Learn About the 'V' in HVAC: Ventilation Basics

with Corbett Lunsford

SPEAKERS
Kendra Seymour, Corbett Lunsford

CL

Corbett Lunsford
00:00
ERV is a better version of an HRV. No one basically should ever get an HRV. I'm just going to say that again, HRVs are less good than ERVs. And I have a whole video about myth busting this, because a lot of people, classically, have thought HRVs are for cold climates. ERVs are for warm climates. Not true.

KS

Kendra Seymour
00:26
Welcome to the HVAC plus D mini class series brought to you by Change the Air Foundation. This series is made possible thanks to the generosity of our sponsor, Santa Fe Dehumidifiers. We are deeply grateful for their support, which helps us continue raising awareness and providing free resources so that more families can breathe safe indoor air. A quick reminder, this 12 part mini class series offers a consumer friendly overview of common HVAC plus D topics. It is not a replacement for professional advice. You can watch the full series on our YouTube channel or by visiting ChangetheAirFoundation.org and clicking on our resources tab. Welcome to episode eight. In this episode, we'll unpack the five factors of ventilation. We'll talk about kitchen and bathroom vents when an ERV might be needed, and how everyday particles and chemicals in your home interact to create a unique indoor chemistry. This introduction to ventilation will help you see why proper ventilation is such a critical piece of healthy indoor air. A bit about our guest. Corbett Lunsford, co hosts the TV show Home Diagnosis, and is the author of Home Performance Diagnostics: The Guide to Advanced Testing. His work investigating and helping clients tune the invisible dynamics of home physics, chemistry and microbiology led him to create hundreds of technical videos for YouTube's Home Performance channel and to build the world's highest performance tiny house on wheels for a US tour in 2016. He's now finishing building a high performance forever home with his family in Atlanta, Georgia.

KS

Kendra Seymour

01:58

Hello everyone, and welcome to part eight of our HVAC mini class series. Today we're diving into the topic of ventilation as it relates to the HVAC system in your home and buildings. Now, when most people think of their HVAC, they think of it in terms of comfort. When I'm hot, I turn on, you know, the air conditioning. When I'm cold, I turn on the heat. But we also need to be thinking of it in terms of our health. So today's episode is designed to help you understand that connection between ventilation and your HVAC system all in this greater pursuit of a healthier home. And I couldn't think of a better person to help us explore this topic than Corbett Lunsford. You are one of my absolute favorite voices when it comes to understanding all things building science and building performance. So thank you so much for being here.

CL

Corbett Lunsford

02:41

That's really nice. Thank you very much.

KS

Kendra Seymour

02:37

Corbett, I know we don't have a ton of time today, so I want you just to kind of jump right in and we'll take it away.

CL

Corbett Lunsford

02:42

Awesome. I can do that. Okay, so ventilation is the V in HVAC, and you can say it HVAC or whatever, but it doesn't. What's really important is that people number one are it's in the name, so you should be thinking about it, but people misunderstand what it is, and the way that I think about it, and I the way that I recommend the most people who are watching this series think about it, and hopefully you are watching this entire series and not just jumping on this because some of the things that I'm going to talk about are embedded in other parts. So you know this list that you all have put together for this class series is awesome, and you have to understand all of them. So I'm going to like refer to filtration, even though it's not in this session, and to dehumidification and design and things like that, but just to make sure that you understand that really, it's this whole series wrapped up into this that I'm going to be kind of getting into, so. So, big picture. What's really fun is that while you'll learn about building science, like, if you start learning about building science, you're learning about physics. I'm going to get to these numbers in a minute, by the way, they're fun. Physics is very interesting for about an hour, and then after that, it gets pretty dry. So I thought about quitting what I do, helping people to science just because it was kind of boring, like it's hard to make like it's hard to make a TV show about physics all the time. And luckily, we were introduced to chemistry and microbiology. And chemistry, just like many people, I almost flunked when I took it in school because I had not a great teacher. And like nothing against school teachers, it's a hard topic to learn, but having things to apply it to. And we're going to get into those in this very quick, you know, lightning flash course through this thing. Microbiology also is really important, and we're learning

more and more about this. Like, in the last, I don't know, 20 years, we've learned about the gut microbiome and that you have one, and that you need to, like, take care of it. It's important that you have gut microbiome. You also, they just discovered you have a brain microbiome, and it gets into your brain through your mouth. So think about what people eat, you know, things like that, all the other holistic things, even outside of this, course, you need to understand so much about life in general in order to be a healthy person. These three numbers are very interesting. They're in the same units. It's not temperature, it's not humidity levels. It is years, 78 years average life expectancy for an American right now, as we record, this. Might be going down, we'll see. 70 of those 78 years you're going to spend indoors. And in fact, if we add vehicles into this, it pops over 90% of your life you spend inside of things. 50 years, of those 70 years you are going to spend inside of your own home. And so understanding how these big basics, the physics, chemistry, microbiology, fit together and affect your health, is super important. So let me say first that you can follow the things that you learn in this, you know, many part series, and apply them to actual homes. What I have done with this tiny house on wheels, which has a solar system that's in this picture. I don't, I decommissioned that because solar is not part of my particular thing. But and our forever home, which you can see under construction, which we've been living in it for five years now, since it's long past being done, is that we've taken these things that I'm going to talk about and the things that other others in the series have talked about, and put them into an actual physical object. This is what the air quality in my house looks like. This is the big house, not the little house, but the little house performs in much the same way. Temperature is basically flat line. This looks like a mountain range, but it's between 74 you know, 73ish and 76ish degrees. So basically you just lock it into that band. There's no real and every room is like that. They are all within one degree of each other within the house. My humidity level is flatlined, seasonally, and it's because we've got the machines that can do that. And you learn from Tim in the last session about dehumidification and how all that should work, and most homes should have a dehumidifier at this point. CO2 is, let me just say it's kind of a red herring often. So if you just start tracking CO2, you're kind of missing the big picture, and like the big picture, we just keep coming back to. So know what the CO2 is, but don't get really focused on it. That being said, My CO2 in my house never goes above, like 800, 900 that is not something for everybody to shoot for. So let's just park that there. Radon super important. And in fact, all sub slab pollution I'm gonna get to this in this session is super low. So I have a shield around my entire house and underneath my house to make sure that nothing can come in, that I don't want to be there. And then also the particles and VOCs are controlled.

