

Radon in Pulmonology (in Nevada)

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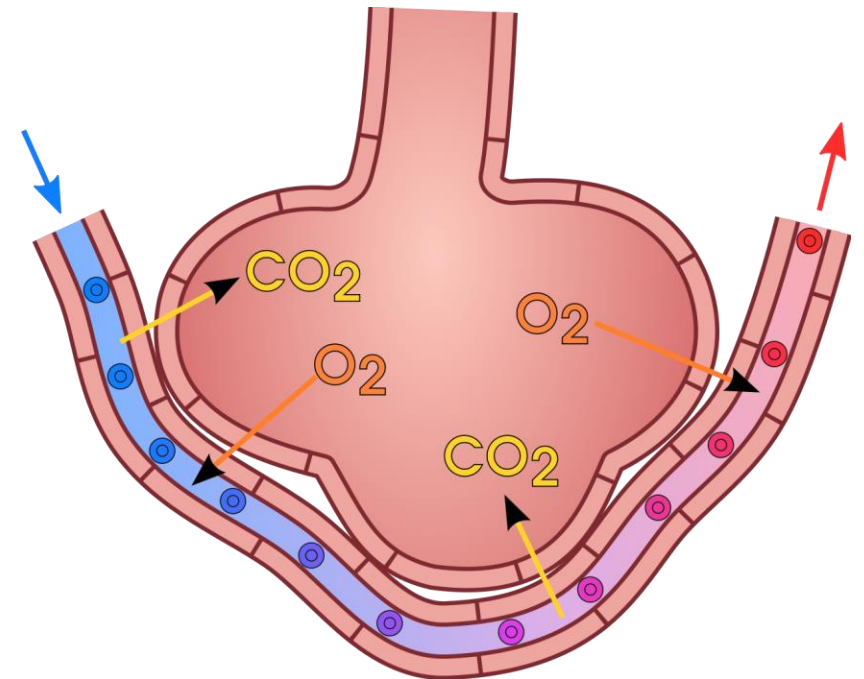
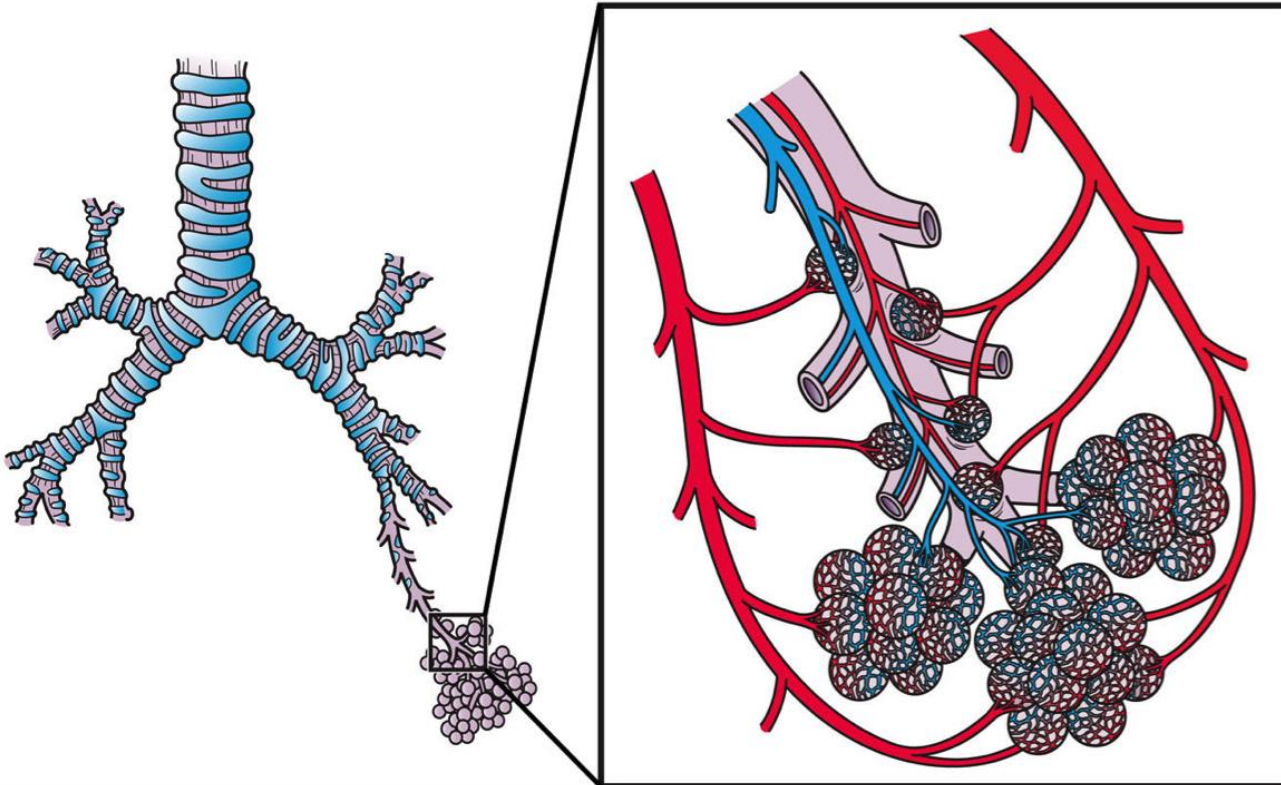
<https://cccnevada.com>

