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ENERGY SERIES: What about Ventilation?

"Ventilation" is "the natural or mechanical process of supplying conditioned or unconditioned air to, or removing air from, any space." "Infiltration" is the uncontrolled leakage of air through cracks and gaps in the building envelope, especially around windows and doors. Infiltration deals with uncontrolled situations. In our homes we want to be able to control air movement.

In the past, air leakage was relied on to provide ventilation. However, a leaky building does not guarantee good indoor air quality. Why? Air leaks often bring in air quality problems from attics, crawl spaces, and the outside. These can include:

- Humidity
- Radon from crawl spaces and under-slab areas
- Mold (fungi)
- Pollen and other allergens
- Dust and other particles
- Insects
- Pesticides

Also, if the building is leaky it can result in higher heating and cooling costs. Furthermore, new construction commonly includes strategies that reduce infiltration.

Indoor air typically contains more types, and higher concentrations of, pollutants than outdoor air, even in industrialized areas. Common home indoor air pollutants include biological pollutants (e.g., mold spores, dust mites, bacteria, viruses, pollen, animal dander); combustion pollutants (e.g., carbon monoxide); lead from old paint or lead-tainted soil; volatile organic compounds (VOCs) emitted from many paints, glues, and other building materials (this is called "outgassing"); and, in some areas, radon.

What types of ventilation are available?

NATURAL VENTILATION

Natural ventilation relies on the opening of windows and doors for the most part. Natural ventilation is mostly unreliable and uncontrolled air movement or infiltration that often does not ventilate the house uniformly, in addition to bringing in unwanted moisture. This type of ventilation is not recommended for tightly sealed homes.

SPOT VENTILATION

Spot ventilation in bathrooms and kitchens is another approach used to control humidity (moisture) and odors. Most building codes require that all bath and kitchen exhaust fans vent to the outside, not just into an attic or crawl space. Nearly all exhaust fans in standard construction are ineffective if they do not vent to the outside and are a prime contributor to interior moisture problems for buildings in hot-humid and mixed-humid climates. General guidelines call for providing a minimum of 50 cubic feet per minute (cfm) intermittent air flow for baths and 100 cfm intermittent for kitchens. Manufacturers typically show the cfm rating for any exhaust fan on the outside of the box or within the installation instructions. Overventilation can cause unwanted air to be drawn into the home, leading to energy inefficiency and humidity problems. To allow for proper run times, purchase an exhaust fan or ventilator with a humidistat or timer.
Exhaust fans can be noisy so consider the level of fan noise, rated by sones. Choose a fan with a sone rating of 2.0 or less; top quality models are often below 0.5 sones. See: http://www.nrel.gov/docs/fy03osti/26466.pdf for more helpful information on spot ventilation.

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WHOLE HOUSE VENTILATION

Improving spot ventilation will help control specific moisture problems but it may not provide adequate ventilation for the entire building. Another type of ventilation, whole-house, can exhaust air from the kitchen, baths, bedrooms and the living area. Whole-home ventilation systems are usually classified as exhaust ventilation if the system forces inside air out of the home, supply ventilation if the systems forces outside air into the home, or balanced ventilation if the system forces equal quantities of air into and out of the home. These systems can provide fresh, filtered, outside air in a controlled amount using the existing heating, ventilation, and air-conditioning (HVAC) system for even distribution and mixing. These systems involve exterior air intakes, ductwork running to the return air side of the HVAC system, dampers to allow control of the air intake and electronic controls to ensure that the HVAC fans operate often enough to draw in adequate fresh air.

Each system has advantages and disadvantages and must be correctly sized by a qualified or licensed HVAC company. For new construction and major renovations, the whole-house ventilation system should be included in the ventilation calculations when determining the cooling/heating requirements of the house, along with any filtering or dehumidification needs. In addition to ventilation, many homes in hot-humid and mixed-humid climates require mechanical dehumidification.

The Department of Energy recommends the practice of integrating mechanical ventilation into the HVAC system. This type of whole-house ventilation system is also required in some state building codes. A good resource for additional information about whole-house ventilation systems can be found at: https://www.nrel.gov/docs/fy03osti/26458.pdf

ATTIC VENTILATION

Most building codes require roof and soffit vents to exhaust humidity and moisture that could cause insulation or other building materials to deteriorate. Most homes should have a combination of a continuous ridge vent along the peak of the roof and continuous soffit vents at the eaves to provide the most effective ventilation. In general, a home should have approximately 1 ft^2 of net vent opening for every 150 ft^2 of ceiling or attic space; though there are some exceptions, so always refer to your local building code. If individual vents are used instead of continuous ones, the vents should be divided equally between the ridge and soffits. A good resource for additional information about ventilation can be found at: https://www.energy.gov/energysaver/weatherize/ventilation

All homes need ventilation to remove stale interior air, pollutants, and reduce excessive moisture and humidity. Researchers recommend whole-house mechanical ventilation systems for all homes. The amount of ventilation required depends on the number of occupants and lifestyle, as well as the size and volume of the building.

References and Resources

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Developed as part of the NASULGC/DOE Building Science Community of Practice. The factsheet editors are: Robert "Bobby" Grisso, Ph. D., Extension Engineer, Biological Systems Engineering; Martha A. Walker, Ph.D, Community Viability Specialist, Central District; Philip Agee, Ph. D., Assistant Professor, Department of Building Construction, and John Ignosh, Extension Specialist, Biological Systems Engineering, Virginia Tech.

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