Dealing with Radon in Real Estate - Webinar

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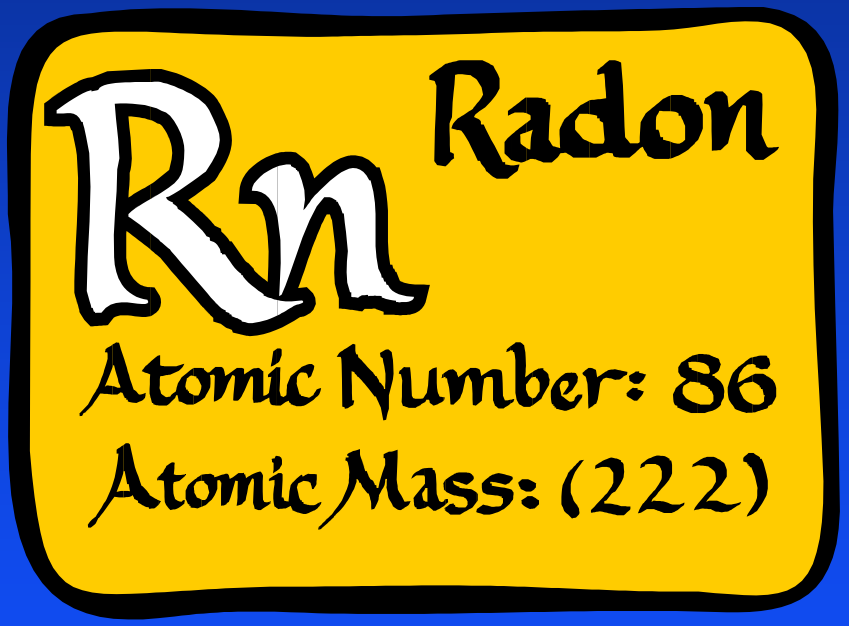
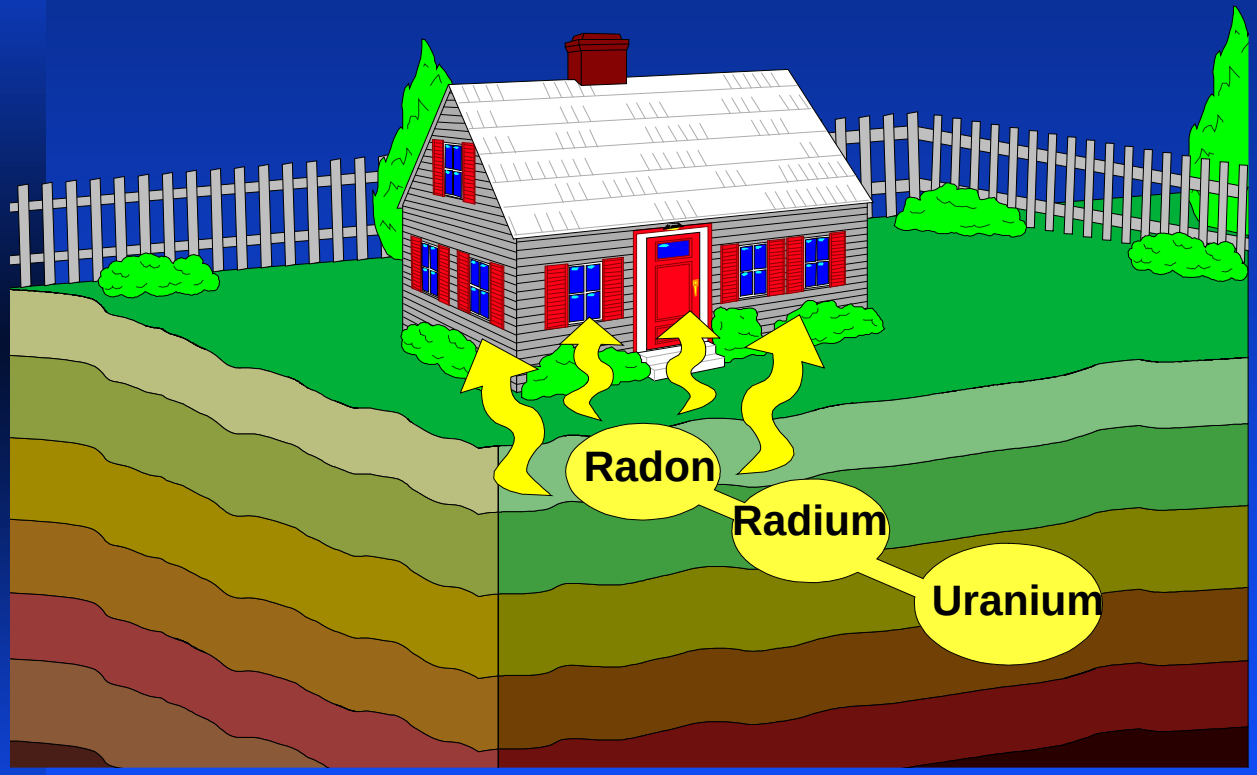
Dealing with Radon in Real Estate Transactions

We'll talk about:

- What it is!
- What it does to us!
- How it gets into our homes!
- How to measure it!
- How to fix it!
- How to address in a real estate transaction!



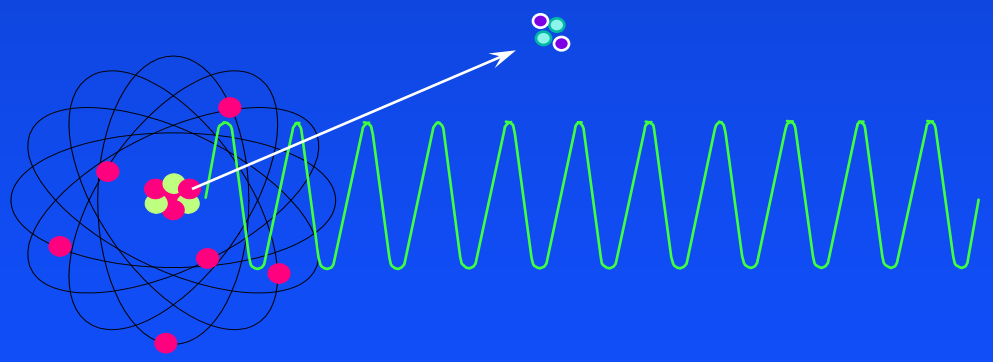
What Is Radon?



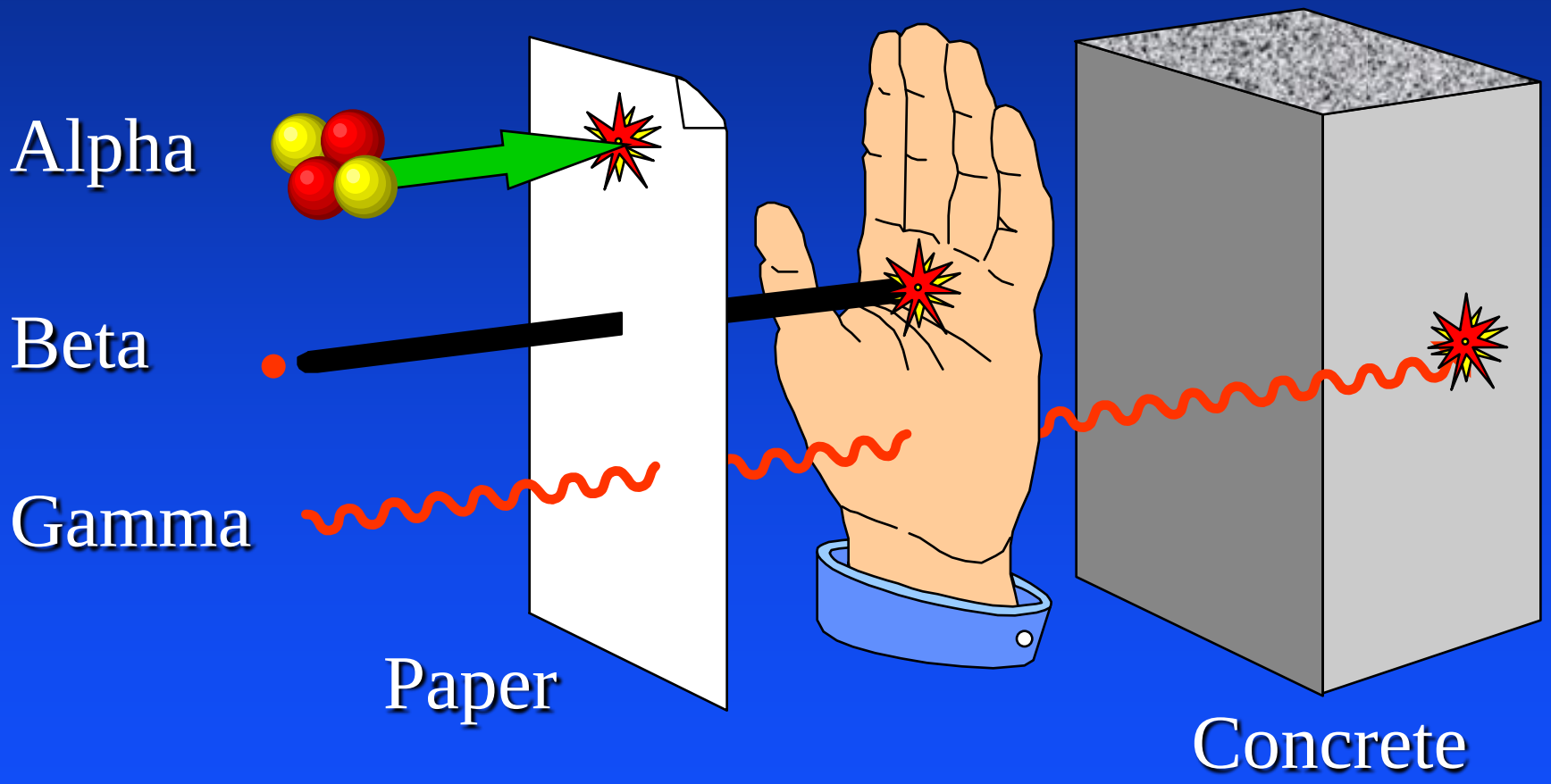
- Radon is a tasteless, odorless, colorless, radioactive gas.
- It is naturally occurring in soil and rock; comes from radioactive decay of uranium and radium.
- It enters buildings from the soil beneath them.

What Is Radioactivity?

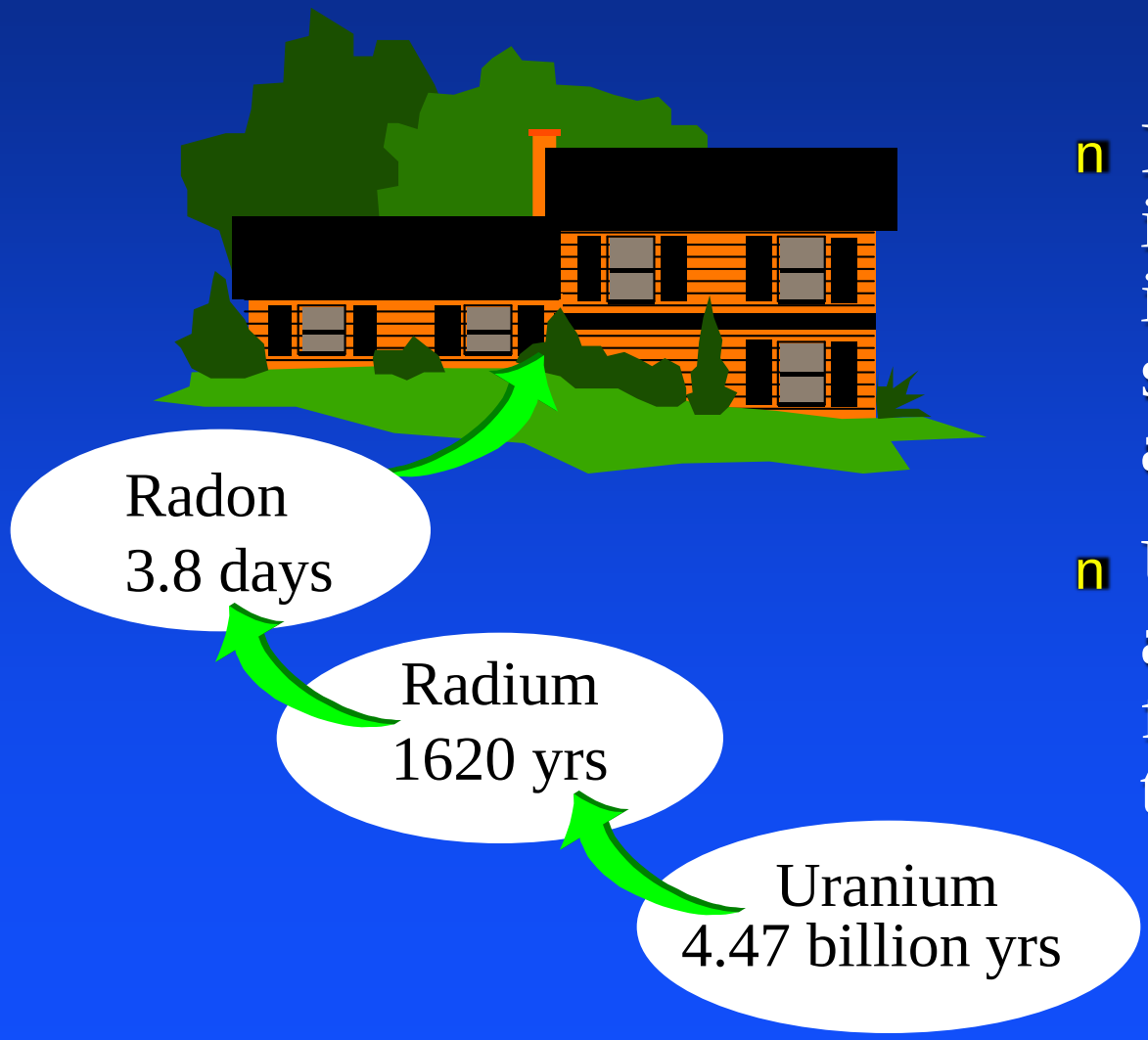
- The spontaneous emission of energy or particles from the nucleus of an atom in an effort to become more stable.
- The atom changes identity, releasing radiation.



