

Introduced by _____

First Reading _____

Second Reading _____

Ordinance No. _____

Council Bill No. B 377-13

AN ORDINANCE

amending Chapter 6 of the City Code as it relates to radon control methods; and fixing the time when this ordinance shall become effective.

BE IT ORDAINED BY THE COUNCIL OF THE CITY OF COLUMBIA, MISSOURI, AS FOLLOWS:

SECTION 1. Chapter 6 of the Code of Ordinances of the City of Columbia, Missouri, is hereby amended as follows:

Material to be deleted in ~~strikeout~~; material to be added underlined.

ARTICLE VI. ONE- AND TWO-FAMILY DWELLING CODE

Sec. 6-65. Adopted.

The 2012 Edition of the International Residential Code for One- and Two-Family Dwellings, published by the International Code Council, Inc., including Appendices A, B, C, E, F, G, H, K and N, one copy of which has been on file with the city clerk for a period of ninety (90) days prior to the adoption of this article, is hereby adopted by reference and made a part of the Code of Ordinances, City of Columbia, Missouri as fully as if set forth in its entirety. At least one (1) copy of the 2012 Edition of the International Residential Code for One- and Two-Family Dwellings shall remain on file in the office of the city clerk and shall be kept available for public use, inspection and examination.

Sec. 6-66. Amendments.

The code adopted by this article is hereby amended by substituting the following sections in lieu of those sections with corresponding numbers in the code, or, where there is no corresponding section in the code, the following sections shall be enacted as additions to the code:

R101.1 Title: These provisions shall be known as the Residential Code for One- and Two-Family Dwellings of the City of Columbia, and shall be cited as such and will be referred to herein as "this code."

R102.5.1 Appendices A, B, C, E, F, G, H, K and N are hereby adopted as published.

...

E3609.7 Bonding other metal piping: Delete "including gas piping" from section.

Appendix F, Radon Control Methods, Section AF101 Scope, AF101.1 General: Is amended to read: This appendix contains requirements for new construction and shall apply without regard to zone designation in Figure AF101 and Table AF101(1).

Appendix G, Swimming Pools, Spas and Hot Tubs, section AG105.2 Outdoor swimming pool: An outdoor swimming pool, including an in-ground, above-ground pool, hot tub or spa shall be surrounded by a barrier which shall comply with the following:

...

SECTION 2. This ordinance shall be in full force and effect from and after its passage.

PASSED this _____ day of _____, 2014.

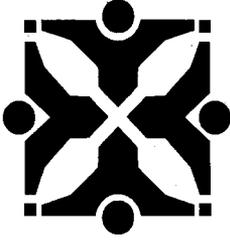
ATTEST:

City Clerk

Mayor and Presiding Officer

APPROVED AS TO FORM:

City Counselor



Source: Community Development - BSD 

Agenda Item No:

To: **City Council**
From: **City Manager and Staff** 

Council Meeting Date: Dec 16, 2013

Re: Radon resistant construction

EXECUTIVE SUMMARY:

Staff has prepared an ordinance which would adopt Appendix F of the International Residential Code (IRC) entitled "Radon Control Methods," with appropriate modifications to make the requirements of the appendix effective immediately. Appendix F requires radon resistant construction in new single- and two-family dwellings.

DISCUSSION:

Appendix F as adopted by the International Codes Council (ICC) states that its provisions shall only become effective if Boone County is demonstrated to be a "high potential" radon zone:

AF101.1 General...

...

Inclusion of this appendix by jurisdictions shall be determined through the use of locally available data or determination of Zone I designation in Figure AF101 and Table AF101 (1).

Currently Boone County is a moderate potential radon zone according to Figure AF101 and the data presented by Mr. Randall Maley, MPH, an Environmental Public Health Specialist with the State of Missouri Department of Health and Senior Services Bureau of Environmental Epidemiology. The Missouri counties designated as high potential are in the west and northwest corner of the state with the exception of Iron County. Either figure AF101 or a local study demonstrating a high radon hazard may activate the provisions of Appendix F. The proposed ordinance amends Appendix F to make the radon-resistant construction methods mandatory for all residential construction in Columbia now, regardless of the designation of high radon hazard.

