New RRNC Standards and Where They Are Used in Kansas

September 22, 2022

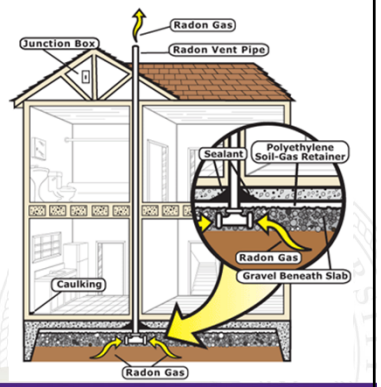
Are There Laws Regarding Radon in Kansas?

- K.S.A 58-3078a went into effect on July 1, 2009 which requires a specific paragraph to be included in all residential real property contracts (next slide)
  - There are no laws requiring people to test, or fix high levels if found.
- Kansas does require a state certification to provide professional radon measurement, mitigation, and laboratory services in the state
- **Radon resistant new construction (RRNC) codes have been adopted in**
  - **Manhattan, Topeka, Lawrence, Salina, Junction City, Eudora, De Soto, Gardner**
  - **Shawnee County (unincorporated), Douglas County (unicorporated)**

What Does it Take to Build a Home Radon Resistant?

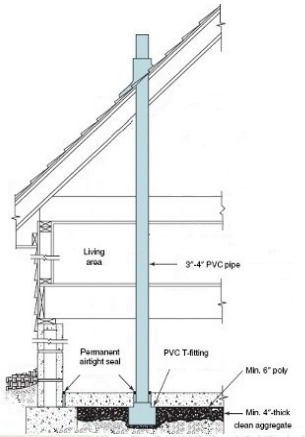
Three Primary Parts:

1. Soil gas collection system
2. Pipe to convey gas through roof
3. Provision to add fan if needed



How is the System Supposed to Work?

- It is designed to vent radon from beneath the structure by use of a vent pipe routed through the conditioned space of a building, connecting the sub-slab area with outdoor air.
- The warmed air in the pipe rises, creating a slight vacuum (pressure differential) on the cooler soil gas.
- Known as Passive Soil Depressurization - PSD



Two Major Reasons Passive Soil Depressurization is Used

1. To reduce indoor radon concentrations
   - In general, potentially 50% reduction is expected if *properly installed*.
2. To make the house easy to fix if further radon reduction is needed
   - By activation with a fan
     - Vent stack must be *easily accessible* and *outside conditioned space* for fan installation.
     - Power must be available near fan.
     - Major openings between soil and occupied space must be sealed.

Building Codes and Standards

- Eleven states (CT IL ME MD MA MI MN NE NJ OR WA) require radon-reducing construction methods.
- CT IL ME and MN protect homes in all areas; other states only require RRNC in homes in Zone 1 counties or another subset.
- Six states (IL ME MN NE NJ WA) cover all types of homes;
- four states (CT MA MD MI) limit protection to one and two family homes and townhouses; one state (OR) covers the same plus apartments.

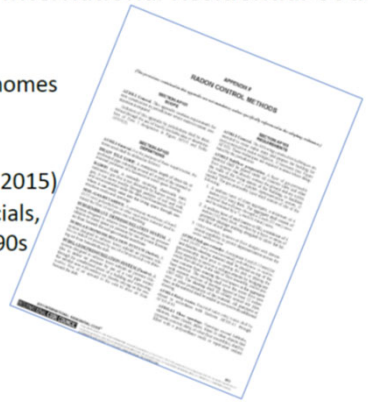
Jurisdictions with Radon Control Building Code Requirements - National

- States (statewide-maybe in zone 1 only)
  - Illinois
  - Maryland
  - Michigan
  - New Jersey
  - Washington
  - Oregon
  - Minnesota
  - Nebraska
- States (statewide but need local adoption)
  - Florida
  - Maine
  - Rhode Island
  - Virginia
- States (where local jurisdictions have adopted)
  - Alabama
  - Colorado
  - Georgia
  - Idaho
  - Iowa
  - Kansas
  - Montana
  - Maryland
  - New Mexico
  - New York
  - Ohio
  - Oklahoma
  - Pennsylvania
  - South Carolina
  - Tennessee
  - West Virginia
  - Wisconsin
  - Wyoming

International Code Council (ICC) Code	Current Radon Provision
International Residential Code (IRC) – applies to one and two-family dwellings and town-homes	Appendix F
International Building Code (IBC) – applies to large buildings including multifamily dwellings, schools and workplaces	None
International Mechanical Code (IMC) – specialty code, used selectively	Section 512 (scroll down to 512)
International Green Construction Code (IGCC) – – specialty code, applies to large buildings including multifamily dwellings, schools and workplaces	Section 801.3.4

