ASHRAE's First Residential Ventilation Standard

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ABSTRACT

ASHRAE has recently published its first ventilation standard dedicated solely to residential applications—Standard 62.2-2003 (although Standard 62-1989 did mention residential application). This standard defines the roles of, and minimum requirements for, mechanical and natural ventilation systems and the building envelope intended to provide acceptable indoor air quality in low-rise residential buildings. The standard includes a minimum whole-house ventilation rate, local exhaust rates, and other kinds of source control. This paper summarizes the standard and indicates the key issues. Providing acceptable indoor air quality often depends more on source control than on ventilation itself. Source control depends on the interactions between ventilation and the building envelope. Unbalanced ventilation systems combined with a tight envelope can lead to building pressurization or depressurization. Building pressures can mitigate or enhance heat and mass transport through the building envelope, which can impact both energy use and moisture performance. These pressures can also impair systems and components not directly tied to ventilation, such as the operation of combustion appliances or entrainment of soil gas. Such "house-as-system" issues were important considerations in the development of the standard and will be discussed in this paper. ASHRAE is continuing to develop and enhance these efforts by using a continuous maintenance process for the standard and by creation of a companion guideline to reflect the state of the art.

INTRODUCTION

Because of the effects it has on health, comfort, and serviceability, indoor air quality in our homes is becoming of increasing concern to many people. According to the American Lung Association, elements within our homes have been increasingly recognized as threats to our respiratory health. The Environmental Protection Agency (EPA) lists poor indoor air quality as the forth largest environmental threat to our country. Asthma is the leading serious chronic illness of children in the U.S. Construction defect litigation and damage in new houses are on the increase, and most of this increase is related to moisture. Residential ventilation can improve many of these indoor air quality problems.

ASHRAE's Role

ASHRAE has long been in the business of ventilation, but most of that focus has been in the area of commercial and institutional buildings. Traditionally, residential ventilation was not a major concern because it was felt that between operable windows and envelope leakage, people were getting enough outdoor air. In the three decades since the first oil crisis, houses have gotten much more energy efficient. At the same time, the types of materials in houses have changed in response to peoples' needs. People have also become more environmentally conscious, not only about the resources they are consuming, but about the environment in which they live.

All of these factors have contributed to an increasing level of public concern about residential indoor air quality and ventilation. Where once there was an easy feeling about the

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residential indoor environment, there is now a desire to define levels of acceptability and performance. Many institutions—both public and private—have interests in indoor air quality (IAQ), but ASHRAE, as the professional society that has had ventilation as part of its mission for over 100 years, was the logical place to develop a consensus standard.

ANSI/ASHRAE Standard 62.2-2003, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings defines the roles of, and minimum requirements for, mechanical and natural ventilation systems and the building envelope intended to provide acceptable indoor air quality. It applies to spaces intended for human occupancy within single-family houses and low-rise multi-family structures, and it generally excludes institutional buildings.

The standard appears to be principally about ventilation, but the purpose of ventilation is to provide acceptable indoor air quality. However, the most effective strategy for keeping exposure to undesirable pollutants low is to keep them from being released to the general indoor environment in the first place. Such "source control" measures actually make up the bulk of the pages in the standard, especially when you consider that local ventilation is intended to exhaust pollutants from specific rooms before they enter the general environment. Whole-house ventilation is intended to bring outdoor air into the general environment to dilute the pollutants that cannot be effectively controlled at the source.

Background

Currently, two of the most important and contentious areas in which ASHRAE works are energy efficiency and indoor air quality. Any reader familiar with ASHRAE will be familiar with standards numbered 62 and 90, as rarely does an issue of *ASHRAE Journal* or *ASHRAE Transactions* go by without significant mention of them. *ANSI/ASHRAE Standard 62-2001, Ventilation for Acceptable Indoor Air Quality* is the parent standard from which our residential version came.

Standard 62 has been around a long time and has changed considerably over that period. The last full revision of Standard 62 was approved by ASHRAE in 2001, but few changes were made since the 1989 version, and a full publication is expected at the end of 2004. While 62-2001 claims to cover spaces intended for human occupancy, it focuses on commercial and institutional occupancies; many occupancies are not explicitly covered at all. Residential occupancies get but half a page.

The residential requirements in 62-2001 include specific ventilation flow rates for kitchens, baths, toilets, garages, and common areas, as well as air exchange rates for living areas. The air change rate of 0.35 ach for living spaces can be provided using infiltration and natural ventilation, but the standard does not really describe how. Because its application is unclear, the residential requirements of 62-2001 could either be quite onerous or mean virtually nothing, depending on one's interpretation.

