

# Radon Risks, Measurement and Mitigation



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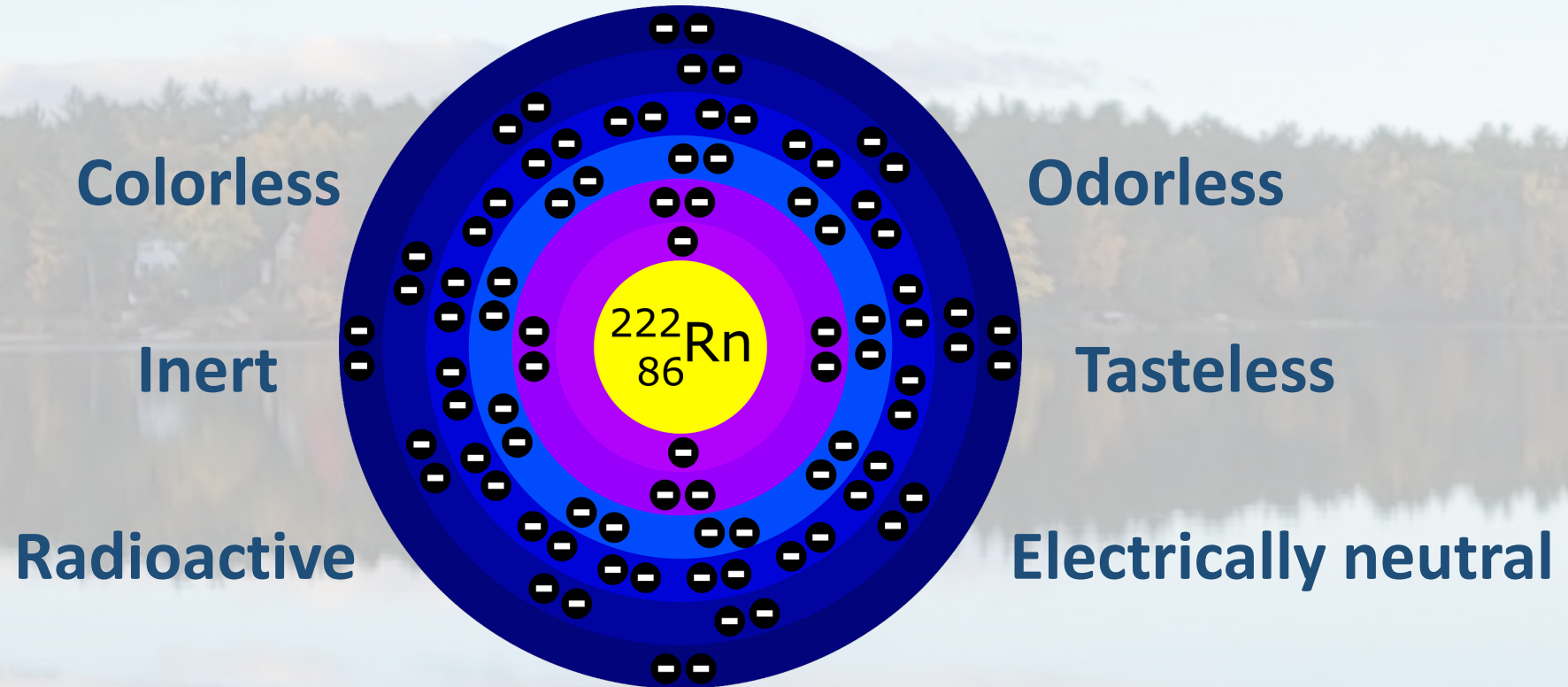
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**[www.srwnh.com](http://www.srwnh.com)**

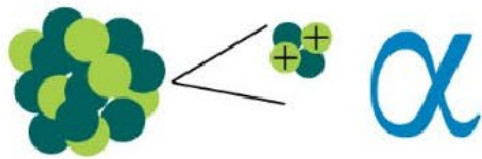
# What is Radon?

An element that is:



# What is Radon?

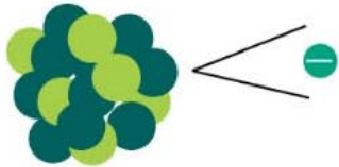
## Penetrating Powers of Ionizing Radiation