3 Types of Ionizing Radiation

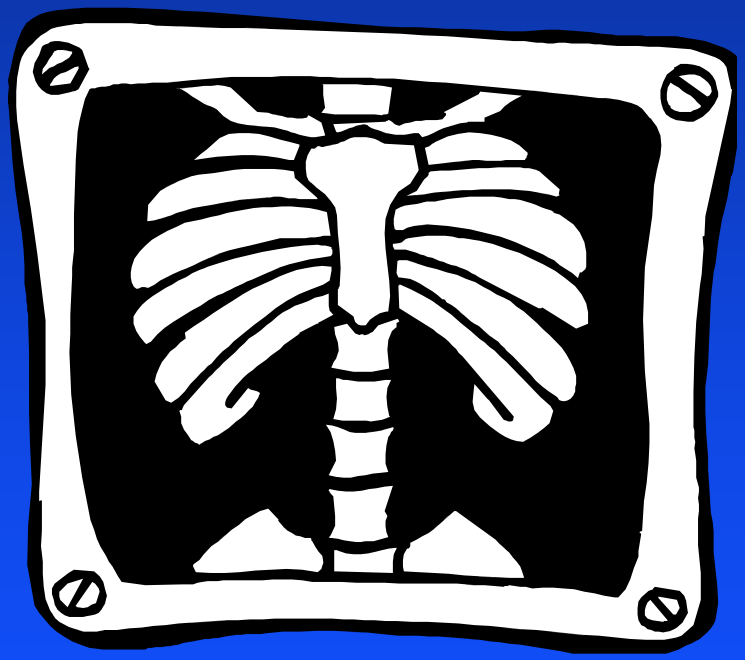


Radioactive Halflife

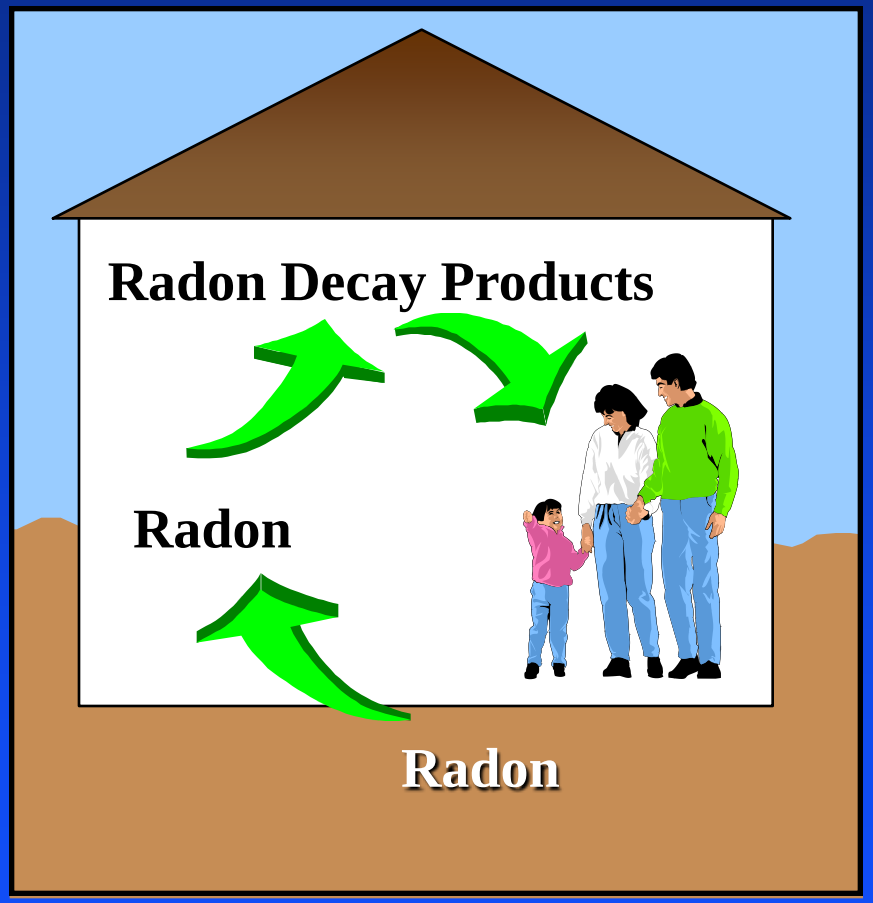


- Radioactive Half-life is the average time that it takes for half of a specified number of atoms to decay.
- Uranium and radium are going to be around for a LONG time, and therefore, so is radon!

Health Effects of Radon



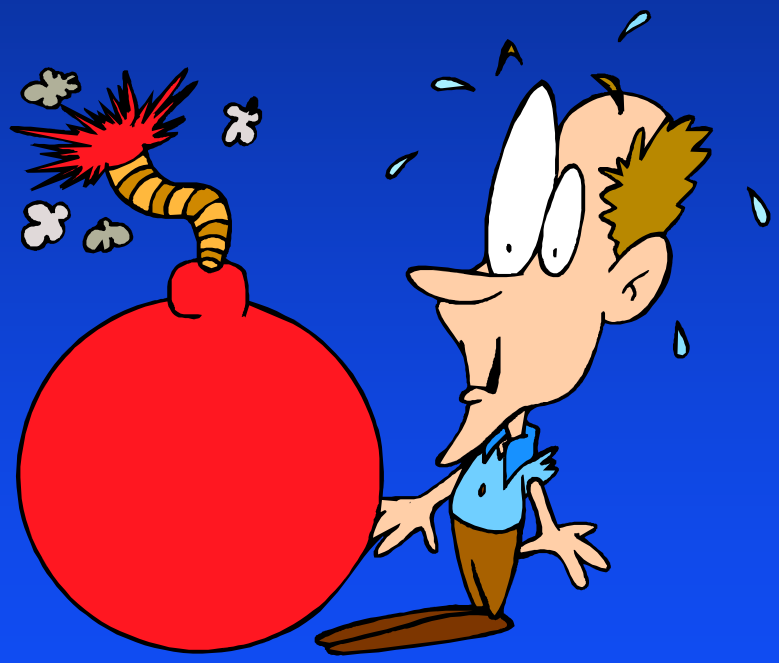
Why Is Radon A Concern?



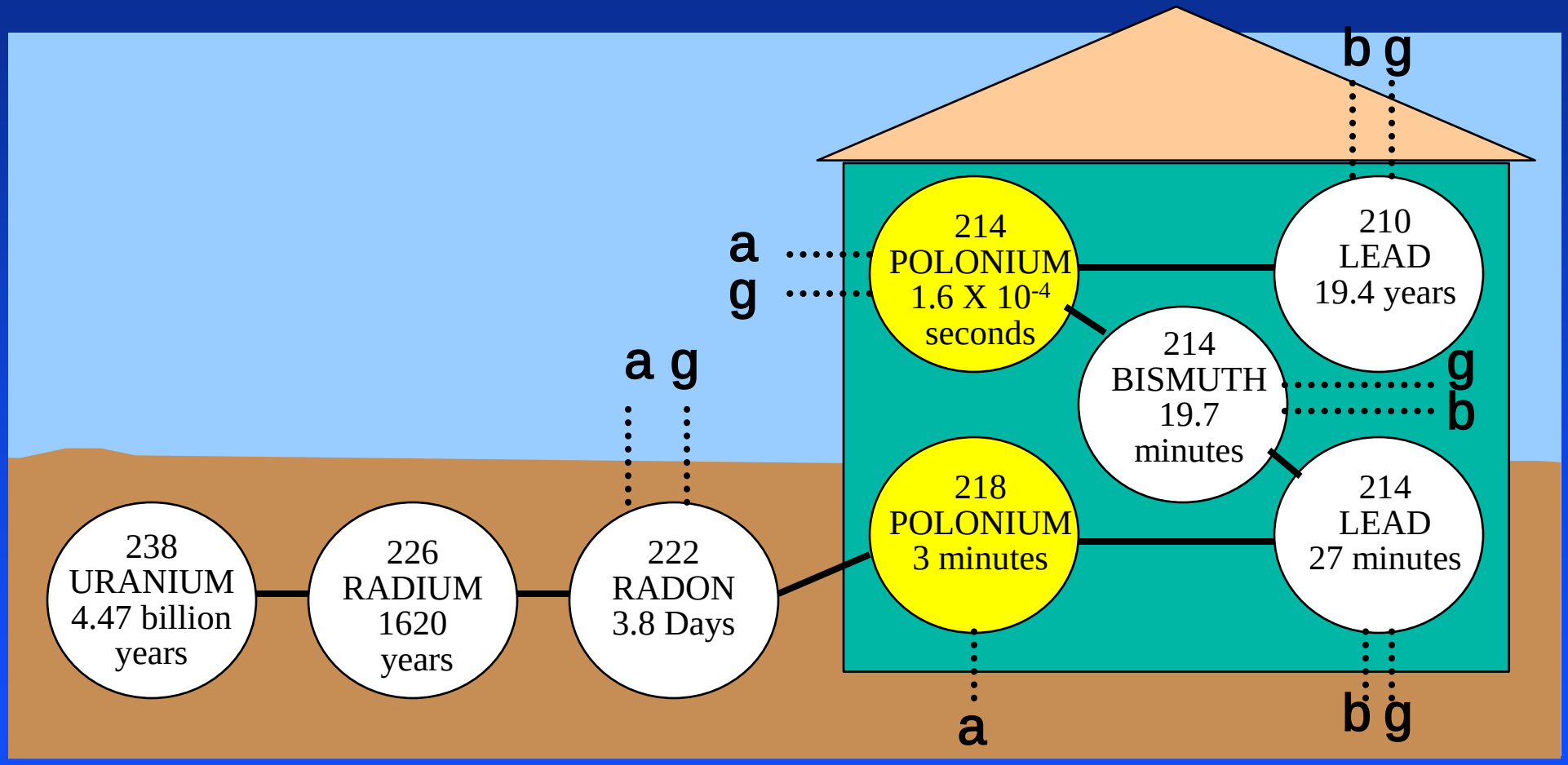
- Radon decays into radioactive particles known as radon decay products.
- These particles are easily inhaled and deposited in the lungs where they can damage sensitive lung tissue.