The audiences and rationale for ventilation are sufficiently different in residential and commercial buildings that it can be difficult to give due justice to both constituencies in a single standard. In the summer of 1997, ASHRAE decided to develop a separate residential standard, numbered 62.2, and created a new committee to develop it. Now that Standard 62.2 is published, Standard 62 will be renumbered 62.1 at its next publication.

Overview of the Standard

In developing this standard, ASHRAE recognized that there were many different kinds of houses, many different climates, and many different styles of constructions. To accommodate these differences, the major requirements were designed with several alternative paths to allow users flexibility. Some requirements are performance based, with specific prescriptive alternatives. The standard recognizes that there are several different ways to achieve a specified ventilation rate and allows both mechanical and natural methods.

There are three sets of primary requirements in the standard and a host of secondary ones. The three primary sets involve whole-house ventilation, local exhaust, and source control. Whole-house ventilation is intended to dilute the unavoidable contaminant emissions from people, from materials, and from background processes. Local exhaust is intended to remove contaminants from those specific rooms (e.g., kitchens) whose intended functions necessarily produce airborne contaminants. Other source control measures are included to deal with those sources that can be reasonably anticipated and dealt with.

The secondary requirements focus on properties of specific items that are needed to achieve the primary objectives of the standard. Examples of this include sound and flow ratings for fans and labeling requirements. Some of the secondary requirements as well as the guidance in the appendices help keep the design of the building as a system from failing because ventilation systems were installed. For example, ventilation systems that excessively push moist air into the building envelope can lead to material damage unless the design of the envelope is moisture tolerant.

Whole-House Rates. The first thing people tend to look at in a ventilation standard are the ventilation rates, specifically the whole-house rates. From 1989 onward, the whole-house rate in Standard 62 was set at 0.35 ach, but no less than 15 cfm/person (7.5 L/s/person). The default number of people was assumed to be two for the first bedroom, plus one for every additional bedroom.

In 62.2-2003, the committee decided to make the target ventilation rate the sum of the ventilation rates necessary to dilute background sources plus sources attributable to occupancy. To find the total amount of outside air needed, one needs to add 3 cfm/100 ft^2 (15 L/s/100 m^2) to the 7.5 cfm required per person (3.5 L/s/person). Thus, the air change rate requirement will vary by the size of the house and the occupancy.

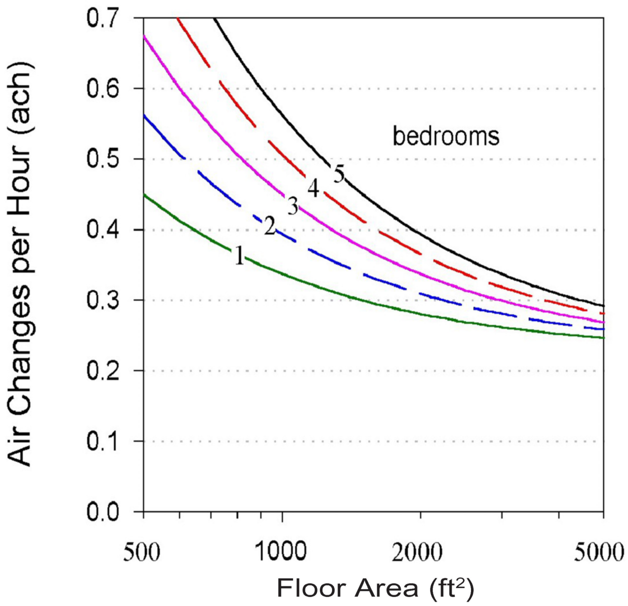

Figure 1 *Required ventilation for typical houses.*

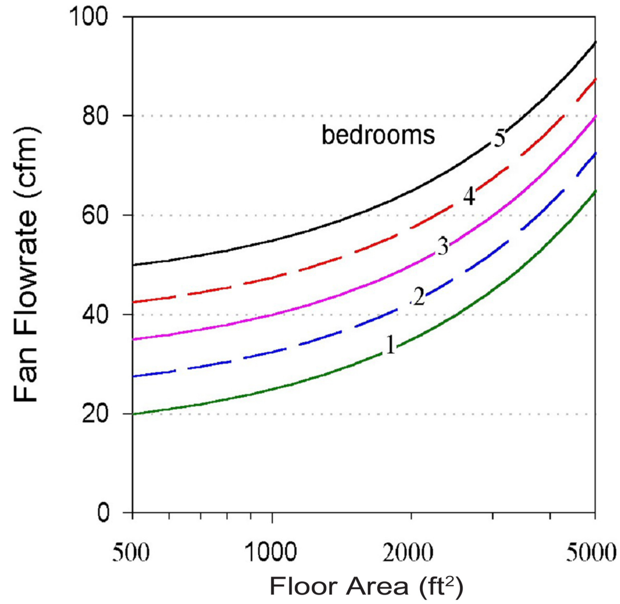

Figure 2 *Minimum size of whole-house ventilation fan, assuming continuous operation and default infiltration credit.*

For larger houses the 62.2 value comes out smaller than the 0.35 ACH of 62-2001, but for small houses the 62.2-2003 rates are higher.

