*Mariana Egea C.:* Hello everyone. Thank you for joining. We're gonna wait a few seconds to wait for other folks to trickle in and then we'll start the webinar.

*[no conversation from 0:00:25 to 0:01:15]*

*Mariana Egea C.:* All right. I see people are still joining, so we're gonna wait a little bit more.

*[no conversation from 0:01:17 to 0:01:57]*

*Mariana Egea C.:* All right. It's 11:02, so I'm gonna start us off. Next slide.

Hello and welcome everybody to the 2021-2022 Better Buildings webinar series. This series is dedicated to bringing you the latest actionable insights from leading industry experts. It's a chance to explore topics, technologies, and trends that affect your organizations as well as efforts to accelerate energy efficiency adoption. Today's webinar is titled Planning for the Future: New and Improved Pandemic Protocols.

Before we dive in, I'm gonna go over a few housekeeping items. Please note that today's webinar will be recorded and archived on the Better Buildings Solution Center and we will follow up when today's recording and slides are made available. Next, attendees are in listen-only mode, meaning that your microphones are muted. If you experience any audio or visual issues throughout the webinar, please send a message in the chat, located to the bottom of your Zoom panel to our support staff. Next slide.

My name is Mariana Egea Casalduc. I am a fellow with the Building Technologies Office. I work primarily on the Better Buildings Initiative and I am the healthcare and hospitality sector lead. Next slide. Wonderful.

Today's webinar is special, as it's a continuation of our Building Operations During COVID-19 webinar series, which went on a hiatus this July. The goal of today's webinar is to reflect on lessons learned from the pandemic, look towards the future, and identify best practices organizations can incorporate into their existing pandemic protocols to improve resiliency, improve preparedness, and make the plans to enact responsive building operations in anticipation of a future event.

You can find all other installments of the Building Operations During COVID-19 webinar series on the Better Buildings COVID-

19 Resource Center, which also houses resources from ASHRAE, EPA, DOE, and more. Before I introduce our speaker, I'd like to introduce Marcus Bianchi. Next slide.

Marcus Bianchi is a senior research engineer at the National Renewable Energy Laboratory. Marcus is going to introduce the Space Conditioning Technology Research Team, which is available to all of our Better Buildings partners. Marcus.

*Marcus Bianchi:* Yes, good morning. The Better Buildings Space Conditioning Technology Research Team, in that role, at NREL and other national labs, work on creating materials guidelines and other resources that can improve the space conditioning for commercial buildings. We got involved very early on in the Epidemic Task Force.

It's really a pleasure to be here today, when Luke Leung will actually talk about some of the findings on that he had on the commercial teams and the pandemic. Next slide, please.

At the Space Conditioning Team, we maintain and collect information about space conditioning as a whole in the HVAC resource map. This is the link to it. In that, you can actually find a series of resources that we keep updating to make sure that the information reaches the partners and the public in general. If you have a chance, please visit. Next slide, please. Thank you.

*Mariana Egea C.:* Wonderful. Thanks, Marcus.

Now today, we're gonna be using an interactive platform called Slido for Q&A polling and feedback. Please go to Slido.com on your mobile device or by opening a new window in your Internet browser. Today's event code is #DOE.

If you would like to ask our panelists questions, please submit them at any time throughout the presentation. We will be answering your questions near the end of the session. You can select a thumbs-up icon through Slido for questions that you liked, which will result in the most popular questions moving up to the top of the queue. Next. Wonderful.

Let's learn a little bit more about you. Which sector are you from? Wonderful. I see a strong showing from commercial real estate. Maybe not. Multifamily housing and industrial manufacturing, a lot of higher education, K-12s, and state and local governments. Excellent. Great to see healthcare and hospitality, a lot of

contractors and service providers. That's wonderful. All right. Let's scroll back to the top.

Great. Let's go to our next poll. All right. This question was developed by Luke and he wants to know, will future health issues be more or less impactful than the current pandemic? All right. I'll give it a few moments.

Wonderful. It looks like the majority of you anticipate future events to be more impactful than the current COVID-19 pandemic. That's very interesting. That's wonderful 'cause today, we're gonna be talking about getting ready for the future. Next slide.

