Standard 62.1
Problems, Perceptions & Panaceas

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ASHRAE Standard 62 was first published in 1973, with the title "Standards for Natural and Mechanical Ventilation."[1] The most recent version, designated as 62.1 and titled *Ventilation for Acceptable Indoor Air Quality,*[2] was published in 2004, with some relatively minor revisions added since that time in a supplemental publication.[3] Throughout its existence, Standard 62 has generated controversy, but at the same time it has served the building industry and the public as the most prominent standard on ventilation and indoor air quality (IAQ).

Ventilation requirements for buildings have long been an important design element addressed by various standards and regulations.[4,5] However, as an ever-increasing number of IAQ problems surfaced starting in the late 1970s, the context in which these requirements existed changed significantly and the need arose for design standards that contained more than just ventilation requirements. Inclusion of requirements beyond ventilation, such as outdoor air quality and moisture management, has generated some of the controversy referred to earlier. This article attempts to describe some of these issues, the place of Standard 62 in the world of code

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and regulation, and some options for addressing some of the concerns that still seem to exist.

Standard 62.1-2004

It is important to understand the current version of the standard and the reasons it was revised. Prior to the 2004 standard, the previous complete revision of the standard occurred in 1989. After Standard 62-1989[6] was published, ASHRAE's leadership realized that the next revision could be rather involved and time consuming, and therefore the revision process began only a few years later. When the new standing standards project committee was tasked with the revision, they also were given direction as to the goals of the revision. The primary directive was to revise the document such that it contained only minimum requirements expressed in mandatory and enforceable language. One reason for this direction was to facilitate adoption or reference by model building codes, which had not occurred to a large extent with the 1989 standard. Another reason for this charge was the fact that many of the requirements in the standard were vague, making it difficult for designers to determine what they needed to do to comply, and how the requirements would be enforced. In addition, the 1989 standard contained many recommendations and informative statements in non-mandatory language, which were clearly inconsistent with adoption into building codes.

A good example of the "code-language" issue relates to exhaust air entrainment into outdoor air intakes. In Standard 62-1989, this concern was addressed as follows: "Ventilating systems should be designed to prevent reentrainment of exhaust contaminants…" One problem with this statement is the use of the word "should," which makes this a recommendation and not a requirement and therefore inconsistent with adoption into building codes. Perhaps more significantly, it is not at all clear either how a designer should comply with this recommendation or how a code authority might enforce it.

Standard 62.1-2004, on the other hand, addresses entrainment by including a table of prescribed minimum distances between outdoor air intakes and exhaust openings, as well as other potential outdoor contaminant sources. This table makes it very clear how to comply with the requirement and how to enforce compliance.

Many other examples exist in which recommendations and vague requirements have been eliminated from the standard in the development of 62.1-2004. Another case is the minimum ventilation requirements in the standard's Ventilation Rate Procedure. The 1989 standard contained a table of ventilation rates, but required adjustments for ventilation effectiveness (mixing in the space) as well as mixing effects in multizone, recirculating systems. However, these adjustments were not explained clearly, which resulted in much confusion and inconsistent application. The 2004 standard, on the other hand, is more explicit about these adjustments and includes tables of default values to make the process even easier.

In addition to replacing vague language with clear requirements in mandatory and enforceable language, the 2004 revision also reflected an update of the technical content of the standard. It is worth noting that the 1989 standard went out for public review in 1986. Since that time our industry has developed a wealth of research findings and practical experience in the area of ventilation and indoor air quality. The membership of the 62.1 project committee included a range of experts from consulting engineers to code officials to equipment manufacturers to IAQ experts, who brought this new information to bear in the committee's efforts.

Issues and Concerns

While Standard 62.1-2004 constitutes a dramatic improvement over the 1989 standard in many respects, a number of issues and concerns still exist that may merit further changes to help the document to better meet the needs of the users and achieve its stated purpose "to specify minimum ventilation rates and other measures intended to provide indoor air quality that is acceptable to human occupants and that minimizes adverse health effects." While all of these concerns were deliberated extensively by the 62.1 committee when revising the standard, many are still unresolved from the perspective of some ASHRAE members and other users of the standard.

