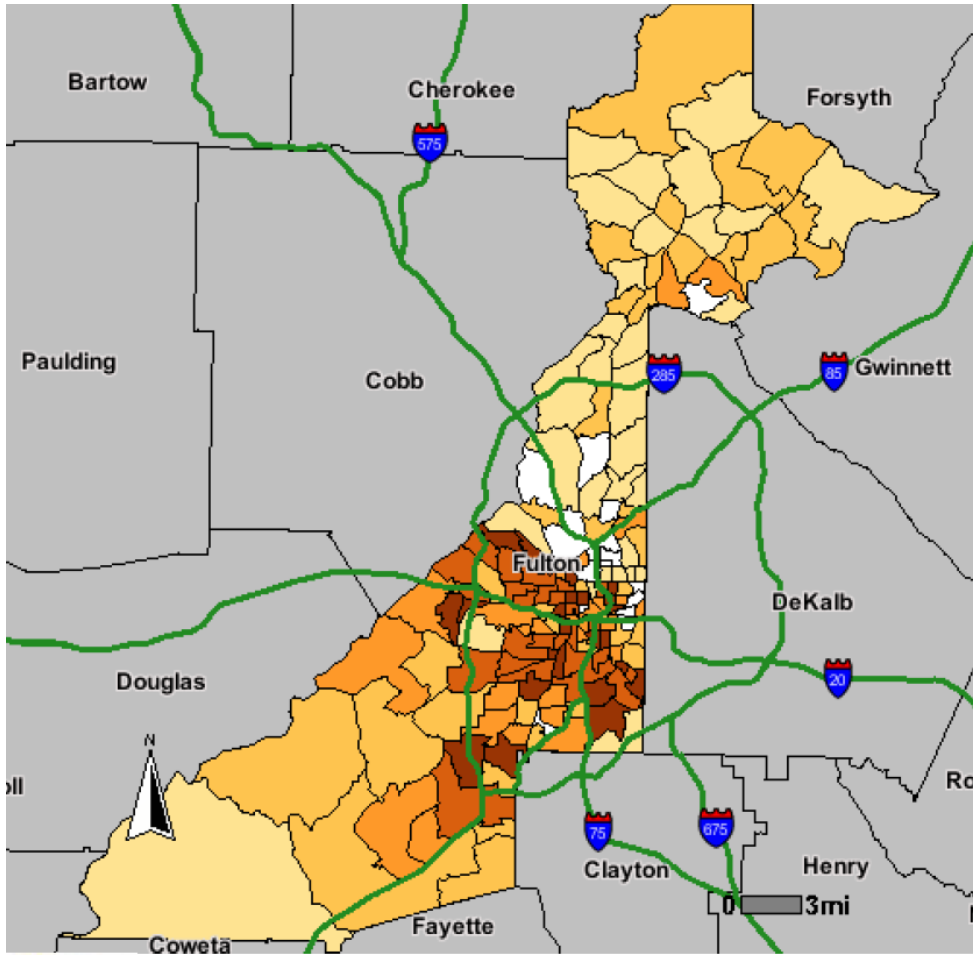
Indoor Air Quality: A significant *Environmental* threat to Human Health.

