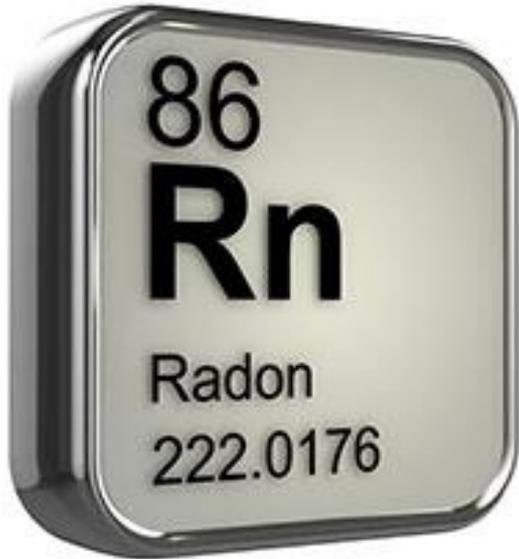


# Radon Aware Training For Real Estate Professionals



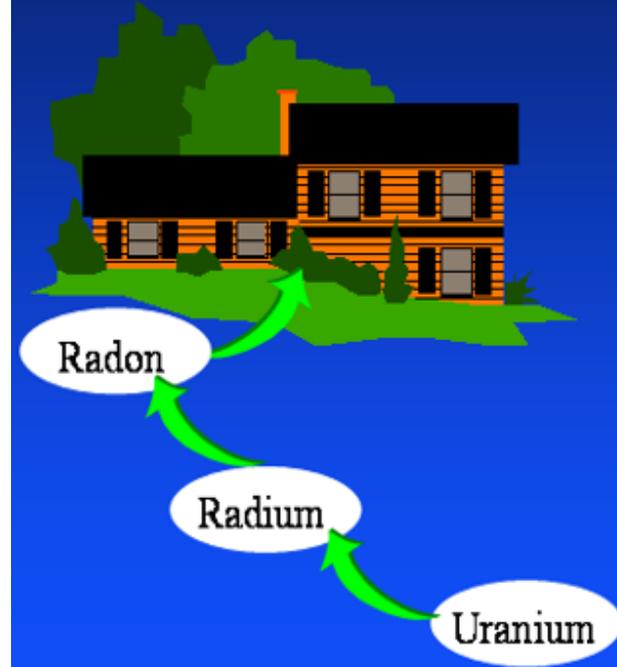
Tony Fourcroy  
Air Quality Programs

- What is radon?
- What are the health risks?
- Testing and Mitigation
- What do Real Estate Professionals need to know?

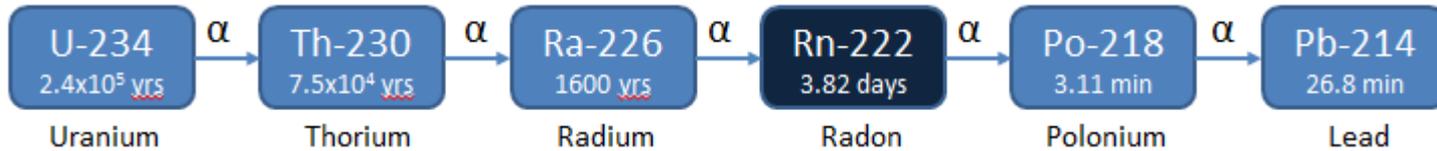
# What is Radon?

## What is Radon?

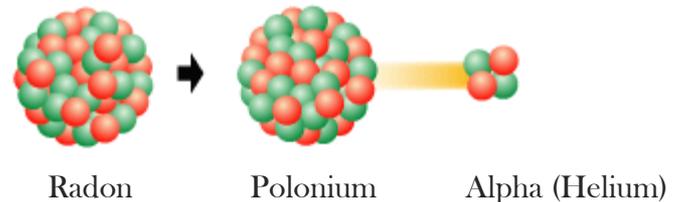
- Byproduct of Uranium decay
- Found in rock, soil and ground water
- *Senseless* radioactive gas
- No symptoms or allergic reactions



Radon is a radioactive gas that comes from the natural decay of uranium that is prevalent in our soils



Radon decomposes into radioactive particles that become lodged in your lungs



*Alpha particle decay*



<https://www.youtube.com/watch?v=VFVZU2YwwJ4>

# How is radon measured?

- Curie (Ci): radioactive decay of Ra-226 over 24-hour period
- pCi = 1 trillionth of a Curie
- 4 pCi/L = 12,787 alpha particles/liter/day

## The EPA “*Action Level*” is 4 pCi/L

*Surgeon General recommends against long-term average exposures above 4 pCi/L*



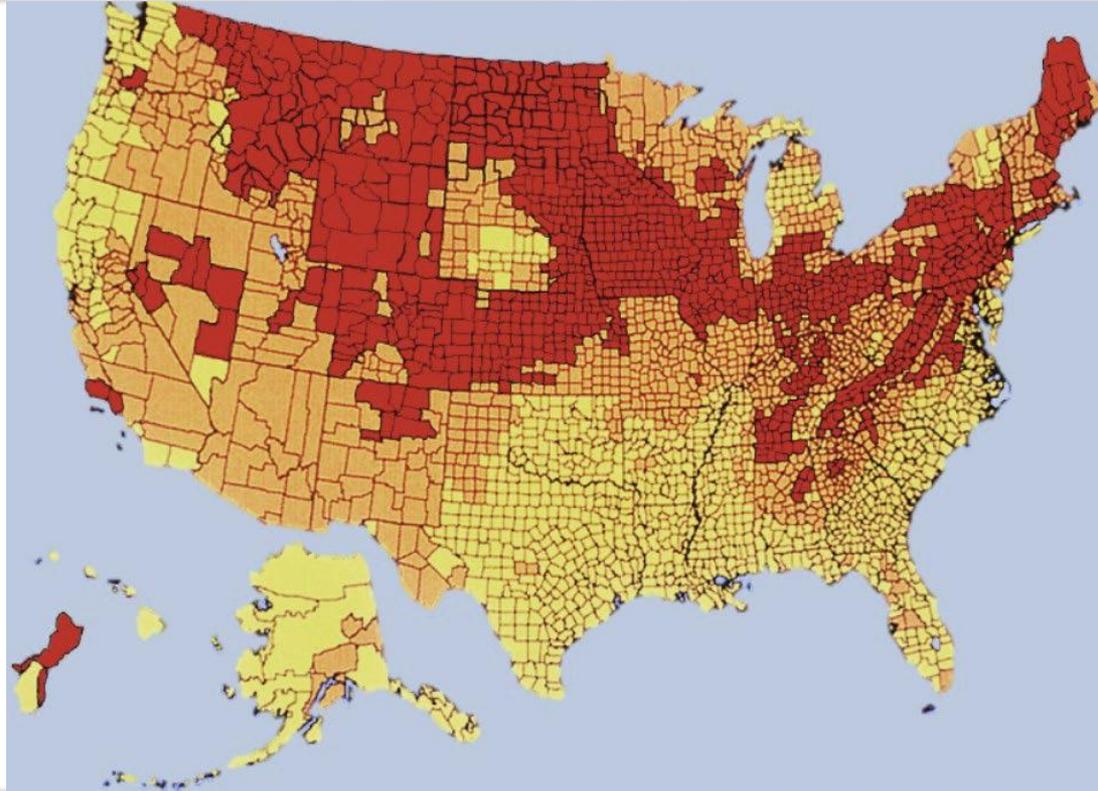
Marie Curie (1867-1934)  
*Theory of Radioactivity*

