Revising the ASHRAE 62 Ventilation Standard

Max Sherman and Steve Taylor (ASHRAE Standards Chairman and Chairman of 62 Ventilation Standards Committee)

There are several ASHRAE Standards that relate to ventilation either directly or indirectly in addition to Standard 62 Ventilation.

- Standard 55 specifies indoor environmental conditions necessary to provide thermal comfort.

- Standard 90 is a design standard for new construction to provide energy efficiency.

- Standard 100 is a broader standard relating to existing buildings. Both have a series (e.g. 90.1) for different building types.

- Standard 119 sets air tightness limits on dwellings for energy efficiency purposes.

- Standard 129 is a measurement technique to determine ventilation effectiveness.

- Standard 136 allows credit towards ventilation requirements for systems incorporating infiltration. It can be used in the residential section of Standard 62 Ventilation.

- Standard 152 will be a method of test to determine the efficiency of thermal distribution systems and impacts ventilation in air systems especially those with duct leakage.

All of the ASHRAE standards share the common theme of being focused at combining energy, environmental, and productivity issues. This focus is different from many of ASHRAE's standards which are focused on methods of test or specific classifications or procedures relating to the HVAC&R industry. Environmental factors affect productivity in a variety of ways. While Standard 62 focuses on health and comfort issue, there is a clear understanding that there is a link to productivity and satisfaction.

Standard 62 has been a significant contribution of ASHRAE for over a quarter of a century. As with all American National Standards, 62 must be maintained and revised as needed. The different versions of the standard have used different approaches and different rates to respond to the needs of the users at that time. It takes about 8 years to cycle through a revision of the Standard. ASHRAE is likely to convert this standard to *continuous maintenance* after this revision so that improvements can be incorporated at a faster rate with less turmoil.

Five key differences proposed for the new version of the standard are:

1. The new version will be written in mandatory language to make it possible to determine whether or not the standard has been met and to be able to be referenced by codes and specifications.

2. The calculus of the calculation is based on the principles of odour acceptability, but considers health. Previous versions did not have a clear philosophy for the ventilation rates.

3. The standard assumes no smoking, but an informational annex discusses how to achieve *comfort* when smoking is allowed. Previous versions assumed a 'moderate' amount of smoking.

4. Many specific energy considerations were included in the committee's deliberation.

5. The standard included operations and maintenance requirements to ensure that the building delivers what it is designed to do. Previous versions only dealt with design.

Calculating the **Design Ventilation Rate** is done using additivity of people-derived sources and building-derived sources. This additivity is a key assumption of the standard, is different from previous versions and follows from the similar additivity found by odour researchers. Because the committee 'liked' many of the numbers in the old standard, these new ventilation values were first calculated to leave the final result unchanged. Committee debate has subsequently modified some of these values.

Various Carbon Dioxide levels have been proposed. The revised guide recognises that CO_2 is not a pollutant of concern, but rather is merely a surrogate for occupancy (when other sources are properly taken care of). Demand controlled ventilation is allowed, but it is not simple linear control because of the need to dilute building generated pollutants.

Productivity may be enhanced by good air quality.

The life-cycle of the building has many distinct phases.

1. Design stage

2. Construction of the building

3. Commissioning before occupancy

4. Operation

5. Renovation as needs change

6. Demolition

The new version of Standard 62 will address all the phases of the buildings life that could impact the occupants. This life-cycle focus is a new addition. Because this focus is new, not as much effort is in the phases of the building other than design, but the new standard will contain much useful information about what needs to happen after design. To some this focus is in conflict with the desires of ASHRAE that Standard 62 be usable in codes, which normally only specify design requirements.

Many of the rates have remained basically unchanged from the 1989 version, but some have decreased. The current version also makes it a lot clearer as to what these rates mean. Retail premises and offices are unchanged, class rooms and conference halls have reduced ventilation.

The Standard's scope limits it to commercial, institutional and residential buildings. This change from previous versions reflects what is actually in the standard rather than any qualitative change. The committee's focus has primarily been on the non-residential buildings within the scope. The chapters which form the Standard are listed below.

1. Purpose
2. Scope
3. Definitions
4. Application and Compliance
5. General requirements
6. Design ventilation rates
7. Construction and start up
8. Operating & maintenance
9. Residential

Chapters 5-8 are the bulk of the standard and a single, stand-alone chapter (9) covers dwellings. The approach to residential buildings often makes different kinds of assumptions than the rest of the standard. There has been debate within the committee on whether or not to separate the residential part as a separate standard.

The title purpose and scope of the Standard as currently approved by ASHRAE is outlined below.

