

WELCOME TO THIS RADON REAL ESTATE COURSE

Protecting Health. Protecting Property.

This course provides essential information about radon,
real estate transactions, and protecting the health of your clients.



AN APPROVED
NCREC
4 HOUR

CONTINUING EDUCATION COURSE

FOR 2026 TO 2027



NCDHHS

North Carolina Department of
Health and Human Services



Knowledge. Awareness. Action. A Safer Future for North Carolina.

COURSE OUTLINE



The intent of this course is to share information with licensed North Carolina real estate brokers on radon with the hope that the information will be transferred to renters, buyers and sellers of real estate.

The core topics for this course are:



What and where is radon?



Why is radon a health concern?



How to test for radon?



What are the recommendations for mitigation of radon?



What are the components of a mitigation system?



How may the resident evaluate a mitigation system?



Available resources for brokers and their clients



INFORMED BROKERS. EMPOWERED CLIENTS. HEALTHIER HOMES.



County's Radon Levels

Rn



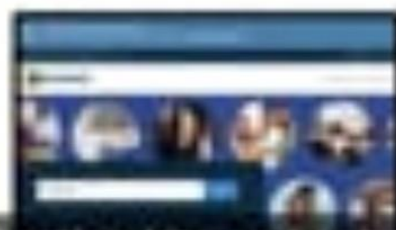
Testing Kits



Mitigation Options



ncdhhs.gov



for testing kits and solutions

WHAT IS RADON?

Radon is a colorless, odorless, tasteless radioactive gas that can be found in homes.



Radon is the leading cause of lung cancer among non-smokers.



Radon is a radioactive particle.



Radon is the resulting by-product of the natural decay process of **Uranium**.



Uranium is naturally found in varying levels in the rock and soil **North Carolina**.



Radon is **7 times** heavier than oxygen.



The half-life of radon is **3.7 days**.



86
Rn
Radon
(222)
Radioactive Gas

THE NATURAL DECAY PROCESS



RADON: THE INVISIBLE THREAT

Understand Where It Comes From and How It Behaves



Radon is an **Alpha Particle**



Naturally occurring gas



Cannot be seen or smelled



Primarily comes from **underlying geology** but can come from **building materials**



Prolonged exposure **increase risk for lung cancer**



Radionuclide

RADON CAN COME FROM BUILDING MATERIALS



CONCRETE

Naturally contains uranium.



GYPSUM

May contain trace amounts of uranium.



SANDSTONE

Naturally occurring uranium.

RADON CAN ENTER BUILDINGS THROUGH EXTERNAL WALLS



Radon-222 Decay Chain



● Alpha decay
● Beta decay

RADIOACTIVE DECAY: ENERGY IS RELEASED

During the decay process, energy is released in the form of radiation.



DURING THE DECAY PROCESS,
energy is released in the form of radiation.

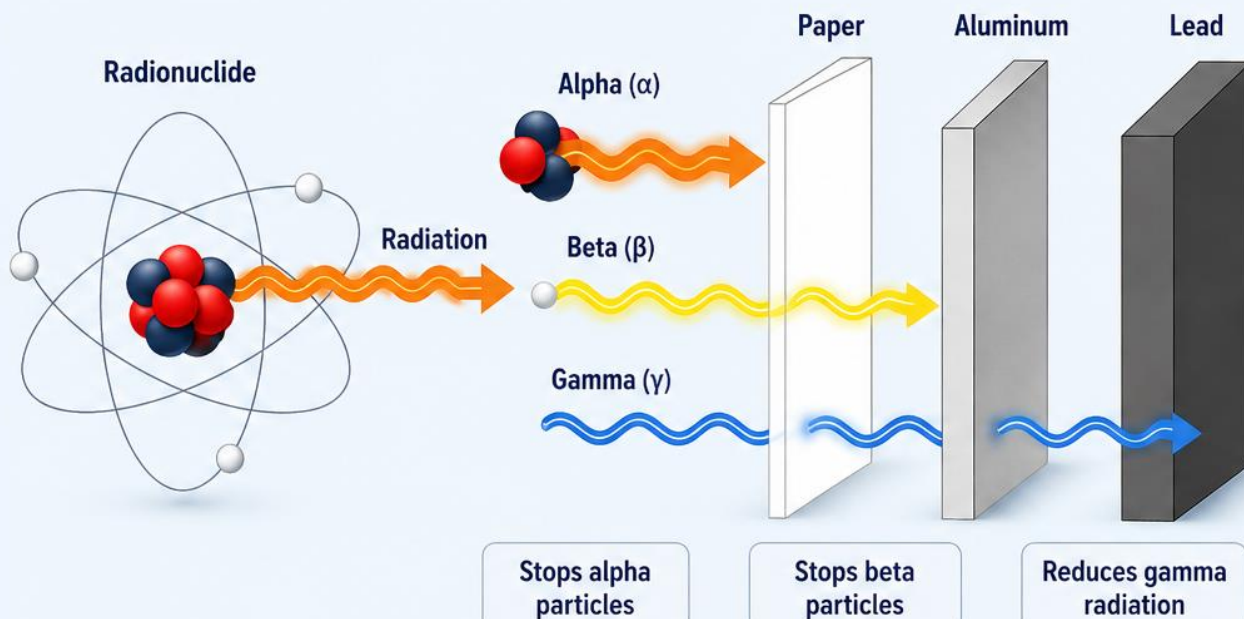


RADIATION CAN BE IN THE FORM OF ALPHA, BETA OR GAMMA EMISSIONS.



THESE PARTICLES ARE WHAT CAN LEAD TO ADVERSE HEALTH EFFECTS.

TYPES OF RADIATION AND THEIR ABILITY TO PENETRATE MATERIALS



ALPHA, BETA AND GAMMA PARTICLES CAN CAUSE DAMAGE TO BODY CELLS AND INCREASE THE RISK OF HEALTH PROBLEMS, INCLUDING CANCER.



Alpha (α)
Heaviest particle.
Stopped by paper or skin.



Beta (β)
Lighter particle.
Stopped by a thin layer of aluminum.



Gamma (γ)
High-energy waves.
Requires dense materials like lead to reduce.



Testing

The only way to
determine if your
home has high
radon levels



**RADON
TEST
IN PROGRESS**



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

radon.ncdhhs.gov

Adapted from a CDC graphic.

OLD DATA: NO MAP CAN BE USED TO PREDICT RADON LEVELS IN A **HOME, COMMUNITY OR COUNTY**

IMPORTANT TO KNOW:

Radon levels can vary greatly from **home** to home, even in the **same street** or neighborhood.



