

Healthy Air In Every Home We Build

Ventilation, Humidity Control and Air Filtration

Joseph Hillenmeyer: Senior Channel Marketing Manager & Chris Howells: Senior Product Manager

Vision and Mission

Our Vision

Healthy air
in every home.



- We create, design, build, and educate on seamless and affordable solutions for healthy air.
- Our products and systems manage air purity, humidity, temperature, and fresh air supply for all types of homes in all locations and environments.
- This is both a responsibility and a market opportunity that will grow along with the health, social, and environmental benefits of making homes more livable.



Our Mission

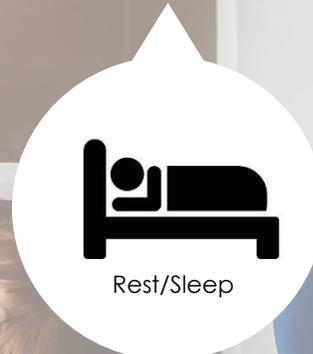
To enhance people's
health by improving the
air in their homes.

AprilAire



Healthier Decisions

Families make many decisions throughout the day in an effort to be healthier.



The environment *around* our body is as important as what we put into it...

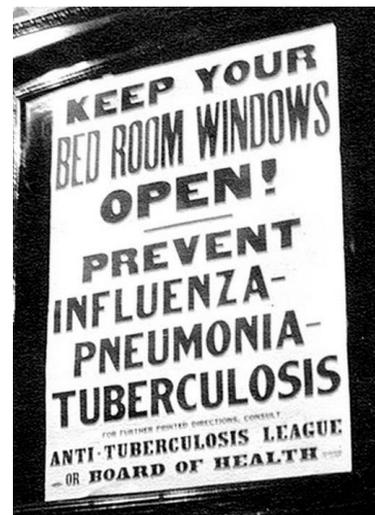
we spend
93%
of our time
indoors

This also builds our human defense against germs, viruses and unhealthy air.

Our homes should be a healthy haven – and IAQ is an integral component.

Doesn't this sound familiar

The H1N1 “Spanish flu” outbreak of 1918–1919 was the most devastating pandemic on record, killing between 50 million and 100 million people. Records from an “open-air” hospital in Boston, Massachusetts, suggest that some patients and staff were spared the worst of the outbreak. A combination of fresh air, sunlight, scrupulous standards of hygiene, and reusable face masks appears to have substantially reduced deaths among some patients and infections among medical staff.



The curative effects of fresh air were investigated at length by the physiologist Sir Leonard Hill (1866–1952) in the years following World War I. The apparent success in reducing the number of infections and deaths reported at this open-air hospital may simply have been caused by patients and staff experiencing levels of natural ventilation far higher than in a conventional hospital ward.

Much more fresh air may be needed than is currently specified for hospitals, schools, offices, homes, and isolation rooms.^{42–44}

Given a Choice



Which glass of water would you give to your family?

Water & Air Quality

A bottle of water at Costco is \$0.25.
The same bottle in the supermarket is worth about \$0.50.
The same bottle in a bar costs \$2.
In a good restaurant or hotel it can be worth up to \$3.
At an airport or on the plane, you may be charged \$5.

The bottle and the brand is the same, the only thing that changes is the place. Each place gives a different value to the same product.

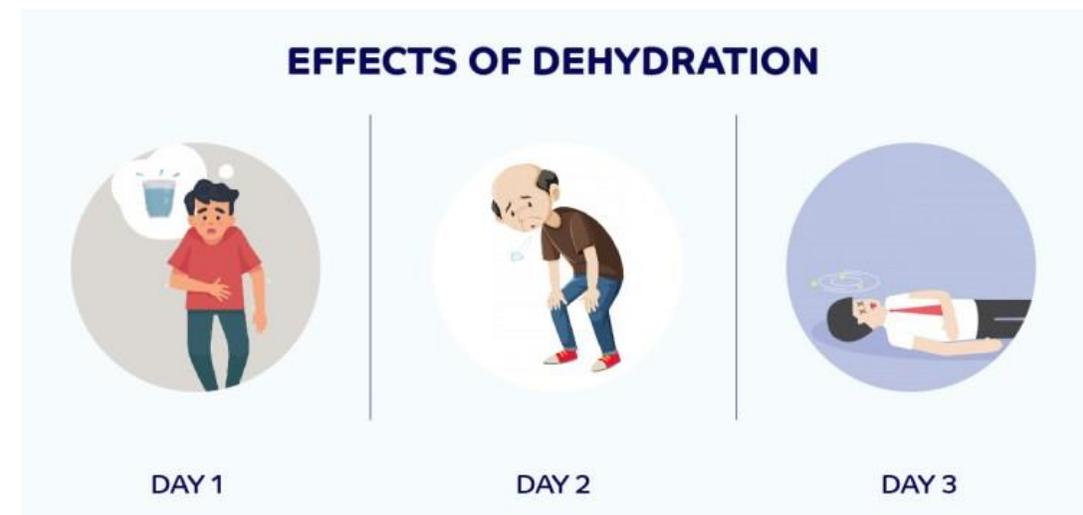
Have the courage to change places and go to a place where you are given the value you deserve. Surround yourself with people who really appreciate your worth. Don't settle for less.



Americans consumed 15 billion gallons of bottled water in 2020, up 4.2 percent from 2019 (compared with 3.7 percent increase the previous year). That means, on average, each American drank 45.2 gallons of bottled water in 2020, a 3.5 percent increase over the previous year. In addition, bottled water's retail dollar sales grew in 2020, up 4.7 percent, reaching \$36.3 billion, BMC data show.

<https://www.bevindustry.com/>

How long
can you go
without
water?



How long can you go without air?



Facts....



5X More Polluted

The air inside your home can be 5x more polluted than the air outside. That's because homes are being built tighter, making it hard for your home to inhale and exhale.

79-70-50

The average person lives to be 79 years old. Of those 79 years, 70 of them are spent indoors. Of those 70 years indoors, 50 of them are spent in your own home. Breathe healthy air in your own home.

30M Pollutants

Just one cubic foot of air can have more than 30 million air pollutants including dust, mold spores, allergens, and more. These irritants can trigger asthma and allergy symptoms.

Why do we need IAQ solutions in a home today?



Innovation Standards

- Energy Efficiency
- Consumer Concerns
- Healthy Home Standards

Tighter Construction

- Less natural air changes
- Better controlled environment

Code Requirements

- RESNET
- ASHRAE Standards
- IBC, IRC
- Energy Star

What is IAQ to you?

Humidifiers

ERV's

Dust/Dirt

Bi-Polar Ionization

Photocatalytic
Oxidation



Dehumidifiers

Viruses

Filters

Allergies

Mold/Mildew
"Microbial
Growth"

UV Lights

Dry Air

It boils down to one statement

- ASHRAE gets right to the heart of the discussion and states, in no uncertain terms, that the best solution is

Providing Fresh Air Ventilation
High-Efficient Filtration
Controlling The Humidity

- And VENTILATION alone as being the best single prong solution right now.



Primary infectious disease
control strategy

ASHRAE/ CDC 2005 Page 13 Report

Creating Healthier Homes is NOT one product



Humidity Control



High Efficient Filtration



Fresh Air Ventilation

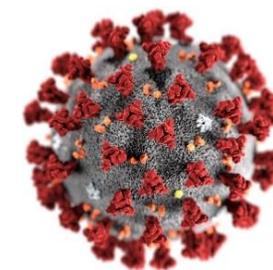
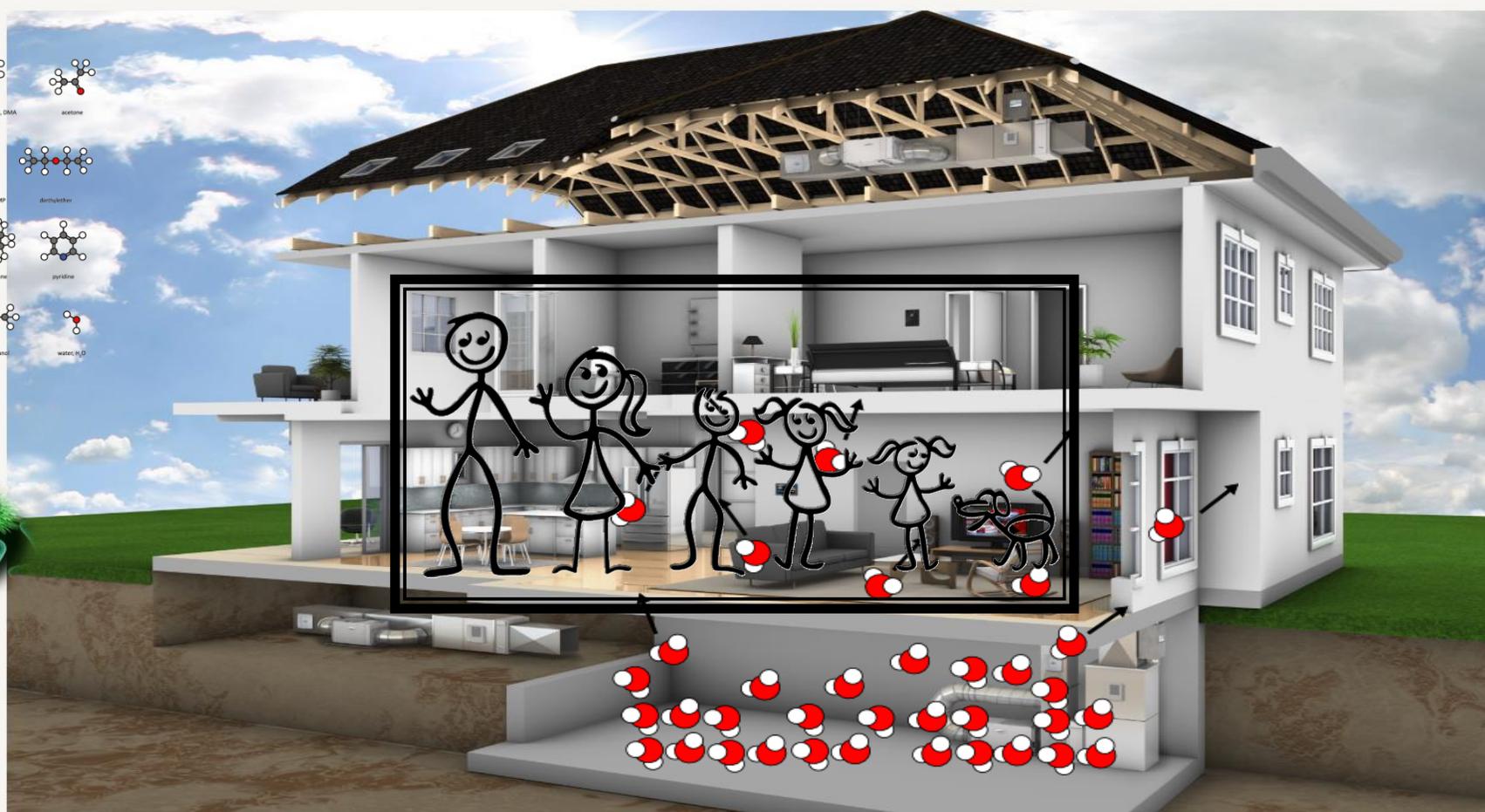
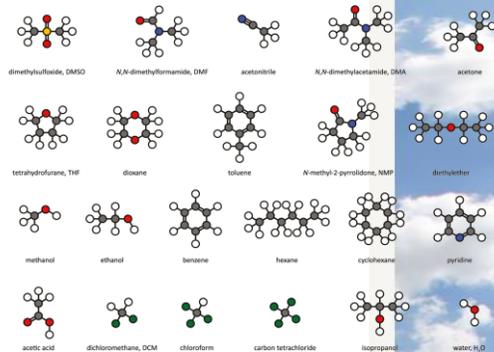
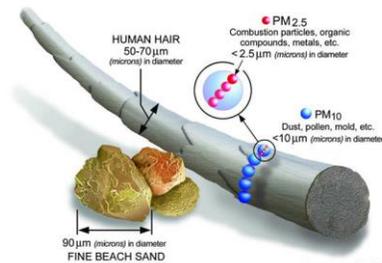


Aprilaire®

HEALTHY AIR SYSTEM™

WHOLE HOME

The environment of a home



Radon Gas

Self Inflicted Unhealthy Air

SOURCES OF VOC

- Furniture
- Cosmetics
- Laminates
- Detergents
- Fabric softeners
- Air fresheners
- Plastics
- Carpets
- Dyes




Aroma Chemistry

THE AROMA OF FRYING BACON

150

Approximate number of volatile organic compounds detected in the analysis of fried bacon's aroma. They were mainly hydrocarbons, aldehydes, ketones and alcohols. Nitrogen-containing compounds such as pyridines & pyrazines, and oxygen-containing furans were also present. Not all of them necessarily contribute to the aroma, but some are significant.