Title, Purpose and Scope for ASHRAE Standard 62R: Ventilation for Acceptable Indoor Air Quality

- To define the roles of and requirements for ventilation, source management and air cleaning in providing acceptable indoor air quality
- To specify methods for determining minimum ventilation rates
- To specific ventilation system design, operational, and maintenance requirements for various types of occupied indoor spaces
- This standard contains requirements for commercial, institutional and residential buildings space intended for human occupancy

- *This standard considers chemical, physical and biological contaminant as well as factors such as moisture and temperature that can affect human health and perceived air quality*
- *Thermal comfort is not included in this standard (see ASHRAE Standard 55)*
- *Considering the Diversity of Sources and contaminants in indoor air and the range of susceptibility in the population, compliance with the standard will not necessarily ensure acceptable indoor air quality for everyone*

The first three bullets are the purpose: Section 1.1, 1.2, 1.3

- 1.1 states the need for general requirements
- 1.2 is the ventilation rate requirements
- 1.3 defines the phases of the lifecycle covered

The next four bullets are the scope of the standard: Section 2.1 - 2.4

- 2.1 limits the buildings under consideration
- 2.2 limits the factors being considered
- 2.3 excludes thermal comfort from consideration
- 2.4 excludes special populations or unique buildings

A key aspect in writing the standard is to define at least qualitatively what the standard is trying to deliver. The most important definition in the standard is that of **acceptable indoor air quality** which sets the tone for what it contains. These definitions have had extensive debate within the committee and always represent a political as well as technical compromise to the issue of what can be done as opposed to what should be done. In the 1989 Standard acceptable indoor air quality was defined as 'air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people do no express dissatisfaction.' The proposed change to this is to define acceptable air quality as 'air in an occupied space towards which a substantial majority of the occupants express no dissatisfaction and in which there are not likely to be known contaminants at concentrations leading to exposures that pose a significant health risk.'

Energy costs are one of the least significant parts of building-related costs, typically £12/m^2 compared with a productivity value of £1,800/m^2. Impacts on productivity are far more important to the economy than energy savings. Commercial buildings in the U.S. use a significant amount of national resources. There are some 6 billion square metres of commercial floor area using £60 billion of energy per year and with a renovation and construction rate of £130 billion pounds/year. Energy saving potentials are 30 - 50% in existing stock and 50 - 75% for new buildings.

Note: $1/sq.ft = £36/sq.m

Unlike previous versions the 62 Revision sets minimum supply rates as well as minimum outdoor air rates. A **Minimum Supply Rate** is required to control human shed air borne contaminants, such as aerosolized virus, that can be filtered out. The minimum supply rate has the added benefit of making multiple space effects easier to calculate and of providing higher mixing rates. One area of concern regarding previous standards was the confusion between the air delivered to the breathing zone compared to the air entering the outside air intakes. The new version will explicitly address this issue by discussion ventilation effectiveness.

$$\text{Total ventilation} = \sum \frac{\text{Design outdoor air rate to space}}{\text{Ventilation effectiveness}}$$

An example of how the proposed ventilation rates will be used is illustrated in Fig 9 for a variety of non-residential buildings, allowing for diversity in occupancy and for typical ventilation system efficiencies.

The committee's focus has primarily been on the non-residential buildings within the scope. A single, stand-alone chapter (9) covers requirements for dwellings. The approach to residential buildings often makes different kinds of assumptions than the rest of the standard. Information is sometimes duplicated from chapters 5 and 6 in order to allow chapter 9 to be used without reference to the non-residential parts.

Special Issues for Dwellings

There are several things that are significantly different about the residential section than the rest of the Standard. As mentioned it is intended to be used separately from the rest of the standard.

For dwellings a single-whole house value is given. It is assumed that there is good mixing throughout the dwelling and that separating pollutants from different rooms is not necessary. Dwellings generally have a much lower level of design and, hence, control than do commercial buildings, so that the level of systems that can be assumed is lower. Kitchen, bath and toilet exhaust as well as whole-building rates have different moisture and energy implications in various climates. For dwellings we assume that the occupants have a much higher level of control over both the operation of the building and its systems and also the sources of pollutants that may be released into the air. The use of windows to provide both continuous trickle and transient purge of ventilation must be considered, but is difficult to quantify.

Multifamily units represent only 15% of the U.S. stock, but have special concerns that are addressed (e.g. common walls). For example, sharing air between flats is not acceptable, but within a flat it is.

The allowability of windows to supply local exhaust is a heated issue in the committee; currently it is only allowed in separate toilet compartments. There are three pathways to comply with the whole-building rate requirement. The first path is a mechanical ventilation system designed to provide the full amount of ventilation with or without heat recovery. The second method allows any design, but requires that it be demonstrated to work. This demonstration can be done through design calculations and can incorporate any combination of fans and infiltration. The third method is to rely on natural ventilation provided by windows opened by the occupants. All three methods require that the building be operated consistent with the path selected in the design.

