ASHRAE'S RESIDENTIAL VENTILATION STANDARD: *EXEGESIS OF PROPOSED STANDARD 62.2*

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ABSTRACT

In February 2000, ASHRAE's Standard Project Committee on "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings", SPC 62.2P, recommended ASHRAE's first complete standard on residential ventilation for public review. The standard is an attempt by the Society to address concerns over indoor air quality in dwellings and to set minimum standards that would allow for energy efficiency measures to be evaluated. The standard has requirements for whole-house ventilation, local exhaust ventilation, and source control. In addition to code-intended requirements, the standard also contains guidance information for the designer and/or user of the standard. This report summarizes the draft standard and attempts to address questions and concerns that those potentially affected by the standard might have. This report may also be of use to those considering public review comments on the draft standard.

Keywords: residential, ventilation, standard, code, environment, indoor air quality

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 a wide variety of sources such as the American Lung Association [ALAM 1999], the Environmental Protection Agency (http://www.epa.gov) and the World Health Organization (http://www.who.org) indoor air quality is a serious concern. For example, elements within our homes have been increasingly recognized as threats to our respiratory health; indoor air quality is often listed in the top five largest environmental threats to our country; asthma is leading serious chronic illness of children in the U.S. [ALA 1999] and moisture-related construction defects and damage are on the increase in new houses. Minimum 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 the focus of that effort has been in the area of commercial and institutional buildings. Residential ventilation was traditionally not a major concern because it was felt that between operable windows and envelope leakage, people were getting enough air. In the quarter of a century since the first oil shock, houses have gotten much more energy efficient. At the same time, the kinds of materials and functions in houses were changing in character in response to peoples needs. People were also becoming more environmentally conscious not only about the resources they were consuming but about the environment in which they lived.

All of these factors contributed to an increasing level of public concern about residential indoor air quality and ventilation. Where once there was an easy feeling about the 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. That standard is now ready for its first public review.

ASHRAE Standard 62.2P (in draft), "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. 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 fresh 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 that ASHRAE works in are energy efficiency and indoor air quality. Any reader of

ASHRAE Journal will be familiar with standards numbered 62 and 90 as rarely an issue goes by without some significant mention of them. Standard 62, "Ventilation for Acceptable Indoor Air Quality" is the parent standard that our residential version came from.

Standard 62 has been around a long time and has changed considerable over that period. The last full revision of Standard 62 was approved by ASHRAE in 1989 and with minor changes in 1999. While standard 62 claims to cover all spaces intended for human occupancy, it focuses on commercial and institutional occupancies; many occupancies are not explicitly covered at all. Residential occupancies got only half a page.

The residential requirements in Standard 62 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 air change per hour for living spaces can be provided using infiltration and natural ventilation, but the standard does not really describe how. Depending on one's interpretation, the residential requirements of 62-89 could either be quite onerous or mean virtually nothing.

In the early 1990s a new committee was formed to update 62-89. One of the recognized needs of the revision was to expand the residential section. The product of that committees work was a completely new document, known simply as "62R." (See Steve Taylor's article in the Feb 1996 ASHRAE Journal [Taylor, 1996].) While that ill-fated document never got past its first public review, it did contain an entire chapter on residential ventilation and actually began to provide useful guidance to the builder.

Rather than attempt to resolve the large number of (especially residential) comments that 62R generated, ASHRAE decided, in the summer of 1997, that the better course of action was to change the structure of how it dealt with such High Profile Standards (HPS). At that meeting it was decided to split off the residential section from the "main" standard and let it follow a path of its own[1]. Practicalities of Standards processing aside, the key reason for the separation was that the users of and assumptions for a residential standard are qualitatively different from that of a commercial-institutional one.

In a commercial building, for example, the occupants who are subject to the indoor environment are often very different people from those controlling the HVAC system, paying the bills; controlling the sources of pollution; and those responsible for operations and maintenance. Typically, in houses, most of these functions fall to the same group of people. Thus assumptions about the level of protection, knowledge and control are very different in the two cases.