Mechanical Ventilation

With some exceptions, 62.2-2003 requires that a fan be used to provide whole-house ventilation. To size the fan, we can start with the values in Figure 1, but the standard allows credit to be taken for infiltration (including natural ventilation). The standard has a default infiltration credit (of 2 cfm/100 ft^2 [10 (L/s)/100 m^2]) that can be used in lieu of an airtightness measurement. Figure 2 shows the required continuous whole-house ventilation fan size using this default infiltration credit.

The standard allows intermittent whole-house mechanical ventilation to be used as an option to continuous ventilation. The size of the fan can be calculated from the Figure 2 values, and the fractional run time with a formula given in the standard. For designs in which the total cycle time is over three hours, the fan size must be further increased to account for the poor efficiency associated with running the fan only rarely (i.e., an infrequently operated fan needs to push through a larger total air volume than a continuously operating one to control the same pollutant). The fan must run at least one hour out of every twelve.

The standard allows approaches in which air is drawn into the house through the forced air system, provided that there is a timer or other mechanism to ensure a minimum amount of ventilation each day and such that some minimum cycle time can be estimated. Such systems currently exist in the market.

Natural Ventilation

Figure 2 represents the required total mechanical air exchange, but there is also a requirement that each room have the capacity for additional ventilation. A dwelling that has 4% of the floor area as operable openings would meet this requirement, provided the openings do not present a hazard when used to provide ventilation. Such hazards need to be evaluated locally, but could include proximity to local sources of air or noise pollution (e.g., a freeway, an airport, industrial sites, etc.). Security and operability may be other reasons to exclude this as an option. In lieu of a window (e.g., for completely interior habitable spaces), a local mechanical ventilation system may be provided.

Infiltration

The default infiltration credit corresponds to a rather tight new house compared to the stock. Unlike standard 62-2001, 62.2-2003 does not allow any additional credit to be taken for infiltration unless it can be demonstrated—and it can only be demonstrated in an existing home. A larger infiltration credit can be used if the air leakage is greater than the default, as demonstrated by ASHRAE Standard 136-1993.

For example, Figure 3 shows minimum leakage rates for an existing house in a mild climate to meet requirements without any mechanical ventilation. The figure is labeled both in

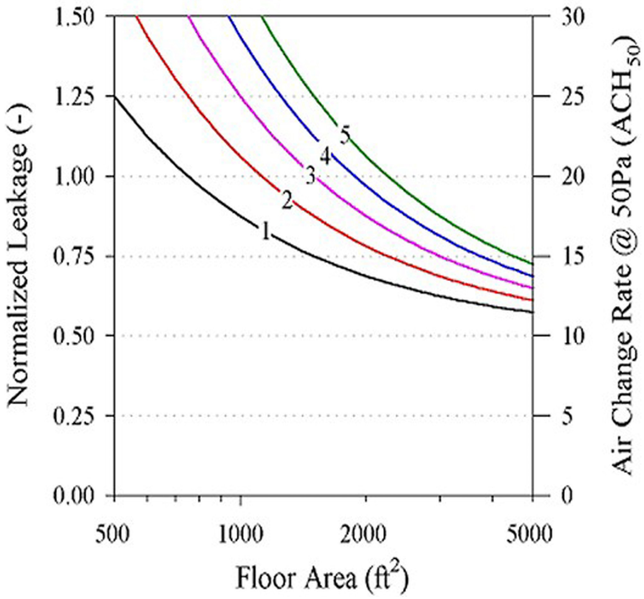

Figure 3 *Minimum leakage levels needed to meet whole-house ventilation requirements by infiltration alone in a mild climate. Approximate conversion to air changes at 50 Pa is included for convenience. Normalized leakage is a dimensionless quantity.*

the normalized leakage parameter of Standard 119 and the more common air changes at 50 Pa.

Extra infiltration credit for new construction is not currently allowed in 62.2 because, from a practical standpoint, it may be unreasonable to design a new house with the intent of making it leaky. The discomfort, energy impacts, and possible moisture problems of intentionally leaky houses make it an unattractive alternative.

Research has shown, however, that older houses in the U.S. are often quite leaky (Sherman and Matson 1997) and are quite likely to meet the requirements of this standard on infiltration alone. Their estimate of the average airtightness of the stock is approximately an ACH_{50} of 24. Those wishing to apply 62.2 to existing houses in the context of home energy rating systems or utility programs can make good use of the infiltration credit for measured airtightness to reduce or eliminate the requirements for additional whole-house mechanical ventilation.