Wonderful. Today's presenter is Luke Leung. Luke is the director of sustainability engineering studio for Skidmore, Owings & Merrill, as well as a distinguished professional with leadership and fellowship positions with LEED, ASHRAE, and ENREL, among many others. His work includes the Burj Khalifa, the current world's tallest building, and other 4 of the top 20 tallest buildings in the world.

As a reminder, please send in questions for our panelist Luke through Slido by going to Slido.com and typing the event code #DOE. We'll try to get to as many questions that we can near the end of the session. Luke, the floor is yours.

*Luke Leung:* Thank you, Mariana. I think you can see the screen. If you cannot, just let me know.

*Mariana Egea C.:* We can see it.

*Luke Leung:* I think it's really interesting that during the survey just now, a lot of you think that maybe the future could be a little worse, the next pandemic. But hopefully, what we learn from this pandemic can help us to minimize the impact.

First of all, a shout-out to Professor Bill Bahnfleth at Penn State. He's the chair of ASHRAE Epidemic Task Force. He helped me to put some of the... Actually, I shamelessly borrow some of his slides. If you see later the good slides, they are from Bill. The slides that are maybe not so good, that's from me.

What does the future hold, when we look into the future? Pandemic hit us hard. The year was 2019. United Nations told the world, there will be ten things that can derail us from our economy. Global influence pandemic is only number three. What is number

two? Non-communicable diseases, chronic diseases oftentimes have something to do with the environment are in, partially could be the air we breathe. Number one, climate change.

Looking into the future, there's a holistic elements in the air that can give us some trouble. You know there is good news in there. If you look at a lot of the elements in the air that holistic can impact us, of course we're concerned about $PM_{2.5}$ responsible for millions of death.

Also, it's an equitable issue. It can penetrate deep into our lung. They are tobacco smoke, natural $PM_{2.5}$, bacteria, viruses, combustion, like a wildfire. But the good news there is, if you have a MERV-13 filter, you can take care of many of this issue, even to the sub-micron level below 1 micron.

There are some holistic strategy that are not particularly costly that can get us good way down there to take care of a lot of these issues. Of course, gas molecule is a little different. If you have odors and stuff like that, you're gonna need carbon filter.

How about the people? Now today, we have about 7.8 billion people. But the percentage above 16 years old, eight percent is actually 1950. What happened since 1950 till today? The life expectancy grow older. People live longer and more people above 60 years old. In fact, 13 percent roughly of people today are above 60 years old.

What about looking into the future? Guess what happen in 2070? Number one, the people increase to 9.4 billion. Number two, the amount of people above 60 years old will increase to 28 percent. I'm quickly approaching to that 60 years old mark. It is an issue because if you look at the amount of cost of energy we're gonna spend to make people healthy, the mushroom would start at around 60 years old.

As we can see in this pandemic, the senior citizen in nursing home hit a lot harder than the other people. This increasing healthcare cost and energy we have to keep our senior healthy is gonna get worse in the future. Not only the population increase, the percentage of the people above 60 also increase. That's issue number one.

But what about a more equitable future? What do we see in pandemic is it doesn't hit the same across all color. If you are Hispanic, Black, or Native Indian, chances are you are three to four

times more likely to be hospitalized and your death rate is two to three times higher than Caucasian. But your cases is actually not that significantly higher.

What's going on there? Possibly you're saying maybe there are also other issues that are underlying their health. For example, in this recent study, it indicates 40 percent of Americans today are still living in area with problematic air. It's an equity issue because people of color is three times more likely to live in those bad air area.

Not only that. If you look at the Vitamin D deficiency across America. If you're African-American or Hispanic-American, you are more likely to be Vitamin D-deficient because you are more likely indoor service industry all the time. That's why you didn't get a chance to get outdoor to get a dose of Vitamin D.

It's not just color of the skin but it's also, like we mentioned earlier, age. In this study here, it's actually from Michigan earlier on this year, it told us if you are K-12 school, a lot of outbreaks happen there. Or if you are in senior assisted living, a lot of problems there. But guys, if we can provide even a simple MERV-13 filter in all these facilities, it would get us a portion of the journey down there, down the road already. There are things we learn from this pandemic that can be applied to create a better world and even a more equitable world moving on.

