of speculation grew around the path of transmission of the SARS-CoV-2 virus. To this day, there is still debate around the primary path of transmission, even though there are numerous studies and research professionals who suggest the virus can in fact be transmitted through the air. In May of 2020, through the advice of ASHRAE, the Center for Disease Control announced publicly that the recommended filtration efficiency for public HVAC systems should be a minimum of MERV 13 in order to provide a safe environment. This announcement sparked an unprecedented demand for high-efficiency air filters without the preparedness of the air filtration industry, the nonwoven media suppliers and the facility engineers who were blind-sided by the HVAC system changes that would need to be made. Now that the general population is aware that high-efficiency air filtration is crucial to the overall health of the building occupants, the air filtration industry as a whole will forever be driven towards delivering high-performance air filters to the market.

10:50-11:15a A Closer Look at Air Filtration, Indoor Air Quality and Covid-19, Jim Rosenthal, Tex-Air Filters



The world of Indoor Air Quality has gone through a major transition since January of 2020. Researchers and practitioners, including those in the air filtration industry, are in high demand to provide good information on how to deal with the spread of Covid-19. Building owners and managers need answers to the many questions about making their facilities safer so that they can be used productively. This presentation will focus on how air filters affect indoor air quality and how air filters can be used to limit exposure to Covid-19 aerosols. It will cover filter efficiency and explain why certain levels of filtration are being recommended. But it will also focus on filter "effectiveness" and draw on recent research to cover how and where filters should be used to obtain optimum results.

11:15-11:40a The Digital Transformation of Clean Air Management, Dr. Ellie, Amirnasr, qlair



It is no secret that our world has become rapidly digitized, and facility management is no exception. With the introduction of smart buildings and IoT devices, digital solutions are being developed every day to help facility managers save time, money, and energy. But while we attach sensors and monitors to just about every piece of equipment in our buildings, we often overlook the world's most valuable asset... clean air. Utilizing clean air management effectively involves selecting the right sensors for your facility's goals, compiling and analyzing the data to develop actionable insights, and ultimately using these data to make critical, informed decisions on what to do next. In doing so, your facility will realize significant energy, material, labor, and operating costs savings.

11:40a-12:00p

Product of Year Award Ceremony

IAQ Health and Safety Solutions Associated with COVID-19

Conference Program

Wednesday, December 16, 2020 , 8:00a – 12:00p, EST

8:00-8:10a Welcome and Introduction

Session 3: Facemask Technologies and Latest Developments

8:10-8:35a Specifications and Ideal Performance of Masks for Protection against COVID-19, Dr. Peter Tsai, Univ of Tenn.



The masks used to protect against COVID-19 are cloth, three-fold, and N95. Cloth and three-fold do not have tight fit, usually called a mask, but N95 does, usually called a respirator. In addition, N95 has a submicron efficiency of 95% or higher based on 42 CFR Part 84. Some three-fold masks like cloth masks do not have specifications for general use. The specifications of medical masks are based on ASTM F2100-19. Electrostatically-charged meltblown microfiber fabrics are commonly used to achieve the specifications of the masks and the respirators. Charges can be retained for longer than ten years. Depending on the charging method, the efficiency can be ten or 20 times improved compared to the uncharged one at the same basis weight and pressure drop. The measured surface charge potential shows that the charged media is a bipolar electret. Therefore, it attracts both positive and negative particles by Columbic force, as well as neutral particles by image force. Several N95 sterilization methods have been validated by NIH, in which some will degrade the charges and/or the shape of the respirators, while others will not. Cloth masks are primarily used to block the virus. Nonwoven media can block and filter the virus. The combination of cloth sandwiched with a nonwoven filter is an ideal design of DIY masks.

8:35-9:00a Respiratory Filtration using Nanofibers, Dr. Jayesh Doshi, eSpin



Covid-19 has created massive demand for masks and air filters resulting in a shortfall of nonwoven filtration media all over the world. Nanofibers has become material of choice for many mask manufacturers as a result of its ability to capture small aerosol drops while providing superior breathability. This presentation will cover nanofiber media production for face masks and air filters to rapid prototyping and manufacturing of masks and respirator filters.