Mr. Maley recommended that the requirement to provide a power source per IRC AF103.12 be removed as he stated power was typically readily available. The proposed ordinance does not remove the requirement to provide a power source per Mr. Maley's suggestion.

FISCAL IMPACT:

None.

VISION IMPACT:

<http://www.gocolumbiamo.com/Council/Meetings/visionimpact.php>

9.3.3 Strategy: Enact regulations and adopt policies to implement better, more efficient technologies.

SUGGESTED COUNCIL ACTIONS:

The Environment and Energy Committee recommended to council that all new single- and two-family dwellings be constructed to the radon-resistant construction methods per Appendix F of the IRC. The Building Construction Codes Commission subsequently reviewed the information and recommended that this not be mandated as it is a penalty for 75% of the homeowners not affected. The BCCC recommended radon testing and educating builders and the public as an alternative.

FISCAL and VISION NOTES:					
City Fiscal Impact Enter all that apply		Program Impact		Mandates	
City's current net FY cost	\$0.00	New Program/Agency?	No	Federal or State mandated?	No
Amount of funds already appropriated	\$0.00	Duplicates/Expands an existing program?	No	Vision Implementation impact	
Amount of budget amendment needed	\$0.00	Fiscal Impact on any local political subdivision?	No	Enter all that apply: Refer to Web site	
Estimated 2 year net costs:		Resources Required		Vision Impact?	Yes
One Time	\$0.00	Requires add'l FTE Personnel?	No	Primary Vision, Strategy and/or Goal Item #	9.3.3
Operating/Ongoing	\$0.00	Requires add'l facilities?	No	Secondary Vision, Strategy and/or Goal Item #	
		Requires add'l capital equipment?	No	Fiscal year implementation Task #	

MALICOAT-WINSLOW ENGINEERS, P.C.
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November 6, 2013

Council Members
City of Columbia
701 E Broadway
Columbia, MO 65205

Re: Radon Recommendation

Radon is a naturally occurring chemical element found in some soils. The accepted safe level in a building is less than 4 units of measure called picocuries per liter. The Missouri Department of Health & Senior Services has determined that 25% of homes in Columbia have radon in excess of 4 picocuries/liter. The State's Department of Environmental Epidemiology's own data shows that Boone County has an average picocurie rating of 3.9, which is less than the EPA's recommended level for concern.

There are at least 2 possible methods of remediation. One is a passive system and the other is an active system. If the measurement of radon is low, a passive method is all that may be required, but if the level is higher a more aggressive, active system may be required. The passive system is a pipe from below the slab to above the roof. An active system has the addition of an electric blower.

The Building Construction Codes Commission feels that requiring any system without testing would be a penalty for the 75% of the homeowners that are not affected. Instead of requiring all new homes to have a system, we feel that all homes should be tested so the proper remediation method can take place. The test kits are available free of charge from the Missouri Department of Health & Senior Services. Also, by requiring each home to have a passive system, this may instill a false sense of security for the homeowner. The passive system may not solve the radon issue and the homeowner would not know without a test. Therefore, we are recommending that each house be tested to determine the proper action. The Building Construction Codes Commission also recommends that efforts be directed at educating the 20-25% of its citizens that have a radon level above the EPA's recommended safe level on remediation options rather than needlessly forcing 75-80% of its citizens buying new homes to install a costly and unnecessary radon remediation system.

Sincerely,



Fred Malicoat
Chair, Building Construction Codes Commission
FM:spr

ENVIRONMENT & ENERGY COMMISSION

City of Columbia & County of Boone

City Hall, Conference Room 1A

November 26, 2013

Mr. Mayor and Council Members,

The Environment & Energy Commission has reviewed data concerning the prevalence of radon in Columbia and Boone County homes and recommends Columbia adopt Appendix F of the International Residential Building Code that requires all new homes have a passive radon mitigation system.