$\alpha$

### ALPHA Particles

Stopped by a sheet of paper and cannot penetrate the outer dead layer of skin



$\beta$

### BETA Particles

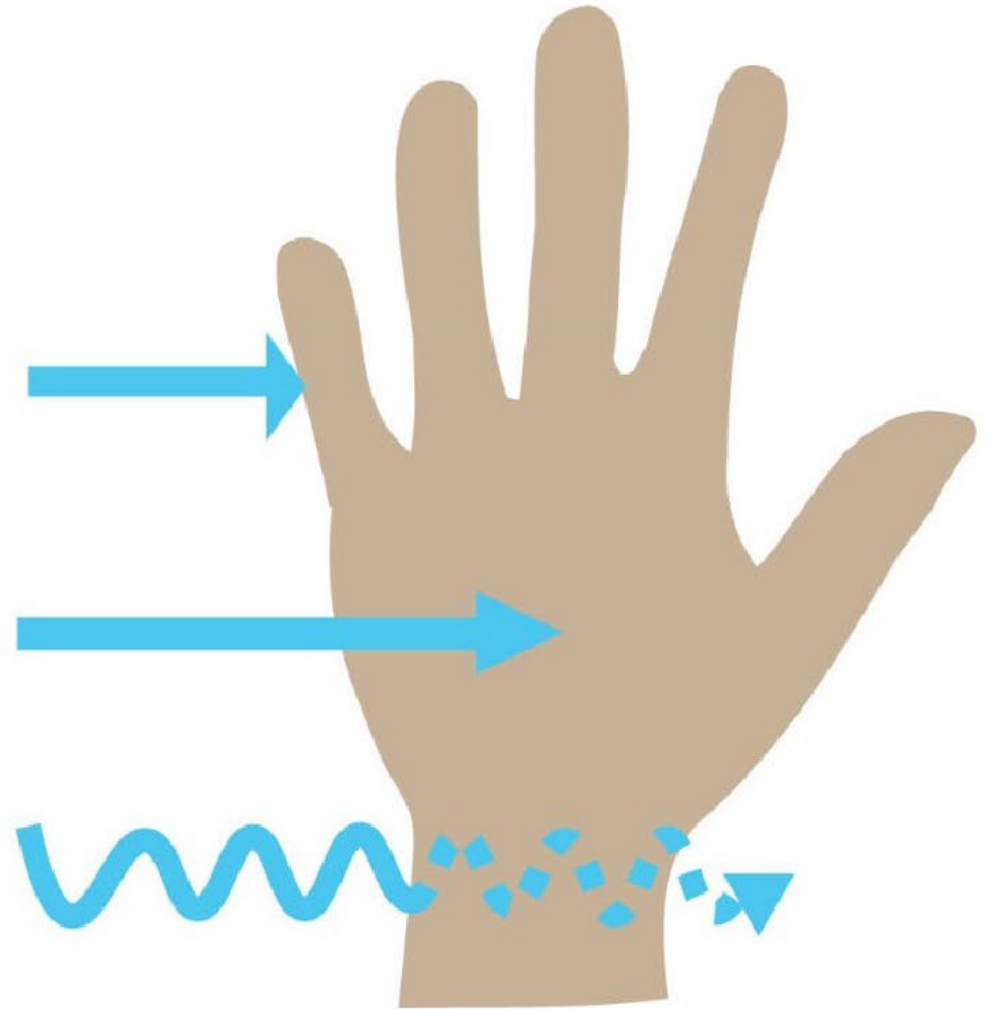
Stopped by a layer of clothing or a thin sheet of a substance, such as aluminum