Role of Health

Some have expressed concern that 62.1-2004 moved the standard into health issues and even made unjustified health claims. In fact, the philosophy towards health in revising the 1989 standard was no different from that of previous versions.[7] Going back to the original 1973 standard, the purpose was to specify "minimum and recommended ventilation air quantities for the preservation of the occupants' health, safety, and well-being." The purpose of the 1981 standard was stated differently but retained a similar emphasis on health as a motivating factor: "Specify IAQ and minimum ventilation rates which will be acceptable to human occupants and will not impair health."

In 1989, the standard's purpose was again rephrased, but maintained the dual goals of acceptability (referred to by some as comfort) and health: "specify minimum ventilation rates and IAQ that will be acceptable to human occupants and are intended to minimize the potential for adverse health effects."

The current standard maintains the health and comfort motivation that has always been behind the standard, which was affirmed by the ASHRAE Board of Directors in 2000 when they adopted the policy that "ASHRAE standards shall consider health impacts where appropriate." This statement was elaborated on in 2004, when the Board adopted a statement:

> *Consistent with the ASHRAE Certificate of Consolidation, Bylaws and Code of Ethics, ASHRAE activities and publications including but not limited to position documents, handbooks, special publications, standards and guidelines, technical and educational programs, and conferences shall consider health and safety impacts, where appropriate. While ASHRAE does not make findings as to the health and safety impacts of environmental exposures, ASHRAE activities and publications where appropriate shall consider and reference findings issued by cognizant organizations with the appropriate scope and expertise.*

In the context of Standard 62.1, while the requirements in the standard are motivated by health concerns, no health claims are made within the document. Basically, the standard contains requirements that must be met for compliance, but no guarantee exists that complying with these requirements will prevent unhealthy conditions or even ensure any level of acceptable indoor air quality. This limitation is unavoidable given our limited understanding of indoor environmental conditions that are associated with health risks.

Complexity

Some individuals feel that the standard is overly complex, or at least more complex than they desire. While these statements are not always specific as to what portions of the standard are too complex, it is important for the requirements in the standard to be as simple and straightforward as possible. At the same time, ventilation and indoor air quality present complex engineering challenges, so addressing them involves some level of complexity. From the perspective of the designer, complexity in complying with any design requirement means added cost to accomplish the design. Some complaints about complexity, therefore, are rooted in a desire to reduce those costs.

Part of the perceived complexity in the standard stems from the comprehensive set of requirements needed to fully address the scope of the document. Not only does the standard cover design requirements, but it also addresses installation and start-up, as well as operation and maintenance. The standard also provides alternative paths and solutions to address these issues by identifying the many elements involved in HVAC system design such as ventilation effectiveness, intermittent occupancy, what constitutes net occupied space, and even the acceptability of the outdoor air itself. The subjectivity of some of these elements—the fact that some design choices must be based on engineering judgement—that can potentially increase the liability exposure for the designer. In the event that indoor environmental issues arise, the designers may be questioned as to why they chose one path vs. another, why they did not select the most conservative design factors (that might have increased the outdoor air volume), or why they had not incorporated the most sophisticated air cleaning, sensing or control equipment. In this liability setting, practical economic cost will not be a satisfactory answer. However, such liability may well exist, regardless of the content of this particular version of the standard. Therefore, the designer must address these issues with the client, so there is a clearly understood direction. And, then they should document that direction as the client's decision.

Another reason the standard is perceived by some as being complex is related to the mandate that the standard contain requirements in mandatory and enforceable language. Such requirements often appear to be more complex because they must spell out exactly what is required to ensure consistent application and enforcement. As noted earlier, this is true of the Ventilation Rate Procedure, in which the adjustments of the minimum ventilation rates appear as complex to some. However, these adjustments have been required since at least 1989, but in the past it was not clear to most designers as to how they were to be implemented.

Frequent Updates of the Standard

Another concern associated with the standard is that it is being revised under "continuous maintenance," a process by which standards are revised one portion at a time instead of all at once. This approach allows targeted revisions of the standard based on new information or insight into a particular topic, without the administrative overhead associated with the review of the entire document. Continuous maintenance has the advantage of focusing the committee's efforts and keeping the document more current than if the entire standard was revised every five to 10 years.

However, keeping up with the revisions has been a challenge and is a particular concern to those who are required to follow the most recent version of the standard. This situation is even more challenging for those who are legally required to comply with a building code that references an older version of the standard but who may wish to or may be expected to comply with the latest version of the standard.

In response to this problem, ASHRAE began a policy last year of publishing code-intended continuous maintenance standards every three years to match the model code cycle. A supplement to these standards is published about halfway through the three-year cycle, which contains all of the approved addenda since the last full publication and is available for free at www.ashrae.org.

