

Health@Home Web Series – Webinar 3: Now More than Ever: Keeping Homes Safe and Dry

Lael Holton:

Good afternoon everyone. My time says here on the system that it is 3:00, so we will go ahead and get started for today. Good afternoon again and welcome. My name is Lael Holton. I'm with AECOM. We're providing contract support and technical assistance to HUD through the community compass technical assistance program, and that's the system that we've used to develop the health of home rehabilitation guidelines. We're happy to have you all here today I've got a few procedural type of things we want to talk about before we dive in and get started. I'm going to buzz through them quickly, so we can save the majority of the time for the content, but just wanted to highlight a few things.

You have on your right side of your WebEx interface, there are a couple of modules. There's a chat module. There is also a Q and A module. If either one of them is not open, please look at the top right of your interface and make sure that the chat button is blue. Then there's a little drop down arrow, make sure that the Q and A button is blue. The reason for that is if you have any technical issues or concerns, we'd like you to put those in the chat box, and you can submit your message to the host and presenters and panelists. That way, we all see that and I can take care of any technical issues that might have popped up.

For questions that are related to today's content, we would like those please put in the Q&A box and that way, we'll be monitoring that throughout the course of today's presentations. We can put answers there. We can also hand those up to the presenters, so that they can work those into the conversations as we move along throughout the course of the day. This is our agenda for today. Oh, I do want to mention one other thing for you all as with our other two webinars in this series, today's material is being recorded, and it will be provided later on the HUD Exchange and the HUD Exchange YouTube page for this. Our agenda for today obviously is me here talking now.

Then our host for the day really, Michael Freedberg from HUD will be giving us a little bit of an overview with the Health@Home guidelines document and the conversation and context that we find ourselves in. Then we will be going to some keep it dry and safe, a little bit more deeper dive to the guidelines document, and then we get some real meat of today's materials with two principal presentations. One on keep it dry by Armand Magnelli from Livable Housing and keep it safe with Jonathan Wilson, from the National Center for Healthy Housing. Then we have a bonus today. We've got with us Maureen Mahle from Steven Winter Associates. She will be providing some information of a timely nature on rehabs relative to the pandemic.

We find ourselves in the COVID-19 virtual space today, and they will be providing some information on how we can do rehabs plan for pandemic-related concerns and everything as we go into that. With that, it will take us over our 4:00 timeframe. We expect to go to about 4:15 today, so we expect and hope that everyone can attend. If your time runs short and you do have to move forward, as I say, all of this is being recorded. There will be a transcript and a PDF of the webinar will be on the HUD Exchange, probably about two weeks after this. The additional material will still be available to everyone from there. These are our presenters today.

As I say, Michael will lead us off and then Ellen will set some more of the Healthy Guidelines context and the document conversation. Then we'll be going through Armand Magnelli for Livable Housing and

keeping it dry, Jonathan Wilson and Maureen Mahle will end the day out. You won't hear too much more from me until we get towards the end, but at this point in time, Michael, it's your turn.

Michael Freedberg:

I guess my job is to welcome you all for this four-part session. I'm with the office of environment and energy at HUD, and we are sponsoring this series. We have some terrific presenters to talk about the applying healthy housing in your rehab projects. I don't need to say much more about that for this group. We're building more energy efficient homes, that's the good news. Lots of good passive house and zero energy ready work that's being done out there, but the importance of indoor air quality has never been more important. Of course, as we're spending extra time in our homes due to the coronavirus, this is even more important.

When we rehab our homes, we need to maximize the indoor experience and minimize the indoor hazards. This is the third of four sessions today, is focusing on keeping the home dry and safe, and the next session will wrap up the series. We'll be focusing on energy efficiency and some other topics. The curriculum for this session are the Health@Home guidelines that can be accessed on the HUD Exchange website. We encourage you to go to the website and use these materials.

Just to provide a bit of context for the guidelines before handing this over, the focus is on moderate rehab, home remodeling, or mobile repair programs, we think that if you think substantial of that rehab, you're likely to be using one of these or other green building standards which have many of these healthy housing elements baked into those, but when you're not building to a standard, these are some guidelines that you should consider as you're doing your home repair program. Also, the focus is primarily on single-family and low-rise multi-family. While much of this is also applicable to high-rise, there are some special issues that we're not going to be dealing with in this series.

With that, I'm going to turn the session over to Ellen Tohn who is the lead instructor. Ellen is with Tohn Environmental Strategies who's been doing this work for several years. I won't say how many, but is a real leader in this space doing one touch work in New England and has authored or co-authored some of the leading studies documenting the benefits of focusing on healthy housing, especially in conjunction with energy efficiency upgrades, so over to you Ellen.

Ellen Tohn:

Thanks so much Michael. You're in for a treat today. We've got some terrific speakers who are good friends of mine, and I will just set the stage so they can provide additional content. As Michael said, with coronavirus, we're thinking a lot more about Health@Home, but even before that, we clearly understood that home conditions really contribute to the health of the folks living there. Just a few examples.

With asthma, about eight percent of adults and children when you look at national data have asthma, and we understand that about 20 percent to 40 percent of those asthma attacks can be linked to home conditions, some of which are shown in the pictures to your right, environmental tobacco smoke, at the top right a cockroach, dust mites below the cockroach, and then below the cockroach and to the left, we see debris from cockroaches and mice and moisture and contaminants. Another great example would be radon gas, we covered in one of our last sessions. EPA estimates an additional 21,000 annual deaths a year and over seven million homes suspected radon risk.

Then just turning to something that really isn't something that related to an inhalation or something we breathe falls is a significant concern. Our national data shows one in four older adults fall in here and if I asked you all right now on this line, how many of you have a family member who's shipped or fallen in their home in the last year, I would venture say more than 25 percent of your hands would go up. We know this is of concern. The guidelines that HUD has put out that I've had a great pleasure of contributing to are organized to make it easy for you to use them. We've given you two doors into the guidelines.

One is we provide all the rehab specs and guidelines organized by one of our healthy home principals, two of which we will cover today, keep it dry and keep it safe. You can see dry on the left and safe on the bottom row in the middle. We've covered some of these other principles if you've been on other sessions in previous webinars, and we'll cover these last three well-maintained, thermally controlled, active design in our final of the four sessions. Many of you, if you're running rehab programs don't necessarily think about your rehab specs by principle, you think about it by building component.