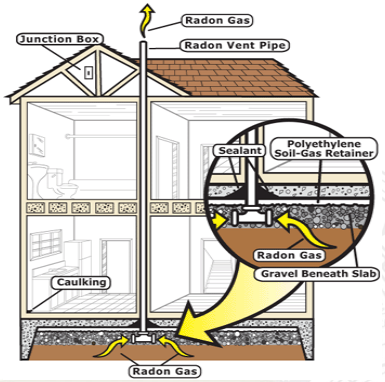
Appendix F of the International Residential Code

- RRNC code in 7 of 8 states
- 1- and 2- family homes, townhomes
- Basic, passive system only
  - No fan, no testing
  - $350 average cost* (NAHB 2015)
- Created by builders, code officials, radon industry in the early 1990s
- Updates needed/attempted



Basic Elements of Appendix F

- Clean Aggregate beneath the slab
- Vapor barrier
- Minimum "T" fitting in Gravel
- 3" Vent pipe running through the house
- Openings to the soil sealed
- Power Source in attic for future fan



IRC Appendix F: Section 103 Requirements (Overview)

1. General
2. Subfloor Preparation
3. Soil-Gas Retarder
4. Entry Routes
5. Passive Submembrane Depressurization (PSD) Systems: Crawlspace
6. PSD Systems: Basements and Crawlspace

Vent Pipe Drainage
Vent Pipe Access
Vent Pipe Identification
Combination Foundations
Building Depressurization
Power Source

Appendix F Changes

AF104 Testing. Where radon-resistant construction is required, radon testing shall be as specified in Items 1 through 11:

1. Testing shall be performed after the dwelling passes its air tightness test

Appendix F Changes

2. Testing shall be performed after the radon control system and HVAC installations are complete. The HVAC system shall be operating during the test. Where the radon system has an installed fan, the dwelling shall be tested with the radon fan operating

3. Testing shall be performed at the lowest occupied floor level, whether or not that space is finished. Spaces that are physically separated and served by different HVAC systems shall be tested separately

Appendix F Changes

4. Testing shall not be performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen

5. Testing shall be performed with a commercially available radon test kit or testing shall be performed by an approved third party with a continuous radon monitor. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing laboratory kit manufacturer's instructions

Appendix F Changes

6. Testing shall be performed with the windows closed. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit. Windows and doors shall be closed for at least 12 hours prior to the testing

7. Testing shall be performed by the builder, a registered design professional, or an approved third party.

Appendix F Changes

8. Testing shall be conducted over a period of not less than 48 hours or not less that the period specified by the testing device manufacturer, whichever is longer

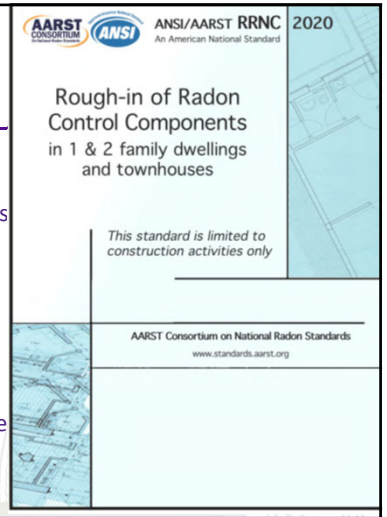
9. Written radon test results shall be provided by the test lab or testing party. The final written test report with results less than 4pCi/L shall be provided to the code official.

Appendix F Changes

10. Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed as specified in Sections AF103.8 and AF103.12
11. Where the radon test result is 4 pCi/L or greater, the system shall be modified and retested until the test result is less than 4 pCi/L.

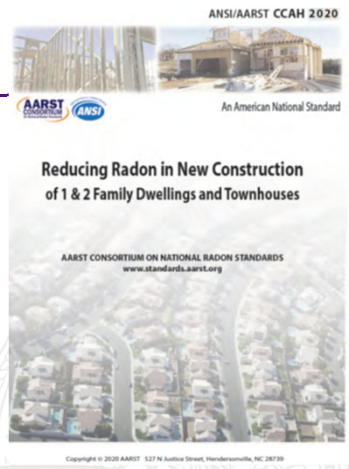
RRNC 2020

This standard provides minimum requirements for the rough-In of radon control system components in new dwelling units under construction. This standard is harmonized with ANSI/AARST CCAH, which additionally addresses requirements for verifying if radon concentrations are below the national action leve and, if required, activation of radon control systems.



CCAH2 2020

This standard provides minimum requirements for the rough-In of radon control system components in new dwelling units under construction. CCAH also includes minimum requirements for verifying if radon concentrations are below the national action level and, if required, activation of radon control systems. This standard is harmonized to compliment the standard designated as ANSI/AARST RRNC, which replicates construction activities for rough-In components only.



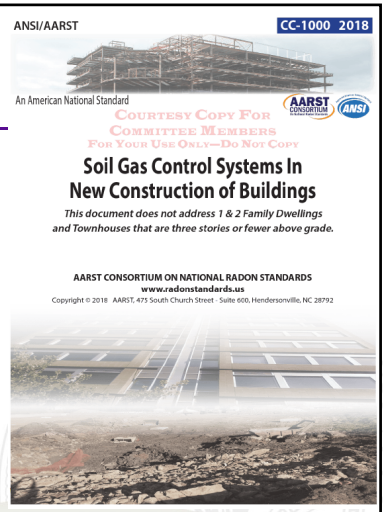
Section 801 **RADON TESTING**

- 801.1 Radon testing. A short-term *radon* test shall be performed prior to or within 60 days of occupancy and shall be performed by a *certified/licensed* measurement professional. Testing shall be performed in accordance with ANSI/AARST MAH *"Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes"* or applicable state protocols or requirements.

Section 801

- Where testing results are greater than or equal to the NAL, a certified/licensed mitigation professional shall perform diagnostic tests and mitigation action until radon concentrations to below the NAL are achieved. The final written test report with results less than the NAL shall be provided to the authority having jurisdiction.

- Soil Gas Control Systems in New Construction of Multifamily, School, Commercial and Mix-Use Buildings



3.2
Soil gas vent systems required

- Soil gas vent systems shall be constructed for each ground contact portion of the building. Each soil gas vent system shall include exhaust piping extended from inlets within soil gas collection plenum(s) to an exhaust location at the roof, in accordance with Sections 4 through 10.
- Exception: Garages attached to a foundation system do not require *soil gas vent systems* if compliant with ANSI/ASHRAE 62.1, Sections 5.17 and 6.5 for ventilation and pressurization of enclosed spaces surrounding the garage

4.3
Soil gas vent systems per plenum size

- An independent soil gas vent system with an exhaust pipe extended from the soil gas collection plenum to the roof shall be installed with exhaust pipe sizing no less than specified in Table 4.3 for each individual plenum and combined set of joined soil gas collection plenums.

Table 4.3		
Nominal inside pipe diameter	Maximum size of Soil Gas Collection Plenum(s) per duct size	
	Compliant plenum installation verified by inspection per Section 5.10.2	Size allowed for gas-tight plenum closure per Section 6.3.2
3 inch (7.6 cm)	3,500 square feet (325 m^2)	4,000 square feet (372 m^2)
4 inch (10.2 cm)	6,200 square feet (575 m^2)	7,100 square feet (660 m^2)
6 inch (15.2 cm)	14,000 square feet (1,300 m^2)	16,000 square feet (1,486 m^2)
	Where any plenum installation is not verified by inspection per Section 5.10.2	Penalty for non-compliant gas permeable layer per Section 5.5
3 inch (7.6 cm)	2,500 square feet (232 m^2)	1250 square feet (116 m^2)
4 inch (10.2 cm)	4,500 square feet (418 m^2)	2250 square feet (209 m^2)
6 inch (15.2 cm)	10,000 square feet (929 m^2)	5,000 square feet (465 m^2)

5.10.2 *Inspect the open plenum*

- An inspection shall be conducted prior to placement of concrete or soil gas retarders over a gas permeable layer to verify that all inlets and ducting are secured and that gas permeable layer materials and closed surroundings are compliant with this standard. The inspection shall be conducted by an individual who is trained and qualified for design of systems that comply with this standard. The inspection shall include items listed in Exhibit A-1. A record of the inspection(s) shall be retained in accordance with Section 12.

6.3.2 *Soil gas retarder installation*

- The *soil gas retarder* installation shall result in continuous closure that resists air movement between soil and indoor air:
- along all outer perimeters and edges of each *soil gas collection plenum;*
- at membrane seams; *and*
- at membrane penetrations.
- *Soil gas retarder* membrane configurations shall be secured to withstand anticipated loads that might pull or tear the *soil gas retarder* membrane away from foundation walls or footings.
- Exception: Monolithic/Post-tension Foundation. Where the floors and footings are monolithic, the *soil gas retarder* shall extend under the footings.

11.3Performance Testing
11.3.1 Radon

- Where the purpose of the system design includes protecting against exposure to radon gas, the building shall be tested, postconstruction, for radon in accordance with ANSI/AARST MAMF or MALB, as applicable. Where radon testing indicates that the indoor radon concentration equals or exceeds the national action level, the system shall be activated and the building shall be retested to verify if the radon concentration is below the national action level. Where testing indicates mitigation goals have not been met after system activation, additional diagnostics and mitigation shall be conducted by a *qualified mitigation professional,* in accordance with ANSI/AARST RMS-MF/LB.