When heated, sugars in bacon react with amino acids. These reactions are known collectively as the **Maillard Reaction**. This, along with the **thermal breakdown of fats**, leads to the production of the compounds that cause cooking bacon's aroma.

SUGAR (GLUCOSE) + AMINO GROUP →

React to form a number of products, which can themselves react further to form many different compounds, impacting flavour and aroma.

VOLATILE COMPOUNDS FROM BACON

Approximate percentages of volatile compounds given off by fried bacon. Other organic compounds account for the remaining percent. Only a selection of these compounds contribute to the aroma.

HYDROCARBONS	15%
ALDEHYDES	31%
ALCOHOLS	10%
KETONES	10%
N-CONTAINING AROMATICS	2.1%
O-CONTAINING AROMATICS	1.3%

NITROGEN-CONTAINING COMPOUNDS

Nitrogen containing aromatic compounds such as pyridines & pyrazines have a differing odour independently, but their presence in combination with other compounds is likely to be a major contributor to the characteristic odour of bacon.

2,5-DIMETHYLPYRAZINE 2-ETHYL-3,5-DIMETHYLPYRAZINE

OTHER COMPOUNDS

Compounds such as furans and pyridines, which have already been isolated as causing meaty aromas in other meats, are also present in bacon, and also contribute to its smell.

2-PENTYLFURAN

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Source	Characteristic sources
Gas stoves	Natural gas, biomass burning
Gas furnaces	Vehicle emissions, biomass burning
Gas water heaters	Plants, VOC oxidation
Gas dryers	Liquefied petroleum gas, natural gas
Gas fireplaces	Industrial emissions, vehicle emissions, biomass burning
Gas heaters	Vehicle emissions, liquefied petroleum gas
Gas boilers	Plants, biofuel
Gas furnaces	Vehicle emissions, gasoline evaporation
Gas water heaters	Solvents, vehicle emissions
Gas dryers	Vehicle emissions
Gas fireplaces	VOC oxidation, biomass burning
Gas heaters	Plants



Controlling Humidity



HEALTHY
HUMIDITY™

Humidification & Dehumidification

Why do homes “dry out” in the winter

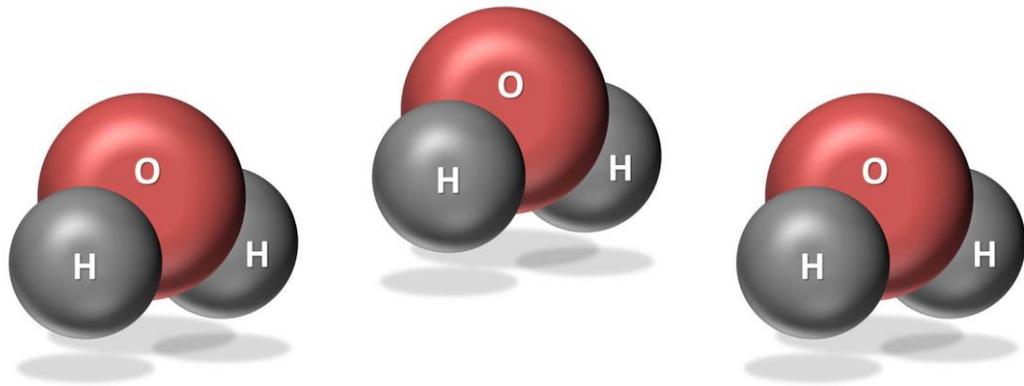
HIGH → **LOW**

Warm Air migrates to Cold Air

Humid Air migrates to Dry Air

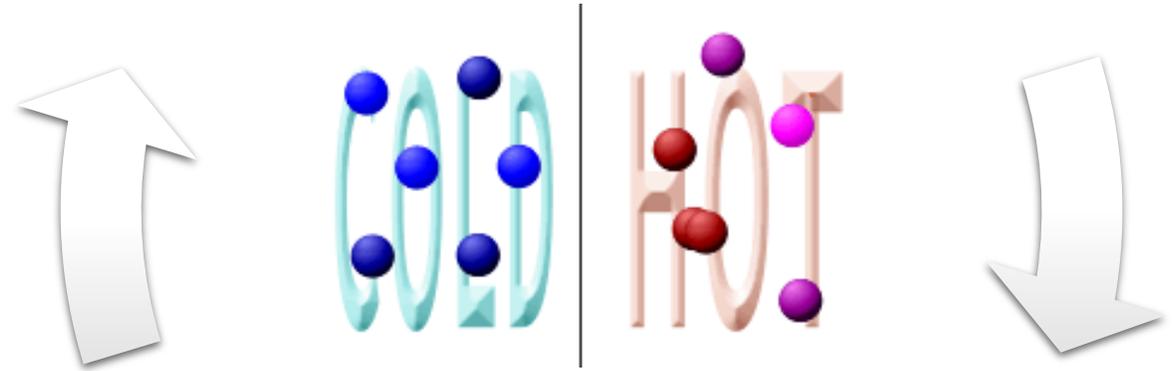
Humid Air is Lighter Than Dry Air

High Pressure to Low Pressure



HEAT

AIR MOLECULES MOVE FASTER



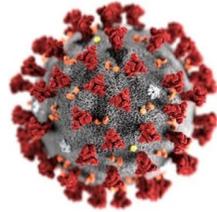
LESS AIR PRESSURE

MOVE APART, BECOME FEWER & WEIGH LESS

Humidity Impact



- Human immune system is compromised when below 20% RH
- Dry, Itchy Skin
- Nose bleeds
- Poor sleeping, snoring
- Reduce pet dander
- Slow the spread of colds, flus and viruses

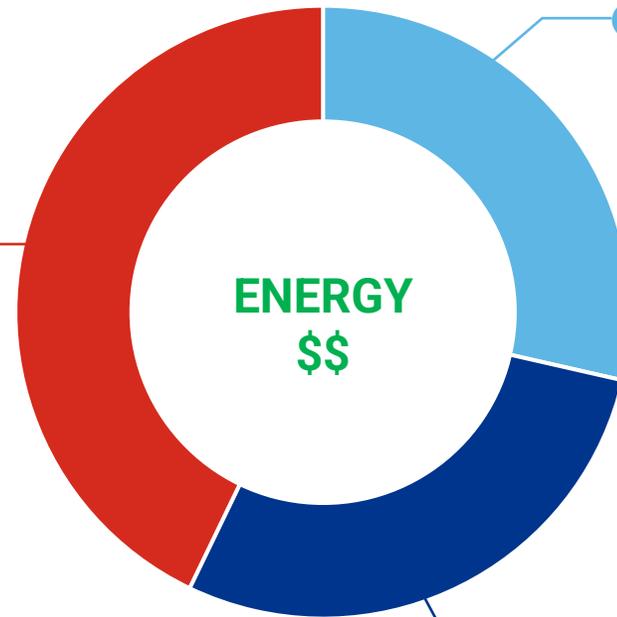


Health Impact



- Cracking, shrinking of wood within the home
- Expanding, warping of wood within the home
- Microbial Growth

Preservation Impact



Comfort Impact

- Feel hot or cold based on the humidity relative to the temperature



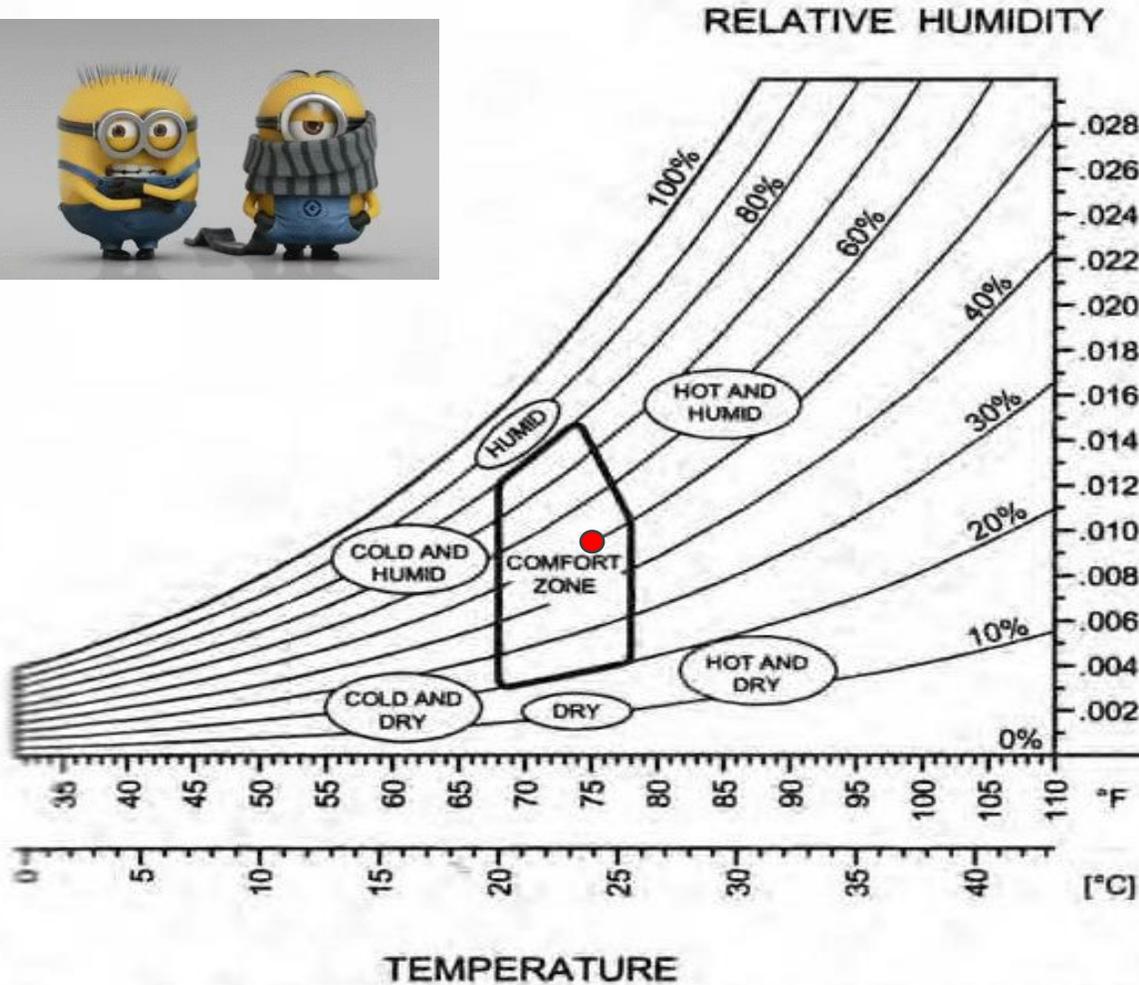
OTHER CONSIDERATIONS

- Eliminate static shock
- Reduce that sticky, damp feeling
- Reduce musty smells
- Plant life and fish tanks



- Feel warmer at a cooler temperature (Add Moisture)
- Feel cooler at a warmer temperature (Remove Moisture)

Psychrometrics in Human Comfort



ASHRAE Comfort Window Says:

67° & 80% Rh

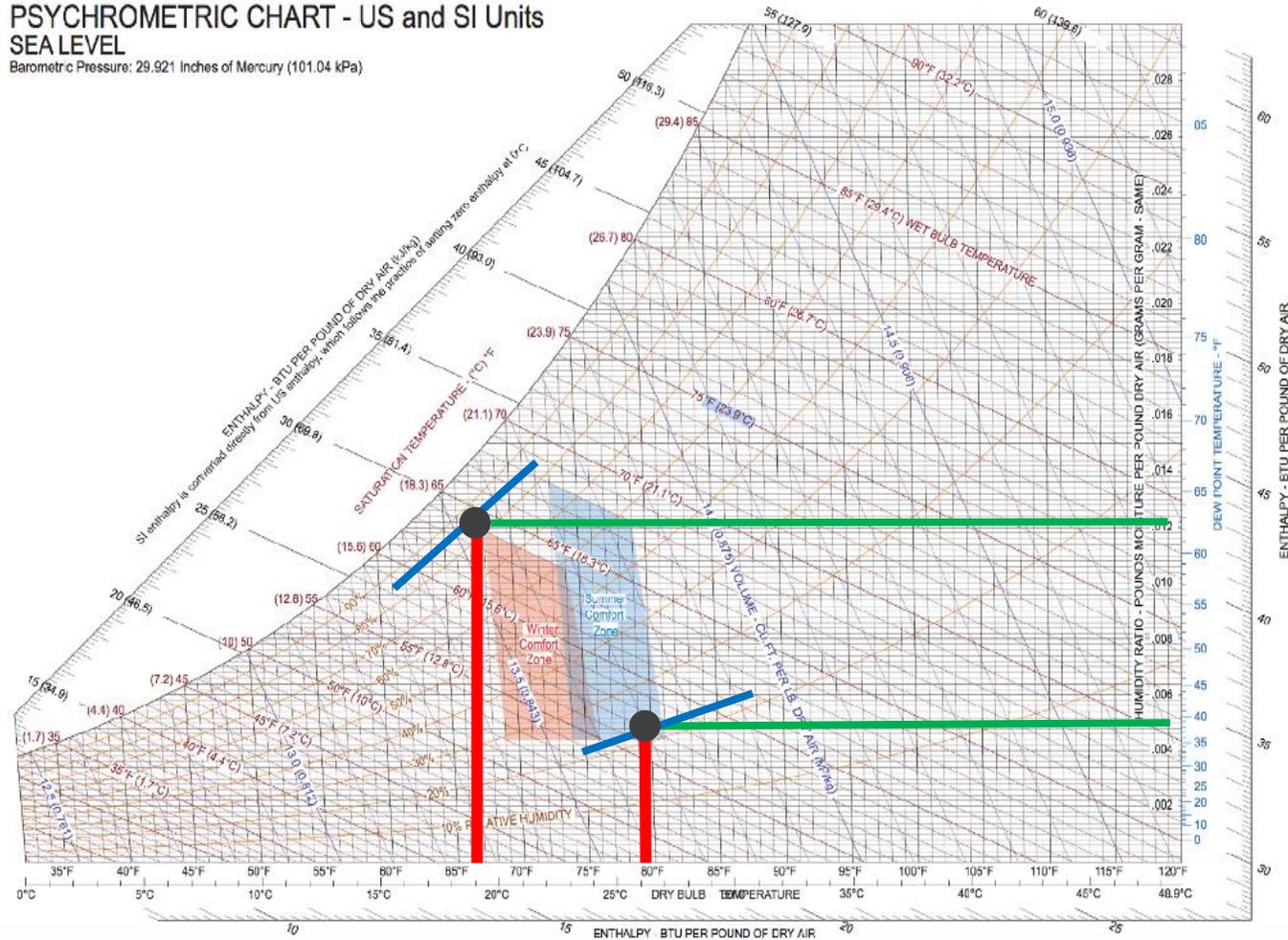
Feels Similar To The Human Skin As

78° & 20% Rh

Psychrometrics: The bigger picture

PSYCHROMETRIC CHART - US and SI Units
SEA LEVEL

Barometric Pressure: 29.921 Inches of Mercury (101.04 kPa)



Relative Humidity :

“The percentage of moisture in the air, as compared to the amount of moisture which the air can hold relative to the temperature of the air”

Temperature & Humidity

Humidity Ratio:

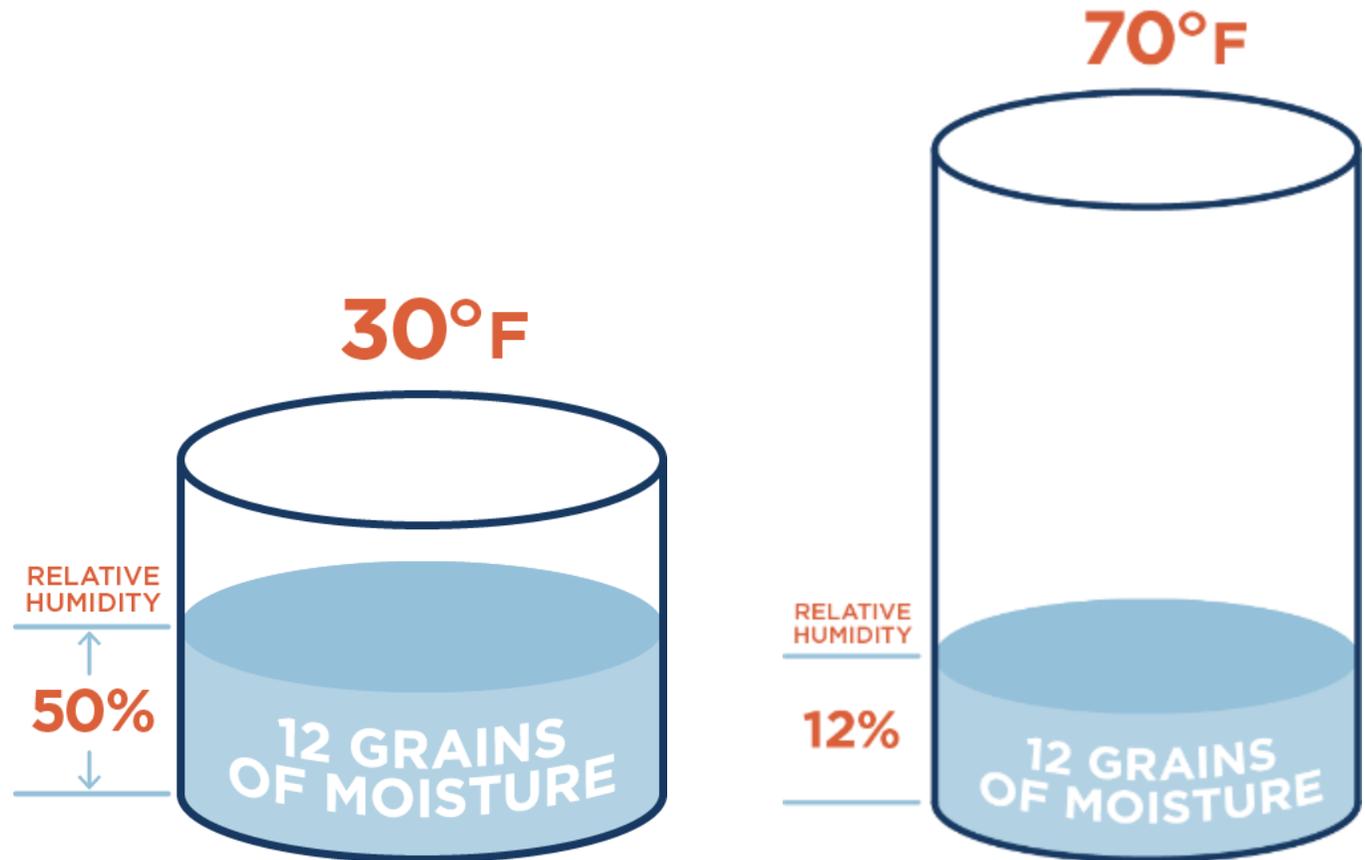
Grains of moisture per pound of dry air.

To bring balance to your home, you must humidify.

Wet Heat, Dry Heat, Hydronic, Radiant, Mini-Split, Oil, Gas, Wood burning...

It's all the same physics, if you take a temperature and increase it, you increase the amount of water it can hold. If you don't physically increase the water, you lower your RH%

All Source Information Generated From Thermodynamic Properties Of Moist Air, Compiled From The ASHRAE Handbook Of Fundamentals, Bulletin 400