CL

Corbett Lunsford

07:20

Okay, so chemistry. Chemistry is the birth of new chemicals that we're not there to begin with. Chemicals are everything. Anybody who says that anything is chemical free, and I have a friend named Corinne who has a great website called My Chemical-Free Home, it's an it's a misnomer, like there's no such thing as chemical free. So everything is chemicals. You have to have chemicals. Some of them are good and some of them are bad. And so you need to be able to assess which ones you want to bring into your home, and then which ones are created, birthed inside of your home. Because that's what chemistry is. And we're gonna like, there's really interesting ways to think about this. Particles always bad. No such thing as good particles. That's why, if you look on the list of carcinogens, to breathe in, sawdust is on the list. Sawdust, totally natural, comes from trees. We like trees, but just anything in the air that gets breathed in is bad, and it's partly because our digestive system developed defense mechanisms over millennia, we have the ability to throw up. We have the ability to shoot things out the other end. We have the ability to sequester things

in the liver. We have all kinds of things can go can happen, but your lungs do not have any defense mechanisms at all. If something goes into your lungs, it will get lodged there, and it might pass through the membrane and go into your bloodstream and become part of your body. And some of these forever chemicals that we worry about never leave because they're not recognized by the trash machines inside of our body as garbage that needs to be taken out, there like, oh I don't know. So we want to be careful about particles, generally, how many and where they go, for sure. And then the third thing is microbes. Microbes are everywhere. On the wall behind me there are millions of creatures alive and doing their business. They have no idea that a class is happening right now. They don't care. They're eating and sleeping and having babies and, you know, giving off byproducts and things like that. And that's fine. Some of them are good and some of them are bad, just like chemicals. And so genocide is not the answer. So when we do antimicrobials and we try to, like, tamp down on this stuff, we are using chemicals to do that, and now we're full circle, and we're back to adding a bunch of chemicals into our house. So the answer to mold is not mold resistant drywall, because what that is is chemical soaked drywall. You might already know if you watch our show that black mold is built into drywall. It comes from the store with black mold built into it. You just have to get it wet. So it's like, kind of in suspension, until it's it's in its happy place, and it's fine, as long as you don't get things wet. It's called dry wall. Keep it dry. Okay?

CL

Corbett Lunsford
09:52
So the three rules that we're going to follow to try and control the chemistry in homes are, number one, don't bring bad stuff home. Ha, ha. That's kind of a joke. You can see this list. This is called the six classes. SixClasses.org, great website. Arlene is a friend of ours who's a mountain climber, who's awesome. She's like, just a total rock star. She came up with this way of talking about chemicals that we don't like in terms of categories, and this is what they are. Basically. I'm not going to go through this right now. You can find more on the YouTube channel and also on her website. You can't help this. We cannot live without plastic in our society. Our society is based on plastic. So we need gas, we need polyurethanes. We need polyethylene. You know, products. We have PVC built into homes. It's like it's it's here to stay. Also, we are bad stuff, and the things we do are also bad to breathe, paradoxically. So the second and third things that are going to help us art ventilate, which is what we're going to talk about how to do in this class, and also to keep it dry, which you talked about with Tim in the last part. Okay, so particle and chemical generators. Is my daughter. This is a face she makes often. She's very intense. I just want to make sure that we know that we are in charge of this. So when you cook inside your home, you are doing bad things to the air in your home. Do we want people to be cooking their homes? Absolutely, you should be. We should not be going out to restaurants every single meal or barbecuing all the time, like weather happens. It's okay. You can cook inside! When we clean, uh oh, or when we vacuum, those are good things, right? Good. But how exactly you do all this very, very important. By the way, cooking you don't get a pass just because you're vegetarian or because you're just like roasting brussels sprouts. Roasting brussels sprouts is actually worse for the air in your home than roasting a turkey. It turns out,