Radon Decay Products

- Solid particles / Heavy metals
- Have static charge
- Chemically reactive
- Source of cell damage in lungs
- Short-lived decay products most significant

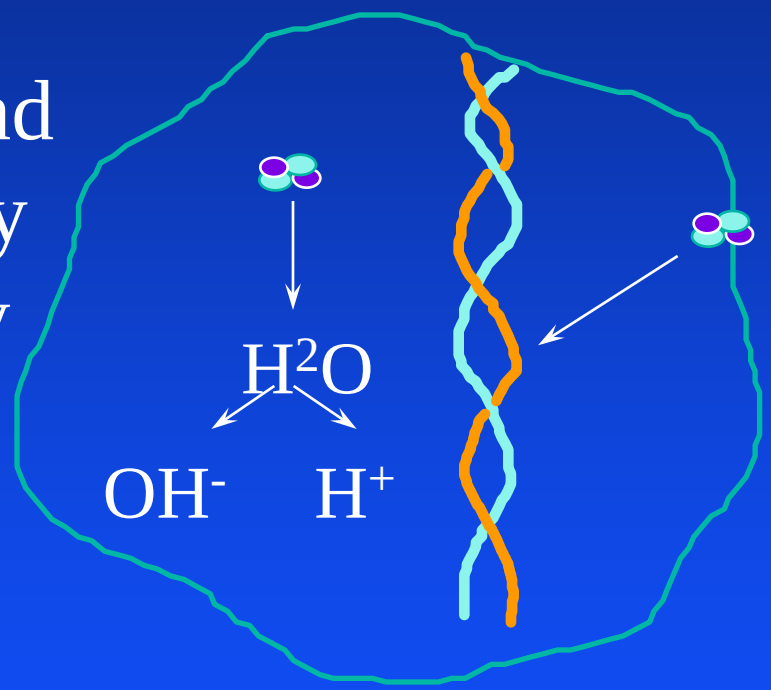


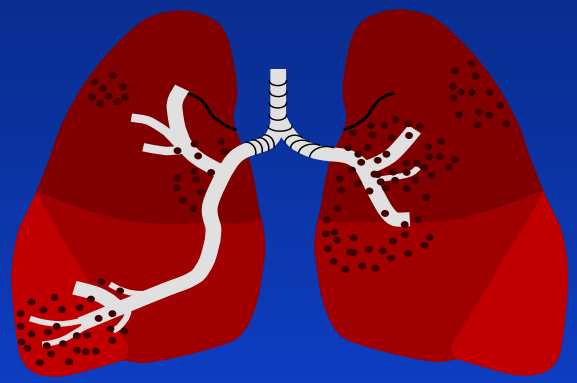
Radon Decay Products



Atomic Particles Can Damage Lung Cells

Double strand DNA split by alpha energy



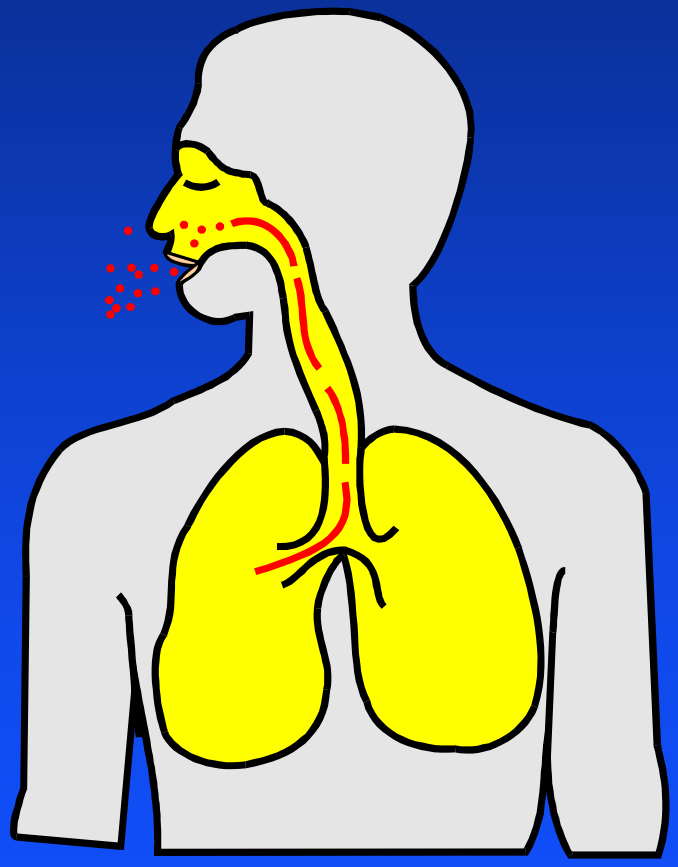


Lung cell will:

Die,
Heal Itself,
or
Become Cancerous

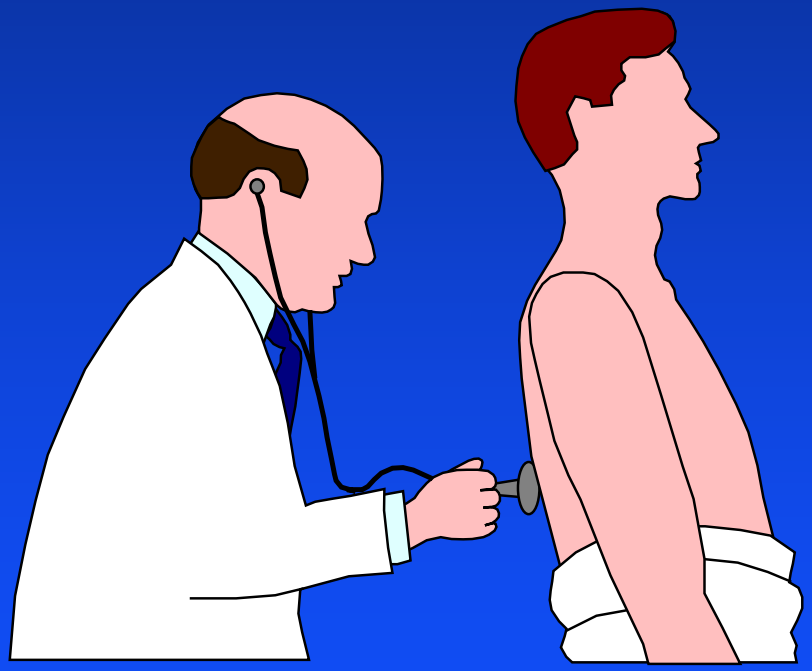
Radon Is the Second Leading Cause of Lung Cancer in the United States

- Radon is a KNOWN Human Carcinogen
  ("Class A" - like mustard gas, tobacco smoke, asbestos, benzene, and vinyl chloride)
- Only smoking causes more lung cancer deaths
- Radon results in approximately
  - 21,000 lung cancer deaths in U.S./yr
  - 600 lung cancer deaths in Michigan/yr
- **These deaths are preventable!**



Your Chances of Getting Lung Cancer?

- How much radon is in your home
- The amount of time you spend in your home (or any indoor environment w/elevated radon levels)
- Whether you are a smoker or have ever smoked



Scientific Basis For Radon Risk Estimates

- Studies on miners.
  - Uranium miners in U.S. and other countries
- Studies on residential occupants.
  - On-going and as a group confirm application of miner data to residential exposures
- Studies on laboratory animals.

EPA & Surgeon General Recommend That People Not Have Exposures Above 4 pCi/L On A Long-Term Basis

- Every home has some measureable level of radon.
- There is no known “safe” level
- 4 pCi/l is considered a “reasonably achievable” level
- Many homes can be reduced to below 2 pCi/l

“Radon Is A Serious National Health Problem”

- American Lung Association
- American Medical Association
- National Academy of Sciences
- National Council on Radiation Protection and Measurement
- U.S. Department of Health & Human Services
- World Health Organization

Lung Cancer Risk per 1000 People

Lifetime Avg.	Smoker	Non-Smoker
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	2

(Info from Citizen's and Home Buyers & Sellers Guides)

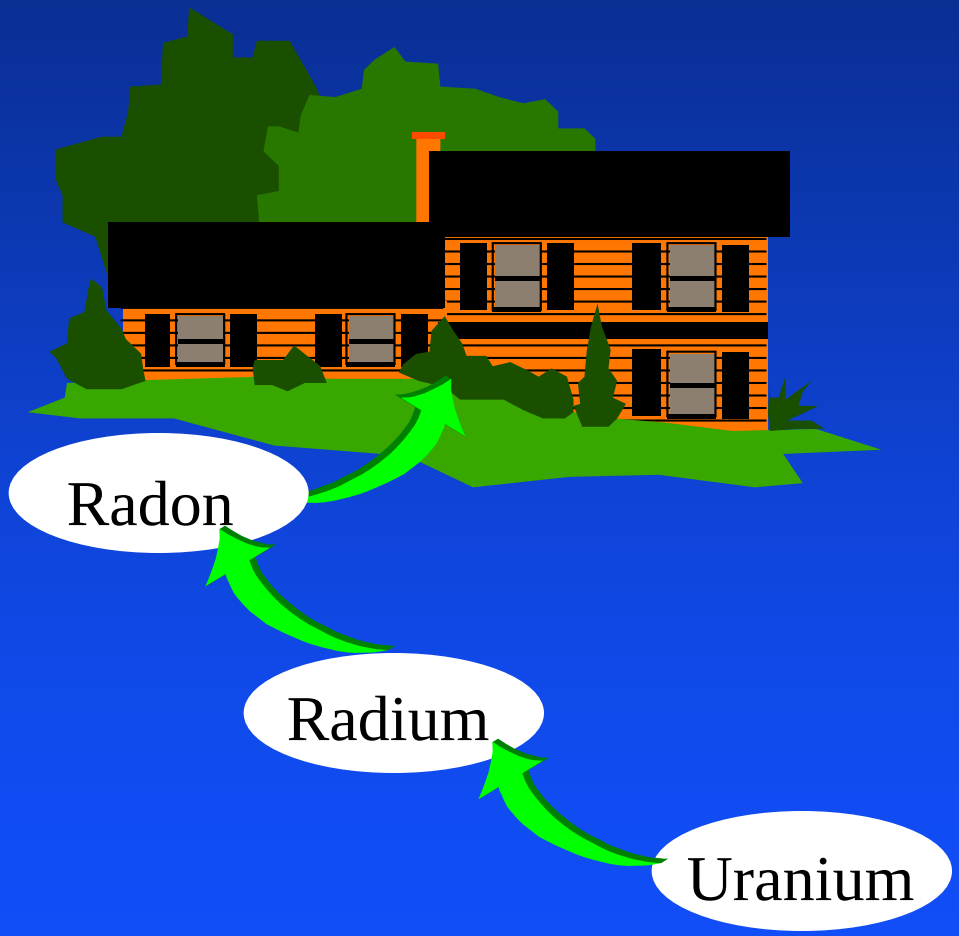
How Long Have We Known About Indoor Radon?

- 1900 – Radon was discovered by Friedrich Ernst Dorn who called it niton.
- 1920s & 30s – Radon was suspected as a cause of lung cancers; particular attention paid to underground miners.
- 1950s – Rn decay products were implicated as the causative agent

Stanley Watras at the Limerick nuclear power plant, 1984

- 1984 – Stanley Watras set off alarms at a Pennsylvania nuclear power plant still under construction. (His home tested at 2,700 picocuries/liter!)

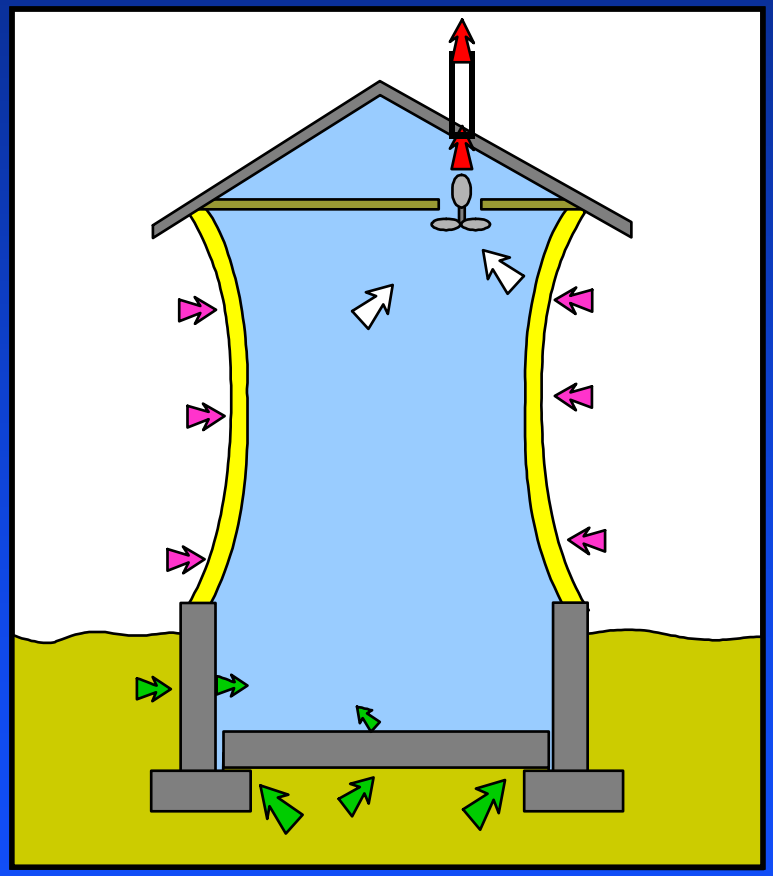
Radon Entry and Behavior



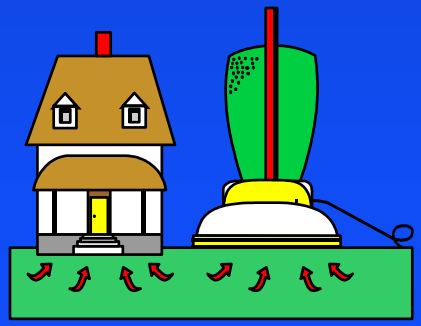
Indoor Radon Levels Depend On:

1. Radon Strength in the Soil
2. Soil Porosity
3. Building-to-Soil Pressure Difference
4. Building Ventilation Rate
5. Openings into the Soil (entry points)