9:00-9:25a Functionalized Filtration Media, Joseph L Menner, Ascend



Traditional particulate air filtration technology relies on the capture mechanisms of impaction, interception, diffusion as well as electrostatic attraction. While pollutants are successfully arrested by the filtration media, these pollutants can retain their malicious attributes even though they are being trapped. And they can e-enter the ambient atmosphere during any subsequent handling for disposal. As an example, it is well documented that bacterial and viral spores trapped on surfaces can remain infectious even after 10s to 100s of days. That could be a plausible explanation for the so-call “filter fever” where filtration technicians developed cold-like or flu-like symptoms after changing filters in commercial buildings. We report a newly developed technology where filter media are
(see next page)

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Session 3 Continued

9:00-9:25a Functionalized Filtration Media, Joseph L Menner, Ascend (Cont'd)



constructed with nanofiber and microfiber layers that also possess the build-in ability to inactivate bacterial and viral strains to not only ameliorate this undesirable phenomenon but also potentially reduce the impact of air borne infectious diseases. The fiber formation process is based on a recently granted melt blowing patent that is not related to electrospinning. The technology to inactivate bacterial and viral strains to protect the filter does not utilize chemicals that are detrimental to the environment and is not applied via traditional means such as topical pad-on treatment or polymer compounding. This technology is well suited for applications such as face masks, air filtration, and ventilators. A description of this unique technology as well as the filtration efficiency and bioefficacy performance will be presented.

9:25-9:50a Pandem-trepreneurship, Mike Atkinson, T3Gear



It was clear to me in early February what became clear to the general public through Bob Woodward's latest book. That was that COVID was rapidly getting out of control. At that time it seemed that trying to find some way to participate in the COVID fight was the best use of my company's efforts. We centered on masks as it was something that we could do and not only participate but also make what I thought would be a big difference. Starting with never having made a mask and knowing nothing about filtration we plunged ahead as my company www.T3gear.com has some of most flexible sewing capacity in the U.S. We designed a cut and sewn mask that was the best mask on the market not N95 rated. Had a large number of people had been wearing our mask or a like product in 2020 we could be in an entirely different place on the Pandemic. My talk will follow this journey in much greater depth, identifying the wide variety of villains along the way.

9:50-10:00a Bio Break

Session 4: Facemask/Air Filter Test Methods and Standards

10:00-10:25a

Latest Update of HVAC Air Cleaner Testing, Kathleen Owen, ASHRAE Fellow and 52.2 Chair



This talk is a work in progress. It will be an update on the recommendations for the ETF for using filtration to battle COVID19 and on filter test methods. Thus, the content will change based on what happens between now and then. Likely discussion will be any changes in recommendations for MERV levels or to air changes including the balance between ventilation with outdoor air and use of clean/filtered air. As appropriate, this talk may include discussion of schools, building reopening, and other ETF topics related to filtration.

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Conference Program

Session 4 Continued

10:25-10:50a Comparing test methods for respirators, medical masks and barrier face covering to improvised methods used during COVID-19, Tim Johnson, TSI



The masks used to protect against COVID-19 have varied widely. There are 3 main categories. NIOSH approved respirators, Medical masks (ASTM method and FDA requirements) and face coverings (not currently covered by any standard). These are tested to different standards and methods. There has recently been an effort to standardize how these devices are tested. In this talk I will describe the different test methods and the changes that are occurring to standardize at least some aspects of how the testing is done. Within the ASTM standards there is a proposal out for ballot to adopt a version of the NIOSH respirator test method for PFE (particulate filter efficiency) testing in place of the method of using PSL particles and optical particle counters that has been used until now. I will give an update on the status of that proposed change. There is also an ASTM task group working on a standard for testing barrier face coverings for use by the general public. It is unknown what the status of this effort will be by the time of this workshop but I will discuss the status. If this proposal does become a standard it will create a category of face coverings that have the potential to be significantly better in terms of source control and protection for the user compared to the many products that have been in use during the pandemic.

10:50-11:15a An outline of current medical face mask performance requirements and testing, Janelle R. Bentz, Nelson Labs



Medical face masks and respirators have taken the spotlight during the current pandemic. With the increased emphasis on wearing of face coverings an understanding of the testing required for approval of these products is imperative. An understanding of the difference between these two products and the test methods used to prove compliance is important for choosing the appropriate product to ensure the right mask is used for each purpose. Test methods can range from simple air differential tests to complicated bacterial filtration efficiency tests; each of these tests gives important information about the functionality of the product. Medical face masks are manufactured and tested with the patient in mind, and testing demonstrates this. Testing for these products is directed toward expected conditions in a medical environment, and includes bacterial filtration efficiency testing, flammability testing, and synthetic blood penetration testing. NIOSH approved respirators are generally used in industrial settings and are meant to protect the user. Testing for these products focuses more on expected conditions when protection is needed from small particulates.

11:15-11:40a In-Place Measure, Monitor and Manage Air Filtration System Associated with COVID-19, Stephen Nicholas, Past President of NAFA, Life Member of ASHRAE



The presentation will highlight the updates of air filtration requirements associated with COVID-19 for actual field applications, such as hospitals and schools. Guidelines and examples will be provided on how to select air filters and schedule filter change-out, and how to select proper air filter clips, latches and gaskets to insure an airtight filter seal. Three T's (Technical Tips – Tricks of the Trade and Traps to Avoid) and 3M's (Measure, Monitor and Manage) to secure an effective air filtration system will be discussed.

11:40a-12:00p

CFSS Certification Ceremony
End of Conference