

ANSI/ASHRAE/ICC/USGBC/IES Addendum ay to ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2017

Standard for the Design of High-Performance Green Buildings

Except Low-Rise Residential Buildings

The Complete Technical Content of the International Green Construction Code®

Approved by ASHRAE and the American National Standards Institute on July 6, 2020; by the International Code Council on June 1, 2020; by the U.S. Green Building Council on June 3, 2020; and by the Illuminating Engineering Society on July 1, 2020.

These addenda were approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

The latest edition of an ASHRAE Standard may be purchased on the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305, telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in the United States and Canada), or e-mail: orders@ashrae.org. For reprint permission, go to www.ashrae.org/permissions.

© 2020 ASHRAE

ISSN 1041-2336



ASHRAE Standing Standard Project Committee 189.1
Cognizant TC: 2.8 Building Environmental Impacts and Sustainability
SPLS Liaison: Walter T. Grondzik
ASHRAE Staff Liaisons: Emily Toto
ICC Liaison: Mike Pfeiffer
IES Liaison: Mark Lien
USGBC Liaison: Wes Sullens

Roger Hedrick*, <i>Chair</i>	John Cross*	Stephen Kanipe	Kathleen Petrie
Charles Eley*, <i>Co-Vice-Chair</i>	Michael Cudahy*	James Kendzel	Teresa Rainey
Josh Jacobs*, <i>Co-Vice-Chair</i>	Thomas Culp*	Andrew Klein	Steven Rosenstock*
Michael Jouaneh*, <i>Co-Vice-Chair</i>	David Delaquila	Gary Klein	Loren Ross
Lawrence Schoen*, <i>Co-Vice-Chair</i>	Jim Edelson*	Vladimir Kochkin	Michael Schmeida
Anand Achari	Anthony Floyd*	Thomas Lawrence	Kent Sovocool*
Vinay Ananthachar	Mark Frankel	Neil Leslie*	Dennis Stanke
Constantinos Balaras*	Patricia Fritz	Christine Locklear	Wayne Stoppelmoor
James Bogdan	Susan Gitlin*	Richard Lord	Christine Subasic*
Jeff Bradley*	Gregg Gress*	David Madsen	Michael Temple
Susan Bronson	Maureen Guttman	C. Webster Marsh	Martha VanGeem*
Scott Buckley	Katherine Hammack	Joel Martell	Scott West*
Julie Chandler	Thomas Hogarth*	Jonathan McHugh*	Daniel Whittet
Ernest Conrad*	Donald Horn*	Adam McMillen*	Joe Winters*
Glen Clapper	Jonathan Humble	Erik Miller-Klein	Jian Zhang*
Dru Crawley	Ksenija Janjic	Gwelen Paliaga	
John Cribbs	Greg Johnson	Thomas Pape*	

* Denotes members of voting status when the document was approved for publication

ASHRAE STANDARDS COMMITTEE 2019–2020

Wayne H. Stoppelmoor, Jr., <i>Chair</i>	Walter T. Grondzik	Karl L. Peterman	Theresa A. Weston
Drury B. Crawley, <i>Vice-Chair</i>	Susanna S. Hanson	Erick A. Phelps	Michael W. Woodford
Els Baert	Rick M. Heiden	Lawrence J. Schoen	Craig P. Wray
Charles S. Barnaby	Jonathan Humble	Steven C. Sill	Jaap Hogeling, <i>BOD ExO</i>
Robert B. Burkhead	Srinivas Katipamula	Richard T. Swierczyna	Malcolm D. Knight, <i>CO</i>
Thomas E. Cappellin	Essam E. Khalil	Christian R. Taber	
Douglas D. Fick	Larry Kouma	Russell C. Tharp	
Michael W. Gallagher	Cesar L. Lim	Adrienne G. Thomle	

Connor Barbaree, *Senior Manager of Standards*

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for

- a. interpretation of the contents of this Standard,
- b. participation in the next review of the Standard,
- c. offering constructive criticism for improving the Standard, or
- d. permission to reprint portions of the Standard.