Ventilation Rates are Too High or Too Low

The minimum ventilation requirements in the standard are based on a combination of the latest scientific research in the area of ventilation, comfort and health, as well as the collective experience and judgment of the committee. These requirements were debated for many hours by the committee and outside parties brought into the discussions to share their experience and opinions.

Even though many of the minimum rates were reduced significantly in the 2004 standard, many individuals still feel that the rates are higher than necessary, while others believe they are too low. Many, but not all, of those who feel the rates are too high argue from the perspective of those designing systems for hot and humid climates where they find the moisture entry associated with the outdoor air intake rates difficult (or perhaps too costly) to manage. Others argue from an energy efficiency perspective that the rates could be lowered without compromising indoor air quality. On the other hand, many others argue that the current rates are too low and need to be increased to meet the health and comfort goals of the standard. For example, results of recent studies indicate that higher rates have a beneficial impact on performance and absentee rates in schools.[8–10]

In discussions regarding ventilation and moisture, the committee heard from many individuals who expressed concern that the ventilation rates in the standard are too high, and that they can create problems (specifically, indoor mold growth) in hot/humid climates. In these discussions, the committee noted that outdoor air intake and moisture control really are separate issues. How much outdoor air a space needs is a function of contaminant sources, occupant expectations, etc., independent of where the building is located and outdoor humidity levels. At the same time, indoor moisture (driven in part by outdoor humidity) must be controlled, regardless of climate, to help control mold growth within the building. The means (primarily equipment and controls) to achieve moisture control exist, and the types of equipment required are a function of climate. Many people believe that part of the problem in hot/humid climates is the use of inexpensive equipment (e.g., constant-volume "air conditioners") that is less able to handle the moisture load than more expensive equipment and controls. In addition, poor design and a lack of consideration of part-load performance have been identified as reasons for some moisture problems.

Code Adoption

As noted earlier, designers are legally required to comply with the state or local building codes, which often reference older versions of the standard. This delay is due to the time required to first revise the model codes, and then for the local codes to adopt the changes. The issue becomes of more concern when a change to the standard is viewed as beneficial to the building owner, the designer and/or the occupants, but has not yet been adopted by the local codes. The designer is then forced to comply with the out-of-date requirement unless the code official is willing to grant an exemption to allow use of the new standard.

Sometimes the standard is more stringent that the current building code. In these situations, some designers may feel compelled to comply with the standard as a proactive measure to reduce their potential liability. Some clients will refuse to pay for the added cost of systems that comply with the standard. A different problem can occur when code enforcement in a jurisdiction is weak in the area of indoor air quality, where designers who follow the standard may be at a competitive disadvantage.

Adoption & Application

It is important to remember that ASHRAE Standard 62.1 is voluntary only until adopted in a local code or other regulation. This section speaks to the status of the 2004 version of the standard in the model codes, state and local regulations, federal design guidelines and other documents.

Standard 62.1-2004 has not yet been referenced as a whole in any of the model codes to date. However, portions of it have been or are on the way to being adopted. For example, the 2006 version of the Uniform Mechanical Code uses the ventilation rates and calculation procedures from the 2004 version of the standard. The Ventilation Rate Procedure, i.e., the prescriptive calculation methodology for determining design ventilation rates, was proposed to replace the ventilation rate table in the International Mechanical Code at the mechanical committee hearings in the fall of 2006, and this change was approved for consideration by the full International Code Council (ICC). The ICC Final Action Hearings are scheduled for the spring of 2007, which could result in the standard's design procedure being adopted into the 2007 revisions to the IMC.

Several federal agencies have adopted Standard 62.1-2004. Of particular note, in 2006, 21 federal departments and agencies signed the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding,

which requires compliance with Standard 62.1-2004. In addition, the General Services Administration's Facilities Standards for Public Buildings (PBS-P100) references the "outdoor air ventilation rates of ASHRAE Standard 62" as " …the minimum acceptable in GSA buildings." This document does not reference a specific year of the standard but does state that the latest version is to be used. In July 2006, the Veterans Health Administration adopted 62.1-2004 "… as a minimum for modernization, alteration, addition, or improvement of real property and construction of new structures."

