SECTION BE102
DEFINITIONS

BE102.1 General.

For the purpose of these requirements, the terms used shall be defined as follows:

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 that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock, and can accumulate under the slabs and foundations of homes where it can easily enter into the *living space* through construction cracks and openings.

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.

SECTION BE103 REQUIREMENTS

BE103.1 General.

The following construction techniques are intended to resist radon entry and prepare the *building* for post-construction radon mitigation, if necessary (see Figure BE103.1). These techniques are required in areas where designated by the *jurisdiction*.

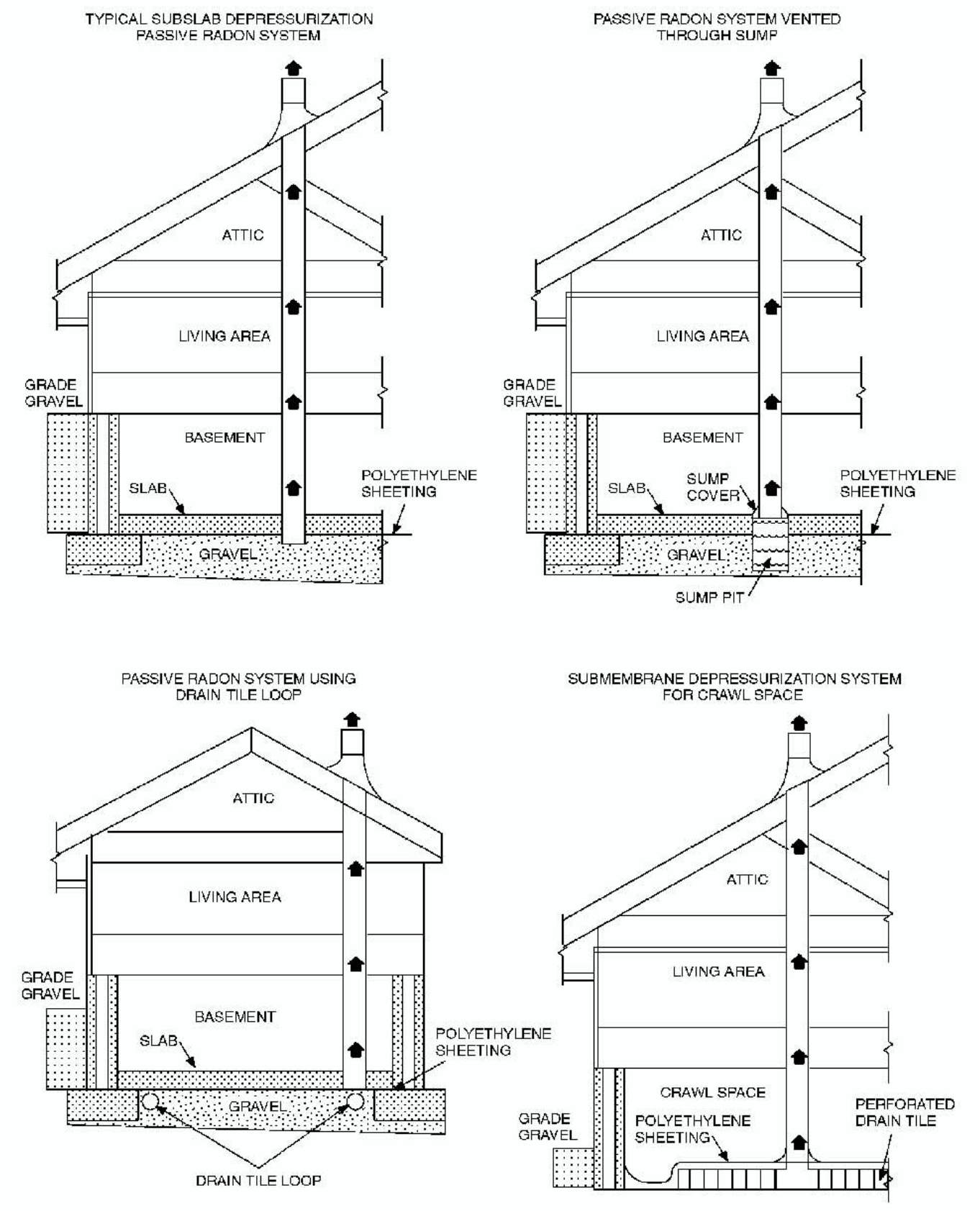

FIGURE BE103.1
RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES

BE103.2 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 are within the walls of the *living spaces* of the *building*, to facilitate future installation of a *subslab*

depressurization system, if needed. 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) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a $^1/_4$-inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill), not less than 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.

   Exception: A sand base course is not required under geotextile drainage matting where the concrete slab is installed on well-drained ground or sand-gravel mixture soils classified as Group 1 according to the United Soil Classification as detailed in Table R401.4.1(2).
3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.

BE103.3 Soil-gas-retarder.

Flexible sheeting material complying with Section R506.3.3 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 not less than 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. Punctures or tears in the material shall be sealed or covered with additional sheeting.

BE103.4 Entry routes.

Potential radon entry routes shall be closed in accordance with Sections BE103.4.1 through BE103.4.10.

BE103.4.1 Floor openings.

Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs, or other floor assemblies, shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.

BE103.4.2 Concrete joints.

Control joints, isolation joints, construction 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 polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.

BE103.4.3 Condensate drains.

Condensate drains shall be trapped or routed through nonperforated pipe to daylight.

BE103.4.4 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 the suction point in a *subslab depressurization system* shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

BE103.4.5 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 the 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 or 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 polyurethane caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

BE103.4.6 Dampproofing.

The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed in accordance with Section R406.

BE103.4.7 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.

BE103.4.8 Ducts.

Ductwork passing through or beneath a slab shall be of seamless material unless the air-handling system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed to prevent air leakage.

Ductwork located in *crawl spaces* shall have seams and joints sealed by closure systems in accordance with Section M1601.4.1.

BE103.4.9 Crawl space floors.

Openings around all penetrations through floors above *crawl spaces* shall be caulked or otherwise filled to prevent air

leakage.

BE103.4.10 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.

BE103.5 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.

BE103.5.1 Ventilation.

Crawl spaces shall be provided with vents to the exterior of the *building*. The minimum net area of ventilation openings shall comply with Section R408.1.

BE103.5.2 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*. The ground cover shall be lapped not less than 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the *crawl space* area.

BE103.5.3 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 or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, and terminate not less than 12 inches (305 mm) above the roof in a location not less than 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*.

BE103.6 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.

BE103.6.1 Vent pipe.

A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gastight 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, and terminate not less than 12 inches (305 mm) above the surface of the roof in a location not less than 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*.

BE103.6.2 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.

BE103.7 Vent pipe drainage.

Components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or *soil-gas-retarder*.

BE103.8 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.

BE103.9 Vent pipe identification.

Exposed and visible interior radon vent pipes shall be identified with not less than one *label* on each floor and in accessible *attics*. The *label* shall read: "Radon Reduction System."

BE103.10 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.

BE103.11 Building depressurization.

Joints in air ducts and plenums in unconditioned spaces shall meet the requirements of Section M1601. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11. *Fireblocking* shall meet the requirements contained in Section R302.11.

BE103.12 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 be accessible in anticipated locations of system failure alarms.