DISCLAIMER

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE's Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

ASHRAE INDUSTRIAL ADVERTISING POLICY ON STANDARDS

ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objections on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

Standard 189.1-2017, Section 10, includes methods and requirements for facilitating and evaluating the systems commissioning, contractor process requirements, specialty testing, facility operations and maintenance planning, service life plans, and transportation plans. This proposal rennumbers and rearranges the sections and paragraphs to simplify and clarify the requirements. The new document groups requirements according to their stage in the process.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strike through~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum ay to Standard 189.1-2017

Modify Section 4.1 to indicate that Section 10 no longer includes mandatory, prescriptive and performance sections. All requirements in Section 10 have been and will remain mandatory, but there will no longer be a Section 10.3, "Mandatory." (I-P and SI units).

4.1 General. *Building projects* shall comply with Sections 4 through 11. Within each of these sections ~~4 through 9~~, *building projects* shall comply with all mandatory provisions (x.3) and, where offered, either the:

- a. Prescriptive Option (x.4) or
- b. Performance Option (x.5).

[. . .]

Modify Section 10 as shown (I-P and SI units).

10. CONSTRUCTION AND PLANS FOR OPERATION

10.1 Scope. This section specifies requirements for construction and plans for operation, including the *commissioning (Cx) process*, *building functional and performance testing (FPT)*, measurement and *verification (M&V)*, energy use reporting, durability, transportation management, erosion and sediment control, construction, and indoor air quality (IAQ) during construction.

10.2 Compliance. All of the provisions of Section 10 are mandatory provisions.

10.3 ~~Mandatory Provisions~~ Functional and Performance Testing and Commissioning. *Building projects* with not greater than 10,000 ft² (1000 m²) of gross floor area shall comply with Section 10.3.1. *Building projects* with greater than 10,000 ft² (1000 m²) of gross floor area, shall comply with Section 10.3.2.

Reorder and renumber the subsections within Section 10 as shown (I-P and SI units).

~~10.3.1 Construction~~

~~10.3.1.1~~ 10.3.1 Building Systems FPT Functional and Performance Testing (FPT). *Functional and performance testing* shall be performed on all building systems specifically referenced in this section using *generally accepted engineering standards* acceptable to the *authority having jurisdiction (AHJ)*.

[. . .]

~~10.3.1.1.1~~ 10.3.1.1 FPT Requirements. An *FPT* process shall be performed for the following:

[. . .]

~~10.3.1.1.1-10.3.1.2~~ Activities Prior to Building Permit for Facilities Using the FPT Process. The following activities shall be completed before a permit is issued for any system requiring *FPT*:

- a. Designate *FPT providers*. For systems that are required to comply with Section ~~10.3.1.1.1-10.3.1~~, *FPT providers* shall be *owner's* qualified employees, independent commissioning (*Cx*) providers, or qualified designers experienced with *FPT* on the designated systems. *FPT providers* shall be independent of the building system design and construction function and shall possess the necessary experience and testing equipment.

[...]

~~10.3.1.1.1.2-10.3.1.3~~ Activities Prior to Building Occupancy for Facilities Using the FPT Process. Before issuance of a certificate of occupancy, the *FPT providers* shall complete the following activities:

[...]

- b. *FPT* of systems shall be verified.

Exception to ~~10.3.1.1.1.2-10.3.1.3~~(b): Systems for which operation is seasonally dependent, and which cannot be fully commissioned in accordance with the *commissioning (Cx) plan* at the time of occupancy, shall be commissioned at the earliest operation time, postoccupancy, as determined by the *FPT providers*.

[...]

~~10.3.1.1.1.3-10.3.1.4~~ Documentation. The completed project design and *FPT* documentation shall be provided to the *owner* and shall be retained with the project records.

~~10.3.1.2-10.3.2~~ Building Project Commissioning (Cx) Process. The *Cx process* shall be performed in accordance with this section using ANSI/ASHRAE/IES Standard 202 or other *generally accepted engineering standards* acceptable to the *AHJ*. The *Cx provider* shall verify that a *Cx process* has been incorporated into the design phases of the project and that commissioning shall be incorporated into the *construction documents*. The *Cx process* documents that the building and its commissioned components, assemblies, and systems comply with the *owner's project requirements (OPR)*. The project requirements, including *OPR*, *BoD*, design and construction record documentation, training plans and records, O&M plans and procedures, and *Cx* reports shall be assembled in a systems manual that provides information for building operating and maintenance staff.

