

Public Review Draft

Proposed Addendum to Standard 189.1-2017

Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings

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

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Foreword

This addendum modifies Sections 8.3.4; 10.3.1.9; and 10.3.2.1.4.4 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.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (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 bo to 189.1-2017

Modify Section 8.3.4 as follows:

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. 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 46, 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.

- e. ~~**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 m) 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.~~

~~**8.3.4.1.1 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.~~
- e. ~~**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*.

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. (25.4 mm) (21 cm²/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)

Modify Section 10.3.1.9 as follows:

10.3.1.9 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/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, 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/m³).

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

Modify Section 10.3.2.1.4.4 (*Indoor Air Quality*), part d as follows:

- d. For buildings where radon mitigation is required under Section 10.3.1.9, 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/m³). Where radon testing indicates that the indoor radon concentration is 2.7 pCi/L (100 Bq/m³) 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/m³).

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.

Create/modify the following entries in the Section 11 Normative References:

Reference	Title	Section
American Association of Radon Scientists and Technologists (AARST) 527 N. Justice Street Hendersonville, NC 28739 (800) 269-4174; https://standards.aarst.org		
<u>ANSI/AARST CC-1000-2018</u>	<u>Soil Gas Control Systems In New Construction of Buildings</u>	<u>8.3.4.1</u>
<u>ANSI/AARST MALB-2014</u>	<u>Protocols for Conducting Measurements of Measuring Radon and Radon Decay Products in Schools and Large Buildings</u>	<u>10.3.1.9, 10.3.2.1.4.4</u>
<u>ANSI/AARST RMS-MF-2018</u>	<u>Radon Mitigation Standards for Multifamily Buildings</u>	<u>10.3.1.9, 10.3.2.1.4.4</u>
<u>ANSI/AARST MAMF-2017</u>	<u>Protocol for Conducting Measurements of Radon and Radon and Radon Decay Products in Multifamily Buildings</u>	<u>10.3.1.9, 10.3.2.1.4.4</u>