$\gamma$

### GAMMA Rays and X-Rays

Stopped by several feet of concrete or a few inches of lead

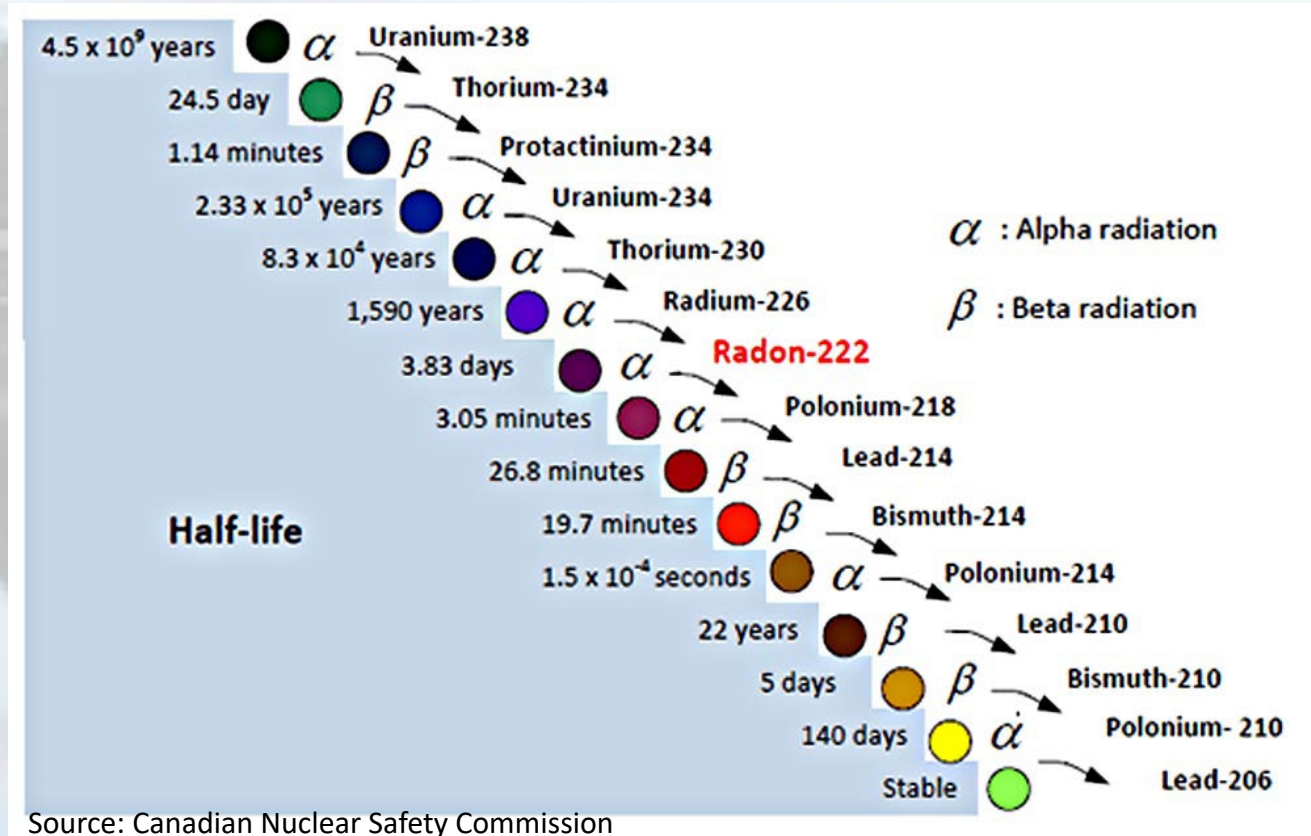


# What is Radon?

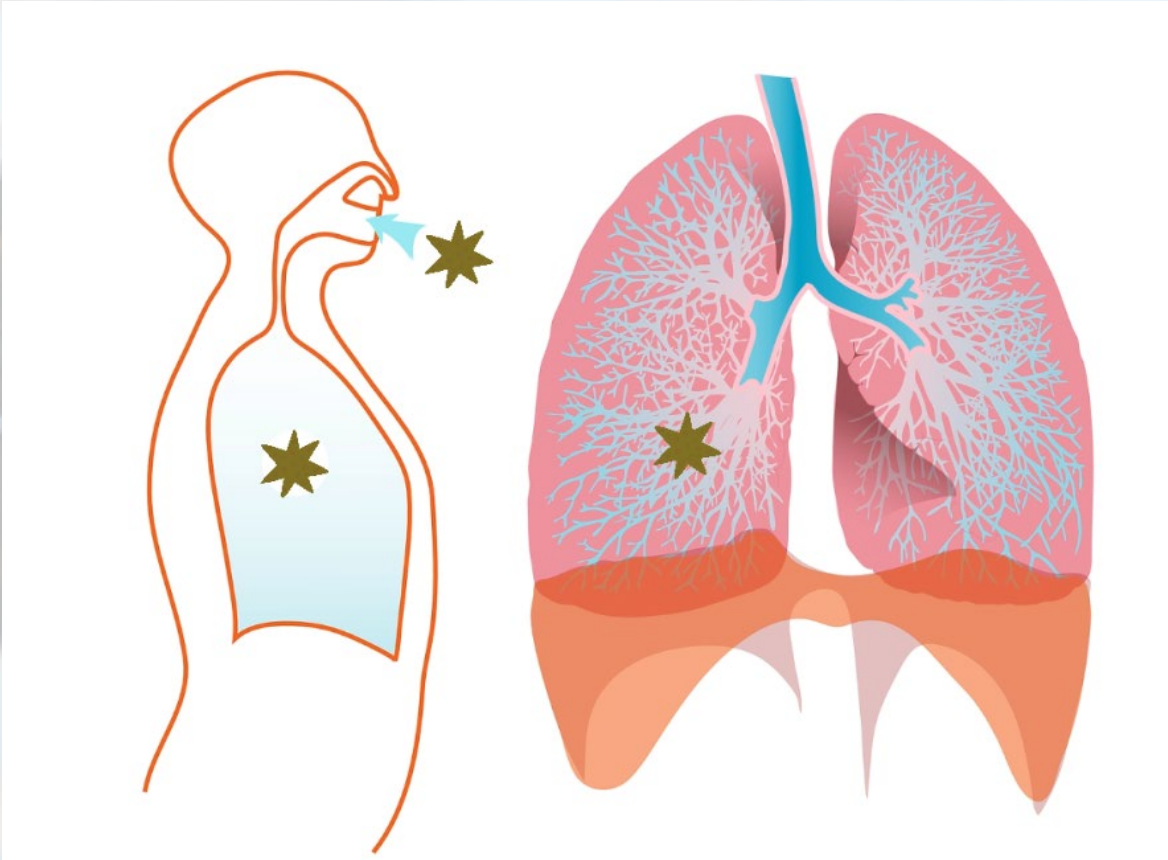
Naturally occurring radioactive element that is part of the uranium decay chain.

Immediate daughter product of radium decay.

The only element in the chain that is a gas.