# Where is Radon Found?

## EPA Radon Zone Map (1993)

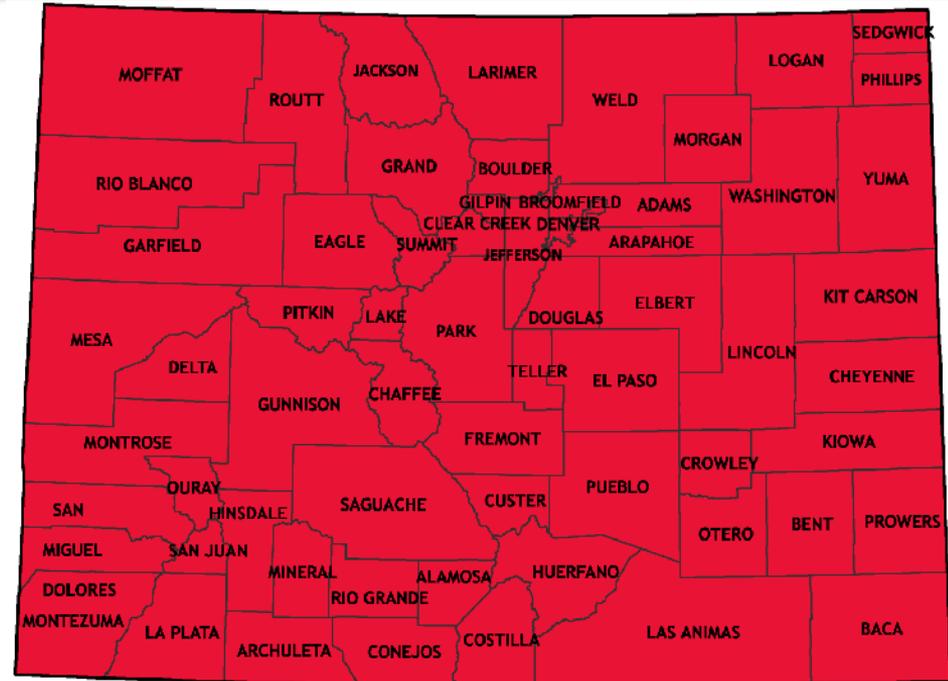
Areas with potential for elevated  
indoor radon levels

	Zone 1	➤ Average Radon > 4 pCi/L
	Zone 2	➤ Average Radon 2-4 pCi/L
	Zone 3	➤ Average Radon < 2 pCi/L



## *CDPHE Zone Classification*

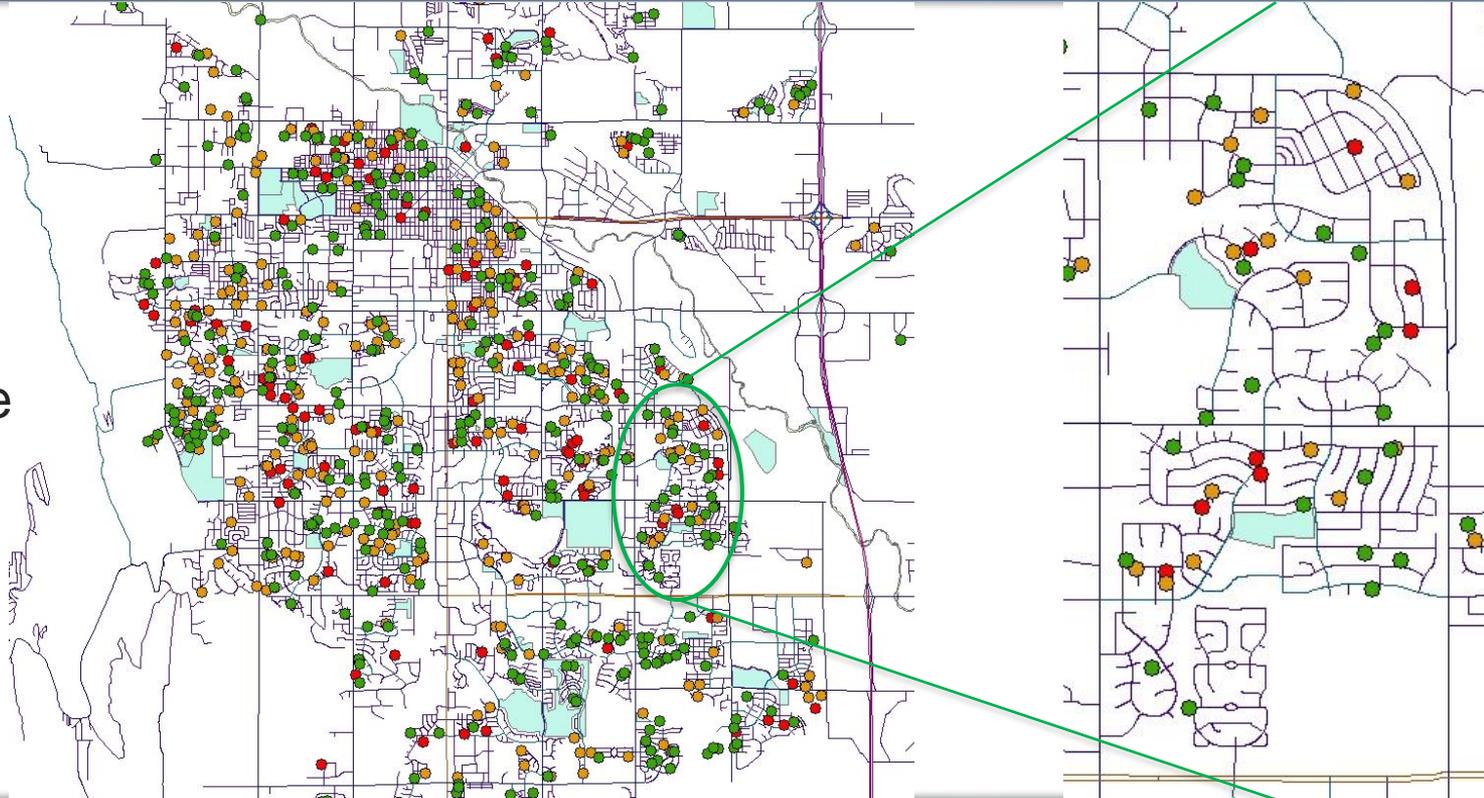
- Every county is Zone 1  
50% of homes test above 4 pCi/L
- Colorado ranks 7<sup>th</sup> in the nation for highest potential radon risk