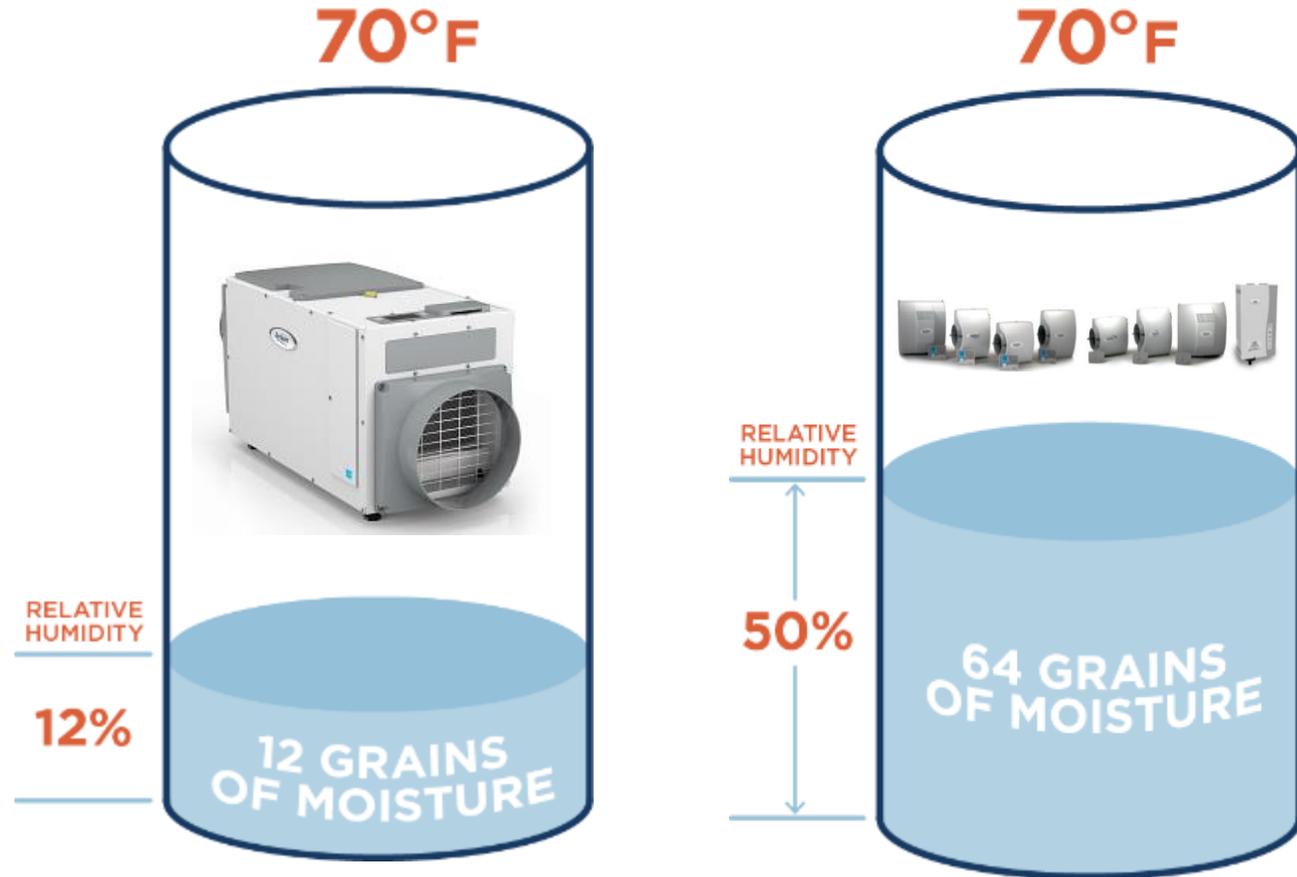


Temperature & Humidity

It's All About Temperature & Relative Humidity

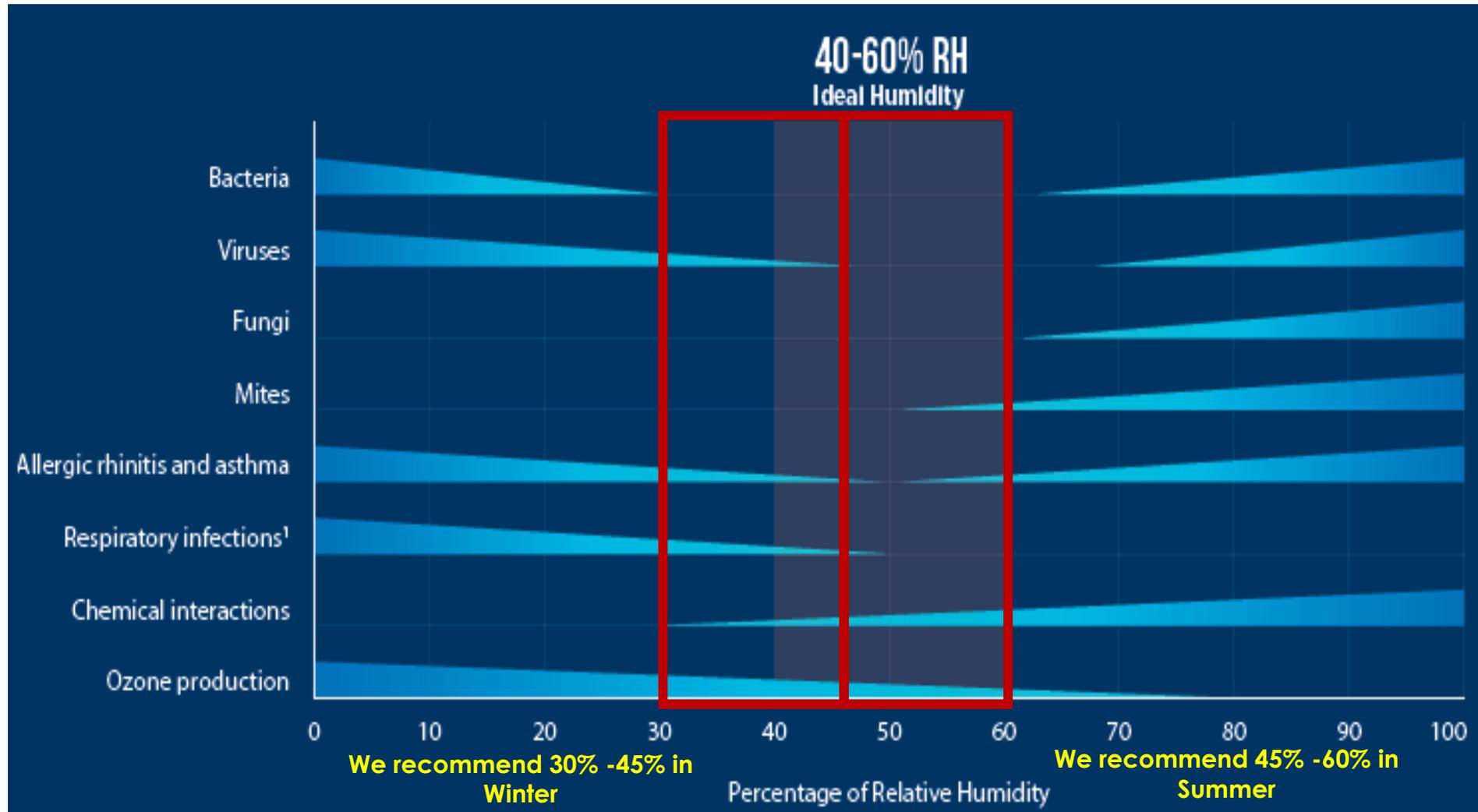
Only by adding water to the air, can you bring your home into the perfect balance of comfort and protection.

This is what an Aprilaire humidifier does for you.



Humidity & Health

Proper humidity levels are dependent on the season, the outside temperature, and also are a compromise between comfort, health, energy use and protection of the home's construction itself.



Virus Transmission

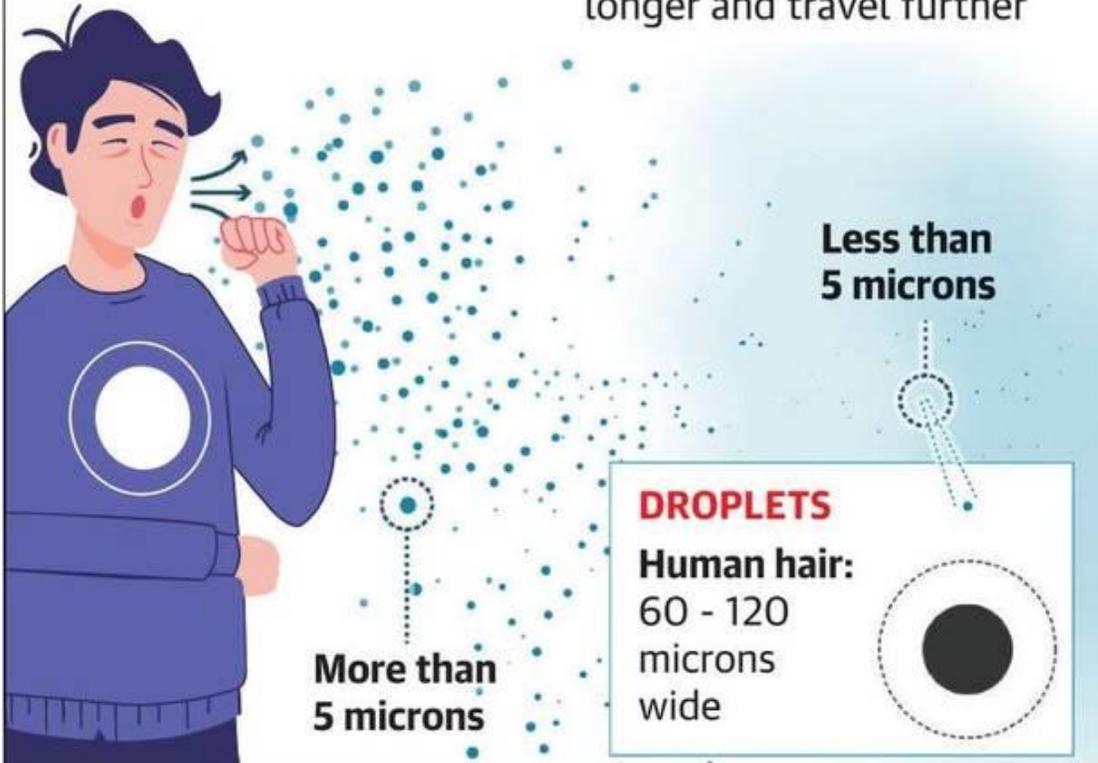
Key difference in transmission

DROPLET

Coughs and sneezes can spread droplets of saliva and mucus

AIRBORNE

Tiny particles, possibly produced by talking, are suspended in the air for longer and travel further



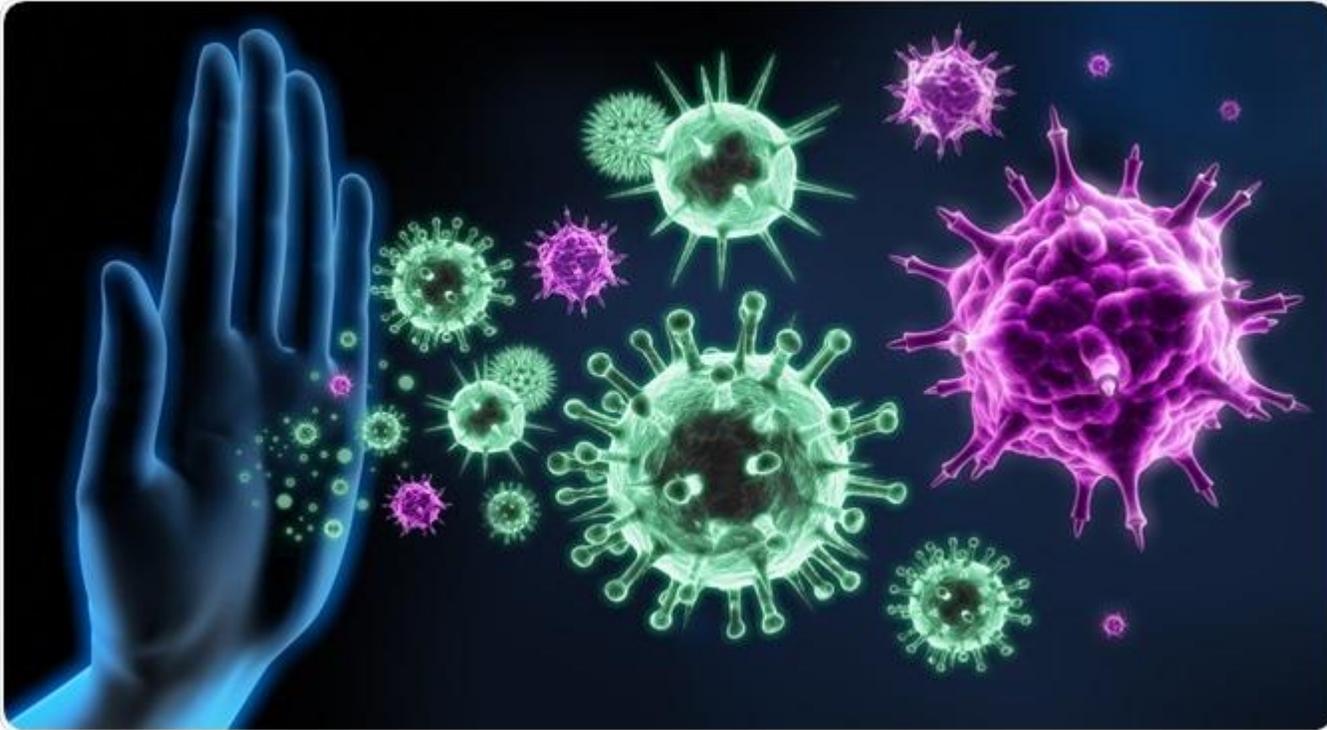
SOURCE: WORLD HEALTH ORGANIZATION

Virus droplets instantly shrink when exposed to dry air. At that point the infectious virus can stay in the air much longer. With the virus now airborne longer it can travel causing possible infection to others.



With proper relative humidity levels in a home, if a virus is exposed, it does not shrink in size when exposed to the air and can quickly fall to the ground. At this point the virus has a very low transmission rate.