Some of the measure we learn. One of the thing you probably remember is inside out. Try to bring some of the activity outside. There's different paper issuing the chance of the rule of 1,000.

The rule of 1,000 is saying, if you are outdoor, you have 1,000 times less likely to breathe in anything compared to indoor. Outdoor activities will be good during future COVID or future infectious diseases. But the outdoor space need to study so that they will be flushed through them because concentration of $PM_{2.5}$ is not so good during pandemic.

My day job - I actually have a day job - is design professional. We are seeing a lot more interest in designing space like that. Half climate space that can open up to outside, maybe with fireplace, or fan, or some sort of shading device to expand the time of people that can spend outdoor. Because during pandemic, infectious disease time, it's probably a better location outdoor. Except if you have high $PM_{10}$, $PM_{2.5}$ ozone and all that stuff in the air, you have

to be careful. Some sort of measuring devices, both indoor and outdoor, to tell you which one is better to go is probably helpful.

Also, space like this. Basically, this is an extruded office building, but with just a south-facing porch. People can get a dose of sunlight in the noontime to get that Vitamin D in there and also allow them to meet outdoor, if they want. This is actually 330 North Green, an office building in Chicago.

Also, we see there is interest from Toronto to Australia to different parts of the world to bring more outside in. As you can see later, clean air doesn't have to come from outside. But oftentimes, outside air can give you a way to save energy in natural ventilation and provide some clean air, as long as the $PM_{2.5}$ and ozone, et cetera, contaminants is not high.

Do you know that China just recently updated their building code? Part of the building code, there's a requirement that buildings should look into natural ventilation to save energy, that whole adaptive comfort issue, and also as a way to potentially get it healthier. Something to think about. Also, if you have three air changes, you can eliminate 95 percent of the contaminants indoor. But remember, you do not need 100 percent outside air to have clean air, which get us right into some of the recommendation we'll be looking at.

This recommendation is the core recommendation of the ASHRAE ETF that we will touch on. In the future, if similar epidemic like COVID-19 hit us, we are at least more prepared for the future. But not every epidemic is the same. We have to look carefully to see how the future epidemic or pandemic may be different than the one we are experiencing right now.

This core recommendation was updated on January 6. It's quite different than the past. It talk about things that, for example, there's a flexible approach that allow combining different strategies and care about costs to minimize the energy consumption. For example, the first one. For a while, when the Epidemic Task Force first come out, we thought about increasing the amount of outside air. Then later on, we find out we can actually provide a code require minimum outdoor air ventilation as a base strategy to save energy.

Now, one of the reason why we want to do that is, as you can see on the screen, the X axis is the dollar to mitigate a unit of contaminants and the Y is risk. As you can see, MERV-13 filter, it already turned the corner on risk but the cost to eliminate per unit

of contaminant is significantly lower than 100 percent outside air. This is a paper done early on in, I think it's 2010 to 2015.

But we also did, this is actual study in different buildings. This team look at seven different buildings. Now, the first thing is, you cannot do 100 percent outside air in many of the buildings. They were not designed to do that. They don't have the coil capacity to do that.

This team looked at seven buildings and only one building can truly do close to 100 percent outside air. But when you do that to this building, it will cost roughly about 30 percent more energy and $0.3 to $0.4 per square foot. This building is in New York state. In the energy standpoint, if you can minimize the outside air, of course you're gonna save quite a bit of energy and money. But you have to supplement it with the recirculation air. It's got to be MERV-13 or the equivalent.

This is from ASHRAE Epidemic Task Force website on COVID-19. If it's MERV-13, one pass, the droplet nuclei filter efficiency is 89 percent. That's actually pretty good because when you go two pass, the first time you got 89 percent, the second time you got the rest, maybe roughly 10 to 11 percent, and 89 percent of that. So, you're over 95 percent, maybe even close to 98 percent with a couple passes already.

The MERV-13 filter, there's a perception that maybe it costs you a lot more energy to run. But as you can look at this ASHRAE journal article, this is in, I think, last year, August, the static pressure differences between a MERV-5 filter and a MERV-13 filter is really not that significant. Now, if you move onto HEPA filter, then of course there's a significant energy cost difference.