Radon is a major cause of lung cancer, and high radon levels can cause this disease. It is possible to install equipment that reduces radon levels. New homes with tighter construction may have increased radon levels.

A quarter of Columbia homes exceed the EPA action level of 4 pCi/L of radon. It is more expensive to retrofit a home with an active radon mitigation system once it is constructed. However, this feature can be built into the house at low cost.

Since it is relatively inexpensive to install a so-called "passive" radon mitigation system in a new home, and it is then inexpensive to upgrade the system to an active one if the radon levels are high, the EEC recommends that all new homes be required to have a passive radon mitigation system in accordance with Appendix F of the International Residential Building Code. The system could then be upgraded to an active one if necessary.

Respectfully Yours,

Lawrence Lile, PE

Chair

Environment and Energy Commission

APPENDIX F

RADON CONTROL METHODS

(The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.)

SECTION AF101 SCOPE

AF101.1 General. This appendix contains requirements for new construction in *jurisdictions* where radon-resistant construction is required.

Inclusion of this appendix by *jurisdictions* shall be determined through the use of locally available data or determination of Zone 1 designation in Figure AF101 and Table AF101(1).

SECTION AF102 DEFINITIONS

AF102.1 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 AF103 REQUIREMENTS

AF103.1 General. The following construction techniques are intended to resist radon entry and prepare the building for

post-construction radon mitigation, if necessary (see Figure AF102). These techniques are required in areas where designated by the *jurisdiction*.

AF103.2 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, a minimum of 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 $\frac{1}{4}$ -inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.
3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.

AF103.3 Soil-gas-retarder. A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material 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.

AF103.4 Entry routes. Potential radon entry routes shall be closed in accordance with Sections AF103.4.1 through AF103.4.10.

AF103.4.1 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.

AF103.4.2 Concrete joints. All 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

APPENDIX F

applied in accordance with the manufacturer's recommendations.

AF103.4.3 Condensate drains. Condensate drains shall be trapped or routed through nonperforated pipe to daylight.

AF103.4.4 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.

AF103.4.5 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.

AF103.4.6 Dampproofing. The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed in accordance with Section R406.

AF103.4.7 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.

AF103.4.8 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 all seams and joints sealed by closure systems in accordance with Section M1601.4.1.

AF103.4.9 Crawl space floors. Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

AF103.4.10 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.

AF103.5 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.

AF103.5.1 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.

AF103.5.2 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 a minimum of 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the crawl space area.

AF103.5.3 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 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.

AF103.6 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.

AF103.6.1 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, and 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.

AF103.6.2 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.

AF103.7 Vent pipe drainage. All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil-gas-retarder.

AF103.8 Vent pipe accessibility. Radon vent pipes shall be accessible for future fan installation through an *attic* or other area outside the *habitable space*.

