

# What Medical Care Providers and Influencers Need to Know About Radon Gas

Sponsored by Colorado Cancer Coalition and The Public Health Radon Reduction Roadmap Project



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COLLEGE OF PUBLIC HEALTH

# Overview

- Lung Cancer Mortality
- Radon Occurrence
- Radon Health Effects
- Radon Epidemiology
- Radon Testing and Mitigation
- Radon Resources

# United States Cancer Mortality 2020

Cancer Mortality 2020	
Cancer Type	Estimated U.S. Deaths in 2020
1. Lung and Bronchus	135,720
2. Colon and Rectum	53,200
3. Pancreas	47,050
4. Breast	42,690
5. Prostate	33,330
6. Liver and Intrahepatic Bile Duct	30,160
7. Leukemia	23,100
8. Lymphoma	20,910
9. Brain & Other Nervous System	18,020
10. Urinary Bladder	17,980
11. Esophagus	16,170
12. Kidney and Renal Pelvis	14,830
13. Ovary	13,940

# Radon from Geologic Sources

- Radon is a radioactive noble gas
- It is naturally occurring outdoors
- You can not see or smell it
- It enters buildings primarily from the soil

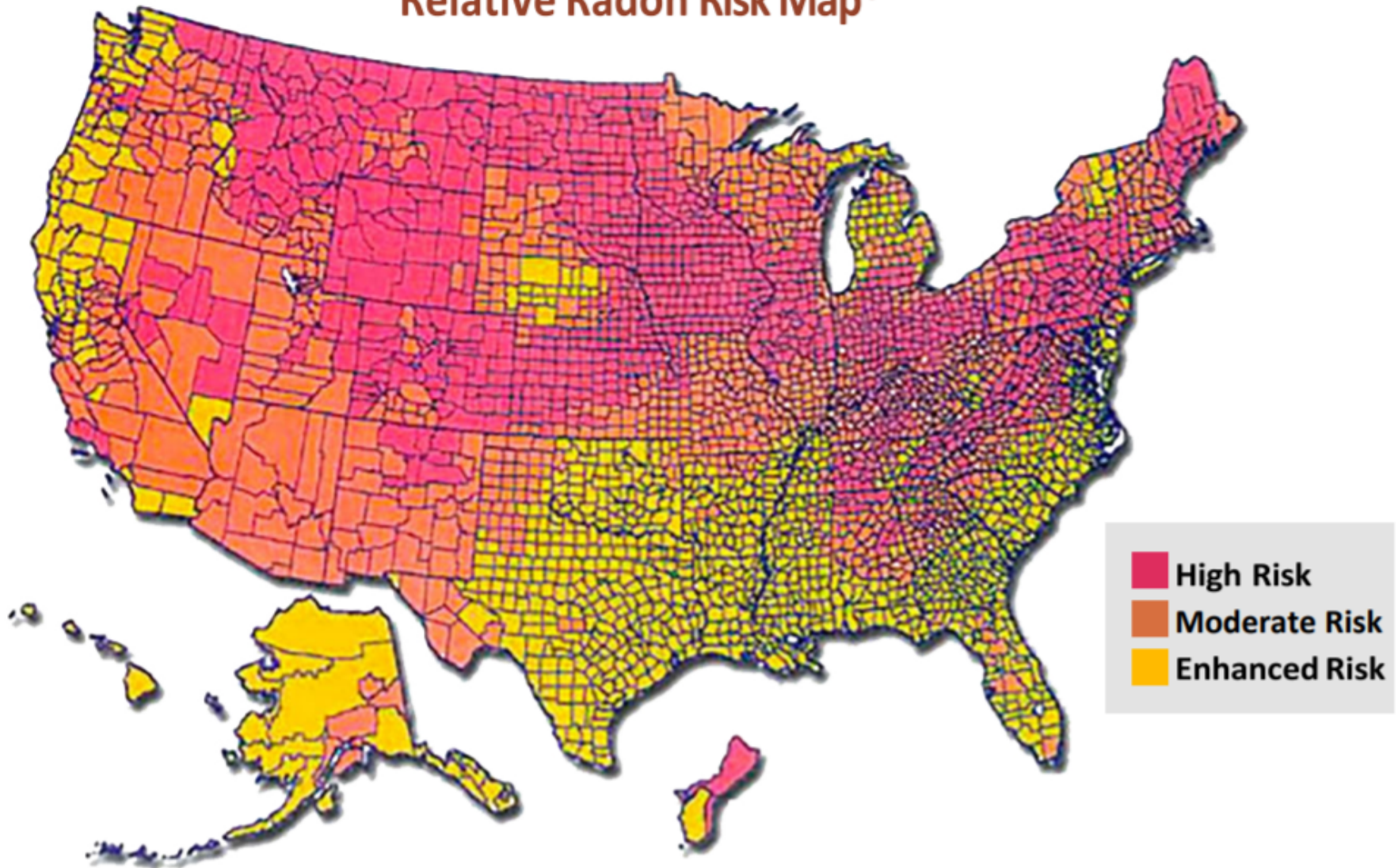




# Radon Measurement

- picoCurie/Liter = pCi/L      1 pCi = 2.2 dpm
- EPA Radon Action Level = 4 pCi/L
- World Health Organization Reference Level = 2.7 pCi/L
- National Average Indoor Radon Concentration = 1.3 pCi/L
- National Average Outdoor Radon Concentration = 0.4 pCi/L