But keeping MERV-13 filter, it may not have a significant impact to your energy consumption because the filter pressure loss is not that significant. So, it's really a good place to be to start with basic co-require ventilation – don't have to go to 100 percent outside air – and the use MERV-13 filter. It's a good place to start.

You wonder, who are the people doing that? This is the latest P100 document from GSA. I think this just came out maybe last week or this week, even, in the last couple weeks. You see in the GSA P100 document, it requires MERV-13 filter in 100 percent recirculation air terminal unit, fan coil units, fan powered boxes, and the air handling unit, not to mention the provision of that in places where there are wildfire. So, you go back to the first chart

that we look at. What is in the air, right? That holistic element and how MERV-13 filter can help to mitigate many of those.

Now, but that's an important point to note here. The co-minimum ventilation and MERV-13 filter may not be adequate to provide the risk mitigation. Now, that may be additional measure will be require. Some of this additional measure could be standalone filters or other cleaners, like UV light, for example, that can reduce that exposure and reduce the risk.

Let's go through a few examples, since we know there's a bunch of audience in there that come from different background. Let's first look at residential. What else do you want to do besides a MERV-13 filter in your home? Well, let's look at one thing we learned from the pandemic this time is many of the outbreaks actually happened in the home.

Moving forward into the future, you probably know – you and I may be experiencing that too – the new normal is you might be of some sort of hybrid. You will be able to work more from home. Our company, for example, allow us to work two days from home. With that in mind, there will be more time you may stay at home.

So, you want to make your home safe. Potentially, if you're gonna do that, maybe you have a portable air cleaner in your working room or something like that. Or if your home has vulnerable people, provide a portable cleaner in the room for them.

What about in an office? Well, portable cleaner for the entire floorplan of an office is gonna be very expensive compared to MERV-13 filter or even UV light. It may be the most expensive option. So, one of the things we can do is if you reduce the density of an office. In this case, the orange is no mask, the blue is with mask. Either way, it's a linear relationship. It reduce the office density, the amount of people, by 50 percent, you roughly reduce the risk of 50 percent.

How about in an industrial area where you don't have the MERV-13 filter and it's just a ventilation unit? One of the things potentially you can do is provide upper level UV light and run the fan in reverse, so it draw the air up and go through the UV light to clean up the air.

How about that elevator? Well oftentimes, we got scared walking into the elevator during COVID because somebody sneezed in there. Then, you are trapped inside that confined space. But if

everybody wear a mask and is everything the same as all the other spaces, the elevator actually could be a safe place to be.

Why is that? Because a typical elevator, if you turn on the exhaust fan, it has 72 air changes in an hour. Compared to five to six in an office building, elevator actually has much higher air changes. So, the risk potentially is much lower. We calculate with that sort of air movement, it's roughly about 0.005 percent of risk using the Wells-Riley.

There are different things you can do in different environment potentially to enhance the space beyond the minimum outside air and the MERV-13 filter. Now, beyond those stuff I already talk about, there are also from this pandemic. We learn just about a whole spectrum of these other devices, what we call the emerging technology. Those technology, you got to look at it with a more careful eye because they oftentimes need a lot more science to prove it. You just have to be really careful in evaluating the manufacturer's claim and data.

The air distribution is important. If there's no need to have some directional airflow in this COVID situation, the air is preferred to be mixed and avoid this extremely high velocity of air going from one place to the other, like the Korean restaurant example you saw, or on the upper right-hand corner. The air actually infected a person that is over six meter away because this high velocity of air forming a movement.

We start looking at the future office. Look at the differences, furniture layout. What you're seeing on the left is typical row. On the middle is actually cubicles. On the right is actually quite interesting. We turn all the people 45 degree to the airflow. The airflow is from the bottom of the picture to the top of the picture. What did we find out? We find out cubicle actually form this trapping area and trap some of the air from moving. So, the mixing is not as well.

Out of all this three, the one that has the best movement of air and a little bit better mixing is actually the one on the right. By turning the people 45 degree to the airflow, the air flow through the people just that much better. Airflow does matter on top of MERV-13 filter and minimum outside air. The way the air flow does matter, pending on how the furniture react with the airflow.

In the earlier discussion of the Epidemic Task Force, we look at relative humidity. We want to keep our building 40 to 60 percent.

