Standard 62.1-2004: Stricter or Not?

The 2004 version seeks to steer designers away from errors by containing more specific requirements, which I believe are harder to ignore but also easier to apply. The multiple spaces issue is now addressed in a lookup table (Table 6-3 System Ventilation Efficiency in section 6.2.5.2).

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I was recently discussing with a code official the comparison between the 2004 version of ANSI/ASHRAE Standard 62.1 and the International Mechanical Code. The latter's ventilation rates are based primarily on the 1989 version of Standard 62.

When I said that the new rates in Standard 62.1-2004 could result in CO_2 levels of 2,500 ppm, eyebrows were raised. How could such high levels be acceptable? People often believe that ASHRAE "recommends" a CO_2 level of 1,000 ppm. ASHRAE did not make this recommendation even in the 1989 standard,* but it did result from calculations based on the 1989 rates. To answer the question about the potential for higher CO_2 levels, it is necessary to go back a little and discuss the rationale for the 1989 rates vs. the 2004 rates.

In the 1980s, the committee that worked to revise Standard 62 eliminated the two-tier rate system that prevailed in the 1981 standard. While the 1981 standard had a base ventilation rate of 5 cfm/person (2.5 L/s per person) for no-smoking occupancies and a base ventilation rate of 15 cfm (7.5 L/s) for smoking occupancies, the 1989 version had a single base rate of 15 cfm/person (7.5 L/s per person).

While the committee cited other reasons for raising rates,[1] arriving at a single rate regardless of the presence of smoking appeared to be one of their main motivators, as did the desire to satisfy people just entering a room, who were not adapted to the odors.

In the 1990s, the committee that worked again to revise Standard 62 had to deal with some new realities. Smoking indoors was becoming less common, and it became increasingly clear that 15 cfm/person (7.5 L/s per person) did not provide acceptable indoor air quality in the presence of smoking. Tailoring the base ventilation rates to smoking occupancies no longer seemed to make sense.

Furthermore, ASHRAE's Board of Directors gave the committee direction in the late 1990s that the standard should express minimum code-intended requirements.

The committee applied this direction by considering ventilation rates for so-called adapted occupants, rather than unadapted. Adapted refers to occupants who have had time to acclimate themselves to odors in a room, as opposed to recent visitors. Studies of people's perception of acceptability in clean metal chambers indicates that 5 cfm/person (2.5 L/s per person) satisfies 80% of adapted occupants.

Since buildings are not clean metal chambers, new rates also include a base ventilation per unit area of 0.06 cfm/ft^2 (0.3 L/s per m^2). (The rationale for this is beyond the scope of this column.) Nevertheless, in a densely occupied room, such as an auditorium or conference room, the per-person rate predominates, and the total ventilation will be nearly equal to 5 cfm/person (2.5 L/s per person).

Let's see how this might work in a 300 ft^2 (30 m^2) conference room holding 12 people. The required air quantity for the 1989 standard (or the 2006 IMC) would be

$$20 \text{ cfm/person} \times 12 \text{ persons} = 240 \text{ cfm}$$

For the 2004 standard, the required ventilation air would be:

$$5 \text{ cfm/person} \times 12 \text{ persons} + 0.06 \text{ cfm/ft}^2 \times 300 \text{ ft}^2 = 78 \text{ cfm}$$

This is a significant relaxation of the standard at the breathing zone, making it more important now to follow other sections aimed at getting this minimum amount of air to the breathing zone at all times.

For single zone and 100% OA systems, which directly deliver outdoor air to the diffuser, the outdoor air required at the intake is the simple sum of what is required at the room air diffusers. For these system types, the new

* Page 10 of ANSI/ASHRAE Standard 62-2001 states, "Comfort (odor) criteria are likely to be satisfied if the ventilation rate is set so that 1,000 ppm CO_2 is not exceeded."

table rates translate directly to reduced intake airflow for many occupancies.

However, the lower table rates do not translate so directly to reduced intake airflow in multiple-zone variable air volume (VAV) systems, depending upon how the designer approached these systems in the past. (It is not and never was correct to simply add up the air required at the breathing zone of each space and supply that total at the outdoor air intake.)

The 2004 version seeks to steer designers away from errors by containing more specific requirements, which I believe are harder to ignore but also easier to apply.

The multiple spaces issue is now addressed in a lookup table (Table 6-3 System Ventilation Efficiency in section 6.2.5.2). Ventilation System Controls Section 5.4 specifically addresses VAV box turndown whereas this was implicitly required in ASHRAE 1989, Section 5.3. All of the above will tend to increase the amount of outdoor air required at the intake.

There's also Section 6.2.2.2 and Table 6-2 covering Zone Air Distribution Effectiveness, which requires more ventilation air for certain supply and return air locations (like hot air supplied from above).

Let's take another look at CO_2 levels as we did at the start of this discussion. There is nothing magical about 1,000 ppm—it is merely a result of ventilating 15 cfm/person (2.5 L/s per person) for relatively inactive occupants (metabolism rate of 1.2 met), resulting in a CO_2 differential of 700 ppm to outside.[2] When the outdoor CO_2 concentration is 300 ppm (which used to be the background level), this adds up to 1,000 ppm indoors. The ventilation rate is the appropriate target and the CO_2 level follows from that—not the other way around.

At 5 cfm/person (2.5 L/s per person), the CO_2 differential to outside will be 2,100 ppm resulting in indoor levels of 2,500 ppm if the outdoor level is 400 ppm (a level more commonly found in today's urban areas). In the conference room example above, the ventilation rate comes out to 6.5 cfm/person (3.3 L/s per person) (78 cfm/12 persons), the CO_2 differential would be about 1,600 ppm and the expected level in the room would be about 2,000 ppm.

While Standard 62.1-2004 has reduced some base ventilation rates, it also requires that the ventilation air gets to the people, all the time. It is easier to properly apply and to properly review for compliance.

I would have to say that it is stricter in some senses yet less strict in others. I believe it will result in better air quality than that provided by previous versions of the standard.

References

1. Janssen, J.E. 1989. "Ventilation for acceptable indoor air quality," *ASHRAE Journal* 31(10):40.

2. ANSI/ASHRAE Standard 62-2004, *Ventilation for Acceptable Indoor Air Quality*, Appendix C, p. 34.

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