ANSI/ASHRAE/ICC/USGBC/IES Addenda bo to ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2020

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 the ASHRAE Standards Committee on November 4, 2020; by the ASHRAE Board of Directors on November 18, 2020; by the International Code Council on October 22, 2020; by U.S. Green Building Council on November 5, 2020; by the Illuminating Engineering Society on October 29, 2020; and by the American National Standards Institute on December 16, 2020.

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FOREWORD

This addendum modifies Sections 8.3.4; 10.8; and 10.9.4.4 to improve soil-gas control requirements and to reflect current industry practices that incorporate ANSI/AARST mandated soil-gas control measures in new building construction projects. This addendum replaces existing soil-gas control requirements in Section 8.3.4 with requirements from ANSI/AARST Standard CC-1000-2018, and adds new requirements associated with soil-gas testing and mitigation standards for multifamily buildings to Sections 10.3.1.9 and 10.3.2.1.4.4, respectively.

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

Addendum bo to Standard 189.1-2020

Modify Section 8.3.4 as shown.

8.3.4 Soil-Gas Control. *Building projects* shall be designed to control soil-gas entry in accordance with Sections 8.3.4.1 or 8.3.4.2.

Exceptions to 8.3.4:

1. Buildings or portions thereof that are not routinely occupied, such as warehouses and open parking garages ~~structures~~.
2. Ventilated garages that comply with ANSI/ASHRAE Standard 62.1, Sections 5.15 and 6.5.

8.3.4.1 Soil-Gas Control Systems. *Building projects* shall comply with the design requirements of ANSI/AARST CC-1000, Sections 2 through 13, as modified by Section 8.3.4.1.1.

8.3.4.1.1 Soil-Gas Retarders ~~Barriers~~. Soil-gas retarder membranes shall comply with ASTM E1745 and shall be installed in accordance with ASTM E1643. ~~*systems* shall be provided and shall comply with all of the following:~~

~~a. Earthen floors in basements and enclosed crawlspaces shall be covered with a soil gas retarder membrane. Such membrane shall be sealed to the foundation at the edges. Soil gas retarder membranes or systems shall be placed between slab floors and the base course gas-permeable layer required by Section 8.3.4.1.2. Soil gas retarder materials shall meet or exceed the durability requirements of ASTM E1745, and the installation shall comply with ASTM E1643. Damp proofing or waterproofing materials shall be installed on the exterior surface of foundation *walls* and shall extend from the top of the footing to above grade.~~

~~b. Joints in concrete around the perimeter of each poured slab section shall be permanently sealed with closed cell gasket materials or equivalent methods that retain closure after the slab has cured.~~

~~c. Openings in slab floors; below-grade masonry *walls*; and membranes, such as those for plumbing, ground water control systems, soil vent pipes, electrical, mechanical piping, and structural supports, shall be sealed at the penetration with caulk that complies with ASTM C920 class 25 or higher equivalent closed-cell gasket materials or other equivalent method.~~

~~d. Sumps shall be covered with a rigid lid that is mechanically fastened and sealed with a gasket or caulk that will allow removal of the lid for maintenance.~~

~~e. Hollow masonry unit *walls* shall be designed and constructed as follows:~~

~~1. The first course of masonry units bearing on a footing shall be laid with a full mortar bedding and shall be solid units or fully grouted masonry units.~~

~~2. Where portions of masonry units are below grade and in contact with earth, the course of masonry units that is at or partially below grade shall be made of solid masonry units or fully grouted masonry units. Such course of masonry units need not change elevation to compensate for lower grade elevations along the building perimeter.~~

Table 8.3.4.1.2 Soil-Gas Conveyance Components

System Vent Pipe Nominal Diameter	Minimum Diameter of Pits [a]	Minimum Length of Perforated Pipe or Geotextile Matting [b]
3 in. (0.08 m)	12 in. (0.30 m) diameter pit	18 ft (5.4 m)
4 in. (0.10 m)	16 in. (0.40) diameter pit	32 ft (10 m)
6 in. (0.15 m)	24 in. (0.60 m) diameter pit	71 ft (22 m)

a. Pits shall not be less than 4 in. (0.10 m) in depth.
b. Openings in perforated pipe and geotextile matting shall not be less than 1.0 in.^{2}/ft (21 cm^2/m) of pipe or matting length.

