

**International Building Code  
(Proposed) Appendix N  
Radon Reduction**

**SECTION N101**

**GENERAL**

**N101.1 Scope.** The provisions of this appendix shall govern the design and construction of subslab soil exhaust systems designed to reduce radon concentrations within buildings.

**N101.2 Applicability.** This chapter shall apply to buildings located in areas designated as Zone 1, as determined in accordance with Figure AF101 of the International Residential Code. Where state or local jurisdictions have approved radon potential data that identify areas with predicted average indoor radon levels that equal or exceed 4.0 picocuries per liter, this data shall supersede Figure AF101.

**SECTION N102**

**SOIL GAS BARRIERS AND BASE COURSE MATERIALS**

**N102.1 Damp proofing, waterproofing and soil gas retarder membranes.** Floors, foundations, and walls that are in contact with the ground, and penetrations through footings, shall be damp proofed or waterproofed in accordance with Section 1805. Earthen floors in basements and enclosed crawlspaces shall be covered with a continuous membrane of 6-mil (0.15 mm) polyethylene or equivalent that is sealed at the edges. Between slab floors and the base course required in Section N102.2, damp proofing materials shall be installed in accordance with Section 1805.2.1. Punctures, tears and gaps around penetrations of a membrane shall be repaired or sealed with additional membrane material.

**N102.2. Sub-slab and sub-membrane.** A base course in accordance with Section 1805.4.1 shall be installed below slab floors and foundations. There shall be a continuous base course within each sub-slab area and under each membrane that is separated by foundation walls or footings.

**N102.3 Soil gas entry routes.** Openings in slab floors, membranes, and joints, such as but not limited to plumbing, ground water control systems, soil vent pipes, electrical, and mechanical piping and structural supports, shall be sealed against air leakage at the penetration with a polyurethane caulk or equivalent applied in accordance with the manufacturer's instructions. Foundation walls shall be constructed in accordance with Section AF103.2.3 of the International Residential Code. Sumps shall be covered with a rigid lid that is sealed with a gasket or caulk and mechanically fastened to facilitate removal for maintenance. Sumps and sump lids intended for ground water control shall not be connected to any part of the subslab soil exhaust system.

**SECTION N103. SOIL GAS VENT.** System components and labeling for a subslab soil exhaust vent shall be installed in accordance with Section 512 of the International Mechanical Code. The vent pipe size shall not be reduced at any location except where the below-floor end of the vent pipe is connected vertically to a pipe fitting with not less than two horizontal openings, such as a T fitting or other manifold system that maintains airflow capacity. The fitting's horizontal openings shall be connected to an unobstructed void space such as a 1pipe not less than 2 feet (0.6 m) in length and not less than 4 inches (10 cm) in diameter that is installed in the base course.

**SECTION N104. VENTED AREA.** The maximum foundation area served by a subslab soil vent shall be determined in accordance with Table N104.1.

**N104.1 Multiple vented areas.** Where interior footing supports divide an area to be vented into two or more areas of unconnected base course materials or membranes, a single subslab soil exhaust system shall vent the multiple areas if each area's vent pipes are joined to the single subslab soil exhaust system above the floor or interconnected below the floors with perforated pipe or equivalent method.

**TABLE N104.1 - FOUNDATION AREA PER VENT**

Maximum vented area per vent	Minimum pipe diameter
2500 sq ft (232 m2)	3 inch (7.6 cm)
4000 sq ft (372 m2)	4 inch (10 cm)
15,000 sq ft (1392 m2)	6 inch (15.2 cm)

**SECTION N105**

**FAN**

**N105.1 Fan.** Each subslab soil exhaust system shall include a fan, or dedicated space for the post-construction installation of a fan. The fan and soil vent piping above the fan shall not be installed in occupied space. Electrical service for the fan shall be provided within six feet (1.8 m) of the fan location.

## Code sections\* referenced in Appendix N

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### *International Building Code*

#### **SECTION 1805**

##### **DAMPPROOFING AND WATERPROOFING**

**1805.1 General.** Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed and dampproofed in accordance with this section, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with Section 1203.4.

**1805.1.1 Story above grade plane.** Where a basement is considered a story above grade plane and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25 percent or more of the perimeter, the floor and walls shall be dampproofed in accordance with Section 1805.2 and a foundation drain shall be installed in accordance with Section 1805.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of Sections 1803.5.4, 1805.3 and 1805.4.1 shall not apply in this case.