Negative Pressures in Building Normally Cause Radon Entry

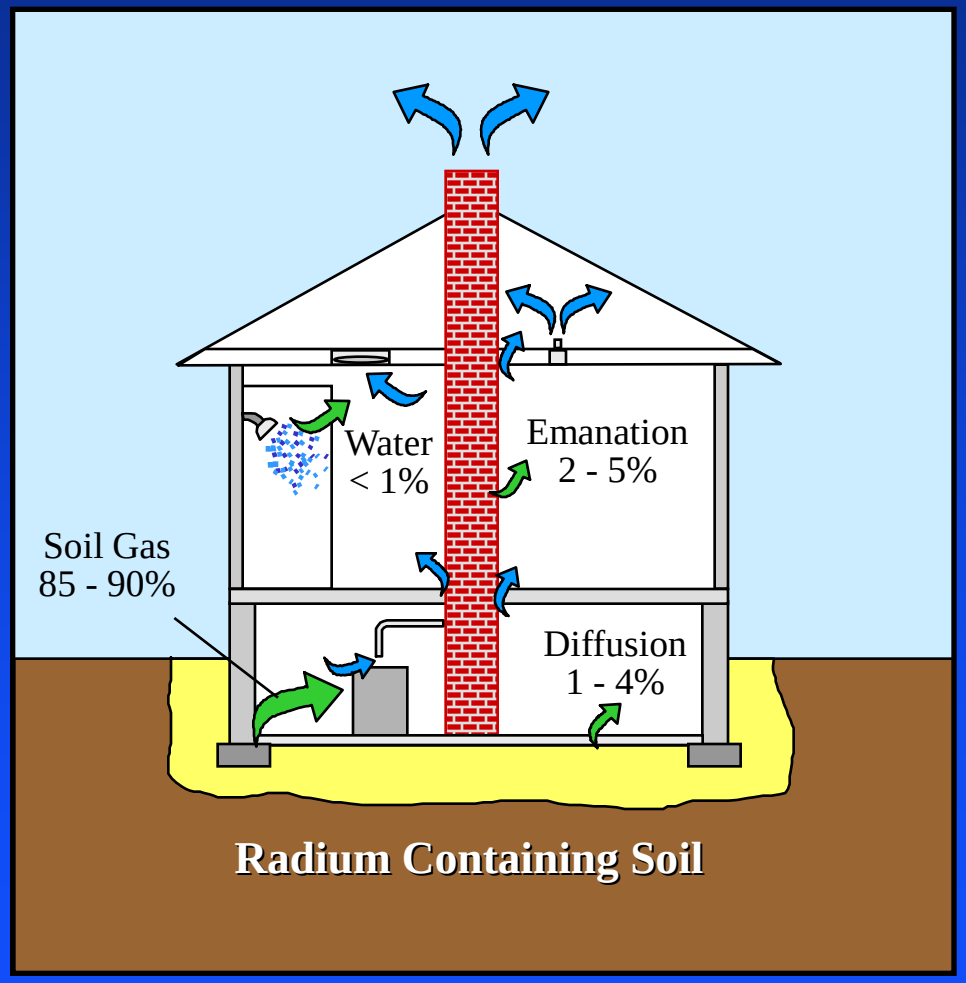


- The same factors that increase outside air infiltration can pull air from soil into home:
  - Stack effect
  - Exhaust systems
  - Weather



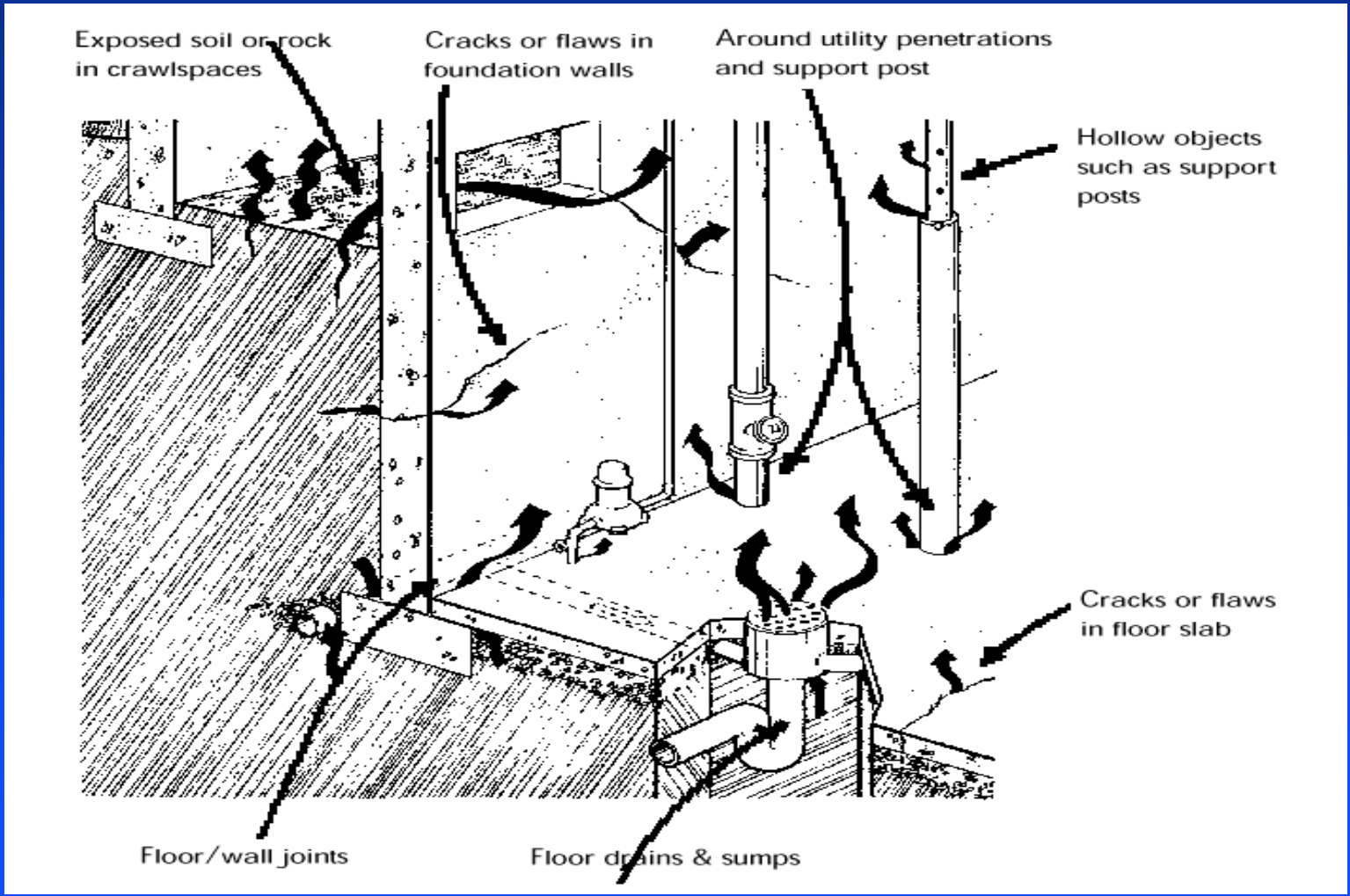
Houses are like soil vacuum cleaners...

How Does Radon Enter A Home?



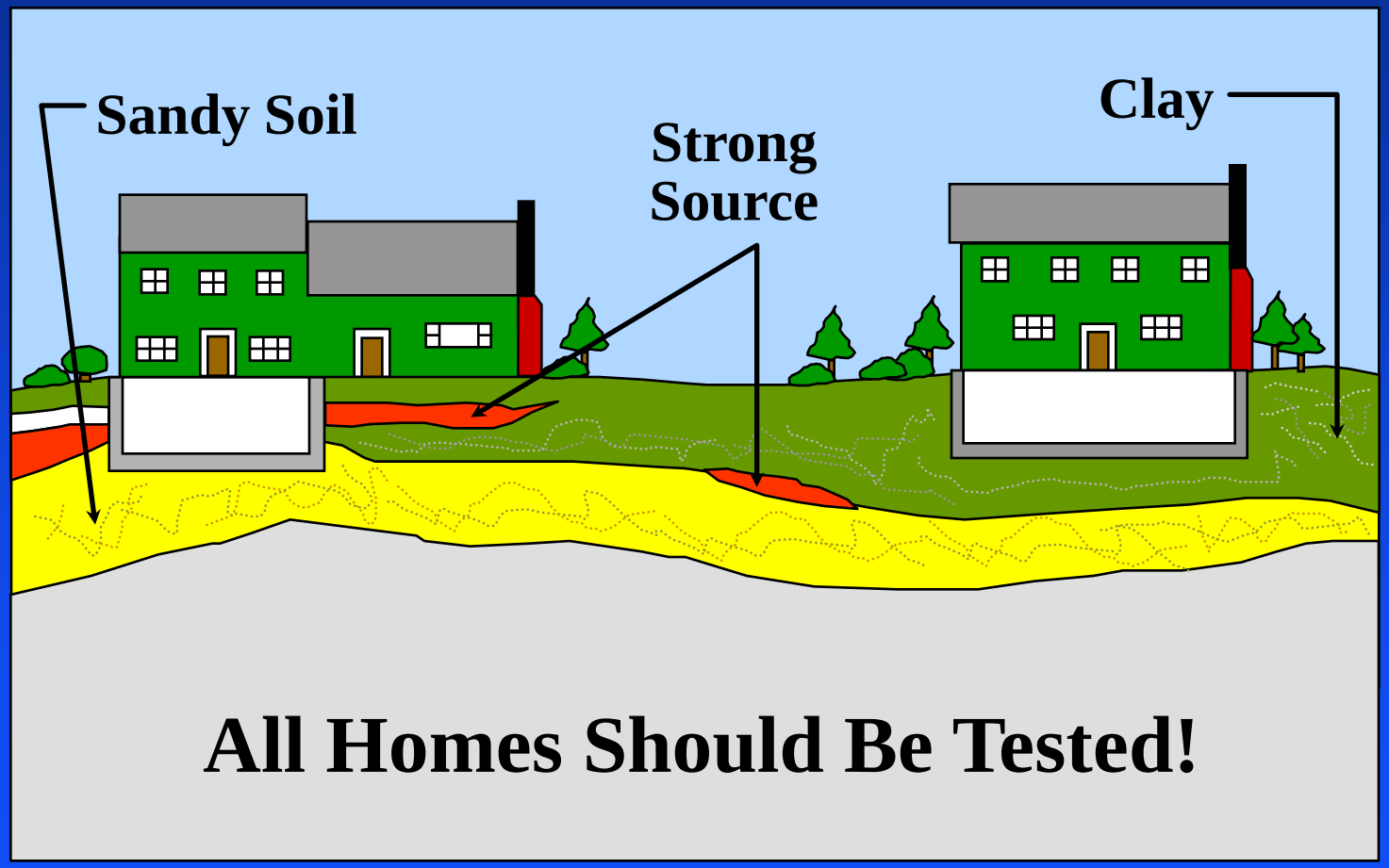
- Most radon comes from the soil and enters through openings in the foundation floor or walls
- Smaller concentrations can come from:
  - Emanation from building materials
  - Diffusion through concrete
  - Water supply

How Radon Enters Your Home

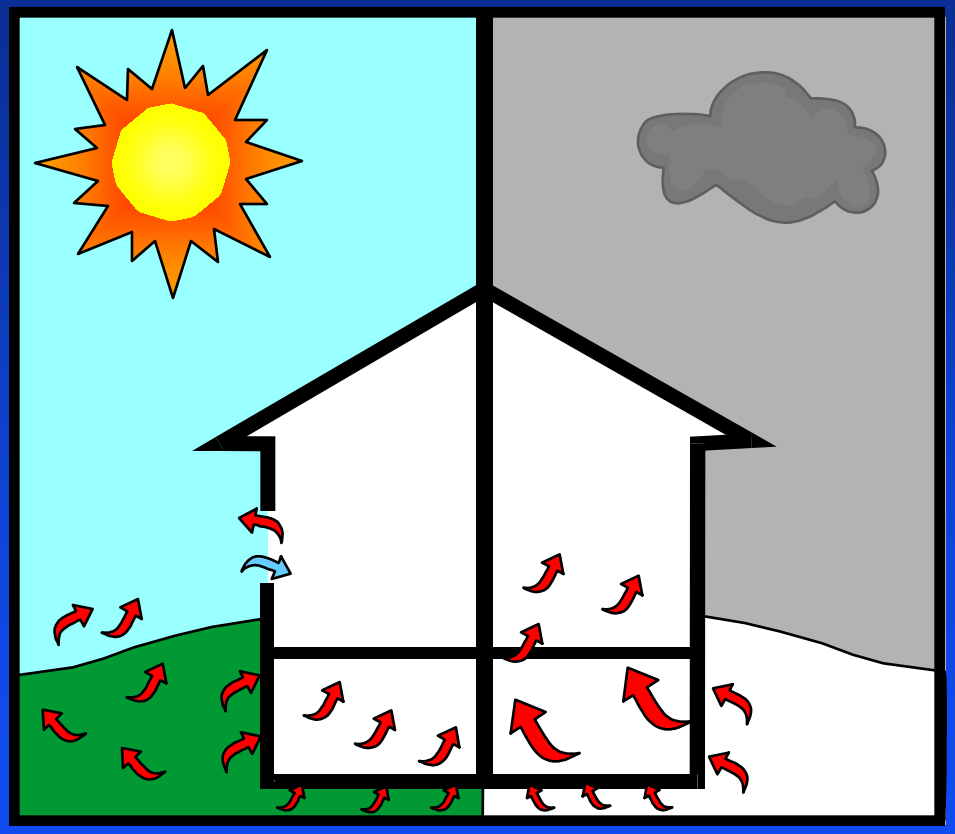


Some Entry Points May Be Hidden

Radon Entry Varies from Building to Building



Radon Levels Fluctuate

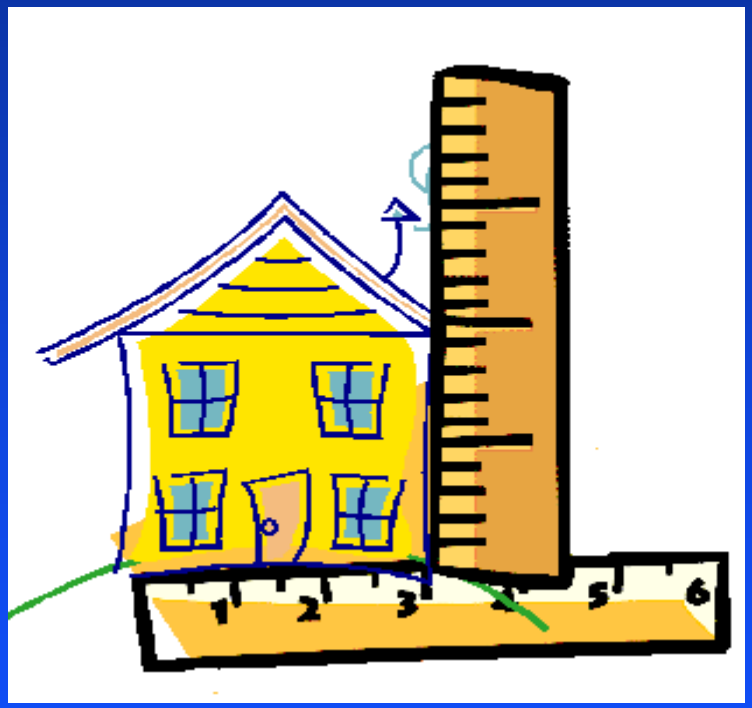


Summer
Open Windows

Winter
Closed Windows

- Radon levels fluctuate from morning to night, day to day, week to week, and season to season.
- Natural and mechanical ventilation can influence radon levels.
- Temperature, wind, barometric pressure and precipitation can influence radon levels.