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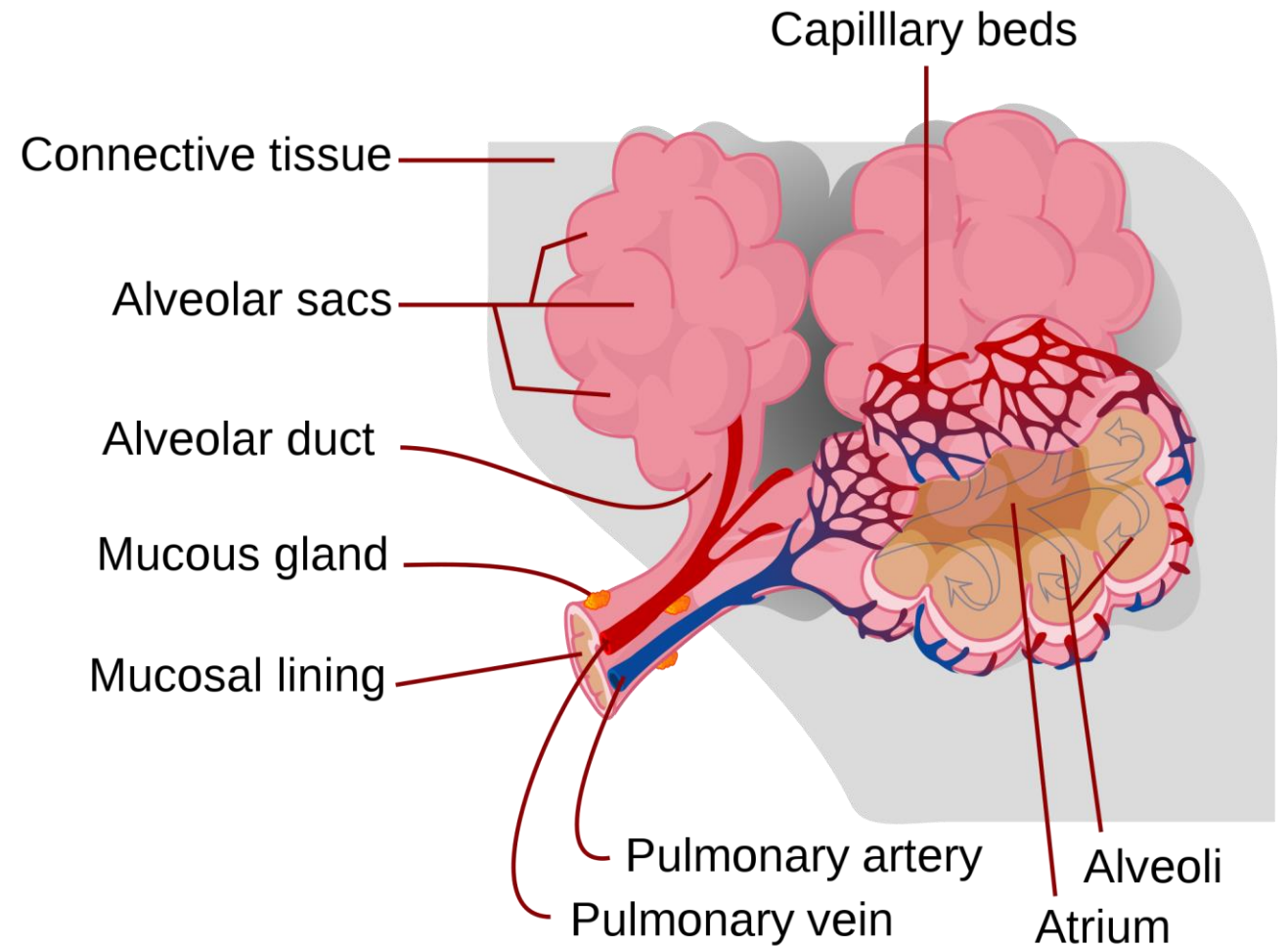
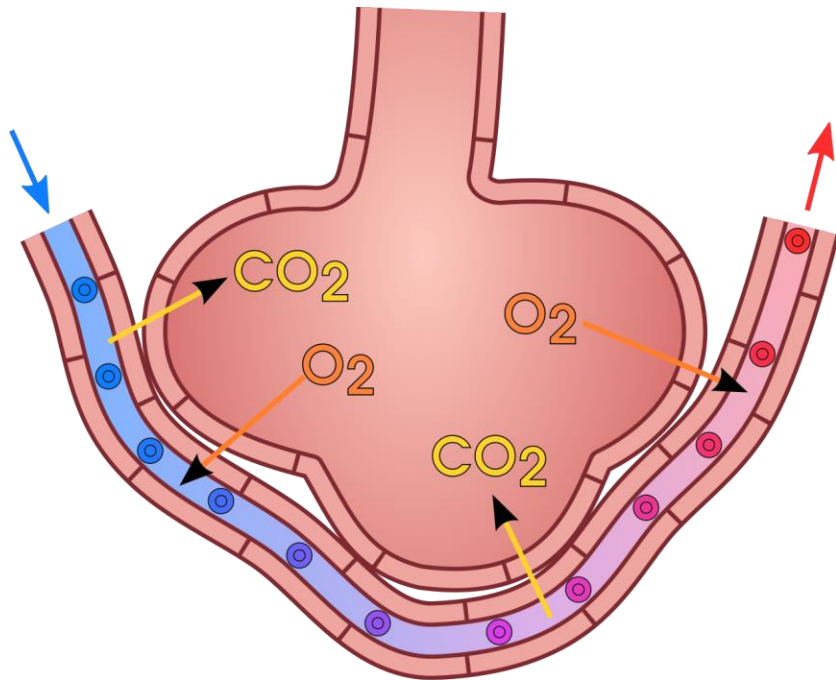
Pulmonology basics