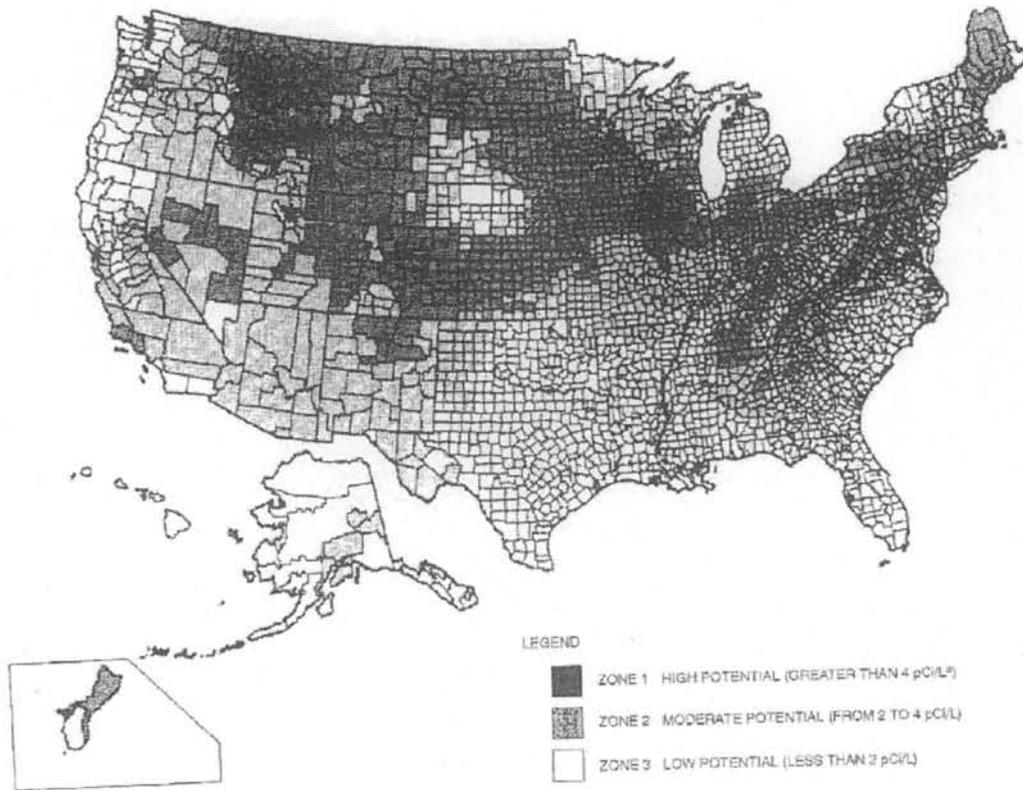
Exception: The radon vent pipe need not be accessible in an *attic* space where an *approved* roof-top electrical supply is provided for future use.

AF103.9 Vent pipe identification. All exposed and visible interior radon vent pipes shall be identified with at least one *label* on each floor and in accessible *attics*. The *label* shall read: "Radon Reduction System."

AF103.10 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.

AF103.11 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.

AF103.12 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.



LEGEND

- ZONE 1 HIGH POTENTIAL (GREATER THAN 4 pCi/L)
- ZONE 2 MODERATE POTENTIAL (FROM 2 TO 4 pCi/L)
- ZONE 3 LOW POTENTIAL (LESS THAN 2 pCi/L)

pCi/L, standard for picocuries per liter of radon gas. The U.S. Environmental Protection Agency (EPA) recommends that all homes that measure 4 pCi/L and greater be mitigated. The EPA and the U.S. Geological Survey have evaluated the radon potential in the United States and have developed a map of radon zones designed to assist building officials in deciding whether radon-resistant features are applicable in new construction. The map assigns each of the 3,141 counties in the United States to one of three zones based on radon potential. Each zone designation reflects the average short-term radon measurement that can be expected to be measured in a building without the implementation of radon-control methods. The radon zone designation of highest priority is Zone 1. Table AF101 lists the Zone 1 counties illustrated on the map. More detailed information can be obtained from state-specific booklets (EPA-402-R-93-021 through 070) available through State Radon Offices or from EPA Regional Offices.

