GG267-14
202, 809 (New), Appendix B

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Add new definitions as follows:

SECTION 202
DEFINITIONS

DRAIN TILE LOOP. A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a basement or crawl space footing.

RADON GAS. A naturally occurring, chemically inert, radioactive gas found in soil that is not detectable by human senses.

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene or other equivalent material used to retard the flow of soil gases into a building.

SUBMEMBRANE DEPRESSURIZATION SYSTEM. A system designed to achieve lower-submembrane air pressure relative to crawl space air pressure by use of a vent drawing air from beneath the soil-gas-retarder membrane.

SUBSLAB DEPRESSURIZATION SYSTEM (Active). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.

SUBSLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent pipe routed through the conditioned space of a building and connecting the subslab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.

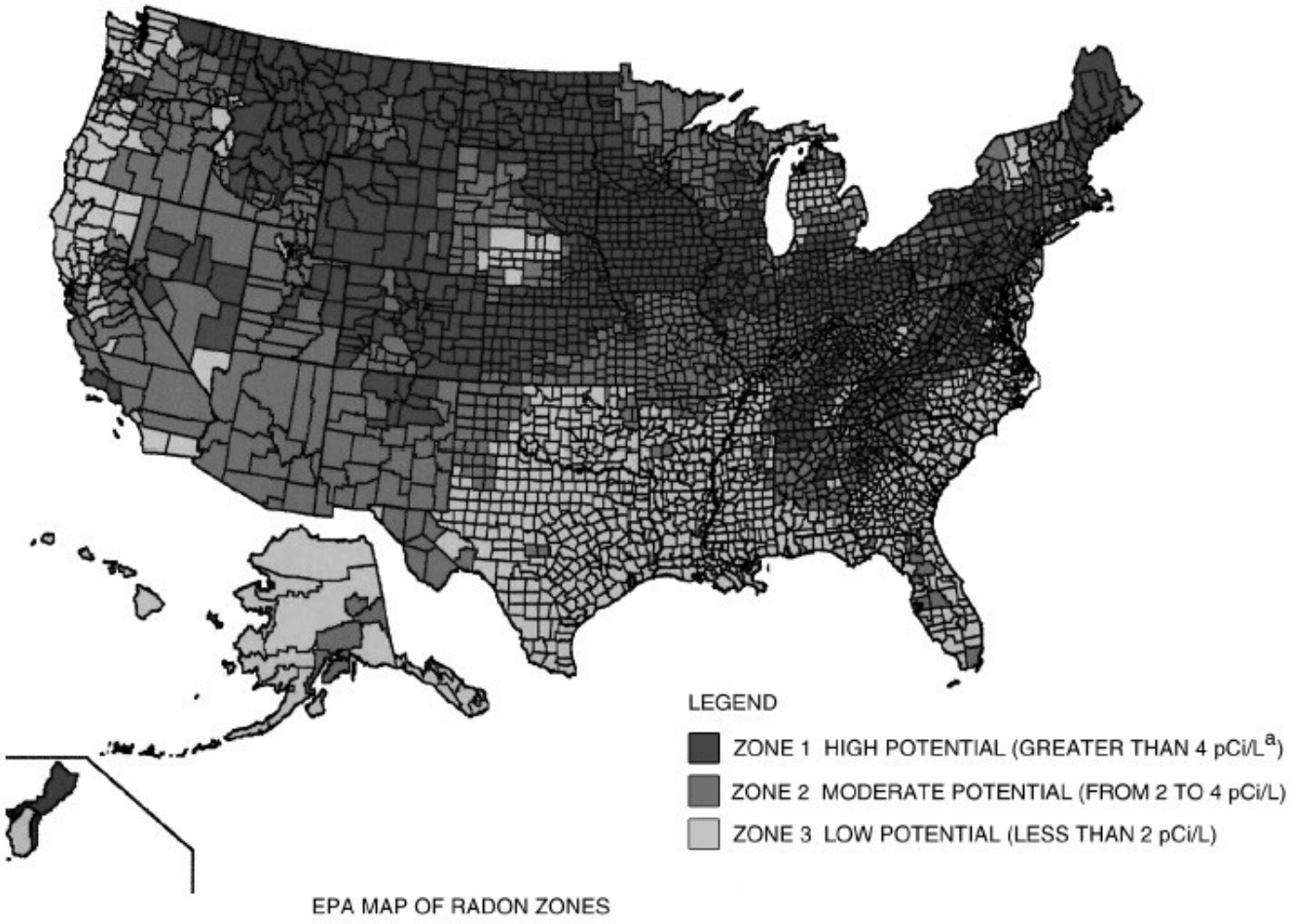
Revise as follows:

~~B101~~ 809
~~GENERAL~~ RADON

~~B101~~ 809.1 Radon mitigation. Buildings in areas of High and Moderate Radon Potential (Zone 1 and 2), as determined by Figure 809.1 ~~B101.1~~ and Table 809.1 ~~B101.1~~ shall comply with Sections 809.2.1 B201.1 through 809.2.12 ~~B201.10.~~

TABLE ~~B101~~809.1
EPA RADON ZONE 1 and 2 COUNTIES BY STATE[a]

(Portions of table not shown remain unchanged.)



EPA MAP OF RADON ZONES

~~FIGURE B101.1~~ FIGURE 809.1
EPA MAP OF RADON ZONES

Delete without substitution:

~~SECTION B102~~
~~DEFINITIONS~~

~~DRAIN TILE LOOP.~~ ~~A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a basement or crawl space footing.~~

~~RADON GAS.~~ ~~A naturally occurring, chemically inert, radioactive gas found in soil that is not detectable by human senses.~~

~~SOIL-GAS-RETARDER.~~ ~~A continuous membrane of 6-mil (0.15 mm) polyethylene or other equivalent material used to retard the flow of soil gases into a building.~~

~~SUBMEMBRANE DEPRESSURIZATION SYSTEM.~~ ~~A system designed to achieve lower-submembrane air pressure relative to crawl space air pressure by use of a vent drawing air from beneath the soil-gas-retarder membrane.~~

~~SUBSLAB DEPRESSURIZATION SYSTEM (Active).~~ ~~A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.~~

~~**SUBSLAB DEPRESSURIZATION SYSTEM (Passive).** A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent pipe routed through the conditioned space of a building and connecting the subslab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.~~

Revise as follows:

~~**B201**~~ **809.2 Mitigation procedures.** Radon mitigation features shall be provided in accordance with Sections 809.2.1 through 809.2.12.

~~**B201.1**~~ **809.2.1 Subfloor preparation.** A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and that are within the walls of the occupied spaces of the building, as a prerequisite for passive and active subslab depressurization systems. The gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate, not less than 4 inches (102 mm) in thickness. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/2 -inch (12.7mm) sieve. Size 5, 56 or 6 aggregate shall be used and shall meet the specifications of ASTM C 33. Where compaction is required or practiced, a geotextile fabric or reinforced vapor retarder shall be used beneath the aggregate to prevent fines and soil from being introduced into the aggregate.
2. A uniform layer of sand (native or fill), not less than 4 inches (102 mm) in thickness, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.
3. Geotextile drainage matting, or other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.

~~**B201.2**~~ **809.2.2 Subslab radon suction pit.A** radon suction pit without aggregate shall be installed in the center of each 100,000 square feet (9390 m^2) of floor area that is in contact with the earth and that has no subslab barriers. The suction pit void area shall be not less than 4 square feet (0.371 m^2) and the pit shall be not less than 8 inches (203 mm) in depth. The resulting suction pit void to aggregate interface shall be 7 square feet (0.65 m^2), or 30 times the cross sectional area of a 6-inch (157.4 mm) radon vent pipe. Alternatively, a concrete drainage distribution box or similar structure meeting the 30:1 ratio shall be employed.

The suction pit shall be covered with 3/4 -inch-thick (19.05 mm) pressure-treated plywood or an equivalent material prior to pouring the slab. The section of slab covering the suction pit shall be reinforced.

~~**B201.3**~~ **809.2.3 Radon vent piping.** Radon vent piping shall be not less than 6 inches (157.4 mm) in diameter and constructed of PVC or equivalent gas-tight pipe.