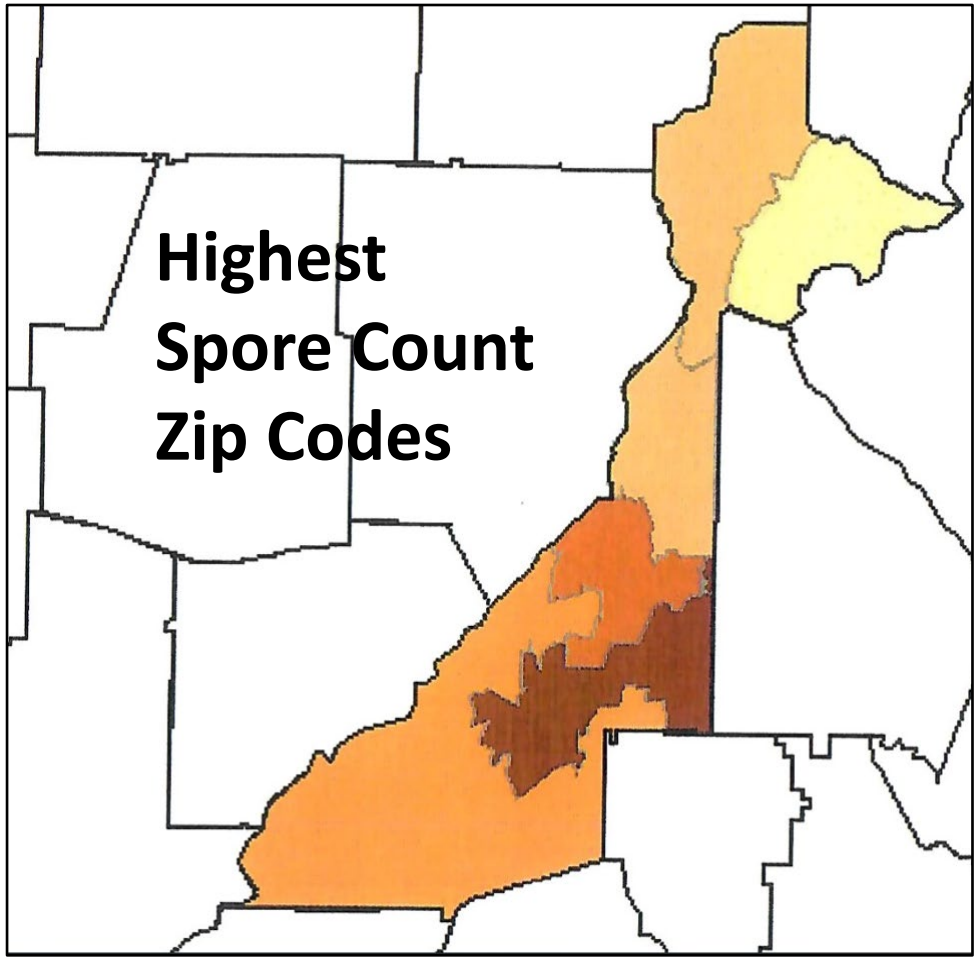
A Presentation to the International Mechanical Code Task Force
February 20, 2025

Background

- BSIE Purdue (Industrial Engineer)
- Manufacturing
- Construction
- Real Estate
- Landlord
- Agriculture
- Healthcare
- Recreation
- Hotels
- Franchise Development
- Financial Services
- Remediation
- Air Quality
- FEMA
- Turnaround Management Association
- Institute of Management Consultants
- Asthma Coalition
- Asthma Advisory Board
- Citizens Commission on Environment
- Healthy Homes Coalition

Fulton County Emergency Room Visits: Best measure for Asthma & COPD Control





Excuses given to ignore preventing Illnesses from particles, microbial growth and poor ventilation in the Indoor air

- Increased filter ratings will burn out my compressor.
- There are mold spores everywhere.
- The outside air can have a higher count of spores than the inside air.
- Everyone's immune system is different.
- There are thousands of species of mold spores.
- Not all mold spores are harmful.
- A filter won't remove 100% of secondhand smoke.
- Better filters are Tabacco companies' argument so we can't support that recommendation.
- The EPA says most spores are not a health risk (unless they are growing indoors).
- I can't smell anything.
- Tests results can vary from time to time and lab to lab.
- Reducing humidity won't eliminate 100% of mold spores.
- Ventilation & humidity control will add to utility costs.
- There are no legal guidelines for acceptable levels of mold spores.
- Better filters are more expensive.
- The HVAC system conforms with the existing building codes.
- The medical community doesn't have reimbursement codes for investigating indoor air quality.

Cited Sources: National Institute of Health; White House Office of Science and Technology; Harvard Chan School of Public Health; Environmental Protection Agency; Journal of Asthma; Center for Disease Control; Thermoscientific; Indoor Air Quality Association; Cincinnati Childrens Hospital; American Society for Microbiology; Allergy and Asthma Proceedings; Journal of Allergy and Clinical Immunology: Milken Institute of Public Health at George Washington University; and many others (300 Plus) which can be found at www.airallergen.com/studies

Pollutants we breathe indoors can be grouped into three categories:

1. Particulate (PM2.5, PM10)

2. Microbial Growth (usually mold)

3. Gaseous Chemicals (dozens)

Indoor Air Quality exacerbates these diseases

	Georgia							Individual cost per patient			Attributable to		
Disease	Annual $	# afflict	% afflicted	Deaths	Hosp	ER visits	Pharma	Hosp	ER visits	Pharma	Particule	Mold	VOC's
Diabetes	14.9 B	1,013,000	9.47%	2,833	5.03 B	9.725 B	240 M	4,933	2,400	4,733	52 M		
Kidney Disease	53 B	453,600	4.24%	1,475	42.1 B	1.08 B	10.16 B	3,500	42,000	22,444	39 M		
Parkinson's	5.35 B	669,600	6.26%	354	9.07 B	6.69 B	9.49 B	13,551	10,000	14,177	21 M		
Alzheimer's	12.7 B	150,000	1.40%	4,222	8.59 B	N/A	4.2 B	57,289	N/A	28,000	2.92 B		939.8 M
Multiple Sclerosis	192.91 M	1200	0.01%	32	78.73 M	42.18 M	72 M	65,612	35,154	60,000	10.1 M		
ADHD	1.3 B	259812	2.43%	2x gen pop	387.9 M	N/A	191 M	1,493	N/A	735	256 K		
Migraines	15.96 B	702,000	6.56%	N/A	4.615 B	5.967 B	5.391 B	6,575	8,500	7,680	2.4 M		
Coronary Heart	4.1 B	18,507	0.17%	22,000	1.6 B	55.5 M	.023 B	11,055	3,000	15,540	2.7 B		
Heart Failure	798 MIL	66,670	0.62%	11,000	.352 B	96.07 M	350.4 M	1,594	1,441	5,256	.24 B		
Hypertension	5.2 B	3,700,000	34.58%	102,052	3.6 B	.090 B	2.2 B	974.13	2,400	336	1.49 B		
Stroke	1.68 B	20,929	0.20%	4,349	.60 B	913.5 M	1.13 B	43,652	43,652	17,081	.08 B		
Asthma	2.6 B	918,000	8.58%	136	177M	2.2 B	1.65 B	640	2,400	1,825.40	.011 B	.480 B	0.293 B
COPD	1.5 B	532,000	4.97%	5,000	.159 B	.042 B	.392 B	298.17	2,400	664.63	.206 B	.200 B	.609 B
Acute Bronchitis	1.420 B	540000	5.05%	4,039	8.82 M	1.404 B	1.01 B	16.34	2,400	1,876		.073 B	
Allergic Rhinitis	5.687 B	1,920,000	17.94%	N/A	539.5 M	4.99 B	209.2 M	281	2,400	281		.150 B	
Rinosinsitis	33.1 B	1,300,000	12.15%	N/A	26.9 B	.005B	.369 B	20,748	2,400	2,100		.151 B	
Pneumonia	.518 B	1,145,000	10.70%	1,339	.426 B	.029 B	.259 B	7,166	2,400	125.3	0.004 mor	.075 B	
Cancer	1.93	54,000	0.50%	18,750	8.1 B	140.4 B	2.27 B	150,000	2,400	42,000	.700 B	.700 B	
Secondhand Smoke	.32 B	19,500	0.18%	1,500	52.3 M	N/A	N/A	2,682	N/A	N/A	N/A	N/A	N/A
Tot ex COVID	27.33 B	13,483,818	126.02%	179,081	121 B	173.23 B	39.55 B	392,060	165,347	224,854	7.152 B	1.83 B	.902 B
COVID	128 B	2,870,000	26.82%	39,748	119.4 B	7.46 B	1.52 B	41,611	2,400	530	0.11 B	21.3 B	
						Cost of Disease divided by chronic disease							