LOW
RADON LEVEL

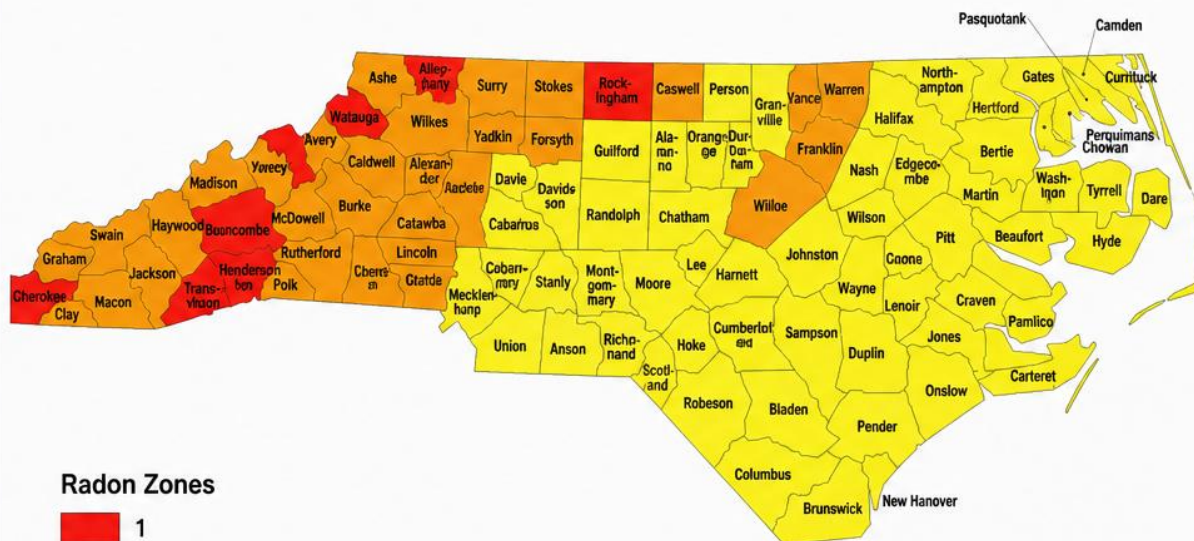


HIGH
RADON LEVEL



**OLD DATA AND MAPS
CANNOT PREDICT
THE RADON LEVEL
IN YOUR HOME.**

RADON POTENTIAL ZONES IN NORTH CAROLINA



Radon Zones

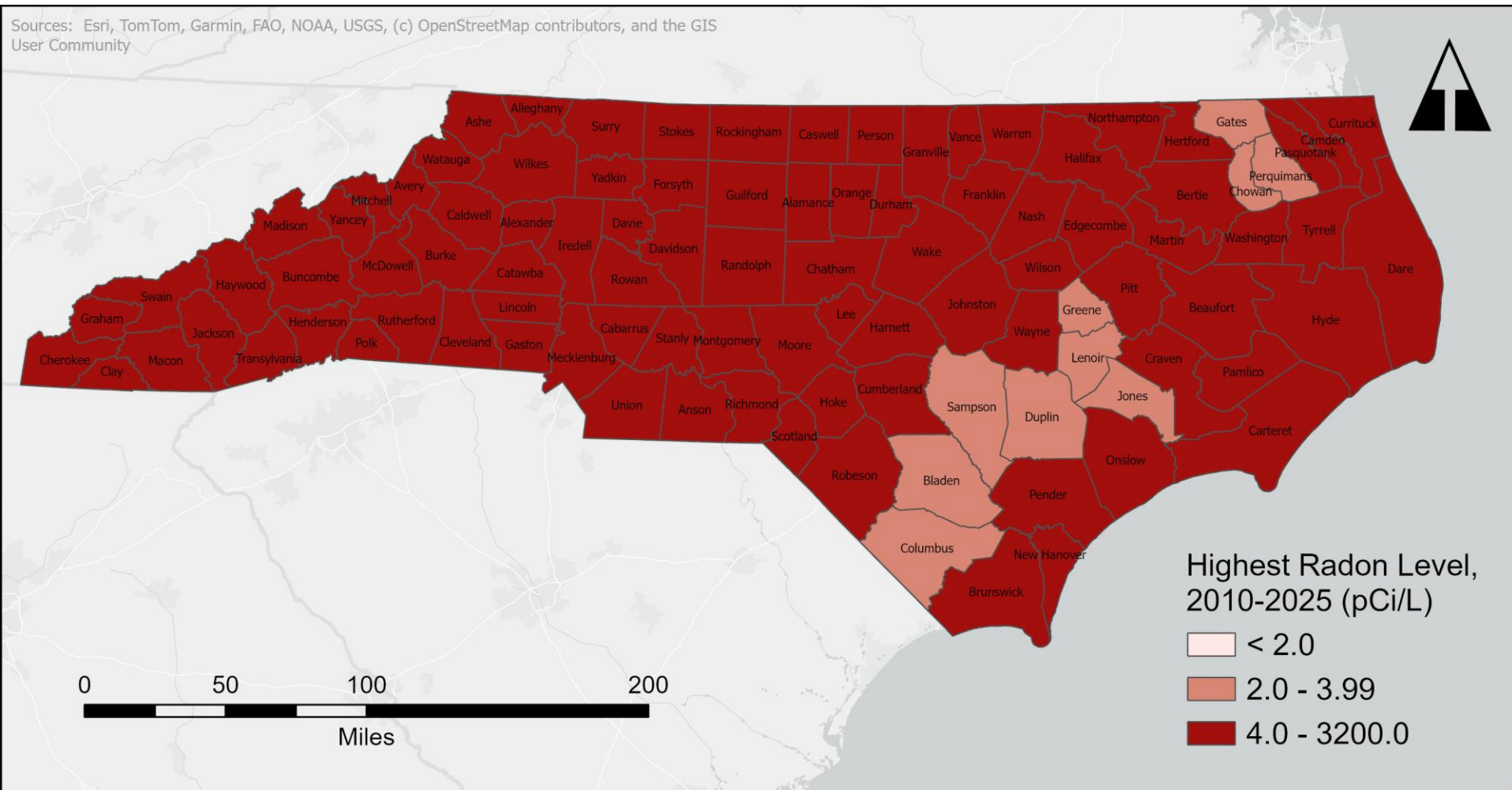


THE ONLY WAY TO KNOW THE RADON LEVEL IN YOUR HOME IS TO TEST.



Elevated Radon Levels Measured in 100 Counties of NC

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community



Protect your Family from Radon

Radon is a gas that you can't **see**, **smell**, or **taste** – but it can be dangerous. It's the second leading cause of lung cancer.

1 OUT OF 15 HOMES HAS HIGH RADON LEVELS



Learn more by calling the National Radon
Hotline: 1-800-SOS-RADON (1-800-767-7236)



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

radon.ncdhhs.gov

ADAPTED FROM A CDC GRAPHIC.

RADON CAN ACCUMULATE TO HIGH CONCENTRATIONS IN A BUILDING.

This depends on radon concentration in the soil and building materials (**source**),
how radon enters the home (**pathways**), and
pressure differences between the outside air and the inside air (**air pressure**) that drive radon into the home.

1 SOURCE

Radon comes from the ground and building materials.

SOIL

Radon is released from the soil.



BUILDING MATERIALS

Radon can be released from certain building materials.



2 PATHWAYS

Radon enters the home through cracks and openings.



Cracks in floors and walls



Openings around pipes



Sump pits and drains



Gaps around windows



Construction joints

3 AIR PRESSURE

Pressure differences can pull radon into the home.



When indoor air pressure is lower than outdoor air pressure, radon is drawn into the building.

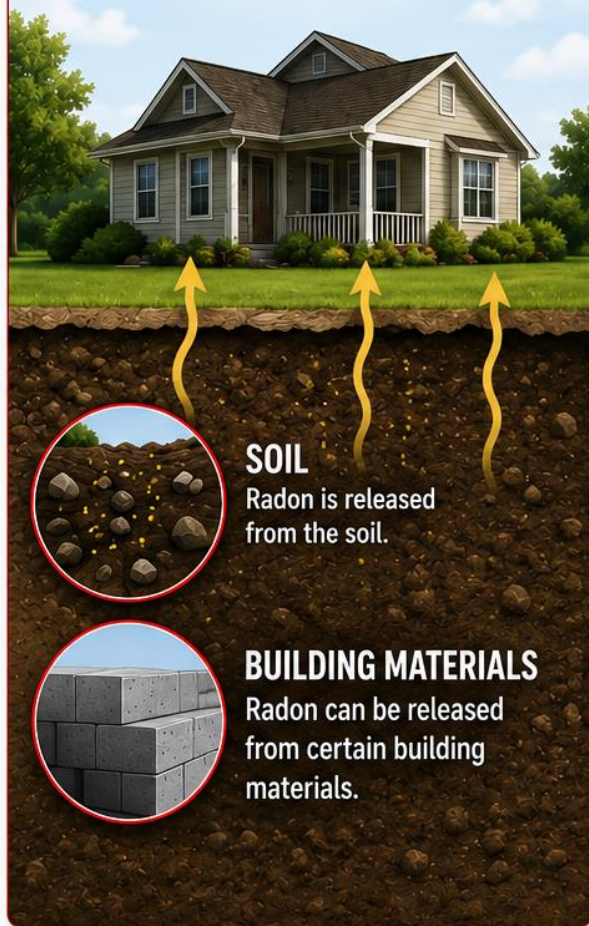


WHEN THESE THREE FACTORS WORK TOGETHER,
RADON CAN ACCUMULATE TO HIGH CONCENTRATIONS IN A BUILDING.