KS

Kendra Seymour
11:41
Well, my children will love that

CL

Corbett Lunsford

11:42

Okay, tell them to eat, eat the veggies is important. But, but they put off the same amount of stuff. Also cooking with gas and cooking with induction, not different. They both create a lot of particles and chemicals. So just because, and this was the thing that happened in the wall, you know, like Washington Post, I think a year ago or two, put out this big thing about how cooking with gas bad. And people like me hate that kind of thing, because it's a you're not seeing the whole picture. You're getting like, a little sound bite, and then you think, oh, if I just replace my gas stove with an induction, I'm good. Absolutely not true. And the scientists who ran that research also would agree, totally not true. The journalist who wrote that article is at fault at that point, because they just took the interesting part and just printed it. That's a problem. So being in homes also, like, you know, skin flakes we emit, we off gas, about a pound of skin flakes a year that goes into our that's particles, and that's bad for you. You could actually get, you know, toxic to breathe your own skin flakes, gross to think about. Also moving around, also puts up a lot of dust from the ground into the air. And, by the way, who spends a lot of time down by the ground, babies, and who breathes more often than adults, babies! You know, so like, thinking about the different types of people that we might be applying this to is also very important. Okay, so redox. This is one of the most beautiful things that I've ever learned about building science. Like I honestly get a little bit choked up when I talk about this. There is a chemical process that we have are all familiar with called a campfire. It's reduction, oxidation. When you look at a fire, what you are seeing is certain chemicals being added and oxygen to and certain others losing that. And it's, it results in heat and light. And it's, it's very cool to look at. It's nice ambiance. Everybody wants a fireplace in their living room for some insane reason. I think a 4k televisions playing one is a lot, you know, it's basically the same thing. The fastest version of that is a rocket taking off or a bolt of lightning. The slowest version of this is literally happening in the air around your face right now. It is not metaphorically or figuratively speaking. This is literally the exact same thing. The air that you are breathing right now is on fire, literally, but it's so slow and the flames are so low temperature that you can't see them, but it is the same exact chemical process that's happening around us. So this is where we want to then immediately start to cross things off the list. You do not want any ozone generators in your home. You do not want any air cleaners that are other than a fan and a filter, which you're going to get to with John in the next session. By the way, all the people that you're hearing present in this series are friends with each other, so like, we're totally, Yay. I'm happy that you're hearing from all the experts on this stuff. Chlorine based cleaners of any kind, unless you have to, if you've been prescribed this because you have some kind of a special immune disorder, cool. But if you don't, don't clean with bleach. Just stop doing it right now. Go get rid of whatever you've got, because it ends up making things like chloroform, for example, and all kinds of chemicals that are just not good. Also super reactive, so makes all kinds of other chemicals that are not obvious ones. Cooking without exhaust, not a good idea. And scented products. So VOCs are tinder basically. So like when you've got chemical reactions, like the air being on fire around us, very, very slow chemical reactivity, chemistry happening in your home. Anything that's going to be a blue light or an ionizer, or any kind of an electronic function on an air cleaner, totally disable it right now! The best way for you to have these air cleaners in your home is that they are unplugged. Then they're a pressure problem, which we learned about in the ductwork section, right but, but they're not hurting your family's health by creating toxic byproducts. So that's important. So the five factors that I go through here and the way that I go through this might help for those of you who have been through all of these sessions and you're like, okay, I just downloaded, like, what is it 11 parts, Kendra?

KS

Kendra Seymour
15:48
12. Yeah.

CL

Corbett Lunsford
15:49
12 parts, okay. Like, how am I supposed to what drawers can I put? I need to build a desk in my head that has like, places for all this stuff that I could reach into later. The five factors, like one of my specialties, because I come from music, obviously, and I did not grow up with this stuff. I was not trained at a trade school. Is I keep coming up with ways to explain this stuff to myself that I understand. So explaining this stuff to myself is how then I turn around and create things like this that help explain it to you. So we've got first factor, circulation. You talked about duct work with AJ in session two. Capture, we're going to talk about right now that spot exhaust, basically bathrooms and kitchen exhaust. Filtration, you're going to talk about that. That is a form of capture. So you're going to talk about that with John in the next session. Humidity control is important to keep it in a range you want it not too dry and not too wet. You talked about dehumidification with Tim in the last part, and that's very important. And by the way, as I go up this list, and I'm gonna teach you how to do this at the end, you have to come back down the list. So when we talk about dehumidification, you want to then think about, how am I going to filter the water that goes into the humidifier, or the the air that's going into that dehumidifier that's come might be coming from outside that he might have hinted at, that is going to be handled today. And then also, how am I going to circulate it? Because if you have all ductless mini splits in your home, you don't have a circulation system built in, how are you going to distribute this dehumidified air? So thinking about those things, as you go up, you get to come back down. Number four is dilution air. And that is the thing that almost everybody's going to think of when they think of the V in HVAC. Is ventilation, means air from outside. This is the problem with that, is that, like, it's actually five things, not just one thing. The last thing is pressure relief. And we are going to get to that a little bit you talked about, I'm sure, a little bit with Chris and Steve in sessions three and four. But this is something that wildly misunderstanding. In fact, it's built into code wrong. It's built into code to create problems for people. They do not realize this. The guys who write code don't understand how pressure testing works, and this is

KS

Kendra Seymour
17:52
Can we just stop there for a minute, because you try not to interrupt my guess, but I'm glad you brought up that about code. I think sometimes people assume that what's written to code equals healthy, and that is not always the case. And so just

CL

Corbett Lunsford
18:06
Super scary. I mean, contractors assume that code officials assume that as well, you know, and like, they don't know what they don't know, and that's the problem. So, yeah, as far as pressure relief goes, just to hit on this we'll to get it later. But like, kitchen, makeup, air, for example, is required once you have more than 400 cfm of kitchen exhaust. That makes no sense. That tiny house right there has a blower door test, which

you talked about the blower door in session four, I think, right of 50 CFM. That means, if I installed a bath fan, one bath fan in that tiny house on wheels that you're seeing in the picture, it would be a blower door. It would be a blower door. It would do a blowers test on my house every single time I did it. That would be a terrible thing to do the house. I would grow mold in that house immediately. And in fact, I know lots of stories of people building tiny houses that then get infested with mold. And the reason they built tiny house in the first place is because they were trying to get away from home problems. They have some kind of you know, sensitivity, and then they're like, I know, I'll just build a little bubble that'll be perfect. A tiny house, we did not build that because we're tiny house people. Tiny houses are way more dangerous than regular houses, because they have everything a house has closer to your face, so it's actually more dangerous. So here's the question, why am I not just doing this? And I need to be able to answer this, and I am about to answer this for you. If you did not think of this question, and now you're like, oh, wait, that is a really good idea. Probably most of you are like, duh, I've been thinking this the whole time. Kendra has been introducing me to these people. I just opened a window. That's all I do. Okay, so here's how this works. We had those three rules, don't bring bad stuff home, ventilate and keep it dry. Passive ventilation, which is opening a window, even if you open two, let's just say you open two and you get a cross breeze, good for you. That's, that's good physics. But number one, it's going to bring bad stuff indoors, sometimes. I live in Atlanta and we have pollen. If you live in Phoenix, you have dust. If you live in the Northwest, you have mist. If you live you know, like, there's all kinds of things outside. If you live in any kind of an Urban area or suburban area, there is smog outside, there is ozone outside. You don't want ozone. We already went over that in your house. It's coming in. So totally unfiltered. And some of you are thinking, oh, I saw an ad on a social media the other day for a window screen that actually is a MERV 11 filter. Absolutely not true. There they are trying to sell you totally insane things. It doesn't work. Second thing is, it's not going to ventilate sometimes, because opening a window depends on stack effect for your ventilation. And hopefully you went over this at some point. Has this been covered Kendra?