We've also provided the content using that organizational framework and here, we will provide content under the rehab standards for these various building components like site and roof, foundation or system, plumbing, heating, cooling, ventilation, and I'll show you an example. We're trying to keep every reader, no matter how your brain is organized or your program is run, a way to access this content. Here's an example of how the guidelines look when they are presented in a principle-based approach ear showing keep it dry, and Armand will go through these details. We give you for each of the principles the why statement, which I just did about increased, and I'll do in a second about increased respiratory risk.

Under each of those principles, we then provide information about what you should do in your rehab spec. This is just a sense of how it looks. Again, Armand will give details, but then we do a wonderful crosswalk and say, "Well, maybe you don't think that way or you want to import some of this content into your own rehab specs, in your own housing rehab program." For each of the content, we provide under the principle, so here we're talking about dry, one of the sets of information we provide is around stormwater management for example. You'll see that we're telling you as a reader that there's content in the component-based approach under site, roofing, building exterior, foundations, and structure.

We give you the specific item under each of those components that you might want to look at. This would be the crosswalk. There's a part of the guidelines you say, "Ah, these principles are not how I think. I just want to go to the component-based approach," and you can do that organized by our components and this is what that would look. For example, in the site section, we provide the crosswalk back to the principal showing that there are linkages to dry, contaminate, free pest, free and safe. If you follow these, you'll make all of those conditions better, and then we provide content for both a repair and a replacement standard, and that format will be very familiar to many of you running rehab programs.

The takeaway is we're giving you lots of ways to access the content. Today's session covers keeping it dry and keeping it safe and the bonus well mentioned that Maureen will cover on opportunities to reduce COVID risks during rehab. To start us off on keep it dry, I'll give you the why statement and then pass it off to my colleague, Armand to talk about how we actually reduce moisture and mold risks in homes, but the why is we know that homes with damp moist conditions increase the risk for residents and occupants living in those homes for a variety of respiratory problems. Upper respiratory attack, the

one we are most familiar with asthma, wheezing, coughing, hypersensitivity to pneumonitis, and a host of other things.

When it's moist, we also see more flaking peeling paint and more pest problems. We know that we don't want damp moist homes, and this was first lots of studies on this, but a seminal report from The National Academy of Sciences on damp moist spaces. Let me hand it over to Armand Magnelli who's with Livable Housing and has been a leader nationwide in writing very practical, useful rehab specifications for enterprise foundation, rebuilding together in numerous city programs. He and I have done a ton of training together, and what I love about Armand is he provides practical and clear guidance. With that, high set of expectations. Let me hand it over to...

Armand Magnelli:

Ellen, I'm not sure you should do that, just place such high expectations on me, but thank you very much. Welcome to the keep it dry portion of today's session. We're going to focus on typical moisture problems, and essentially how to use the standards, the Health@Home standards to make sure that your program is really in a good position to address moisture issues and the problems that are caused by moisture issues. A quick review of Ellen's content was this is the beginning of keep it dry. We have this start with this statement keep it dry and mentions moisture and mold. Then immediately after that, the standards will present you with some thoughts about prevention.

It starts off with a pretty general statement about stormwater management and then gets into more detail from there about gutters and downspouts and downspouts and grading, and encourages you to think about maybe some innovative ways to move stormwater away. Here are our focus of stormwater, and we're talking about the different ways that you might consider preventing problems related to stormwater management. This is how just giving you a sense of how the standards are organized. Then we also talk about the standards that Ellen mentioned by building component. When it comes to the keep it dry principle, you'll find information around keep it dry under the site, under roofing gutters and downspouts, under foundations and structure, under plumbing.

I'm going to talk about examples today within each of those categories of components and how the standards relate and how you might make use of the standards, but I'm also then going to talk about mold, and mold is officially under contaminants within the principles, but it is so, so connected to moisture. We thought it would be very good to talk about it here as well. All right, so let's start with stormwater management. Here's an interesting photo, and you'll see many of my slides have this title, sometimes it's obvious. Maybe it's not so obvious, but sidewalks can create lots of problems when it comes to stormwater management and sidewalks I think of as a category of issues that revolve around preventing moisture and bulk stormwater especially from flowing away from the building.

You can see here that in this slide that the grade is what we call negative. It slopes towards the building, and this is not good obviously. In this photo, you can also see that there is a vent to the crawl space under this building and moisture and bulk water that comes into this space is pretty clearly likely to move into that building through that vent. This is not good. There's another situation where in this case sidewalks aren't in destruction. The grading, it's gentle, it's slight, but it is positive. It is moving away from the building, but we have other problems. The corrugated plastic extension to the downspout, one could argue that it's moving the moisture, the bulk water from the downspout in the wrong direction.

This is one of the reasons why we don't typically care for these types of downspout extensions because they can move about quite freely. They often get moved by folks cutting the grass, doing landscaping

work, doing any kind of gardening, and they're just not a good permanent solution. We're going to give you some ideas, better ways to deal with this. In this pair of photos, you can see on the upper right, there's a photo and it shows a situation where the grade is negative again. In this case, this is a pretty tough situation to deal with because the grade is going to move quite a bit of bulk stormwater towards the building, and the downspouts are dumping water in that same location.

You can see the close-up of the outlet for the downspout going into the corrugated extension and boy, that's a problem. It's certainly not moving water away from the building. It's got a huge crack in it. Solutions here might include abandoning the downspout closest to us in the photo, sloping the gutter so that it all goes to the opposite end of the building, and trying to move the water away from the building in that direction. A fairly inexpensive and simple solution, but clearly something to be concerned about. Think of these examples of how to deal with grading issues. Within the site portion of the standards, we talk about positive grading being a very simple way to deal with moisture and bulk water.

We would argue that grading is such a good idea because it just lets gravity do the work for us, and it is a pretty long-lasting solution. Within grading, you can see below our repair standard for grading, and it suggests quite a bit of slope, but certainly enough to move moisture away from the building. This is an EPA illustration just for bonus content, that gives you an idea of what we're talking about when we're saying grading. This is an exaggerated illustration, but it does do a good job I think of promoting this idea of having the grading all move away from the building and the potential use of Swales to help. All right, so let's move on to gutters and downspouts. Sometimes again problems are obvious.