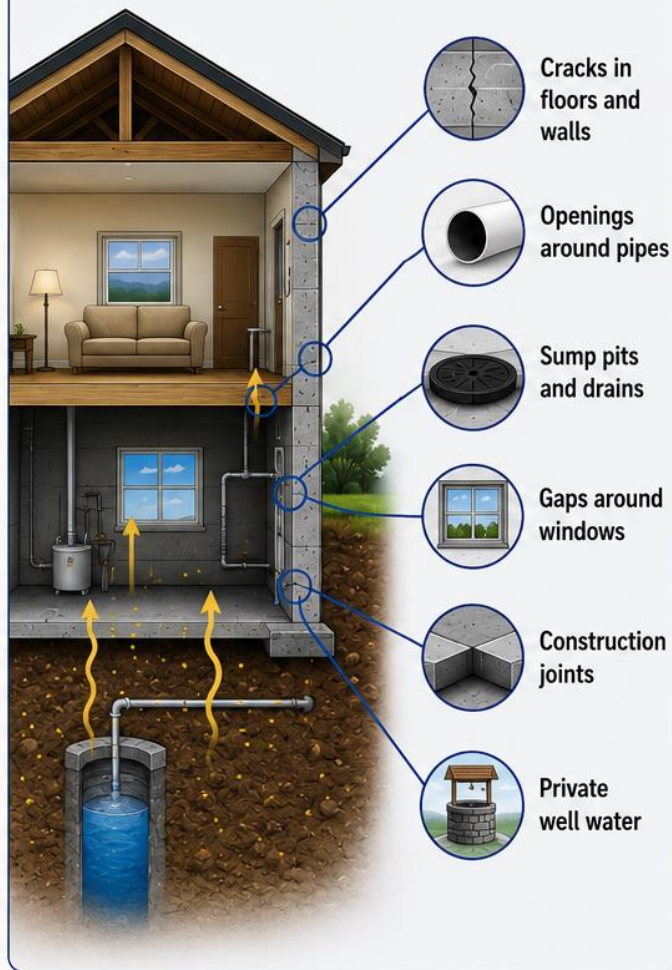
1. SOURCE

Radon comes from the **ground** and **building materials**.



2. PATHWAYS

Radon enters the home through cracks and openings.



3. AIR PRESSURE

Pressure differences between the outside air and the inside air (**air pressure**) can pull radon into the home.



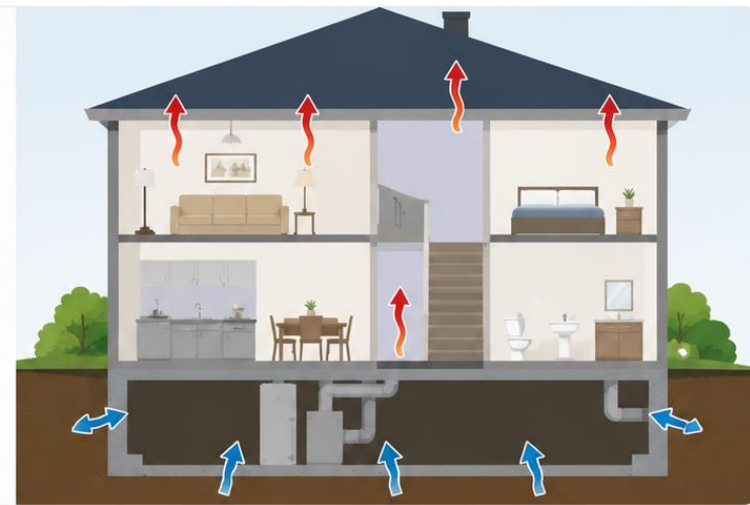
Air Pressure

1 STACK EFFECT

Warm air rises to the upper part of the home and is lost to the outside air.

Make-up air enters the lower part of the home.

Some of that make-up air comes from the soil.



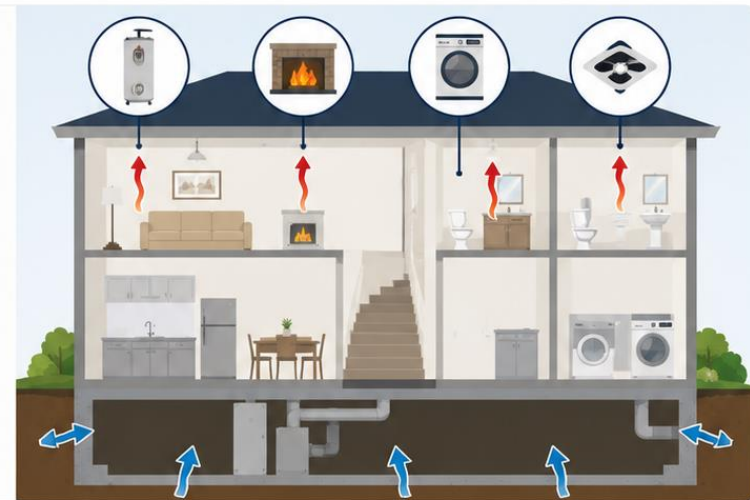
2 DOWN WIND DRAFT EFFECT

Strong winds can blow over the top of the home, pushing and pulling air into and out of the house.



3 VACUUM EFFECT

Appliances (water heaters, fireplaces, clothes dryers, older furnaces, etc.) and exhaust fans remove air from the home. This can drive soil gas into the home as make-up air enters from the lower part of the house.





ELEVATED RADON LEVELS CAN OCCUR IN ANY TYPE OF BUILDING



Radon is a naturally occurring, radioactive gas that comes from the soil.

It can enter **ANY** building through cracks and openings in the foundation.



Elevated radon levels can be found in **ANY** type of building.

SINGLE-FAMILY HOMES



New or old, with
or without a basement.

MULTI-FAMILY BUILDINGS



Apartments, condos,
and townhomes.



Schools, libraries,
churches, and more.



You can't see, smell, or taste radon,
BUT IT CAN BE DANGEROUS.



The only way to know your
radon level is to **TEST.**

Test every building. Protect every occupant.



Radon testing is simple,
affordable, and can give
you peace of mind.

Test today!



1 BASEMENT

A basement provides a large surface area in contact with the soil, where radon can enter through different pathways.

Taller homes have the potential for a greater stack effect.

KEY POINTS



Basements are surrounded by soil on all sides.