KS

Kendra Seymour
20:30
Yeah, it'll be covered. I don't remember which episode, but it is 100% covered.

CL

Corbett Lunsford
20:35
So stack effect is based on temperature differential between inside and outside and the height of the building. And if there's no temperature differential, it doesn't matter how tall your building, there's no air movement if the wind is not blowing. So sometimes you're just not going to get any air movement at all. Sometimes you're going to get way more than you want. At which point your house gets really dry in the wintertime or really humid in the in the summertime. By the way, there's this myth that people think that forced air HVAC systems dry out their house. Not true. Another myth, it's like, has absolutely no basis in reality. And we address this in the television series also, Home Diagnosis. Number three thing is we will not keep your home dry sometimes if we do this, because it rains. So that is why we don't just open windows. Is because if you want control over your home. If you're like this nerdy that you're watching this series right now, you're nerdy enough to not be this window thing is just not going to work for you. Okay, so let's get into exhaust. We have circulation, capture, infiltration. Capture is exhaust. This is factor two. So we're just skipping over the circulation, because AJ covered that in the ductwork section. There's only two

tools that you have to work with. You have fan power, which you can see over Grace, my lovely bride. And then you've got geometry. And the geometry here on the right, you can see the kitchen in our tiny house. We have shoved this kitchen exhaust hood, which is only a 300 cfm model by the way, that's six blower door tests worth in that house, up into the corner. So we've used geometry to try and limit the amount of options that air has to be able to go in there. So now we've created not just a back trap, which is definitely something you want to do in a kitchen. Have your kitchen cooktop up against a wall, at least, so that then we the air has to go back into the wall. And now you're using it as a trap to push it up and out with the air that's coming in at the cooktop. If you're going to do an island cooktop, by the way, you're just like, I'm sorry, but there's no possible way to do this. And that's not just me. This is, I've asked a bunch of mechanical engineers this, and they all agree that, like, yeah, you can't really do that well. So if you have an island cooktop, this is just not going to work very well, but geometry can be your friend. For example, I have a cat litter box not and I'm not going to get choked up, but our two, the second of our two cats, just died last week, and so I don't have a litter box anymore in my house, but I but you could walk into my house, in through the front door, and walk by the litter box, and you have to in order to come into my home, and you would never smell the litter box, because we had five CFM drawn out of that litter box as an as a capture and exhaust fan. And you would and it was just enough, because we limited the geometry to like a little cat sized door, that air always went in, never came back out. This is kind of that elegant thing. Another enemy of this geometry problem is open concept showers. If you're gonna have a glassless shower, number one, if you've ever showered in one they're freezing cold. Number two, in order to make that work, we have to have a giant exhaust fan, which makes it even colder in there than it would otherwise be, because you're trying to make sure that the steam doesn't come out, billowing out all over the bathroom and get your your mirror steamy. Okay, so the kitchen exhausted in general. Here's what you want to follow. This is the one in our forever home. You can see it's not shoved up at the corner, because we could do that here, because it's a ton, you know, it's like you could do whatever you want. In this case, it's a real house. You want to make sure that it looks like a nice way as well. So you have to get clearance from your bride with everything you're going to do. We have what you can see here is a kitchen hood liner. This is just a metal box. There's no fan in there. First thing that we did is put the fan outside because you want the fan to be quiet. The main reason people do not use these is because they are loud as hell. Let's not do that. It's totally unnecessary. Ours is so quiet. In fact, with the fan being outside with the silencer in place right here, which is what you can see. This little bell thing that starts it's a 30 inch long silencer, which some people have never even heard of, and then it just goes right outside, up through the wall there that we will forget that it is on overnight. I will walk out and say, why does this room feel a little weird? And it'll be like, oh, oops, we left the fan on all night because I can't even tell that it's on. So that's how quiet it can be. Overhang is the cooktop. On all sides, it's wider and as deep as the cooktop, that's very important. And you can see what it looks like finished over here, by the way. It grabs all the fumes. You can easily demonstrate this if you turn on your cooktop, exhaust fan, you take a candle, and you light it, let it burn for a few seconds, blow it out. You get a little trail of smoke. Trace the edge of your cooktop at that point, and if all the smoke gets drawn up into the hood, you're good. I bet you $100 it doesn't. And you know, if you're thinking about like, oh, I want a microwave fan of some kind, those just won't work. So the microwave thing just is not going to work for you as well. Again, if you're a nerdy enough, you need an actual hood that's going to do it. You're building basically an upside down bathtub, because the cooking fumes aren't going straight up. They're kind of gathering air from the room. And it's getting bigger. If you can imagine, like a spray head, shower head in your living room. It's not, you can't put a bucket that's exactly the same size underneath it. You got to get a bigger one that's going to catch all the like little droplets that are going out to the sides. And you wanna size it about 100 cfm per 10,000 BTUs. By the way, if you're using an