Source: CDPHE Radon Outreach Program and Colorado Environmental Public Health Tracking

Almost half of all homes test above 4.0 pCi/L

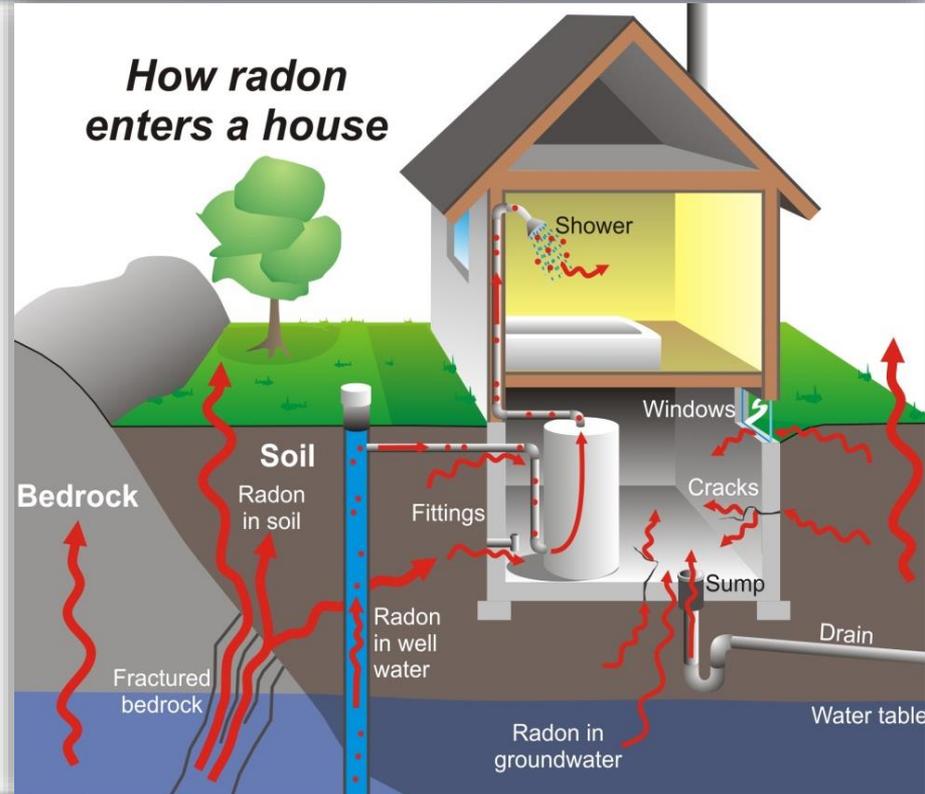
2018	
pCi/L < 4.0	52%
4.0 < pCi/L < 10.0	34%
pCi/L > 10.0	14%



# How Does Radon Get Into Homes?

# How Does Radon Get Into Homes?

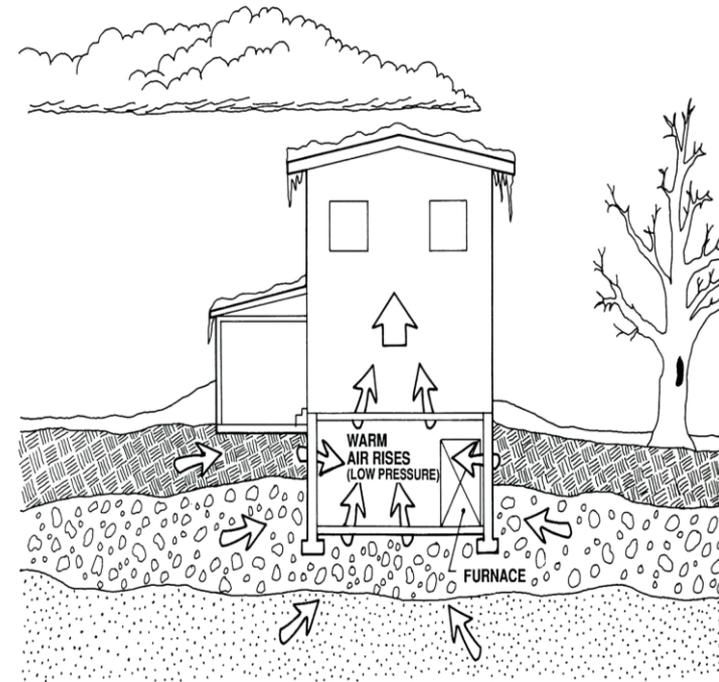
- Crawlspace and sumps
- Foundation joints and cracks
- Plumbing protrusions
- Well water
- Granite and building materials?