OTHER REQUIREMENTS

The standard is more than just whole-house rates. It also contains requirements to control local pollution either by direct source control or by local exhaust. It contains requirements to ensure that any systems intended to meet the ventilation requirements can and do deliver ventilation without, in themselves, causing additional problems.

Local Exhaust

Houses are designed to have certain activities in certain rooms. Kitchens, bathrooms, lavatories, laundries, utility rooms, and toilets are all built to accommodate specific functions. These functions produce pollutants such as moisture, odors, volatile organic compounds, particles, or combustion by-products. The purpose of local exhaust requirements is to control the concentration of these pollutants in the room in which they were emitted and to minimize the spread of the pollutants into other parts of the house. Local exhaust ventilation is source control for the sources of pollution that are expected in certain rooms. The standard requires mechanical exhaust in some of these rooms.

Unlike the whole-house rates, which are most effective when they are operated continuously, source control through exhaust is best operated when the source of pollution is active. The basic rates in the standard are for intermittently operated exhaust fans. For kitchens the basic rate is 100 cfm (50 L/s) and for bathrooms the rate is 50 cfm (25 L/s).

Continuous local exhaust is allowed as an alternative to give the designer the flexibility of making the local exhaust part of a larger ventilation system (e.g., a continuous, whole-house ventilation system). The rate in bathrooms is 20 cfm (10 L/s). Because of the concern about migration of pollutants out of the kitchen, continuous kitchen ventilation cannot be used unless the exhaust rate is at least five kitchen air changes per hour. For larger kitchens, this value will be bigger than the 100 cfm (50 L/s) required for intermittent operation, but for small kitchens such as those found in many apartments, this requirement may allow central exhaust systems to be used.

Standard 62-2001 allowed operable windows as a substitute for exhaust ventilation requirement. Standard 62.2-2003 requires natural ventilation in all habitable spaces (that do not have local ventilation) but does not allow natural ventilation to meet the local ventilation requirement in bathrooms. This is because of the low pollutant removal efficiency of operable windows (e.g., a window could just as easily allow moisture to blow into the rest of the house as out of the bathroom).

Laundries can meet the requirement using their dryer vent; toilet compartments can meet the local exhaust requirement through a connected bathroom. There are no local exhaust requirements for other rooms having unvented combustion equipment, lavatories, garages, home offices, or hobby or utility rooms.

Ventilation System Requirements

The ventilation system, whether it be natural or mechanical, has to meet some basic requirements.

- ***Capacity and Distribution.*** Because there will sometimes be activities that produce pollutants in excess of those handled by the basic ventilation rates, the standard requires that each room have either a window or meet the local exhaust requirements for bathrooms These kinds of activities might include cleaning, smoking, parties, painting, etc. The requirement would usually be met by the code-required amount of window area. There is no explicit requirement, however, for air distribution.

- ***Flow Rating.*** To make sure that the fan actually delivers the amount of air intended, the standard requires either that the airflow rate be measured in the field or that certain prescriptive requirements be met. These prescriptive requirements deal with the size and length of ducting, as well as the fan manufacturer's ratings.

Source Control

While many of the potential sources of pollution are beyond the control of a standard such as 62.2, there are various measures that can reasonably be taken to reduce pollutant sources at the design stage and, thus, reduce the need for excessive ventilation. Indeed, for some sources, ventilation increases pollutant level. This section summarizes some of the source control measures in the standard.

Outdoor Air. Outdoor air can be a source of pollution. The ventilation rates in the standard assume that the outdoor air is relatively clean and able, therefore, to improve indoor air quality by diluting indoor pollutants. When outdoor air quality excursions are foreseeable (e.g., excessive ozone) the standard requires that the occupants be able to reduce whole-house ventilation rates. In humid climates, the moisture that outdoor air can contain should be considered as a contaminant, and suitable source control measurements should be undertaken to mitigate any undesirable impacts (e.g., mold).

Ventilation Inlets. Even if regional outdoor air is of good quality, pollution in the building's microclimate can be of poor quality. The standard requires that there be adequate separation between inlets and exhausts or other known sources of pollution.

Garages. Attached workspaces and garages can be a source of significant pollution. Carbon monoxide is of particular concern when combustion (e.g., from cars) is taking place. The standard requires that any air-handling equipment placed in these spaces be sealed to prevent entrainment of these contaminants.

Clothes Dryers. Standard 62.2 requires that clothes dryers be vented directly outdoors both to minimize moisture and laundry pollutions. Laundry rooms that are intended to have clothes dryers (i.e., with installed vents) are exempt from requirements for exhaust fans or windows.