- Lungs serve many functions including transport of
 - Oxygen into the blood, from the air
 - Carbon dioxide out of the blood, into the air



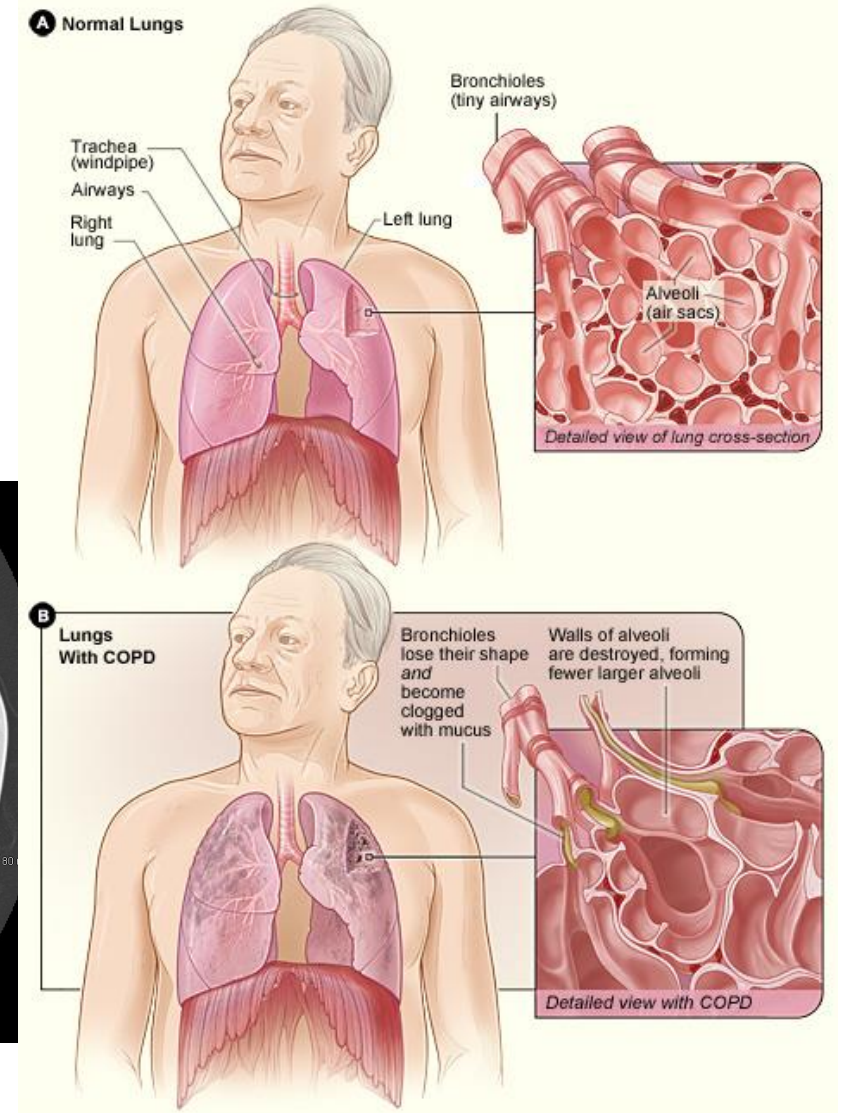
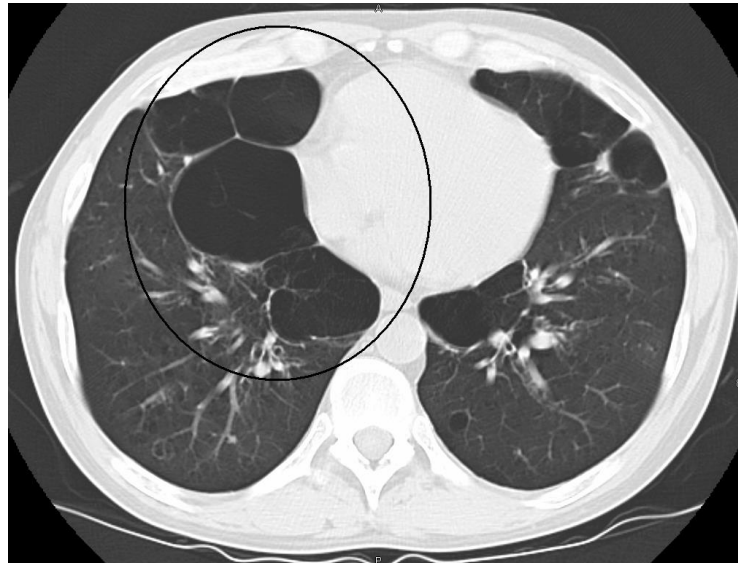
Pulmonology basics