# Health Effects?



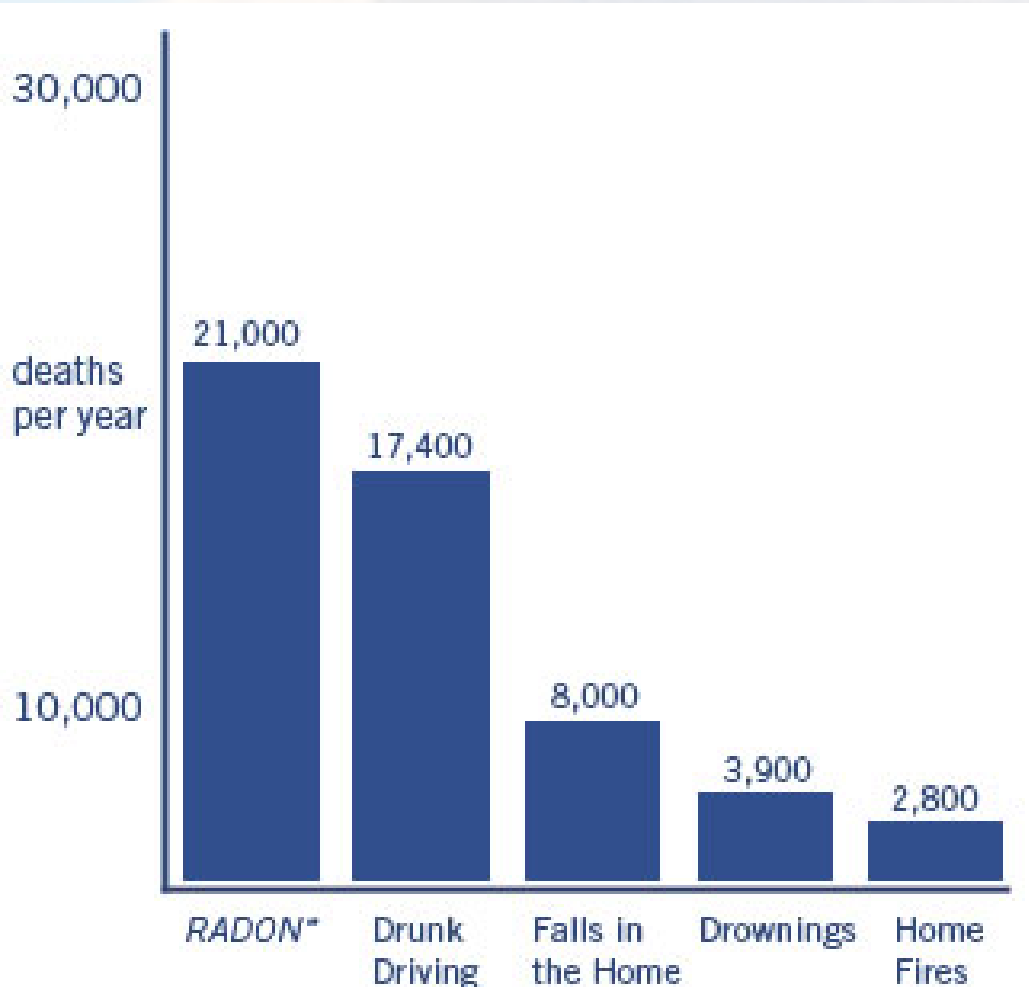
**Causes lung cancer**

**Damages cell, repairs itself  
(best outcome)**

**Kills cells (ok outcome)**

**Damages tumor suppressor genes  
(worst outcome)**

# Health Effects?



Source: EPA

**#2 cause of lung cancer after smoking**

**#1 environmental cause of any cancer**

**21,000 lung cancer deaths / year in United States**

# Health Effects?

Expressed in picocuries per liter (pCi/l) - a measure of radiation

EPA recommended action level is 4.0 pCi/l



4.0 pCi/l ~ 200 chest x-rays a year

4.0 pCi/l ~ 8 cigarettes a day



# Health Effects?

## 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.

## 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.

[EPA - Health Risks of Radon \(link\)](#)



# How are People Exposed?

**Outdoor air poses some risk**

**Reaches higher levels inside the home than outside the home**

**Doesn't accumulate but reaches general equilibrium**

# How Do You Know Your Radon Level?

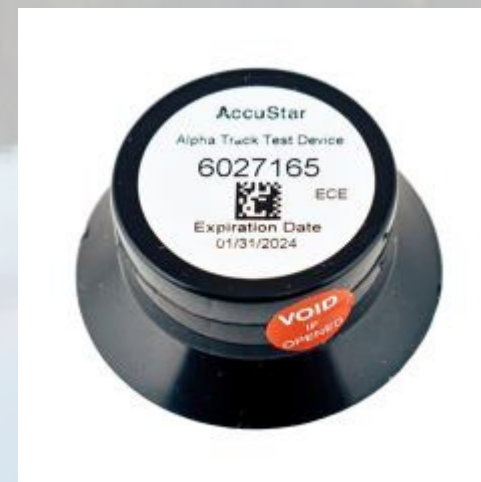
## Short term test

- Time sensitive (48 hours)
- Closed building conditions
- Measures potential
- Lowest livable level



## Long term test

- 3 months to a year
- Measures actual exposure
- No closed building conditions



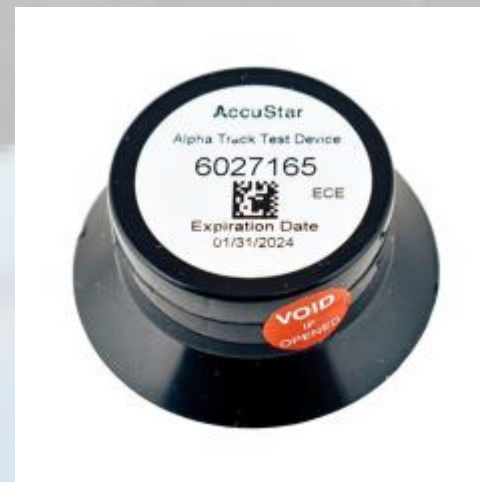
# How Do You Know Your Radon Level?