Moisture Migration. If moisture is forced into building cavities or the building envelope where it is able to condense, molds and other microbiological contamination can become a threat to indoor air quality and material serviceability. The standard restricts the use of some ventilation methods (at excessive rates) in some applications (e.g., supply ventilation in very cold climates) that would contribute to this effect unless the building envelope has been designed to accept it. The primary purpose of 62.2 is to provide ventilation to dilute indoor contaminants. This can, if not handled properly, cause or exacerbate moisture problems. The system, the envelope, and the climate must all be properly considered in the design in order to keep that from happening.

Combustion Appliances. Keeping combustion appliances from becoming indoor pollutant sources is a concern of the standard. Vented combustion appliances can become a problem if there is any significant spillage or backdrafting. Standard 62.2 is not a standard about combustion safety, but indoor combustion sources can be a significant source of pollution, and the requirements of 62.2 could have adverse impacts on those sources. The standard mostly considers the impact that envelope tightness and/or ventilation systems could have on the operation of a combustion appliance. Backdrafting is not always a ventilation issue. Excessive exhaust ventilation, however, can cause backdrafting.

To minimize the potential for backdrafting, the recent addendum 62.2a forbids naturally aspirated combustion appliances in the conditioned space if the total of the largest two uncompensated exhaust appliances exceed about 1 ach of ventilation (not counting any summer cooling fans). Many new houses would be exempt from these restrictions either because all of their vented combustion appliances are outside the pressure boundary or are direct-vent, or because their two biggest exhaust appliances fall below the limit.

Unvented combustion sources such as indoor barbecues, vent-free heaters, cigarettes, decorative gas appliances, or candles can be the cause of high-polluting events and are presumed to be under the control of the occupants. Occupants are presumed to know when such sources are important and to take appropriate action—such as opening windows—when necessary. Despite the fact that they are known sources of contaminants, unvented combustion space heaters are explicitly excluded in the scope of the standard.

BEYOND REQUIREMENTS

The formal requirements in 62.2 constitute only a small fraction of the total number of pages. The committee felt it would be useful to users of the standard for it to contain information that goes beyond the requirements or to give some guidance on how to make choices to meet the standard.

Operations and Maintenance

While the standard does not contain operation and maintenance (O&M) requirements, it does contain labeling and information requirements. The committee felt that acceptable indoor air quality could not be achieved if the occupants did not operate and maintain the ventilation system consistent with its design intent. Building occupants need to be informed of how to do that.

The philosophy behind this is that the building should be designed so it can be ventilated properly. The standard requires that whoever is designing the ventilation system must supply appropriate documentation to the occupant but is not responsible if the occupant fails to operate or maintain it correctly. The standard gives some guidance on the kind and format of information that should be given to the occupants.

Particulate Filtration

Using ASHRAE Standard 52.1-1999, Standard 62.2-2003 requires a MERV 6 filter (which is approximately 60% filtration efficiency of 3 micron particles) in air handlers. Principally, this requirement is intended to keep the duct system, the air handler, and the heat exchange components from becoming pollutant sources as dirt builds up on them. The filtration also benefits the thermal performance of the system as well as reducing airborne particles to which the occupants are exposed. Any other dedicated supply air system would also require filtration.

Source Control and Exposure

While the body of the standard does contain some specific source control requirements, the standard as a whole does not address all of the contaminants that may be present in a house. The standard addresses things like installed appliances but does not really have requirements for the sources people may introduce into the building in the form of furniture, household goods, candles, pets, smoking, hobbies, or other activities.

Control of moisture is often a key to keeping microbiologicals from becoming either a health hazard or a serviceability problem. Depending on the climate, either indoor or outdoor moisture can be a problem if it is allowed to come in contact with certain materials. Design of the building envelope is a key part of moisture control and is discussed briefly. Detailed envelope design recommendations are beyond the scope of the standard, however.

HVAC System

The design and operation of the HVAC system can affect the pressure in the living space, which can cause moisture, backdrafting, radon entry, or other kinds of IAQ problems. In general, depressurization has more potential risks, but pressurizing a building in a cold climate can cause interstitial condensation in the building envelope.

Standard 62.2 has several compliance paths and allows a fair degree of flexibility in selecting the ventilation system. To help the designer, the standard also contains some guidance on when to select certain kinds of systems and when to use them. It also contains guidance on the energy impacts of different choices. The pluses and minuses of the most common systems are summarized and can help the user of the standard make an informed choice of approach.

WHAT DOES IT MEAN?

It is often difficult to read a standard and understand what the purpose of a particular requirement is, let alone what the rationale for it is. Even those who have been close to the process may misstate or confuse particular issues. Thus, there are a lot of questions that often get asked. Appendix A proposes and then answers such questions regarding the new standard.

New Construction

Standard 62.2 is not a code, but it is written so that it could be adopted as one, and there are those who will try to have it adopted as one. Whether or not it is actually adopted, 62.2 represents good practice, as defined by ASHRAE; thus, it behooves those designing and building new homes to meet it. HVAC professionals have a professional obligation to specify and follow standards that define good practice, as should others in the building trade. Following this standard offers benefits to the user and some level of protection for the designer.