**1805.1.2 Under-floor space.** The finished ground level of an under-floor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground-water table rises to within 6 inches (152 mm) of the ground level at the outside building perimeter, or that the surface water does not readily drain from the building site, the ground level of the underfloor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of Sections 1803.5.4, 1805.2, 1805.3 and 1805.4 shall not apply in this case.

**1805.1.2.1 Flood hazard areas.** For buildings and structures in flood hazard areas as established in Section 1612.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on at least one side.

**Exception:** Under-floor spaces of Group R-3 buildings that meet the requirements of FEMA TB 11.

**1805.1.3 Ground-water control.** Where the ground-water table is lowered and maintained at an elevation not less than 6 inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be dampproofed in accordance with Section 1805.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to operate and the rated capacity of the disposal area of the system.

**1805.2 Dampproofing.** Where hydrostatic pressure will not occur as determined by Section 1803.5.4, floors and walls for other than wood foundation systems shall be dampproofed in

accordance with this section. Wood foundation systems shall be constructed in accordance with AWC PWF.

**1805.2.1 Floors.** Dampproofing materials for floors shall be installed between the floor and the base course required by Section 1805.4.1, except where a separate floor is provided above a concrete slab.

Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than 6 inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than 4-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

**1805.2.2 Walls.** Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level. Dampproofing shall consist of a bituminous material, 3 pounds per square yard (16 N/m<sup>2</sup>) of acrylic modified cement, 1/8 inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C887, any of the materials permitted for waterproofing by Section 1805.3.2 or other approved methods or materials.

**1805.2.2.1 Surface preparation of walls.** Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than 3/8 inch (9.5 mm) of Portland cement mortar. The parging shall be coved at the footing.

**Exception:** Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

**1805.3 Waterproofing.** Where the ground-water investigation required by Section 1803.5.4 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1805.1.3, walls and floors shall be waterproofed in accordance with this section.

**1805.3.1 Floors.** Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected. Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in

accordance with the manufacturer's installation instructions.

**1805.3.2 Walls.** Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected. Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805.2.2. Waterproofing shall consist of two-ply hotmopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

**1805.3.2.1 Surface preparation of walls.** Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805.2.2.1.

**1805.3.3 Joints and penetrations.** Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made water tight utilizing approved methods and materials.

**1805.4 Subsoil drainage system.** Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1805.1.3 shall be deemed adequate for lowering the groundwater table.

**1805.4.1 Floor base course.** Floors of basements, except as provided for in Section 1805.1.1, shall be placed over a

floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

**Exception:** Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.

**1805.4.2 Foundation drain.** A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend a minimum of 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1805.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

**1805.4.3 Drainage discharge.** The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the International Plumbing Code.

**Exception:** Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

### **International Residential Code**

[Figure AF101 is the EPA radon map]

**AF103.2.3 Foundation walls.** Hollow block masonry foundation walls shall be constructed with a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above grade. Where a brick veneer or other masonry ledge is installed,

the course immediately below that ledge shall be solid masonry, one course of masonry grouted solid, or a solid concrete beam. Joints, cracks or other openings around penetrations of both exterior and interior surfaces of foundation walls below grade shall be filled with polyurethane caulk.

### **International Mechanical Code**

#### **SECTION 512 SUBSLAB SOIL EXHAUST SYSTEMS**

**512.1 General.** Where a subslab soil exhaust system is provided, the duct shall conform to the requirements of this section.

**512.2 Materials.** Subslab soil exhaust system duct material shall be air duct material listed and labeled to the requirements of UL 181 for Class 0 air ducts, or any of the following piping materials that comply with the International Plumbing Code as building sanitary drainage and vent pipe: cast iron; galvanized steel; brass or copper pipe; copper tube of a weight not less than that of copper drainage tube, Type DWV; and plastic piping.

**512.3 Grade.** Exhaust system ducts shall not be trapped and shall have a minimum slope of one-eighth unit vertical in 12 units horizontal (1-percent slope).

**512.4 Termination.** Subslab soil exhaust system ducts shall extend through the roof and terminate not less than 6 inches (152 mm) above the roof and not less than 10 feet (3048 mm) from any operable openings or air intake.

**512.5 Identification.** Subslab soil exhaust ducts shall be permanently identified within each floor level by means of a tag, stencil or other approved marking.