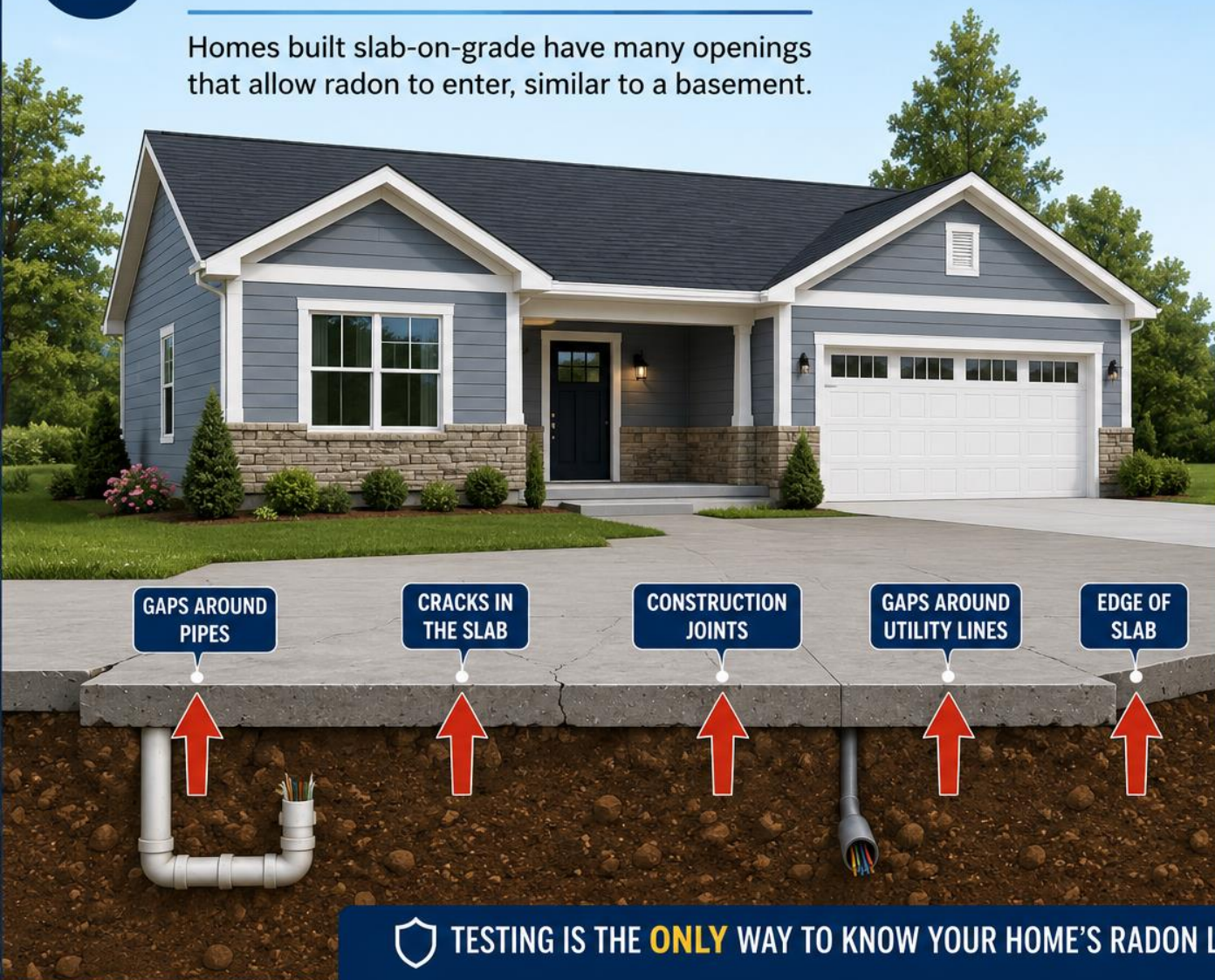
Radon can enter through cracks, joints, and openings.



Warm air rises and can increase the stack effect in taller homes.

2 SLAB-ON-GRADE

Homes built slab-on-grade have many openings that allow radon to enter, similar to a basement.



KEY POINTS



Slab-on-grade homes sit directly on the soil.



Radon can enter through cracks, joints, and openings in the slab.



Gaps around pipes and utility lines create direct pathways for radon.



TESTING IS THE **ONLY** WAY TO KNOW YOUR HOME'S RADON LEVEL.

3 CRAWL SPACES

Homes built with crawl spaces are directly connected to the soil and create a pathway for radon to enter the home.



KEY POINTS



Crawl spaces are vented to the outside and connected to the soil.



Radon can enter through the soil and any openings in the crawl space.



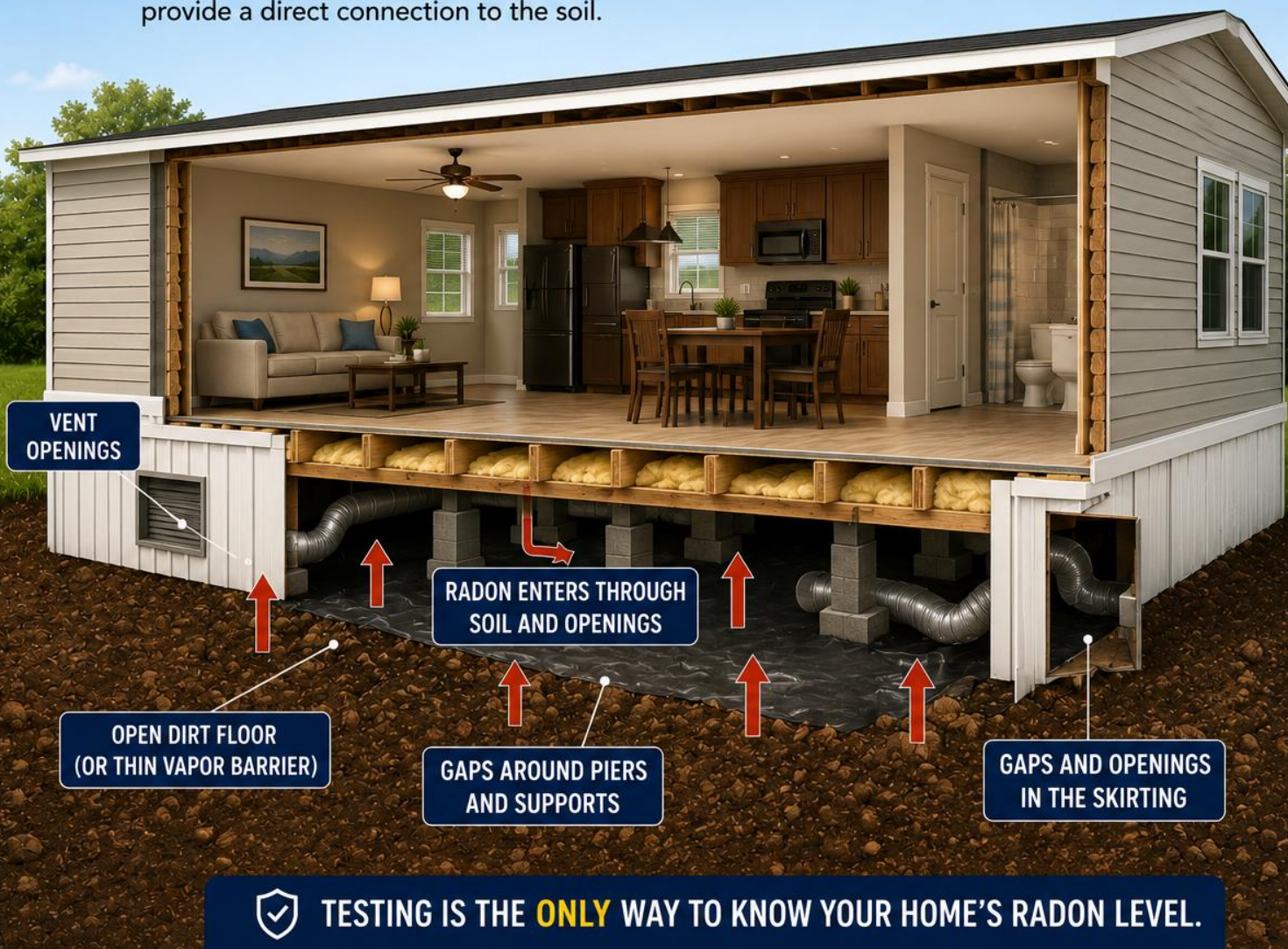
Air pressure differences can pull radon from the crawl space into the living area.

IMPORTANT:

Once radon enters the home, it can spread throughout the living space.

4 MANUFACTURED HOMES WITH SKIRTING

Manufactured homes with solid skirting act like crawl spaces and provide a direct connection to the soil.



KEY POINTS



Solid skirting creates an open space beneath the home, similar to a crawl space.



Radon can enter through the soil and any openings in the skirting.



Air pressure differences can pull radon from under the home into the living area.



Vent openings help with moisture control but do not stop radon.



TESTING IS THE **ONLY** WAY TO KNOW YOUR HOME'S RADON LEVEL.

5A MID-RISE CONDOS (3 – 8 STORIES)

Building materials such as concrete, brick, and stone can contain naturally occurring uranium, which is the source of radon.

RADON FROM
BUILDING MATERIALS
(CONCRETE, BRICK,
STONE)

RADON ENTERS
THROUGH SOIL

CRACKS IN
CONCRETE WALLS
AND FLOORS

OPENINGS AROUND
PIPES AND
UTILITIES

KEY POINTS



Concrete, brick, and stone can contain naturally occurring uranium—the source of radon.



Radon can enter through cracks in concrete, construction joints, and utility penetrations.



Radon from soil can move up into common areas and individual units.