## Relative Radon Risk Map\*

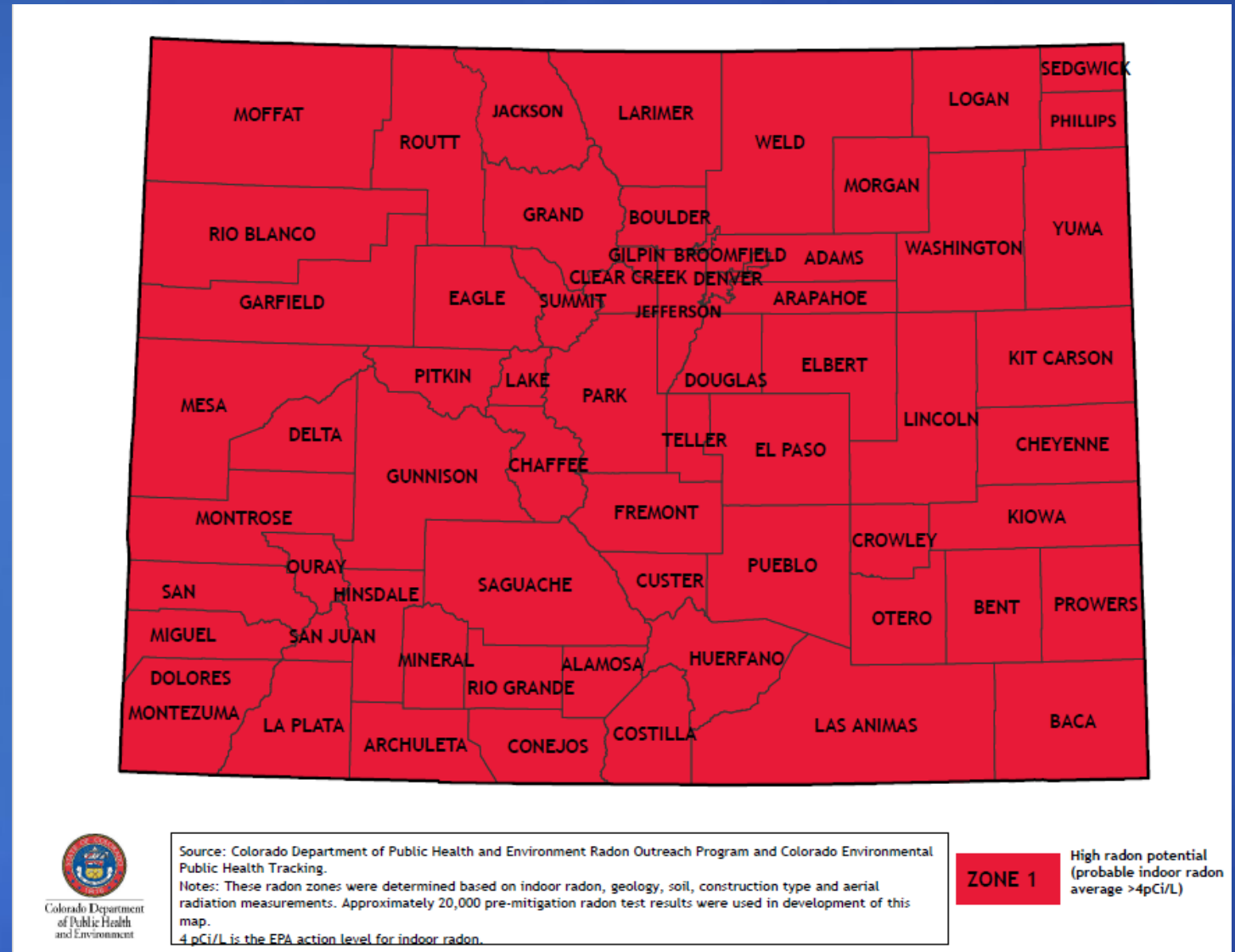


<https://canceriowa.org/breathing-easier/>

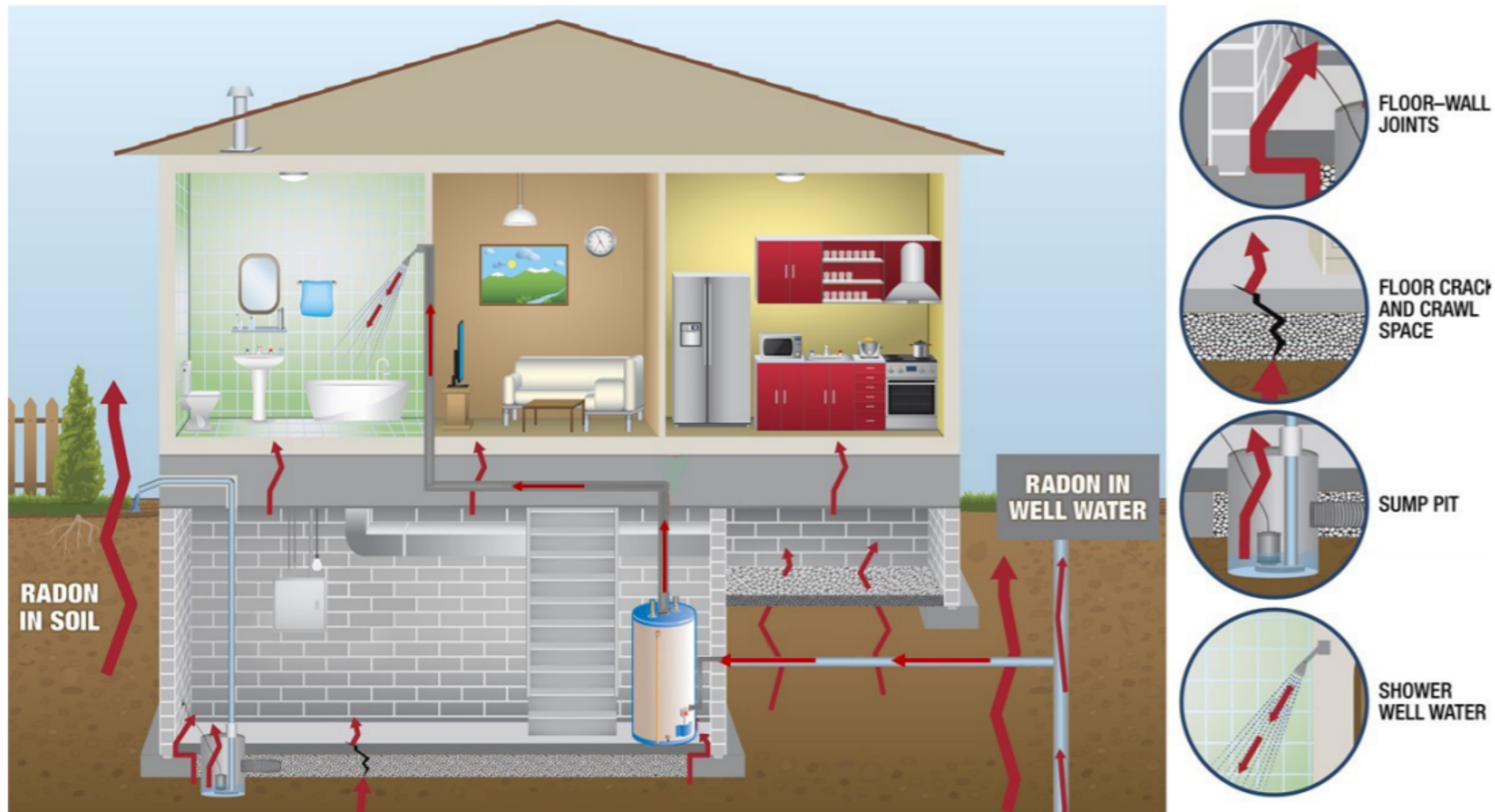
# Statewide Concern

**Zone I** counties have a predicted average indoor screening levels greater than 4 picocuries per liter (pCi/L)

In Colorado, about half the homes have radon concentrations higher than the EPA's recommended radon action level of 4 pCi/L

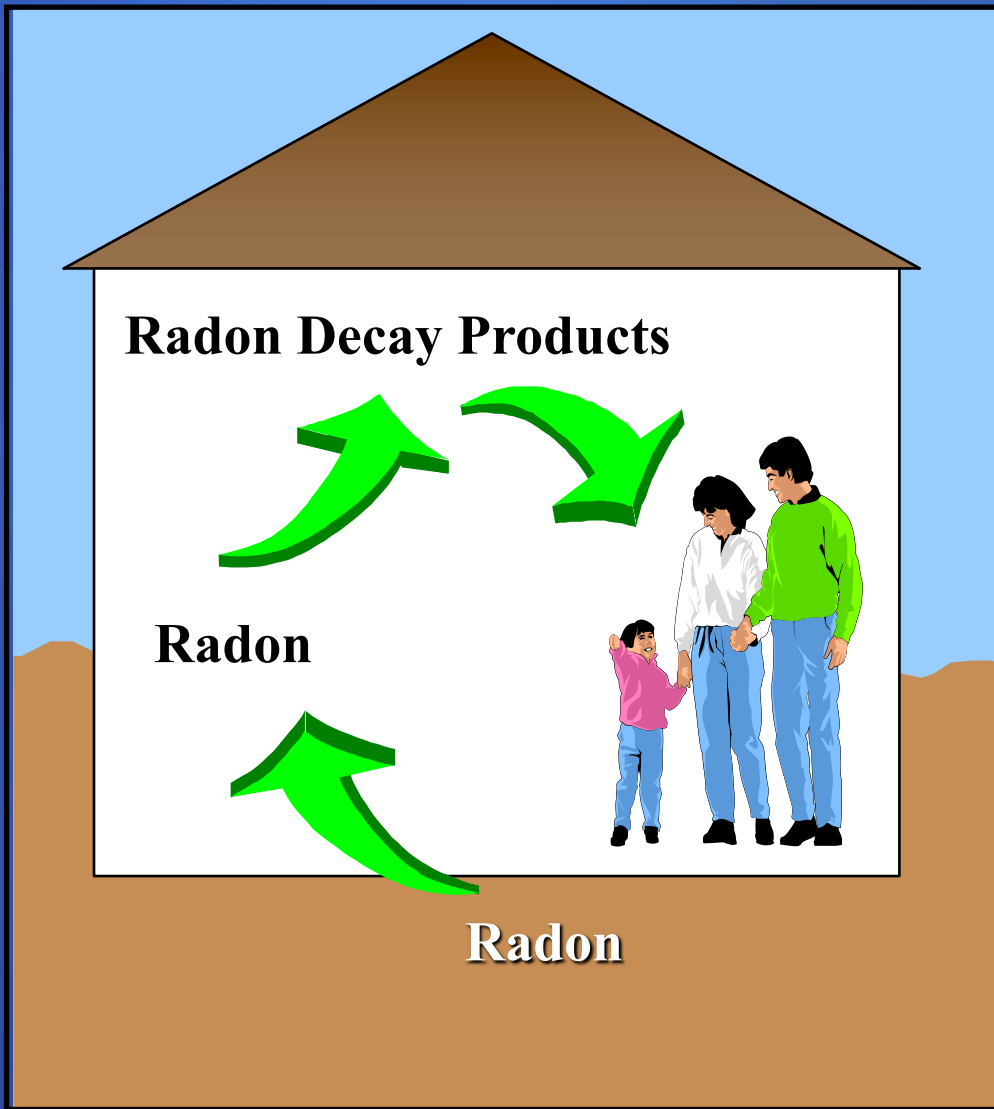




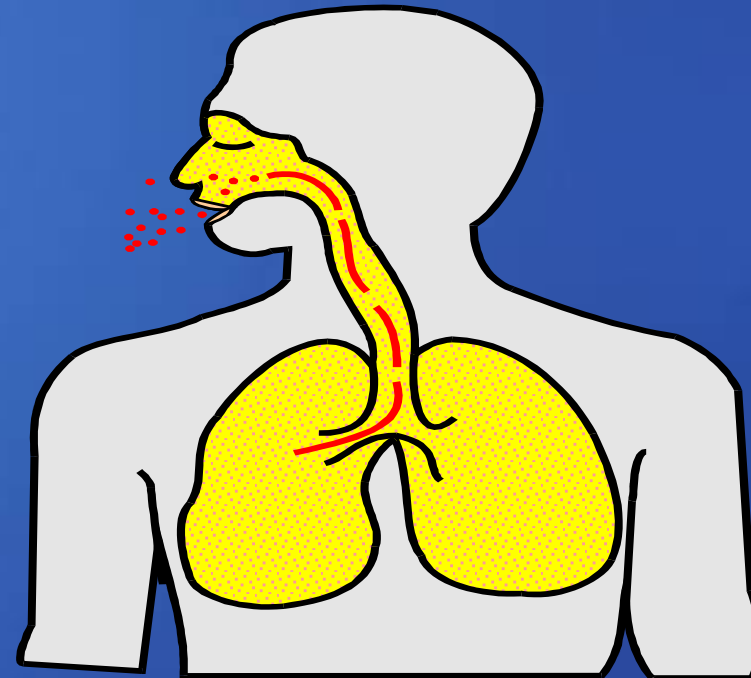


Radium, which naturally occurs in soils and rocks from the radioactive decay of uranium, produces radon gas that can move through the soil into a home or other building through these common entry points. Because the air pressure inside a home is often lower than the pressure in the soil around the foundation and basement floor slab, radon is easily drawn into a home due to these air pressure differences.

# Why are radon decay products a health concern?



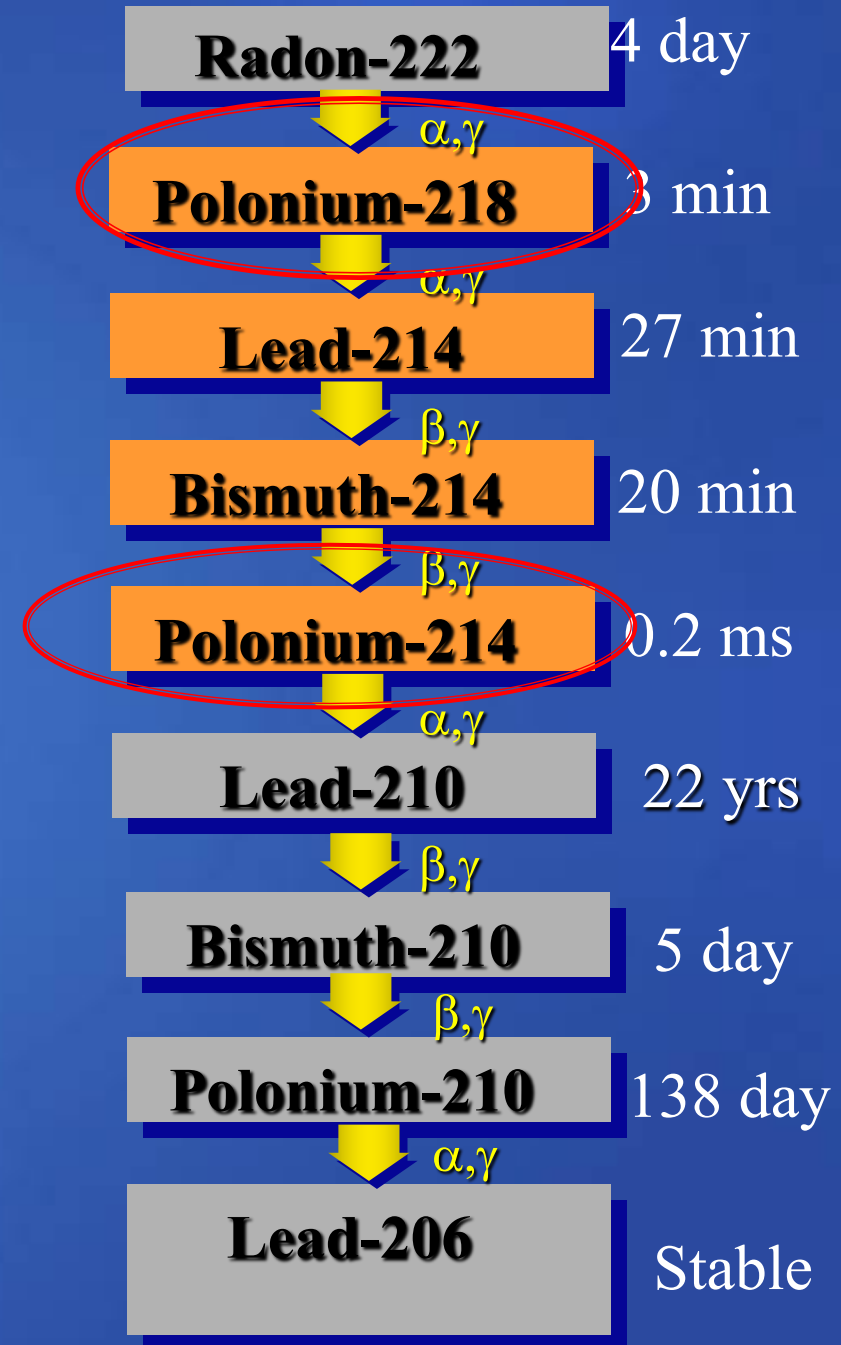
These particles are easily inhaled and deposited in the lungs where they can damage sensitive lung tissue.





# Radon Decay Products

Po-218 and Po-214  
deliver the majority of  
radiation dose to the lung.



# Ionizing radiation can directly and indirectly damage DNA

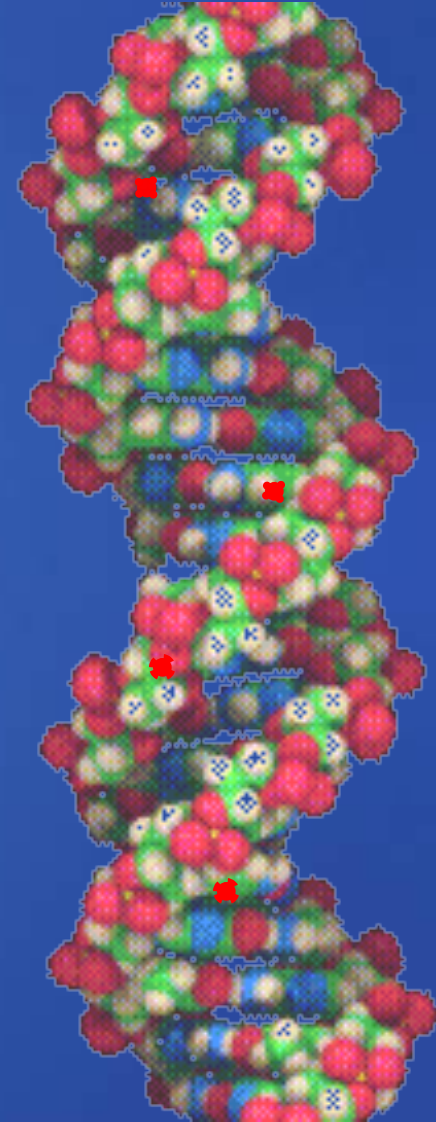
## ***Alpha Particle***

Defects in tumor suppressor genes – p53

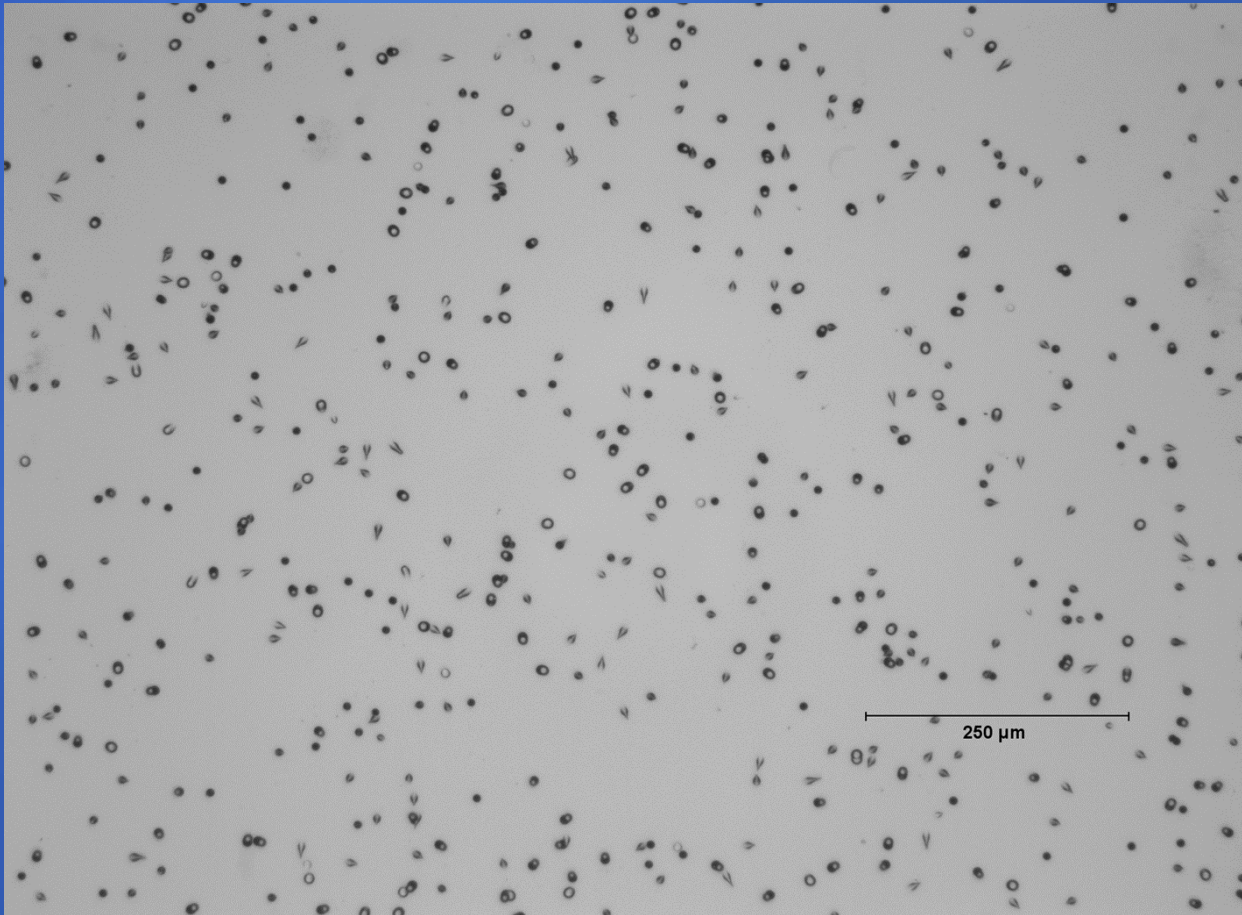
At risk individuals—GSTM<sub>1</sub>  
(glutathione S-transferase M1)

*Free radical formation*

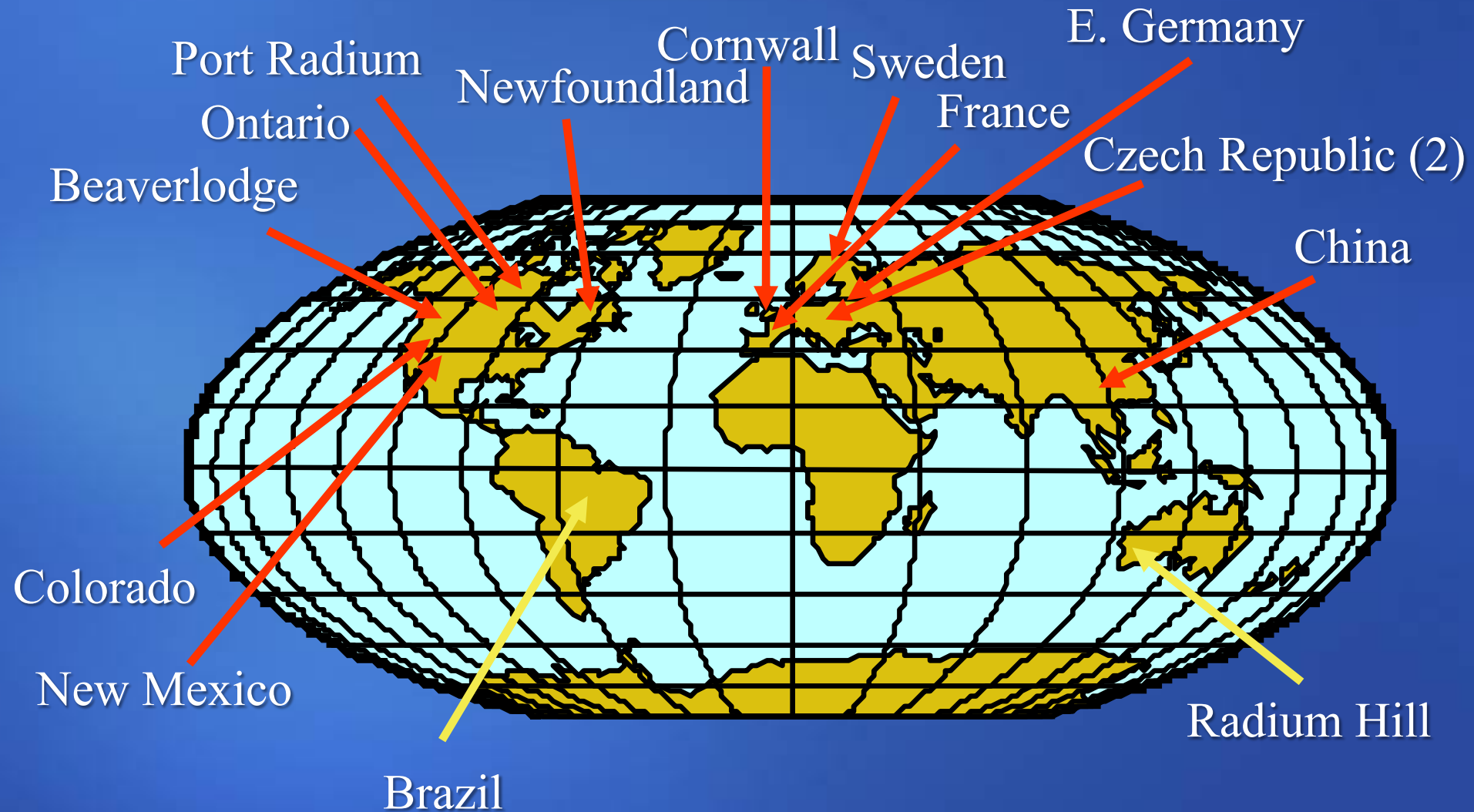
*Double-strand DNA breaks*

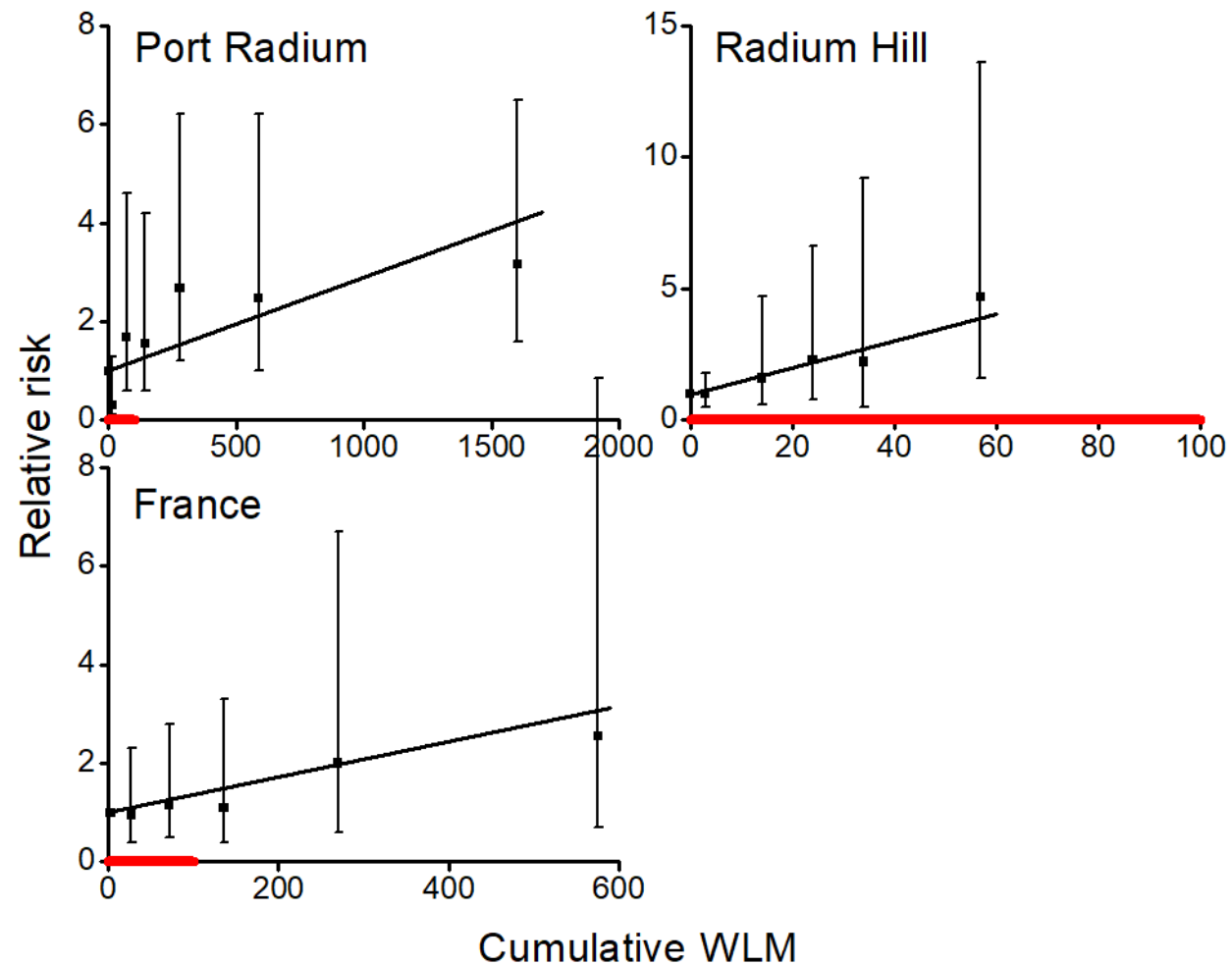
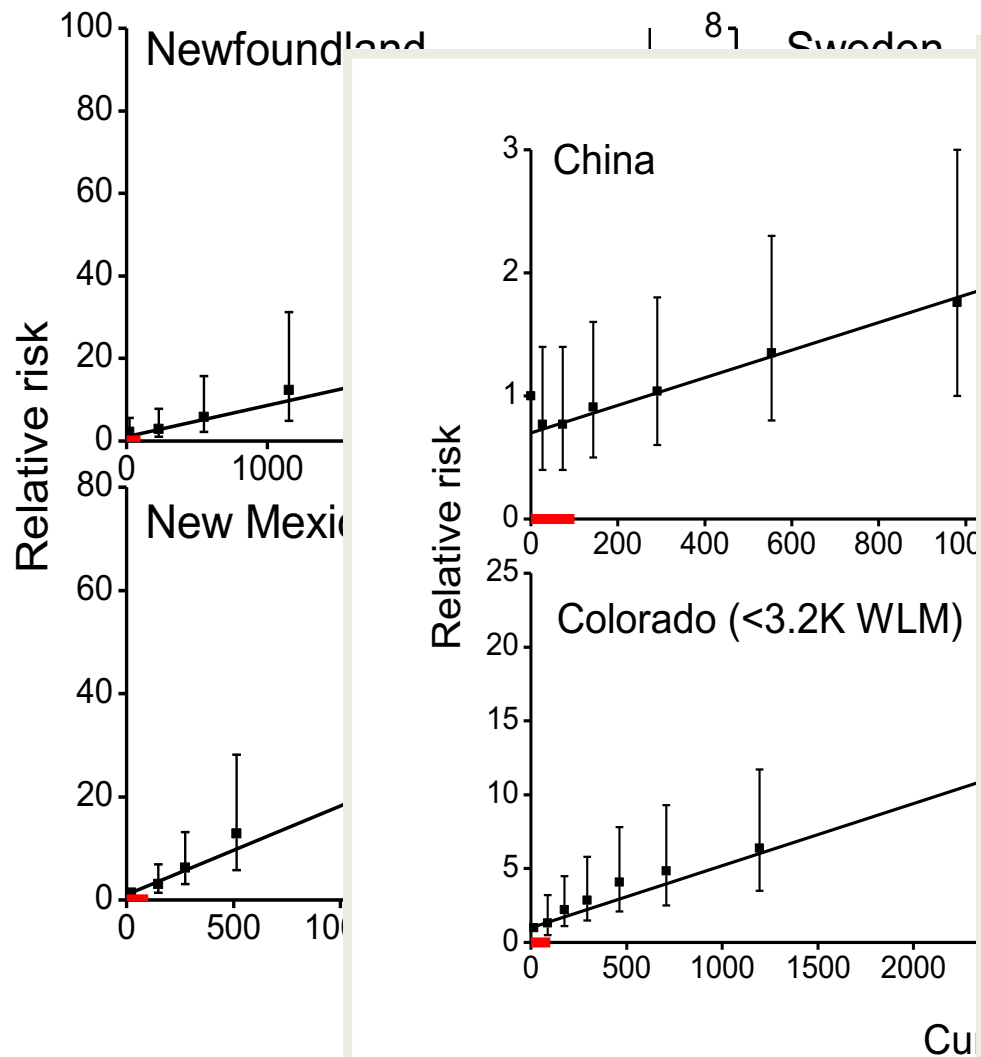


# Alpha Tracks



# Cohort Studies (15) of Radon-Exposed Miners

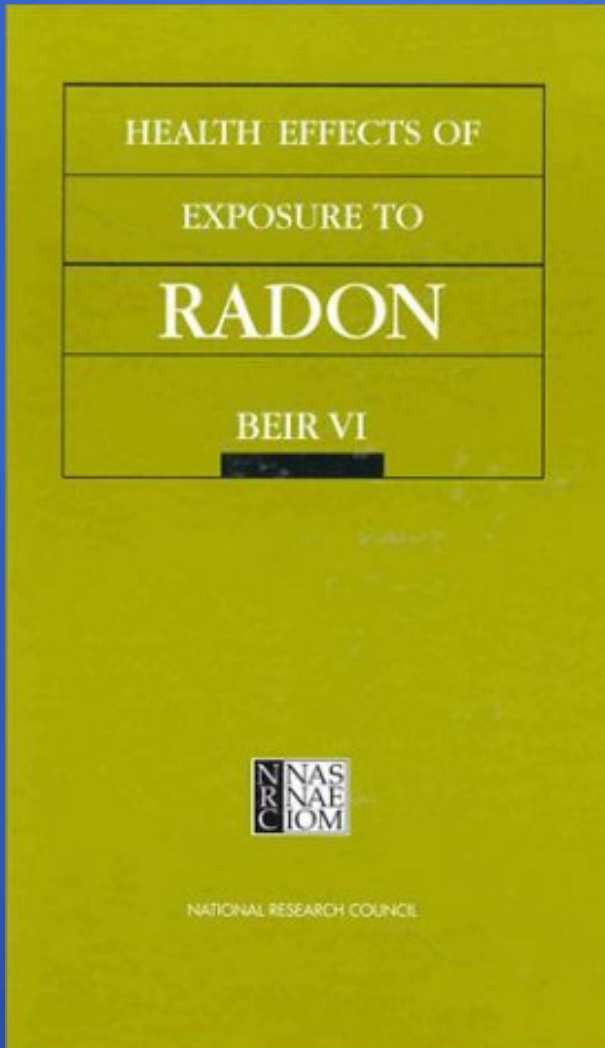




Lubin et al. 1995, NRC BEIR VI, 1999



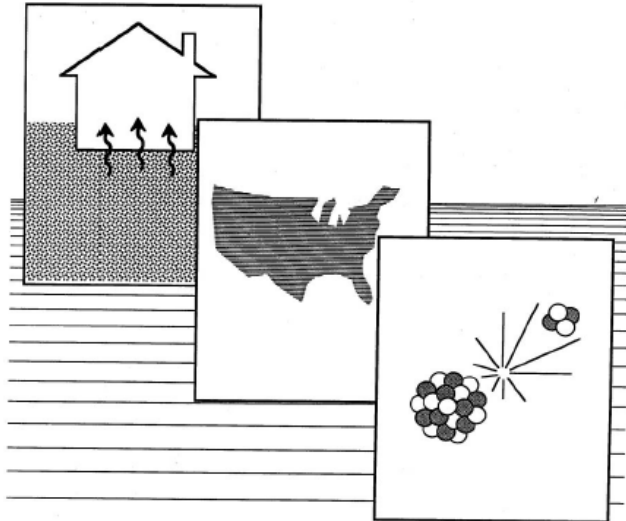
# National Academy of Sciences - BEIR VI 1999



- Risk estimates based primarily on radon-exposed miners
- Estimated 18,600 lung cancer deaths each year in the U.S. from residential radon exposure



## EPA Assessment of Risks from Radon in Homes



In 2003, the EPA updated the BEIR VI risk estimates to 21,000 radon-related lung cancer deaths each year in the United States.

[http://www.epa.gov/radon/risk\\_assessment.html](http://www.epa.gov/radon/risk_assessment.html)

Based on its analysis, EPA estimates that out of a total of 157,400 lung cancer deaths nationally in 1995, **21,100 (13.4%)** were radon related.

## Lifetime Risk of Lung Cancer Death from Radon Exposure in Homes

Risk Is Shown per 100,000 Individuals

RADON LEVEL (pCi/L)	NEVER SMOKERS	CURRENT SMOKERS	GENERAL POPULATION
20	3,600	26,000	11,000
10	1,800	15,000	5,600
8	1,500	12,000	4,500
4	730	6,200	2,300
2	370	3,200	1,200
1.25	230	2,000	730
0.4	73	640	230

Estimated Risks at the EPA Action Level (4pCi/L)

Never Smokers 7/1000 | Smokers 62/1000

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<b>Radon-Induced Lung Cancer</b>	<b>21,100</b>
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CA: A Cancer Journal for Clinicians



Article | [Free Access](#)

### Cancer statistics, 2020

Rebecca L. Siegel MPH, Kimberly D. Miller MPH, Ahmedin Jemal DVM, PhD

First published: 08 January 2020 | <https://doi.org/10.3322/caac.21590>

# Residential Radon Case-Control Studies Around the World

## European Studies

13 Studies from 9 Countries

- Austria
- Czech Republic
- Finland [nationwide]
- Finland [south]
- France
- Germany [eastern]
- Germany [western]
- Italy
- Spain
- Sweden [nationwide]
- Sweden [never smokers]
- Sweden [Stockholm]
- United Kingdom

## North American Studies

**7 Studies from 2 countries:**

- New Jersey
- Winnipeg
- Missouri I [non-smoking women]
- Missouri II [women]
- Iowa
- Connecticut
- Utah-South Idaho