- What is the interstitium?
- What are pneumocytes?



Radon & the lungs

- Lung cancer
- COPD/emphysema (chronic obstructive pulmonary disease)



Lung cancer

- Leading cause of cancer deaths in NV, in the US & worldwide
- Exposure to tobacco smoke is the #1 etiologic factor (2/3 of cases)
- Radon is #2
- Increasingly, we are seeing lung cancer in **never** smokers
 - In Asia – 60-80% of women with lung cancer have never smoked
 - In the US – 19% of women with lung cancer have never smoked
- Principal causes – lung cancer in **never** smokers
 - Radon
 - Second-hand smoke

Dangers of radon – lung cancer in **never** smokers

- Radon is implicated in lung cancer cases in **never** smokers
- The chemical properties of radon – colorless, odorless, tasteless – make it especially concerning
- Naturally occurring in all 50 states
- Directed testing – only way to know the levels
- Radon, and the breakdown products (progeny), can be breathed in

When it breaks down, it releases harmful ionizing radiation

How much is too much?

- Direct measurements of radiation from radon are done in picocuries per liter of air – pCi/L
- 4 pCi/L is the recommended action level for radon i.e. fixing homes to keep levels below 4 pCi/L
 - **lower is better**
- Radon typically enters via the soil or rock beneath a dwelling and can **get trapped** inside
- EPA estimates 21,000 deaths from radon annually

Radon + smoking

RADON RISK IF YOU SMOKE

Radon Level	If 1,000 people who smoked were exposed to this level over a lifetime* . . .	The risk of cancer from radon exposure compares to** . . .	WHAT TO DO: Stop Smoking and . . .
20 pCi/L	About 260 people could get lung cancer	◀ 250 times the risk of drowning	Fix your home
10 pCi/L	About 150 people could get lung cancer	◀ 200 times the risk of dying in a home fire	Fix your home
8 pCi/L	About 120 people could get lung cancer	◀ 30 times the risk of dying in a fall	Fix your home
4 pCi/L	About 62 people could get lung cancer	◀ 5 times the risk of dying in a car crash	Fix your home
2 pCi/L	About 32 people could get lung cancer	◀ 6 times the risk of dying from poison	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 20 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult)
0.4 pCi/L		(Average outdoor radon level)	

Note: If you are a former smoker, your risk may be lower.