- Homes typically under negative pressure
  - Exhaust fans
  - Dryer
  - Furnace/AC
- More prevalent in colder months
  - Stack Effect – warm air rises
  - Windows & doors closed

January is *Radon Action Month*

**RADON ENTRY—STACK EFFECT**  
(Heating House in Winter)



# What Are the Health Risks?

## Radon is a Class A Carcinogen

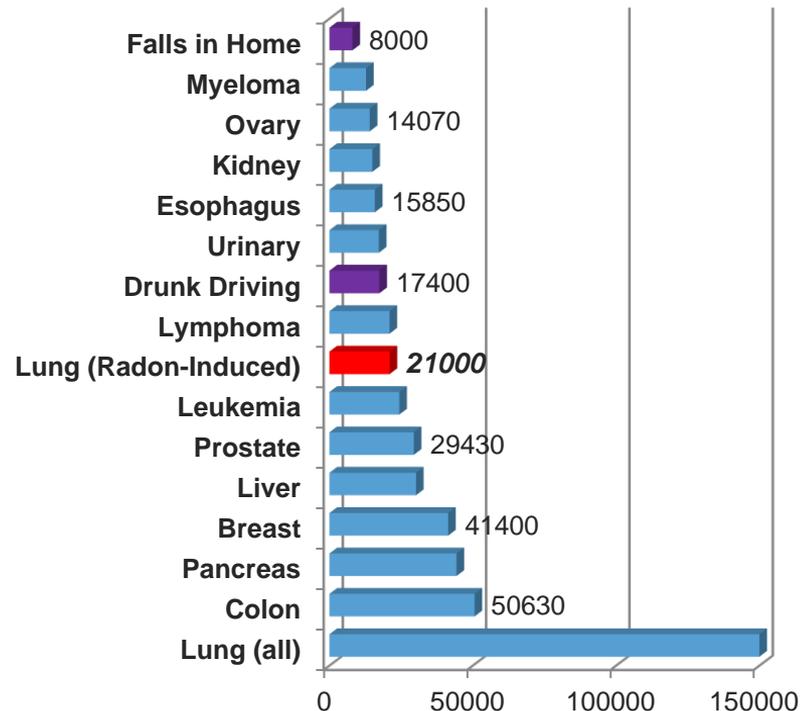
- Asbestos, benzene, tobacco
  - Radiation (UV, Ionizing)
- 2<sup>nd</sup> leading cause of lung cancer
- No noticeable side effects

$$\textit{Risk} = \textit{Level} * \textit{Exposure}$$



## *Radon Induced Lung Cancer*

- Lung cancer is deadliest form of cancer
- 15% of all lung cancer are radon related
- 21,000 deaths per year (U.S.)  
Colorado: 500 deaths annually



- First reported 1879 – *Miner's Disease*
- 1949: Uranium miners study in Colorado Plateau
- 1995: *Lung Cancer in Radon-Exposed Miners and Estimation of Risk from Indoor Exposure*  
(11 studies of radon-exposed miners)
- 2001: *Review of Residential Radon Case-Control Epidemiologic Studies in the U.S.*  
(7 residential North American Studies)
- 2005: *Radon in Homes and Risk of Lung Cancer*  
(13 European studies)



# Testing for Radon

## Short Term Test Kit: 3-7 days

- Snapshot of current radon levels
- Inexpensive - \$6
- Closed House Conditions
- Time Sensitive

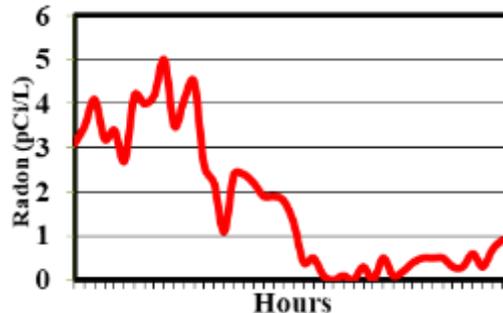


- Average radon level over test period
- Inexpensive - \$20
- Normal living conditions in home
- A 1-year test is considered the most accurate method to test a home

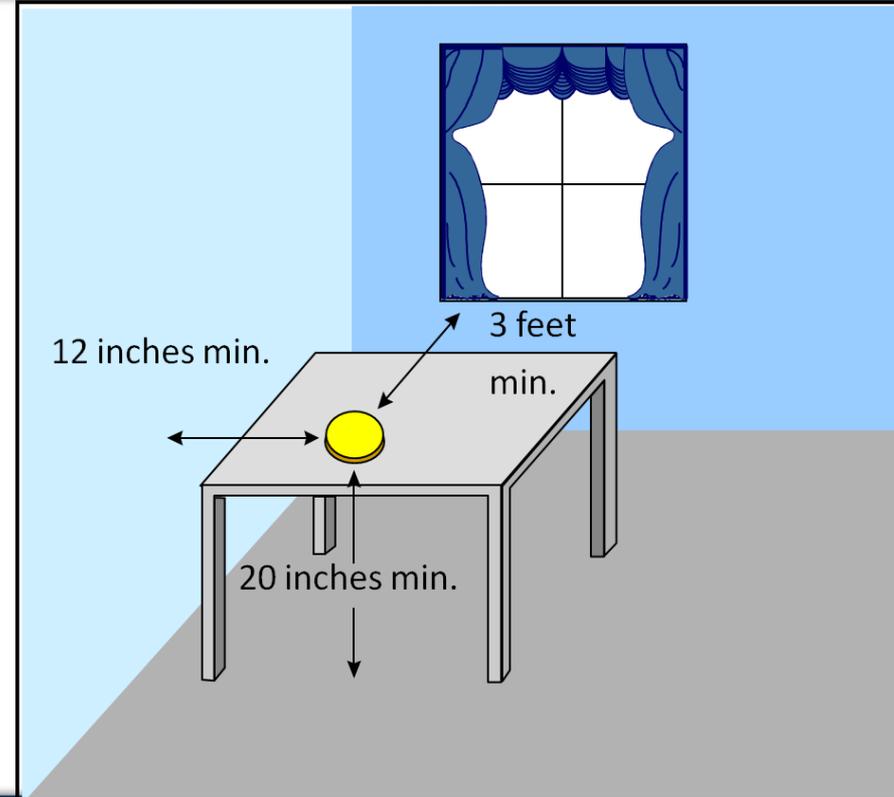


# Continuous Radon Monitor (CRM)

- 48 hour minimum test
- Closed house conditions
- Track temperature and pressure
- Preferred method for real estate



- Test the lowest ***occupiable*** level
- Not in crawlspace or attic  
*(living space)*
- Not in closet, kitchen, bathroom  
*(humidity)*
- Away from doors, windows, exterior walls, vents, and fans  
*(ventilation)*
- Closed-house conditions



- Start 12 hours prior to testing
- Maintain constant temperature and pressure
  - Windows and doors closed
  - No Attic fans, window A/C unit, swamp cooler, fireplace
- Central Heating and AC operating normally
- Radon mitigation fans operating

**KEEP ALL EXTERIOR DOORS AND WINDOWS CLOSED!**

(except for entry and exit, interior doors between rooms can remain open)

## Sample

### RADON TEST IN PROGRESS

**DO NOT REMOVE THIS NOTIFICATION**

(Open doors and windows invalidate this test, thus delaying the process)

**The following conditions must be maintained:**

- Do not touch, cover, move or alter the performance of the radon detector(s).
- Do not operate any whole house fans(s). Do not use any fireplaces(s) or wood stoves(s) unless they are the primary heat source.
- Operate heating and air conditioning normally. Turn off and keep off any equipment which supplies fresh air to the dwelling, such as swamp coolers, unless it is vented supply air to a combustion appliance.