~~10.3.1.2.1-10.3.2.1~~ Systems to be Commissioned. ~~For buildings that exceed 10,000 ft² (1000 m²) of gross floor area, the~~ *Cx process* shall be included in the design and construction of the *building project*. The following systems and associated controls, where included in the *building project*, shall be commissioned:

[...]

~~10.3.1.2.2-10.3.2.2~~ Cx Activities Prior to Building Permit. The following activities shall be completed prior to issuance of a building permit:

[...]

~~10.3.1.2.3-10.3.2.3~~ Cx Activities Prior to Building Occupancy. The following activities shall be completed prior to issuance of a certificate of occupancy:

- a. For the systems being commissioned, verify that commissioning has been completed, installation has been verified, *FPT* has been performed, and that reporting includes documentation of test results.

Exception to ~~10.3.1.2.3-10.3.2.3~~(a): Systems for which operation is seasonally dependent and which cannot be fully commissioned in accordance with the *Cx plan* at the time of occupancy shall be commissioned at the earliest operation time, postoccupancy, as determined by the *Cx provider*.

- b. The *owner* shall be provided with a preliminary *Cx* report per compliance with Section ~~10.3.1.3-10.3.2.3~~. A copy of the *Cx* preliminary report shall be submitted to the *AHJ* upon request.
- c. The *Cx provider* shall verify that the *owner* has been provided with a systems manual that includes the information needed to understand and operate the commissioned systems as designed, including warranty information for the commissioned systems. The systems manual with design and operational information shall be available for building operator and maintenance training.

10.3.1.2.4-10.3.2.4 Postoccupancy Cx Activities. The *Cx plan* shall contain postoccupancy Cx requirements in accordance with ANSI/ASHRAE/IES Standard 202. The *Cx provider* shall provide the *owner* with a complete systems manual, all record documents, and a complete final Cx report in accordance with Standard 202.

10.3.1.3-10.3.2.5 Project Cx Documents

10.3.1.3.1-10.3.2.5.1 Cx Plan. A *Cx plan* shall be developed by a *Cx provider* in accordance with ANSI/ASHRAE/IES Standard 202 for all systems to be commissioned and/or tested.

10.3.1.3.2-10.3.2.5.2 Design Review Report. The *Cx provider* shall provide to the *owner* and design teams a Cx design review report that complies with ANSI/ASHRAE/IES Standard 202 and details compliance with the *OPR*. This Cx design review shall not be considered a design peer review or a code or regulatory review.

10.3.1.3.3-10.3.2.5.3 Preliminary Cx Report. The *Cx provider* shall provide a preliminary Cx report that includes the following information:

[. . .]

10.3.1.3.4-10.3.2.5.4 Final Cx Report. The *Cx provider* shall provide to the *owner*, prior to project completion, a final Cx report that complies with ANSI/ASHRAE/IES Standard 202.

10.3.1.3.6-10.3.2.5.5 Documentation. *Owner* shall retain the systems manual and final Cx report.

10.4 Construction Operations and Start-Up Requirements

10.3.1.4-10.4.1 Erosion and Sedimentation Control (ESC). Develop and implement an ESC plan for all construction activities. The ESC plan shall conform to the erosion and sedimentation control requirements of the most current version of the USEPA NPDES General Permit for Stormwater Discharges from Construction Activities, or local erosion and sedimentation control standards and codes, whichever is more stringent, and regardless of size of project.

10.3.1.5-10.4.2 IAQ Construction Management. Develop and implement an IAQ construction management plan to include the following:

- a. Air conveyance materials shall be stored and covered so that they remain clean. All filters and controls shall be in place and operational when HVAC systems are operated during building flush-out or baseline IAQ monitoring. Except for system startup, testing, balancing, and commissioning, permanent HVAC systems shall not be used during construction.

[. . .]