~~**B201.3.1**~~ **809.2.3.1 Subslab suction pit horizontal vent pipe.** A section of vent pipe not less than of 5 feet (1.52 m) in length shall be placed in the aggregate and shall enter the suction pit horizontally. One end of the vent pipe shall be placed so as to terminate midway in the suction pit. The vent pipe shall be supported at the boundary of the aggregate-void space so as to maintain its position. The horizontal pipe run shall provide positive condensation drainage to the suction pit with a pitch of not less than 1/8 inch per foot (13 mm per meter).

~~**B201.3.2**~~ **809.2.3.2 Subslab suction pit vertical vent pipe.** A 90-degree (1.57 rad) elbow shall be installed on the end of the vent pipe in the aggregate. A section of vent pipe shall be connected to the elbow and shall pass vertically through and above the slab to a height of not less than 2 feet (610 mm), and shall be covered with a temporary cap. A pipe sleeve or coupling extending through the full

depth of the slab shall be used to protect the vent pipe where it passes through the slab, and the slab penetration shall be sealed in accordance with Section 809.2.5 ~~B201.5~~.

~~**B201.4**~~ **809.2.4 Soil-gas-retarder.** A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material that conforms to ASTM E 1643 shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped at least 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting having an overlap of not less than 12 inches (305 mm) on all sides.

~~**B201.5**~~ **809.2.5 Entry routes**. Potential radon entry routes shall be sealed or closed in accordance with Sections 809.2.5.1 ~~B201.5.1~~ through 809.2.5.10 ~~B201.5.10~~.

~~**B201.5.1**~~ **809.2.5.1 Floor openings.** Piping and other penetrations through concrete slabs or other floor assemblies shall be filled or sealed with a polyurethane caulk or equivalent sealant that complies with ASTM C 920 Class 25 or greater and is applied in accordance with the manufacturer's recommendations. Prior to sealing, backer rods shall be used to fill gaps greater than 1/2 inch (12.7 mm).

~~**B201.5.2**~~ **809.2.5.2 Concrete joints.** Slab joints, control saw joints, isolation joints, construction joints, pour joints, floor and wall intersection joints, and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with a polyurethane caulk or other elastomeric sealant that complies with ASTM C 920 Class 25 or greater and is applied in accordance with the manufacturer's recommendations. Prior to sealing, backer rods shall be used to fill gaps that are greater than 1/2 inch (12.7 mm) in depth.

~~**B201.5.3**~~ **809.2.5.3 Drains.** Where floor, condensate and other drains discharge to the soil and not a sewer, such drains shall be provided with a water-seal trap or shall be water trapped or routed through nonperforated pipe to a point above grade.

~~**B201.5.4**~~ **809.2.5.4 Sumps.** Sump pits open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

~~**B201.5.5**~~ **809.2.5.5 Foundation walls.** Hollow block masonry foundation walls shall be constructed with either a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks and other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with a polyurethane caulk or other equivalent sealant that complies with ASTM C 920 Class 25 or greater and is applied in accordance with the manufacturer's recommendations. Penetrations of concrete walls shall be filled.

~~**B201.5.6**~~ **809.2.5.6 Dampproofing.** The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed.

~~**B201.5.7**~~ **809.2.5.7 Air-handling units.** Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit.

Exception: Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.

~~**B201.5.8**~~ **809.2.5.8 Ducts.** Ductwork for supply or return air shall not be located in crawl spaces or beneath a slab in areas with high or moderate radon potential. Where ductwork passes through or beneath a slab, it shall be of seamless material or sealed water tight. Joints in such ductwork shall be sealed water tight.

~~**B201.5.9**~~ **809.2.5.9 Crawl space floors.** Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

~~**B201.5.10**~~ **809.2.5.10 Crawl space access.** Access doors and other openings or penetrations between basements and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.

~~**B201.6**~~ **809.2.6 Passive submembrane depressurization system.** In buildings with crawl space foundations, the following components of a passive submembrane depressurization system shall be installed during construction.

Exception: Buildings in which an *approved* mechanical crawl space ventilation system or other equivalent system is installed.

~~**B201.6.1**~~ **809.2.6.1 Ventilation.** Crawl spaces shall be provided with vents to the exterior of the building.

~~**B201.6.2**~~ **809.2.6.2 Soil-gas-retarder.** The soil in crawl spaces shall be covered with a continuous layer of minimum 6-mil (0.15 mm) polyethylene soil-gas-retarder that conforms to ASTM E 1643. The ground cover shall be lapped a minimum of 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the crawl space area.