IMPORTANT TO KNOW

Radon can move between units through shared walls, floors, and mechanical systems.

5B HIGH-RISE CONDOS (9+ STORIES)

Radon can enter on lower levels and move up through the building via stairwells, elevator shafts, and mechanical systems.

RADON ENTERS
THROUGH SOIL

ENTRY THROUGH CRACKS,
JOINTS, AND PENETRATIONS

KEY POINTS



Radon can enter on lower floors through soil and building openings.



It can move upward through stairwells, elevator shafts, and mechanical systems.



Multiple units on multiple floors may be affected.

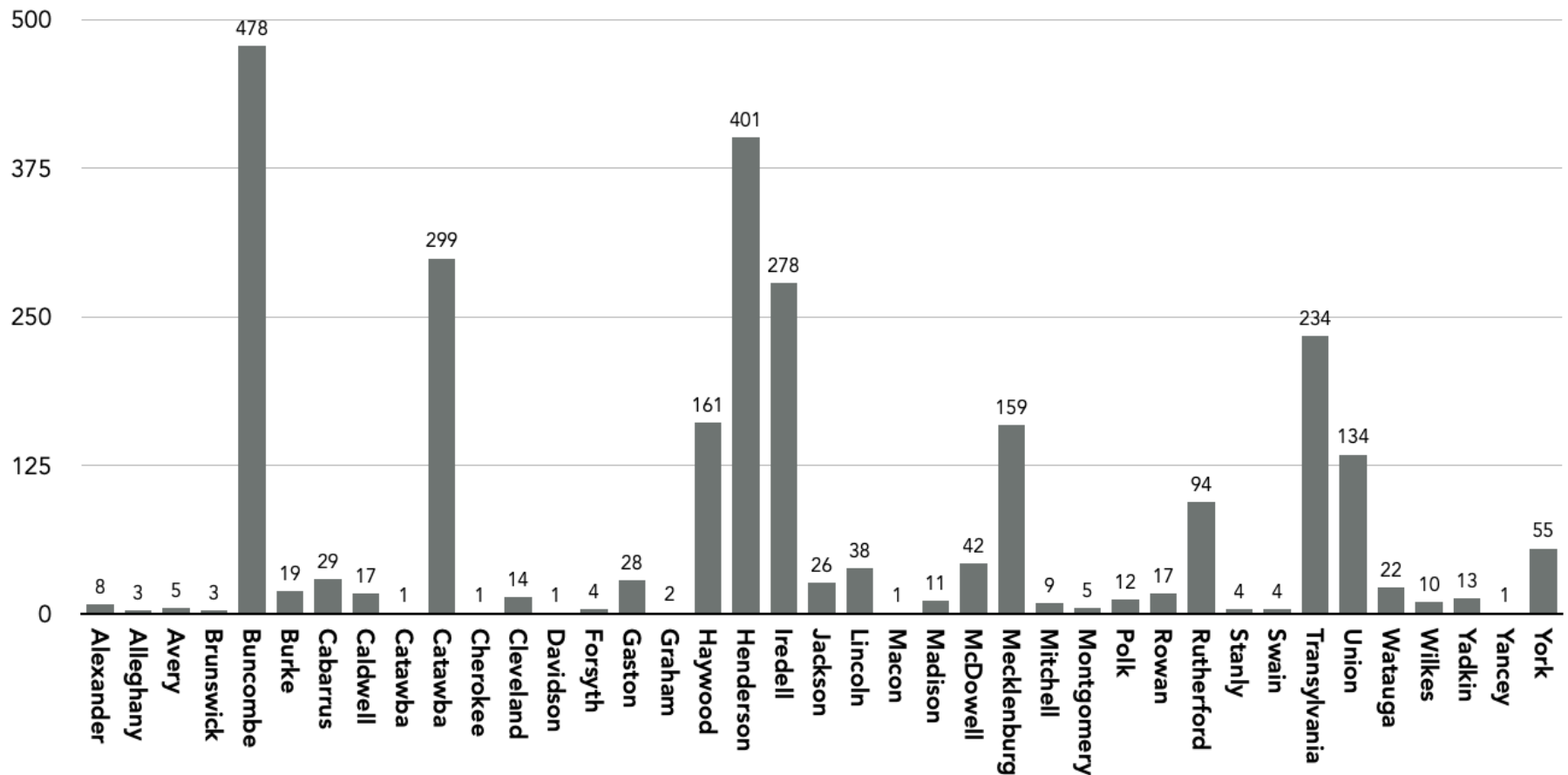


IMPORTANT TO KNOW

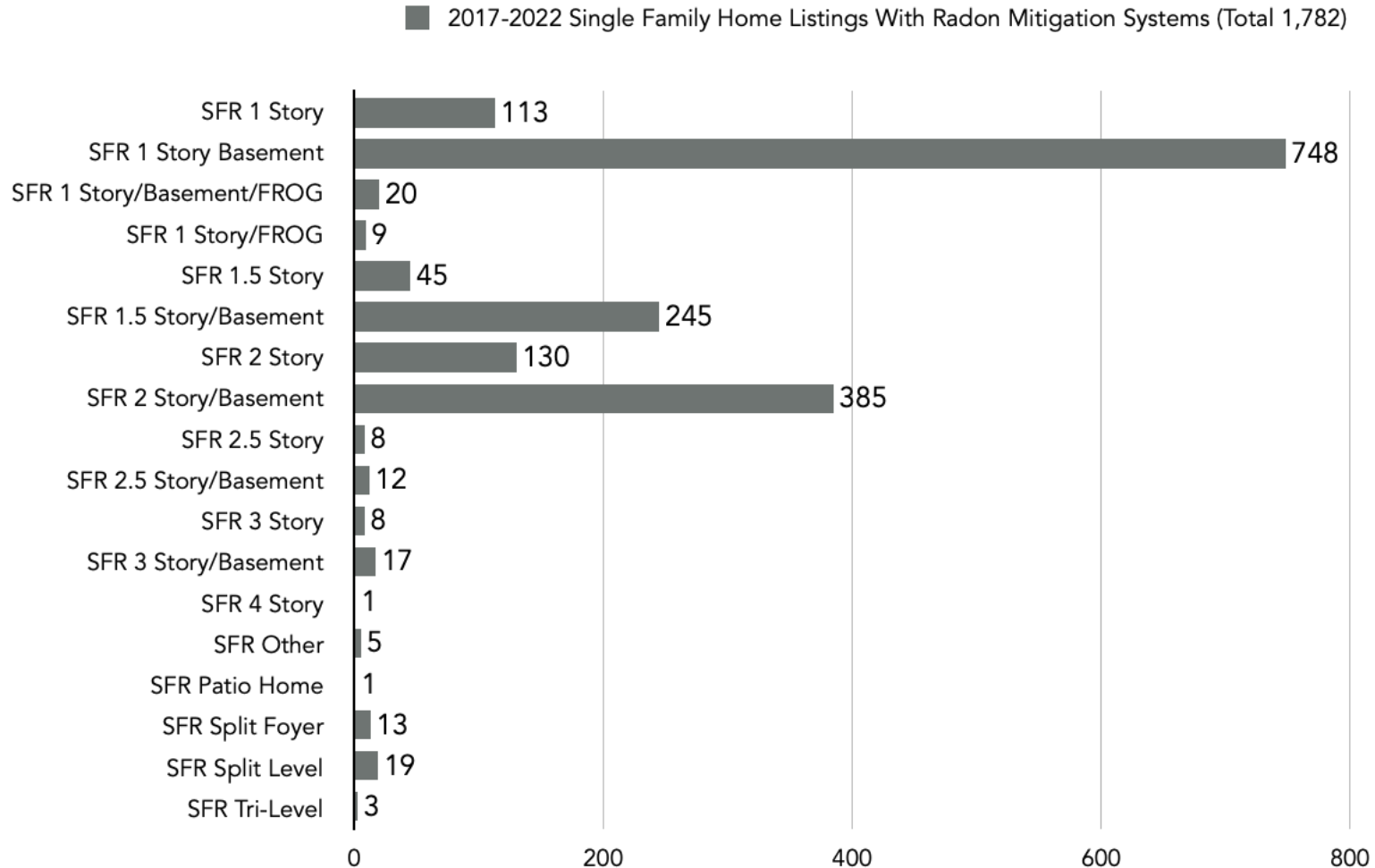
Radon testing is the only way to know your unit's radon level, regardless of floor or building height.