Single family residence  
Typically 1 location

Condominium townhouse  
Each unit

Multi-family building  
All ground contact units  
10% upper floors

Schools  
All rooms



# How Do You Know Your Radon Level?

Do it yourself

[NH DHHS - Test kits available](#) (link)



Home improvement stores

[Continuous monitor](#) (link)



# How Do You Know Your Radon Level?

Find a Certified Professional

[National Radon Proficiency Program](#) (link)

[National Radon Safety Board](#) (link)





CERTIFIED RADON PROFESSIONALS



Click for more info



Rochester, NH



(603) 330-3537



[Company Website](#)



[Contact](#)



**New Hampshire**

State Radon Office Contact

Lynne Clement

[lynne.m.clement@dhhs.nh.gov](mailto:lynne.m.clement@dhhs.nh.gov)

(603) 271-1708

[Radon Office Website](#)

[Interested in becoming a Member of AARST?](#)



**Todd Scheffer**  
**SRW Environmental Consulting, LLC**

**Total NRPP Training/Education Hours: 156**

- Multi-Family Measurement Certificate (MFM)
- Multi-Family Mitigation Certificate (MFMT)

**Certified as a Radon Measurement Professional**

- Certified by the National Radon Proficiency Program (NRPP)
- NRPP Certification **#107362-RMP**
- Certified since: December 11, 2013
- Certification Expires: February 29, 2024
- Certified to provide Analytical Services using the following approved devices:
  - \* AirThings Corentium Pro

**Certified as a Radon Mitigation Specialist**

- Certified by the National Radon Proficiency Program (NRPP)
- NRPP Certification **#107467-RMS**
- Certified since: February 26, 2014
- Certification Expires: February 29, 2024

**Other services provided**

- Consulting
- Member of the National Radon Speakers' Bureau

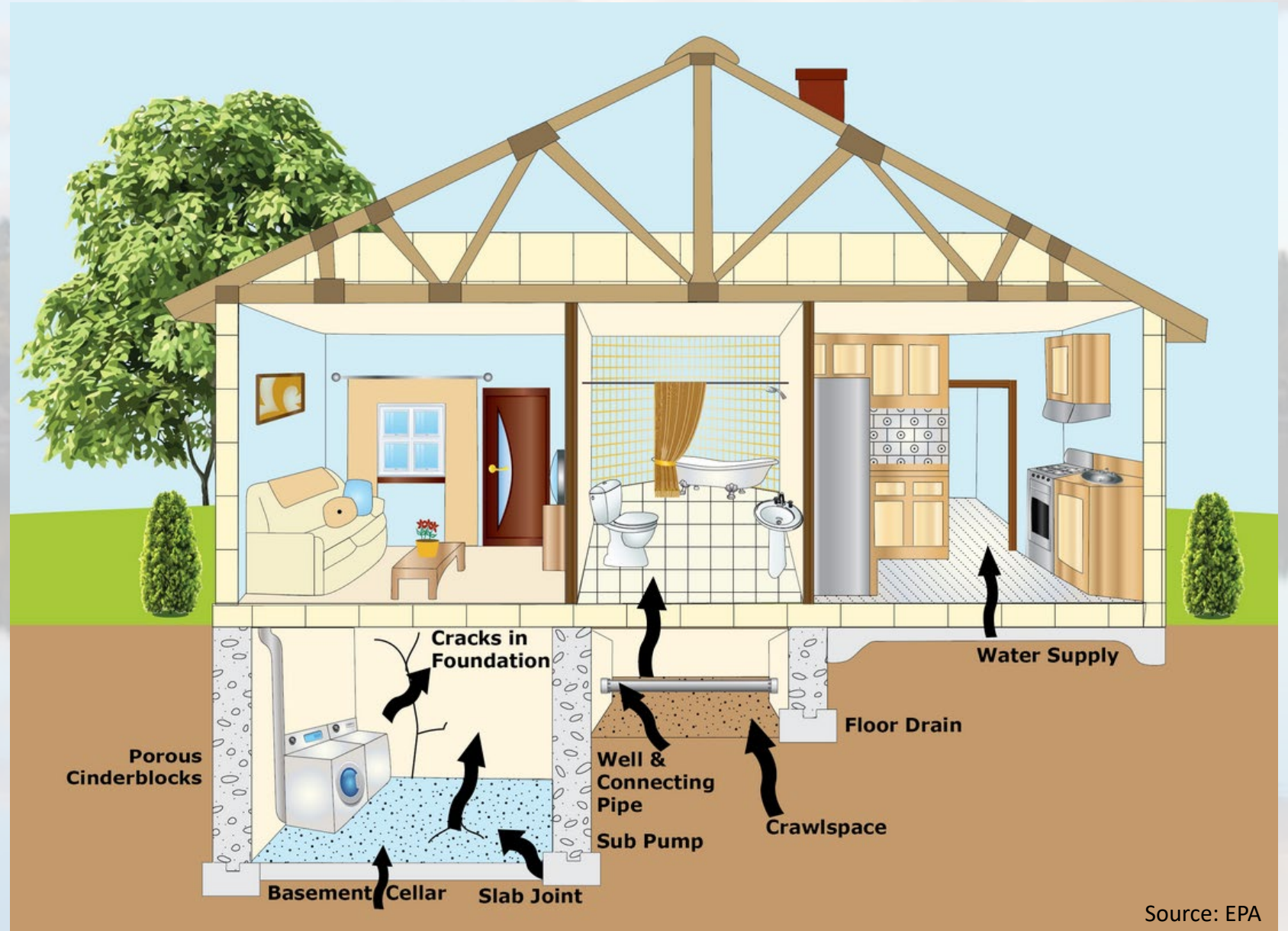
# How Does Radon Enter Buildings?