FIGURE AF101
EPA MAP OF RADON ZONES

TABLE AF101(1)
HIGH RADON-POTENTIAL (ZONE 1) COUNTIES*

ALABAMA	CONNECTICUT	Moultrie	Warren	Wallace	Jackson	Wilkin
Calhoun	Fairfield	Ogle	Washington	Washington	Kalamazoo	Winona
Clay	Middlesex	Peoria	Wayne	Wichita	Lenawee	Wright
Cleburne	New Haven	Piatt	Wells	Wyandotte	St. Joseph	Yellow Medicine
Colbert	New London	Pike	White		Washtenaw	
Coosa		Putnam	Whitley	KENTUCKY		MISSOURI
Franklin	GEORGIA	Rock Island		Adair	MINNESOTA	Andrew
Jackson	Cobb	Sangamon	IOWA	Allen	Becker	Atchison
Lauderdale	De Kalb	Schuyler	All Counties	Barren	Big Stone	Buchanan
Lawrence	Fulton	Scott		Bourbon	Blue Earth	Cass
Limestone	Gwinnett	Stark	KANSAS	Boyle	Brown	Clay
Madison		Stephenson	Atchison	Bullitt	Carver	Clinton
Morgan	IDAHO	Tazewell	Barton	Casey	Chippewa	Holt
Talladega	Benewah	Vermilion	Brown	Clark	Clay	Iron
	Blaine	Warren	Cheyenne	Cumberland	Cottonwood	Jackson
CALIFORNIA	BoiseBonner	Whiteside	Clay	Fayette	Dakota	Nodaway
Santa Barbara	Boundary	Winnebago	Cloud	Franklin	Dodge	Platte
Ventura	Butte	Woodford	Decatur	Green	Douglas	
	Camas		Dickinson	Harrison	Faribault	MONTANA
COLORADO	Clark	INDIANA	Douglas	Hart	Fillmore	Beaverhead
Adams	Clearwater	Adams	Ellis	Jefferson	Freeborn	Big Horn
Arapahoe	Custer	Allen	Ellsworth	Jessamine	Goodhue	Blaine
Baca	Elmore	Bartholomew	Finney	Lincoln	Grant	Broadwater
Bent	Fremont	Benton	Ford	Marion	Hennepin	Carbon
Boulder	Gooding	Blackford	Geary	Mercer	Houston	Carter
Chaffee	Idaho	Boone	Gove	Metcalfe	Hubbard	Cascade
Cheyenne	Kootenai	Carroll	Graham	Monroe	Jackson	Chouteau
Clear Creek	Latah	Cass	Grant	Nelson	Kanabec	Custer
Crowley	Lemhi	Clark	Gray	Pendleton	Kandiyohi	Daniels
Custer	Shoshone	Clinton	Greeley	Pulaski	Kittson	Dawson
Delta	Valley	De Kalb	Hamilton	Robertson	Lac Qui Parle	Deer Lodge
Denver		Decatur	Haskell	Russell	Le Sueur	Fallon
Dolores	ILLINOIS	Delaware	Hodgeman	Scott	Lincoln	Fergus
Douglas	Adams	Elkhart	Jackson	Taylor	Lyon	Flathead
El Paso	Boone	Fayette	Jewell	Warren	Mahnomen	Gallatin
Elbert	Brown	Fountain	Johnson	Woodford	Marshall	Garfield
Fremont	Bureau	Fulton	Keamy		Martin	Glacier
Garfield	Calhoun	Grant	Kingman	MAINE	McLeod	Granite
Gilpin	Cass	Hamilton	Kiowa	Androscoggin	Meeker	Hill
Grand	Champaign	Hancock	Lane	Arroostook	Mower	Jefferson
Gunnison	Coles	Harrison	Leavenworth	Cumberland	Murray	Judith Basin
Huerfano	De Kalb	Hendricks	Lincoln	Franklin	Nicollet	Lake
Jackson	De Witt	Henry	Logan	Hancock	Nobles	Lewis and Clark
Jefferson	Douglas	Howard	Marion	Kennebec	Norman	Madison
Kiowa	Edgar	Huntington	Marshall	Lincoln	Olmsted	McCone
Kit Carson	Ford	Jay	McPherson	Oxford	Otter Tail	Meagher
Lake	Fulton	Jennings	Meade	Penobscot	Pennington	Missoula
Larimer	Greene	Johnson	Mitchell	Piscataquis	Pipestone	Park
Las Animas	Grundy	Kosciusko	Nemaha	Somerset	Polk	Phillips
Lincoln	Hancock	LaGrange	Ness	York	Pope	Pondera
Logan	Henderson	Lawrence	Norton	MARYLAND	Ramsey	Powder River
Mesa	Henry	Madison	Osborne	Baltimore	Red Lake	Powell
Moffat	Iroquois	Marion	Ottawa	Calvert	Redwood	Prairie
Montezuma	Jersey	Marshall	Pawnee	Carroll	Renville	Ravalli
Montrose	Jo Daviess	Miami	Phillips	Frederick	Rice	Richland
Morgan	Kane	Monroe	Pottawatomie	Harford	Rock	Roosevelt
Otero	Kendall	Montgomery	Pratt	Howard	Roseau	Rosebud
Ouray	Knox	Noble	Rawlins	Montgomery	Scott	Sanders
Park	La Salle	Orange	Republic	Washington	Sherburne	Sheridan
Phillips	Lee	Putnam	Rice		Sibley	Silver Bow
Pitkin	Livingston	Randolph	Riley	MASS.	Stearns	Stillwater
Prowers	Logan	Rush	Rooks	Essex	Steele	Teton
Pueblo	Macon	Scott	Rush	Middlesex	Stevens	Toole
Rio Blanco	Marshall	Shelby	Saline	Worcester	Swift	Valley
San Miguel	Mason	St. Joseph	Scott		Todd	Wibaux
Summit	McDonough	Steuben	Sheridan	MICHIGAN	Traverse	Yellowstone
Teller	McLean	Tippecanoe	Sherman	Branch	Wabasha	
Washington	Menard	Tipton	Smith	Calhoun	Wadena	
Weld	Mercer	Union	Stanton	Cass	Waseca	
Yuma	Morgan	Vermillion	Thomas	Hillsdale	Washington	
		Wabash	Trego		Watonswan	