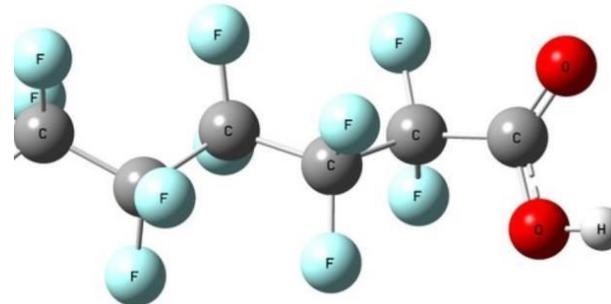
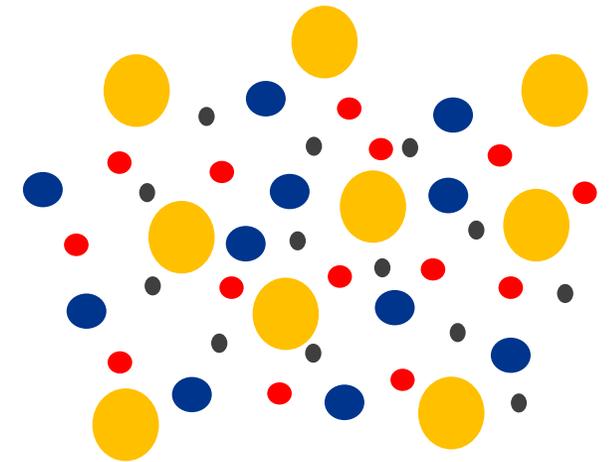
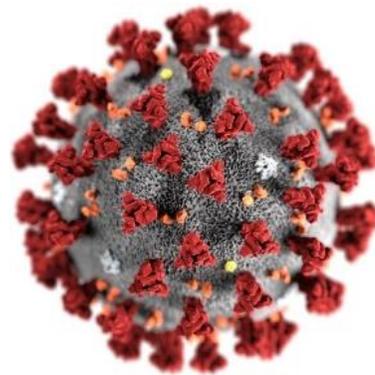
Human & Humidity Defense Against Unhealthy Air



A **Healthy Lifestyle** can boost the immune system but the **air around us** is just as important.

- In just 15 minutes of exposure to dry air, our cells begin to breakdown and show signs of weakness.
- 8 hours of exposure to an environment of 20% RH or less is considered clinically dehydrated
- 50% RH is the best Relative Humidity for your immune system
- 20% RH is when your immune system is now impaired

When could we be most susceptible to unhealthy air?



“When cold outdoor air with little moisture is heated indoors, the air’s relative humidity drops to about 20%. This dry air provides a clear pathway for airborne viruses, such as COVID-19.”

- Prof. & Dr. Akiko Iwasaki (Immunologist) – Yale, School of Medicine



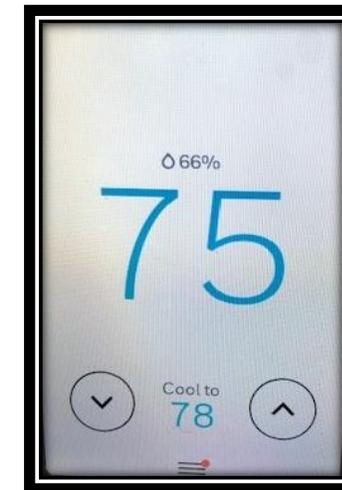
Indoor RH Recommendations



Recommended Indoor Humidity Levels

Outdoor Temp (°F)	Recommended Humidity
+40	45%
+30	40%
+20	35%
+10	30%
0	25%

Great partner
to your
Central A/C
System



63° Dew Point

75° & 50% RH =
55° Dew Point

Recommendation:

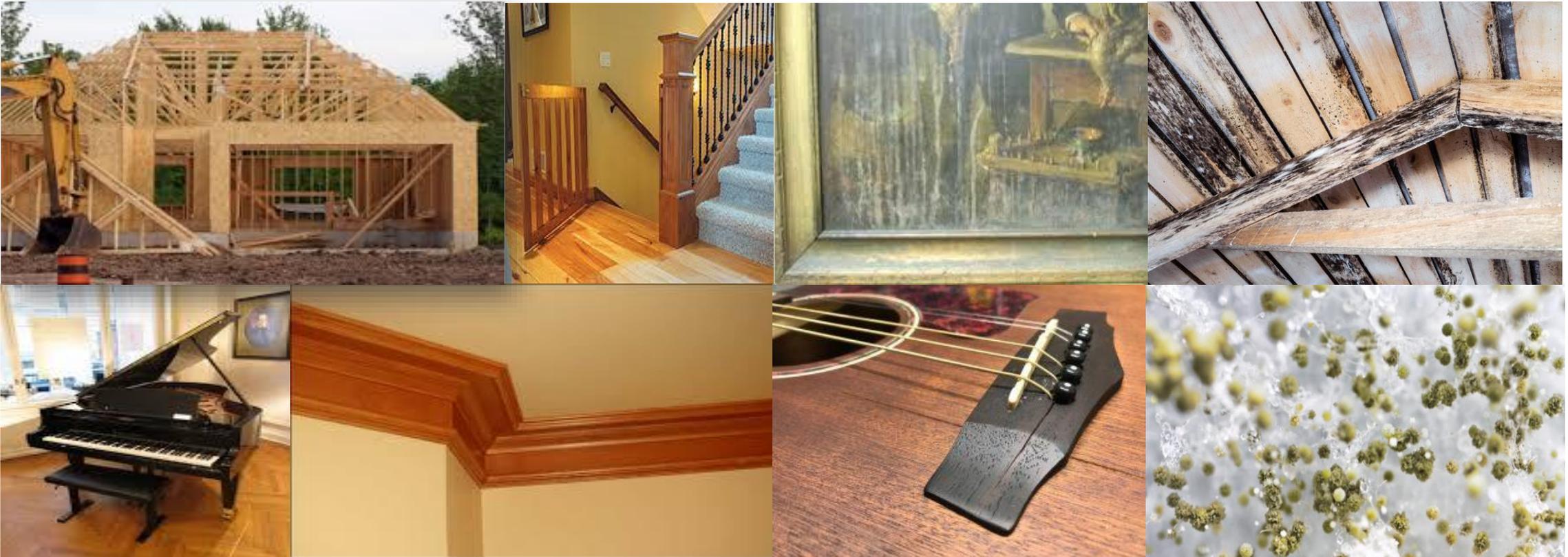
45-55% RH

*Must Consider Dry Bulb
Temperature

Moisture Impact on a Home

One cubic foot of wood holds
@(1 pound) or (1 pint) of water at
60% RH

- Expansion/Contraction
- Weight of home increases/decreases
- Musical Instrument become out of tune or damaged
- Damaged Artwork
- Microbial Growth
- Wood Damage or Rot



Details to consider in today's RNC

Tight Envelope

Energy Savings
Builder Standards
Code Requirements



Less Equipment Run Time

Lower Loads
Limited in IAQ Control
Stagnant Air Potential
Lingering Odors

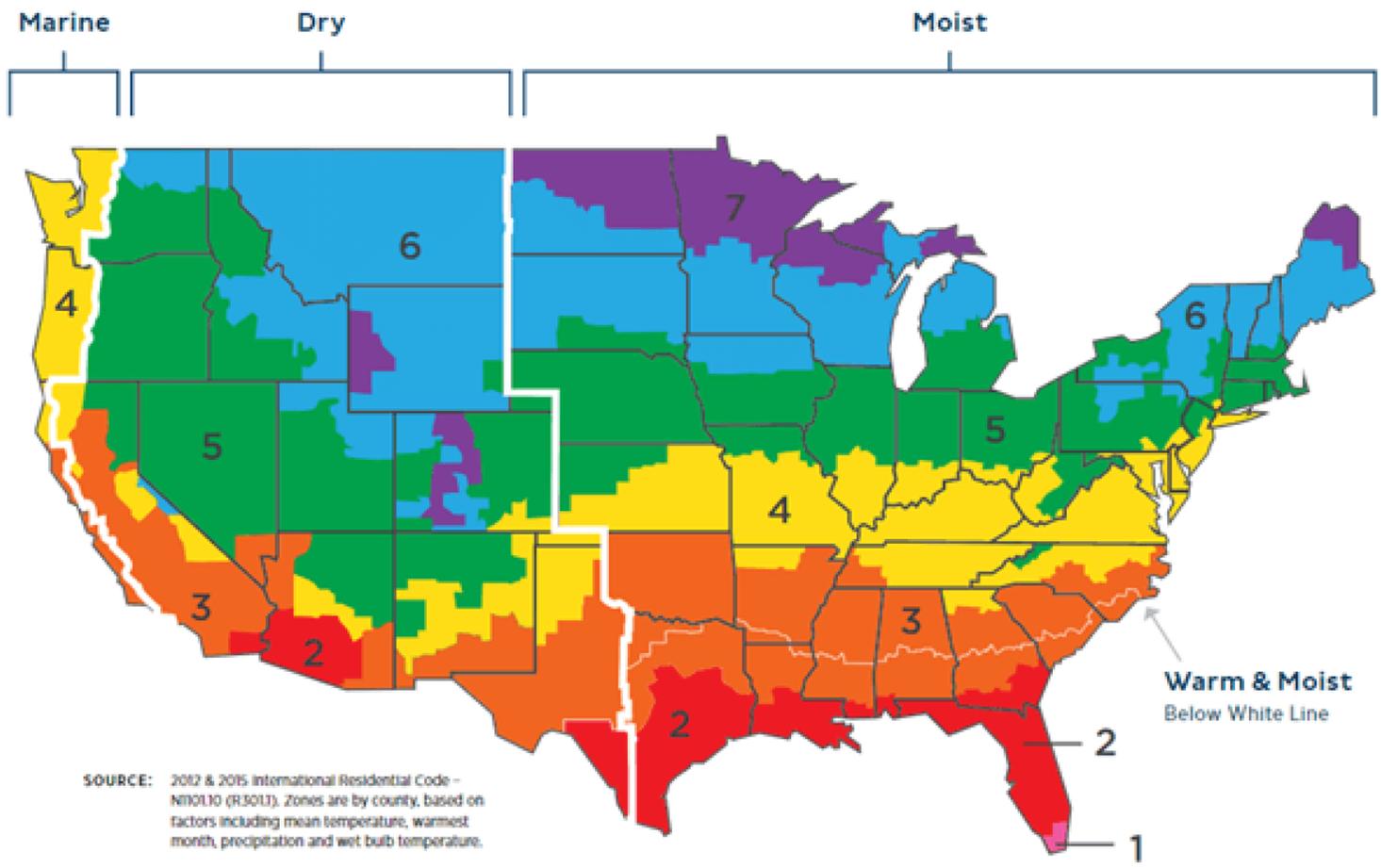


Moisture Increases

Trapped Moisture from construction
Families add 1-4 lbs of moisture per hour
Ventilation
sensible/latent
additions/subtractions



Regional Considerations

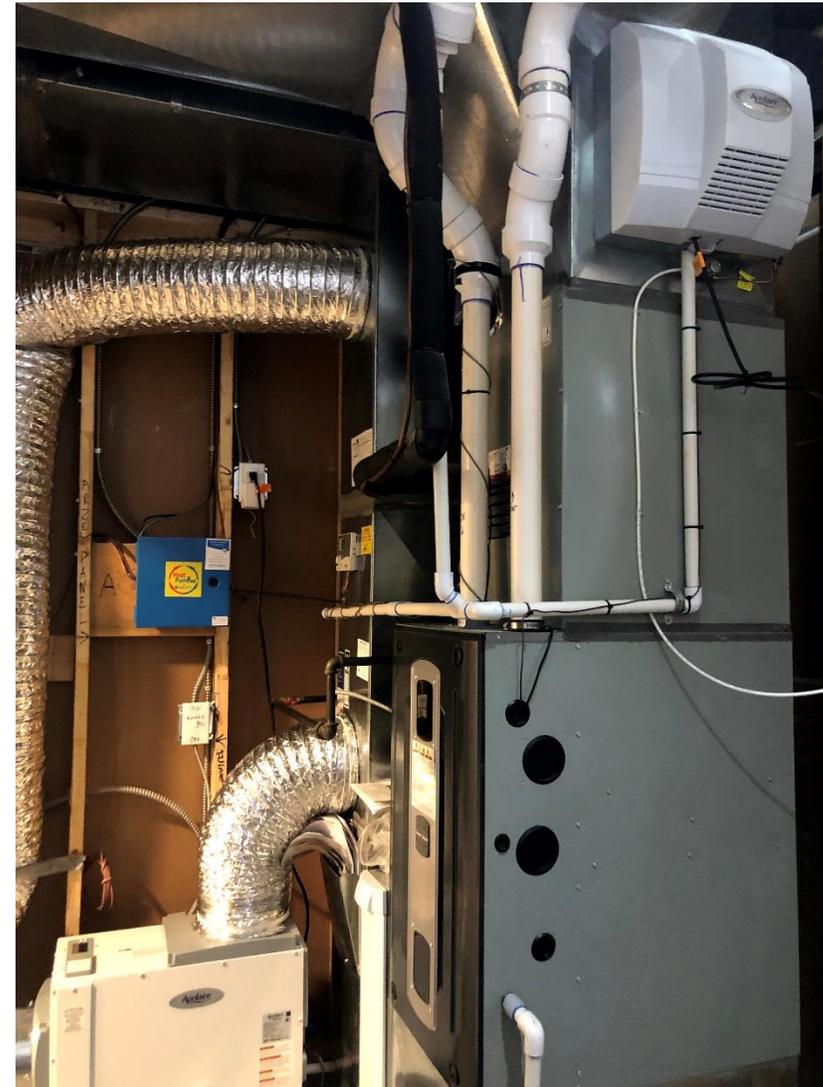


SOURCE: 2012 & 2015 International Residential Code – N1101.10 (R301.1). Zones are by county, based on factors including mean temperature, warmest month, precipitation and wet bulb temperature.



