Public Review Draft

Proposed Addendum ay to Standard 189.1-2017

Standard for the Design of High-Performance Green Buildings

Except Low-Rise Residential Buildings

First Public Review (February 2020)
(Draft Shows Proposed Changes to Current Standard)

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(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 objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

Foreword

ASHRAE Standard 189.1-2017, Chapter 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 renumbers 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 to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by <u>underlining</u> (for additions) and strikethrough (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum ay to 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

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

a. Prescriptive Option (x.4) or

b. Performance Option (x.5).

...

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.

Add the following explicit charging statement, which was formerly implicit.

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 below.

***[Note to reviewers:** In Section 10 of this addendum, various sections are being moved and renumbered. Only the numbering and any other changes to the text that are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions). Text that is not changed other than by being moved, is not marked. The various sections are shown in their proposed (moved) location. Only the changes shown using strikethrough or underlining are open for review and comment at this time. Text that is moved but not otherwise changed is not open for comment except as it relates to the proposed marked changes.]*

~~10.3.1 Construction~~

~~10.3.1.1~~ 10.3.1 Building Systems ~~FPT~~ *Functional and Performance Testing*. *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*).

An *FPT* process and system performance requirements shall be incorporated into *construction documents* and construction schedule of the *building project* to verify system performance.

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

a. Heating, ventilating, air conditioning, and refrigeration systems (mechanical and passive) and associated controls that exceed total system capacities of 180,000 Btu/h (53,000 W) for cooling, 300,000 Btu/h (88,000 W) for heating, or 10,000 cfm (5000 L/s) for ventilation.

b. Lighting systems over 5 kW in total capacity, including *automatic* and daylighting controls, manual daylighting controls, occupancy-sensing devices, time switching, and *automatic* shut-off controls.

c. Domestic water-heating systems rated at over 50,000 Btu/h (15,000 W).

d. Water pumping and mixing systems over 5 hp (4 kW).

e. Irrigation systems that use more than 1000 gal (4000 L) per day.

~~10.3.1.1.1.1~~ 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 ~~10.3.1.1.1~~, *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 possesses the necessary experience and testing equipment.

b. *FPT providers* shall review the *construction documents* to verify that the relevant sensor locations, devices, and control sequences are properly specified; performance and testing criteria are included; and equipment to be tested is accessible for testing and maintenance.

~~**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:

a. Installation and startup of the specified systems shall be verified.

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*.

c. The preparation of operation and maintenance (O&M) documentation and warranty information shall be verified. O&M documentation, including the information needed to understand, operate, and maintain the building systems, shall be provided to the building *owner* and facility manager.

~~**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~~ 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:

a. Heating, ventilating, air-conditioning, and refrigeration systems (mechanical and/or passive) and associated controls

b. Air-curtain systems

c. Lighting systems: *automatic* and manual daylighting controls, occupancy sensing devices, *automatic* shut-off controls, time switching, and other lighting control devices, and dimming systems claiming a lighting power allowance for institutional tuning according to Section 7.4.6.1.1(f)

d. Domestic hot-water systems and controls

e. Water pumping and mixing systems over 5 hp (4kW) and purification systems

f. Irrigation system performance that uses more than 1000 gal (4000 L) per day

g. Renewable energy systems and energy storage systems

h. Energy and building management and demand-control systems

~~**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:

a. A copy of the *Cx plan* in accordance with ANSI/ ASHRAE/IES Standard 202 shall be submitted for review with the building permit application.

b. An *approved Cx provider* shall be designated by the *owner* to manage *Cx process* activities prior to completion of *construction documents*. The *Cx provider* shall have the necessary training, experience, and equipment and be independent from the design team and the contractor responsible for the work being commissioned. The *Cx provider* shall disclose possible conflicts of interest so that objectivity can be confirmed. The Cx team shall include an *FPT provider* who may also be the *Cx provider*.

c. Construction phase Cx requirements shall be incorporated into project specifications and other *construction documents* developed by the design team.

~~**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:

a. Performance of commissioned equipment, systems, and assemblies

b. Issue and resolution logs, including itemization of deficiencies found during testing and commissioning that have not been corrected at the time of report preparation

c. Deferred tests that cannot be performed at the time of report preparation

d. Documentation of the training of operating personnel and building occupants on commissioned systems and a plan for the completion of any deferred trainings that were unable to be fully commissioned at the time of report preparation

e. A plan for the completion of commissioning, including climatic and other conditions required for performance of the deferred tests

~~**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.~~ b. Materials stored on-site, or materials installed that are absorptive, shall be protected from moisture damage.