electrical induction, you do Watts times 3.41 and it'll give you the same that'll give you the BTUs. So generally, looking at, like, you know, for a 40,000 BTU cooktop, you're looking at 400 cfm, and that's what we have. Bathroom exhaust. Here's my lovely daughter. There is my toilet exhaust. What in the kitchen or in the shower, excuse me, there is my shower exhaust in a shower. I'm gonna get back to this, because this is really fun little nerd out moment. But this is the correct place to put a shower exhaust 100% of the time, in the shower. You are using geometry at that point. And this is my open concept problem. There is glass in the shower, like we this was during construction that we took this picture. So the glass prohibits everything but two feet of airflow at the top, so air moves into the shower, not out. This is 25 CFM, what we're drawing out of the shower up here. And that's it, 25 CFM that never shuts off. What code requires, which again, code like, should we? But code requires 20. So they they're perfectly fine with this, and in fact, they're fine with less than what I've got, in the case of this toilet, what I have kind of thought about in the tiny house, we had this composting toilet. This got an exhaust fan that pulls air down into it. So even when you're sitting there doing your business, you can't smell what's going on in the toilet. I thought that was so cool. So what we decided to do was try and build that same thing into the house, even though we're using toilets. So what you do is the air is going to come in underneath the door and then go straight for the exhaust fan. So if you put the exhaust fan back here where it's going to get it's going to sweep by the toilet without then letting the odors go up my clothes and soak into my skin and my hair, and then when I come out of the bathroom. Of course, everybody knows I was in the bathroom because I smell like a bathroom. This solves that, as long as you close the doors, which my children don't always close the door when they use the bathroom. But that's fine, like everybody learns. So put them where the pollutants are created. So you take advantage of that geometry thing. This is the international mechanical code requirement, you either have a 50 CFM bath fan, or you do this thing, that five CFM litter box thing is my own invention, and you have either an intermittent, big one, like a 50 CFM bath fan, you turn on and off. By the way, 50 CFM is more than enough for almost everybody. So don't try to, don't think that, like, 50 CFM is for plebes and 100 cfm is for, like, fancy stuff. It's not true. 50 CFM where it belongs much better think of any hotel that you've by the way, I've got a series on YouTube on hotel testing. I know hotels are hilarious because, like, you think about how many engineers were on those projects. So this is the best way to design a bathroom. If you have the choice, put the toilet between the door and the exhaust fan, which is in the shower, and then you get a two for one, the air sweeps in under the door, goes past the toilet and to outside. Done.

CL

Corbett Lunsford

28:36

Okay, this is also important to talk about. So we're leaving bathrooms and kitchens. Now we're getting into radon. This is a map from the EPA that is from 1993 it makes no sense anymore, because nobody was building as airtight back then as we are building now. So don't believe this, this map. And also don't believe statewide ones that you're going to get in your own state, because those are generally homeowner generated, homeowner reported. Do people really want to know? And if you do report it, then you have to disclose it when you sell the home remember. So generally, like, just take care of radon. And I'm going to include sub slab pollution in this category too, because even if you live in a place that doesn't actually have radon, which there are some places where you can actually monitor 24/7, like I do in my home, and you can know, without a radon system at all, there's no radon on the house, and I've got a super airtight house, and that's good that that is the test. But if a train derails half a mile away from your house, or a factory explodes, and both of those things have happened within miles of my home in Atlanta, then that pollution can go into the ground and go across and then evaporate, volatilize. That's what voc stands for,

volatile organic compounds. They prefer to be in the air in gas phase, so it can go under your house, turn into a gas and then come up through the cracks in your slab. And if you don't have this system, you're not worried about radon at that point. You're worried about these other whatever it is that they spilled and Like. So, you know, oversight and quality control being what they are into these regulatory climates. Just think about that. Okay, so you want to look for, by the way, an NRPP certified Pro, when you're going to look for somebody who can do radon mitigation, which also serves for this sub slab mitigation. By the way, this video over here is how you prove that a radon system is actually going to do its job before you install it? All right? So we're skipping over we did circulation is duct work. Capture, we just covered. Humidity control was with Tim. Now we're going to dilution air, which is factor four. So you've got a couple different ways to do this. You can just have exhaust, so you're pulling air out of the house. Stale air out of the house all the time. And the stale list air in the house is, consider this in the kitchen or in the bathrooms. So we might use a kitchen exhaust hood or a bath exhaust for this function, just to pull air out of the house. And then, because one CFM in equals one CFM out, which we've already gone over, probably in the testing portion, you're going to have air come into the house to as a result, you can just supply air, just push air into the house all the time or on a regular basis, to try and flush out the stale air by chasing it with with fresh air, fresh air from outside. Again, trained you are on this and whatever. Or you could do a balance, which is a version of like combining those two things. That's generally really hard to do. We're not going to get into that in this session. There's, lastly, the kind that I have, and most people who are building very airtight homes are going to have, which is balanced with an energy recovery core of some kind. This is what I call an equalizing ventilator, which we'll get into in a minute. So exhaust only, again, you're going to try and use the places where you're you've got this stuff going on, it is going to result in your home being a negative pressure zone. So you will then, if you do have a radon problem, and this is how you choose to ventilate your home, you're going to increase the amount of radon in your home as a result. Also, if you've got humidity problems, you're gonna be increasing the humidity problems in the home, because you're sucking on all parts of the house. So that stuff comes in. Again, you're you've placed them where they're important. You have to be quiet. In this case, you can't use some builder grade new tone fan. And I love Broan the other side of that, but like, there's manufacturers make all kinds of different things. And you, again, the devil's in the details with almost everything that we're talking about in this entire series. So the switch needs to have a label. It needs to be able to be switched off, which sometimes is a problem. Like, builders might have built this into your home that you're living in right now, and you might not know, because, like, they just didn't label it. Like they have to put this in code because, like, we have to say this stuff out loud, because it's not obvious necessarily. So you might have accidentally shut off the thing that was like supplying your house with fresh air. Supply ventilation is going to have its own little kind of quirks, and I've got a video about this. This is a video of testing supply and kind of how a unit like this would be configured. This over here is called a ventilating dehumidifier. Did you go over this with Tim Kendra?