Pictures from the field

Creating the Healthiest, Most Comfortable and Protected Home for the occupants takes more than just heating and cooling equipment. Here are some great examples of that.....



Healthy, Fresh & Clean Air In Every Home



HEALTHY
FRESH AIR™



HEALTHY
CLEAN AIR™

Ventilation and High Efficient Filtration

Remember This....

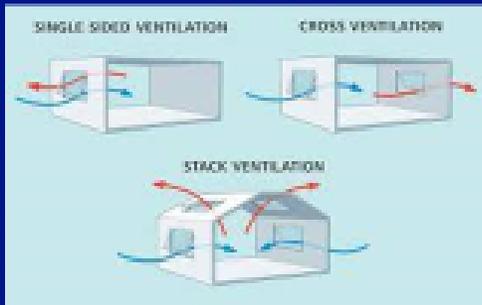


**Approx. 20,000
Breathes A Day**

**What's the
quality of
that air?**



Four Types of Ventilation Systems

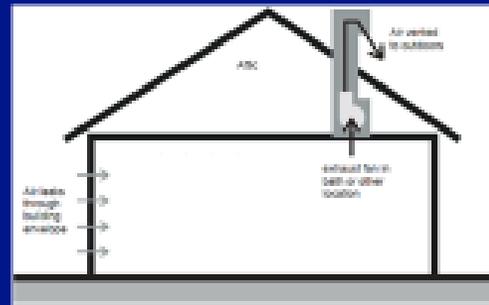


Natural Ventilation

Utilizing products that are already in place – operable doors/windows

Something a homeowner does whenever possible to freshen the air in the home

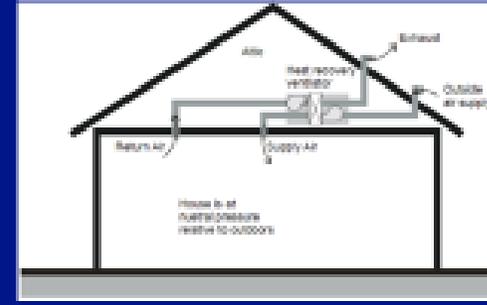
Uncontrolled (How much air do I need? Do I care?)
Unconditioned (Temp, RH, PM)(Weather)
Safety Concerns



Exhaust or Negative Pressure

Bathroom fans, and range hoods only **increase dirty air problems.**

They put the home under negative pressure literally causing the house to suck in air from the worst spots possible. Basements, crawlspaces, mold laden walls, garages, basement floor drains, gas hot water heater venting etc...



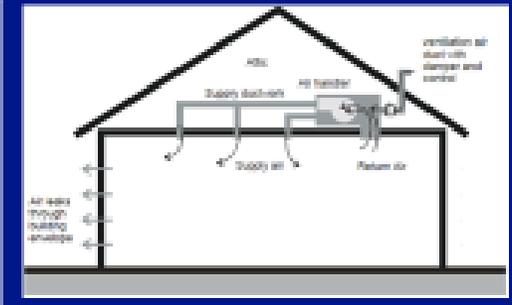
Balanced Pressure

HRV (Northern Climates), ERV or combination of equal pressures in/out of home (non-recovery)

Very effective when installed and commissioned correctly.

Home is at an equal pressure when operating

Most expensive ventilation strategy



Supply or Positive Pressure

Easiest to install, affordable, most flexibility and gives the customer lots of control.

It's rapidly becoming code in new construction parts of America!

Can incorporate dehumidification with ventilation for latent removal

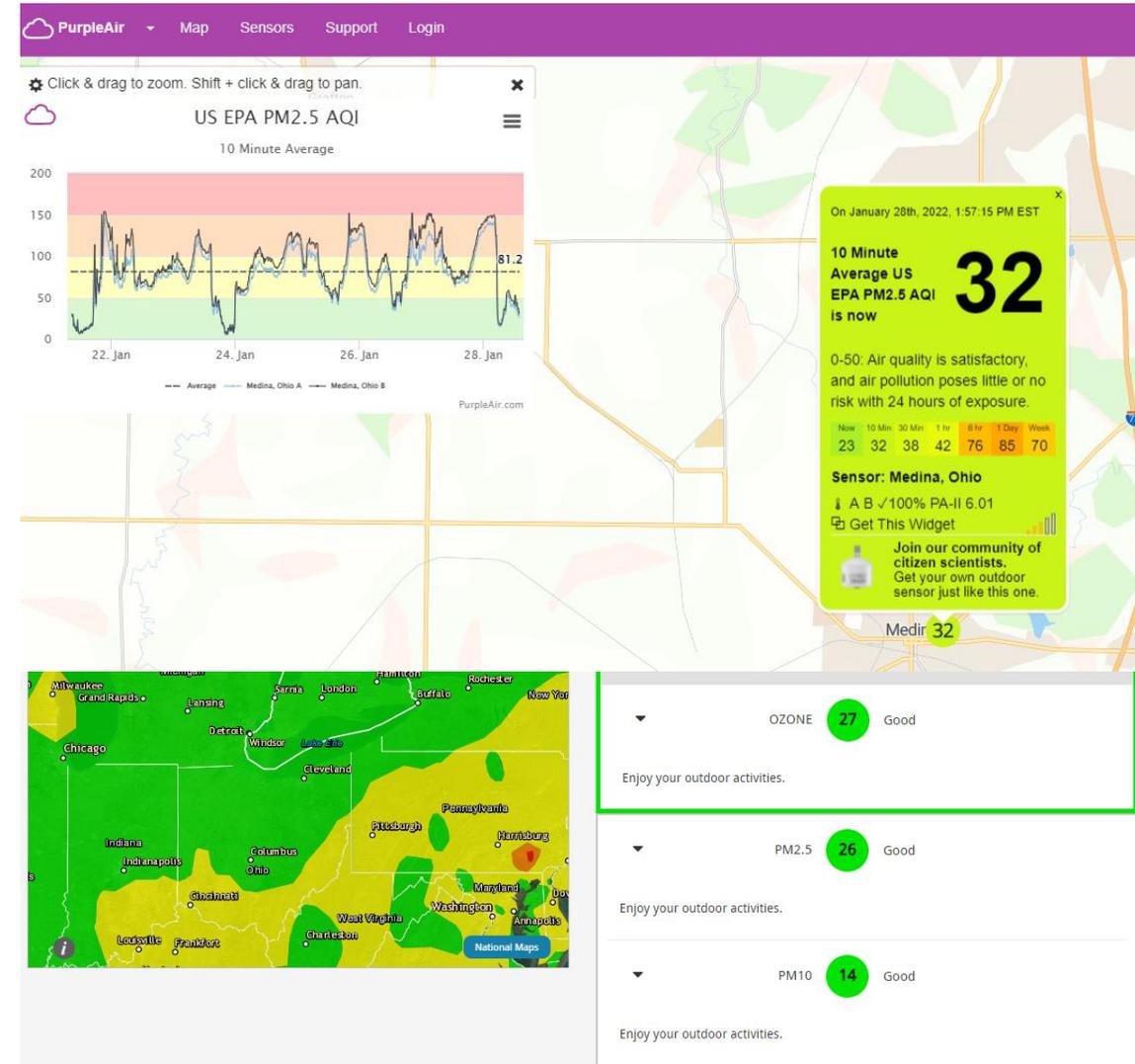
Study with Supply Pressure Ventilation and High-Efficient Filtration

Supply Ventilation and MERV 13 filter to on the central forced air system reduced indoor PM_{2.5} by 90% relative to outdoor when **operated at least 20 min each hour** or continuously at low speed. With a MERV 16 filter the PM_{2.5} was reduced by 97%.



Singer, B.C., W.W.Delp, D.R. Black and I.S.Walker
(2017) Indoor Air 27(4) 780-790

Is the outdoor air really fresher than my indoor air?



What is the best ventilation strategy then?

The answer is....

You have options!

Option 1



Option 2



Option 3



Option 4



Dilution and Replacement Of that unhealthy air

1. Based on the volume of the home and the amount of outdoor air brought in on an hourly basis would vary the replacement rate.
2. You see at first that dilution of the unhealthy air takes place with eventual replacement.
3. This would be the cycle of your home either intermittently or continuously based on ventilation system.