TPS for ASHRAE Standard 62R:
Ventilation for Acceptable Indoor Air Quality

- To define the roles of and requirements for ventilation, source management and air cleaning in providing acceptable indoor air quality
- To specify methods for determining minimum ventilation rates
- To specific ventilation system design, operational, and maintenance requirements for various types of occupied indoor spaces
- *This standard contains requirements for commercial, institutional and residential buildings space intended for human occupancy*
- *This standard considers chemical, physical and biological contaminant as well as factors such as moisture and temperature than can affect human health and perceived air quality*
- *Thermal comfort in not included in this standard (See ASHRAE Standard 55.)*
- *Considering the Diversity of sources and contaminants in indoor air and the range of susceptibility in the population, compliance with the standard will not necessarily ensure acceptable indoor air quality for everyone.*

Standard 62 Definitions:

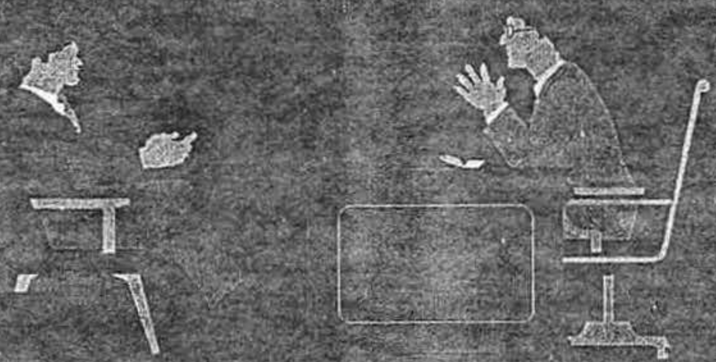
What is "Acceptable IAQ"?

- Standard 62-1989: "Air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction."
- Standard 62R: "Air in an occupied space toward which a substantial majority of occupants express no dissatisfaction and in which there are not likely to be known contaminants at concentrations leading to exposures that pose a significant health risk."

62 Focus on Commercial Buildings

Your Office: Dollars and Sense

- Energy Cost: $2
- Maintenance: $3
- Taxes: $4
- Rent: $40
- Productivity $300



Commercial Buildings, 62R Example (SI):

Minimum Supply Rate

If DVR < 15 cfm/person, filtered recirculated air must be added:

V_R = supply of recirculated air to the space

E_{ac} = air change effectiveness

E_F = filter efficiency in 1 to 3 micron range (%)

Commercial Buildings, 62R Example (IP):

Minimum Supply Rate

If DVR < 15 cfm/person, filtered recirculated air must be added:

V_R	=	supply of recirculated air to the space
E_{ac}	=	air change effectiveness
E_F	=	filter efficiency in 1 to 3 micron range (%)

Commercial Buildings, 62R Example:

Ventilation System Efficiency

DVR = Design ventilation (outdoor air) rate to space

V_{ot} = Total outdoor air at ventilation system intake

E_V = System ventilation efficiency (combination of air change effectiveness with other system effects)

Commercial Buildings, 62R Example (SI):

Proposed Ventilation Rates

	Ventilation Requirement		Guideline Occupancy Assumptions		Ventilation Requirements at Guideline Occupancy and Typical System Efficiency		
Occupancy Category	People R_P l/s/person	Building R_B l/s/m^2	Density people/ 100 m^2	Diversity Factor	System Efficiency	Outdoor air l/s/person	Outdoor air l/s/m^2
Office space	3.0	0.35	7	1	0.80	10.0	0.7
Retail sales floor	3.5	0.85	15	0.75	1.00	11.1	1.25
General classrooms	3.0	0.55	35	1	0.90	4.9	1.8
Conference rooms	2.5	0.35	50	1	1.00	3.2	1.6

Commercial Buildings, 62R Example (IP):

Proposed Ventilation Rates

	Prescriptive Ventilation Requirement		Guideline Occupancy Assumptions		Ventilation Requirements at Guideline Occupancy and Typical System Efficiency		
Occupancy Category	People R_P cfm/person	Building R_B cfm/ft ^{2}	Density people/ 1000 ft ^{2}	Diversity Factor	System Efficiency	Outdoor air cfm/person	Outdoor air cfm/ft ^{2}
Office space	6.0	0.07	7	1	0.80	20.0	0.14
Retail sales floor	7.0	0.17	15	0.75	1.00	22.2	0.25
General classrooms	6.0	0.11	35	1	0.90	9.7	0.35
Conference rooms	5.0	0.07	50	1	1.00	6.4	0.32

Acceptable Indoor Air Quality:

What about CO_2?