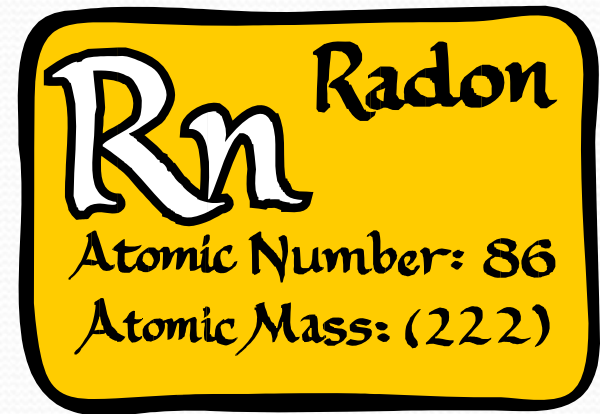


Radon 101

Ellen Bloom, MPH, CHES
Indiana State Department of Health
Lead and Healthy Homes Program

What is Radon?

- Naturally occurring radioactive gas
- Noble gas
 - Colorless
 - Odorless
 - Tasteless
- Radium decay chain
 - Thorium or uranium → radium → radon → radon progeny



Where Does Radon Come From?

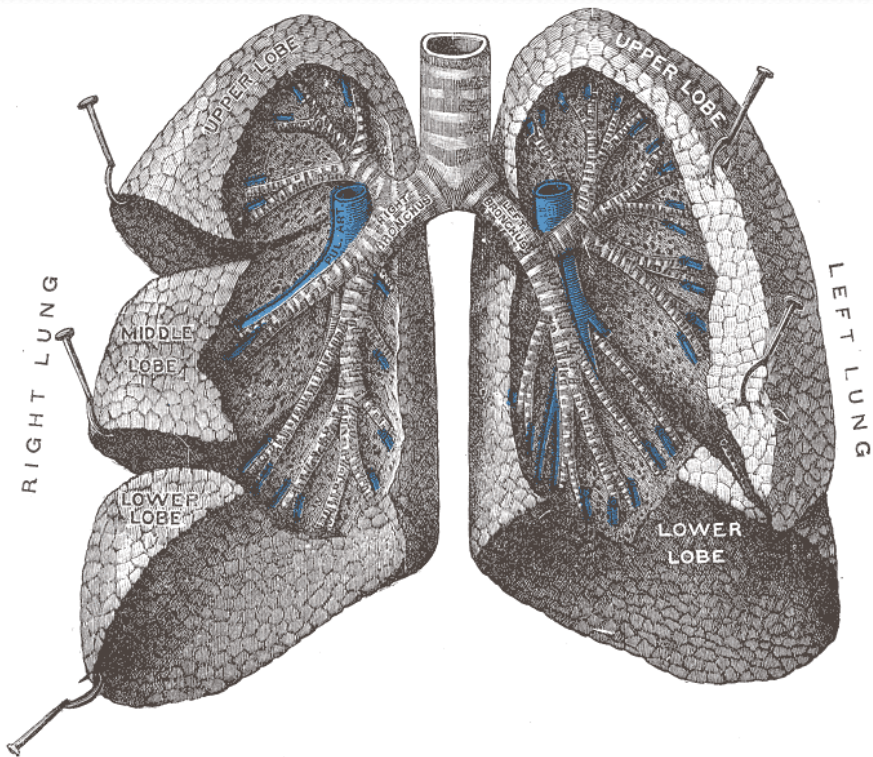
- Natural product of the environment
- Found in rock and soil
 - Can move to air, groundwater, or surface water
- Can also be found in natural gas
 - Exposed to underground uranium or thorium



Routes of Exposure

- Inhalation

- Radon progeny attaches to surfaces
 - Airborne particles
 - Walls
 - Floors
 - Clothing
- Radon *gas* is breathed in and out without much effect
- Radon *progeny* are carried to the lungs on particulate matter and expose the lungs to radiation



Routes of Exposure

- Inhalation
 - Radon can also be released into the air from:
 - Groundwater
 - Natural gas
 - Tobacco
- Ingestion
 - Radon can be swallowed in drinking water

Inhalation is the most important exposure route.