Home Spec:
ClimateZone – 2A
3000 Sq Ft
9' Ceilings = 27,000 Cu. Ft

3 Bedrooms, 3000 Sq Ft.

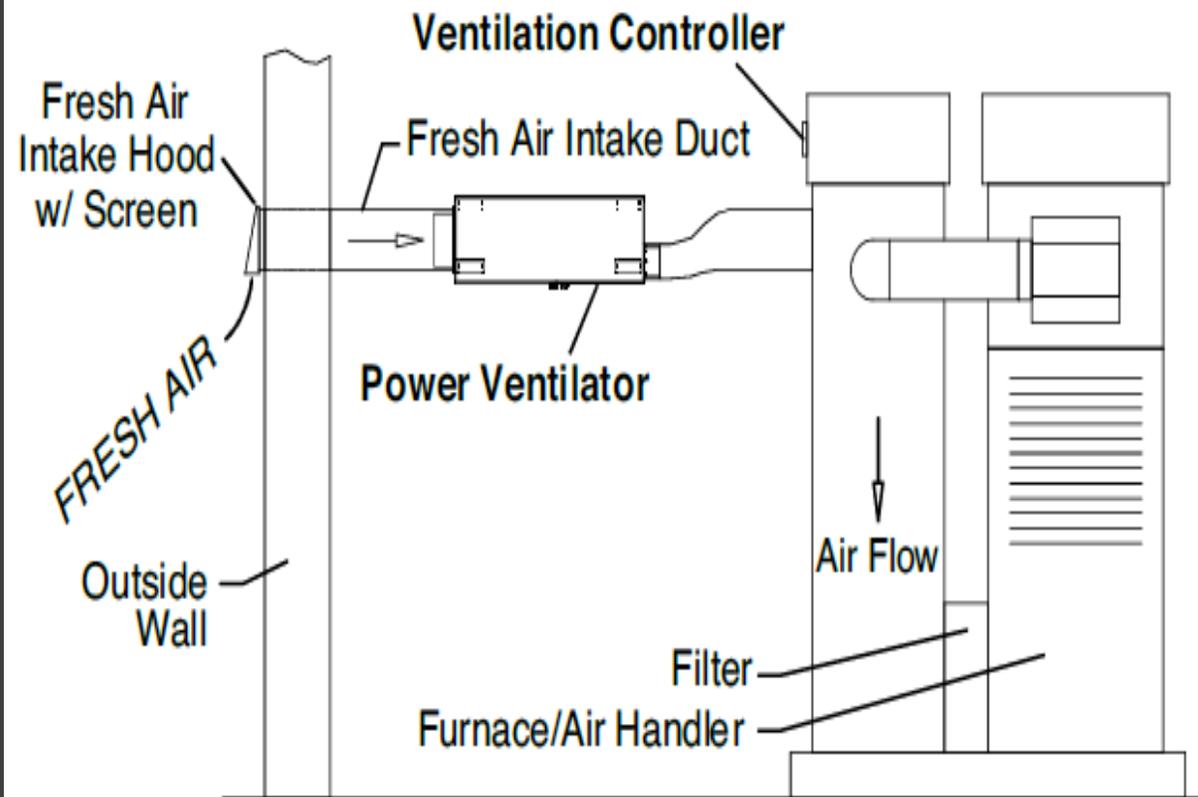
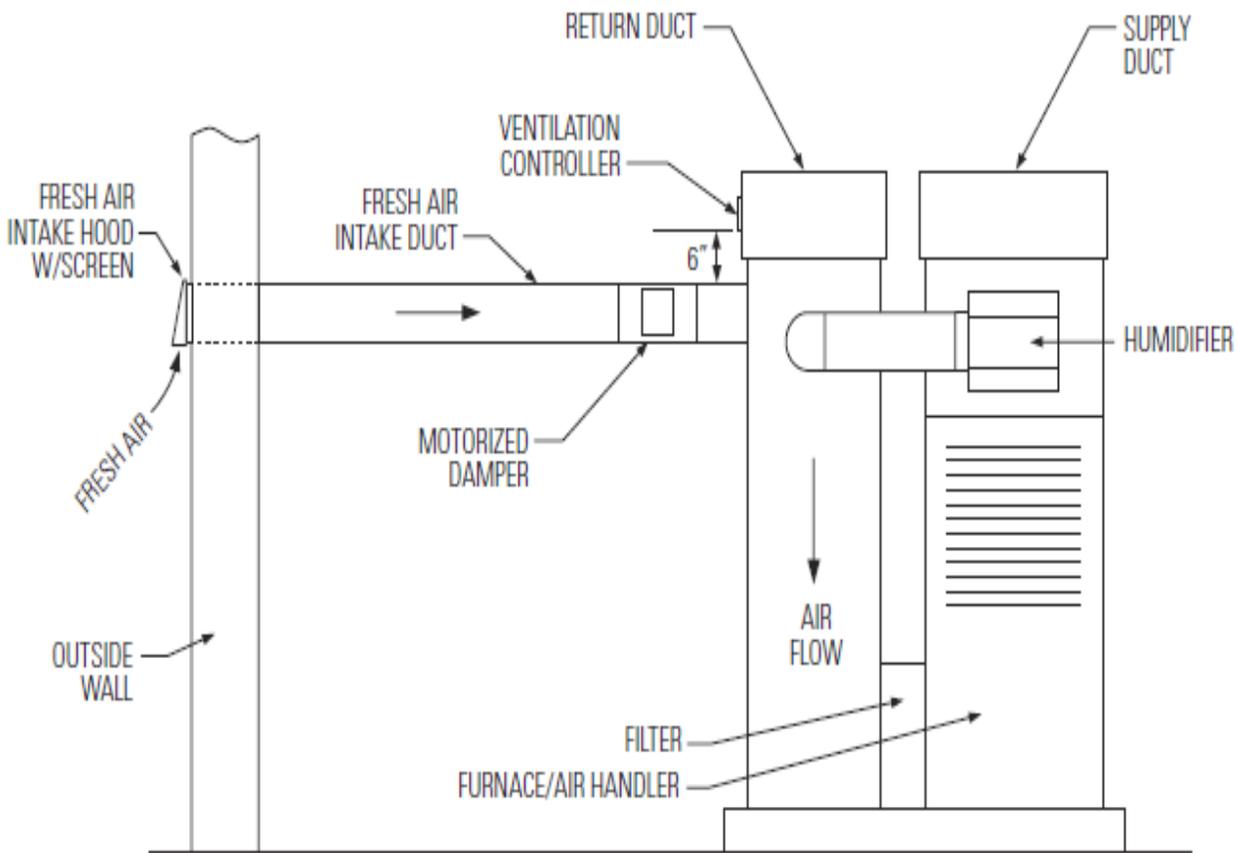
119 CFM of OD air continuously delivered to home from ERV
(entered from Table 1 once system is balanced)

119 CFM x 60min x 24hr = 171,360 Cu Ft of air brought into home

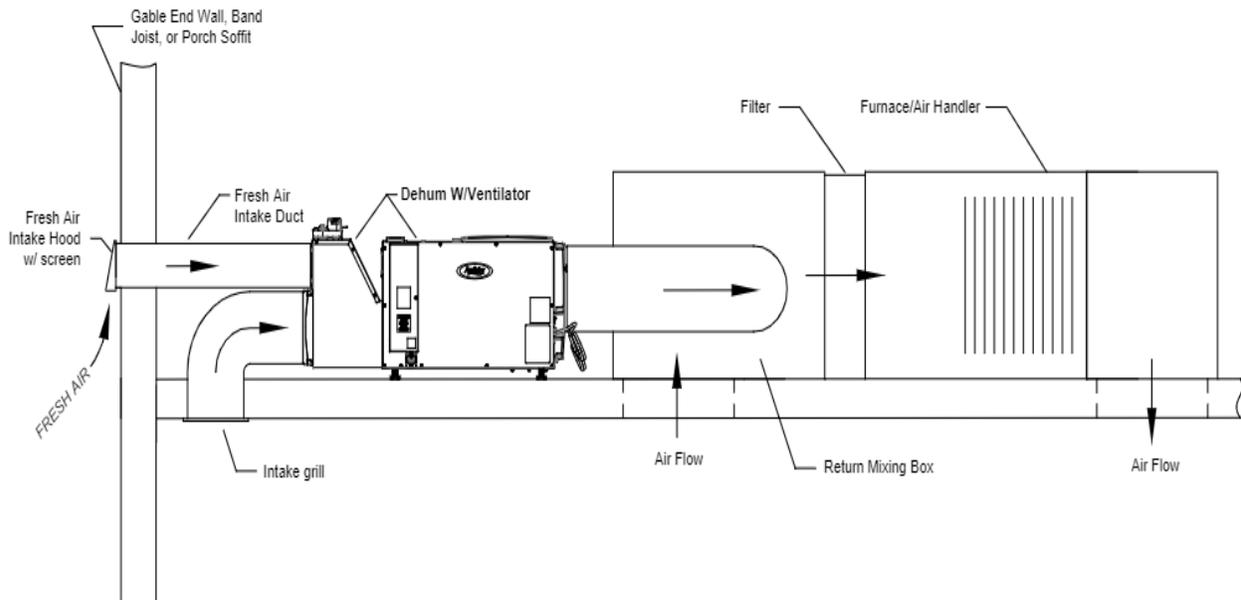
171,360 Cu Ft./ 27,000 Cu Ft Home = 6.35ACD



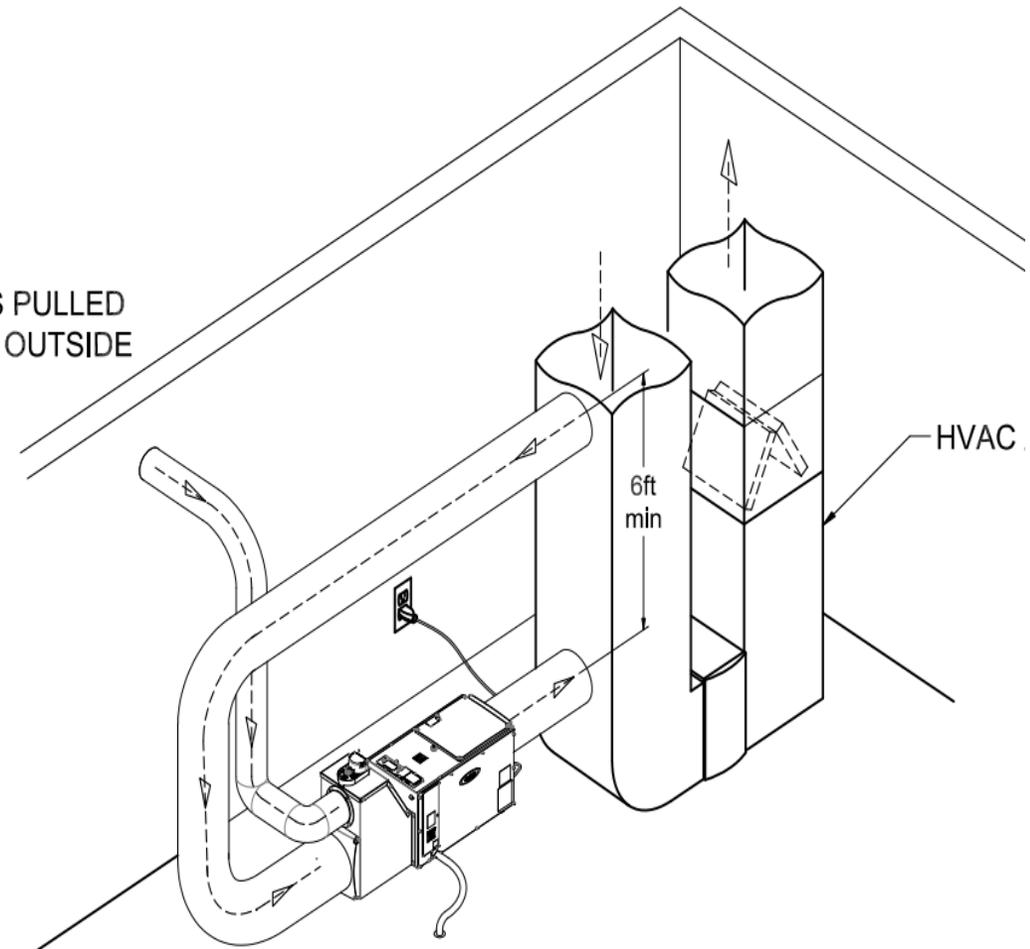
Positive Pressure (Passive & Powered)