Later on, we find out that relative humidity compared to the other measures for pandemic in COVID-19 is actually not as effective. So, we relax that requirement and change to maintain temperature and humidity design set points, rather than try to maintain a relative humidity really high.

I live in Chicago. I can tell you that 40 percent relative humidity in Chicago, you're gonna have some issue on condensation. I suspect you all know that, those from the northern climate.

The other piece to think about is whenever there are people in the office, we got to maintain the required supply air and the MERV-13 filter. Oftentimes, we think oh, occupy hours and unoccupy hours. Well, unoccupy hours, there would still be cleaning crews in there. Sometimes construction people work in the off-hours. Make sure when there are people in there that the equipment are on to protect them. Remember, oftentimes those people tend to stay a longer time indoors. To create a more equitable environment, we should really protect them.

When necessary, we will flush the space, right? There was a time when we think about flushing the space with three air change to eliminate 95 percent of the contaminant in outside air. But we move forward into this equivalent outdoor air calculation. It's a simple calculation. You can go to this Excel spreadsheet on the ASHRAE website.

What it does for you is it can look at your strategies. In this case, you have 1.56 outdoor air change, and then you have a MERV-7 filter and a UVC light, 85 percent efficiency. What this Excel spreadsheet allows you to do is collapse all those three strategies together and add them together.

You see the red, blue, and yellow? The red is 1.56 same outside air. But the MERV-7 filter gives you 2.08 air change per hour. The UV light give you 3.2 air change per hour. Totally, this add up to get a 6.84 of equivalent outdoor air. If you want to flush through this space, three air changes, you don't need 100 percent outside air. You can use these three strategies and in 26 minutes, then you can flush this space with three air changes.

This is a simple calculation. You can download the Excel spreadsheet and it will do a lot of the work for you.

We got to avoid some of this reentry of the element from our heat recovery devices. On the top right corner it shows you, you do not

have to turn your heat recovery devices off depending on the arrangement you have. Certain arrangement is more concerning, you want to turn it off. But others, you don't.

The other thing to think about is no matter if the first SARS or the second SARS, COVID-2, we saw multiple high-rises that through the water system or the air system, the contaminants, the material, was spread to different floors. Think about trapping your plumbing system. Make sure the water to trap the plumping trap. If you have common exhaust riser, make sure you have motorized damper or backdraft damper, or some other device to isolate the flow when the unit is not on to avoid this air movement from one apartment to the others, both from the air side and the water side.

Other things to think about is some of this could be just maintenance issue. For example, in this case, the filter is not mounted correctly. If you do that, 1 CFM of correct in the filter rack, it would change your MERV-13 to MERV-8.

Other maintenance issue, including this one, which is a paper done by Mr. Fisk from Lawrence Berkeley Lab. What it indicates is there are many schools actually have very high carbon dioxide level in the space. If they have issue in the normal times, then probably they will have more issue in the pandemic times. Make sure the maintenance is good so that you don't see this extra high level of $CO_2$ in our schools.

Finally, one of the things we want to look at is control and monitoring. During pandemic mode, we suggest use the BAS system to create that pandemic mode. Oftentimes, we have fire mode and occupy mode in our BAS system. Why not have a pandemic mode? Push of a stroke from the operator will set up the building to be ready for pandemic mode. Let's do that for the next pandemic so that we don't have to go through that whole BAS control sequence again.

Or the measured spaces. There are a lot more devices come out in the past. We use $CO_2$ as a proxy of human being, but there are now devices that can actually measure how many people you have in the room. Also, you know exactly, from the toilet to the conference room to your office, at any time, how many people are there. There are counters like that. There are devices to check the temperature.

How do we think about this holistic measured space? That's gonna inform us in the future what about our normal times and our emergency times. Part of that could be this virus monitoring. This

is not a real-time, though there are some devices approaching real-time.

But this is actually a device, you put a cartridge in there and it will monitor the virus in the air. Some suggest up to 1,000 different virus they can measure. They can give you the result the day after, like a really short time. It can start inform you both during flu season, are your space trending in virus buildup? Or during pandemic time, are there actually virus inside the air handling unit? Now, you have to send a cartridge to the manufacturer for them to do it for you.