Measuring Radon

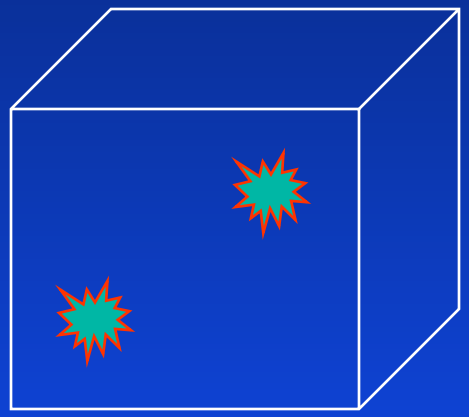


Radon Measurement Units

- Radon is measured in picocuries per liter of air - pCi/L
- The picocurie is named for French (Polish) physicist Marie Curie
  --A curie is a measure of radioactive decay
  --Pico is trillionth
  --Picocurie is a trillionth of a curie

Radon Measurement Units

- One picoCurie per liter (pCi/L) is 2.22 disintegrations per minute within a liter of air



- 4 pCi/L is equal to 8-9 atoms decaying every minute in every liter of air inside the house -- a 1,000 sq. ft. house at 4 pCi/L has 2 million decays per minute

Typical Radon Levels

- Radon in soil air ranges from 20 to 100,000 pCi/L
- Most soils range from 20 to 2000 pCi/L
- Outdoor air is 0.2 to 1 pCi/L
- Radon in indoor air ranges from less than 1 to 3,000 pCi/L
- Average indoor level is 1.3 pCi/L
- 4 pCi/L is EPA's guideline level

Testing Is Easy and Inexpensive

Charcoal canisters, vials, and bags

- Do-it-yourself screening measurement kits generally $10 or less from local health departments (a few charge more)
- $15 and up from hardware stores/home improvement centers ($25 is typical)
- Professional testers charge $50-$200

Other Devices

Alpha Track Detectors
(for long-term testing – 90-365 days)

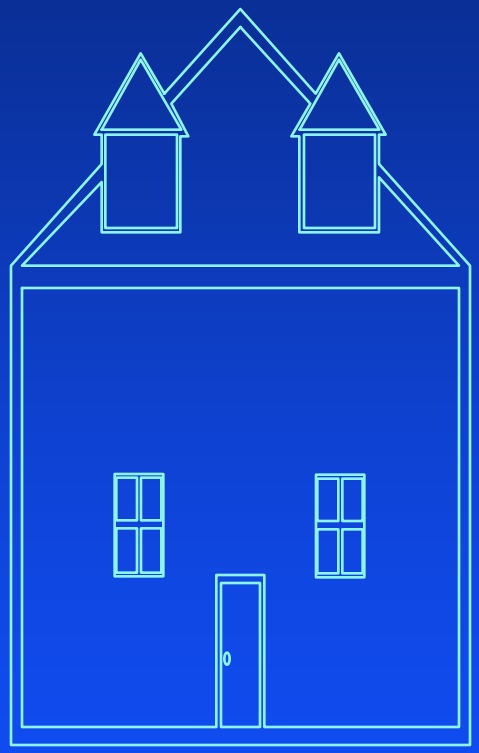
Electret Ion Chambers
(Electret Passive Environmental Radon Monitor – E-PERM – for short or long tests; available to individuals but generally used by professional testers)

Continuous Radon Monitor
(generally for short tests; used by professionals and **most often for real estate transactions**)

Screening Measurements
(Short-term: 2 - 90 days)

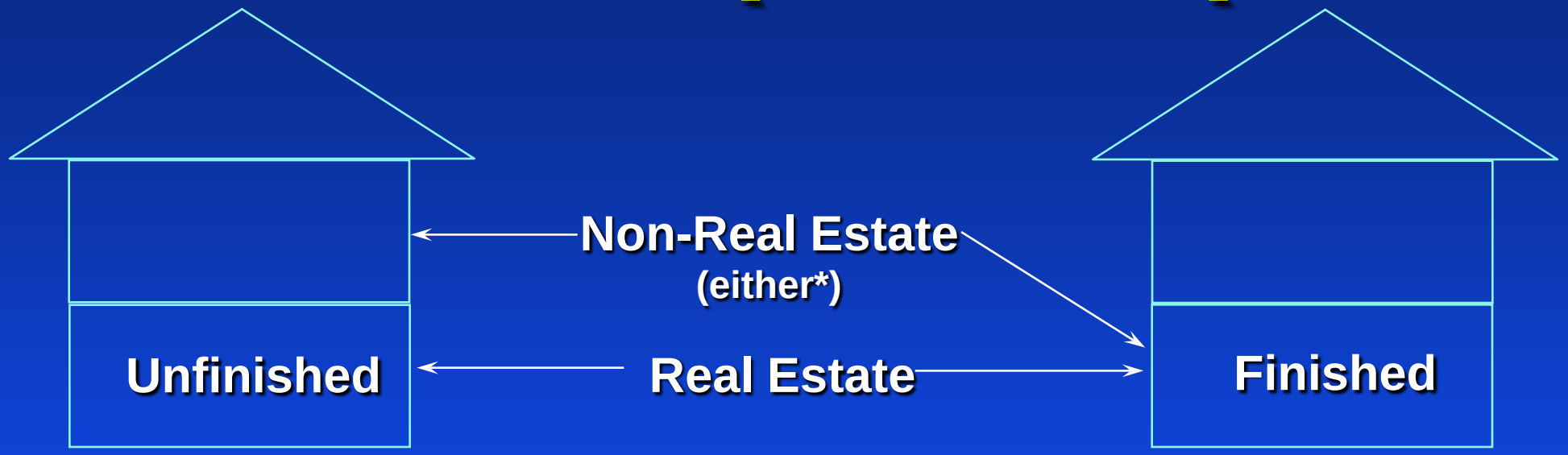
- All exterior doors and windows closed, except for normal entry and exit, prior to and during test.
- Place device in lowest livable level of home.
- Select a room where you do or could spend time.
- Avoid testing during severe storms or periods of high winds.

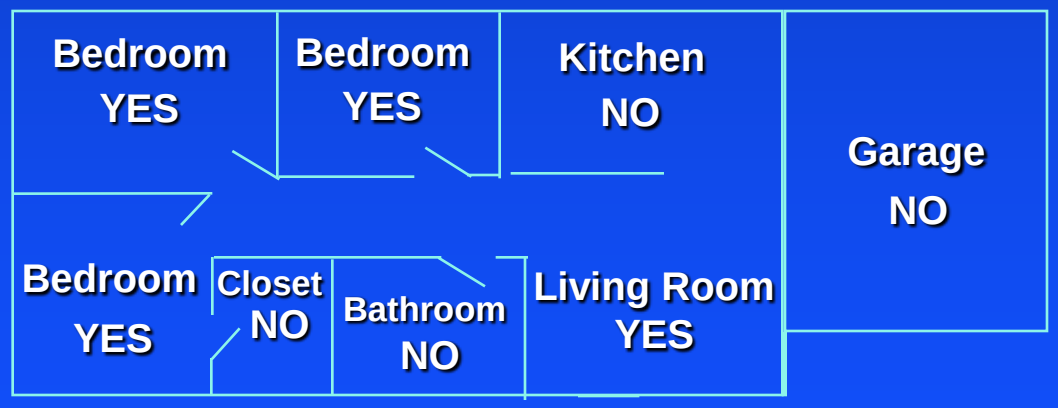
Closed House Conditions For All Short-Term Tests



- All exterior doors and windows closed, except for normal entry and exit.
- Internal-external air exchange systems off.
  - Total internal recycle is allowed.
  - Combustion or make-up air must not be closed.
- Permanent radon mitigation systems remain on.

Test Location Depends On Purpose



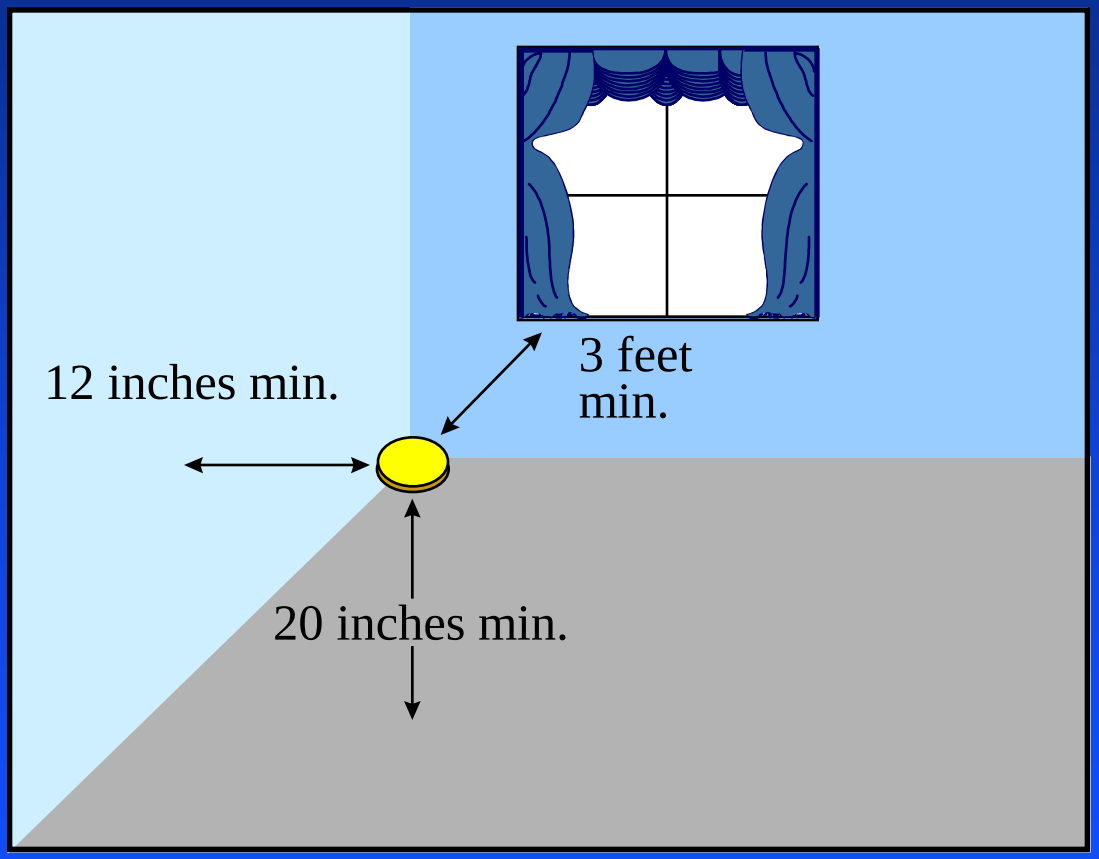


Choose an occupied room.

Keep away from drafts and moisture.

***Michigan DEQ recommends lowest livable level of home regardless of purpose.**

Test Placement Within A Room



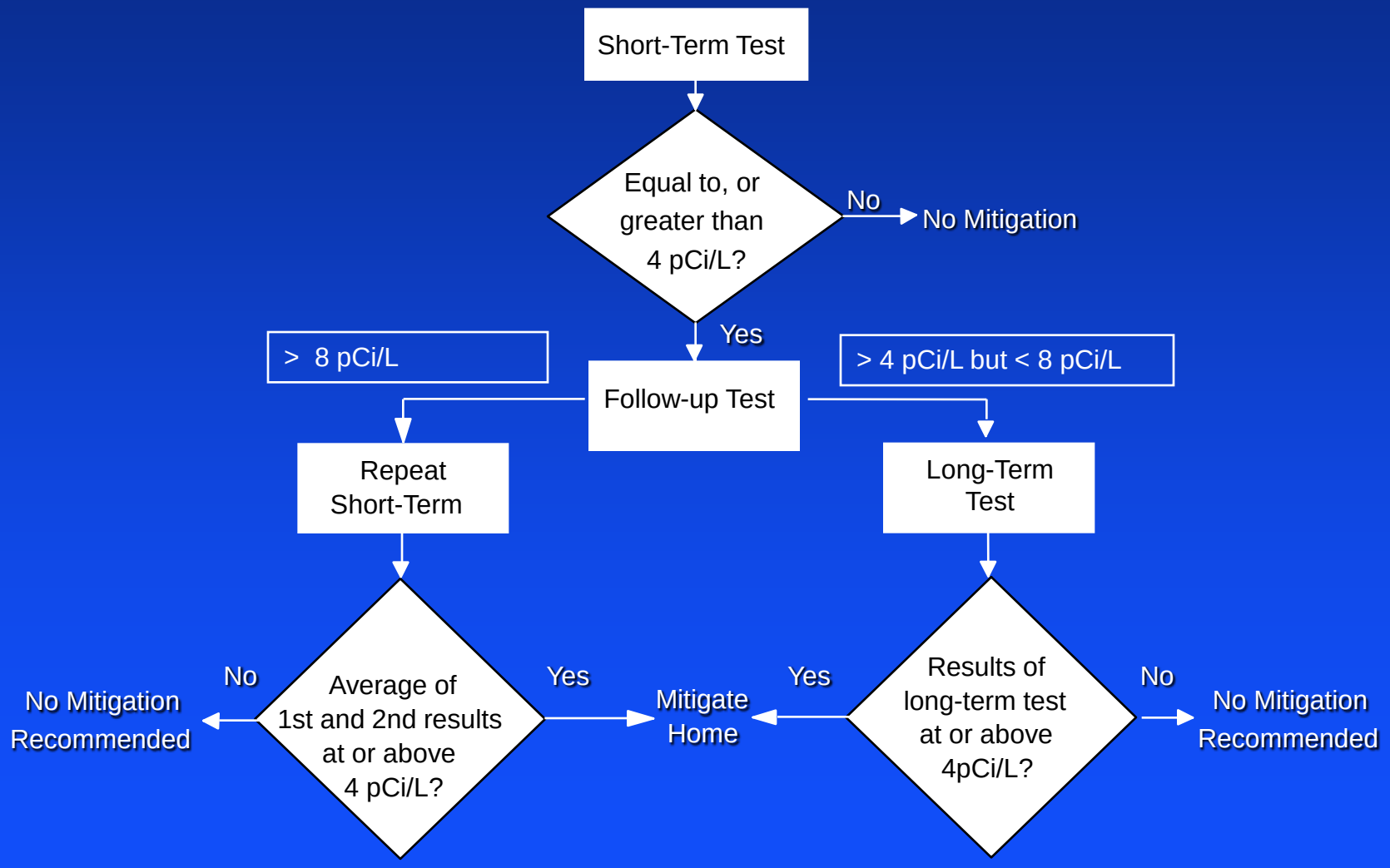
- At least 3 feet from windows, exterior doors, or other openings in foundation floor or walls.
- At least 20 inches above floor (preferably 3-6 feet – “breathing zone”).
- At least 12 inches from exterior walls and 4 inches from other objects.
- Away from air vents, drafts, or heat sources.
- Where it won’t be disturbed.

Long-Term Measurements
(91 days to 1 year)

Radon levels tend to be higher in winter and lower in summer, but risk actually comes from long-term exposure. A year-long test takes into account all changes in occupancy, as well as changes in wind, temperature, barometric pressure and precipitation. (When doing long-term tests, a full year is best!)

- Doors and windows opened or closed whenever you like. (Live the way you normally live!)
- Place device where original test was placed, as well as on any other levels you wish to test.
- Select a room where you do or could spend time.
- READ and FOLLOW instructions!

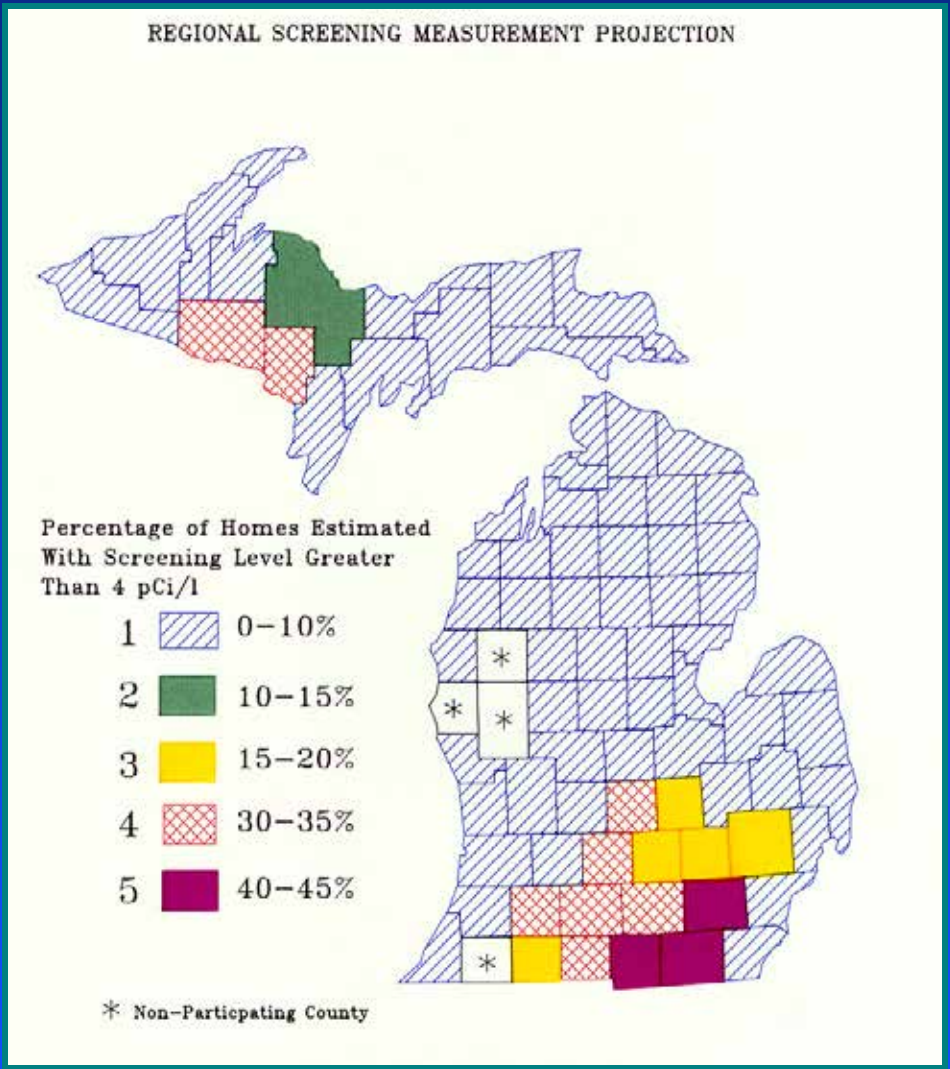
Interpreting Radon Results



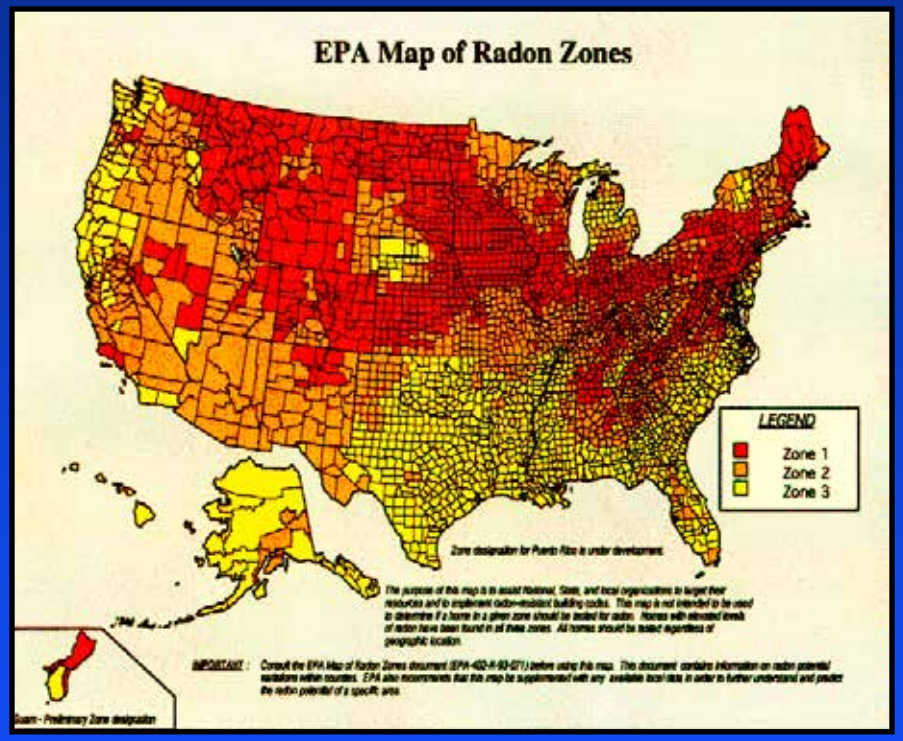
And The Survey Says...

MDPH worked with local health departments to conduct statewide residential radon survey in 1987-88:

- Tested more than 2,000 randomly selected homes
- 12% projected to have elevated indoor radon levels
- In some counties, more than 40% of homes could have a problem



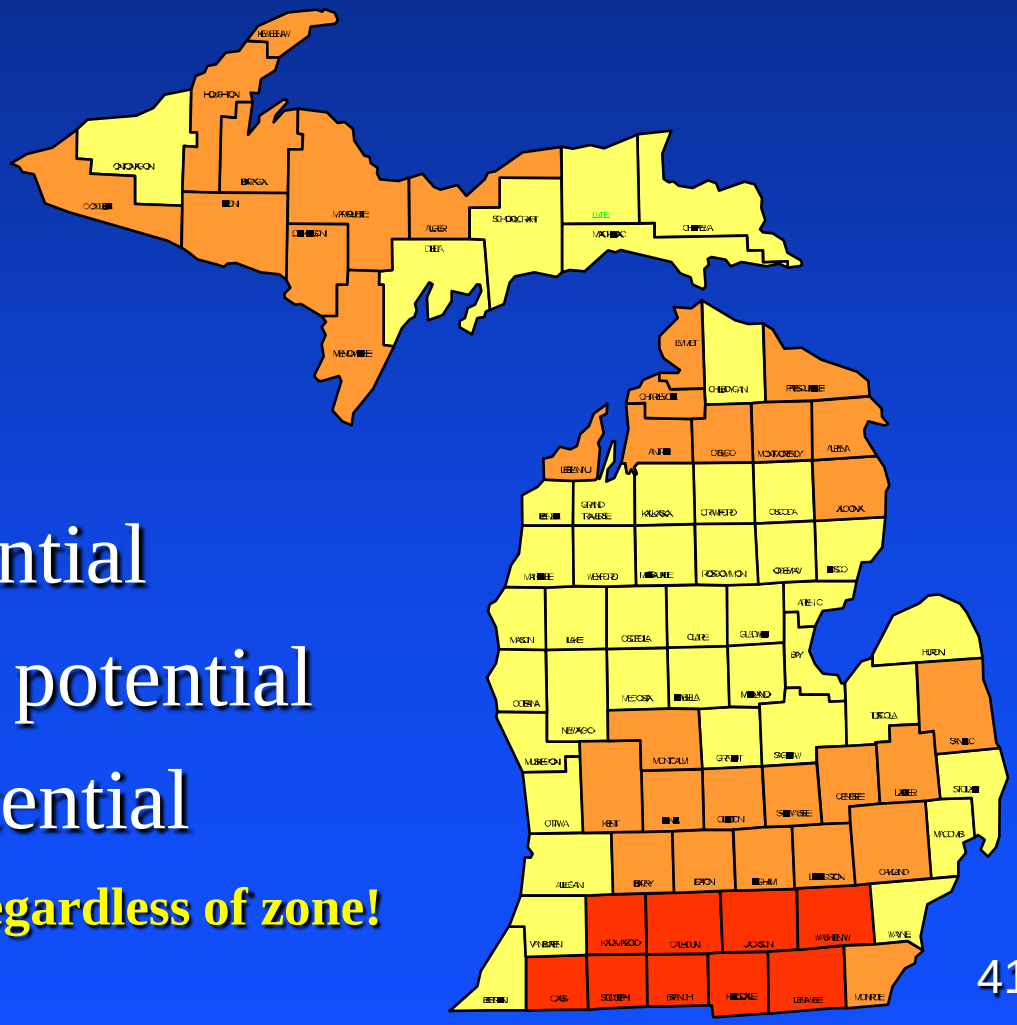
Map of Radon Zones By County



Map generated in 1993

- More than 3100 counties in the U.S.
- Zone designations based on indoor radon measurements, geology, aerial radioactivity, soil parameters, and foundation type.
- Expected short term Rn (pCi/L):
  - Zone 1: > 4.0
  - Zone 2: > 2 < 4.0
  - Zone 3: < 2.0

Michigan Radon Potential By County (1993)



Zone 1: high potential

Zone 2: moderate potential

Zone 3: lower potential

NOTE: All homes should be tested, regardless of zone!

What If My House Has...?

You cannot predict radon levels based on:

- Heating System
- Foundation Type
- Age of Structure
- Air-tightness
- Style of House
- Presence of Sumps, Cracks or Other Features

The Only Way To Know Is to TEST!

Real Estate Disclosure

- Michigan Sellers Disclosure Act, requires sellers to report knowledge of radon problems in the home being sold.
- Home purchasers are encouraged to test for radon as part of the home inspection prior to purchase.

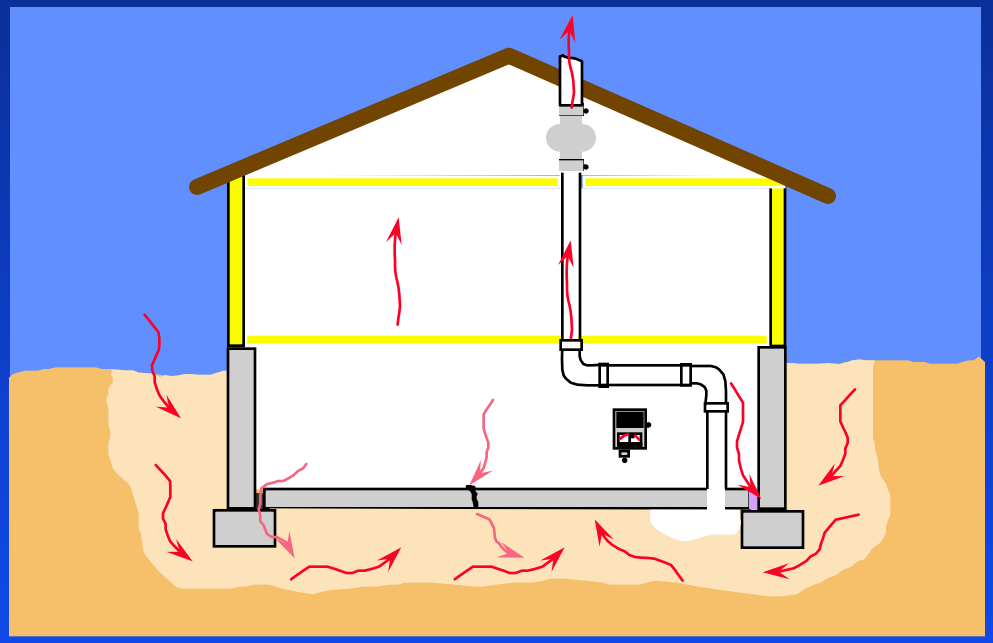
Radon Mitigation Overview

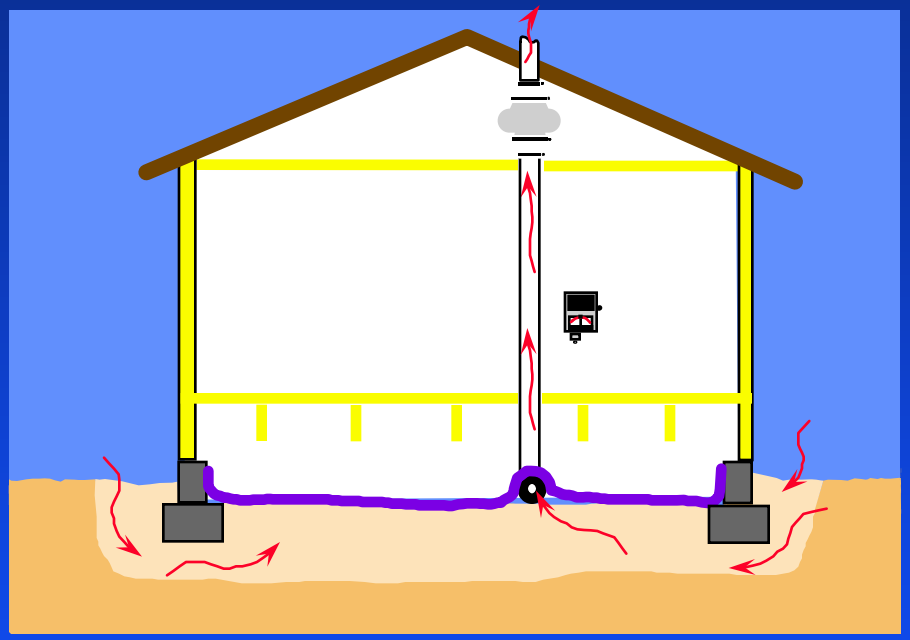
So, the home has an elevated radon level.
Now what?

Radon Mitigation

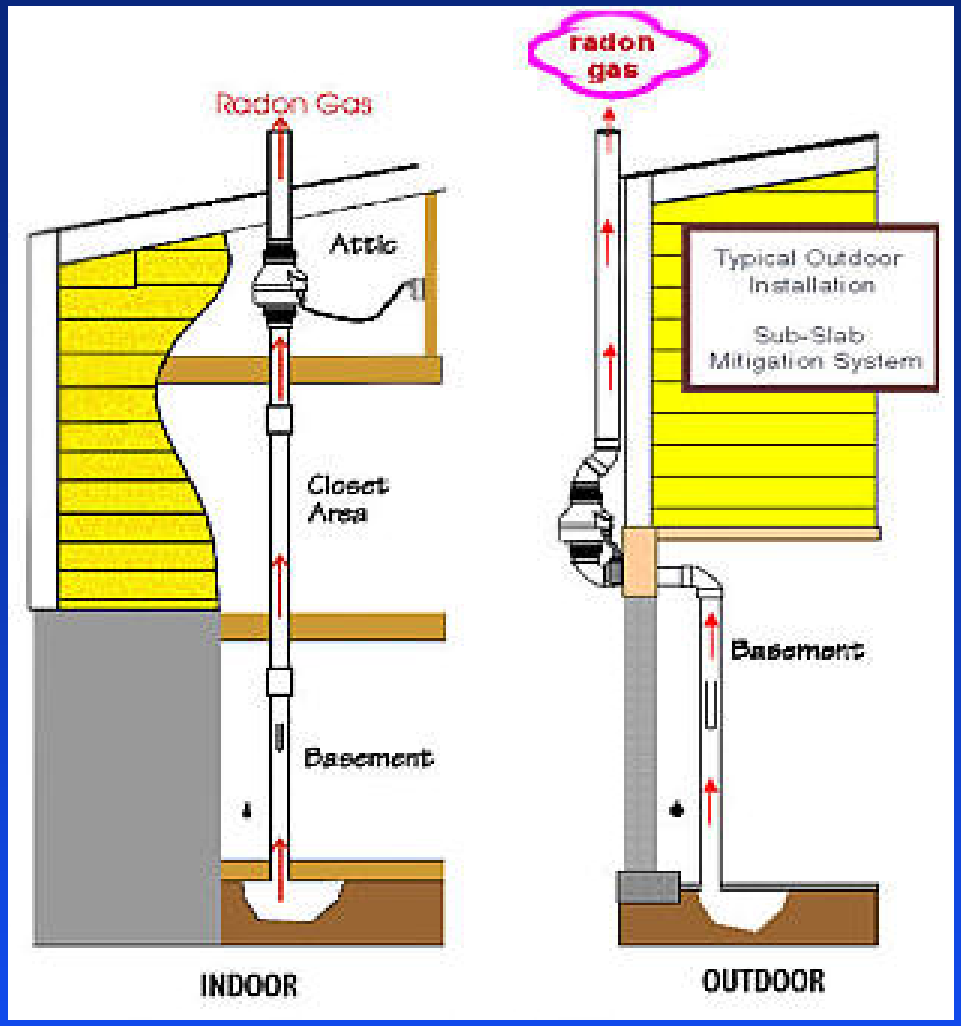
- Active Soil Depressurization (ASD) is the most common approach.
  - Employs a method for creating a vacuum beneath the foundation greater in strength than the vacuum applied to the soil by the building.
  - Almost all systems can be installed in a day or less by a qualified contractor.
  - The repairs take 24 hours to take effect before retesting can occur.
- Caulking and Sealing is not a stand-alone technique.
- Ventilation approaches have proven more costly and less effective.

Fixing A Home With A Radon Concern





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.