Total 3,622 cases and 4,966 controls

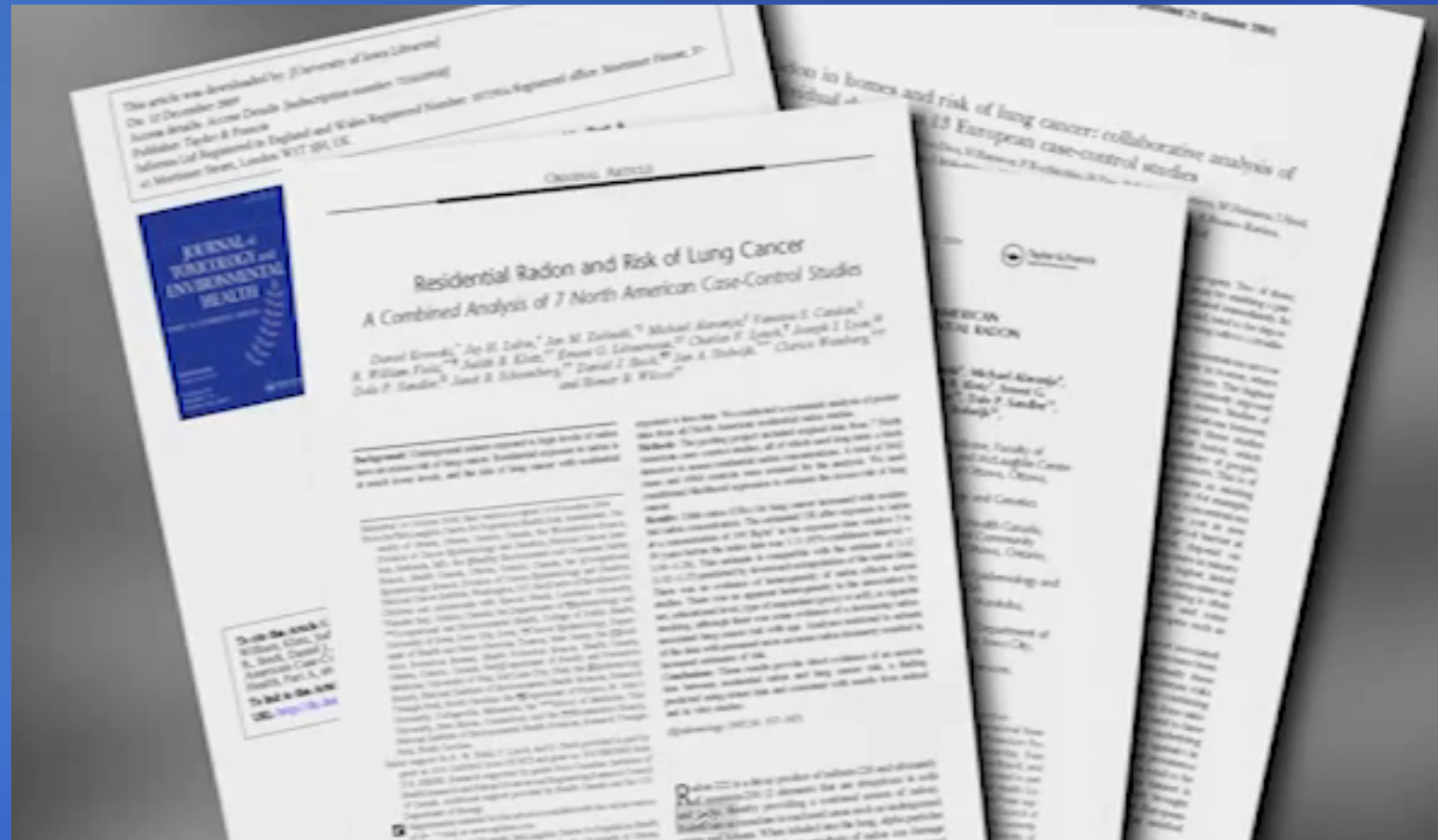
Total 7,148 cases and 14,208 controls



# Pooled Residential Radon Studies

- Pooling results published 2004-2006

- North America (7)
- Europe (13)
- China (2)



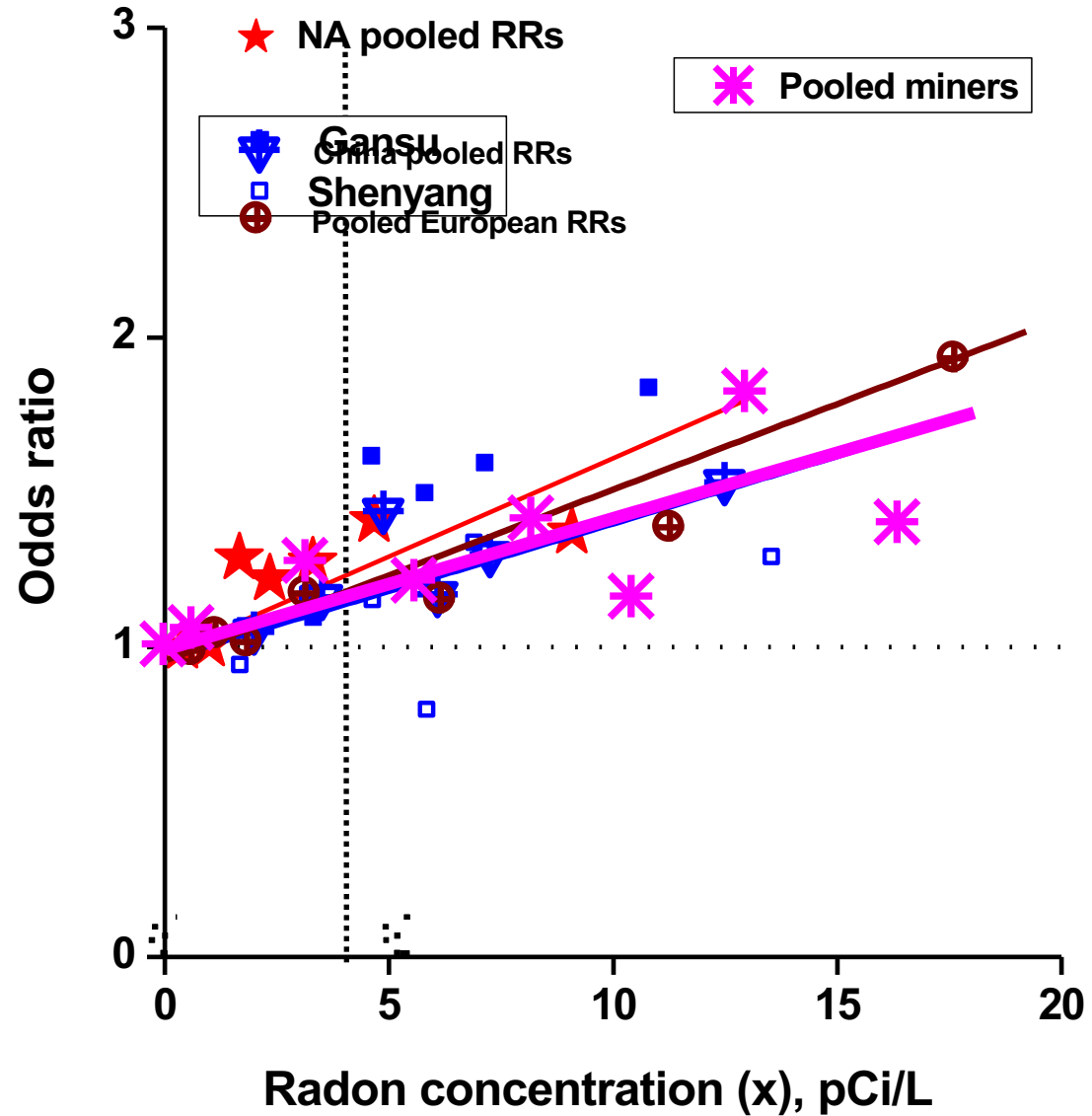
# Pooled Analyses Agreement at 3 pCi/L ??

10% – 18%

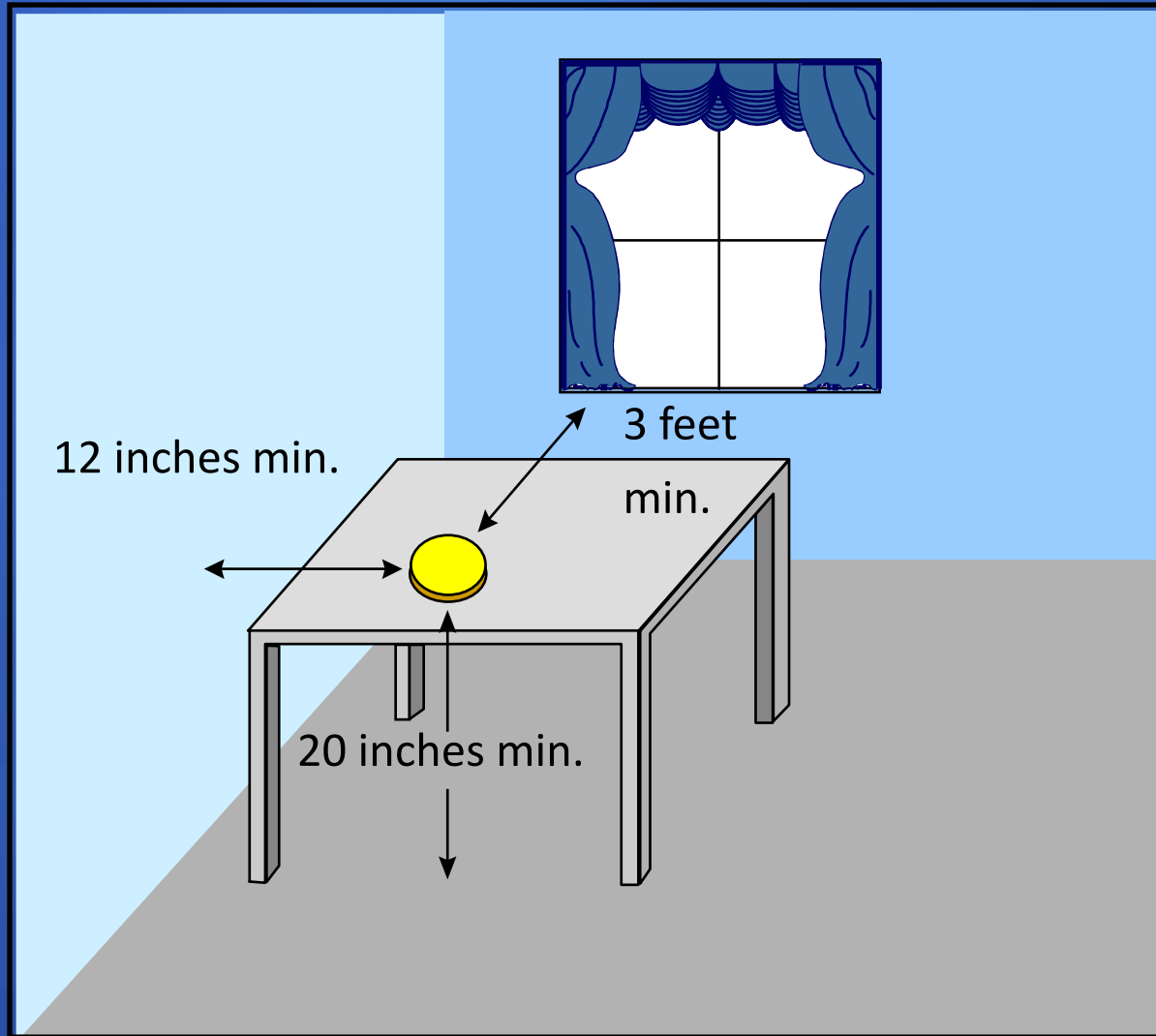
New Jersey, Missouri I, Canada, Iowa, Missouri II, a combined study from Connecticut, Utah and S. Idaho