~~b.~~ c. 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 Leq* 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.

$$TAC = V_{ot} \times \frac{1}{A} \times \frac{1}{H} \times 60\,\text{min/h} \times 24\,\text{h/day} \times 14\,\text{days} \qquad \text{(I-P) (10-1)}$$

$$TAC = V_{ot} \times \frac{1\,\text{m}^3}{1000\,\text{L}} \times \frac{1}{A} \times \frac{1}{H} \times 3600\,\text{s/h} \times 24\,\text{h/day} \times 14\,\text{days} \qquad \text{(SI) (10-1)}$$

where

TAC = total air changes

V_{ot} = system design *outdoor air* intake flow, cfm (L/s) (according to ANSI/ASHRAE Standard 62.1)

A = floor area, ft² (m²)

H = ceiling height, ft (m)

~~2.~~ **10.7.2 Postconstruction, preoccupancy baseline IAQ monitoring.** 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.

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

Contaminant	**Maximum Concentration, µg/m³ (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 (PM2.5)	35 (24 h)
Particulates (PM10)	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.

~~**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:

a. Where trees and vegetation are used to comply with the shade requirements of Section 5.3.5, the plan for operation shall include the maintenance procedures needed to maintain healthy vegetation growth. The plan shall also outline the procedures for replacing any vegetation used to comply with the provisions in Section 5.

b. For *roof* surface materials selected to comply with the requirements of Section 5.3.5.3, the plan for operation shall include the maintenance procedures for keeping the *roof* surfaces cleaned in accordance with manufacturer's recommendations.

c. For vegetated terrace and roofing systems selected to comply with Section 5.3.5.5, the plan for operation shall include the maintenance procedures needed to maintain healthy vegetation growth and *roof* membrane system. The plan shall also outline the procedures for replacing any vegetation used to comply with the provisions in Section 5.

~~**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, 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:

a. **Water use reports.** Develop a plan for collecting *building project* water use data for water sources and subsystems measured in Section 6.3.3.

b. **Benchmark water performance.** Develop a plan to enter building operating characteristics and water use data into the ENERGY STAR Portfolio Manager. For building parameter inputs into Portfolio Manager (***Informative Note:*** e.g., number of occupants, hours of operation, etc.), use actual average values.

c. **Assess water use performance.** Develop a plan to assess *building project* water use efficiency.

~~**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:

a. **Energy use reports.** Develop a plan for collecting *building project* energy data for energy sources and system energy loads measured in Section 7.3.3. The reports shall include the following, as a minimum:

1. Hourly load profile for each day
2. Monthly average daily load profile
3. Monthly and annual energy use
4. Monthly and annual peak demand

b. **Track energy performance.** Develop a plan to enter building operating characteristics and energy consumption data into the ENERGY STAR Portfolio Manager for those building types addressed by this program to track building performance. For building parameter inputs into Portfolio Manager (***Informative Note:*** e.g., number of occupants, hours of operation, number of PCs, etc.), use actual average values.

c. **Assess energy performance.** Develop a plan to assess *building project* energy performance.

~~**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:

a. For each mechanical ventilation system where direct outdoor airflow measurement is required according to Section 8.3.1.2, a procedure shall be in place to respond when there is notification that the *minimum outdoor airflow* is in an *outdoor air fault condition*. For systems that use a damper indicator instead of a direct measurement, per the exception to Section 8.3.1.2, a procedure shall be in place to respond when there is notification that the indicator identifies that the damper is out of position.

b. For each mechanical ventilation system where direct *minimum outdoor airflow* measurement is required according to Section 8.3.1.2, the *minimum outdoor airflow* shall be recorded every three months in either electronic or written form.

c. For systems that use a damper indicator per the exception to Section 8.3.1.2, the *minimum outdoor airflow* shall be measured and recorded in either electronic or written form every two years for air-handling systems with a design supply airflow rate of more than 2000 cfm (1000 L/s). The *minimum outdoor airflow* shall be measured using methods as described in ANSI/ASHRAE Standard 111 and with an accuracy of ±10% or better.

~~**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:

a. A list of each air system requiring direct outdoor airflow measurement.

b. Monitoring procedures and monitoring frequencies for each monitored sensing device, including a description of the specific response measures to be taken if needed.

c. Ventilation systems shall be operated such that *spaces* are ventilated when these *spaces* are expected to be occupied.

d. Operation and calibration check procedures and the records associated with operation checks and recalibration.

~~**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 nonattainments areas for PM2.5, 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 PM2.5.