Overview of the Standard

In developing this standard, the committee recognized that there were many different kinds of houses, many different climates, and many different styles of construction. To accommodate these difference, the major requirements were designed with several alternate 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 main primary sets of 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) in which sources are expected to be produced by design. Other source control measures are included to deal with those sources that can reasonably be anticipated and dealt with.

The secondary requirements focus on properties of specific items that are needed to achieve the main 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 push moist air into the building envelope can lead to material damage unless the design of the envelope is moisture tolerant.

[1] The "main" standard is currently 62-99 and continues on with the non-residential focus. Should the residential standard 62.2P be published by ASHRAE, the residential parts of the main standard will be removed and it will get renumbered to 62.1.

WHOLE-HOUSE RATES

The first thing people tend to took at in a ventilation standard are the rates, specifically the whole-house ventilation rates. In Standard 62 the whole-house rate was set at 0.35 air changes per hour, 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 62.2P the committee decided to make the target ventilation rate comprise a sum of the ventilation necessary to dilute background sources and sources attributable to occupancy. To find the total amount of outside air needed one needs to add 2 cfm/100 sq. ft. (10 l/s/100 sq. m.) to the 15 cfm/person (7.5 l/s/person). Thus the air change rate requirement will vary by the size of the house and the occupancy. Figure 1 shows the required air change for typical houses:

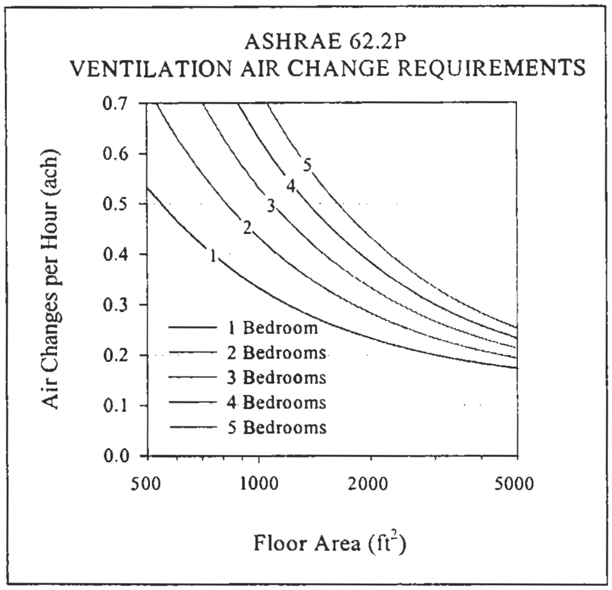

Figure 1: Required Ventilation for different size houses

For larger houses the 62.2P value comes out smaller than the 0.35 ACH of 62-99, but for small houses the 62.2P rates are higher.

Mechanical Ventilation

62.2P requires that a fan be used to provide minimum ventilation rates. 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 1 cfm/100 sq. ft. [5 l/s/100 sq. m.])that can be used in lieu of an air tightness measurement. Figure 2 shows the required continuous whole-house ventilation fan size using this default infiltration credit.

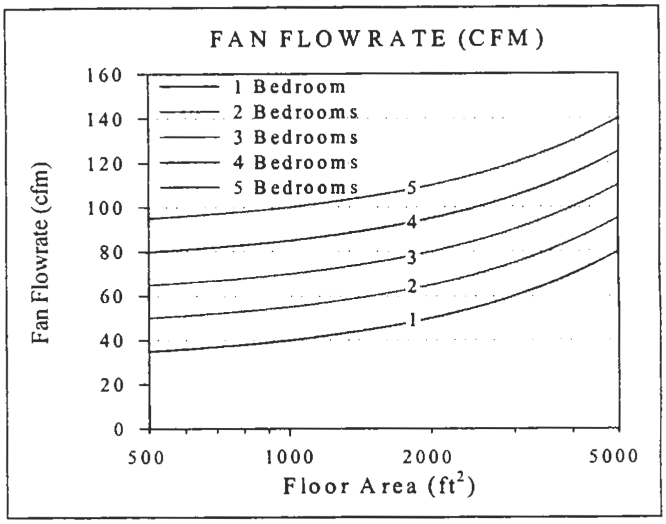

Figure 2: Minimum size of whole-house ventilation fan, assuming continuous operation and default infiltration credit.