(continued)

APPENDIX F

TABLE AF101(1)—continued
HIGH RADON-POTENTIAL (ZONE 1) COUNTIES^a

NEBRASKA	Hunterdon	Belmont	Delaware	McPherson	Bland	Hancock
Adams	Mercer	Butler	Franklin	Miner	Botetourt	Hardy
Boone	Monmouth	Carroll	Fulton	Minnehaha	Bristol	Jefferson
Boyd	Morris	Champaign	Huntingdon	Moody	Brunswick	Marshall
Burt	Somerset	Clark	Indiana	Perkins	Buckingham	Mercer
Butler	Sussex	Clinton	Juniata	Potter	Buena Vista	Mineral
Cass	Warren	Columbiana	Lackawanna	Roberts	Campbell	Monongalia
Cedar		Coshocton	Lancaster	Sanborn	Chesterfield	Monroe
Clay	NEW MEXICO	Crawford	Lebanon	Spink	Clarke	Morgan
Colfax	Bernalillo	Darke	Lehigh	Stanley	Clifton Forge	Ohio
Cuming	Colfax	Delaware	Luzerne	Sully	Covington	Pendleton
Dakota	Mora	Fairfield	Lycoming	Turner	Craig	Pocahontas
Dixon	Rio Arriba	Fayette	Mifflin	Union	Cumberland	Summers
Dodge	San Miguel	Franklin	Monroe	Walworth	Danville	Wetzel
Douglas	Santa Fe	Greene	Montgomery	Yankton	Dinwiddie	
Fillmore	Taos	Guernsey	Montour		Fairfax	
Frontier		Hamilton	Northampton	TENNESSEE	Falls Church	WISCONSIN
Franklin	NEW YORK	Hancock	Northumberland	Anderson	Fluvanna	Buffalo
Furnas	Albany	Hardin	Perry	Bedford	Frederick	Crawford
Gage	Allegany	Harrison	Schuylkill	Blount	Fredericksburg	Dane
Gosper	Broome	Holmes	Snyder	Bradley	Giles	Dodge
Greeley	Cattaraugus	Huron	Sullivan	Claiborne	Goochland	Door
Hamilton	Cayuga	Jefferson	Susquehanna	Davidson	Harrisonburg	Fond du Lac
Harlan	Chautauqua	Knox	Tioga	Giles	Henry	Grant
Hayes	Chemung	Licking	Union	Grainger	Highland	Green
Hitchcock	Chenango	Logan	Venango	Greene	Lee	Green Lake
Hurston	Columbia	Madison	Westmoreland	Hamblen	Lexington	Iowa
Jefferson	Cortland	Marion	Wyoming	Hancock	Louisa	Jefferson
Johnson	Delaware	Mercer	York	Hawkins	Martinsville	Lafayette
Kearney	Dutchess	Miami		Hickman	Montgomery	Langlade
Knox	Erie	Montgomery	RHODE ISLAND	Humphreys	Nottoway	Marathon
Lancaster	Genesee	Morrow	Kent	Jackson	Orange	Menominee
Madison	Greene	Muskingum	Washington	Jefferson	Page	Pepin
Nance	Livingston	Perry		Knox	Patrick	Pierce