~~**10.3.1.6 Moisture Control.** The following items to control moisture shall be implemented during construction:~~

- ~~a. Materials stored on-site, or materials installed that are absorptive, shall be protected from moisture damage.~~
- ~~b. Building construction materials that show visual evidence of biological growth due to the presence of moisture shall not be installed on the *building project*.~~

10.3.1.7-10.4.3 Construction Activity Pollution Prevention: Idling of Construction Vehicles. Construction-related vehicles shall not idle on the construction *site* for more than five minutes in any 60-minute period, except where necessary to perform their construction-related function. Signage shall be posted at vehicle entrances to the *building project* providing notice of this requirement.

10.3.1.8-10.4.4 Construction Activity Pollution Prevention: Protection of Occupied Areas. The *construction documents* shall identify operable windows, doors, and air intake openings that serve occupied *spaces*, including those not associated with the *building project*, that are in the area of construction activity or within 35 ft (11 m) of the limits of construction activity. Such windows, doors, and air intake openings that are under control of the *owner* shall be closed, or other measures shall be taken to limit *contaminant* entry.

Management of the affected buildings not under the control of the *building project owner* shall be notified in writing of planned construction activity and possible entry of *contaminants* into their buildings.

10.3.1.10-10.4.5 Construction Waste Management

~~10.3.1.10.1-10.4.5.1~~ Collection. Specific areas on the construction *site* shall be designated for collection of recyclable and reusable materials. Alternatively, off-site storage and sorting of materials shall be permitted. Diversion efforts shall be tracked throughout the construction process.

~~10.3.1.10.2-10.4.5.2~~ Documentation. Prior to issuance of the final certificate of occupancy, a final construction waste management report documenting compliance with Section 9.3.1 shall be submitted to the *owner* and *AHJ*.

~~10.3.1.1.2~~ Acoustical Control

~~10.3.1.1.2.1-10.5~~ Acoustical Field Measurement. Where required by Section 8, the *FPT* specified in Sections ~~10.3.1.1.2.1.1-10.5.1~~ through ~~10.3.1.1.2.1.2-10.5.3~~ shall be completed.

~~10.3.1.1.2.1.1-10.5.1~~ Interior Background Sound Levels. The interior sound level shall be measured in accordance with ANSI S12.72 using a sound level meter in slow-response setting as defined in ANSI/ASA S1.4. The testing shall include not less than 10% of the rooms of each type specified in Table 8.3.3.2 that has a prescribed maximum *hourly average sound pressure level* L_{eq} dBA of 40 or less. The measured performance of the *spaces* shall not exceed the values specified in Table 8.3.3.2 by greater than 5 dBA or 5 dBC.

~~10.3.1.1.2.1.2-10.5.2~~ Interior Sound Transmission. The testing of interior sound transmission shall be in accordance with ASTM E336 with respect to noise isolation class (NIC) and ASTM E1007 with respect to impact sound rating (ISR). Tested NIC values shall not be more than five less than the composite sound transmission class (cSTC) values, and the ISR values shall not exceed 5 less than the impact insulation class (IIC) values in Table 8.3.3.3. Testing shall be performed on not less than 10% of the partitions between rooms of each type in Table 8.3.3.3 that has a prescribed cSTC or IIC of 50 or higher.

~~10.3.1.1.2.1.3-10.5.3~~ Property Line Sound. Testing shall be performed at the locations and times of day or night that are estimated to most likely result in failure and shall be performed with all equipment operating under normal 100% load operation. If daytime test results comply with the nighttime requirements, nighttime testing is not required. The testing shall be in accordance with ANSI/ASA S1.13. The testing results shall comply with the property line noise levels in Table 8.3.3.5.2. At the discretion of the *AHJ*, noise that is not created on the source property need not be included in the reported test results.