Radon w/o smoking

RADON RISK IF YOU'VE NEVER SMOKED

Radon Level	If 1,000 people who never smoked were exposed to this level over a lifetime* . . .	The risk of cancer from radon exposure compares to** . . .	WHAT TO DO:
20 pCi/L	About 36 people could get lung cancer	◀ 35 times the risk of drowning	Fix your home
10 pCi/L	About 18 people could get lung cancer	◀ 20 times the risk of dying in a home fire	Fix your home
8 pCi/L	About 15 people could get lung cancer	◀ 4 times the risk of dying in a fall	Fix your home
4 pCi/L	About 7 people could get lung cancer	◀ The risk of dying in a car crash	Fix your home
2 pCi/L	About 4 people could get lung cancer	◀ The risk of dying from poison	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 2 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult)
0.4 pCi/L		(Average outdoor radon level)	

Note: If you are a former smoker, your risk may be higher.

*Lifetime risk of lung cancer deaths from *EPA Assessment of Risks from Radon in Homes* (EPA 402-R-03-003).

**Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

Dangers of radon – lung cancer – **work exposure**

- A combined analysis of 3 case-control studies
- Uranium miners in Europe
- Smoking history & radon exposure evaluated
- 1046 – lung cancer cases. 2492 – control cases.
- Results showed the carcinogenic effects of radon persist even when adjusting for smoking status

> [Radiat Res.](#) 2011 Sep;176(3):375-87. doi: 10.1667/rr2377.1. Epub 2011 Jun 29.

Radon, smoking and lung cancer risk: results of a joint analysis of three European case-control studies among uranium miners

Klervi Leuraud ¹, Maria Schnelzer, Ladislav Tomasek, Nezahat Hunter, Margot Timarche, Bernd Grosche, [Michaela Kreuzer](#), Dominique Laurier

Dangers of radon – lung cancer – **work exposure**

- Uranium miners in the Colorado plateau
- 209 lung cancer cases

- Standardized mortality ratio for lung cancer vs regional population
 - 3.99 for white miners
 - 3.27 for native American miners

- Elevated mortality rates were observed from interstitial pulmonary fibrosis, multiple myeloma, and non-Hodgkin lymphoma

[> Am J Epidemiol. 2009 Mar 15;169\(6\):718-30. doi: 10.1093/aje/kwn406. Epub 2009 Feb 10.](#)

Radon exposure and mortality among white and American Indian uranium miners: an update of the Colorado Plateau cohort

Mary K Schubauer-Berigan ¹, Robert D Daniels, Lynne E Pinkerton

Dangers of radon – lung cancer – **home exposure**

- 13 studies – European data
- 9 countries
- 7148 – lung cancer cases. 14208 – controls.
- Risk of lung cancer increased by 8.4% (95% confidence interval 3.0% to 15.8%) per 100 Bq/m³ increase in measured radon (P = 0.0007)
- Linear dose response relationship
- Proportionate excess risk did not differ significantly with study, age, sex, or smoking
- *25 times* greater risk of lung cancer from radon for smokers v/s non-smokers
- Responsible for 2% of all deaths from cancer in Europe

> [BMJ](#). 2005 Jan 29;330(7485):223. doi: 10.1136/bmj.38308.477650.63. Epub 2004 Dec 21.

Radon in homes and risk of lung cancer: collaborative analysis of individual data from 13 European case-control studies

S Darby ¹, D Hill, A Auvinen, J M Barros-Dios, H Baysson, F Bochicchio, H Deo, R Falk, F Forastiere, M Hakama, I Heid, L Kreienbrock, M Kreuzer, F Lagarde, I Mäkeläinen, C Muirhead, W Oberaigner, G Pershagen, A Ruano-Ravina, E Ruosteenoja, A Schaffrath Rosario, M Tirmarche, L Tomásek, E Whitley, H-E Wichmann, R Doll

Dangers of radon – lung cancer – **home exposure**

- 7 large studies in North America
- 4081 – lung cancer cases. 5281 – controls.
- Estimated odds ratio of lung cancer increased with radon levels
- Findings match extrapolations from industrial exposures to radon e.g. miners

Multicenter Study > J Toxicol Environ Health A. 2006 Apr;69(7):533-97.