Sub-slab vapors

Groundwater

Building materials

Countertops

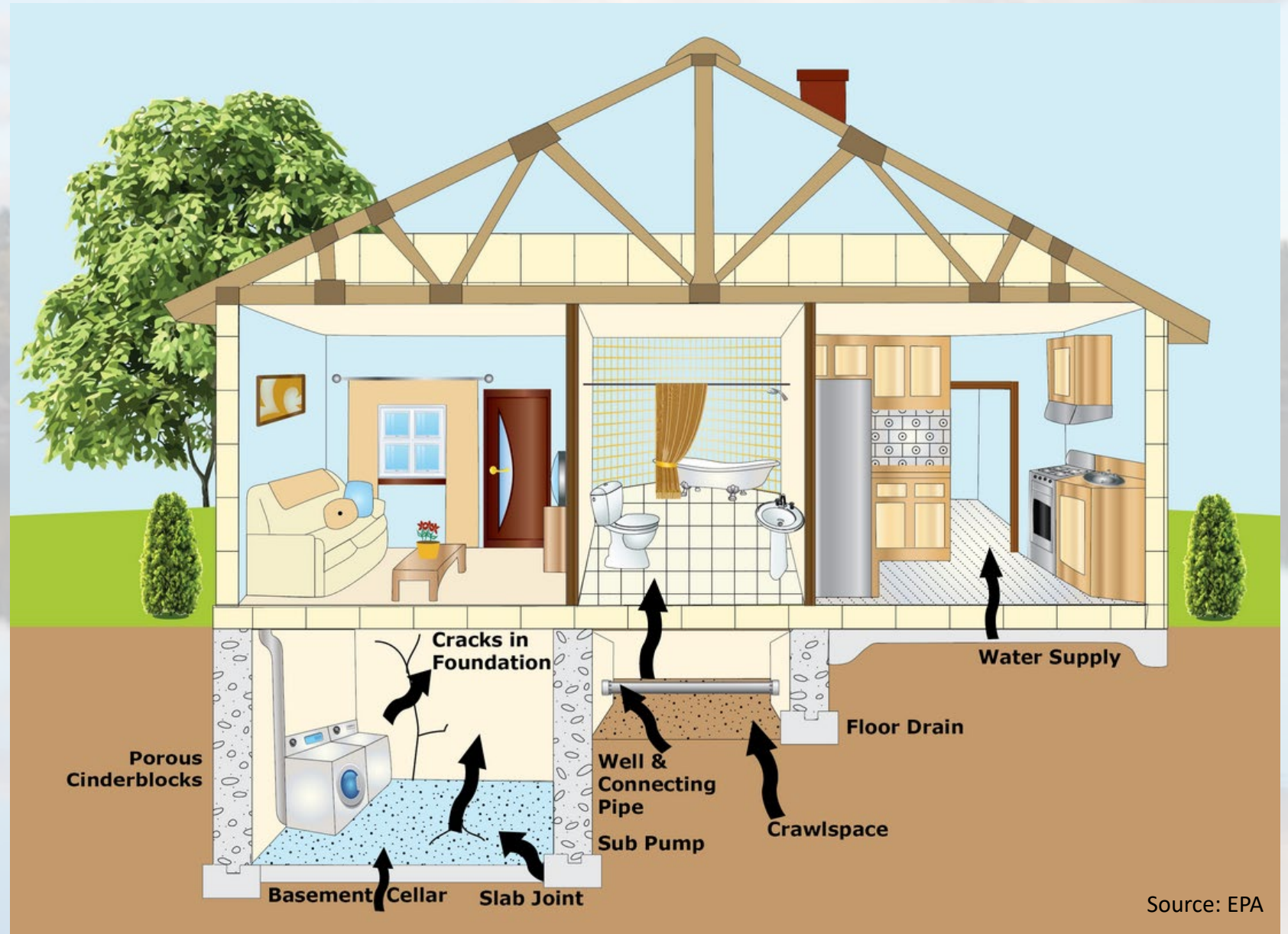


# How Does Radon Enter Buildings?

Radium/radon  
under slab

Entry pathway

Differential pressure





# Radon in Air Mitigation

## Main Mitigation Concepts

Dilute indoor radon levels

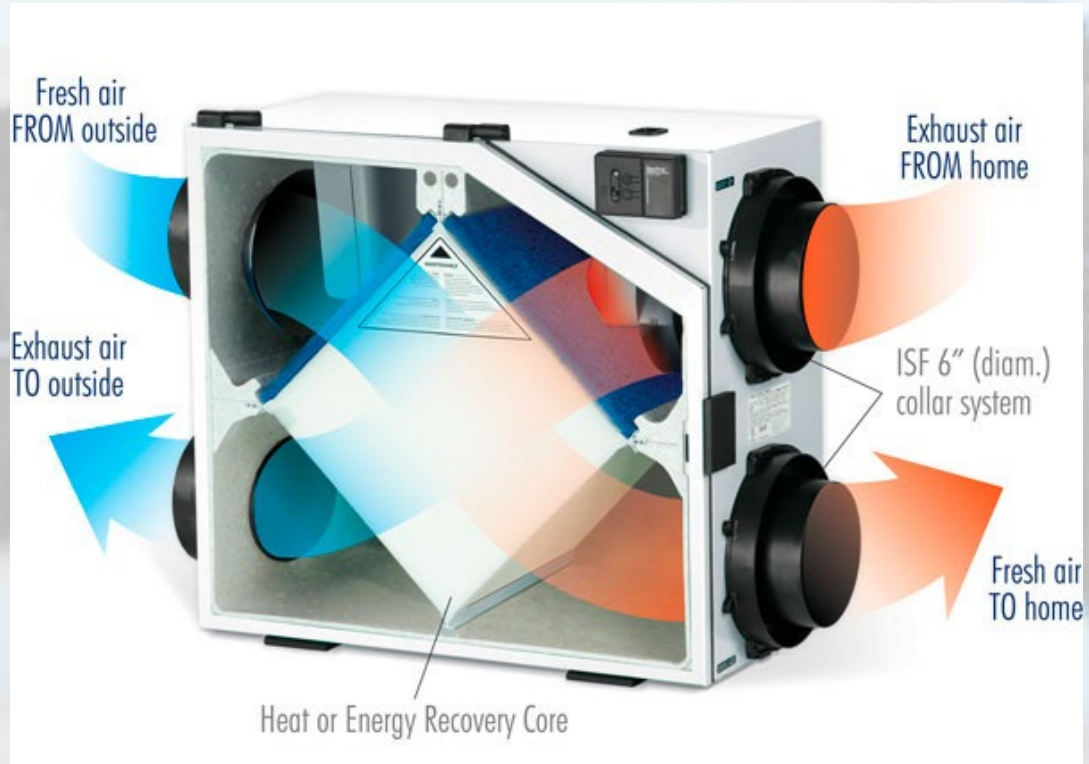
Prevent radon entry

Reverse pressure gradient

Seal openings

Large buildings can use both

# Energy Recovery and Heat Recovery Ventilators



Dilutes indoor air and recovers heat

Can alter pressure

More expensive

Can be effective where active depressurization is not easy

Increased indoor air quality