~~**B201.6.3**~~ **809.2.6.3 Vent pipe.** A plumbing tee or other *approved* connection shall be inserted horizontally beneath the sheeting and connected to a 3- or 4-inch-diameter (76 mm or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the conditioned spaces of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

~~**B201.7**~~ **809.2.7 Passive subslab depressurization system.** In basement or slab-on-grade buildings, the following components of a passive subslab depressurization system shall be installed during construction.

~~**B201.7.1**~~ **809.2.7.1 Vent pipe.** A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gas-tight pipe shall be embedded vertically into the subslab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the subslab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the subslab aggregate or connected to it through a drainage system.

The pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the surface of the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the conditioned spaces of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

~~**B201.7.2**~~ **809.2.7.2 Multiple vent pipes.** In buildings where interior footings or other barriers separate the subslab aggregate or other gas- permeable material, each area shall be fitted with an

individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

~~**B201.8**~~ **809.2.8 Vent pipe drainage.** All components of the radon vent pipe system shall be installed to provide positive drainage to a suction pit beneath the slab, or to the ground beneath the slab or soil-gas-retarder. The slope of vent piping shall be not less than 1/8 unit vertical in 12 units horizontal

~~**B201.9**~~ **809.2.9 Vent pipe accessibility.** Radon vent pipes shall be accessible for future fan installation through an attic or other area outside the habitable space.

Exception: The radon vent pipe need not be accessible in an attic space where an *approved* roof- top electrical supply is provided for future use.

~~**B201.10**~~ **809.2.10 Vent pipe identification.** All exposed and visible interior radon vent pipes shall be identified with at least one marking on each floor and in accessible attics. The marking shall read: "Radon Reduction System."

~~**B201.11**~~ **809.2.11 Combination foundations.** Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.

~~**B201.12**~~ **809.2.12 Power source.** To provide for future installation of an active submembrane or subslab depressurization system, an electrical circuit terminated in an *approved* box shall be installed during construction in the attic or other anticipated location of vent pipe fans. An electrical supply shall also be accessible in anticipated locations of system failure alarms.

Add new standard(s) as follows:

Moving the following standards from Appendix B, Section B202 to Chapter 12:

ASTM

C 33/33M-08	Standard Specifcation for Concrete Aggregate
C 920-11	Standard Specification for Elastomeric Joint Sealants
E 1643-10	Standard Practice for Selection, Design, Installation, and Installation, and Inspection of Water Vapor Retarder Used in Contact with Earth of Granular Fill under Concrete Slabs

Reason: Radon is the number one cause of lung cancer among non-smokers. Radon is responsible for about 21,000 lung cancer deaths in the U.S. every year. In 2005, the Surgeon General issued a national health advisory on radon. Studies show definitive evidence of the association between residential radon exposure and lung cancer, leaving no doubt about the risks that radon in the home presents to Americans or its association with lung cancer. Although lung cancer can be treated, the survival rate is one of the lowest for those with cancer. After diagnosis, only 11-15% of lung cancer victims live beyond five years.

Adding radon-resistant new construction (RRNC) provisions to construction codes will ensure that new buildings do not expose occupants to dangerous levels of radon. Excluding radon from buildings prevents lung cancer. Builders can install features during new construction to create either a passive radon-resistance system or an active radon reduction system. An active system includes a fan, while a passive system could be upgraded with a fan if there's an elevated radon level. Radon-resistant new construction (RRNC) is much more cost effective than installing a radon reduction system after the building has been constructed. RRNC is consistent with energy-efficiency standards because tightening the building and sealing openings keep fuel costs down.

Similar language was a requirement in the IGCC's section 804 prior to the 2012 edition of the IGCC. At the 2011 hearings, the language was improved by several modifications but then demoted from the body of the code to Appendix B. With this proposal we seek to add radon resistant construction back as a requirement in Zones 1 and 2. This stretch code should not skip this fundamental green construction practice for ensuring indoor environmental quality.

This proposal is submitted on behalf of American Lung Association, Enterprise Community Partners, National Center for Healthy Housing, and the Environmental Protection Agency.

Cost Impact: Will increase the cost of construction

Analysis: The standards are not new. They are being moved from Appendix B to Chapter 12.

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