Where is radon?

■ Number of Homes Listed For Sale with Mitigation by North Carolina County (2017 - 2022)

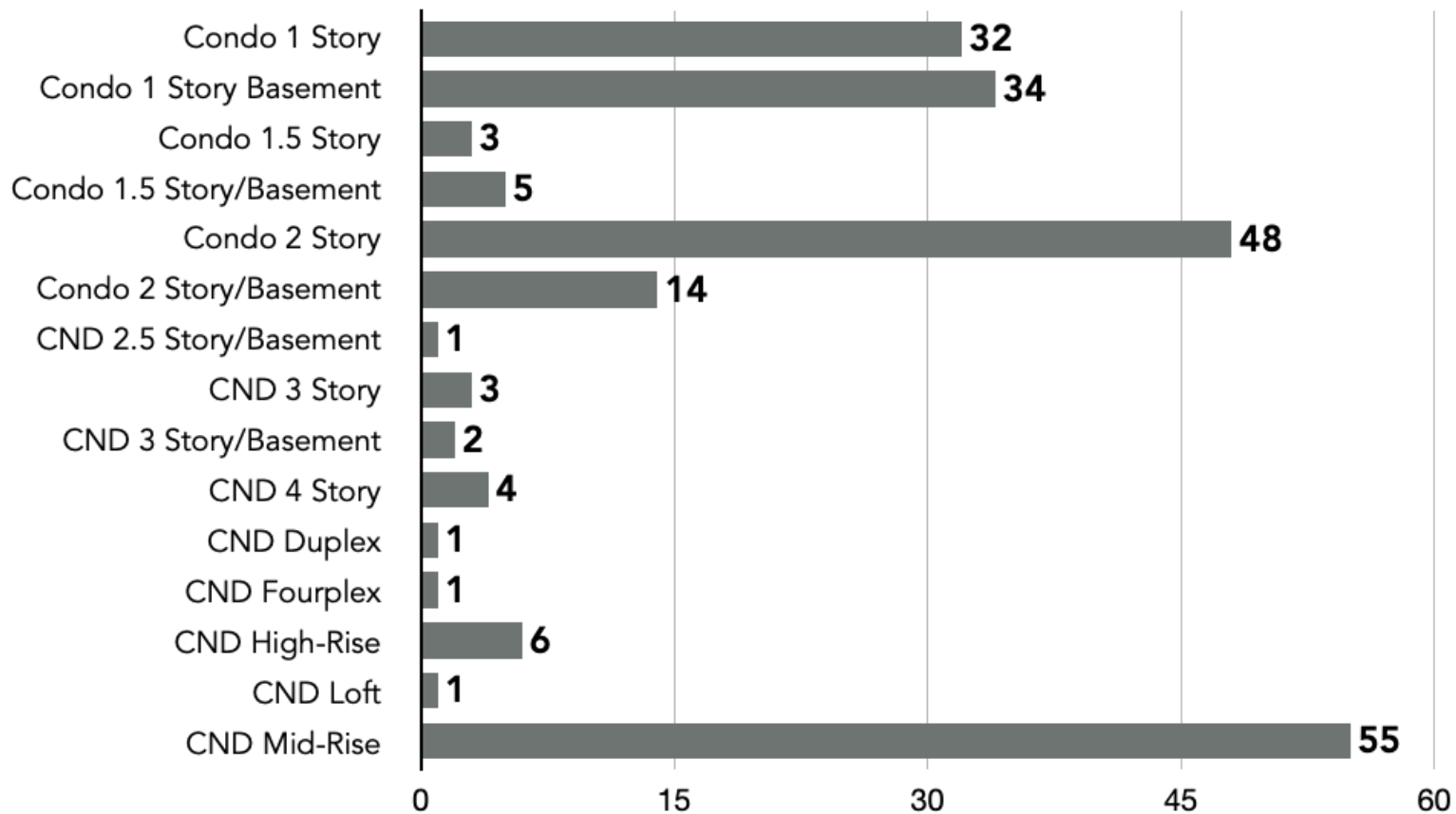


Where is radon?



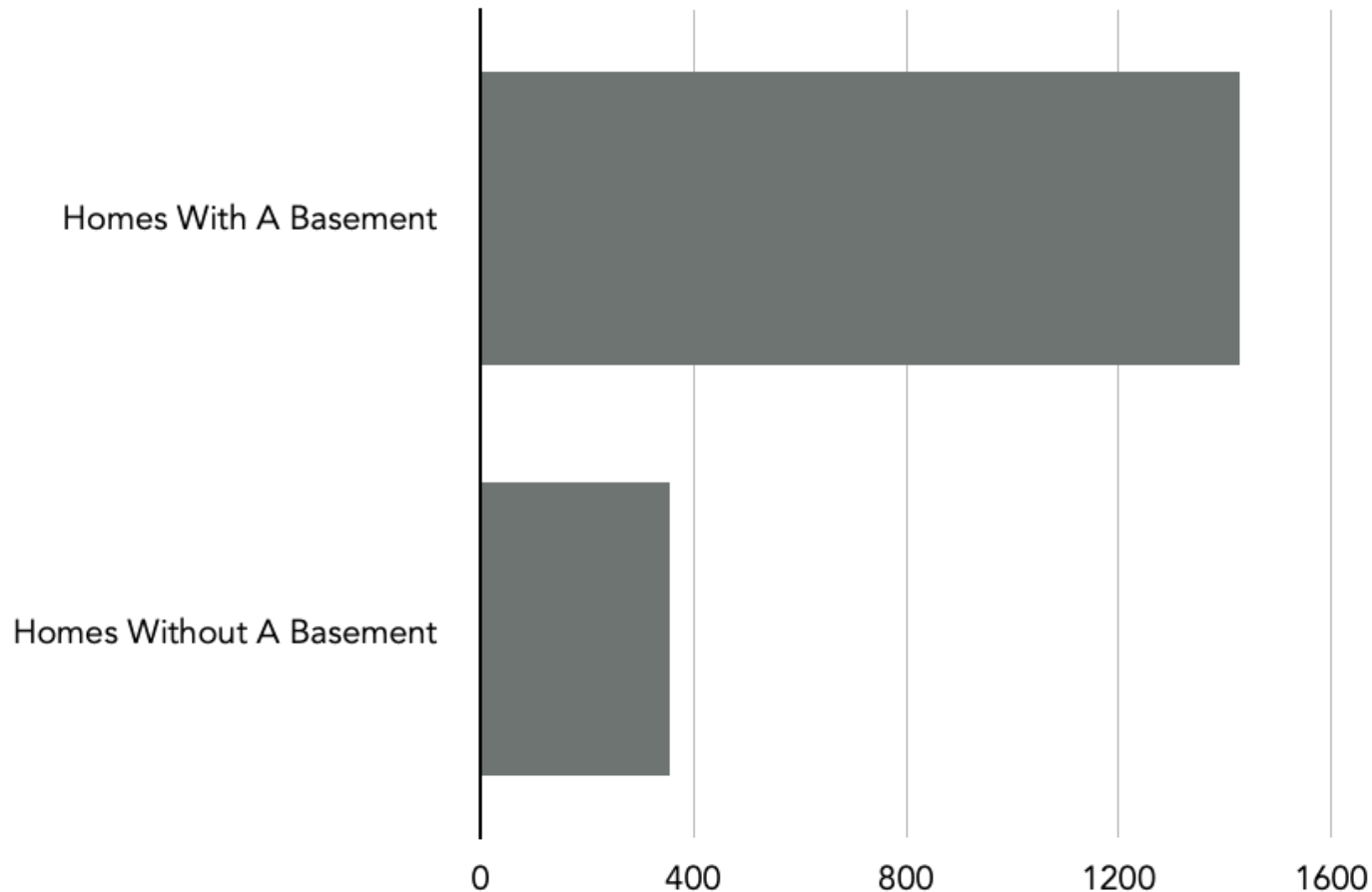
Where is radon

■ 2017-2022 Condo Listings With Radon Mitigation Systems (Total 210)