# Sub-slab Depressurization

**Passive – convection currents**

**Less expensive**

**No maintenance**

**Limited impact**

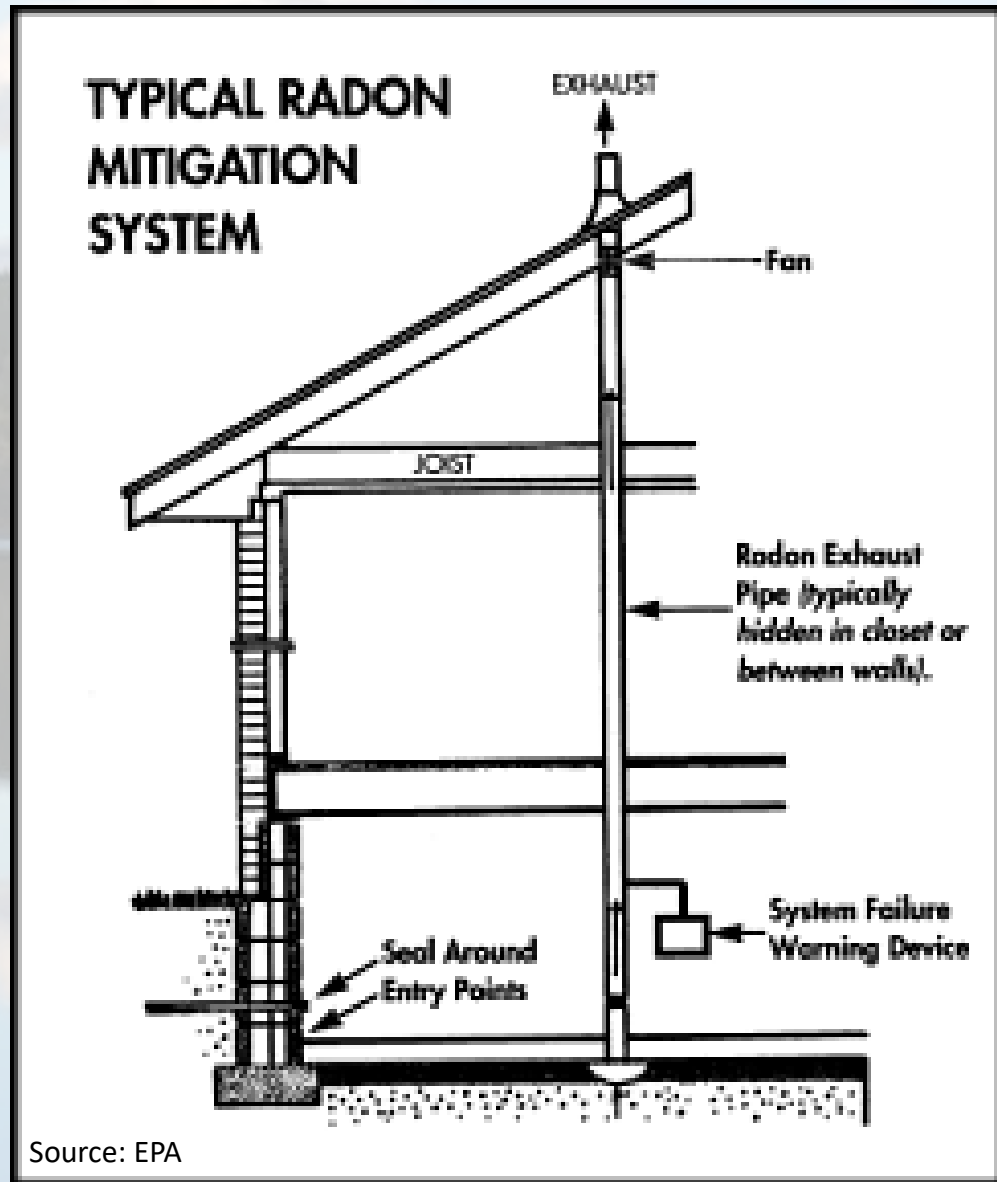
**Active – induced vacuum**

**More expensive**

**Maintenance**

**Much greater impact**

# Sub-slab Depressurization System



Hole in floor – vacuum pit

Vent pipe

Fan (outside of conditioned space)

Exhaust pipe

Performance monitor

Sealing cracks

# Sub-slab Depressurization System



Hole in floor –  
vacuum pit

Vent pipe

Performance  
monitor / alarm

Sealant



# Sub-slab Depressurization System



The sub-slab vacuum pit can be accessed from outside through the frost wall in walk out basements.