MERV Rating Chart

MERV Rating:	0.3-1.0 µm	1.0-3.0 µm	3.0-10.0 µm
MERV 1	Under 20%	Under 20%	Under 20%
MERV 2	Under 20%	Under 20%	Under 20%
MERV 3	Under 20%	Under 20%	Under 20%
MERV 4	Under 20%	Under 20%	Under 20%
MERV 5	Under 20%	Under 20%	20% - 34%
MERV 6	Under 20%	Under 20%	35% - 49%
MERV 7	Under 20%	Under 20%	50% - 69%
MERV 8	Under 20%	Under 20%	70% - 85%
MERV 9	Under 20%	Under 50%	Above 85%
MERV 10	Under 20%	50% - 64%	Above 85%
MERV 11	Under 20%	65% - 79%	Above 85%
MERV 12	Under 20%	80% - 90%	Above 90%
MERV 13	Under 75%	ve 90%	Above 90%
MERV 14	75% - 84%	Above 90%	Above 90%
MERV 15	85% - 94%	Above 95%	Above 90%
MERV 16	Above 95%	Above 95%	Above 90%
MERV 17	99.97%	Above 99%	Above 99%
MERV 18	99.997%	Above 99%	Above 99%
MERV 19	99.9997%	Above 99%	Above 99%
MERV 20	99.99997%	Above 99%	Above 99%

Filtration

- A MERV 13 rated filter is the lowest rated filter that can the captures a majority of PM2.5 particles.
- PM2.5 is the most damaging to human health.
- Homes often exceed the national PM 2.5 and PM 10 National Ambient Air Quality Standard (NAAQS).
- Children are more vulnerable to particulate due to their faster respiration rates and small lungs.
- Particulate Matter exposure accounts for 10-30% of the total burden of disease in the US.
- There is an 8-18% increase in mortality rate per 10ug/m^3 increase in PM2.5.
- There is a 13% increased risk of cardiovascular disease with each 5ug/m^3 increase in PM2.5.
- Increased particulate matter levels leads to increased ER visits and/or hospitalizations.
- Particulate matter is a significant trigger for asthma attacks and secondhand smoke is significantly associated with the development of asthma in children.
- Secondhand smoke is a significant health and economic burden on the US.
- High efficiency filters effectively filter out particulate, secondhand smoke, pet allergens, mold spores, small microbials, and more.

As a Result, the EPA and ASHRAE recommend a MERV 13 filter when the HVAC system can support it.

Humidity Control

- Mold proliferates indoors where there is any type of water intrusion or leakage that is not promptly cleaned up. Mold can also grow because of poorly controlled humidity.
- Dust mites are known asthma triggers and live in bedding and upholstery where humidity is sufficient.
- Several studies have confirmed that occupying a water-damaged building or home contaminated with high amounts of mold increases the risk of developing asthma before the age of 7 by 7.5 times.
- Mold significantly increases asthma morbidity in both adults and children.
- Mold is primarily responsible for Sick Building Syndrome cases or Water-Damaged Building related illnesses.
- Molds have the potential to produce known carcinogens and mutagens, known as mycotoxins.
- Mold is difficult and expensive to remediate, and the best course of action is prevention.
- Mold affects multiple systems of the body, including the respiratory, nervous, digestive, vascular, cutaneous, reproductive, and immune systems.
- Many people in the US are allergic to several species of molds.
- Landlords often do not repair or remediate water leaks/intrusions or mold infestations, leading to expensive litigation and adverse health effects for the residents.
-

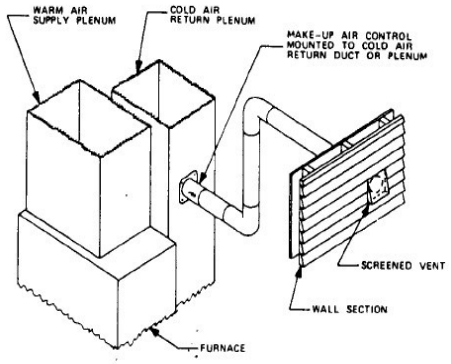
As a result, the EPA recommends that humidity be held between 30% and 50% at room temperature

Ventilation

- **Fast Facts:**

- The concentration of VOCs indoors is often significantly higher than the concentration outdoors.
- Common indoor pollutant sources of VOCs include combustion sources such as a g stoves or fireplaces, candles, or incense, as well as pressed wood products, gypsu board, carpet, and more.
- The World Health Organization has deemed air pollution as the biggest environmental killer, killing 7 million people each year. We spend 90% of our time indoors.
- Increased ventilation in schools and workplaces has been proven to increase productivity and cognitive skills in reading, writing, and math. It has also led to decreased absenteeism and increased worker health. This has significant economi benefits.
- Many VOCs are known to be human carcinogens, such as benzene and formaldehyde.
- Several studies have linked different VOCs (i.e. formaldehyde and aromatic compounds) to the diagnosis of asthma and other chronic and acute respiratory conditions.
- The increase of ventilation rate has minimal energy consumption impact or cost. T environmental impact is also minimal when using an energy recovery system.
- The best control method for levels of bioaerosols and other VOCs is through the HVAC system.
- Experts have confirmed that several COVID-19 outbreaks in public spaces have been due to inadequate ventilation.

Make Up Air



Barriers

- A significant issue is the separation of cost from benefit. The benefits are lower medical subsidies or by the occupants with less suffering and better health, although the cost burden is often on Landlords and other taxpayers through medical payment systems.
- Public ignorance of how the indoor quality is affecting them and what to do about it.
- The majority actions of the Health Care Providers and the Department of Health focus on treatment, rather than prevention.
- While this data reflects today's circumstances, the building codes will affect unknown and sudden future events, such as particles from forest fires, volcano eruptions, meteor strikes, storm events related to environmental conditions and future pandemics such as Covid, where it has been stated that the transmission rate could have been cut in half with better filtration and adequate ventilation.
- To provide the necessary preventions, the building codes must be modified to provide appropriate filtration, humidity control and conditioned ventilation, not only for us, but for future generations to be prepared for the unknown and intermittent events.

The White House Office of Science and Technology Policy recently described Indoor Air Quality as *"absolutely critical if we think about improving public health in America".*

It is time we give air we breathe indoors the same attention for preventing adverse health effects that we give to the water we drink and food we ingest by providing adequate filtration, humidity control, and conditioned ventilation in occupied indoor spaces.

Proposed Amendment regarding Filtration

605.1 General.

Heating and air-conditioning systems shall be provided with approved air filters in a *filter box or tray that can accommodate an approved air filter up to 6 inches thick. Approved filters shall have a minimum of a MERV 13 rating.* Filters shall be installed such that all return air, outdoor air and makeup air is filtered upstream from any heat exchanger or coil. Filters shall be installed in an approved convenient location. Liquid adhesive coatings used on filters shall have a flash point not lower than 325° F (163 ° C).

Reason or Intent:

PM2.5 has been shown to be associated with every major chronic disease. A MERV 13 filter has been shown to capture up to 75% of PM2.5.

The EPA and ASHRAE recommend a MERV 13 filter when able to be supported by the air handler fan.

Proposed Amendment regarding Humidity control

Description: *312.2 Humidity control*. *(new section)*

Dehumidification shall be provided by the HVAC system capable of maintaining the humidity near or below 50 percent (ideally 30-50%) a*t 70 degrees controlled by a humidistat co-located with the thermostat.*

Reason/Intent:

30 studies, experts, professionals, and countless others have confirmed that inadequate humidity control in the indoor environment leads to the proliferation of mold, dust mites, and cockroaches. 74 studies have confirmed the wide variety of minor to severe adverse health effects that exposure to mold can cause. Dozens of studies regarding the effects of inadequate humidity control on chronic diseases are included in the previously distributed notebooks and can be found online at www.airallergen.com/studies.

The EPA recommends that humidity be held between 30% and 50% at room temperature

Proposed Amendment Ventilation (Makeup Air)

Description: 504.7 Makeup air.

Installations exhausting more than ~~200 cfm (0.09 m^3/s)~~ *50 cfm (0.0225–m^3/s)* shall be provided with *makeup air*. Where a closet is designed for the installation of a clothes dryer, an opening having an area of not less than 100 square inches (0.0645 m^2) shall be provided in the closet enclosure or *makeup air* shall be provided by other *approved* means.

Reason/Intent:

Air exhausted from residential clothes dryers averages 150-200 CFM. High-end dryers can blow up to 300 CFM. The exhaust rate for a kitchen exhaust fan is 100 cfm. According to ASHRAE standard 62.1-2010, the exhaust CFM for a private toilet/bathroom is 50 CFM. At 150 CFM for 50 minutes, a typical dryer cycle exhausts 7500 cubic feet of air, equivalent to a 10’ X 11’ room. Exhausted air is replaced by unconditioned and unfiltered air through walls, from basements, attics and crawlspaces. Unconditioned and unfiltered air from these sources have been implicated in virtually all chronic diseases.

The best control method for levels of bioaerosols and other VOCs is through the HVAC system.