There is obviously a cost in meeting a standard such as 62.2. There can be a first cost impact during construction or renovation of a home in order to meet it. Reasonable estimates from case studies can be in the range of $200, although the real answer depends on the starting point; it is always possible to design the system to cost much more.

There can also be an operating cost impact because of the need to run fans and to condition ventilation air. Again, the actual costs will depend on the basis for comparison. A drastically underventilated house would show a significant cost penalty, but a house that was overventilated could show a savings. While the cost of installing and operating ventilation systems can be accurately calculated, there are very real but not easily quantifiable costs related to inadequate ventilation, including increased health care costs, increased loss of work time due to illness, decreased durability, etc.

The purpose of Standard 62.2, however, is not to minimize first cost or operating cost, but to provide the necessary building service of minimum acceptable indoor air quality. Professionals have an obligation to society to protect health and safety, whether it is a code or not. This ethic is what separates professionals from other kinds of interests.

Thus, a standard such as 62.2 is of great benefit to the industry because it defines a demonstrable set of criteria for acceptability. The user of the standard can show a customer, client, or court that he or she has done what the profession says is needed and, thus, has met his or her professional responsibility. The clients and occupants have some level of assurance that the building will perform and the professional has some level of protection by doing due diligence.

Another benefit to a standard such as 62.2 is to provide a level playing field. If all those competing for a particular job or in a particular market are required to meet 62.2, one cannot gain a competitive advantage by providing poor indoor air quality and/or insufficient ventilation. Ideally, those who promote unacceptable ventilation solutions would be eliminated from the marketplace.

Existing Buildings

Standard 62.2-2003 is written so that it can be applied to existing buildings, but it is not anticipated that it will become a retroactive code requirement. It could, however, be useful at particular times in the life of an existing building. For example, evaluating a home against the 62.2 requirements at time of sale could be an important consideration for a home buyer.

Programmatically, Standard 62.2 could be instrumental in removing barriers to increased energy efficiency. Certain retrofits, such as duct or envelope tightening, have potentially large impacts on ventilation and IAQ. These impacts have slowed or stopped retrofit programs that are concerned about liability and IAQ. Ensuring that any retrofit program leaves a house meeting Standard 62.2 provides some protection for the institution promoting the retrofits. Similarly, home energy rating and similar programs could require compliance with 62.2 just as they require that appliances meet manufacturers' safety instructions.

SUMMARY

Taken as a package, ASHRAE Standard 62.2-2003 represents a significant step forward for ASHRAE in applying professional consensus standards to the residential area. Houses meeting this standard will have improved indoor air quality, reduced moisture problems, and provide better value to the homeowner and occupant than those that do not. The standard represents a minimum set of requirements and it may be beneficial to the occupants to go beyond that minimum, depending on circumstances.

Standard 62.2-2003 is a beginning. Field experience and changes in technology and user expectations will require that changes be made to the standard on an ongoing basis. For this reason, ASHRAE has designated this standard to be on continuous maintenance and, even now, new addenda are being considered.

ACKNOWLEDGMENT

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REFERENCES

ASHRAE. 1988. *ANSI/ASHRAE Standard 119-1988, Air Leakage Performance for Detached Single-Family Residential Buildings*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

ASHRAE. 1993. *ANSI/ASHRAE Standard 136-1993, A Method of Determining Air Change Rates in Detached Dwellings*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

ASHRAE. 1999. *ANSI/ASHRAE Standard 52.2-1999, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

ASHRAE. 2001. *ANSI/ASHRAE Standard 62-2001, Ventilation for Acceptable Indoor Air Quality.* Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

ASHRAE. 2003. *ANSI/ASHRAE Standard 62.2-2003, Ventilation and Acceptable Indoor Air Quality.* Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

Grimsrud, D.T., and D.E. Hadlich. 1999. Residential pollutants and ventilation strategies: Volatile organic compounds and radon. *ASHRAE Transactions* 105(2):849-863.

Hadlich, D.E., and D.T. Grimsrud. 1999. Residential pollutants and ventilation strategies: Moisture and combustion products. *ASHRAE Transactions* 105(2):833-848.

Sherman, M.H., and D.J. Dickerhoff. 1998. Air tightness of U.S. dwellings. *ASHRAE Transactions* [Report No. LBL-35700].

Sherman, M.H., and N.E. Matson. 1997. Residential ventilation and energy characteristics. *ASHRAE Transactions* 103(1) [LBNL-39036].