# Sub-slab Depressurization System



Fan

Exhaust pipe

Hardwired switch

Critter guard

Condensation trap



# Sub-slab Depressurization System

Started as passive

Fan in attic

Room for fan

Outlet nearby





# Sub-membrane Depressurization System



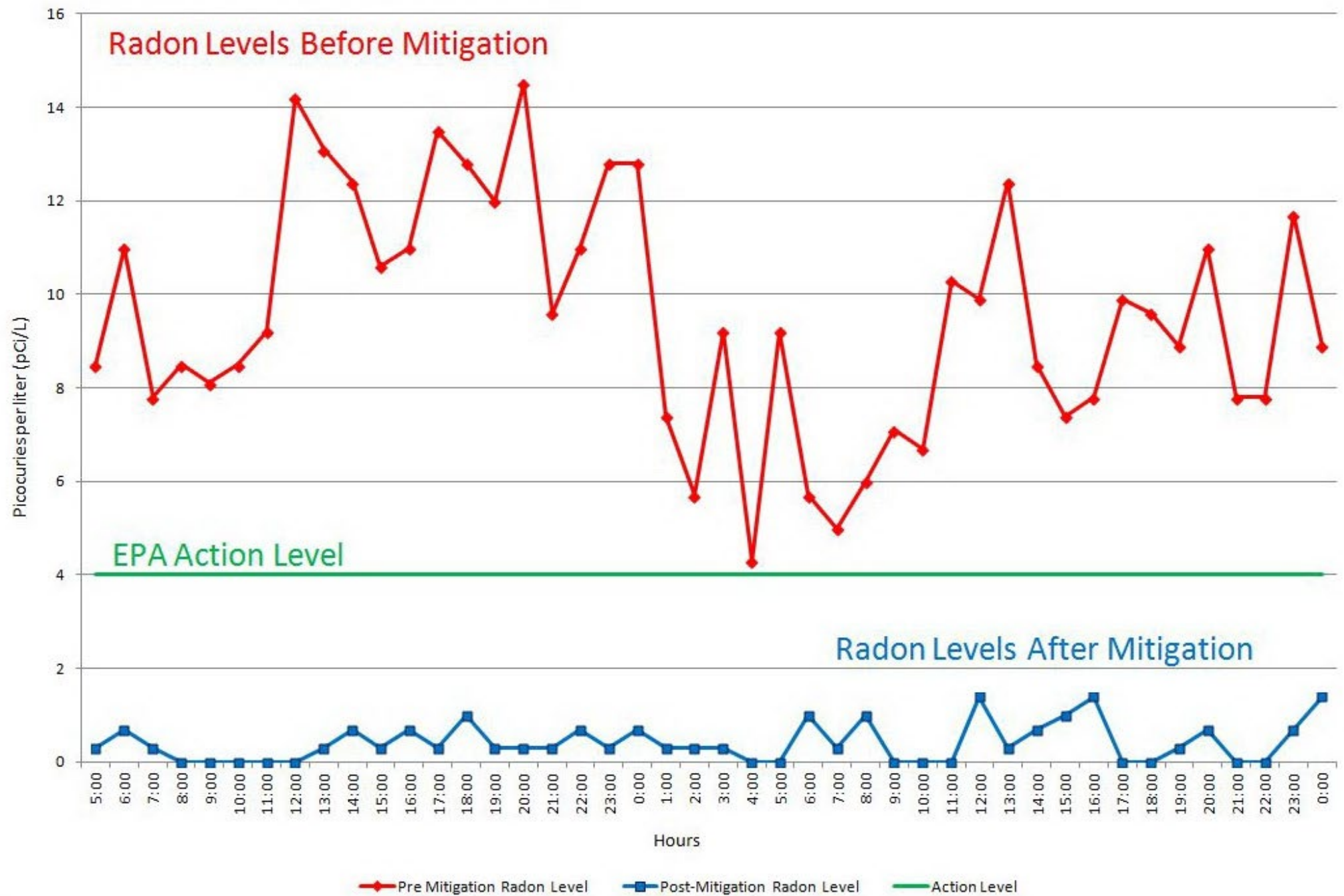


**If you know the  
concepts...**



**...you can adapt!**





# Water Mitigation

## Bubble System



Very effective  
for high levels

Pre-treatment  
may be  
required

Maintenance

## Carbon System



Typically, just  
for low levels

Treats other  
substances

Can become  
radioactive

# Summary

**Radon is a significant health hazard**

**You are most exposed in your home**

**You need to test your home to know if you are being exposed**

**Easy to mitigate – manage pressure, ventilation, aeration or filtration (water)**

**Learn more from [NH Department of Health and Human Services](#) or [EPA](#)**