**NOTE:**

Exhaust fans such as dryer, range hood, or bathroom fan can be operated normally.

Any exhaust fan or any combustion appliance such as whole house attic ventilating fan may decrease the pressure in the dwelling, which can affect the radon concentration.

Test Period from: \_\_\_\_\_ to: \_\_\_\_\_

Responsible Individual: \_\_\_\_\_

Date: \_\_\_\_\_

***“People should not have long-term exposure to indoor radon levels of 4.0 pCi/L or more. This an economic guidance rather than a level below which no risks exists” (EPA)***

- 6176 pCi/L Highest recorded level in US (PA - 2016)
- 598 pCi/L Highest recorded level in Larimer County (80545 - 2013)
- 277 pCi/L Highest recorded level in Fort Collins (80526 - 1999)
- **4.0 pCi/L** ***EPA Action Level***
- 2.7 pCi/L WHO action Level
- 2.0 pCi/L Target level for mitigation
- 0.4 pCi/L Average outdoor radon level

Test the home even if ...

- No basement (slab or crawlspace)
- Basement is unused or unfinished
- Townhouse or condo
- Already has a mitigation system
- Neighbor has already tested



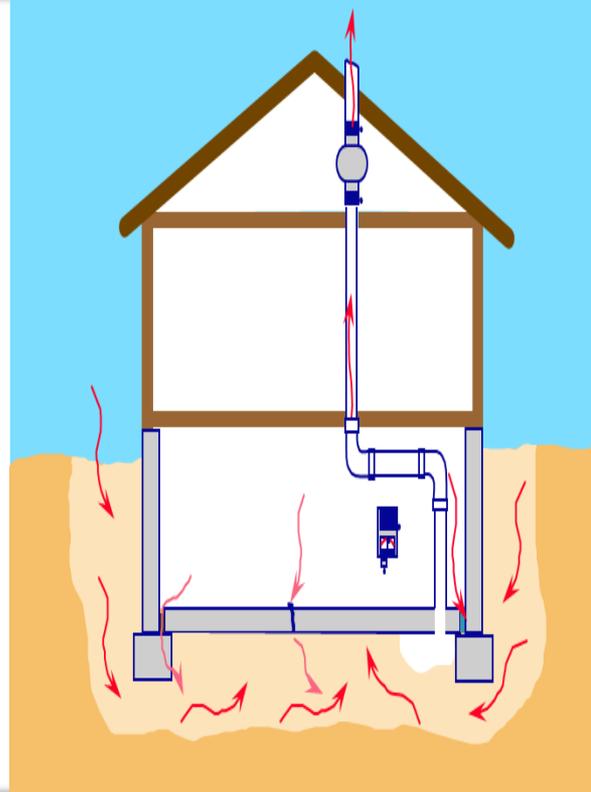
... except maybe this one

# Radon Mitigation

- Ventilation
- Positive Pressure
- Depressurization



- Sub-slab collection pit
- 3-4" PVC pipe penetrating slab
- Optional fan



- Plastic membrane sealed around the edges
- PVC pipe under membrane
- Optional fan
- Keeps crawlspace dry



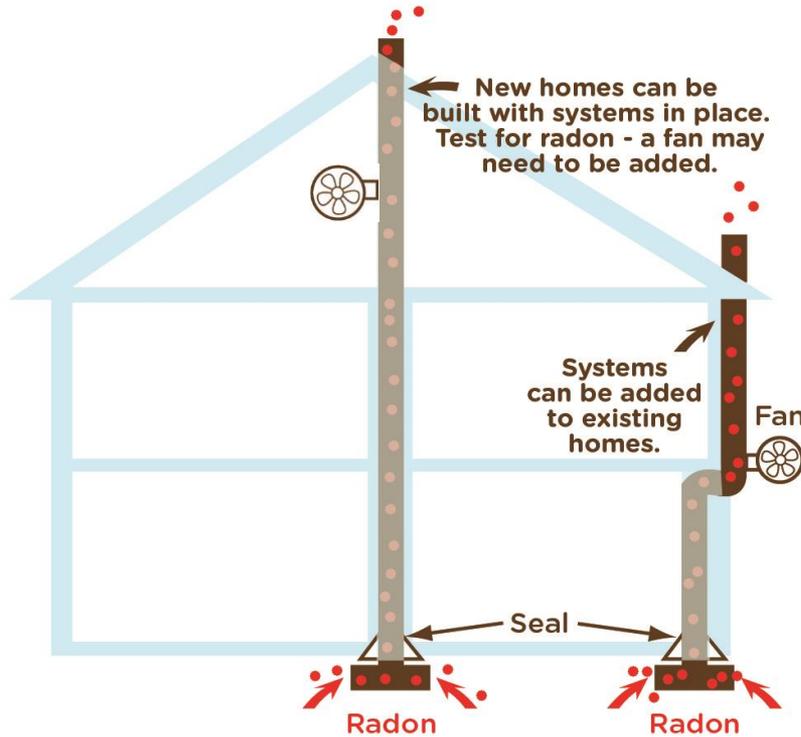
- Fan Location (fans can leak!)
  - Outside or above living space
- Discharge Point
  - 10 feet away from openings
- Moisture reduction benefit!