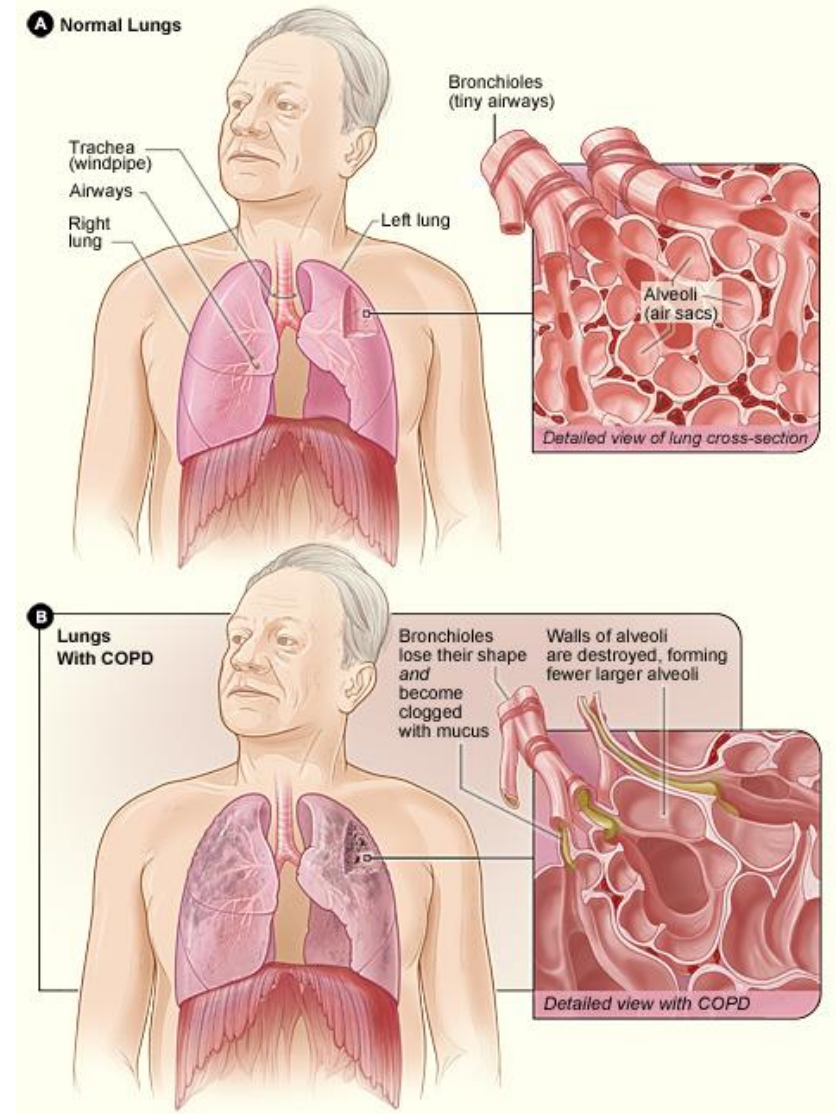
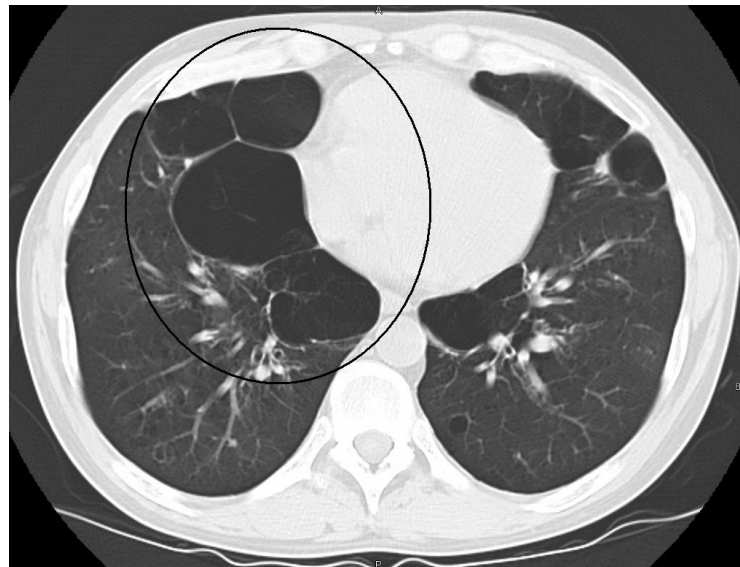
doi: 10.1080/15287390500260945.

A combined analysis of North American case-control studies of residential radon and lung cancer

Daniel Krewski ¹, Jay H Lubin, Jan M Zielinski, Michael Alavanja, Vanessa S Catalan, R William Field, Judith B Klotz, Ernest G Létourneau, Charles F Lynch, Joseph L Lyon, Dale P Sandler, Janet B Schoenberg, Daniel J Steck, Jan A Stolwijk, Clarice Weinberg, Homer B Wilcox

Dangers of radon – what about COPD?

- COPD = emphysema for our purposes today
- Destroyed lung tissue leading to lungs larger than the chest cavity



Dangers of radon – what about COPD?

- Metanalysis
- 13 papers reviewed
- Poor quality data, many lacked information on tobacco use
- 2 studies on general population suggest association between mortality and residential radon
- Not enough information for firm conclusions regarding radon and COPD

Review > Int J Chron Obstruct Pulmon Dis. 2020 Apr 28;15:939-948. doi: 10.2147/COPD.S245982.
eCollection 2020.

Exposure to Residential Radon and COPD: A Systematic Review

Alejandro Conde-Sampayo ¹, María Lorenzo-González ¹, Alberto Fernández-Villar ²,
Juan Miguel Barros-Dios ^{3 4 5}, Alberto Ruano-Ravina ^{3 4}

Dangers of radon – what about COPD?

- Assesses effect of residential radon of COPD pt. (v/s prior data trying to find a *cause* for COPD)
- 142 pt w COPD, predominantly men, from eastern MA
- Indoor and outdoor radon exposures measured
- High indoor radon exposure showed lower lung function
- Association was similar after particulate matter adjustment

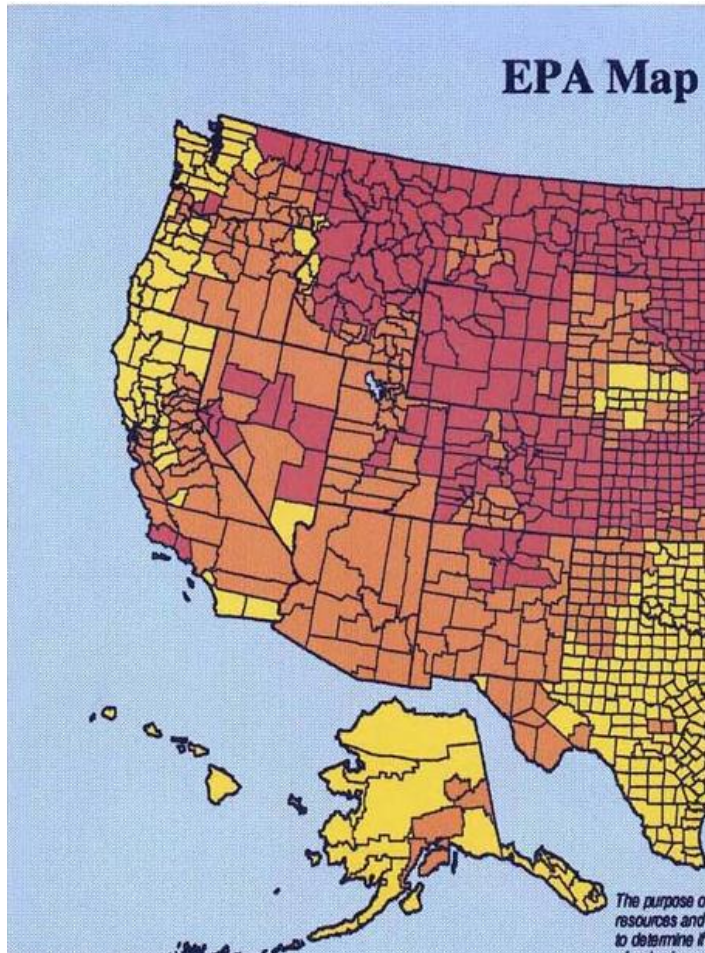
> [Environ Res. 2023 Jan 1;216\(Pt 1\):114492. doi: 10.1016/j.envres.2022.114492. Epub 2022 Oct 6.](#)




Particle radioactivity from radon decay products and reduced pulmonary function among chronic obstructive pulmonary disease patients

Veronica A Wang¹, Petros Koutrakis¹, Longxiang Li¹, Man Liu¹, Carolina L Z Vieira¹, Brent A Coull², Edward F Maher¹, Choong-Min Kang¹, Eric Garshick³

What about Nevada?

- Here is a map from the EPA



	Zone 1 (red zones)	Highest potential; average indoor radon levels may be greater than 4 pCi/L (picocuries per liter)
	Zone 2 (orange zones)	Moderate potential; average indoor radon levels may be between 2 and 4 pCi/L
	Zone 3 (yellow zones)	Low potential; average indoor radon levels may be less than 2 pCi/L

Radon home testing

Nevada is known for its beautiful landscape, but did you know that it also has a significant radon problem? Radon is a colorless, odorless and tasteless gas that is the leading cause of lung cancer among nonsmokers. In this brochure, we will provide you with essential information on radon and how to protect yourself and your family from its harmful effects.

What is Radon?

Radon is a naturally occurring radioactive gas that comes from the breakdown of uranium in soil, rocks and water. It can seep into buildings through cracks in the foundation, walls and floors. Radon can be found in all types of buildings, including homes, schools, and workplaces. It can accumulate to high levels in enclosed spaces, especially in areas with poor ventilation.