~~10.3.1.3.5-10.6~~ Building Envelope Airtightness. *Building envelope* airtightness shall comply with ANSI/ASHRAE/IES Standard 90.1, with the following modifications and additions. Air leakage *verification* shall be determined in accordance with ANSI/ASHRAE/IES Standard 90.1, Section 5.9.2.2:

- a. When implementing the testing option in ANSI/ASHRAE/ IES Standard 90.1, Sections 5.9.2.2(b) and 5.4.3.1.3(a), whole-building pressurization testing shall meet the following requirements:
 1. It shall be conducted in accordance with ASTM E779, ASTM E1827, CAN/CGSB-149.10, CAN/CGSB- 149.15, ISO 9972, or equivalent standard by an independent third party.
 2. The measured air leakage rate of the *building envelope* shall not exceed 0.25 cfm/ft² (1.25 L/s·m²) under a pressure differential of 0.3 in. of water (75 Pa), with this air leakage rate normalized by the sum of the above- and below-grade *building envelope* areas of the *conditioned* and *semiheated space*.
 3. Section 5.4.3.1.3(a), Exception (1), is not allowed.
 4. Section 5.4.3.1.3(a), Exception (2), is allowed where the measured air leakage rate exceeds 0.25 cfm/ft² (1.25 L/s·m²) but does not exceed 0.40 cfm/ft² (2.0 L/s·m²).
- b. When implementing the *verification* program option in ANSI/ASHRAE/IES Standard 90.1, Section 5.9.2.2(a), the air barrier design review shall be performed by an independent third party.

~~b-10.7~~ Postconstruction Building Flush-Out and Air Monitoring. After construction ends, prior to occupancy and with all interior finishes installed, a postconstruction, preoccupancy building flush-out as described under Section ~~10.3.1.4(b)(1)-10.7.1~~, or postconstruction, preoccupancy baseline IAQ monitoring as described under Section ~~10.3.1.4(b)(2)-10.7.2~~, shall be performed:

~~1-10.7.1~~ Postconstruction, preoccupancy flush-out. A total air volume of *outdoor air* in total air changes as defined by Equation 10-1 shall be supplied while maintaining an internal temperature of a minimum of 60°F (15°C) and relative humidity no higher than 60%. For buildings located in nonattainment areas, filtration and/ or air cleaning as described in Section

8.3.1.3 shall be supplied when the Air Quality Index forecast exceeds 100 (category orange, red, purple, or maroon). One of the following options shall be followed:

i.-a. **Continuous postconstruction, preoccupancy flush-out.** The flush-out shall be continuous and supplied at an outdoor airflow rate no less than that determined in Section 8.3.1.1.

ii.-b. **Continuous postconstruction, preoccupancy/postoccupancy flush-out.** If occupancy is desired prior to completion of the flush-out, the *space* is allowed to be occupied following delivery to the *space* of half of the total air changes calculated from Equation 10-1. The *space* shall be ventilated at a minimum rate of 0.30 cfm per ft² (1.5 L/s per m²) of *outdoor air*, or the outdoor airflow rate determined in Section 8.3.1.1, whichever is greater. These conditions shall be maintained until the total air changes calculated according to Equation 10-1 have been delivered to the *space*. The flush-out shall be continuous.

[. . .]

~~2-~~**10.7.2 Postconstruction, pPreoccupancy bBaseline IAQ mMonitoring.** Baseline IAQ testing shall be conducted after construction ends and prior to occupancy. The ventilation system shall be operated continuously, within ±10% of the outdoor airflow rate provided by the ventilation system at design occupancy, for a minimum of 24 hours prior to IAQ monitoring. Testing shall be performed using protocols consistent with the USEPA Compendium of Methods for the Determination of Toxic Organic Pollutants in Ambient Air, TO-1, TO-11, TO-17, and ASTM Standard Method D 5197. The testing shall demonstrate that the *contaminant* maximum concentrations listed in Table 10.3.1.5 are not exceeded in the return airstreams of the HVAC systems that serve the *space* intended for occupancy. If the return airstream of the HVAC system serving the *space* intended for occupancy cannot be separated from other *spaces*, then for each portion of the building served by a separate ventilation system, the testing shall demonstrate that the *contaminant* maximum concentrations at *breathing zone* listed in Table ~~10.3.1.5~~ **10.7.2** are not exceeded in the larger of the following number of locations: (i) no fewer than one location per 25,000 ft² (2500 m²) or (ii) in each contiguous floor area. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with *outdoor air*, and retest the specific parameters exceeded to demonstrate that the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from the same locations as in the first test.