Also, some of these devices have the ability now to put in tracer gas so you can actually measure how the airflow in your building, like what you see on the right. Again, think about how this device can help you now or in the future to prepare for better healthier indoor.

Finally, I want to touch on beyond the indoor air quality. Indoor air quality is the dark cloud of the day but hopefully, we'll go past that. Think about the humanity in the future, as we all grow longer and maybe above 60 years old. Maybe closer to one-third of the population in the U.S. is approaching that 60 years old.

How do we make them healthy? It's gonna be beyond just indoor air. It's gonna be about the holistic indoor environment, so we can create the best and the optimal environment for human beings to live there to minimize the energy consumption to take care of their health and create a better world.

This will be things like all the stuff you saw just now, from thermal acoustic to air quality to many other considerations. Because it's only that we can minimize our energy and our health and create a low-carbon future so we don't spend a lot of energy and money to take care of our older folks, which I'm quickly approaching towards that direction.

With that, thank you.

*Mariana Egea C.:* Wonderful. Thank you so much, Luke. Now, we're going to be moving over to the Q&A portion of this presentation. Our first question is, does it matter if MERV-13 filters are on supply versus return? How about increasing outside air percentage? I think you spoke to that, but if you want to give a brief summary of your main points?

*Luke Leung:* Yeah. I think the second part is easier. Obviously, if the outside air is 100 percent clean, bringing in 100 percent outside air is slightly better. But as we went through the example earlier, the first pass is 89 percent given COVID profile. The second pass is already at 98 percent. So, you can quickly see that the recirculation through a MERV-13 filter will quickly approach the outside air.

In terms of supply air and return air, it's probably more helpful to put it on the return air because the return air is the one that carry all those good stuff or not so good stuff, I should say, back from the space into the air handling unit.

Now, there's also a lot of discussion putting MERV-13 filter on the outside air. Think about it. If the static pressure lost is not significant, putting it on outside air also can potentially prevent the wildfire, the $PM_{2.5}$, all that bad stuff from coming in. So, there's that benefit, too. Put it on the supply side, the benefit will be smaller than compared to the return side.

*Mariana Egea C.:* Thanks, Luke. Before I continue with all these questions, I have a quick question of my own. You mentioned a lot of different ways that we can improve our indoor air environments. For some folks on this webinar that might not have the capital resources to invest in all of those technologies, can you let us know what are the most cost-effective ways to achieve a health indoor air environment?

*Luke Leung:* Yeah. We actually look at that from ASHRAE standpoint. You can first cost-wise. Actually, look at maybe life cycle cost-wise. There are a few things we can do. One, improve outside air. Two, MERV-13 filter. Three, UV light. Four, portable air cleaners.

On the first course basis, probably the cheapest is potentially either change the filter. We look at that as roughly about $0.05 per CFM. It's really inexpensive. Increase the outside air can be inexpensive because you just adjust the damper location. But it's gonna cost you a lot to run.

On the first course and operating cost basis, MERV-13 is probably the cheapest, the first thing you got to do. Now, the next thing is potentially first course is still not too expensive and also energy-wise, maybe not too bad, is probably some sort of UV light. Usually, the cost is slightly lower than putting in portable air cleaners all over the place, let's say if you have an office floor, right, because the CADR, the clean air delivery rate, is only a certain amount. So, the portable air cleaner, you're gonna need quite a bit of those to clean the floor.

The cheapest first course and lowest operating cost is probably your MERV-13 filter. That's how you want to start.

*Mariana Egea C.:* Great. Then, beyond the pandemic and beyond building systems, what other things can we do to improve and achieve a healthier human environment?

*Luke Leung:* Wow. This is no doubt a loaded question. There are many things you can do. ASHRAE is focused on that in the strategy plan. Happy to work with you more on those. But your thermal comfort, your acoustic, and then your indoor air quality. Now, there are also microbial. There's a lot of discussion about microbial. It's still in process, but there's another dimension of microbial electromagnetic wave, which is inside SIPSI as one of the element they look at. Just a very holistic set of things.

I don't know whether I can dive into all those topic in this short duration, but this is a great question. Happy to try to work with you together on that on a separate email or come join ASHRAE and let's explore that together. I think that humanity in the future health is the next carbon, maybe even more significant than the next carbon.