A number of states, including Iowa and Minnesota, have adopted Standard 62.1-2004 in their state building code. The building codes of both Washington and Georgia allow the use of the 2004 standard as an alternative to a table of minimum ventilation rates in their codes. Wisconsin's Executive Order related to high-performance green buildings, issued in 2006, also requires compliance with 62.1-2004.

The U.S. Green Building Council LEED®-NC rating system contains a prerequisite requirement to meet the requirements of the Ventilation Rate Procedure of Standard 62.1-2004 and awards one credit for ventilation rates that exceed the rates in the standard by 30%.

Options to Resolve Concerns With Standard 62.1

This article has attempted to explain some of the concerns regarding ASHRAE Standard 62.1, and to counter some of the issues that have been raised. Nonetheless, given the prominence of the standard and the varied needs of the HVAC industry and others, it is important to explore options for resolving these concerns. While there is unlikely to be a "silver bullet" that will serve everyone's needs, much thought has been given to some potential strategies regarding the further development of the standard. Last year, various committees and individuals within ASHRAE developed a series of options, which are presented here, along with a short list of pros and cons.

1. Continue on the current course of revising Standard 62.1, developing code proposals for the model building codes based on the standard, and developing an ASHRAE guidance document with supplemental information on ventilation and IAQ.

Pros

- A single standard for designers and code authorities.
- Avoids "pulling the rug out from under" the many current users of the standard, including the federal agencies, state and local jurisdictions, and other bodies who have adopted or reference the standard.
- Least impact on ASHARE committees, making more effective use of staff and volunteer time.
- Allows for ongoing corrections and improvements through the continuous maintenance process.

Cons

- May be viewed as unresponsive to those members who have been objecting to 62.1-2004.

2. Withdraw Standard 62.1 and start over with a new best practices standard rather than a standard driven by minimum requirements.

Pros

- Responsive to some complaints about the standard.
- May fulfill perceived need for "best practices" document.

Cons

- Does not provide a ventilation-only standard that some have been advocating.
- Without a clear definition of best practices, the authors will not have a clear goal to work toward.
- The process would take many years to complete. ASHRAE risks losing IAQ/ventilation leadership if another organization publishes a standard in the meantime.
- ASHRAE recently published a User's Manual for 62.1-2004, which would become irrelevant.
- The public review would likely generate a large number of comments, requiring many hours of staff and volunteer time.
- Requires agencies, jurisdictions and organizations that currently use the standard to remove the references and/or the language taken from the standard.
- A best practices standard would include more than minimum requirements and, therefore, is unlikely to be adopted into code.

3a. Convert 62.1-2004 into a minimum standard that addresses ventilation rates only, written specifically for code adoption.

Pros

- A single, short document with fewer requirements for designers and code authorities.
- May increase the possibility of model codes adopting an ASHRAE standard by reference.
- May fulfill the desire of some for a simpler ventilation-only standard, although many would be disappointed by the likely increase in the ventilation rates for many occupancy categories.

Cons

- As requirements are removed, other requirements may need to be made more stringent (e.g., higher ventilation rates) to ensure acceptable IAQ.
- Fails to recognize the complexity of IAQ and ventilation systems.
- It could take many years to approve the new standard, and would generate lots of controversy in the process.

Discussing the Future of Standard 62.1

At the 2007 ASHRAE Winter Meeting, a forum was held with the title "The Future of Standard 62.1." The forum was organized around the following six questions:

Question 1: Is the current standard hard for practicing engineers to use? If so, what specifically makes it hard to use? What about other users such as contractors, builders, specifiers, manufacturers, code officials, etc.?

Question 2: Should the model building codes and government agencies that adopt and implement codes to govern construction be concerned with IAQ or just ventilation? What about ASHRAE—IAQ or just ventilation?

Question 3: Who are the "consumers" for Standard 62.1, and what do each of them need from the standard? Can one standard address all their needs?

The discussion built upon these three questions, with some of the major points summarized here under a few headings. Of course, not everyone agreed, but the discussion was productive and provides some useful insight into the issues surrounding Standard 62.1.