The standard allows intermittent whole-house mechanical ventilation to be used as an option to continuous ventilation. The size of the fan must be increased over the rates from the Figure 2 to deliver the same effective ventilation. When the fan cycles relatively frequently (i.e. a 3 hour cycle time or less), it is only necessary to make sure that the daily average flow is the same as for a continuous fan. When the intermittent fan cycles less frequency, the capacity must be increased even further to account for its poor temporal ventilation efficiency.

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 assure 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. Unlike the current Standard, 62-99, 62.2P does not allow any additional credit to be taken for infiltration. One could imagine that a larger infiltration credit might be used if the air tightness were measured in accordance with ASHRAE Standard 119-1988 [RA 94], which requires a measurement such with a *blower door*. ASHRAE has another Standard 136-1993 that might be used for this purpose, but it is not [ASHRAE Standard 136, 1993].

The default credit in 62.2P is based on defining the infiltration in a critical week and at a critical tightness. If we consider extending that logic further, a house that is leaky enough could meet 62.2P without a mechanical ventilation system, regardless of climate. Figure 3 shows how leaky a house would have to be meet these requirements. The figure is labeled both in the Normalized Leakage of Standard 119 and the more common Air Changes at 50 Pa used in the field.

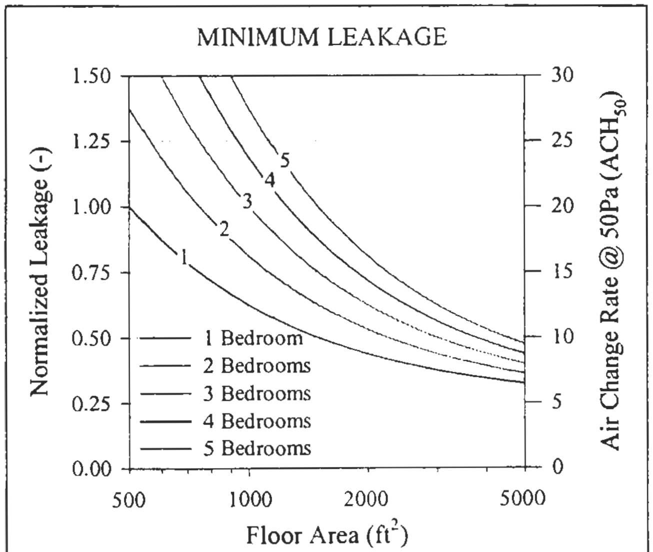

Figure 3: Minimum leakage levels needed to meet whole-house ventilation requirements by infiltration alone. Approximate conversion to air changes at 50Pa is included for convenience. (See Standard 119 for the definition of Normalized Leakage.)

Allowing infiltration credit is not currently implemented in 62.2P 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 are often quite leaky [Sherman & Matson, 1997] and are quite likely to meet the requirements of this standard on infiltration alone. Their estimate of the average air tightness of the stock is approximately an ACH_{50} of 24. Those wishing to apply 62.2P to existing houses in the context of Home Energy Rating Systems or utility programs, will make good use of the infiltration credit for measured air tightness.

OTHER REQUIREMENTS

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

Local Exhaust

Houses are designed to have certain activities in certain rooms. Kitchens, bathrooms, laundries 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 they were emitted in 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. For example, contaminants from stoves, ovens, dishwashers and other kitchen appliances are presumed to be controlled by the required kitchen ventilation.

Unlike the whole-house rates, which are most effective when continuous, 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 other rooms requiring local exhaust the rate is half that. Because of concerns over capture efficiency, vented range hoods are required air flow rate yields less than five kitchen air changes per hour.

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 is generally 20 cfm (10 l/s) for each room requiring it. 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.

62-99 allows operable windows as a substitute for exhaust ventilation requirement. 62.2P requires natural ventilation in all habitable spaces (that do not have local ventilation), but does not allow it to meet the local ventilation requirement in bathrooms, because of the low pollutant removal efficiency of operable windows. (e.g. a window could just as easily blow moisture into the rest of the house as out of the bathroom.) Because of cost concerns, however, 62.2P allows a recirculating fan (a fan with a filter that does not exhaust outdoors) to meet this requirement in kitchens under some circumstances.