Nemaha	Madison	Pickaway	S. CAROLINA	Lawrence	Pittsylvania	Portage
Nuckolls	Onondaga	Pike	Greenville	Lewis	Powhatan	Richland
Otoe	Ontario	Preble		Lincoln	Pulaski	Rock
Pawnee	Orange	Richland	S. DAKOTA	Loudon	Radford	Shawano
Phelps	Otsego	Ross	Aurora	Marshall	Roanoke	St. Croix
Pierce	Putnam	Seneca	Beadle	Maury	Rockbridge	Vernon
Platte	Rensselaer	Shelby	Bon Homme	McMinn	Rockingham	Walworth
Polk	Schoharie	Stark	Brookings	Meigs	Russell	Washington
Red Willow	Schuyler	Summit	Brown	Monroe	Salem	Waukesha
Richardson	Seneca	Tuscarawas	Brule	Moore	Scott	Waupaca
Saline	Steuben	Union	Buffalo	Perry	Shenandoah	Wood
Sarpy	Sullivan	Van Wert	Campbell	Roane	Smyth	
Saunders	Tioga	Warren	Charles Mix	Rutherford	Spotsylvania	WYOMING
Seward	Tompkins	Wayne	Clark	Smith	Stafford	Albany
Stanton	Ulster	Wyandot	Clay	Sullivan	Staunton	Big Horn
Thayer	Washington		Codington	Trousdale	Tazewell	Campbell
Washington	Wyoming	PENNSYLVANIA	Corson	Warren	Warren	Carbon
Wayne	Yates	Adams	Davison	Washington	Waynesboro	Converse
Webster		Allegheny	Day	Wayne	Winchester	Crook
York		Armstrong	Deuel	Williamson	Wythe	Fremont
		Beaver	Douglas	Wilson		Goshen
NEVADA		Bedford	Edmunds		WASHINGTON	Hot Springs
Carson City		Berks	Faulk	UTAH	Clark	Johnson
Douglas		Blair	Grant	Carbon	Ferry	Laramie
Eureka		Bradford	Hamlin	Duchesne	Okanogan	Lincoln
Lander		Bucks	Hand	Grand	Pend Oreille	Natrona
Lincoln		Butler	Hanson	Piute	Skamania	Niobrara
Lyon		Cameron	Hughes	Sanpete	Spokane	Park
Mineral		Carbon	Hutchinson	Sevier	Stevens	Sheridan
Pershing		Centre	Hyde	Uintah		Sublette
White Pine		Chester	Jerauld		W. VIRGINIA	Sweetwater
		Clarion	Kingsbury	VIRGINIA	Berkeley	Teton
		Clearfield	Lake	Alleghany	Brooke	Uinta
NEW HAMPSHIRE	OHIO	Clinton	Lincoln	Amelia	Grant	Washakie
Carroll	Adams	Columbia	Lyman	Appomattox	Greenbrier	
	Allen	Cumberland	Marshall	Augusta	Hampshire	
NEW JERSEY	Ashland	Dauphin	McCook	Bath		
	Auglaize					

a. The EPA recommends that this county listing be supplemented with other available State and local data to further understand the radon potential of a Zone 1 area.