CDPHE: Measuring and Mitigating Radon in Colorado

[https://www.fcgov.com/airquality/files/cdphe2018\\_measuringmitigatingradon.pdf](https://www.fcgov.com/airquality/files/cdphe2018_measuringmitigatingradon.pdf)

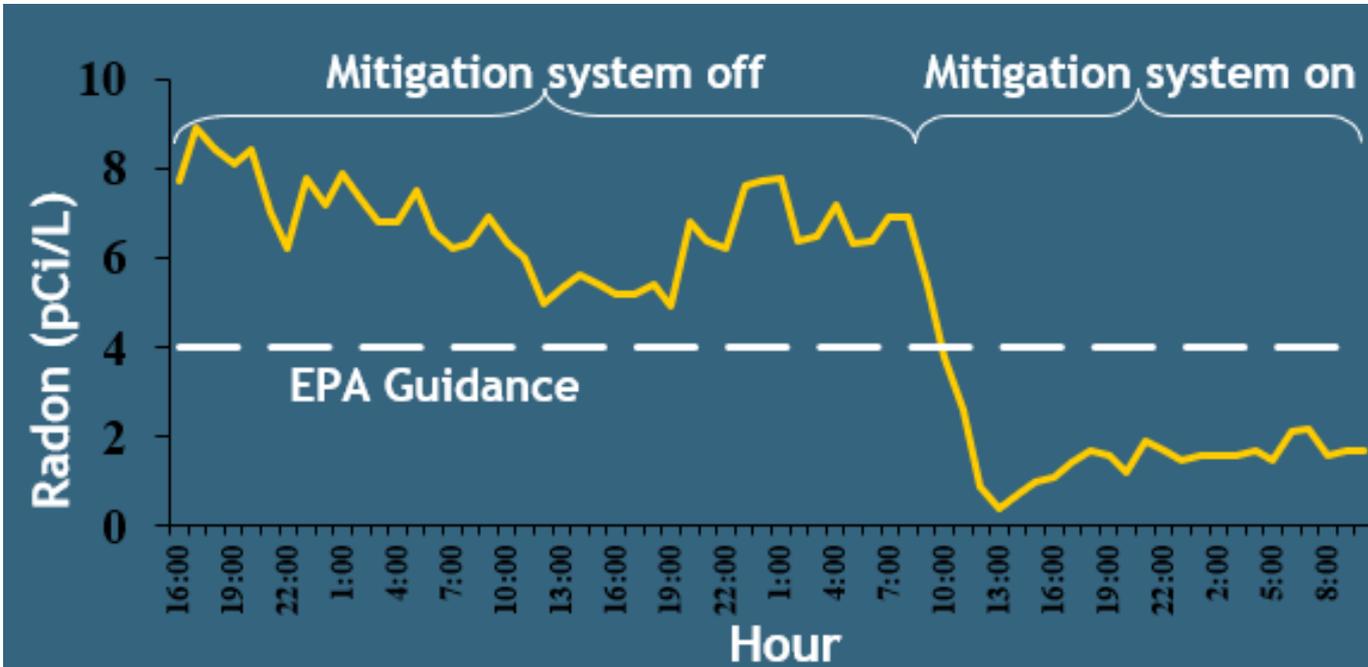


# Passive vs Active System



- Passive systems can reduce radon potential by 50%

# Radon Mitigation Works!

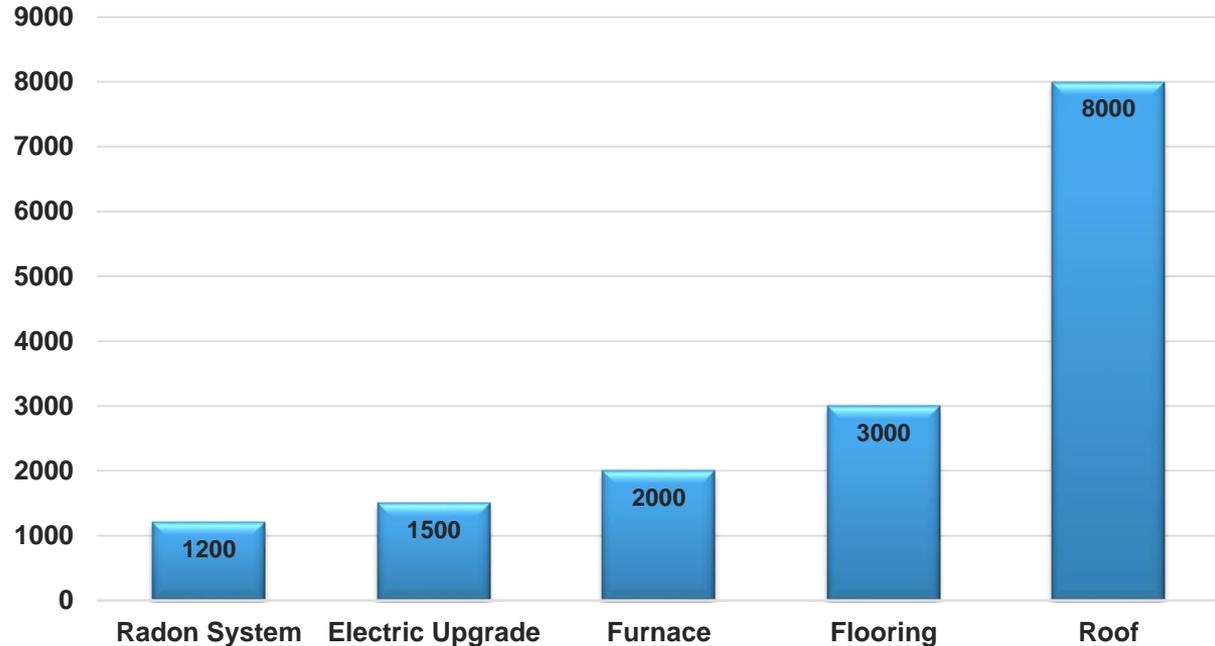


- Retest 24 hours after completion
- Retest every few years

Cost is a function of:

- Foundation type
- Aesthetics

## Improvement Cost Comparisons



[epa.gov/radon/consumers-guide-radon-reduction-how-fix-your-home](http://epa.gov/radon/consumers-guide-radon-reduction-how-fix-your-home)

# Radon Resistant New Construction (RRNC)

## International Residential Code (IRC) Appendix F – Radon Control Methods

- Fort Collins 1<sup>st</sup> to adopt (2005)  
*All new single-family and duplex housing must be equipped with a radon reduction system during construction*



Appendix F of the International Residential Code adopted in Colorado as of 4/15/2019