Table 8.3.4.1.3 Vent Pipe Diameter per Vented Area

Vent Pipe Diameter	Maximum Vented Area per Vent Pipe
3 in. (0.08 m)	2500 ft^2 (230 m^2)
4 in. (0.10 m)	4500 ft^2 (420 m^2)
6 in. (0.15 m)	10,000 ft^2 (1000 m^2)

Openings in *walls* that are below such course of solid or fully grouted masonry units, such as window and door openings, shall be surrounded by solid or fully grouted masonry units.

8.3.4.1.2 Gas-Permeable Layer and Soil-Gas Conveyance. There shall be a continuous gas-permeable layer under each slab-on-grade and basement slab for the entire area of the slab and under each membrane installed over earth for the entire area of the membrane. Perforated pipe, geotextile matting, or soil-gas collection pits shall be installed below the slab or membrane and shall be connected to exhaust vent pipe as specified in Section 8.3.4.1.3. The gas-permeable layer and soil-gas conveyance pipe shall comply with Table 8.3.4.1.2 and (a), (b), or (c) as applicable.

a. **Stone Aggregate Layer.** The gas-permeable layer shall be a uniform layer not less than 4 in. (0.1 m) in depth and shall consist of gravel or crushed stone that meets ASTM C33 requirements for size numbers 5, 56, 57, or 6. Vent pipe openings to unobstructed interstices between stones within the gas-permeable layer shall not be less than the equivalent values indicated in Table 8.3.4.1.2.
b. **Small Stone, Sand, and Soil.** The gas-permeable layer shall be a uniform layer not less than 4 in. (0.10 m) in depth that consists of any of the following:
   1. Small stone aggregates classified in ASTM C33 as size numbers 467,67,7, or 8.
   2. Sand classified in ASTM C33 as size number 9.
   3. Soil that contains less than 35% sand, rock fragment fines, clay, and silt. Such clay and silt shall consist of not more than 10% high-plasticity clay or silt.

   Perforated pipe or geotextile drainage matting shall be placed at distances not farther than 20 ft (6 m) apart and not farther than 10 ft (3 m) away from foundation *walls* or other surfaces that surround the gas-permeable layer. Perforated pipe shall be surrounded by not less than 4 in. (0.10 m) of gas-permeable aggregates that meet ASTM C33 requirements for size numbers 5, 56, 57, or 6. The minimum length and soil-gas inlet openings in the perforated pipe and geotextile matting shall not be less than equivalent values indicated in Table 8.3.4.1.2.
c. **Crawlspace Membranes.** Perforated pipe or equivalent material not less than 10 ft (3 m) in length and 3 in. (0.08 m) in nominal diameter shall be provided under the membrane. The configuration shall allow air movement under the entire area of the membrane.

8.3.4.1.2.1 Soil-Gas Conveyance Clearance and Dimension. Geotextile mats and perforated pipe shall not be less than 12 in. (0.3 m) and not farther than 10 ft (3 m) from foundation *walls* or other surfaces that surround the gas-permeable layer. Soil-gas inlet openings into the geotextile mats and perforated pipe shall have an area of not less than 1.0 in.2/ft (21 cm2/m) of length. The airway path within geotextile mats and perforated pipe shall not be less

~~than the nominal equivalent area of 3 in. (0.08 cm) pipe inner diameter. Pipe materials below slabs and membranes shall be configured to drain collected water within piping.~~

~~**8.3.4.1.2.2 Connections to Exhaust Vent Pipes.** Exhaust vent piping, as specified in Section 8.3.4.1.3, shall connect to soil-gas inlet configurations within the gas-permeable layer and extend not less than 2 ft (0.6 m) above the top of the slab or membrane. Such pipes shall be temporarily capped or otherwise closed during construction to prevent debris from entering the pipes. The pipe that extends above the slab or membrane shall be labeled with the words "radon vent" or "soil-gas vent" in the prevailing language at the location.~~

~~**8.3.4.1.3 Soil-Gas Exhaust Vent Pipe.** Soil-gas exhaust vent piping shall be provided as follows:~~