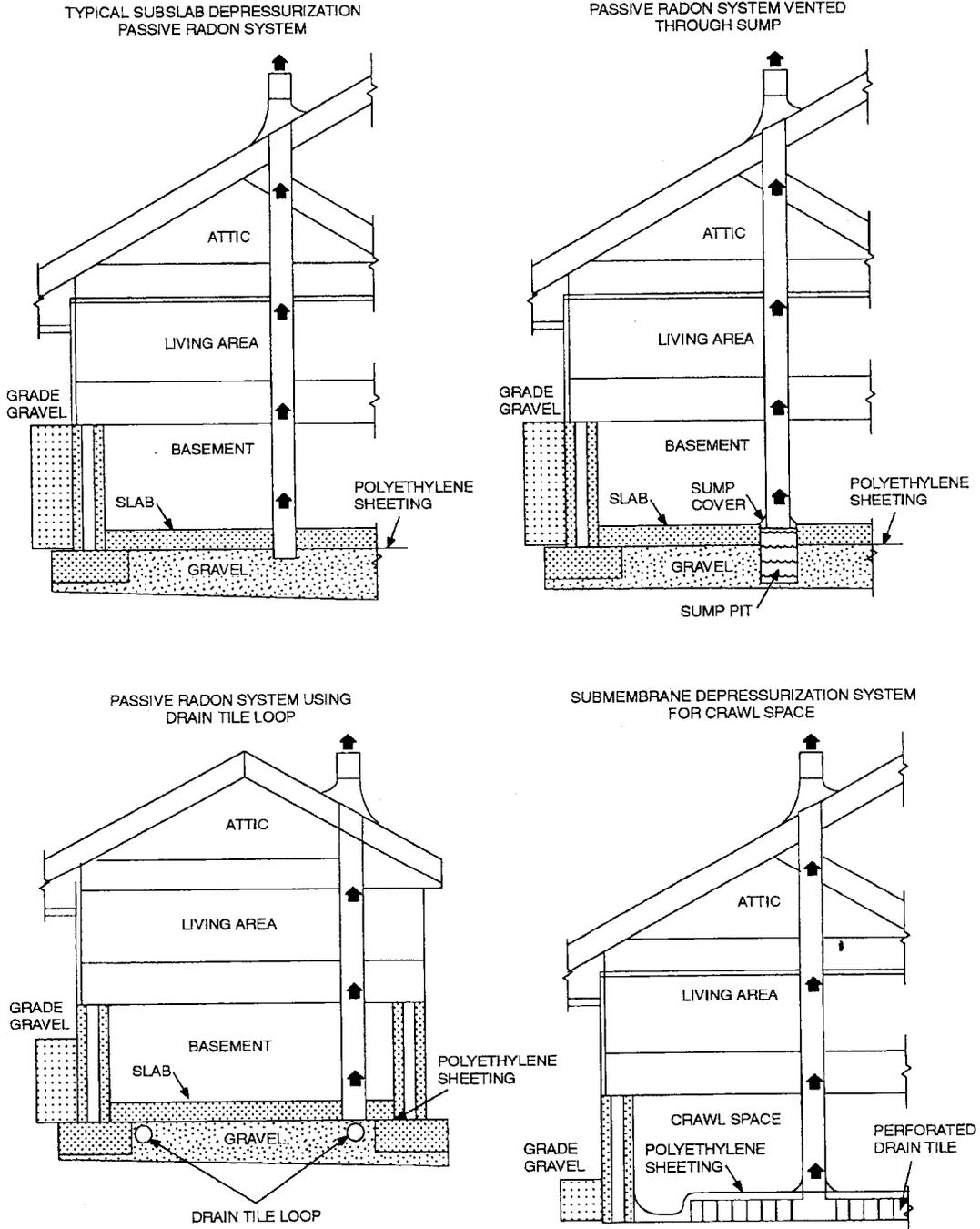


FIGURE AF102
RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES

