



CLEARING THE AIR

Four strategies for indoor air quality, in the order they actually work: source control, exhaust, ventilation, filtration.



Clean, fresh, breathable air is a core expectation of homeowners. They naturally assume that the new house they just purchased will deliver a healthy environment for them and their family. The challenges of COVID, increasing outdoor air pollution, and wildfires have only heightened this expectation by bringing the awareness of indoor air quality to the forefront.

Modern homes are tighter, contain more manufactured products, and are occupied differently than homes built decades ago. While these changes improve energy efficiency and comfort, they also make indoor air quality a design issue rather than something left to chance.

As a builder, if you had to rate the air quality in the homes you build, how would it score? Would that rating be based on anything more than a guess?

Very few of us know what harmful gases or particulates circulate within our houses. Sure, radon is tested, but dozens of other pollutants are introduced during construction and everyday occupancy. Building a house that limits the pollutants introduced during construction and is designed to limit the ongoing assault from environmental factors and just plain living should be part of a high-quality builder's process and design.

While there is no single definition of "good" indoor air quality, the most effective way to improve indoor air quality is to address pollutants in the order below. Each strategy builds on the previous one.

THE ORDER MATTERS

NO AMOUNT OF FILTRATION CAN COMPENSATE FOR POOR SOURCE CONTROL OR INADEQUATE EXHAUST.

1

REDUCE WHAT
COMES IN

SOURCE CONTROL

Reduce the amount of pollutants that are introduced into the home during construction.

Use low-VOC materials. Some of the biggest offenders are engineered wood products (cabinets, OSB, etc.), paints, vinyls, laminates, adhesives, synthetic carpets and padding, etc. There are numerous sources to determine the VOCs in construction materials and provide alternatives or confirmation that selections reduce indoor air pollution at the beginning of occupancy.

Build the house as tight as possible. Gaining control of air exchange between the indoor and outdoor environment is critical for a variety of reasons, such as wildfires. This is even more critical between the house and garage, where all sorts of nasty things are stored.

Educate homeowners. Building with low-VOC items has little impact if homeowners install high-VOC furniture and store and use cleaning products and other items that bring all the bad things back in. However, normal living will impact indoor air quality. While it may have a positive impact, telling a homeowner they should not bring their pets inside the house is a non-starter, so we need to employ additional strategies.

2

REMOVE THE
WORST AT THE
SOURCE

EXHAUST

Assuming you do not smoke, cooking is one of the largest sources of indoor air pollution in a home. Gas cooking adds combustion pollutants such as nitrogen dioxide and carbon monoxide, but all cooking generates fine particles and grease aerosols that should be exhausted outdoors. Installing a stove hood that effectively exhausts cooking byproducts to the outside should be mandatory. **Hoods should have a minimum of 80% capture efficiency, and high CFM does not mean high capture efficiency.** Installing a recirculating microwave over a stove top is a completely ineffective alternative and should never be considered.

High indoor moisture promotes mold growth, dust mites, and other biological contaminants. Install exhaust fans in bathrooms and laundry rooms that are **tested to exhaust a minimum of 50 CFM after installation.**

FIELD CHECK**TEST AFTER INSTALL, NOT ON THE SPEC SHEET.**

Rated CFM and installed CFM are different numbers. Verify the range hood captures and the bath fans move 50 CFM once ductwork, terminations, and dampers are all in place.

3

DILUTE WHAT
REMAINS

VENTILATION

DILUTION

Most of the time, the air outside a home has less pollution than the air inside a home. Therefore, removing inside air and replacing it with outside air is beneficial to overall indoor air quality. **Since the 2012 IRC, mechanical ventilation has been required in home construction.** The realities of tighter building envelopes and conditioned homes, where open windows are the exception rather than the rule, led to this code change. Diluting inside air with fresh outside air lowers the percentage of harmful particles and improves indoor air quality.

There are three primary methods of mechanical ventilation:

EXHAUST

Using a dedicated exhaust fan to continuously remove an ASHRAE-defined CFM of indoor air. Since air in equals air out, the same CFM of outside air will find its way into the house through leaks in the building envelope.

A

SUPPLY

Works the opposite of exhaust by bringing fresh outdoor air into the house and pushing stale air out through those same leaks within the building envelope.

B

BALANCED

Provides a dedicated path for both supply and exhaust. Typically, balanced also includes additional benefits of exchanging heat (**HRV**) or heat and moisture (**ERV**).

C MOST EFFECTIVE

The most effective and efficient method of ventilation is an Energy Recovery Ventilator (ERV). Balanced ventilation minimizes pressure differences within the home, reducing the likelihood of pulling contaminants from garages, crawl spaces, attics, or wall cavities. In addition, ERVs transfer both heat and some of the moisture between the outgoing and incoming air streams. This reduces heating and cooling loads while helping maintain more stable indoor humidity throughout the year.

4

CATCH WHAT'S
LEFT

FILTRATION

Reducing the source of pollution, exhausting the really bad stuff, and replacing stale indoor air with fresh outdoor air all have a positive impact on indoor air quality.

However, the darn dog is still contributing hair, dirt, and dander inside. No matter what we do, there will still be a level of particulates in the air. **Filtration is the final step in the indoor air improvement process.**

During normal HVAC operation, a significant portion of the home's air repeatedly passes through the system filter, giving the HVAC system the opportunity to remove airborne particles over time. Originally, furnace filters were designed to protect the furnace motor from large particles. However, filters have evolved to enable the HVAC system to be a whole-home air filtration system. Filters have MERV Ratings (Minimum Efficiency Reporting Value) that identify average particle removal efficiencies across a range of particle sizes from 0.3 to 10 microns. The higher the MERV rating, the better the filter is at removing small particles.

That said, the higher a filter's MERV rating, the more it restricts airflow. When installing a filter in furnace ductwork, there are some practical limits as to how much restriction is reasonable. For example, most manufacturers rate the airflow capabilities of their furnaces at **0.5 inch to 0.7 inch external static pressure (ESP)**, which typically includes the resistance of the standard filter shipped with the unit.

A GOOD SOLUTION**DEEP MEDIA FILTERS, 4–5 INCHES THICK.**

High filtration efficiency with substantially lower pressure drop than 1-inch filters.

DESIGN THE HOME. NOT THE HOMEOWNER.

Builders cannot control how homeowners live, but they can control how well a home is designed. By incorporating source control, effective exhaust, balanced ventilation, and properly designed filtration into every project, builders can deliver homes that are healthier, more durable, and better prepared to maintain excellent indoor air quality for years to come.

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