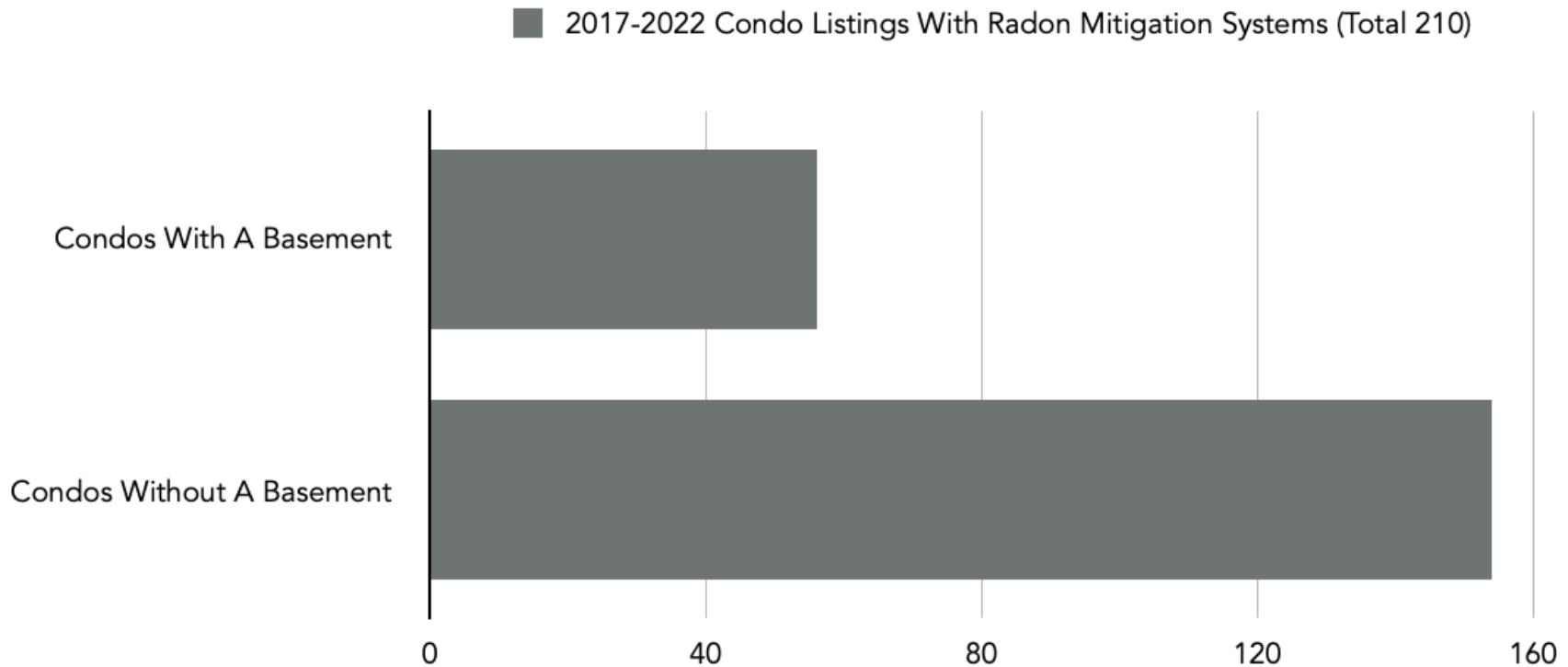


Where is radon?

■ 2017-2022 Single Family Home Listings With Radon Mitigation Systems (Total 1,782)



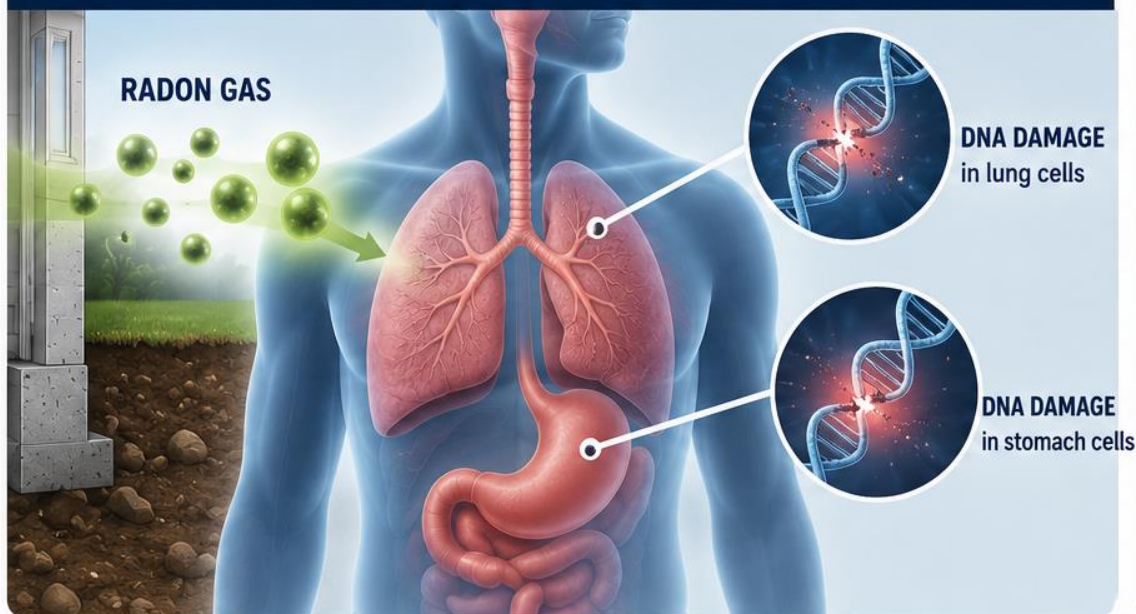
Where is radon?



RADON EXPOSURE: A SERIOUS HEALTH RISK

Radon is a silent threat that can have lasting, life-threatening effects.

**RADON IS A RADIOACTIVE ELEMENT THAT
DAMAGES THE DNA OF CELLS IN THE LUNGS AND STOMACH.**



**RADON IS THE
LEADING CAUSE
OF LUNG CANCER
AMONG NON-SMOKERS.**



480
NORTH CAROLINIANS
DIE EACH YEAR
FROM RADON-INDUCED
LUNG CANCER.



21,000
**RESIDENTS OF THE
UNITED STATES**
DIE EACH YEAR
FROM RADON-INDUCED
LUNG CANCER.



**RADON IS ODORLESS, COLORLESS, AND TASTELESS.
THE ONLY WAY TO KNOW IS TO TEST.**



Protect your family. Test your home. Reduce your risk.

3 PRIMARY VARIABLES

THAT INFLUENCE A PERSON'S RISK FOR **CANCER** FROM RADON EXPOSURE

1 RADON LEVEL

The average level a person is exposed to, primarily in their home.

HIGHER
RADON LEVEL
=
HIGHER RISK

LOWER
RADON LEVEL
=
LOWER RISK



2 LENGTH OF TIME EXPOSED

The longer a person is exposed to radon, the greater the risk of developing lung cancer.



SHORTER TIME
LESS RISK

LONGER TIME
GREATER RISK

3 EXPOSURE TO CIGARETTE SMOKE

The combination of radon exposure and cigarette smoke greatly increases the risk of lung cancer.