We have a big puddle of water in the basement of this home. This home's in Massachusetts, older stone foundation. The floating mouse trap in the puddle is interesting. My wife refers to this as a potential life raft. I don't know that it would actually serve that purpose, but the water in this basement can be a serious problem, can create all kinds of health issues. It's caused primarily by a problem with the downspout and the way the downspout directs stormwater to the foundation, and this again could be a very simple solution, simply moving the water away from the foundation with an elbow and probably a short extension and just making sure the grade works with that part of the system.

Sometimes problems relate to maintenance and like many systems in homes, gutters and downspouts require maintenance. Here we have the outlet for the gutter clogged by leaves and other debris, and when you have a rainstorm in a situation like this, the water just flows over the edge of the gutter and soaks the foundation all along the building. Here we are rather than using the gutter and downspout to direct the water away, it's not serving any purpose. I want to make the point with this photo and actually series of photos, there's three related to this building that we have to look closely at systems to make sure that they're working properly.

In this photo, from this distance at least from this view, it looks a fairly well-kept house, nice and tidy, but if we zoom in and look at the front section of gutter on this, you can see that the gutter is damaged, it's bent, and will not drain properly. It won't have the proper drainage to the outlet and could overflow and create all kinds of problems, and also is more likely to get clogged over time. At the rear of the property, the gutter even has a bigger problem. It's become a planter. Those plants are getting plenty of moisture I suspect and again, this is partly a maintenance problem, but the point here is it's one thing to have good standards and think about this another thing we need to really be attentive and look at these details on our buildings.

Here's an interesting photo. It is of a downspout that's directed to a section of bare earth. If we could stand back for a bit, you could see that the downspout comes down and directly onto the concrete slab adjacent to here. If it had been directed out onto the slab, it probably would have drained all on its own, but instead, they moved a couple feet over and to dump water on the bare earth, and now it has created a depression, and moisture is draining into the building. Sometimes simpler is better. We often get questions about gutters and downspouts and the clogging portion and ask wouldn't gutter guards be a good solution to that? Well, not always.

Maintenance is still an issue with these and we should be thinking about maintenance as an opportunity for occupant education about how to maintain things. Enough said about that. Let's move on to roofing, gutters, downspouts, stormwater management. Here we're talking about roofing as part of a system. Key concept is that these things all have to work together to move stormwater away from buildings and avoid moisture problems, and here is the repair standard for gutters and downspouts. Simple stuff, gutters and downspouts must be leak-free and operational, and must move water away from the building. There should be positive drainage because for the downspout to work well, the grading has to be part of the system.

If we look at the replacement standard for this, it's very similar in this case to the repair standard, but it also provides the program with permission to use an underground drain leader as a way of moving water away from the building. These standards in some cases can suggest to the user that there's an opportunity to use something a technique, a method of material that's a little more advanced, and we're going to talk a little more about these underground drain leaders in a moment. Part of the standards when you talk about sloped and gutters moving water away from buildings, it doesn't have to be extreme. This is one manufacturer's spec.

A quarter of an inch every 10 feet will actually suffice to move water to an outlet and help to keep the gutters and downspouts free of debris. This EPA illustration is making the point that extending the downspout so that it gets to a point where the grade is positive away from the building is a good thing. Here they suggest five feet. I would suggest that it's a hard and fast number here is not so important as it is important to get the outlet of the downspout to a point where the grading will help move the water away. I mentioned underground drain leaders before. This is what we're talking about, and this is a case where a little bit more work obviously than just installing gutters and downspouts, but here we are moving water further away from the building by using an underground pipe.

In this case, there's a little device on the top of that elbow at the outlet that's called a pop-up emitter. What we like about these is foot traffic won't damage it. You can actually run lawnmowers over these. They're that sturdy and they don't allow rodents or insects to get in and yet, they do allow the water to escape a certain distance away from the building. These are relatively easy to install. Here's a photograph of a team of volunteers working with a rebuilding together affiliate in Arlington, Fairfax, Falls Church, Virginia. It took about 10 minutes of describing the process to these gentlemen before they were knee-deep in the project, and you can see it didn't take a lot of excavation.

They preserved the sod and just replaced it after they were done. They did this to the four outlets around this building, and it had a very positive impact on the amount of water infiltration into the basement of the soldier brick home. Again, a simple relatively inexpensive solution, and let's move on and talk specifically about roof leaks as moisture problems well, and we'll weave in a little about plumbing here as well. Looking at this photo, we have a couple spots on the ceiling that look signs of moisture problems, or is it a roof leak? Is it a plumbing leak? Are the leaks active or has there been a

repair that's dealt with this and they just haven't fixed the aesthetics of the ceiling? Well, we don't know.

We must look a little further and that's part of the issue, or the inspection side of this is figuring out what the sources of problems are. In this particular case, this is a view of the attic directly above that ceiling. There's a chimney running in the wall to the right of the previous photo and here, we can see water stains on the roof sheathing and also some signs of water dripping down the chimney that's in that wall. Pretty obvious we have a roof leak here, or at least it was a roof leak at one point in time. Here is the roof above that chimney, and you can see they've been trying to repair this for a long time.

They've spent quite a bit of effort and money on roofing cement trying to solve a roof leak problem, pretty much proves to me that it's a roof leak. Now we have to decide if it's active or not, and the tool that we most like to recommend for this is a moisture meter. This is a fairly fancy one. You can get moisture meters for \$30, \$40 at the big box stores, and what we would use this for is to determine if the moisture levels at the size of those leaks is higher than it is at the drier sections of the ceiling. Just looking for comparative readings, and that's how we could confirm beyond a doubt whether or not we have an active leak, whether it's from plumbing or roofing or whatever.

This is a handy tool to use, but moisture again, we need to know whether it's active or not. This is what the standard says. We want to identify and repair any kind of leak that we find, and we have to assess for structural problems, deterioration of components. Then after we figure out what the source of the problem is and how much damage has been done, then we need to determine the appropriate actions. Key concepts to consider around this is roofing should be watertight, and one of the concepts that we do reference on occasion is what is the predicted useful life of the component that we're looking at. In the case of roofing, this might have an impact on whether we decide to replace the roof or to repair it.