APPENDIX A
QUESTIONS AND ANSWERS ABOUT 62.2-2003

Q: *Why do we need 62.2? Isn't what is in 62-2001 good enough?*

A: The half-page of residential requirements in 62-2001 has many shortcomings. First and foremost, it is not in code language and could not easily be adopted as a code. Secondly, it is very vague. Some have interpreted it to mean almost nothing, while others have interpreted its rate requirements to be rather severe. Finally, it leaves out many issues that were felt both by the 62R public review and by the current committee to be important in the residential environment. In short, it does not come close to meeting the charge that ASHRAE has laid out.

Q: *Why could not the residential parts be handled under Continuous Maintenance with the rest of 62-2001?*

A: ASHRAE felt that it was important to separate the residential parts from the commercial and institutional parts for several reasons. The target audiences were very different and users of the residential parts wanted a document that addressed their needs. The technical expertise for the committee resided in different people and, thus, there is not enough expertise on SSPC 62. Finally, the basic assumptions about who controlled the sources and the systems, who was responsible for design, operations, and maintenance, and what kinds of excursions might be tolerable were very different in a home environment.

Q: *How do the rates in 62.2-2003 compare with 62-2001?*

A: The whole-house rate in 62.2 depends less on the floor area and ceiling height of the house than does that of 62-2001. Expressed in airflow, the rates fall in a narrower band of flow. In general, the airflow requirements in 62.2 are mostly lower than those of 62-2001 but must be met with mechanical ventilation. The local exhaust rates are in the main the same as for 62-2001. In both cases, however, 62.2 contains more detail and is clearer on how to apply the rates.

Q: *Does 62.2-2003 credit occupant use of windows?*

A: Yes, in some ways. There is a ventilation capacity requirement to allow for unusual events; this is generally satisfied by windows and it is assumed that the occupants will know when to use them. The whole-house requirement, however, may not be met with windows, except under some highly restrictive conditions. Kitchen and bath ventilation requirements can only be met with mechanical exhaust.

Q: *Does the standard give credit for infiltration?*

A: Some. The standard has a default credit based on a relatively tight house. For new houses, you cannot use any other credit unless a licensed design professional approves it as part of an alternative design. For existing homes, however, some measured envelope leakage (using ASHRAE Standard 136) can be used to offset the mechanical ventilation requirement.

Q: *How big a fan would I need to mechanically ventilate a house?*

A: The calculation depends on the size of the house but in using the default infiltration credit, the whole-house mechanical ventilation requirement typically falls in the 40-60 cfm range.

Q: *What has changed for kitchen ventilation?*

A: Standard 62.2 requires that a fan be installed in the kitchen (and also the bathroom); windows alone are not usually sufficient to control the moisture and cooking by-products. Because of the low capture efficiency at low air flows, range hoods are required if the installed exhaust capacity does not provide at least five kitchen air changes per hour.

Local Exhaust Airflow Rates

Application	Continuous Flow	Intermittent Capacity
Kitchen	5 ach	100 cfm (50 L/s)
Bathroom	20 cfm (10 L/s)	50 cfm (25 L/s)

Q: *Are there new rooms that require local ventilation?*

A: All rooms are required to have some kind of ventilation capacity. This is normally met with operable windows. Bathrooms and kitchens are the only rooms required to have mechanical exhaust systems all the time. Laundries are presumed to be ventilated by their dryer (vent); toilets are presumed to be ventilated by their attached bathroom.

Q: *Can recirculating fans meet any local ventilation requirements?*

A: No. The local ventilation requirements generally specify that the air must be exhausted outside. Supplemental filtration, however, is not prohibited in any room.

Q: *Does this mean that houses have to have many fans to meet the standard?*

A: No. A large house may have several rooms that require exhaust, but even in those situations in which mechanical whole-house and local ventilation is required, the standard can always be met with one or two fans, provided remote-mounted, branched exhaust fans are used. Certainly, there will be cases in which one may choose to install many individual fans, but the standard allows flexibility of design. The designer will need to consider first cost, energy cost, and value to the customer in making that determination.

Q: *What specifications do the various fans have to meet?*

A: Because people will disable noisy fans, most surface-mounted fans must meet sound requirements. Such continuous fans need to meet a 1 sone rating; intermittent ones must meet a 3 sone rating. Because different fan and duct arrangements may not deliver the proper amount of air, fans must either have their installed flow rate measured or must meet prescriptive requirements on sizing and rating. Finally, ducted supply systems and the central air handler must meet minimum filtration efficiency of MERV 6.

Q: *Can the central air handler be used to supply the whole-house ventilation?*

A: Yes, but only if it has a timer control. Systems that pull in outdoor air through the air handler fall into the category of intermittent, whole-house ventilation. The standard allows various types of intermittent ventilation schemes to be used to meet the whole-house requirement. A key provision, however, is that they must be controlled to operate at least one hour in twelve and that the minimum daily on-time can be estimated. The standard describes how to increase the intermittent ventilation rate to make it equivalent to the continuous requirements.