~~10.3.1.9~~ **10.8 Soil-Gas Control.** The building shall be tested, postconstruction, for radon in accordance with ANSI/AARST MALB. The indoor radon concentration shall be below 2.7 pCi/L (100 Bq/m³). Where radon testing indicates that the indoor radon concentration is 2.7 pCi/L (100 Bq/m³) or greater, radon mitigation shall be conducted in accordance with ANSI/AARST RMS-LB, and the building shall be retested to verify that the radon concentration is below 2.7 pCi/L (100 Bq/m³).

~~10.3.2-~~ **10.9 Plans for High-Performance Building Operation.** This section specifies the items to be included in plans for operation of a *building project* ~~that falls under the requirements of this standard.~~ A plan for operation starting immediately prior to occupancy shall be developed that meets the requirements specified in Sections 10.9.1 through 10.9.8. The plan shall be turned over to the owner.

~~10.3.2.1~~ **High-Performance Building Operation Plan.** A master building plan for operation shall be developed that meets the requirements specified in Sections 10.3.2.1.1 through 10.3.2.1.5.

~~10.3.2.1.1~~ **10.9.1 Site Sustainability.** A *site* sustainability portion of the plan for operation shall be developed and shall contain the following provisions:

[. . .]

~~10.3.2.1.2~~ **10.9.2 Water Use Efficiency.** The plan for operation shall specify water use *verification* activities for *building projects* to track and assess building water consumption. The plan shall describe the procedures needed to comply with the requirements outlined below.

~~10.3.2.1.2.1~~ **10.9.2.1 Initial M&V.** Use the water measurement devices and collection/storage infrastructure specified in Section 6.3.3 to collect and store water use data for each device,

Table 10.3.1.5-Table 10.7.2 Maximum Concentration of Air Pollutants Relevant to IAQ

Contaminant	Maximum Concentration, $\mu\text{g}/\text{m}^3$ (Unless Otherwise Noted)
Nonvolatile Organic Compounds	
Carbon monoxide (CO)	9 ppm and no greater than 2 ppm above outdoor levels
Ozone	0.075 ppm (8-h)
Particulates (PM _{2.5})	35 (24 h)
Particulates (PM ₁₀)	150 (24 h)
Volatile Organic Compounds	
Acetaldehyde	140
Acrylonitrile	5
Benzene	60
1,3-butadiene	20
t-butyl methyl ether (methyl-t-butyl ether)	8000
Carbon disulfide	800
Caprolactam ^a	100
Carbon tetrachloride	40
Chlorobenzene	1000
Chloroform	300
1,4-dichlorobenzene	800
Dichloromethane (methylene chloride)	400
1,4-Dioxane	3000
Ethylbenzene	2000
Ethylene glycol	400
Formaldehyde	33
2-Ethylhexanoic acid ^a	25
n-Hexane	7000
1-methyl-2-pyrrolidinone ^a	160
Naphthalene	9
Nonanal ^a	13
Octanal ^a	7.2
Phenol	200
4-phenylcyclohexene (4-PCH) ^a	2.5
2-propanol (isopropanol)	7000
Styrene	900
Tetrachloroethene (tetrachloroethylene, perchloroethylene)	35
Toluene	300
1,1,1-trichloroethane (methyl chloroform)	1000
Trichloroethene (trichloroethylene)	600
Xylene isomers	700
Total volatile organic compounds (TVOC)	— ^b

a. This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.

b. TVOC reporting shall be in accordance with CDPH/EHLB/Standard Method V1.1 and shall be in conjunction with the individual VOCs listed.

starting no later than after building acceptance testing has been completed and certificate of occupancy has been issued.

~~10.3.2.1.2.2~~ **10.9.2.2 Track and Assess Water Use.** The plan shall specify the procedures for tracking and assessing the *building project* water use and the frequency for benchmark comparisons. The initial assessment shall be completed after 12 months but no later than 18 months after a certificate of occupancy has been issued. Ongoing assessments shall be completed at least every three years. The plan shall include the following:

[. . .]