If it's a relatively new roof that's leaking, a repair might suffice, and then we would have a repair spec to relate to that, or it may be that replacement is inappropriate because the roof is old enough that we can't predict that it's going to last very much longer. That's an example of why we have separate repair and replacement specs. In the case of roofing, we further define the standards by talking about separate standards for pitched roofs and low slope roofs because they often use different materials, and repair and replacement can be different. This photo shows a home with a shingled sloped roof and a pitched roof rather and a flatter low slope roof with a single membrane on it.

Just for your information, we do separate which the standards for these two different types. Okay, moving quickly to plumbing. Sometimes it's obvious, we have to look under the sink of course to find this kind of leak, but in this case, yet pretty obvious and very likely the trap for the drain, and that is something that we need to address, but sometimes we need to move things around to find them. Having a standard that says we're going to deal with leaks is one thing. Making sure we find all the leaks is the next thing to consider, and the standards talk about key concepts. Water leaks could cause ongoing damage, especially if they're undetected, and it points to water heaters.

Under the plumbing standards, we talk about drain waste vent lines, water supplies, plumbing fixtures, water heaters all being potential sources and have separate standards for each of those components. I want to mention basements and crawl spaces quickly because they are incredible sources of moisture. Both of these crawl spaces have bare dirt floors and are leaking tons of moisture into the building. The one on the left floods on a regular basis, creating obvious problems. Rehab standards speak to this by suggesting no dirt floors, plastic vapor barriers, especially on dirt floors of crawl spaces that encourages

concrete for basement floors and if you're doing a new concrete slab, having a vapor barrier underneath it.

This illustration from the Building America Program shows a plastic vapor barrier being applied to a crawl space, wrapping from the floor up onto the foundation walls and seams sealed at all points, so there's no way for moisture from the dirt to get into the building. I want to mention in the standards, we also talk about surfaces materials in high moisture rooms, areas like kitchens, bathrooms, laundry rooms. Having durable moisture resistant materials in those rooms is of high value, just helps to keep rooms drier, and finally, we get to mold. I'm going to talk about mold specifically because it is of great interest and certainly a health hazard. We got to remember it's contaminant. Moisture is at the root of all mold problems.

We got to solve the moisture problems. Remember that keeping ventilated helps to keep it dry and to keep it dry and keep it clean helps to keep it contaminant free. Very quickly you'll see that we have some resources that we're going to want you to look at, and this is generally what the recommendations are. Find the moisture problems, determine what the source is, figure out what the solution is, protect people that are working, protect the homeowners, replace or clean materials, whichever is most appropriate. Sometimes treatment is necessary, but drying out the building's crucial. Again, the moisture meter comes in handy, and here are four documents that we'd like you to... Well, I'm going to end with this four documents for you to consider for much more background on addressing mold problems.

With that, I think I've run over a little bit. Hopefully no one's too upset with me. I'll hand it back.

Ellen Tohn:

Great. Thanks Armand. I think we will turn this now to talking about keep it safe and Armand, there's one question that came in about ice damming. Maybe in the Q and A, you can just put some thoughts into everybody if Kelly or Lael can put that in the Q and A, and Armand can respond with some thoughts by ice damming. Keeping it safe, as I noted earlier, our data has shown us that one in four Americans older than 65 fall each year, and a large percentage of those falls are in homes. Other safety issues around poisoning fires and burns, some of those risks are to young kids. I want to just highlight a study that I had the great pleasure of doing with our next speaker Jonathan Wilson, where we added fall prevention to weatherization and energy efficiency jobs along with a visit from an occupational therapist.

We only enrolled people in this study who had fallen in the previous six months. At baseline, it turned out 94 percent of the people had fallen after we did the fall prevention measures, and I'll show you a few pictures of that. Six months later, only nine percent of the folks had fallen. Can you go back to the previous slide just for one sec, Jonathan? Then the other thing that we track was not only falls, but falls that were significant enough that somebody would have called for assistance, like an ambulance. Before we did the work, 24 percent of the occupants had called out a fall that required a call for assistance and after we did the repairs, that fell to three percent.

Next slide, so you'll see that the measures that we talked about doing, and Jonathan will go over these in more detail, like putting more hand rails inside and outside, putting them on both sides of the staircase, installing grab bars, raising the height of toilet seats, and improving lighting, although it still looks quite dim in the picture to the right, but the chandelier that was there before was really dark. All of those repairs really made a difference in terms of reducing falls and significant falls resulting in

transport to a healthcare facility. I'm going to then turn it over to my good friend and colleague, Jonathan Wilson, who directs the research efforts at The National Center for Healthy Housing.

I realized my camera wasn't on, and they do wonderful work focusing on what I would call policy relevant research in the healthy home space. I've been at it for a long time and in particular, Jonathan is great at translating that research into action, so that we can promote evidence-based solutions, changes in practices in rehab and maintenance that we know will reduce health risks, so over to you Jonathan.

Jonathan Wilson:

Thank you, Ellen. I have the great pleasure of working with all the folks here on the call, and it is a pleasure to be here today. The focus of mine is it's going to be a little quicker than Armand's, and it's going to be looking at keep it safe. The actions that are in the guidelines talked about reducing trip and fall hazards, making sure you have adequate lighting as Ellen was just saying, universal design which could be a whole day-long course, but we'll get it down to a minute, smoke alarms and carbon monoxide alarms. All of these are common causes of home injuries and death. For falls, just giving a few more steps, and I think that when we think about falls, we really think about the lifespan of a person.

It is much worse when you're very young and much worse when you're very old, and we see that the number of emergency room visits for children are very high. It's the leading cause of non-fatal injuries of children less than 16 and 50 percent of injuries to children under the age of one are due to fall. You can see in this picture that there are challenges here. There are no handrails to address. Those stairs look slippery to me. I would be concerned especially if I had a young child or an older person with just socks on, how they would get down these stairs safely. Now there's certain things when you're doing rehab you have no control over. If people are leaving things on the stairs, then that's outside of your realm.