KS

Kendra Seymour
32:59
Yeah

CL

Corbett Lunsford

32:59

Yeah, Tim. So Tim's got this kind of a system in house. I have one of these, but mine, that is mine in my crawl space, which my crawl space is one of my favorite rooms in my house. No bugs down there or anything like that. It's beautiful. Mine I don't use at all. So you can have it and then just not use it. You're going to create a slight positive pressure in your house. Some people think, oh, I'll just pressurize my house, and then I'll have to worry about pollution from anywhere, even under the slab. Actually pressurizing a house to more than, like, one pascal, which you can barely feel, is almost impossible in most people's cases. So, like, don't try to that's not something that's realistic for most people. And then it's going to be the simplest and the most inexpensive version of this. Also it's not gonna it won't pressurize your home as much as an exhaust fan would depressurize it, because one of the things that most people's homes are gonna have is Backdraft dampers in all of the back the bathrooms. So as soon as you pressurize the house, all those things push open. And so it's much harder to pressurize a home than to depressurize it generally. Intake vents, if you're gonna do this supply thing, you wanna make sure that it's 10 feet away from any contaminant sources, like a dryer. By the way, vented dryers can be a major depressurization source as well. You want to make sure that it's up out of the snow and also out of bugs. Mine, this is mine, and these get a lot of mosquitoes in there. So if I was going to do it again, I might try to find a way to put them up 10 feet off the ground, that would be nice. And then I like to put them someplace where you're going to see them on a regular basis. So you know, if there's like a wasp nest or a bird nest, or some like a dead possum or something, and I'm gonna spend a week cleaning my house thinking there's a dead possum somewhere in my house, and it's like, oh, it's just underneath the intake outside. Equalizing ventilators are this is something that is very useful if you end up with a tight enough house to warrant this. So this is only really for people who have a tight enough house that you can't use bath fans anymore. I call them equalizing ventilators because you've got two kinds. ERV, HRV. What they are doing is taking the same amount of air out of the house, stale air out. And fresh air in. So they're taking equal air flows in and out, trying to equalize the pressure in the home, with reference to outside and on the way, it's brushing those two air streams up against each other and trying to make them equal temperature and humidity. That's basically what it does an ERV does the humidity side. ERV is a better version of an HRV. No one, basically should ever get an HRV. I'm just going to say that again, HRVs are less good than ERVs. And I have a whole video about myth busting this, because a lot of people, classically, have thought HRV cold climates, ERVs are for warm climates. Not true, and so we won't get into it, but it's that's important to understand. You have to do this if you're in an airtight home. If you don't have to do this, it's kind of a pain in the butt, because I have to go into my crawlspace and change. I have to open up that door, change the filters, inspect the core, maybe clean it out with a vacuum. I'm going to have to make, you know, make sure that there's not condensation, make sure at some point to clean the vent. Your other alternative to this is bath fans, and we're using this as the bath fan exhaust at that point. So there are no bath fans in my house. There's only this thing that's pulling out of all of those spots. And I mentioned 25 CFM out of the shower, 15 CFM out of the toilets. Bath fans are easy to get. You can buy a really good one for 150 bucks. You can get them at the big box store down the street. If yours goes bad, you can go replace it today. No filters, no maintenance. Anybody can install it like, what's not to like? So I will say this is not a lot of people think, oh, I want ventilation. I love my family, I want the best IQ possible. What's the best thing I can buy? And then they're gonna go down this rant, and then they're gonna find the most expensive version of this thing, and then they're gonna be like, you they're gonna be like, is this what I need? And in general, no, it's not, but, but it's hard thinking through the systems, and it's worth it. Generally, the hard thing and the right

thing are the same thing, right? So you're going to add an extra half duct system to this house, generally, because we're using this thing to exhaust from the bathrooms. Here are the targets. So just take a look at this. Find where you are generally. This is not with the blower door reduction built in. And generally, you do want to do that, because over ventilating has some consequences. So if you ventilate too little, which is where you're probably at. If you're watching this and you're like, Ah, I want to take care of making my home healthier, you have contaminant and humidity problems as a result, if you ventilate too much, now we have conditioning waste, so we have to re condition and re humidify, or dehumidify and re filter the air that comes in from outside. And also we might end up with humidity problems like, for example, in a home that's got an HRV installed instead of an ERV, you're going to have twice as much humidity problems as with an ERV. And even if you install an ERV, which is what I'm recommending, you're going to have more problems with humidity than if you didn't have one at all. You'll have less contaminant problems, but you'll have a lot more humidity problems. So like this is where that interplay between these different parts of this series are becomes really important. This is a calculator that you can use that's a lot easier than just trying to find this. This is like a big, round, blobby number that has a bunch of fat built into it. This is going to give you the actual answer. This is free for everyone to use. This from the Department of Energy. So there's the website for it, and we'll probably like, I use this on the YouTube channel a ton. So you'll find it. If you're looking for it. You can build in the infiltration credit. So if you have had a blow order test on your home, and if you have not, you should, because it's the most important test you could possibly do on a home. And you can also now add a filtration credit. So if you're going to do what John is going to recommend in the next part, then you can also credit yourself for that. And now we can just give your home the amount of fresh air that it needs. So now we've gone through the dilution air portion, what we need to do is go back down. How is that dilution air gonna affect my humidity control? Am I going to increase the need for dehumidification? Yes, if I start introducing more fresh air into my home, 100% yes. If I did not size for that and I just used like, I went onto the website and the manufacturer said, Oh, this dehumidifier is for 2000 square feet, and my house is 2000 square feet. And I'm like, Yeah, that's great. That's exactly for me. And we didn't look at your climate data. We didn't look at your, you know, any of the stuff that's that might be the absolutely the wrong choice. So think about that also, is it going to get drier in the wintertime? Yes, in Atlanta, I was on the verge of installing a steam humidifier. Tell you that I've got one. I have a nice steam humidifier in my crawlspace right now. For the last two years, and I've just been like, Please don't make me install this thing. I've been hoping that climate change is going to, like, make it go away.