*Mariana Egea C.:* Yeah, we'll have to bring you on to a follow-up webinar to discuss health in detail. But let's go to this next question, which has five up votes.

This question is about occupant density. If only custodians are in a building after hours, there is no population density and a minimal risk of transmission. Shouldn't one of them be able to reduce ventilation based on occupant density?

*Luke Leung:* This is not an easy question to answer. There's two things about it. On one side is if you can know how many people are in there and provide the co-required ventilation, that's certainly one way to do that. But oftentimes, it's not that easy to find out how many people are in there. If you know that, great. But if you don't know that, that becomes a little bit of that discussion.

But at the end of the day, it's really the risk level you want to accomplish and the measures to get there. But if you know the exact occupants and can provide the co-required ventilation, then obviously that's a way to save energy.

*Mariana Egea C.:* Next question, which has three up votes. Does adding a MERV-13 filter cause a higher pressure drop? If changing to a MERV-13 filter, would a fan still work? In other words, does an AHU fan need to be replaced to a higher pressure fan when adding a MERV filter to an AHU system?

*Luke Leung:* For the most part, I think what you find is you may not need to do that. The filter can be completely transparent to the fan. The fan doesn't have to do anything. Now, you want to make sure the MERV-13 filter pressure loss is very similar to what you have right now. Oftentimes it will be, if you just seek out a filter that can do that.

As we saw in the presentation, the study from the ASHRAE journal suggests that there are definitely filter out there, MERV-13, the performance very similar to MERV-5 to MERV-8. You can actually don't do anything to the fan and the filter can be transparent to what the fan is doing.

*Mariana Egea C.:* Got it. The next question is, is ASHRAE working on a pandemic mode guidance and testing protocol?

*Luke Leung:* This is a good question. Maybe Bill can have a much better insight than I do. In the commercial guide we just mentioned that prepare pandemic mode, the pandemic mode will be what you're doing in your building right now. But build it into a BAS sequence so that just like an occupy mode, when you heat it, it will engage that sequence. Similar thing here.

That will be difference in df building type. Also, even in the same building type, you might have different sequence. For example, commercial office building. Some, they have to warm up an hour before you occupy. Some maybe two hours, for whatever reasons. Those will be different too. But what you want to do is build all those sequence of how you control the building during pandemic mode into a one-stroke by the operator, you will be there.

*Mariana Egea C.:* The next question is, are there industry practices for risk measurements?

*Luke Leung:* If you look for actual measurement, I'm not aware how you're gonna do them. Maybe some people do. The risk we are talking about here is really the industry as a whole right now, a lot of us is just using the Wells-Riley equation to calculate the risk level that you're experiencing. There are tons of assumptions behind it, but that's one of the tools we are using.

I'm not aware of anything you can do on the measurement side. But then again, there are many people much smarter than me. They may be able to answer that better.

*Mariana Egea C.:* Got it. For those of you in the chat that are asking where you can submit additional questions, please go to Slido.com and use the #DOE. Then, you'll be able to land on this page and include your questions.

Moving onto the next question. For a building using 100 percent outside air ERVs plus fan coils for temperature control, which cannot handle a MERV-13 filter, do you recommend installing other technologies in the space, say in an assisted living facility?

*Luke Leung:* Oh, wow. This is a lot of material in there. Fan coil, depending on what type of fan coil you have. For example, you saw in P100 document, GSA actually is suggesting using MERV-13 filter on the back of a fan coil. There are fan coils that can handle that sort of pressure drop. You have to look at the configuration. You saw just now, the pressure drop is about 0.1 something in a MERV-13 filter. I think it's anywhere from 0.05 plus or minus north or south of that.

If you have a typical fan coil, 0.3 steno static pressure, potentially you can take that, if your ductwork is not too much. You need to look at that carefully, whether your fan coil can take a MERV-13 filter.

But if your fan coil cannot take a MERV-13 filter, I don't know whether you want to quickly go to 100 percent outside air. I think if you have a MERV-13 filter... Oh. If you cannot handle a MERV-13 filter in the fan coil, then okay, increase the outside air, or UV light, or portable air cleaner will be the next strategies to look at.