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

b. For buildings located in nonattainments 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.
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:

1. Quarterly inspection to verify operation of fans and other mechanical components.
2. Biennial radon testing in accordance with AARST MALB to verify that radon concentrations remain below 2.7 pCi/L (100 Bq/m^3). Where radon testing indicates that the indoor radon concentration is 2.7 pCi/L (100 Bq/m^3) or greater, mitigation shall be conducted in accordance with AARST RMS-LB, and the building shall be retested to verify that the radon concentration is below 2.7 pCi/L (100 Bq/m^3).

Where the required effectiveness of mitigation systems is consistently demonstrated for a period of not less than eight years, and such systems are inspected quarterly to verify fan operation, radon testing shall be repeated at intervals of not less than every five years.

3. Biennial inspection and repair as needed for mitigation system performance indicators, fans, and visible mitigation system components, including piping, fasteners, supports, labels, and soil-gas barrier closures at exposed membranes, sumps, and other openings between soil and interior *space*.

4. Documentation and retention of inspection and repair records and testing reports.

~~**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.

Exception: *Dwelling units* of a *building project.*

~~**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:

a. For systems complying with Section 8.3.1.4, using relative humidity sensors to determine *HVAC zone* relative humidity directly, or using dew-point and zone temperature sensors to determine *HVAC zone* relative humidity indirectly, the relative humidity determined shall be checked annually and compared to the relative humidity established using methods described in ASHRAE Standard 111.

b. Sensors shall be cleaned or repaired and recalibrated as necessary to ensure that sensor measurements are within 10% of actual relative humidity measurements.

Delete the following subsection which is redundant.

~~**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:

a. The survey shall be implemented within a period of 6 to 18 months after issuance of the certificate of occupancy. The survey shall be repeated not less often than once every three years.

b. The survey questions shall include satisfaction questions and diagnostic questions for IAQ, lighting, acoustics, and thermal comfort. The survey questions shall use a sevenpoint satisfaction scale and comply with ANSI/ASHRAE Standard 55, Section 7.3.1.1.

c. A plan for reporting the survey results shall be produced that includes the following:

1. The survey report shall state where the response rate was less than the response rates specified in ASHRAE Standard 55, Section 7.3.1.

2. The survey report shall indicate the percentage of satisfaction for each question in accordance with ASHRAE Standard 55, Section 7.4.1(a).

3. The percentage satisfaction results shall be compared to a nationally recognized survey benchmarking database where the building occupancy category is represented in the databases of nationally recognized organizations.

~~**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:

a. The plan shall be in accordance with ANSI/ASHRAE/ ACCA Standard 180 for HVAC systems in buildings that meet the definition of commercial buildings in ASHRAE/ ACCA Standard 180.

b. The plan shall address all elements of ASHRAE/ACCA Standard 180, Section 4, and shall develop required inspection and maintenance tasks similar to ASHRAE/ ACCA Standard 180, Section 5, for electrical and plumbing systems in buildings that meet the definition of commercial buildings in ASHRAE/ACCA Standard 180.

c. *Outdoor air* delivery monitors required by Section 8.3.1.2 shall be visually inspected at least once each quarter and cleaned or repaired, as necessary, and calibrated at the manufacturer's recommended interval or not less than once per year, whichever is more frequent.

d. For systems with a damper indicator and with less than 2000 cfm (1000 L/s) of supply air, the system components that control the *minimum outdoor airflow* shall be visually inspected every two years. Records of this inspection shall be maintained on-site either in electronic or written form.

e. Documentation of the plan and of completed maintenance procedures shall be maintained on the building *site* at all times in

1. electronic format for storage on the building energy management system (EMS), building management system (BMS), computerized maintenance management system (CMMS), or other computer storage means, or

2. maintenance manuals specifically developed and maintained for documenting completed maintenance activities.

~~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:

a. Building assembly description

b. Materials or products

c. Design or estimated service life in years

d. Maintenance frequency

e. Maintenance access for components with an estimated service life less than the service life of the building.

Provide a service life plan at the completion of design development. The *owner* shall retain a copy of the service life plan for use during the life of building.

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

~~**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.

~~**10.3.2.4.1**~~ **10.11.1 All Building Projects.** The plan shall include the following:

a. Preferred parking for carpools and vanpools with parking facilities

b. A plan for bicycle transportation

~~**10.3.2.4.2**~~ **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) above: Multifamily *residential building project.*

In addition, the *owner* shall provide all of the following to the *owner*'s employees:

a. Access to an *emergency ride home* for employees, either provided in-house or by an outside organization

b. A central point of contact in charge of commuter benefits

c. Maintenance of commuter benefits in a centralized location

d. Active promotion of commuter benefits to employees

~~**10.3.2.4.3**~~ **10.11.3 Building Tenant.** The building *owner*

a. shall provide a copy of the plan to tenants within the building and

b. shall not include parking fees in lease rates, or shall identify the value of parking in the lease.