CL

Corbett Lunsford
39:32
Well, the only silver lining I can think of, but anyway, it's humidification. It can be kind of dangerous, so you want to be careful about that. How is it going to affect my filtration? And then how am I going to circulate this dilution air? And if I again, if I do not have a duct work, which is where we started this whole conversation, at the beginning of the series, then how am I going to get this stuff around? You kind of have to have ducts. So duct free and ductless is like not. It's not everything it's cracked up to be. Last thing is pressure relief, makeup air. So this is a fifth factor. Some people do not have to worry about this. If your house is leaky enough, you don't have to worry about this. Combustion air is often something you do not have to worry about. Code will require that a room like this have some kind of a makeup error, and most people think that means a duct that goes to the attic or goes to outside, and that's not true. So I can test this, and I've got videos on our channel about that, with all these things firing, and see what they're doing

to this room as they work. And you can find out like, oh, this room is fine. It's got plenty of air in here for these things to use. We're not depressurizing at all. There's no risk of these backdrafting. So at that point, then you can know for a fact, and in general you want to know. So testing is super important. You can't really skip the testing passive makeup. Okay, passive makeup is opening a hole to outside, just like we were talking about in that mechanical room. In this mechanical room, if we punched a hole to outside and these things fired on the room will be a negative pressure period. You can't avoid that because airflow, if you could see my hand, is a barrier with a pressure differential across it, and there's a hole in the barrier. That is what airflow is. You have to have all three of those things. If we don't have, I guess a weather system could count as no barrier in place, right? There's a pressure differential. But if you were to actually equalize the pressure between inside and outside, there is no airflow, therefore there's no makeup air. So that's like kind of a you can't make that happen. So when you use this approach, and you can see down here underneath our stove, here's the exhaust fan in the tiny house as it's being built. This is the makeup air. This is an eight inch round duct that opens up when we activate the exhaust fan. In that case, I'm going to still leave my house slightly negative, and how negative I leave it depends entirely on what equipment I've got in my house, what I'm worried about, backdrafting, particularly if I have a atmospheric draft water heater or a fireplace in this house, I cannot use this technique period, because both of those are going to become an additional makeup. Air pathway, the chimney for this exhaust fan, because it's not able to pull all of what it needs through this, this hole to outside.

KS

Kendra Seymour

42:13

And then you start getting into like carbon monoxide and things like this creates other issues. And so this is and then we're one of those things that can like that, unattended consequences that you're not thinking about. So it's worth

CL

Corbett Lunsford

42:25

Exactly, yep. Okay. So what we do generally is, I tell people, like, here's how many holes to outside you would need to try and make this work. And it ends up being an insane amount, like, in this case, this house with this blow order test 567, cubic feet per minute at 50 Pascals with a 300 cfm exhaust fan. And this is not the tiny house, by the way. This is like a house that's relatively airtight and relatively compact, which I think is a smart thing, is going to depressurize this whole house. That 300 cfm exhaust fan depressurize the house to almost half a blow order test, 19 Pascals. That's way too much. You can't really do that. You're going to start growing mold in weird places and things like that down the line. So that's generally not recommended. We can come over here and say, Okay, if we're going to try and relieve that, here's what we need, four eight inch round holes to outside to open up all at the same time. And by the way, when they're not open, the only thing that's protecting the inside from the outside at that point is an eight inch round disc of metal, totally uninsulated. Is it dripping wet on one side of the other in all seasons? Yes, 100% is it gonna rust out in a couple of years? Yep, it is. It's gross. So we probably are not gonna do that. And that's when we then get into an active makeup or system, which looks like this. So active makeup areas, we have another fan. We have a fan that moves air out, we have a fan that moves air in, and they can work together. So this what you see here is the brain of this system. There's only a few of these that are really available. You can see them on our YouTube channel. But here's the fan, here's a filter, here's the damper that opens

up that lets the air come in that is activated by the brain up here. This is the silencer. This is that duct silencer that I also have built into the kitchen hood. And here's a heater, and that heater is to keep not just my bride's feet warm, but also to make sure that we don't blow 400 cfm of 30 degree air across building materials. Because if you blew that kind of air at that volume across drywall, it will crack the drywall. It'll shrink so fast, it'll snap all of its seams, and you'll see cracks in your drywall just from it changing shape so rapidly. We heard little gunshots of our floor separating the seams with the finish. So anyway, this kind of thing, it's important to have that kind of a heating element thought into it. Your three rules generally are, don't blow this makeup air on people. That's a comfort thing. Don't blow it on surfaces. That's a condensation thing. Because if it's 90 degrees outside and it's raining and I bring that air inside, it's going to get stuff wet. So in my case, I broke two of these three rules. The one that I did keep is keep the circuit as short as possible, so the makeup air comes in right under here and comes up and captures this stuff you. Can see that I had to take out a bunch of these little toe kicks across the kitchen to make sure that it was slow enough, because I don't want this makeup air to come in and beam across the kitchen and then make a huge circuit to the back wall and come back. I wanted to come in be less than 300 feet per minute, and then make its way directly at the thing. So the idea is this makeup air only spends a few seconds inside the house. The reason that we were able to break these first two rules is that my wife is very forgiving. And also we have a complete plywood cabinetry that is finished on both sides. So in the underside of this we've got finished floor going all the way back to the wall that is finished. And then we've got underside of plywood cabinetry also finished with polyurethane. And so if there is any condensation in there, there's no way for it to get things wet and keep them wet. So then again, you move back down the list. Think about how this pressure relief, this makeup air, is going to interact with our dilution air, how it's going to interact with our humidity control, our filtration and our circulation. So that's basically the whole enchilada. And of course, obviously you need to get into all the other parts of this. So thanks very much Kendra.

KS

Kendra Seymour

46:02

Yeah, no, that was wonderful. And there are so many components. When we think of ventilation, and I think you're right, the people listening to this mini class series are ones who are steal your phrase, and I love it, nerding out a little bit more, and we're thinking about every time we do something to our home, it can create an impact or a domino effect on something else. And so, you know, just to give people like context for part of the reason why I wanted to do this series is I had to switch out my HVAC system not long ago. And for as much as I know about the inspection and remediation side, the HVAC area is still one that I feel very much a novice, like many of our listeners, and I thought I did everything right, and we switched it out. And of course, it's because the system went out during the heat wave in Virginia. So we're under the gun a little bit. And all of a sudden, after years and years and years of never having a humidity problem, all of a sudden in our home, we're having a humidity problem. And I'm like, the temperature says it's 73 degrees. Like, why are the doors sticking? Why do I feel like, like, this is, you know, my body is sticky. And really it was not understanding that the home is a system. And every time we we make a choice, it influences something else. And so I guess my question when it comes to ventilation, because that's something I've personally been oh, by the way, I have solved that dehumidification problem. Talk about that in an earlier episode, but it took some detective work and finding the right people. But when somebody's thinking about maybe they're in a newer home, and they suspect, all right, I know I'm probably in a tighter home. Like, what is their first step? Is it to get a blower door test and just see, hey, what's going on? What's the air exchange in my home? What do you recommend for where do people start

CL

Corbett Lunsford

47:41

Thinking about medical analogies is super important. So when you walk into a doctor, if you were like, hey, my tummy hurts. I need you to take out my appendix, please, any good doctor should be like, why don't you just be quiet for a minute and sit down and we're going to take a bunch of measurements. We're going to take your pulse, your blood pressure, and your weight and your you know, etc, your pulse ox maybe. We're going to ask you a bunch of questions about your diet and your exercise and you like, how you're feeling and things like that. And then you could tell me what you want to tell me, but like I don't, I need to get a baseline of what your body is actually doing. Same exact thing with houses. Do not do any surgery on your house until you know what the house is actually doing that's that so important to understand?

KS

Kendra Seymour

48:24

Yeah, so don't just buy an ERV and put it in and think, all right, I did. I took care of that, check, because it's, it's not that simple. And so, and I think this is where I've it's really fascinating to see people like yourself and so many of our speakers on the series who are really understanding building science and high performance homes. Who should somebody call first, in your opinion, not to put you on the spot, but if they want, like the the most qualified or knowledgeable person about it? Is it the HVAC company that they found online on Google? Or how do we, how do they connect with someone who is thinking about the home in this way.

CL

Corbett Lunsford

49:01

This is, I'm looking at my list of presenters on this thing, and this is gonna give me a lot of trouble. Did you ask everybody this question?

KS

Kendra Seymour

49:08

No, I'm just asking you, because it's like the natural thing that I think people want to know is okay, have this information, but who do I I have to help me find it? AJ, is going to talk about it a little bit, but in your in your opinion, in your advice.

CL

Corbett Lunsford

49:22

Yeah, so on this list, I'm one of the only people on this list who's not an HVAC contractor. So I'm gonna say, and I'm gonna get in trouble for it. HVAC contractor is generally not the right person to go to. That being said, I do have a list on this website that is on the for the TV show of scientific HVAC pros. They these are science. You know, HVAC installers who believe in science and math, and they have to say, hell yeah, I believe in math. I believe in science. I know that people with higher performance homes have lower loads

and da da da. So I would trust those people on that list more than like a typical and all the people who are on your presenter list are on that list. But in general, I would say somebody who has no incentive to sell you something is a useful thing to have. That has always been my personal business model. I will say that most of my clients would probably rather once I give them the information like, oh, here's what you need to do, they mostly go, well, can I just hire you to do it? Because I honestly don't care about your independence now that I trust you. So I'd say to that end, if you can find somebody who is, comes recommended from someone you know, not an online source, because it's so easy to fake all that stuff. But if you can, if you have a way to get in touch with them, and honestly, that's one of the reasons I'm on YouTube, is because people can get to know me, and they, in almost all cases, they're like, I feel like we're friends already because I've watched like hours of you know, you talking about things. So that this is how I make that rapport with people. If you can spend a few minutes on the phone with them and be like, hey, I've been told to ask for static pressure testing on my HVAC. And they're like, oh my God, thank you for calling us because we wish that everybody would be like you and ask for it. You know, in general, if somebody starts fawning over you for having done your research on your own online, that is the right person. If they say, oh, God, you did a Google search and now you're like, you're going to tell me how to do my job. Or somebody said, what did they they said, do you take your your own steak to the restaurant. If anybody says that to you, it's going to be a man first of all, secondly, just don't that's not the person you want to work with generally. No offense to the guy who said that to me, but I was like, but he said it's me. And I'm like, okay, I can play this. Yeah. So, so I'd say, like, open somebody who's open minded, who's going to be patient and who explains stuff, who takes time to explain things in a way that you understand. There are those people out there. They are not often the best business owners, so they're not gonna have a great website. So you can't really grade people by that. If you go by website quality, then it's like you're gonna end up with the person who's got the biggest marketing budget.

KS

Kendra Seymour
51:56
Yeah, and we're gonna talk about that, and I will say the reason why I love all of the people on this series is these people that we've chosen to put in front of our community really go above and beyond, like they get into the science, they get into health. They eat, breathe and sleep this. They go to conferences, they nerd out with one another. And I love that because they're changing the conversation. That's why I love what you and your wife do so much as well. So much as well. So what we're going to do is we're going to link to your list, because I've used that list before, if that's okay, and along with your website and resources, so people don't have to hunt too much, but all of this is a great place to start. Corbett, thank you so much for your time today.

CL

Corbett Lunsford
52:34
It was a pleasure. Kendra, thank you very much.

KS

Kendra Seymour

52:36

And if you found this episode helpful, do me a favor, hit like follow, so that you don't miss upcoming episodes. Also, you can head on over to ChangetheAirFoundation.org, and sign up for our newsletter, because every week we're sending great information and tips and resources directly for you, homeowner and renter. So I want you to check that out. Thank you so much. We'll see you next time.