Shenyang, China, Stockholm, Sweden, Swedish nationwide, Winnipeg, Canada, S. Finland, Finnish nationwide, SW England, W. Germany, Sweden, Czech Republic, Italy-Trento, Spain, Austria, France, China - Gansu Province, E. Germany 16%

# Results of Major Radon Epidemiological Studies



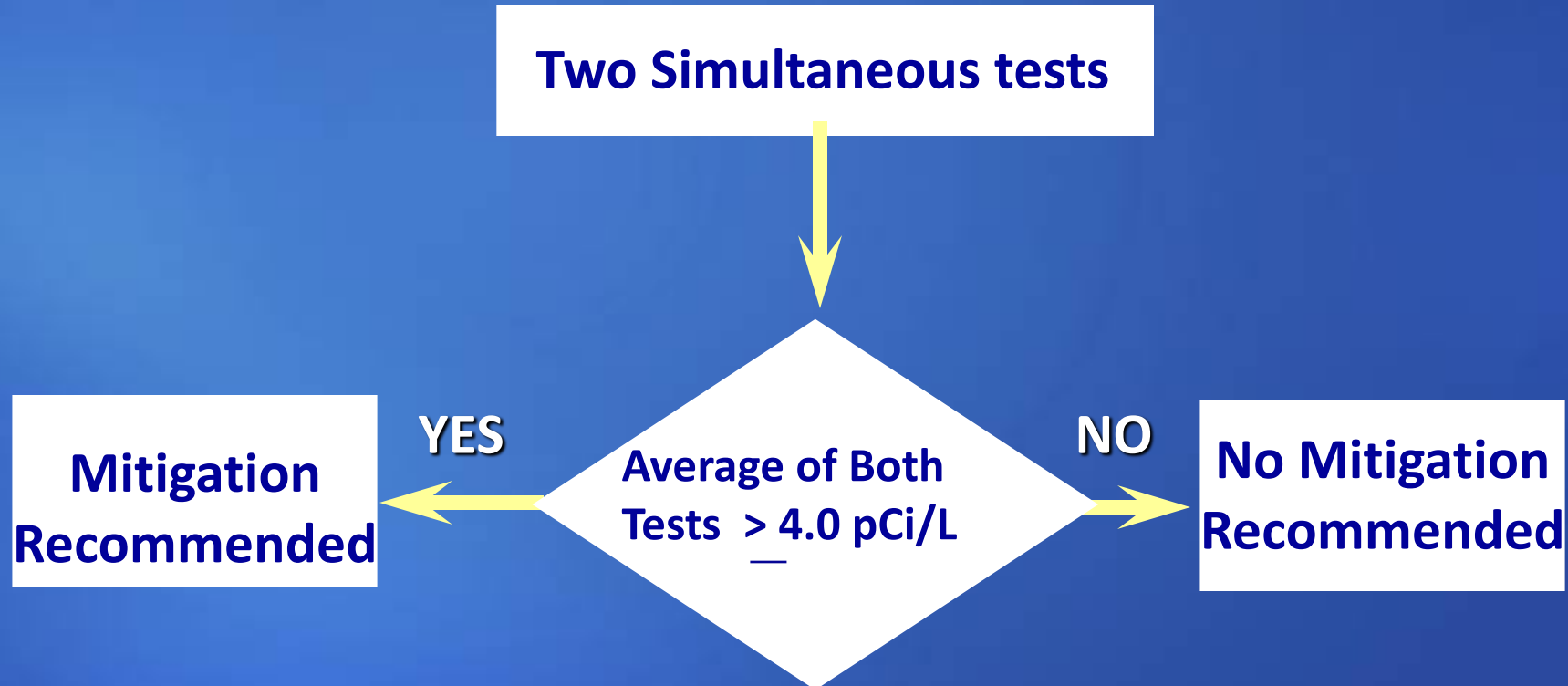
# Test Placement Within A Room



- 3 feet from windows or exterior doors
- At least 20 inches above floor
- 4 inches from other objects
- Where it won't be disturbed

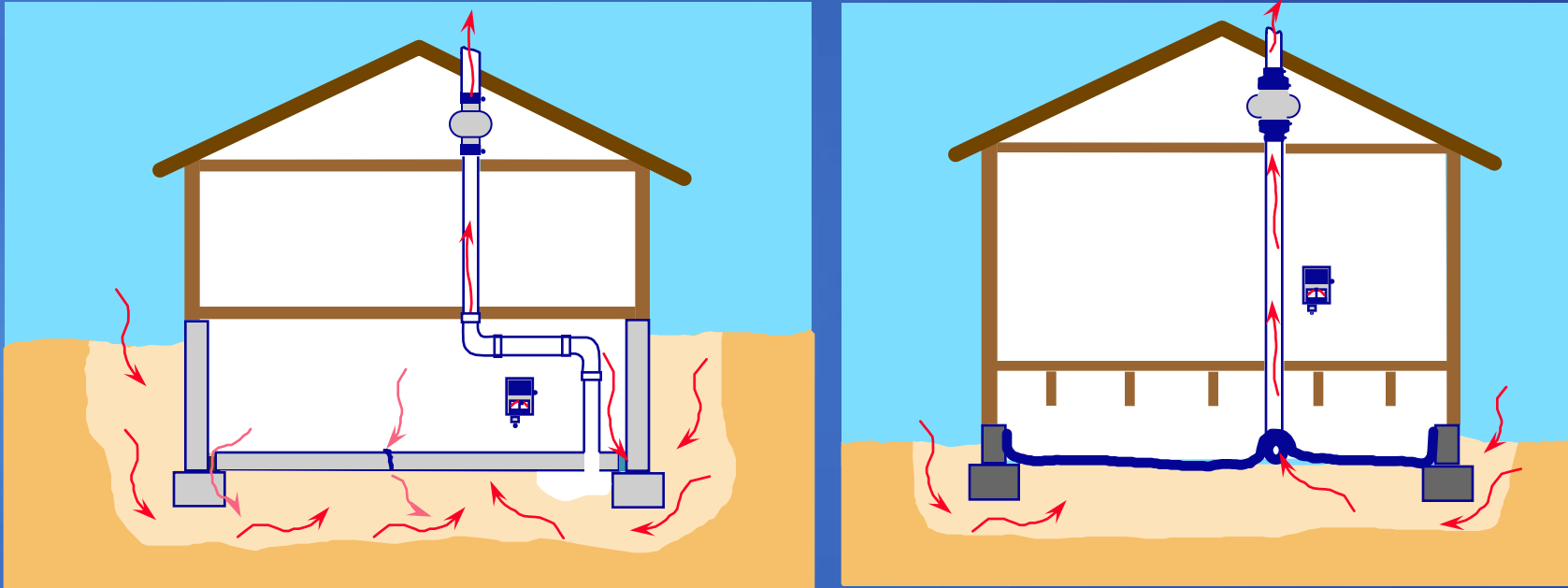
# A Common Real Estate Testing Method

## 2 Simultaneous Tests





# Homes With High Radon Concentrations Can Be Remediated



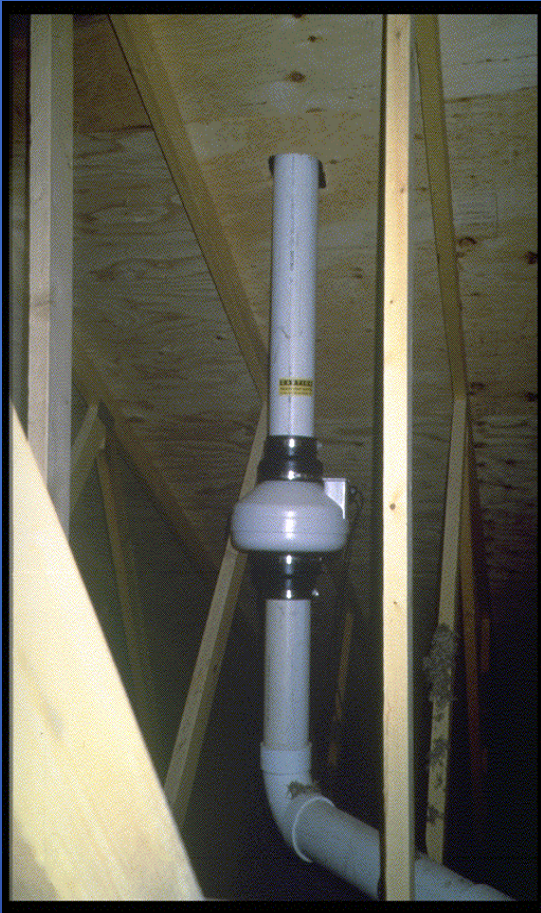
Active soil depressurization is a means of creating a vacuum beneath a slab or plastic sheet and collecting the radon before it enters a building.