But I don't know how efficient is your ERV. You need to do that comparison between UV light, your 100 percent outside air or the increased outside air, or portable air cleaner to look at those three options to see which one is maybe better. Or a combination of those.

That will involve an exercise. That may be something you may want to go to a local engineer or some engineer you trust to have them do some quick study for you to see what's the best way to use those different strategy, either independently or together to create the risk level reduction you want.

*Mariana Egea C.:* There's a lot of different things to balance and to consider. I want the audience to know that for those more complicated questions, we'll be sharing Luke's contact information one more time later, when we're wrapping up. You can feel free to reach out to him and ask him any questions that were left unanswered here today.

With that, I think we're going to wrap up. Thank you all so much for all of your incredible questions.

*Luke Leung:* I do want to let you know that ASHRAE website has a question button, or question location. They are free. That will be a good place to go to, if you have any question.

*Mariana Egea C.:* That's great. I actually didn't know that they had some form of question or chat function. That's really great. Thanks for letting us know, Luke.

*Luke Leung:* Yeah. Go for it!

*Mariana Egea C.:* We want to go to the next slide and wrap up Slido.

This webinar is part of the 2021-2022 Better Buildings Webinar Series. As you can see, we have a great lineup of presentations through April. Please feel free to visit the Better Buildings Solution Center to learn more and register for all of those great sessions. Next slide. Great.

We hope that you will join us on November 9th for our next webinar, which is titled Reimaging Carbon Costs: Finance Your Way to a Low-Carbon Future. Join this webinar to hear from experts about how they increase the use of financing mechanisms to achieve their carbon reduction plans. This webinar is going to explore how three leading organizations are using finance to address their carbon profile. Next slide.

If you're interested in learning more about the topics discussed today, I know we had a lot of questions in the chat about all of the resources that Luke shared, I really encourage you to download the additional resources handout from the Zoom chat box. The handout contains links to resources from Better Buildings and our speakers. Please take advantage of that. In addition, like I mentioned before, the recording of this session and Luke's slides will also be made available, once this webinar is finalized.

With that, I'd like to thank Luke and Marcus very much for taking the time to be with us today. Like I mentioned, please feel free to contact our presenters directly with additional questions or if we couldn't get to your question during the Q&A period. For all of those Better Buildings partners on the line, please remember that Marcus Bianchi and his team, the Space Conditioning Tech Team, are available to provide guidance on any challenges that you might be facing in your organizations with your buildings at this time.

I also encourage you to follow the Better Buildings Initiative on LinkedIn and Twitter for all of the latest news. You can find our handles by their respective icons on the left of this slide. Like I mentioned, you'll receive this slide and the recordings, everyone's emails, and the handout with resources later.

Thank you all so much for joining. Thank you, Luke. I really appreciate your time and expertise. This was an incredible session. I really appreciated your emphasis on equity and the inequalities that have been highlighted through this pandemic.

*Luke Leung:* Thank you.

*Mariana Egea C.:* All right. Thank you all.

*[End of Audio]*

# Planning for the Future: New and Improved Pandemic Protocols

## Additional Resources

Learn more about the topics discussed on the webinar by visiting the resources below.

### Better Buildings Resources

- COVID-19 Resource Center
- Healthy Buildings On-Demand webinars
- Space Conditioning Technology Research page

Explore more resources on the Better Buildings Solution Center

### Other Resources

- HVAC Resource Map
- ASHRAE COVID-19 Response Resources
- ASHRAE's Instructor-led seminars
- National Air Filtration Association MERV Filter Models
- NIST Fate and Transport of Indoor Microbiological Aerosols (FaTIMA) Simulator
- ASHRAE Epidemic Taskforce: Reducing Airborne Infections guidance
- SARS-CoV-2 Airborne Decay Calculator

### Up Next in the 2021-2022 Better Buildings Webinar Series

**Reimagining Carbon Costs: Finance Your Way to a Low-Carbon Future**
Tuesday, November 9th from 11 – 12 pm ET

This webinar will discuss how organizations are increasingly using financing mechanisms to achieve their carbon reduction targets. This webinar will explore how three leading organizations are using finance to address their carbon profile.
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