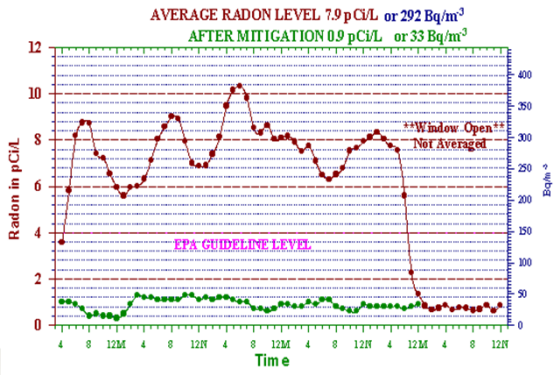
11.4.6 ASD fan monitors required

- Each *ASD* system shall be provided with system monitors to monitor fan performance and notify occupants or maintenance personnel of fan failure. The system monitors shall be connected to the fan piping and located in an area where the monitor status is readily observable by the occupants or maintenance personnel. Each *ASD* system shall include both:
- 1) Negative pressure meter, such as manometer type pressure gauge; and
- 2) Fan failure notification by audible or visual fan alarm or remote telemetry.

11.4.6 ASD fan monitors required

- 11.4.6.1 Electrical Power
- System monitors that require electricity for indication of fan failure shall be on non-switched circuits
- separate from the circuit powering the radon fan unless loss of power triggers the alarm. Battery operated
  - monitors shall be equipped with a low battery-power warning feature. Electrical *ASD* system monitors, whether visual or audible, shall be designed to reset automatically when power is restored after power outage.
- 11.4.6.2 Startup marking
  - *ASD* system negative pressure monitors shall be clearly marked to indicate the pressure that existed when the system was initially activated. The monitor device shall have a durable label on or in close proximity to it that describes how to interpret the monitor and what to do if the monitor indicates that system performance has changed.

Active Mitigation Is the Best Bet!

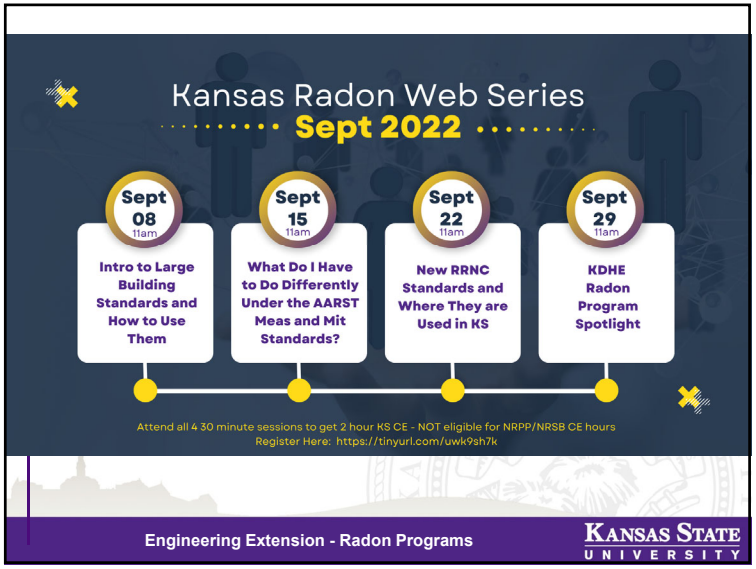


PSD Can Work But... It Needs To Be Done Correctly

- If not done correctly . . .
  - May not provide much, if any, radon reduction
  - Can make future activation, if needed, difficult, impractical, or impossible
- It is ***highly important*** to test all new homes for radon, even those with PSD
  - PSD does not guarantee < 4 pCi/l but . . .
    - It does reduce indoor radon and it provides a system ready for activation if needed
    - Testing can occur when ready for occupancy

Performance Issues

- Subslab Permeable Layer Missing or Incomplete
- Sealing Incomplete
- Sumps Unsealed
- Air Leaks from Sub Slab to the Outdoors
- Pipes Blocked by Construction Debris or Soil
- Stack Pipe too Small
- Pipe routed through unheated space.
- Pipe does not discharge above roof.
- Pipe Joints Not Sealed
- System Labels Lacking
- Radon Performance Tests Not Done
- Pipe inaccessible.
- Pipe in attic installed without slope.
- Pipe not labeled in attic or basement.



Engineering Extension - Radon Programs
KANSAS STATE UNIVERSITY