If they decide to put a throw rug at the bottom that's loose, that's out of your control, but if you've got a rug that's permanent, a world wall rug, make sure that it's attached. It's not going to be peeling up and that it's going to be safe for people. Those are the principles you need to be thinking about as you're doing your rehab. Here are some examples that are in the guidelines, some quick ideas. Making sure that you have two handrails on either side. When people are going downstairs, they have an opportunity. These are relatively inexpensive, \$750 to \$1,000 for full install. Slip covers on stair treads, \$15 of stair tread. Then in bathrooms and around the toilet, having grout bars for people.

Even if you don't think there's going to be a senior there, you never know who's going to be living there the next time. Having the ability to put them in is the first step, so having a place that they can be attached, but then potentially going to the next step of actually installing them. Grab bar can be as little as \$80 to \$250, \$280 per grab bar. Sometimes it's an issue not of having the support adequate lighting, if it's too dark that you may miss that step. Certain things are really simple. A \$4.50 limited light switch can make all the difference in allowing somebody to find where the light switch is to turn it on when they go into a room. Having light switches at the top and bottoms of stairs are important.

That's a little bit more complicated. You got to set up a system so that those switches are interconnected, but it's not rocket science to do that. You want to make sure that whatever lighting you put in as Ellen was saying, sometimes you think you've got the right lighting, but you look at it, you sit back and it's not enough. Making sure you have the right wattage, the right lumens to make sure that people can navigate around the room. Going to universal design, I think it's important to recognize this. This is just not about handicapped accessibility.

We call it universal design because of the principles I was talking about, that it's a lifespan, that whether you're a young child that needs to get around a house or a young woman who is pregnant and needs special support, to someone who's just moving around the house and needs access to certain things and wants to move a dolly, moving in and out of the property to your older adults who they need the wheelchair accessibility. Then you have those unknown factors that a son or daughter playing sports, and they break the leg or something, and they've got that temporary need. All these are good reasons to have a place that is accessible at all times to all people.

We recommend looking at the enterprise community partners guidelines, the AGM place design guidelines. Again, we tend to focus on aging in place, but it's for all ages. It's a huge document, but use it for what you want and here are some of the things that they talk about in the rehab section. Four key challenges for rehab. Making sure you have vertical circulation barriers removed, so these are stairs and steps. Do you have ramps that allow people to get into the property and allow people to move between levels in the property? Again, if you take a day-long course, you're going to get some really interesting photos from architects who are supposedly so smart that they put a ramp in that goes up to a landing that has three more steps to get into the building.

You just must think about this holistically on what you really need to do. Next is horizontal circulation. How do you get around rooms? Do you have enough space within the bathroom to allow people to navigate with a wheelchair? Is there a way to move in and out of a kitchen? Where are the islands? Is the island so close to the sink or to the oven? There's no way if you had a wheelchair, you could actually navigate and work and do what you need to do to be able to cook your own meal. Sometimes, it requires thought about reconfiguring the property. Maybe you need to expand that at the bathroom.

As you can see, pushing out the wall in that upper image and then pushing out the wall around your kitchen to give you that space, but when you do that, you need to think what's in those walls. If you're moving them, is it structural member wall? Is it got some plumbing or lighting? Those are things that you have to consider as you do this work. The fourth challenge is thinking about cabinetry. This is an essential part of universal design. Some things are easy. Maybe sometimes just not having a door makes it easier for people to access it. Sometimes it's designing it, so you don't have under think cabinetry that allows somebody with a wheelchair to be able to pull up and use the sink easily.

Do you have access in this upper photo to see the where they have a drying rack right above the sink, so you can put your dishes there? It can also serve as a one-stop cabinet in a way. You can have easy access to not only drying, but once it's dried, it can just stay there, so you can see glasses and dishes right above. Then there's other techniques. There's a whole industry that makes easy access products for active design and universal design. Then moving on to smoke alarms and CO alarms. It is quite clear from the evidence from fire protection safety experts that smoke alarms save lives. Annually, there are over 2,500 million deaths in US home fires, and the level is twice as high in homes without a working smoke alarm than one with it.

Often, we think well, that just means putting in a smoke alarm. That's just not enough. Smoke alarms have to work to save lives. What they found in a study was that smoke alarms are present in 74 percent of homes and especially low. We know that that number is getting closer to 90 percent these days, but it only founded in 53 percent of the fires, only 71 percent of the time. The leading reason for this was that people were annoyed by batteries. They would take them out. They would decide they needed the battery for their game system, or they were just dead. They had been there for so long that they had died. The fire safety community has figured this out.

Over a decade ago, they figured that the best solution was to actually design the smoke alarm so the battery is in it in its field, so you can't remove it for your video game. It's going to last long enough to blast the same length as the sensor. If you're in a community where you don't have a hardwired smoke alarm requirement, then these are excellent choices, about \$25. They should go into the places where the fire department tells you should be put in around sleeping areas and in hallways and around your kitchen, but they are now being required. I think about 25 percent of states now require this type of alarm for smoke alarms. Now not all fires are the same.

Some are smoldering fires, and some are flaming fires, and there's now two different types of sensors to go off. More commonly, people are dying in these smoldering fires because there's some slow, and we don't recognize them as quickly. Now it's being recommended that we have photoelectric sensors, but really it's better to have both. Now they sell dual sensor smoke alarms. Now this isn't part of the guidelines, but it's really a new best practice and use it with a sealed 10-year smoke year battery, and it's about the similar prices of photoelectric only. That's \$35 a top and finally, we have carbon monoxide, the silent killer. You'll see headlines like this regularly.

People dying and being hospitalized for carbon monoxide. We know from the Hurricane Laura that just came through that in the first week, it was about half of the deaths were caused by smoking carbon monoxide poisoning and not by the storm itself. Nearly 400 people die annually from CO poisoning that's unintentional and not fire related. We know the rifts are from portable generators. This is what we saw in the hurricane. Sometimes from heating sources like furnaces and space heaters. Grills if they're too close to the house can actually blow in and cause problems or gas tools and appliances. The solution is to have carbon monoxide alarms or carbon monoxide detectors and again, we can get them with 10-year batteries built in.

We can purchase them with a digital display, so you can see high peaks in your house to see what's going on, and it offers you an opportunity to have a well-protected home. Now there are dual smoke and CO alarms, but from my read of the evidence, it's better to actually have your CO alarm and your smoke alarm separate. One is that they don't have dual sensor smoke alarms and CO alarm, so you can get that dual sensor smoke alarm, and then also the location is better. Smoke alarms are better on the ceiling. CO alarms are better on your walls. The location works better when you make that right choice get a smoke alarm separate from your CO alarm. I want to thank you for that, and I'm going to turn it back over to Lael to introduce our next panel.

Lael Holton:

Thank you, Jonathan. Yes, I am going to go ahead and transfer over now. Our next presenter is Maureen Mahle. She's a managing director of Sustainable Housing Services at Steven Winter Associates Incorporated, where SWA is a leading research and consulting firm that specializes in energy efficiency and sustainable buildings. Maureen has spent well over a dozen years at SWA encouraging developers, designers, and builders to think holistically and build meticulously. She leans on the skill and recognition that she's developed in certifying over 13,000 green dwelling units in 10 states under the lead for homes and other programs. Maureen works hard to tie human health to energy efficiency and green building.

The projects have been early adopters of active design guidelines, the well-building standard, and Fitwell information. Under her leadership and time at SWA, they are a 5-time recipient of EPA's Indoor airPLUS Leader Award for operating healthy homes, and she herself is a WELL AP and a Fitwell ambassador. We've brought Maureen and team on here in the last couple weeks to try to encourage and increase the

relevancy to the COVID-19 aspect. It was something we realized that the guidelines did not have how to handle pandemics, and so we've brought Maureen and team here to talk about that. Maureen, it's up to you for the next session.

Maureen Mahle:

Excellent. Thank you so much for that introduction. I think you'll find that there's actually a fair amount of overlap in the strategies that we are promoting as a way to control the spread of COVID-19 and the healthy homes guidelines that are all about keeping things safe and dry, but now we have maybe an additional reason to implement some of those measures. We're going to go over just very quickly what we know and this is always changing a bit about how the SARS-CoV-2 virus spreads, and then what are some of the key methods of prevention to address each of those methods of spread.

Large respiratory droplets at close range and person-to-person contact is thought to be the primary form of spread and of course, personal protective equipment like masks and social distancing are the key interventions there, but there's more research coming out about the role that small aerosol droplets play that stay airborne longer. This is where we get into ventilation filtration and cleaning and disinfection as additional interventions. Contact transfer, you hear the term fomite. This has to do with touching a surface that may be contaminated with a viable virus, and then transferring that to your mouth, nose or eyes.

This is where hand hygiene cleaning and disinfection come into play, but also no touch solutions to limit the common surfaces that people might be in contact with. I just want to mention briefly that the virus can move throughout these different phases. A large droplet that falls to the floor is now on a fomite. If somebody shuffles across that, it could turn into an aerosol. This can be a changing field and changing methods of intervention. The guidelines that we've created as a supplement here are divided really into four sections and those are physical protections, social distancing, HVAC systems, and then cleaning and disinfection.

Within each of those four categories of interventions, we have building upgrades so actual changes to the building itself, and then we have operations and maintenance practices, where maybe it's either to implement the effectiveness of an upgrade or if we are not making an upgrade. You'll also see that we've indicated with the icons whether the strategies are most applicable to multi-family, single-family or both, and I'm going to do a little recap at the end of the single family strategies as well. There are not quite as many of those. In the first category of physical protections, the building upgrades that we might be talking about first and foremost, hand hygiene is on everybody's mind.

While we ideally would have hand washing stations in every lobby, more likely we might have hand sanitizers. One of the places that we might not immediately think of that could be useful is outside of a public bathroom, so that if people enter and use a handle, for example, a shared handle, they have the opportunity to perform hand hygiene afterward. Physical barriers like Plexiglas at a lobby, for example, would be another way to maintain distance, and then air sealing. Now air sealing is obviously something that is beneficial for many reasons, energy mitigating the transfer of sound, smells, pests from unit to unit in multi-family buildings or adjacent town homes, for example, but it also helps stop the spread of virus that's aerosolized.

It can also help ventilation systems work more effectively by breaking up stack effect, and then lower no touch solutions for entryways, circulation areas or common areas. Examples here would be things like automatic door openers or potentially switching from maybe a keypad to a key fob to access either

backup house spaces or secure entrances. On the operations and maintenance side of providing physical protection, the first one of course is masks and PPE, and ensuring that workers are wearing those and then asking residents as well if they're in contact with workers during the time that upgrades are going on. When you're wearing a mask, you cannot be understood as easily.

Managing sound interference, turning down the radio is another strategy to consider. Designating space for people to separate clean and exposed personal items can be a very important strategy to keep track of that. Then it's not the most maybe polite topic, but shared bathrooms have been linked to outbreaks of COVID. Facilitating the use of toilet seat lids, either adding them in a public restroom if they were not already there or maybe doing some education around the use of toilet seat lids, so that if you close the lid before you flush, you can avoid introducing aerosols into the air. Then the last topic would be setting up temporary isolation spaces within a household itself.

If there was a member that's infected or perhaps a household member who is in a high-risk occupation or at risk for additional exposure, for example, you might have some temporary separation measures that you wanted to be able to provide or to provide information about how that temporary isolation might be set up, such as closing off common ductwork and providing temporary sources of heating or cooling. Promoting social distancing. Much of this applies to multi-family buildings, but mapping the occupant experience or how workers might be able to move through a building and trying to do so realistically. At this point, we've probably all been in a grocery store trying to follow arrows that just don't make any sense and can't get you from point A to point B.

We might want to think about the usage of additional entries, exits, or stairwells that perhaps were seldom used before. Maybe an egress only door could be turned into an entrance to give people more options and allow people to space themselves out a little bit better. Then the last bullet here really has to do with the health risk of social isolation, which is a real thing and something many people are experiencing during this pandemic. To the extent that in an upgrade we could accommodate outdoor gathering or outdoor recreation spaces, that could be something that would be very beneficial for the occupants.

From an operations and maintenance side of the social distancing, obviously limiting occupancy, making it clear with rules and signage and where people are supposed to be and what we'd like them to adhere to. Having the rules and signage be designed with universal design in mind. Big fonts, right upfront, perhaps even posting any rules or information before people entered a building. The third topic is one that's got a lot of meat in it, and this is addressing heating ventilation and air conditioning systems. From an upgrade perspective, increasing fresh air ventilation is something we could want to do for a lot of reasons, but it's getting a lot of attention now because we believe that this is a successful strategy for dealing with aerosols that might have the SARS-CoV-2 virus in them.

We still want to reference standards ASHRAE, but the more recent standards from 2013 on had about a 30 percent increase in the amount of fresh air that they're looking for. We want to aim for those targets while maintaining normal temperature and humidity, and there's a number of different strategies that are available to do this. I've ranked them perhaps in order of okay to good to best. Exhaust only would be one strategy where you're running kitchen or bath exhaust. Using economizers or fresh air ducts to directly introduce fresh air into a space could be a great strategy, but probably energy or heat recovery ventilation might be regarded as the best because it's not only balanced.

Meaning, you're not introducing negative or positive pressure on homes relative to one another, but you're also able to capture that temperature and humidity from the air that's already been conditioned indoors. We're able to do this a little bit more efficiently and maintain better comfort, as well as introducing the additional fresh air. Exhaust fans in kitchens and bathrooms with where they're missing, certainly we would recommend installing them, but also making repairs and testing for flow rates. It's very common that we're finding exhaust fans are underperforming. Ensuring that they're actually performing well where they exist or making the changes necessary to get them working is a great strategy.

The combination microwave range hood can be a tricky issue. Actually, I apologize as a typo on this slide. We want them to be rated by HVI for performance. Otherwise, we want to avoid them. Then let's talk about filtration or air cleaning. We would like to recommend filters that are capable of removing small particles, and so that means they should be rated MERV 13 or higher or be HEPA rated filters. If you can add those to existing air handlers, wonderful if you already have that structure in place, but be aware that you might be increasing the static pressure and choking off the system, and you might have to increase the filter slot or the return air ductwork size in order to accommodate that.

If that's not an option for you, then there are standalone units and in our resources, we've got a guide on where you can find out more about what you should be looking for in terms of selecting one of those as effective. It's very important to make sure that the filters are installed effectively. We need a tight fit or if the air is bypassing the filter, it's not going to be doing any good. Generally speaking, filters that are deeper and have pleated media are going to last longer and be more effective. Where you can make room for a 4-inch filter, instead of a 1-inch filter, chances are it's going to be working longer and you'll be replacing it less often.

You've probably been hearing about different technologies or chemical solutions to address COVID-19, such as ultraviolet light. UVGI or ultraviolet germicidal radiation is a technology that's been used successfully in buildings for a long time in different ways, primarily to disinfect coils or drain pans or sometimes ductwork itself. I want to use this slide as a caution against using technologies that perhaps are not completely vetted for a given application. There is a lot of uncertainty about the exact light strength and the exposure time that you would need to actually disinfect air. It seems to depend on temperature and humidity and the amount of viable virus, et cetera.

This is probably not necessarily a silver bullet and in addition, there's a lot of air purification strategies historically that have been linked to introducing other pollutants like ozone or free radicals. There are some resources I strongly suggest you utilize before venturing into this area, such as the California Air Resources Board, air cleaners, and ozone generating products information or the ASHRAE position document on filtration and air cleaning. Just to restate, it's not that there isn't potential there. I absolutely think there is, but it might be more difficult than it appears to do it well and to do it properly.

As far as the operations and maintenance of HVAC systems, first and foremost, we want to maintain the normal temperature and humidity settings to the greatest extent possible, while still increasing the fresh air ventilation. Of course, depending on our budget and ability to do upgrades, we might be limited to things utilizing existing fans for circulation, opening windows, et cetera. Changing to filters is a big deal. They will not be working if they are dirty, and we can be doing damage to our equipment if we're not changing them frequently enough. The frequency with which you need to change them depends a lot on occupants behaviors, and whether people have pets and whether people have carpet, and whether they have rugs that shed or not.

It's not necessarily a one-size-fits-all strategy there. Then lastly, just bearing in mind if we did have to set up a temporary isolation space within a home for a family member that is ill, we would need to consider how to do separate heating, cooling, and ventilation on a temporary basis for that space. Cleaning and disinfection. Now at first glance, this looks almost entirely an operations and maintenance item, but I think there are some upgrades that are relevant. Most notably, making design decisions when we're doing upgrades to enhance the cleanability of surfaces, especially at entryways, circulation spaces, et cetera. This means avoiding carpeting, avoiding porous surfaces, and avoiding finishes that have lots of different joints and seams.

This is also very relevant in kitchens and bathrooms. A second point is when we're making product selections, minimizing the use of antimicrobial products and finishes, which I think people are maybe paying a lot of attention to right now as hopeful solutions, but thus far, those are unproven against the virus and not only that, but there is a large body of evidence that the prevalence of things Microban and all kinds of building products is being linked to treatment resistant illnesses. Bacteria, for example, that don't respond to antibiotics any longer, that type of long-term I guess problem that's really growing quite a bit. I suggest avoiding those to the extent that you can, and then of course cleaning and disinfection.

From the operations and maintenance perspective, cleaning means we're removing virus without necessarily killing it. Disinfecting means we're killing it without necessarily removing it. The two together provides a very complete solution, and both the CDC and EPA have protocols and joint requirements. We've got four facilities and they break it down by different facility types. We've got some links in these guidelines to resources there, but the critical thing to remember is that in order for a disinfectant to be effective against the SARS-CoV-2 virus, it needs to be an EPA list in product, and that's a hyperlink there where you can find the list of acceptable products.

You can of course cross-reference that against green cleaning products to find ones that are demonstrated as being a bit healthier and safer for kids and pets and so on as well. Cleaning and disinfecting high touch surfaces or shared spaces at least daily is what's recommended, and depending on your occupancy type, that might increase. Then making sure you've got a strategy if you are known to have an infected person in a building or in a space. Maybe that strategy includes, for example, 24 hours of vacancy before you apply that special cleaning protocol. The last item, this is another bathroom one, is to maintain water and plumbing traps.

I would speak to this in particular in unoccupied units or seldom used plumbing fixtures. Maybe a laundry sink, for example, and the reason is that there have been some evidence that the virus which is found in human fecal matter can be introduced into dwelling units as aerosols if the water has evaporated out of the trap.

The single family approaches just to recap quickly, what we're looking at here is the accommodation of outdoor gathering and recreation, upgrading the fresh air, making sure that we have exhaust fans and testing them to see that they're working effectively, using or adding air filters or air cleaners that are MERV 13 or HEPA rated, making sure that those filters are designed and installed well if they're integrated, avoiding any air purification strategies that are not thoroughly vetted by trusted resources as they could produce harmful old run or free radicals, and choosing cleanable services especially in the bathrooms, the kitchens, and entryways, and minimizing those use of antimicrobial products.

Great. The key takeaways are here is ventilation, filtration, and cleanability along with the list and disinfectants.

Ellen Tohn:

Great. Thanks Maureen. We're getting close to wrapping up, but we've seen one question come in as you've covered a lot, and one of our participants is asking, can you just go back to the UV light, and just you went a little fast for her. Can you scoot back a couple slides and just remind us what it is that you really think you were saying may be useful, but don't rely on this solely right now. We still have a little bit to learn of the extent to which this is working, although we've used this in the past in some of our mechanical systems.

Maureen Mahle:

I think you've summed it up. I think it can be very useful and it's known to be effective when enough light can spend enough time on a given surface. What's less known is whether you can treat moving air effectively, and that has to do with a lot of factors including the air speed, the humidity of the air, the temperature, and so on. That's where it maybe is not yet proven, and it could be very difficult to implement effectively because there are a lot of factors to consider.

Ellen Tohn:

Now don't rush to put that in, work on these other things first around filtration, ventilation, cleanable surfaces, and so on.

Maureen Mahle:

Right now, those more physical interventions, whereas physically filtering with the pleated media is maybe a bit more reliable at this moment in time.

Ellen Tohn:

Okay, great. Thank you very much. One question that came in on the moisture section was on ice damming, which I think Armand answered in the chat, but Armand, one of the participants said, "Hey, you didn't mention ice damming. What..." I'll just phrase it. What is the most likely causes and how do I fix that. You have one minute to answer the very complicated ice damming question.

Armand Magnelli:

Okay, here comes record time. Ice damming's mostly caused by heat escaping from the building at the lower portions of the roof and creating a pre-slow cycle that causes ice to form and then water backs up typically underneath shingles. It's often associated with gutters and downspouts being a problem, and that's mostly because gutters are often damaged by ice dams, but they're much less likely to be the cause. Actually air sealing and insulating the attic especially in that section at the lower edge of the roof is the best strategy and Ellen, you know as much about this as I do. You're being very kind letting me answer the question, but it's actually a great weatherization program tactic to insulate and air seal in that area.

I'll say one last thing about it. Sometimes, it's a challenge because there may be very little space to get back that section of the roof. Access maybe a real issue.

Ellen Tohn:

Okay, thank you. Thank you. One other question that came in that we have time for is Maureen, you mentioned encouraging people to use MERV 13 filter. The Health@Home guidelines currently states as

the best practice of MERVE 8. What are your thoughts on that? I'm happy to have Jonathan chime in as well. I know not all systems can accommodate a 13. If you were starting from scratch, replacing a system, that would be terrific, but in rehab, I think we were concerned that not all mechanical skills could accommodate a 13 without starving the system a little for air.

Maureen Mahle:

I think that's a very valid point. From the virus perspective, we need the additional small size capture of those 2.5 micron sized particles, and that's where a standalone air filter would probably be the appropriate solution if you were looking to try to address that.

Ellen Tohn:

In a rehab, if the system couldn't accommodate a 13, we could provide a portable room air filtration relying on something with a good HEPA filter and a good heater rate like we're just getting enough air moving. Jonathan, do you have other thoughts on this question?

Jonathan Wilson:

Just there's some folks working in Western Pennsylvania. They call themselves ROCIS, R-O-C-I-S, and they've been doing some really great low-cost retrofits on air handlers and the systems to be able to give the size, to be able to put that in and also sometimes these air handler systems are just poorly designed. At the same time, you're making sure the airflow is flowing better and more efficiently. You're also giving it space for the filter, so it's a great resource.

Ellen Tohn:

Well, Jonathan we'll forward that onto Lael, and we'll make sure it's in our follow-up. I'll hand it to you Lael to wrap this up.

Lael Holton:

All right, thank you Ellen, and thank you to the rest of the team, Maureen, Jonathan, Armand, Armand's wife Jane who helps participate and provide more information than I think any of us can really handle in a quick hour and 15 minutes, and Michael, thank you for keeping us all on task and moving forward. We have gone through some questions. At the end here, I just want to wrap up a few things. I know people are getting tight on time, but we want to remind everyone that we do as part of this program have the ability for some on-call technical assistance. We'd like to take a look at some rehab standards and specs that are out there, provide you some recommendations on how you could make them more healthy, or incorporate the guidelines as they've been put together.

The information that Maureen provided today relative to COVID will also be compiled into an addendum for the Health@Home guidelines. We intend to have it on our health home website on the HUD Exchange by the end of this month, but keep an eye out for that as well. The TA requests, we need those in to the energy action at hud.gov email address by September 30th lease in order for us to be able to do this and move forward and get some TA going. I mentioned the Health@Home website. This slide does have some information here. I'm going to pause for a minute or two on it, so you all can take it, but also if you Google Health@Home and HUD Exchange, you'll get the links that show up here.

The first link gives you the connection for registration to the last webinar, as well as if you need to go back and get any information on the previous two webinars that we've had. Then it will also be the website where this information will be put together in a couple weeks. Those of you who have attended all three presentations so far have one more to go. Once you've completed all of them, then in

November, we'll be sending out certificates. If you have missed any of them, you can get credit from that website above, and you can also come back and let us know through the community compass training at aecom.com email, and we can help you get the credit for those, so that you can get the other get the certificate at the end of the program.

One final reminder, October 8, that will be our final webinar in this series, Bringing it Home: Energy Plus Health Equation, also talking about maintenance, and active design, keeping a home thermally controlled and things like that. I'd like to thank you all for sticking with us today. I'd like to thank the presenters once again. We are three minutes over time, but I think it was a fantastic webinar and at this point in time, we are done for the day. Thank you all and have a great day.