Q: *Are there special considerations in hot, humid climates?*

A: Yes. Outdoor moisture is of particular concern in hot and humid climates. Ventilation often increases rather than decreases indoor humidity. Mechanical cooling (or dehumidification) is often the only way to reduce indoor moisture levels. Because of the risk of condensation in or on the building envelope, whole-house exhaust ventilation above a certain limit should not be used unless a moisture-tolerant envelope design exists.

Q: *Can any required mechanical ventilation cause problems for vented combustion appliances?*

A: Possibly, but probably not at minimum levels. Depending on the tightness of the envelope, exhaust fans can depressurize the house and cause naturally aspirated combustion appliances in the conditioned space to backdraft. The problem is less likely to occur in a leaky house, but even in a tight house the minimum air flows required by the standard are unlikely to cause any problems. Clothes dryers alone, for example, normally exhaust more than is required to meet 62.2. Backdrafting can still be an important issue, but it is not likely to be caused by the minimum requirements of 62.2. The real depressurization culprits are often poor chimney design or large down-draft or commercial-size kitchen ventilation systems that are getting popular in upscale homes. These flows can be ten times higher than any requirements of 62.2.

Q: *What are the requirements for naturally aspirated combustion appliances in the conditioned space?*

A: If the two largest uncompensated exhaust devices are not too large, there are no other requirements. Otherwise, the appliance must pass an industry-approved backdrafting test, as described in an appendix. Sealed combustion appliances or appliances outside the pressure envelope are not affected by these requirements.

Q: *What are the requirements for unvented combustion appliances?*

A: The standard does not address the use of unvented combustion appliances; unvented combustion space heaters are explicitly excluded from the scope of the standard. These appliances are treated as unusual sources, and it is assumed that occupants will use them wisely and open windows as appropriate. Even if the combustion is perfect, the minimum rates in this standard may not be enough to keep the moisture and other combustion products from causing a problem without some occupant intervention.

Q: *What are the requirements relating to attached garages?*

A: Because of the health hazards associated with carbon monoxide and other pollutants from the garage getting into the house, the committee has been quite concerned about this issue. Standard 62.2 requires that any air-handling equipment placed in the garage be demonstrably sealed to the same specifications currently being used in California.

Q: *Is there a requirement for a carbon monoxide alarm?*

A: As can be seen from the last several questions, CO might be expected in some circumstances that still meet the minimum requirements of 62.2. Because of concerns about reliability, however, CO alarms are not currently required in the standard, but the committee has committed to review the issue as technology changes.

Q: *Are there really as many new requirements as it seems?*

A: Not really. Very few of the requirements in the standard are not directly related to requirements in relevant codes, standards, or guidelines currently in use. Many of the requirements in the standard are already code in parts of the U.S., but perhaps none of them is code everywhere. The standard is ASHRAE's best estimate of the minimum set of requirements necessary to achieve the objective. For some jurisdictions, adopting it as a code would entail many new requirements; for others, there may be almost none.

Q: *Does the document contain more than just requirements?*

A: Yes. There are more pages of guidance in the appendices than there are of requirements in the body of the standard. Users of the standard need some guidance in selecting among the alternative paths and in understanding what ramifications some choices may have. Standard 62.2-2003 has informative appendices on operations and maintenance and on HVAC systems. This information may eventually be transferred to companion documents that are currently being developed by the committee.

Q: *What data were used to develop this standard?*

A: Like almost all consensus standards, the primary data source is the assembled knowledge, experience, and expertise of the technical experts composing the committee. Between the committee and other participants, there are centuries of experience on relevant topics. A significant amount of the archival research work can be found in the proceedings of the 1999 ASHRAE Annual Meeting in the papers by Grimsrud and Hadlich.

Q: *Does the draft standard address energy issues?*

A: Not primarily. Conditioning ventilation air has, of course, an energy cost, which can be quite large in very cold or hot, humid climates. The committee considered energy impacts in its debate but acted only when it was clear that there was always a better way to do something. Many of the allowed ventilation systems (e.g., natural ventilation, infiltration, or intermittent whole-house ventilation) can be quite energy inefficient in some circumstance. Fans themselves have differing efficiencies. Heat recovery ventilation can be cost-effective in some circumstances. These issues are important in the overall design of a good house, but they are beyond the scope of this standard.

Q: *What is the status?*

A: Standard 62.2 became an ASHRAE standard in fall of 2003 and received ANSI approval early in 2004. It is under continuous maintenance and several addenda are in process There are two companion documents under development. There is a user's manual, which is intended to assist a user in applying the standard. There is also a guideline, which is intended to address issues that go beyond the minimum requirements of the standard itself. All of these activities are under the direction of SSPC 62.2.