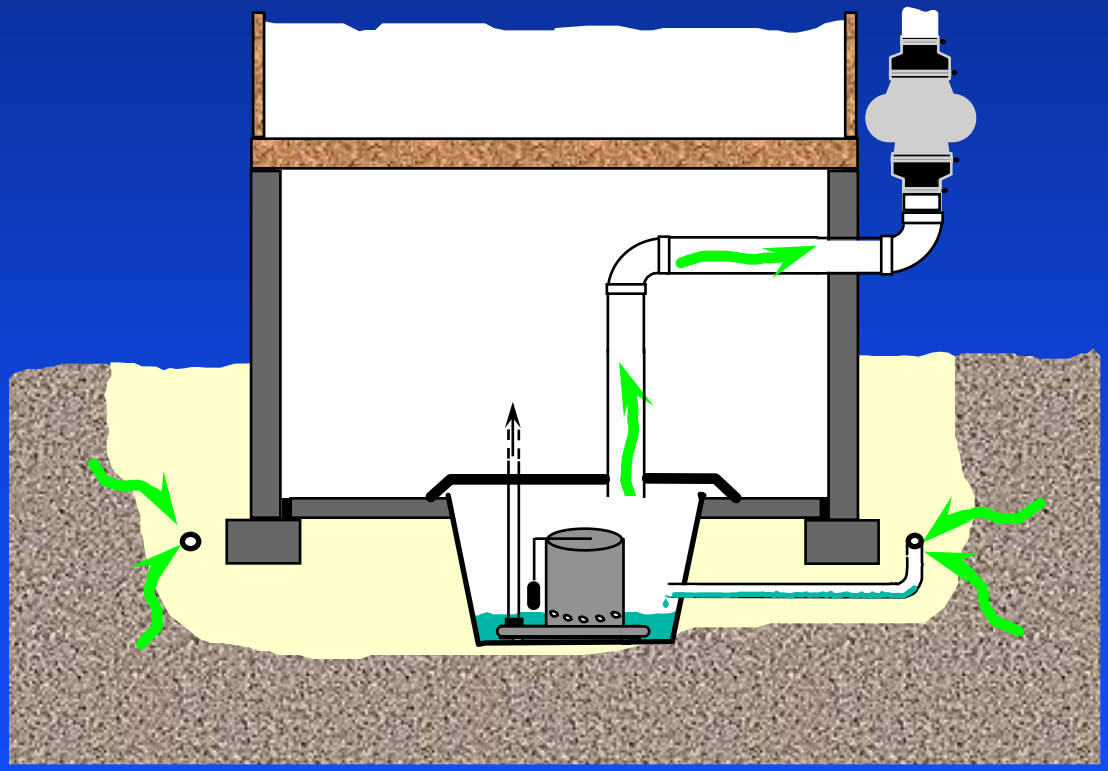
Indoor Fan System

Outdoor Fan System

Suction Point For Slabs and Basements

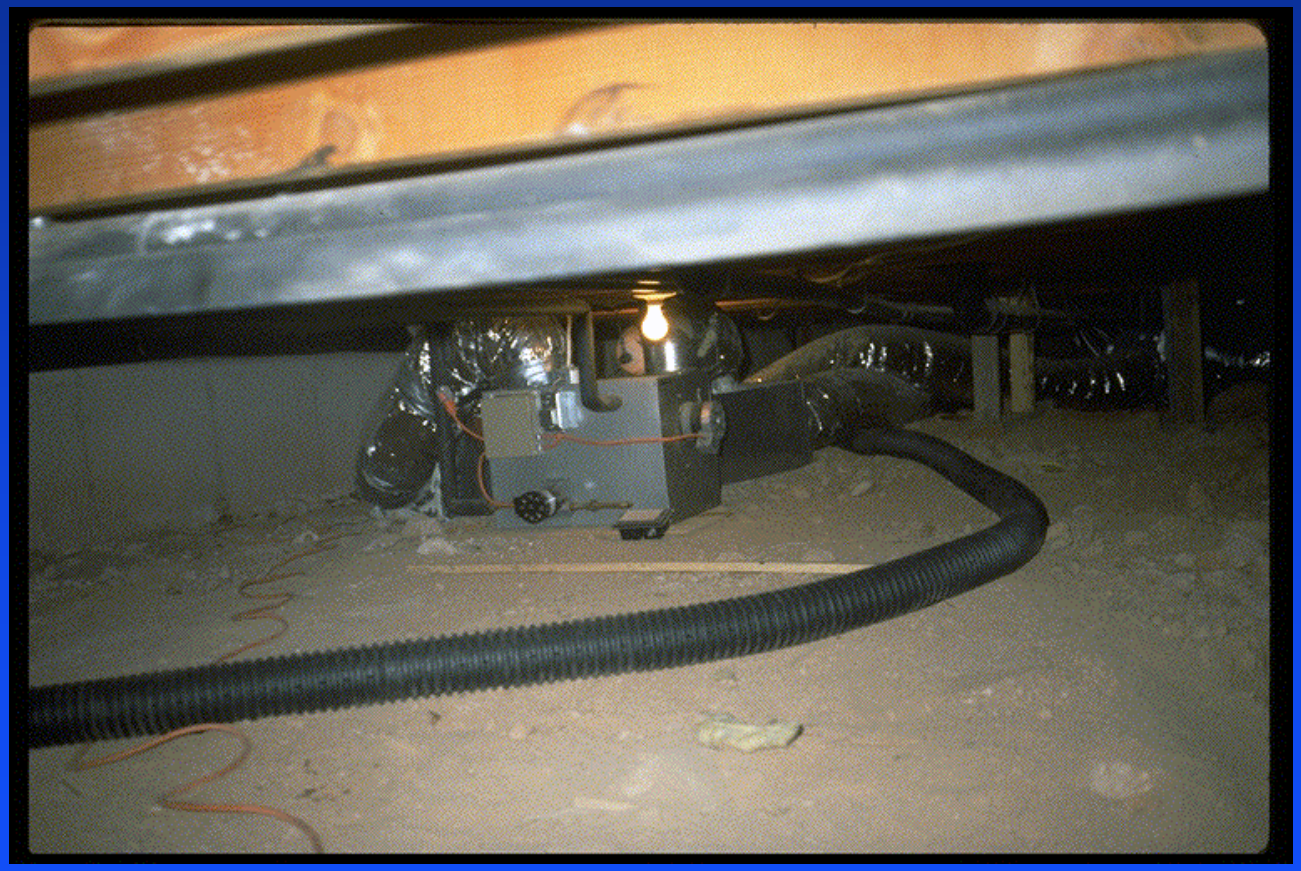
- Hole cut through slab.
- Pit dug out.
- PVC pipe connected to hole.
- Pipe routed to fan.
- May require more than one suction point.
- Pipe sloped to allow condensate drainage to soil

Radon Collection Via Drainage Systems (Sump Depressurization)



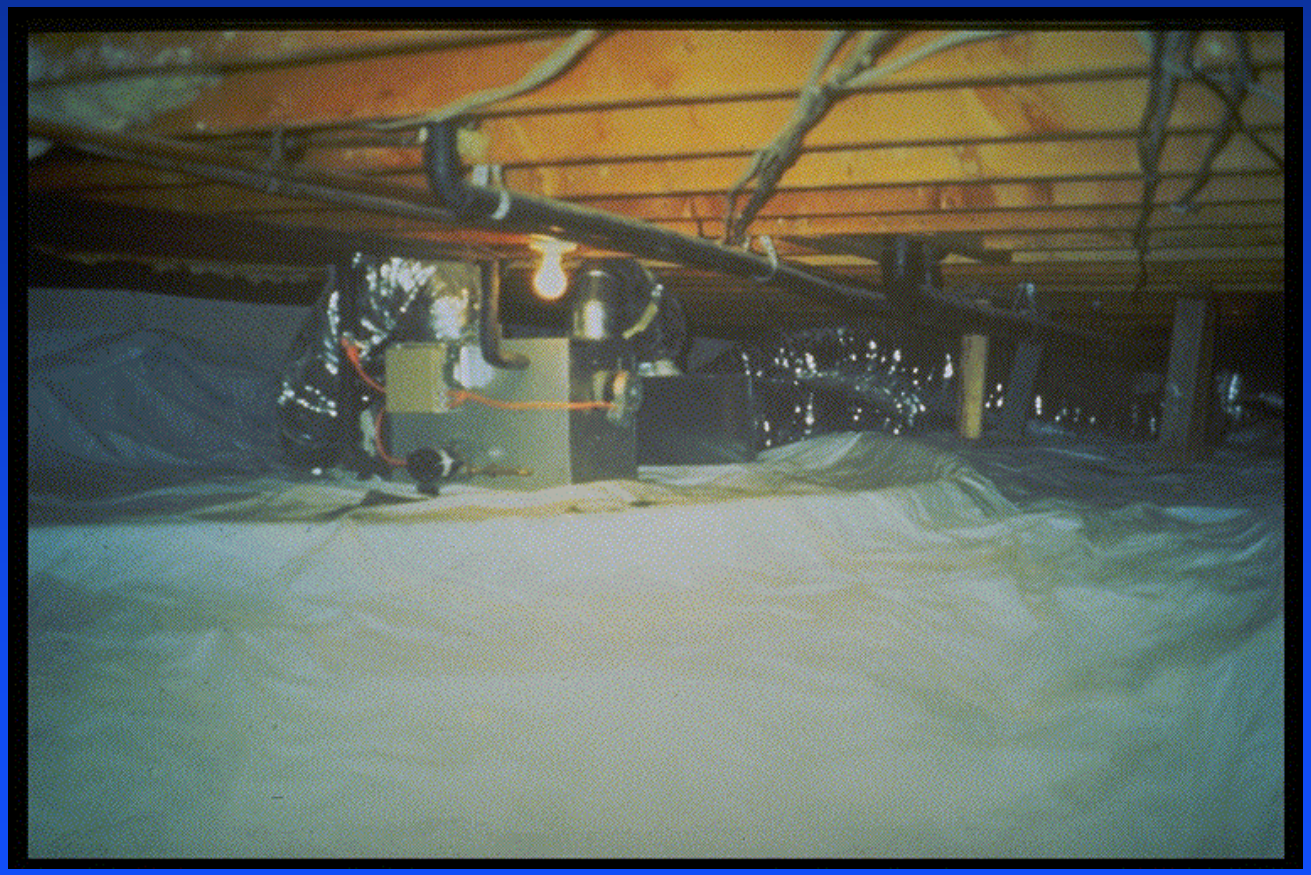
- Very cost-effective.
- Creates vacuum around building.
- Care taken to avoid impacting water collection capacity.

Fixing A Home On A Crawl Space



- Perforated pipe used to collect soil gas.
- Laid on floor of crawl space.

Plastic Is Spread Out In Crawl Space



- High density polyethylene laid on dirt.
- Edges and seams sealed.

Perforated Pipe Connected To Suction System

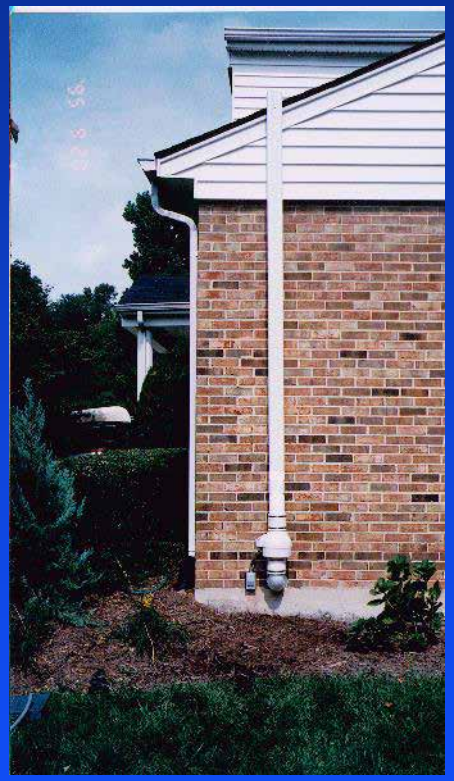
- Perforated pipe connected to solid Schedule 40 PVC pipe.
- Riser routed to fan.
- Pipe labeled.
- Plastic helps dry out crawl space and reduce mildew and odors.

Depressurization Fan

- Installed in attic, garage, or outside (not in basements, crawlspaces, or below grade)
- Quiet.
- Less than 90 watts.
- Expected life: 11 years.

System Discharges Away From Building Openings

- Discharge should be high to avoid radon entering building.
- No rain cap necessary.
- 1/4 inch bird screen optional.



Radon Exhaust Requirements

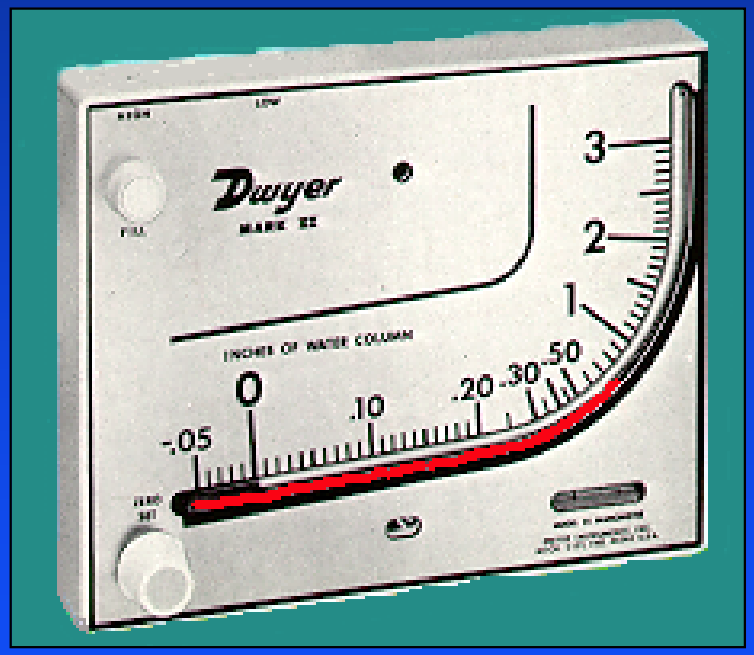
Must be:

- Minimum of 10 ft above ground
- Above the edge of the roof
- At least 2 feet above windows, doors or other openings that are within 10 feet horizontally
- At least 10 feet from openings into adjacent buildings

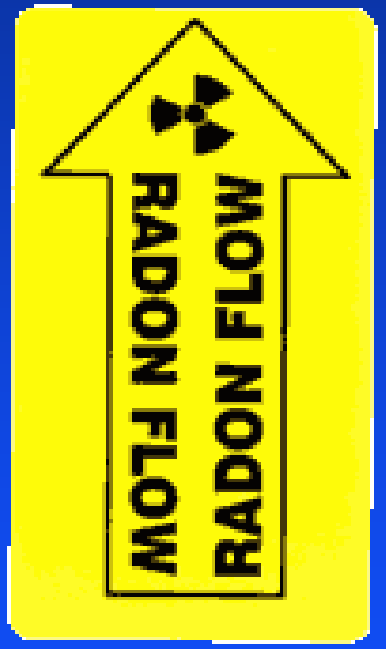
Discharge Point Locations

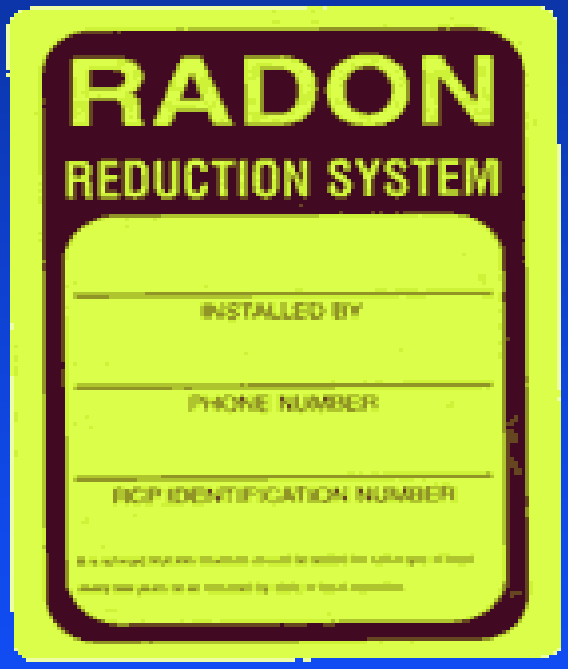
These systems will vent moisture from the soil! Exhaust away from building!

A System Performance Indicator Is Needed



System Also Needs To Be Labeled*





* Labels are needed on each floor where the system is visible.

Caulking Improves Performance

- Improves vacuum
- Reduces loss of interior air
- Polyurethane caulk
- Not a stand-alone technique

Post-Mitigation Testing

- Must wait at least 24 hours before starting a post mitigation radon test
- A short term test must be placed in the same location as the first test
- Must test system within 30 days
- A year-long measurement is also a good idea
- Must conduct radon testing every 2 years

Radon Proficiency Programs

- Currently, the state of Michigan doesn't license, certify, register, or otherwise regulate radon testers and mitigators .
- Recommend utilizing certified radon professionals
  - American Association of Radon Scientist and Technologist - www.nrpp.info/
  - National Radon Safety Board - www.nrsb.org

Resources for Home Buyers and Sellers

- Home Buyers and Sellers Guide to Radon
- Consumers Guide to Radon Reduction
- Dealing with Radon in Real Estate Transactions
- Building Radon Out

Need More Info?

- Outreach materials include general info, measurement, mitigation, real estate, and new construction
- More information:

  DEQ – 1-800-723-6646
  www.michigan.gov/radon

  EPA – 1-800-767-7236
  www.epa.gov/radon

Radon Program Contact Information

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