Radon in the Home

- Average radon levels are significantly higher indoors than out
 - Indoor: 1.3 pCi/L (picocuries per liter)
 - Outdoor: ~0.4 pCi/L
- EPA recommends mitigation in homes with radon levels at or above 4 pCi/L
 - Approximately 6% of U.S. homes

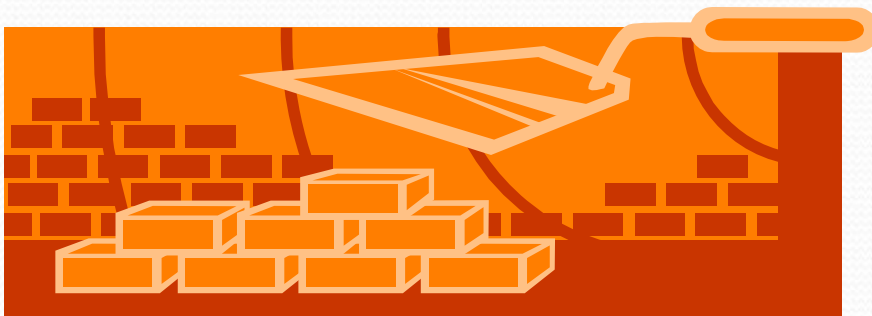
Radon in the Home

Enters the home through:

- Cracks in walls and floors
- Gas appliances
- Pressure driven air flow
- Water supply
- Basements and crawlspaces

Released into the home through:

- Brick and mortar
 - Cinderblock walls
 - Concrete floors
 - Sheet rock
 - Stone products
-
- Can also be released through cooking with a gas stove



Who is at Risk of Exposure?

- Everyone!
 - Risk increases linearly with dose
- Smokers
 - At higher risk for adverse health effects
- Increased Exposure
 - Children
 - Faster breathing rates
 - Take in more air, pound for pound, than adults
 - Residents of the 6 million U.S. homes with high radon levels (4 pCi/L or above)

Who is at Risk of Exposure?

Occupations with Increased Exposure

- Excavators
- Fish hatcheries
- Natural gas and piping facilities
- Nuclear waste repositories
- Miners (particularly uranium mines)
- Oil refineries
- Phosphate fertilizer plants
- Fossil fuel power plants
- Utility and subway tunnels
- Water treatment plants
- Hospitals



Guidelines for Exposure

- Indoor Radon Abatement Act, 1988
 - Long-term goal of indoor radon levels to be as low as outdoor levels
- EPA recommends mitigation in houses with radon levels of 4 pCi/L or greater
 - Suggests mitigation in homes with levels between 2 and 4 pCi/L in areas of the house that are heavily used
- No federal enforceable regulations to control indoor radon levels

Potential Health Effects

- Twenty thousand radon-related deaths from lung cancer each year in the U.S. (EPA estimate)
 - Almost 3,000 are people who have never smoked
- Second-leading cause of lung cancer deaths in the U.S.
 - Leading cause of lung cancer deaths for non-smokers
- Worldwide: Cause of 6-15% of lung cancers (WHO estimate)
- The risk of lung cancer from radon exposure is 10-20% greater for smokers as for non-smokers

Radon Risk: Smokers vs. Non-Smokers

Radon Level	Cancer rate/1,000 Smokers	Cancer rate/1,000 Non-Smokers
20 pCi/L	260	36
10 pCi/L	150	18
8 pCi/L	120	15
4 pCi/L	62	7
2 pCi/L	32	4
1.3 pCi/L	20	4
0.4 pCi/L	3	—

Source: EPA. Data based on lifetime exposure rates

Questions

- Ellen Bloom, MPH, CHES
Health Educator
Indiana Lead and Healthy Homes Program
Indiana State Department of Health
2 N. Meridian 5J
Indianapolis, IN 46204
- Phone: 317-233-1290
- Email: ebloom2@isdh.in.gov