# Suction Point For Slabs and Basements



- Hole cut through slab
- Pit dug out
- PVC pipe connected to hole
- Pipe routed to fan
- May require more than one suction point

# System Depressurization Fan



- Installed in attic, garage, or outside
- Quiet
- 40 - 90 watt fan runs continuously
- 11 year expected life



# System Discharges Away From Building Openings



- Discharge should be high to avoid radon entering building
  - Minimum of 10 feet above grade
  - 10 feet from openings, 2 feet below discharge
  - Above eave
- Rain cap not recommended
- 1/4 inch bird screen

US EPA Mitigation Standards

<http://www.epa.gov/iaq/radon/pubs/>

# New Homes Can Be Built With Radon Control Systems





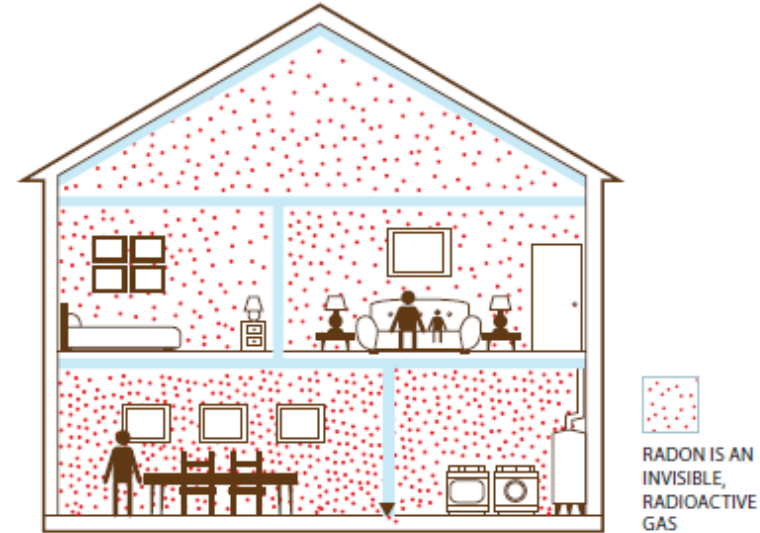


# RADON

and  
REAL ESTATE  
TRANSACTIONS  
in Colorado

August 2019

More often, informed buyers are having radon tests performed when purchasing a home. Discovering elevated radon concentrations doesn't mean you need to walk away from the deal! Testing for and mitigating radon is easy and affordable.



## Understanding Radon

### RADON OCCURS NATURALLY

Radon is an invisible, radioactive gas created from natural deposits of uranium and radium in the soil. Radon is easily drawn into homes through cracks and gaps in the foundation and can reach concentrations that increase the potential for developing lung cancer.

Although there are rare cases where radon comes from building materials, the major source of radon in Colorado homes comes from natural deposits of uranium and radium commonly found in Colorado's soil. It is rarely caused by mankind like other environmental concerns.

# Real Estate Transaction Requirements

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## RADON DISCLOSURE IS REQUIRED IN COLORADO REAL ESTATE TRANSACTIONS

Section N of the Environmental Conditions portion of the Colorado Seller's Property Disclosure Form specifically lists radon as a hazard that, if known by the seller to exist or ever have existed, must be disclosed. This is true even if previous test results were less than 4 pCi/L. In all cases, sellers should provide copies of any test results to potential buyers. If a radon mitigation system exists, it should also be disclosed, as it is presumed that radon had existed previously, and that if the system were to fail, the radon level would return to its original level.

# Real Estate Transaction Requirements

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## RADON DISCLOSURE IS REQUIRED IN COLORADO REAL ESTATE TRANSACTIONS

### SPD19-6-17. SELLER'S PROPERTY DISCLOSURE (RESIDENTIAL)

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

Radon section on Seller's Property Disclosure document

# Breathing Easier



## Do you ask your patients if they've tested their homes for radon?

*"Educating patients about the risk, and promoting the use of radon test kits, is something everyone can do and should do."*

- Charles Lynch, M.D., Ph.D.

*"I remember him putting his face in his hands. He was sitting next to me out in his waiting room, and he just said, 'Why don't physicians know about this?'"*

- Gail Orcutt, Pleasant Hill

*"I want physicians personally to test their homes. We can really have an influence if we can get people to test. As physicians, we can model the behavior that we'd like our patients to follow."*

- Timothy Vermillion, D.O.

**Watch a video to learn how asking this important question could save lives:**



(12-minute version)



**Download educational fliers to hang in clinic or exam rooms:**

Iowa-Specific Fliers (click images below to view and print)



National Fliers (click images below to view and print)



CRCPD Publication E-15-2

## Reducing the Risk from Radon: Information and Interventions

*A Guide for Health Care Providers*

RadonLeaders.org



<http://www.canceriowa.org/BreathingEasier.aspx>



## Interventions to Reduce the Burden of Radon-Related Lung Cancer

- ☒ Ask your patients if they have tested their home for radon. If they have not, inform them about the health risk posed by radon and urge them to test their home for radon.
- ☒ Add radon testing questions to the routine electronic medical record questionnaire.
- ☒ Team up with the Centers for Disease Control and Prevention (CDC)-funded comprehensive cancer control program in your state. These programs have aligned the priorities, goals and activities of cancer coalitions with practices that reduce radon-induced lung cancer: [https://www.cdc.gov/cancer/ncccp/ccc\\_plans.htm](https://www.cdc.gov/cancer/ncccp/ccc_plans.htm).
- ☒ Provide information in your offices and clinics that promotes radon testing and mitigation; information can be obtained from the following sources:
  - Iowa Cancer Consortium—[www.canceriowa.org/breathingeasier](http://www.canceriowa.org/breathingeasier)
  - Online learning and action network—[www.radonleaders.org](http://www.radonleaders.org)
  - EPA—[www.epa.gov/radon](http://www.epa.gov/radon)
  - CDC—[www.cdc.gov/radon](http://www.cdc.gov/radon)
  - State radon offices—[www.epa.gov/radon/find-information-about-local-radon-zones-and-state-contact-information](http://www.epa.gov/radon/find-information-about-local-radon-zones-and-state-contact-information)
- ☒ The USPSTF recommends annual LDCT screening for lung cancer in adults ages 55 to 80 who have a 30-pack-year smoking history and currently smoke or have quit within the past 15 years. For individuals who do not have lung cancer or do not qualify for screening, interviews for LDCT screening eligibility represent teachable moments to discuss efforts to reduce lung cancer risk, such as testing their homes for radon.
- ☒ Share information about the health risks of protracted radon exposure with other health care providers. For example, encourage your colleagues to participate in the discussion forums at [www.radonleaders.org](http://www.radonleaders.org), where they can learn about the experiences of other health care providers regarding radon and find links to the research that provides the scientific foundation for radon risk estimates.





**Do you smoke?**

☐ Yes

☐ No

If yes, how much per day? \_\_\_\_\_

If you are a former smoker, when did you stop? \_\_\_\_\_

**Have you tested your home  
for radon?**

☐ Yes

☐ No

**Do you have a living will or advance  
medical directive?**

☐ Yes

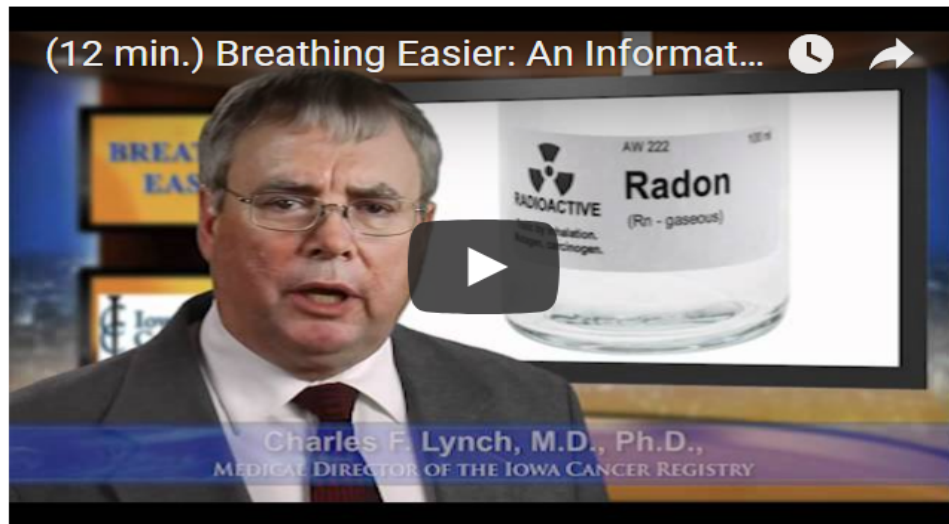
☐ No

# Availability of Guide and Reference Material

## Radon Leaders -

<http://www.radonleaders.org/resources/reducingtheriskfromradon>

The following videos explain how asking this important question could save lives:



<http://breathingeasier.info> website

# Educational Resources

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Sep 1, 2018 Issue

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**Editorials**

**Radon: A Leading Environmental Cause of Lung Cancer**

 PDF  PRINT  COMMENTS

SHARE   

R. WILLIAM FIELD, PhD, MS, University of Iowa College of Public Health, Iowa City, Iowa  
*Am Fam Physician.* 2018 Sep 1;98(5):280-282.

Protracted exposure to radon decay products is the leading environmental cause of cancer mortality in the United States.<sup>1,2</sup> Family physicians play a key role in informing their patients about the health risks posed by radon exposure and in recommending proactive actions to reduce radon exposure.



## Reducing the Risks From Radon: Information and Interventions

*A Guide for Health Care Providers*

## Additional Resources



**COLORADO**  
Department of Public  
Health & Environment

<https://cdphe.colorado.gov/radon>

Chrystine Kelley

Radon Program coordinator

303-692-3442

1-800-846-3986

[chrys.kelley@state.co.us](mailto:chrys.kelley@state.co.us)



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Please feel free to contact me if you have questions

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University of Iowa