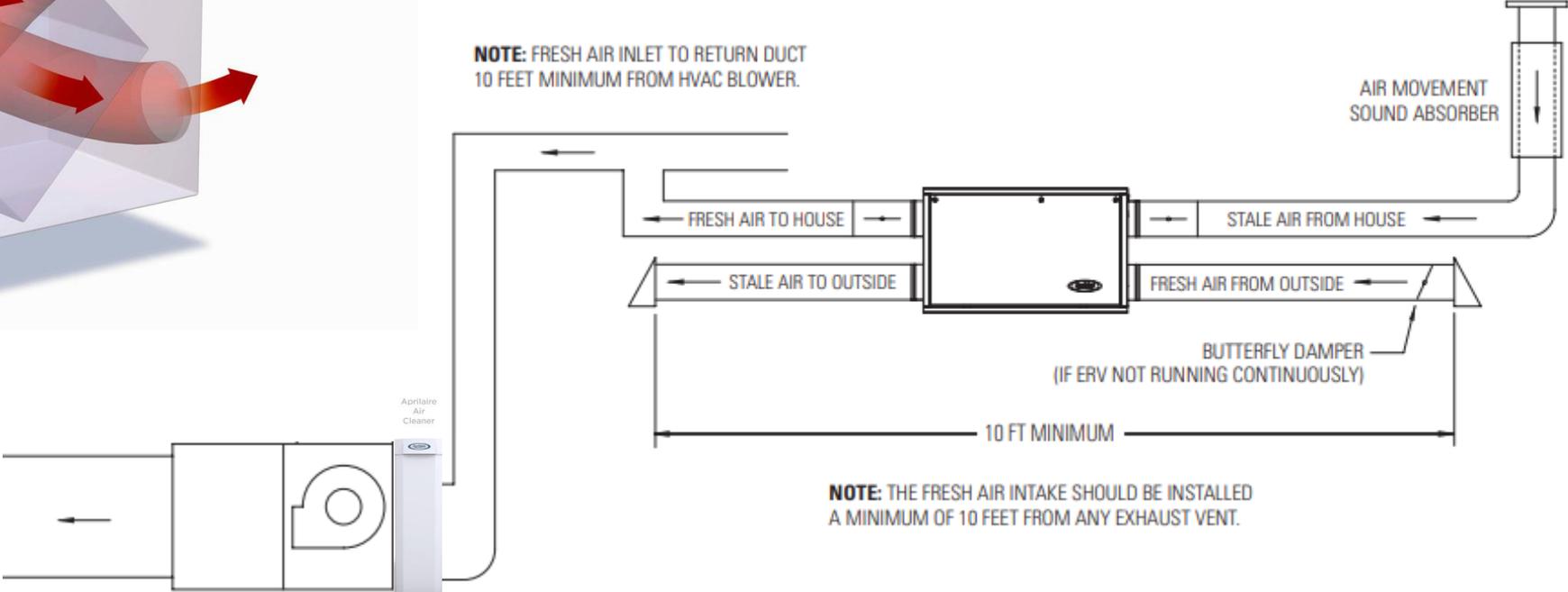
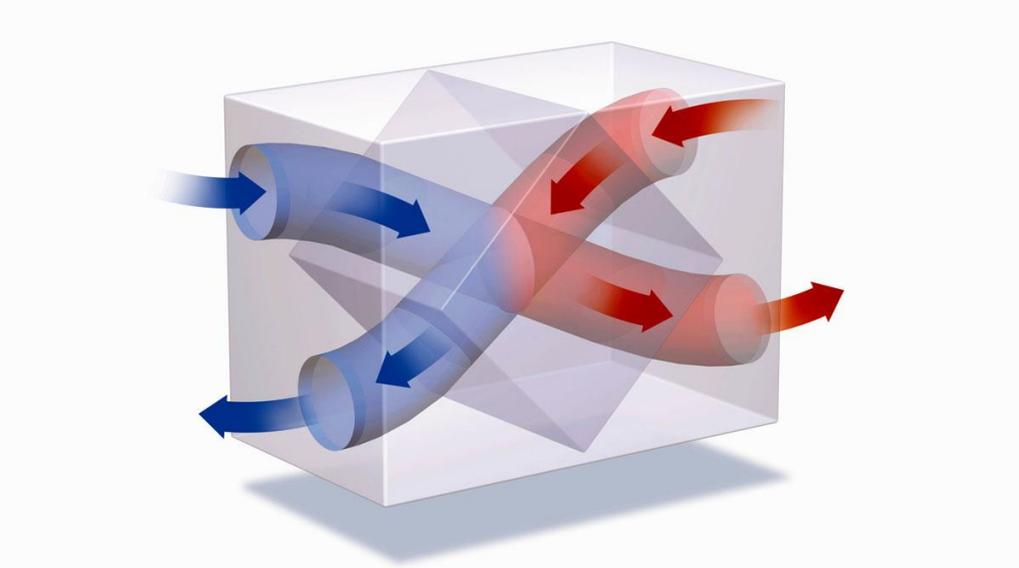
Ventilating Dehumidification



AIR IS PULLED FROM OUTSIDE



Energy Recovery Ventilation



The benefits of positive or balanced pressure ventilation

1. You know where the air is coming in from.
2. Outdoor air is conditioned, heated or cooled before being introduced to the home.
3. Can be turned off temporarily in extreme conditions.
4. Calculated ACH – Fresh Air
5. That air is filtered. Sometimes twice!



Fresh + Clean Air = Healthy Air

1. An air cleaner with a 4-inch MERV 16 filter is hands down one of the most effective media filters on the planet when it comes to capturing virus size particles (including Novel Coronavirus COVID19) ...and will hold it, till it is no longer a danger!
2. Running an HVAC blower in a home continuously will move all the dirty air in that home through the whole home's filter @ 144 times a day!
3. MERV 16 filters have higher static system pressure. But AprilAire's are as low as you are going to find (ask me to prove it with data).
4. My MERV 13 filters are pretty darn close and can stay in the system twice as long.



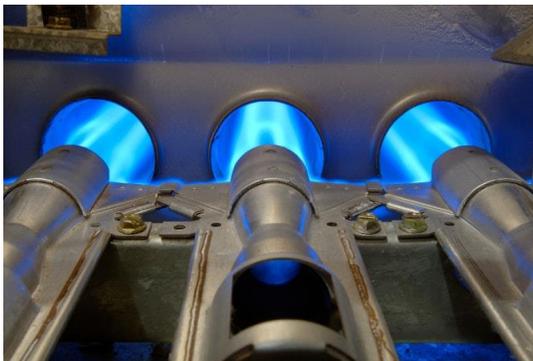
CAPTURES UP TO 96%
OF VIRUS-SIZE PARTICLES



Minimum Requirement



Which leads to this.....



Issues That Cause Static Pressure Readings to Look Great

How air-moving equipment from the factory as it is in the box. When you take it, what's included? What are the components? The manufacturer's TESP measurement includes anything else is external.

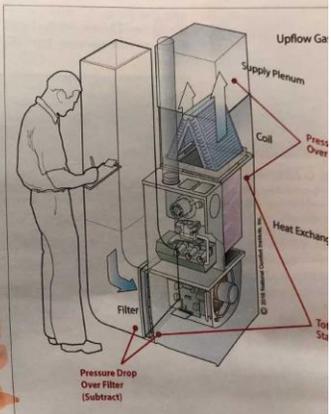
Consider a gas furnace installed on the job site. The blower wheel, filter, and duct system are not the same as shipped. This is why TESP is measured before the filter, after the filter, and before the coil, and after the coil. Remember this, it's the TESP measurement that matters.

If you're in doubt about your readings, record multiple readings. Aim to measure and record static pressures on each gas furnace systems, before the filter, after the filter, after the coil, and after the coil. Remember this, it's the TESP measurement that matters.

DIRTY BLOWER WHEEL

A dirty blower wheel is another issue that makes static pressure measurements look better than they are. Think of blower wheel vanes like snow shovels. When a snow shovel is clean, you can scoop and move a lot of snow with it. When the shovel gets compacted with snow, you don't move nearly as much.

Blower wheels "scoop" air from the return duct system and throw it into the supply duct system. When the vanes are clean, a properly designed and installed system moves the right airflow. If the vanes are compacted with dirt, airflow decreases substantially. It's estimated that a 1/8-inch coating of dust on blower wheel vanes reduces fan capacity by as much as 30 percent. As airflow is reduced through the equipment, so is static pressure.



X MARKS THE SPOT: A firm understanding of proper test locations is one of the top issues that cause deceptive static pressure readings.

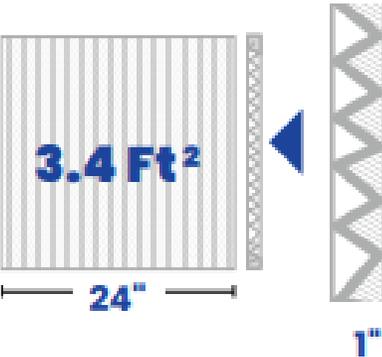
Remember this the next time you see static pressure readings that look great, but the cooling system you're testing is flooding back refrigerant to the compressor. A clean blower wheel is a potential suspension. Once it's clean, expect static pressure to improve.

The NEWS Aug. 20, 2018
 David Richardson : National
 Comfort Institute
 Curriculum Developer & Trainer

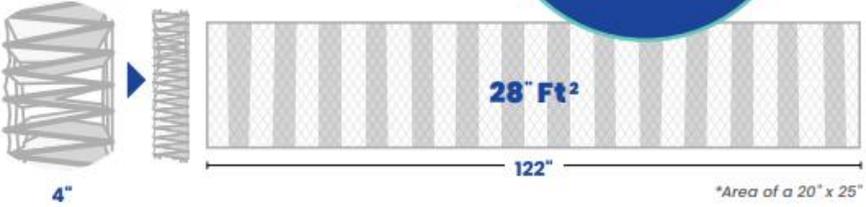
Premature system failures, inefficient operations and NO Health Benefits to the occupants

Not all filters are equal

1" FILTER
(1 TO 3 MONTHS)



APRILAIRE MODEL 213
(12 MONTHS)



MORE FILTER AREA
for lower static pressure & longer filter life

Surface Loading vs Depth Loading

High-Efficient Filtration to meet the needs of the system, home and occupants



Start with the needs of the level of filtration and then size the media cabinet accordingly to the system design pressure drop allowance



 GENUINE Aprilaire AIR FILTER	Clean Air VACUUM & DUST LESS OFTEN	 EFFICIENCY MERV 11 1-YEAR LIFE	STOCK NO. 210 Fits Aprilaire Purifier Models: 1210 1620 2210 3210 4200
 GENUINE Aprilaire AIR FILTER	Healthy Home REMOVES MOST COMMON ALLERGENS	 EFFICIENCY MERV 13 1-YEAR LIFE	STOCK NO. 213 Fits Aprilaire Purifier Models: 1210 1620 2210 3210 4200
 GENUINE Aprilaire AIR FILTER	Allergy & Asthma REMOVES UP TO 99% OF ASTHMA TRIGGERS	 EFFICIENCY MERV 16 6-MONTH LIFE	STOCK NO. 216 Fits Aprilaire Purifier Models: 1210 1620 2210 3210 4200
 GENUINE Aprilaire AIR FILTER	Odor Reduction REMOVES PET & COOKING ODORS <small>Captures common household VOC's (Volatile Organic Compounds)</small>	 WITH ACTIVATED CARBON EFFICIENCY MERV 13 6-MONTH LIFE	STOCK NO. 213 CR ODOR REDUCTION Fits Aprilaire Purifier Models: 1210 1620 2210 3210 4200

Cleaner, Healthier Air

REMOVAL EFFICIENCY (Based on Particle Size)

	0.3–1.0 Microns	1.0–3.0 Microns	3.0–10.0 Microns
MERV 16	95%	98%	99%
MERV 13	63%	88%	93%
MERV 11	37%	67%	92%
MERV 10	22%	56%	92%
EAC (Model 5000)	89%	95%	98%

Test Method – MERV 10-16 – ASHRAE 52.2.2012, EAP – AHRI 680-2009



It's Time to Care About
Healthy Air

Aprilaire's Differentiation



The Aprilaire Pure Fit Promise guarantees a filter that was not only made to fit flawlessly into your Aprilaire system, it delivers purer, healthier air.



Our Patented Self-Seal Technology reduces bypass, improving filter performance and providing superior protection of your home and indoor air quality health.



The Aprilaire Interlock Rail System allows your high performance air filter to work without assembly of cardboard or metal reinforcements.



Should your new indoor air conditioner coil require a professional cleaning in the next 10 years, Aprilaire will pay \$100 toward a cleaning by an HVAC contractor.

Not only will you have a healthier home, your heating and cooling systems will have the best air flow for maximum efficiency and a protection like no other..... **10 Year Clean Coil Commitment**

Make every new home a Healthier Home



The image features a central shield-shaped logo with a house outline and the text "HEALTHY AIR SYSTEM". Below the logo, three HVAC components are displayed, each with a small shield icon to its right. The components are: "Fresh Air Ventilation" (a grey rectangular unit), "Air Filtration" (a white rectangular unit with a filter), and "Humidity Control" (a white rectangular unit with a control panel). A dashed line connects the three components to the main logo above them.

Fresh Air Ventilation

Air Filtration

Humidity Control

These essential components are designed to work with your HVAC equipment.

Create a healthy air environment in your home by introducing healthy, fresh air. Help to remove airborne dust, allergens, bacteria and viruses and maintain a level of humidity that helps prevent the proliferation of viruses.

Thank you for your time and attention today! We look forward in partnering further with you in creating Healthy Homes.

QUESTIONS?

Contact Information



**Joseph Hillenmeyer | Senior Channel
Marketing Manager | AprilAire®**

1015 East Washington Avenue | Madison, Wisconsin 53703
Cell: 608-977-0554

Joseph.hillenmeyer@AprilAire.com | AprilAire.com
| AprilAirepartners.com

**Chris Howells | Senior Product Manager:
Ventilation & Purification | AprilAire®**

1015 East Washington Avenue | Madison, Wisconsin 53703
Cell: 608-628-7134

chris.howells@AprilAire.com | AprilAire.com
| AprilAirepartners.com

THANK YOU