### Cities/Towns:

Aspen  
Breckenridge  
Boulder  
Carbondale  
Cedaredge  
Clark  
Crested Butte  
Dillon  
Durango  
Frisco  
Ft Collins  
Golden  
Gunnison  
Hahn's Peak Village  
Hayden  
Lake  
Lakewood  
LaVeta  
Louisville  
Longmont  
Milner  
Mount Crested Butte  
Oak Creek  
Orchard City  
Pagosa Springs  
Phippsburg  
Ridgway  
Sheridan  
Silverthorne  
Snowmass Village  
Steamboat Springs  
Sterling  
Superior  
Toponas  
Trinidad  
Vail  
Walsenburg  
Yampa

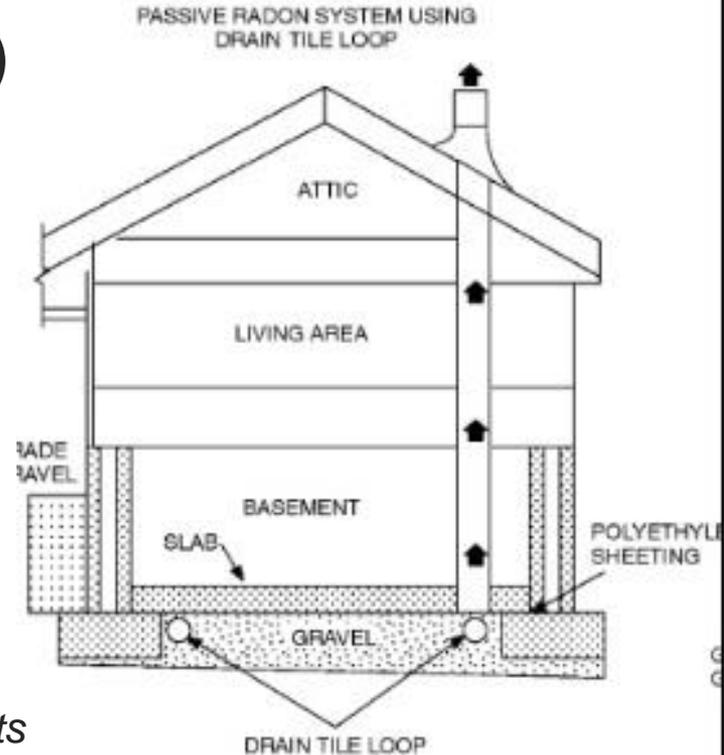
### Counties:

Archuleta County  
Boulder County  
Eagle County  
Elbert County  
Gunnison County  
Huerfano County  
Jefferson County  
La Plata County  
Las Animas County  
Logan County  
Montrose County  
Pitkin County  
Routt County  
San Miguel County  
Summit County

Multi-family Radon-Resistant New Construction required:

Ft Collins

- Gas Permeable Layer (4" gravel)
- Plastic Sheeting
- Sealing and Caulking
- Vent Pipe
- Junction Box



*Techniques vary for different foundations and site requirements*

# Real Estate Transactions

# What Should Homebuyers & Sellers Know?

- Testing and Mitigation not required
- Colorado: Disclosure is required
- Fort Collins: Seller **required** to provide radon information
- Radon measurement and mitigation professionals must be licensed starting July 1<sup>st</sup>, 2022

*Colorado Seller's Property Disclosure*

N.	ENVIRONMENTAL CONDITIONS If you know of any of the following EVER EXISTING on any part of the Property check the "Yes" column:	Yes
1	Hazardous materials on the Property, such as radioactive, toxic, or biohazardous materials, asbestos, pesticides, herbicides, wastewater sludge, radon, methane, mill tailings, solvents or petroleum products	<input type="checkbox"/>

# Radon Information for Buyers

## RADON

Buying and Selling a Home in Fort Collins

What you need to know about radon gas

**WHAT IS RADON?**  
Radon is an invisible, odorless, radioactive gas emitted during the natural decay of uranium in the soil. Homes pull in radon gas through cracks and openings in basements, crawl spaces and sides. Levels vary between homes and have nothing to do with age, quality or seepage.

**WHY IS RADON A CONCERN?**  
According to the EPA, radon is the second leading cause of lung cancer. There is no known "safe" exposure level. The EPA recommends mitigating over 4 pCi/L, and also recommends considering mitigation for levels between 2 pCi/L and 4 pCi/L.

**HOW DO I TEST FOR RADON?**

1. The City of Fort Collins sells low-cost short and long-term radon test kits. You can buy them at the following location:  
Fort Collins Senior Center 1200 Raintree Dr.
2. Have a Healthy Homes Assessment. These free assessments provide a comprehensive look at factors in your home related to indoor air quality, health and safety. Each assessment includes a free short-term radon test kit. Visit [fcgov.com/healthyhomes](http://fcgov.com/healthyhomes) to arrange an assessment.

City of Fort Collins  
Environmental Services

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City of Fort Collins  
Environmental Services

## RADON

and  
REAL ESTATE  
TRANSACTIONS

in Colorado

May 2018

[colorado.gov/pacific/cdphe/radon-and-real-estate](http://colorado.gov/pacific/cdphe/radon-and-real-estate)

## IS YOUR HOME SAFE FROM RADON?

**What is radon?** Radon is a naturally occurring invisible, colorless gas that comes from the natural radioactive breakdown of uranium in soil, rock, and water.

**Radon can enter any home**  
Radon is drawn in through cracks and gaps in the foundation.

**Radon occurs naturally in soil**  
Due to the geology of Colorado, homes in our state have higher levels of radon than the national average.

**200 chest x-rays**  
That's more than three per week, per person, per year.

**Radon causes cancer**  
Every year in the U.S., over 20,000 people die from lung cancer caused by radon.

**Testing for radon is easy**  
Ask your home inspector about radon and request a radon test.

**Fixing the problem is easy and inexpensive**  
Radon decays into radioactive particles, that, unless removed, can damage the DNA in sensitive lung cells. The damaged cells can become cancerous.

Colorado Department of Public Health & Environment

[bouldercountyradon.org](http://bouldercountyradon.org)

[fcgov.com/airquality/files/radon\\_rack\\_card\\_english.pdf](http://fcgov.com/airquality/files/radon_rack_card_english.pdf)  
[fcgov.com/airquality/files/radon\\_rack\\_card\\_spanish.pdf](http://fcgov.com/airquality/files/radon_rack_card_spanish.pdf)

## Colorado Revised Statutes

### Title 12, Article 165: Radon Professionals

Effective July 1<sup>st</sup>, 2022

The prevalence of Colorado homes with excessive levels of radon has created a market in which unqualified individuals are representing themselves and practicing as radon professionals.