~~a. **Pipe Placement.** Nonperforated Schedule 40 pipe, as defined by ASTM D1785, shall extend from within the gas-permeable layers to the point of exhaust above the *roof*. The vent pipe size shall not be reduced at any point between its connection to the gas permeable layers and the exhaust terminal above the *roof*. Such piping shall be labeled on each floor level of the building with the words "radon vent" or "soil-gas vent" in the prevailing language at the location.~~

~~b. **Multiple Vented Areas.** Where interior footings divide a gas-permeable layer into two or more unconnected areas, such areas shall be interconnected by piping below the slab or membrane or above the slab or membrane. Such piping shall be nonperforated and of a size indicated in Table 8.3.4.1.3.~~

~~c. **Provision for Fan.** Soil-gas venting systems shall include a fan or a dedicated *space* for the future installation of a fan. The fan and soil-gas vent piping on the discharge side of the fan shall not be installed within or under occupied *spaces*. A dedicated *space* having a vertical height of not less than 48 in. (1.2 m) and a diameter of not less than 21 in. (0.53 m) shall be provided in the *attic* or other interior area to accommodate the installation of a fan. The fan inlet and outlet vent pipes shall be centered in such dedicated *space*. An electrical supply for the fan shall be provided within 6 ft (1.8 m) of the fan location.~~

~~d. **Vented Area.** The maximum foundation area served by a soil-gas exhaust vent pipe shall be determined in accordance with Table 8.3.4.1.3.~~

~~**Exception to 8.3.4.1.3.(d):** Where inspections verify compliance with Sections 8.3.4.1.1 through 8.3.4.1.3, the maximum vented area per vent pipe indicated in Table 8.3.4.1 shall be increased by 40%. Where the soil-gas barrier consists of a spray-applied vapor barrier or a geomembrane that provides a homogeneous closure, the maximum vented area per vent pipe shall be increased by an additional 20%.~~

8.3.4.2 Alternative Methods of Soil-Gas Control. A soil-gas control system shall be provided, and such system shall be clearly identified or otherwise noted on *construction documents* and shall be *approved* by a qualified soil-gas professional and the *building project FPT provider*.

Modify Section 10.8 as shown.

10.8 Soil-Gas Control. The building shall be tested, postconstruction, for radon in accordance with ANSI/AARST MALB or ANSI/AARST MAMF as applicable. The indoor radon concentration shall be 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, radon mitigation shall be conducted in accordance with ANSI/ AARST RMS-LB or ANSI/AARST RMS-MF as applicable, and the building shall be retested to verify that the radon concentration is below 2.7 pCi/L (100 Bq/m^3).

10.8.1 Documentation. The radon test reports shall be provided to the *owner* and shall be retained with the project records.

Modify Section 10.9.4.4(d) as shown.

d. For buildings where radon mitigation is required under Section 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 ANSI/AARST MALB or ANSI/AARST MAMF, as applicable, 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 ANSI/AARST

RMS-LB, or ANSI/AARST RMS-MF, as applicable, 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 prepared in accordance with ANSI/AARST MALB, ANSI/AARST MAMF, ANSI AARST RMS-LB, or ANSI/AARST RMS-MF, as applicable.

Modify Section 11 as shown.

Reference	Title	Section
American Association of Radon Scientists and Technologists (AARST) **527 N. Justice Street** **Hendersonville, NC 28739** **(800) 269-4174; http://standards.aarst.org**		
ANSI/AARST CC-1000-2018	Soil Gas Control Systems In New Construction of Buildings	8.3.4.1
ANSI/AARST RMS-LB-2018	Radon Mitigation Standards for Schools and Large Buildings	10.3.9, 10.9.4.4
ANSI/AARST MALB-2014	Protocols for Conducting Measurements of ~~Measuring~~ Radon and Radon Decay Products in School and Large Buildings	~~10.3.9, 10.9.4.4~~ 10.8, 10.9.4.4
ANSI/AARST RMS-MF-2018	Radon Mitigation Standards for Multifamily Buildings	10.8, 10.9.4.4
ANSI/AARST MAMF-2017	Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily Buildings	10.8, 10.9.4.4

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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.

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Standard 189.1 and the International Green Construction Code

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