Ventilaton-Only Standard or IAQ

- The standard should consider health, which includes IAQ in addition to ventilation.
- IAQ and ventilation should not be tied together, as it's pretty hard to make this connection without identifying contaminants and target concentrations. However, there are no clear contaminant levels than define acceptable IAQ.
- ASHRAE is viewed as responsible for ventilation requirements. We should also define IAQ contaminant levels. Changing the standard is more important than changing the code.
- Reasonable people disagree about safe contaminant levels. Therefore, Standard 62.1 should be a ventilation standard rather than an IAQ standard.
- Why couldn't you definite acceptable IAQ as a carbon dioxide (CO_2) level? [Several answered that CO_2 alone can't be used as an IAQ indicator.]
- The state of California is questioning whether Standard 62.1 adequately protects health and safety.
- LEED is saying that there's a benefit to increased outdoor airflow. It should be an option to increase airflow, but the standard shouldn't go beyond a minimum ventilation rate.

Complexity

- Some designers and code officials think the standard is complex and hard to use. They want a basic ventilation standard with minimum levels.
- The standard requires some effort on the part of the designer, but it can and should be used.
- If you're an engineer and study the standard, it's not that bad.
- Complexity seems to be just a matter of whether or not you're willing to invest the time needed to understand the requirements of the standard.
- Regarding complexity, one attendee seemed to say that if the standard were not complex, the contractors would do a worse job than they already do. The complexity forces them to consult with an engineer.

What Causes IAQ Problems? What Are the Solutions?

- We really never did have a big IAQ problem in buildings.
- The problem in VAV systems is achieving proper ventilation under all circumstances. So, the real problem is operation, not design.
- There is only one way to ventilate properly; use 100% outdoor air.
- Lack of enforcement of existing codes makes for an uneven playing field among ventilation system designers. The standard should level the playing field, which in turn protects the health and safety of the public.

Engineering and Economic Issues

- Dedicated OA units are often "value engineered" out of jobs. There's a different "pocket" for capital expenses than for operational expenses; increased capital costs can't always be justified by operating cost savings.
- Many of the problems sound more like business problems than engineering problems. The standard can't solve problems caused by value engineering or capital budget pressures.

Who Needs the Standard?

- Consulting engineers need this guidance.
- Manufacturers are also consumers and help designers by incorporating Standard 62.1 requirements into load calculation programs. This makes it easier for designers to comply with the standard.
- Health inspectors also use the standard, but it seems that the minimum ventilation rates are based on energy.

- "Weakening" the standard could negatively impact the reputation of ASHRAE.

3b. Same as Option 3a, but also retain 62.1.

Additional Pros

- Retains 62.1 for those who have adopted it already and other users.

Additional Cons

- Two standards will be confusing for users.
- Designers may increase risk of liability if the most stringent standard is not followed.

3c. Convert the current standard into a best practices guideline and also develop a ventilation-only minimum standard.

Additional Pros

- Would not necessarily result in two competing documents, provided the new guideline is written in non-advisory, non-mandatory language.

Additional Cons

- Some currently dissatisfied members will not like the guideline for some of the same reasons they don't like the current standard.
- Designers may increase the risk of liability if the most stringent standard is not followed.

4. Withdraw Standard 62.1, and develop a best practices guideline in its place.

Pros

- It might be easier to write the guideline than the standard.
- Avoids multiple, competing documents.

Cons

- Code bodies will continue to use rates from 62-1989 (generally higher than those from 62.1-2004).
- Would create a storm of controversy and comments during the public review to withdraw 62.1.
- Would negatively impact the reputation of ASHRAE and allow another body to become the de facto leader in ventilation and IAQ.
- Requires authorities, jurisdictions and organizations that have adopted the standard to remove their reference to the standard.
- ASHRAE's recently published User's Manual would become irrelevant.

5. Develop additional addenda to Standard 62.1 to increase its stringency beyond the minimum towards best practices.

Pros

- Designers will have a single document to follow.
- Consistent with ASHRAE's mission to advance HVAC&R.
- Avoids multiple, competing documents.

Cons

- Addition of non-minimum requirements may increase the cost of design, installation and operation of a ventilation system.
- Criteria unclear for adding new material to the standard.
- Would not satisfy those who wish to shorten the standard.
- Makes existing 62.1 more complicated and perhaps less likely to be adopted.
- Could increase controversy.
- The same conflicts related to increasing or decreasing ventilation, which confronted the committee for years, would arise again.

Conclusions

This article attempts to describe the current status of the ASHRAE Standard 62.1, along with some concerns that exist regarding the document. A number of options for addressing some of these concerns have been presented, though none of them are perfect and definitely will not meet the needs and desires of all stakeholders. For now and the foreseeable future, the first option seems to be holding strong, but rational discussions among reasonable people should be encouraged and new ideas explored.

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