~~10.3.2.1.2.3~~ **10.9.2.3 Documentation of Water Use.** All documents associated with the M&V of the building's water use shall be retained by the *owner* for a minimum of three years.

~~10.3.2.1.3~~ **10.9.3 Energy Efficiency.** The plan for operation shall specify energy performance *verification* activities for *building projects* to track and assess building energy performance. The plan shall describe the procedures needed to comply with the requirements outlined in the following subsections.

~~10.3.2.1.3.1~~ **10.9.3.1 Initial M&V.** Use the energy measurement devices and collection/storage infrastructure specified in Section 7.3.3 to collect and store energy data for each device, starting no later than after acceptance testing has been completed and certificate of occupancy has been issued.

~~10.3.2.1.3.2~~ **10.9.3.2 Track and Assess Energy Consumption.** The plan for operation shall specify the procedures for tracking and assessing the *building project* energy performance and the frequency for benchmark comparisons. The initial assessment shall be completed after 12 months but no later than 18 months after a certificate of occupancy has been issued. Ongoing assessments shall be completed at least every three years. The plan shall include the following:

[. . .]

~~10.3.2.1.3.3~~ **10.9.3.3 Documentation of Energy Efficiency.** All documents associated with the M&V of the building's energy efficiency shall be retained by *owner*.

~~10.3.2.1.4~~ **10.9.4 IAQ.** The plan for operation shall include the requirements of Section 8 of ASHRAE Standard 62.1 and shall describe additional procedures, ~~as outlined in Sections 10.3.2.1.4.1 through 10.3.2.1.4.6,~~ for implementing a regular indoor environmental quality M&V program after building occupancy.

~~10.3.2.1.4.1~~ **10.9.4.1 Outdoor Airflow Measurement.** The plan for operation shall document procedures for implementing a regular outdoor airflow monitoring program after building occupancy and shall meet the following requirements:

[. . .]

~~10.3.2.1.4.2~~ **10.9.4.2 Outdoor Airflow Scheduling.** Ventilation systems shall be operated such that *spaces* are ventilated when these *spaces* are expected to be occupied.

~~10.3.2.1.4.3~~ **10.9.4.3 Outdoor Airflow Documentation.** The following documentation shall be maintained concerning outdoor airflow M&V:

[. . .]

~~10.3.2.1.4.4~~ **10.9.4.4 IAQ Maintenance and Monitoring.** The plan for operation shall document procedures for maintaining and monitoring IAQ after building occupancy and shall contain the following:

- a. For buildings located in nonattainment areas for PM_{2.5}, as defined by USEPA, air filtration and/or air cleaning equipment, as defined in Section 8.3.1.3(a), shall be operated continuously during occupied hours or when the USEPA Air Quality Index exceeds 100 or equivalent designation by the local authorities for PM_{2.5}.

Exception to ~~10.3.2.1.4.4~~ 10.9.4.4(a): *Spaces* without mechanical ventilation.

- b. For buildings located in nonattainment areas for ozone, as defined by the USEPA, air cleaning equipment, as defined in Section 8.3.1.3(b), shall be operated continuously during occupied hours during the local summer and fall seasons or when the USEPA Air Quality Index exceeds 100 or equivalent designations by the local authorities for ozone.

Exception to ~~10.3.2.1.4.4~~ 10.9.4.4(b): *Spaces* without mechanical ventilation.

- c. Biennial monitoring of IAQ by one of the following methods:
 1. Performing IAQ testing as described in Section ~~10.3.1.4~~ 10.7.1.2.

Table 10.3.2.3 10.10 Minimum Design Service Life for Buildings

Category	Minimum Service Life	Building Types
Temporary	Up to 10 years	Nonpermanent construction buildings (sales offices, bunkhouses); temporary exhibition buildings
Medium life	25 years	Industrial buildings; stand-alone parking structures
Long life	50 years	All buildings not temporary or medium life, including the parking structures below buildings designed for long life category

2. Monitoring occupant perceptions of IAQ by any method, including but not limited to occupant questionnaires.
3. Each building shall have an occupant complaint/ response program for IEQ.
- d. For buildings where radon mitigation is required under Section ~~10.3.1.9~~ 10.8, operation, maintenance, and monitoring procedures shall include all of the following:

[...]