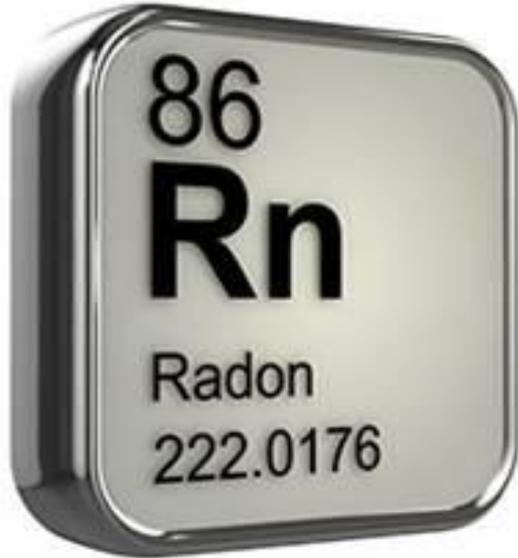
Therefore, to protect the public, it is necessary to establish minimum qualifications for radon professionals and to require professionals who possess such qualifications to acquire a license before performing radon measurement or radon mitigation.

- National Radon Proficiency Program (NRPP) certification
  - Training and competency exam
  - Quality assurance procedures – testing protocols
  - Proof of annual instrument calibration and performance
  - Continuing education requirements
  - Re-certify every 2 years
  - <https://certifiedradonpros.org/co.html>
  
- Licensed Radon Professionals - Dept of Regulatory Affairs (DORA)
  - <https://dpo.colorado.gov/RadonProfessionals>

- Home inspection
  - Quick screening to determine the *potential* for radon
  - Licensing issue
- Testing & mitigation
  - Use a *Radon Professional*
  - Plan for 1 week to test, mitigate, retest
- Don't interpret test results
  - Provide them with the information they need to make a decision
- Negotiation
  - Who will test, what type of test, where to test
  - How seller and buyer will share test results and costs
  - What mitigation measures will be taken and who pays

- Avoid general statements
  - *Purchase agreement is based upon a radon test*
    - *There will be radon*
  - *The house tested safe*
    - *4.0 pCi/L is an economic guideline, not a safety threshold*
  - *Not aware of a problem in this area*
    - *Radon is variable from house to house*
  - *Radon isn't as bad as some people think*
    - *Implies an expert opinion*

*Elevated radon level doesn't mean you need to walk away from the deal.*



# Questions?

*(before final exam)*

1. How does radon enter the home?
  - a) Through cracks in the foundation
  - b) Through the crawlspace
  - c) Through plumbing protrusions in the foundation
  - d) All of the above

2. Which homes should be tested?
  - a) Only homes with a basement
  - b) Only homes with a finished basement
  - c) All homes
  - d) Only homes without a radon mitigation system

3. What is the main concern with radon in water?
- a) Radon can contaminate drinking water making it unsafe to drink
  - b) Radon can diffuse into the air of a home when used for showers, laundry and other purposes
  - c) Radon in drinking water can diffuse into the soil resulting in an increased amount of radon coming through the foundation
  - d) Radon is not a concern in drinking water

4. What is the minimum amount of time a short-term test should be conducted?
- a) 12 hours
  - b) 24 hours
  - c) 48 hours
  - d) 60 hours

5. Which of the following is *not* true about radon and real estate transactions in Colorado?
- a) The seller must provide information about radon to the buyer
  - b) A home is required to be tested for radon prior to the sale
  - c) Testing for radon must be performed by a Licensed Radon Professional
  - d) The seller must disclose known radon test results

6. What is the EPA Action Level for radon mitigation?
- a) 4.0 pCi/L
  - b) 4.1 pCi/L
  - c) 4.0 mmHg
  - d) There is no safe level of radon

7. How do you find a licensed radon professional
  - a) The CDPHE radon webpage
  - b) The National Radon Proficiency Program (NRPP) website
  - c) The Dept of Regulatory Affairs (DORA) website
  - d) All of the above

8. If Radon Resistant New Construction (RRNC) is used in the building of the home, the homeowner will not need to test for radon in the future
- a) True
  - b) False

9. Which of the following is true about radon?
- a) Radon is the 2<sup>nd</sup> leading cause of lung cancer
  - b) Radon is a Class A Carcinogen
  - c) Radon is only a health concern for smokers
  - d) All of the above
  - e) A & B only

10. Which of the following is true about radon mitigation systems?
- a) The fan should be located inside the home so it does not get wet
  - b) Only homes with basements need to have mitigation systems installed
  - c) A radon mitigation system can terminate anywhere outside the home
  - d) None of the above are true

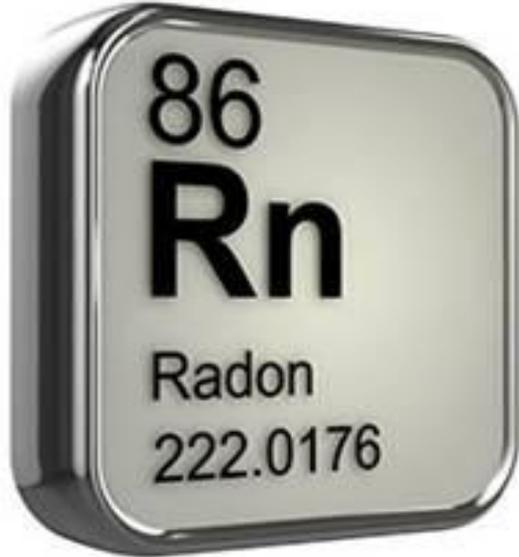
*Public Health Radon Reduction Roadmap (PHR3)*

*Boulder County Public Health – 2015*

- Promote radon awareness
  - *Real estate community, Building industry, Policy makers*
- Criteria
  - Attend radon aware informational session
  - Provide clients with up-to-date information
  - Encourage use of certified radon professionals
- Recognition
  - Radon Aware listing and certificate



[www.radonawarecolorado.org](http://www.radonawarecolorado.org)



More information and resources  
[fcgov.com/radon](http://fcgov.com/radon)

Tony Fourcroy  
[tfourcroy@fcgov.com](mailto:tfourcroy@fcgov.com)

*Thanks for taking the time to learn about radon  
It's a gas!*