Ventilation System Requirements

The ventilation system, whether it be natural or mechanical has to meet some basic requirements including the following: capacity and distribution, filtration, sound ratings, and flow rating.

Capacity and Distribution. Because there will be activities that in the normal course of use of a house that produce pollutants in excess of what is handled by the basic rates, the standard requires that each room have either a window or a local exhaust system. These kind 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, such as a supply or return in each room, or the presence of an air handling system.

Filtration. Air handlers are required to have particulate filters having a minimum efficiency of 60% for 3 micron particles (MERV6). Although this level of filtration has some direct benefit to the occupants, its main benefit is in keeping the HVAC and distribution system from becoming a contaminant source. In hot, humid climates this is especially important because dirt build-up combined with moisture can lead to microbiological growth on the cooling coils.

Sound Ratings. In most cases occupants will not use noisy fans. Occupants are more likely to disable them than to run them. The standard requires that whole-house fans be very quiet and that bathroom and kitchen fans be reasonably quiet at their rated flows.

Flow Rating. To make sure that the fan actually delivers the amount of air intended, the standard requires either that the air flow rate be measured in the field or that certain prescriptive requirements be met. These prescriptive requirements include the size and length of connected ducting as well as the manufacture'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 may make them worse and not better. This section summarizes some of the source control measures in the standard, including: outdoor air, ventilation inlets, garages, clothes dryers, and moisture migration.

Outdoor Air. The 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.

Ventilation Inlets. Even if the outdoor air is of good quality, pollution in the building's microclimate can make the air that comes in through windows or other intakes of low quality. The standard requires that there be adequate separation between inlets and exhausts or other known sources of pollution, such as flues, exhausts, cars, etc.

Garages. Attached workspaces or garages can be a source of significant pollution. Carbon monoxide is of particular importance when combustion (e.g. from cars) is taking place. The standard requires than any air handling equipment placed in these spaces be sealed to prevent entrainment of these contaminants, but specifies no limits or tests to determine how well it is sealed.

Clothes Dryers. 62.2P requires that clothes dryers be vented directly to outdoors both to minimize moisture and laundry pollutions. Clothes dryers are treated as exhaust fans for the purposes of combustion safety and ventilation.

Moisture Migration:

If moisture is forced into building cavities or the building envelope and allowed to condense molds and other microbiological contamination can become a threat to indoor air quality and material serviceability. The standard forbids the use of ventilation methods (e.g., supply ventilation in very cold climates) that would contribute to that effect unless the building envelope has been designed to accept it. For example, exhaust ventilation is not to be used in hot, humid climates unless special precautions have been taken to keep condensation from occurring on the interior sheetrock.

Combustion Safety

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 backdrafting. 62.2P is not a standard about combustion safety, but indoor combustion sources can be a significant source of pollution and the requirements of 62.2P 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.

To minimize the potential for backdrafting the standard requires that naturally aspirated combustion appliances in the conditioned space pass a specific backdrafting test if the total of the largest two exhaust appliances exceed 15 cfm per 100 sq. ft. (about 1 air change per hour of ventilation not counting any summer cooling fans). Many new houses would be exempt from these considerations either because all their vented combustion appliances are outside the pressure boundary or are sealed combustion or because their two biggest exhaust appliances fall below the limit.

CO Alarm. The draft standard requires that a carbon monoxide alarm, meeting the current UL standard, be installed. Ideally, no carbon monoxide should be generated or allowed to come into the occupied space, but the requirements to assure this would be prohibitively costly (e.g., prohibiting air handlers in garages, unvented or naturally aspirated combustion within the pressure boundary etc.). By installing a CO alarm in the space it provides more flexibility for the builders.

BEYOND REQUIREMENTS

The requirements in 62.2P are only a small fraction of the total number of pages in the Standard. 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 in how to make choices to meet the Standard.

Operations and Maintenance

The draft Standard does not contain Operation and Maintenance (O&M) requirements, but 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. Building occupants need to be informed as to how to do that.

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

Particulate Filtration

The standard requires 60% filtration efficiency of 3 micron particles in air handlers principally 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 that the occupants are exposed to. Any other dedicated supply air system would also require filtration.