~~10.3.2.1.4.5~~ **10.9.5 Building Green Cleaning Plan.** A green cleaning plan shall be developed for the *building project* in compliance with Green Seal Standard GS-42.

[...]

~~10.3.2.1.4.6~~ **10.9.6 Moisture Measurement.** The plan for operation shall document procedures for implementing a regular humidity sensor monitoring program after building occupancy. Such procedures shall include provisions for the following:

[...]

Delete the following section, which is redundant, and continue renumbering (I-P and SI units).

~~10.3.2.1.4.7~~ Document all M&V data.

~~10.3.2.1.5~~ **10.9.7 Indoor Environmental Quality Survey.** The plan for operation shall include an indoor environmental quality occupant survey complying with all of the following:

[...]

~~10.3.2.2~~ **10.9.8 Maintenance Plan.** A *maintenance plan* shall be developed for mechanical, electrical, plumbing, and fire protection systems. The plan shall include the following:

[...]

~~10.3.2.3~~ **10.10 Service Life Plan.** A service life plan that is consistent with the *OPR* shall be developed to estimate to what extent structural, *building envelope* (not mechanical and electrical), and *hardscape* materials will need to be repaired or replaced during the service life of the building. The design service life of the building shall be no less than that determined using Table ~~10.3.2.3~~ 10.10. The estimated service life shall be documented for building assemblies, products, and materials that will need to be inspected, repaired, and/or replaced during the service life of the building. *Site* improvements and *hardscape* shall also be included. Documentation in the service life plan shall include the *building project* design service life and basis for determination, and the following for each assembly or component:

[...]

~~10.3.2.4~~ **10.11 Transportation Management Plan.** A transportation management plan shall be developed compliant with the following requirements. *Owner* shall retain a copy of the transportation management plan.

~~10.3.2.3.1~~ **10.11.1 All Building Projects.** The plan shall include the following:

[...]

~~10.3.2.3.2~~ **10.11.2 Owner-Occupied Building Projects or Portions of Building Projects.** For *owner*-occupied buildings, or for the employees in the *owner*-occupied portions of a building, the building *owner* shall offer at least one of the following primary benefits to the *owner's* employees:

- a. Incentivize employees to commute using mass transit, vanpool, carpool, or nonmotorized forms of transportation.

- b. Initiate a telework or flexible work schedule program that reduces by at least 5% the number of commuting trips by the *owner's* employees.
- c. Initiate a ridesharing or carpool matching program, either in-house or through an outside organization.

Exception to ~~10.3.2.4.2~~ 10.11.2(a) through (c): Multifamily *residential building project*.

[. . .]

~~10.3.2.4.2~~ 10.11.3 Building Tenant. The building *owner*

[. . .]

**POLICY STATEMENT DEFINING ASHRAE'S CONCERN
FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES**

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

Standard 189.1 and the International Green Construction Code

Standard 189.1 serves as the complete technical content of the International Green Construction Code® (IgCC). The IgCC creates a regulatory framework for new and existing buildings, establishing minimum green requirements for buildings and complementing voluntary rating systems. For more information, visit www.iccsafe.org.

About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

To stay current with this and other ASHRAE Standards and Guidelines, visit www.ashrae.org/standards, and connect on LinkedIn, Facebook, Twitter, and YouTube.

Visit the ASHRAE Bookstore

ASHRAE offers its Standards and Guidelines in print, as immediately downloadable PDFs, and via ASHRAE Digital Collections, which provides online access with automatic updates as well as historical versions of publications. Selected Standards and Guidelines are also offered in redline versions that indicate the changes made between the active Standard or Guideline and its previous edition. For more information, visit the Standards and Guidelines section of the ASHRAE Bookstore at www.ashrae.org/bookstore.

IMPORTANT NOTICES ABOUT THIS STANDARD

To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

Addenda, errata, and interpretations for ASHRAE Standards and Guidelines are no longer distributed with copies of the Standards and Guidelines. ASHRAE provides these addenda, errata, and interpretations only in electronic form to promote more sustainable use of resources.