According to Experts, Radon Levels Pose Same Risk as Smoking

According to the Environmental Protection Agency (EPA), radon exposure is responsible for about 21,000 lung cancer deaths each year in the United States. The EPA estimates that the risk of lung cancer from radon exposure is about 10 times greater for smokers than for nonsmokers. However, even nonsmokers can develop lung cancer from radon exposure.

Contact Us

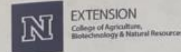
Phone: 775-336-0252

Radon Program Officer

Chris Kelly, chrisk@unr.edu

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An EEO/AA Institution



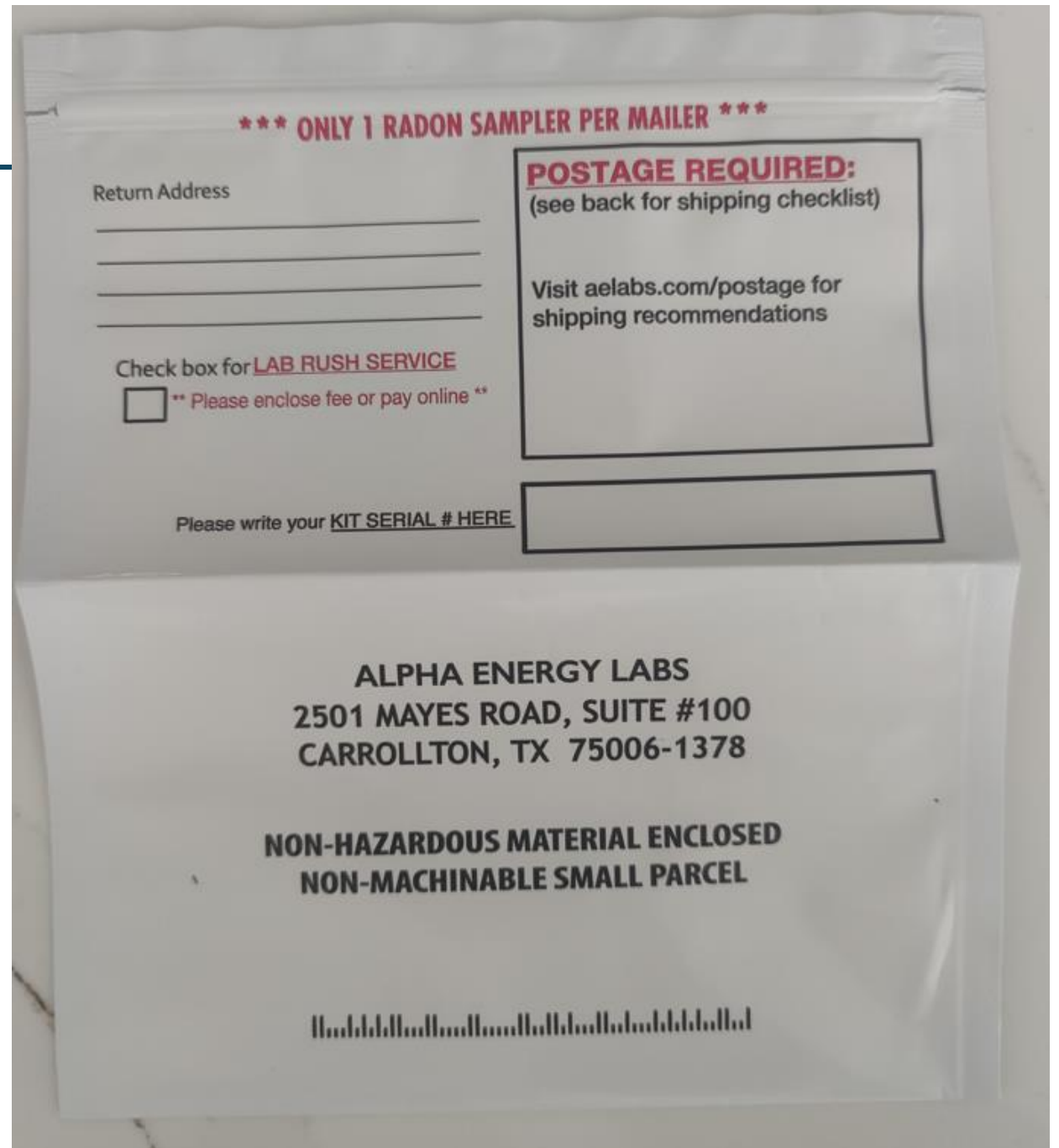
Radon
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Protecting Your Home
and Your Health



Radon home testing



Summary

- Radon worsens lung cancer risk even in smokers
- Radon is a major contributor to lung cancer risk in *never* smokers
- Radon can worsen lung function in COPD patients
- We do not know enough to say if radon *causes* COPD