The minimum level of filtration can be achieved using a 1" pleated filter that costs a couple of dollars more than the most common furnace filters and is commonly available. Because there are many different kinds of filters available, having different efficiencies, capacities, costs, sizes and filter lives, the standard provides guidance on how to select a filter.

Source Control and Exposure

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

In an appendix to the draft standard, there is some background information and guidance on potential pollutant sources, acceptable contaminant levels, and the role of building materials, building microclimate and construction details. The appendix provides guidance on control of some of these sources and references to literature on specific ones.

Control of moisture is often a key to keeping microbiologicals from becoming either a health hazard or a serviceability problem. Depending on climate either indoor or outdoor moisture can be a problem if it is allowed to get 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 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 condensation inside of the building envelope.

62.2P has several compliance paths and allows a fair degree of flexibility in selecting the ventilation system. To help the designer along, the draft standard also contains some guidance on when to select certain kinds of systems and when to stay away from them. It also contains guidance on the energy impacts of different choices.

Guidance in selecting both the whole-house and local ventilation systems is provided. 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.

THE BIG QUESTIONS

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. The following Questions and Answers are intended to help explain the standard and give some of the justification and background of it.

Q **Why do we need 62.2? Isn't what is in 62-99 good enough?**

A The half page of residential requirements in 62-99 has many short comings. 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 in the Continuous Maintenance with the rest of 62?**

A ASHRAE felt that it was important to separate the residential parts from the commercial and institutional parts for several reasons. First, the target audiences were very different and users of the residential parts wanted a separate document that addressed their needs. Second the technical expertise for the committee resided in different people than those who were responsible for 62R and thus there was not enough expertise on the old 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 62.2P compare with 62-99?**

A The whole-house rate in 62.2P depends less on the floor area and ceiling height of the house than does that of 62-99. Expressed in air flow, the rates fall in a narrower band of flow. In general, the air flow requirements in 62.2P are lower for larger houses and higher for smaller houses than that of 62-99. The local exhaust rates are virtually the same as for 62-99. In both cases, however, 62.2P contains more detail and is more clear on how to apply the rates.

Q **Does 62.2P credit occupant use of operable operable windows?**

A Yes, in some ways. There is a ventilation capacity requirement to allow for unusual events; this is generally satisfied by operable 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. The local exhaust requirements in some situations can met with windows.

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

A Very little. The standard has a default credit based on a relatively tight house. Even though leakier houses will in fact have a large infiltration rate, the standard does not give any credit for it. The default infiltration credit is based on the weather in a presumed critical week and for a presumed tightness. This critical week is when the weather gets extreme enough that occupants decide to no longer open their windows. The driving forces for this week and envelope tightness are used to calculate the infiltration credit. Where the critical week may be on the calendar will be different in different climates, but the credit size is independent of climate. The energy cost of infiltration, however, is climate dependent.

Q **Will 62.2 replace ASHRAE Standard 136** (*A Method of Determining Air Change Rates in Detached Dwellings*)**?**

A No. Standard 136 looks at long-term (i.e. seasonal or annual) exposures to pollutants and so tolerates periods of low ventilation. 62.2P uses the time base of one week rather than one year and is, less tolerant of periods of low ventilation. The net effect is that 62.2P gives far less credit for infiltration than does Standard 136, especially in severe climates.

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

A The calculation depends on the size of the house, but using the default infiltration credit the whole-house mechanical ventilation requirement typically falls in the 60-100 cfm range.

Q What has changed for kitchen ventilation?

A 62.2P requires that a fan be installed in the kitchen (and also the bathroom); windows alone are not usually sufficient to control moisture, dishwasher pollutants and cooking by-products. When a vented exhaust fan is impractical a recirculating hood may be used under some circumstances. Because of the low capture efficiency at low air flows and the importance of the range as a source, range hoods are required if the installed exhaust capacity does not provide at least five kitchen air changes per hour.

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 are the only rooms required to have mechanical exhaust systems in all circumstances.

Q Can recirculating fans meet any local ventilation requirements?

A Rarely. The local ventilation requirements generally specify that the air must be exhausted outside. A kitchen may use one of these devices if it also has a window. Supplemental filtration, however, is not prohibited in any room.

Q Does this mean that houses have to have six 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, if remote-mounted, branched exhaust fans are used. Certainly, there will be cases in which one may choose to install six 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.

Local Exhaust Air Flow Rates

Application	Continuous Flow	Intermittent Capacity
Kitchen	5 air changes per hour	100 cfm (50 l/s)
Utility	20 cfm (10 l/s)	50 cfm (25 l/s)
Bathroom	20 cfm (10 l/s)	50 cfm (25 l/s)
Toilet	20 cfm (10 l/s)	50 cfm (25 l/s)

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 s. Because different fan and duct arrangements may not deliver the proper amounts 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 60% for 3 micron particles.

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 operated 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 Can humidistats or other IAQ sensors be used to control the ventilation system?

A Only as supplementary control methods. It is rare in a residential environment that the need for base ventilation is determined by a single pollutant or single class of pollutant. Control of the whole-house ventilation system with, for example, a humidistat can lead to inappropriate ventilation rates. Continuous whole-house ventilation is the preferred method.

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 should not be used unless a moisture tolerant envelope design exists. In houses without mechanical cooling, whole-house mechanical exhaust is allowed as is natural ventilation. The Standard does not exempt hot, humid climates from minimum ventilation requirements, just because of the loads imposed by it.

Q **What is the best system for use in hot, humid climates?**

A There are several good choices and the answer will depend on the economics and whether value-added features are desired. The cheapest solution is a supply ventilation system integrated with the air handler. Because the system must run during periods when cooling demand is low, supplemental dehumidification may be required, however. Conversely, a continuously operating supply ventilation system with a heat-pump dehumidifier/heat-recovery system can be very energy efficient and provide good comfort, but can be quite expensive. A balanced ventilation system with air-to-air enthalpy recovery is intermediate in both cost and performance.

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

A Probably not. 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 critical 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 62.2P. The real depressurization culprits are often 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 62.2P.

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

A If the two largest exhaust devices are not too big (i.e. 15 cfm/100 sq. ft.), 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.

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Q **What are the requirements for unvented combustion appliances.**

A The standard is silent on the use of unvented combustion appliances. 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 quick concerned about this issue. The door to the house does not have to have an automatic closing device to minimize the direct communication between house and garage nor does it forbid return ducting or air handlers in the garage. It does require that any air handling equipment placed in the garage be sealed, but there are no specifications on how much.

Q **Why is there a requirement for a Carbon Monoxide Alarm**

A As can be seen from the last several questions, CO could reasonably be expected in circumstances that still meet the minimum requirements of 62.2P. The CO alarm offers more cost-effective life-safety protection than would increasing the stringency of other requirements.

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 draft standard are already code in parts of the U.S., but perhaps none of them is code everywhere. The standard is the committee'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 it 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. 62.2P has informative appendices on Operations and Maintenance; Air Filtration; Pollution Sources Exposures and Control; and on HVAC Systems.

Q **What data was used to develop this standard?**

A Like most all consensus standards, the primary data source is the assembled knowledge, experience, and expertise of the technical experts comprising 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

Annual ASHRAE meeting in the reviews 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 are beyond the scope of this standard.

Q **Is it a done deal?**

A No. The standard must undergo public review, the purpose of which is to inform the committee about issues, concerns or problems that individuals may see in the standard. While the committee would be happy if everyone accepted it as is, there is a recognition that issues large and small may have been missed or not given enough thought. Thoughtful, constructive, and concise public review comments will be of great value to the committee.

Taken as a package, ASHRAE standard 62.2P 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 home owner and occupant than those that do not.

PUBLIC REVIEW PROCESS

The review period for the Standard 62.2P is expected to be approximately summer of 2000. During this period any interested party can file comments. Instructions for filing comments on this or any other standard can be found in the standards section of the ASHRAE Home Page (http://www.ashrae.org).

Anticipated dates are that the standard will be available for public review in June 2000, and that the public review period will close in September. The committee will begin review of comments in the fall.

For those interested in asking questions of the committee, there will be a forum at the ASHRAE Annual meeting in Minneapolis during June 2000.

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