Smoked less than
100 cigarettes
in lifetime

INCREASED RISK



Smoked at least
100 cigarettes
in their lifetime

HIGHER RISK



Secondhand
smoker

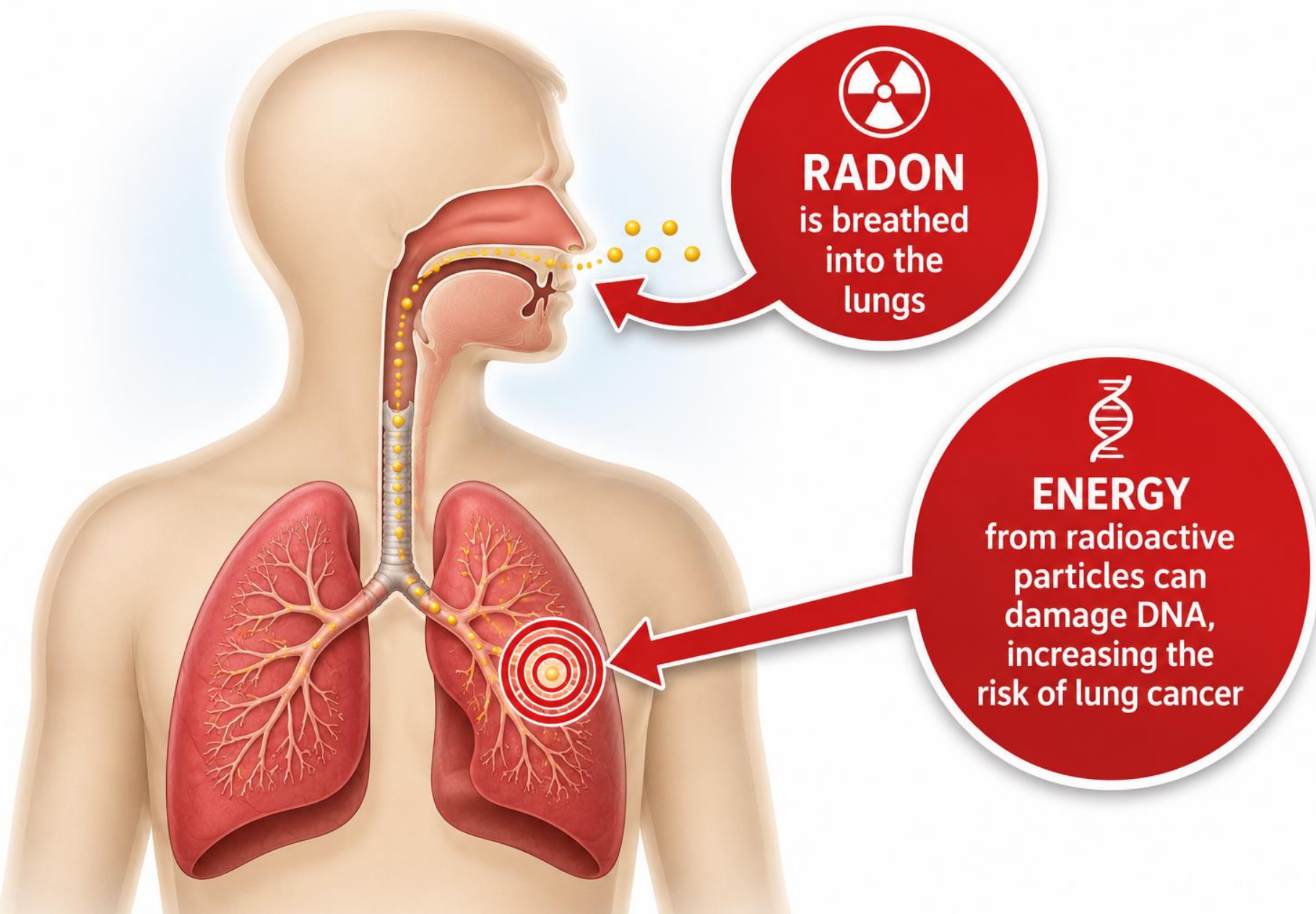
INCREASED RISK



You can't see, smell, or taste radon,
but it could be putting your health at risk.



TEST YOUR HOME.
PROTECT YOUR FAMILY.



Lifetime Risk of Lung Cancer Death from Radon Exposure in Homes

Risk Is Shown per 100,000 Individuals

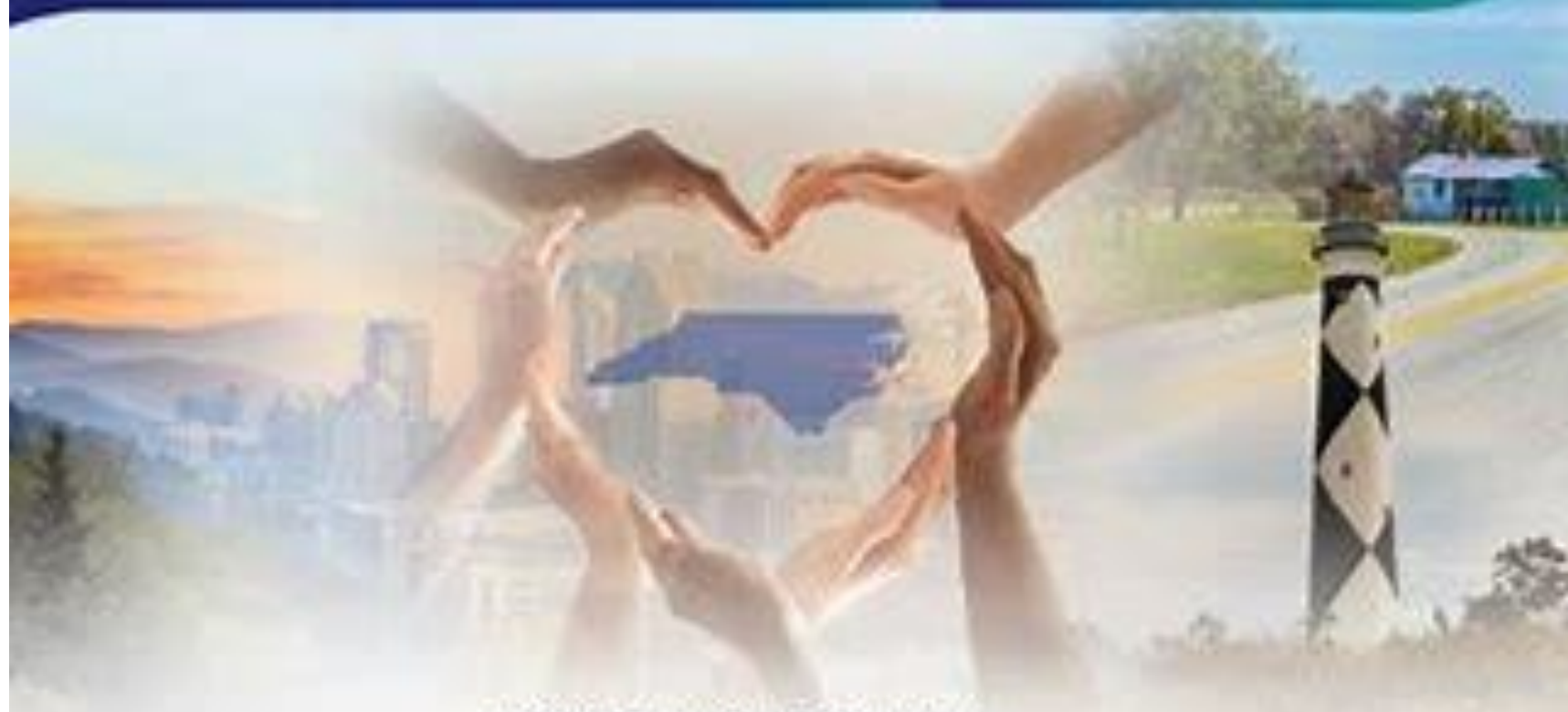
RADON LEVEL (pCi/L)	NEVER SMOKERS	CURRENT SMOKERS	GENERAL POPULATION
20	3,600	26,000	11,000
10	1,800	15,000	5,600
8	1,500	12,000	4,500
4	730	6,200	2,300
2	370	3,200	1,200
1.25	230	2,000	730
0.4	73	640	230

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

Never Smokers 7/1000 | Smokers 62/1000

Cancer Mortality 2020	
Cancer Type	Estimated U.S. Deaths in 2020 ^{4,5}
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
Radon-Induced Lung Cancer	21,100*
8. Lymphoma (Combined Hodgkin & Non-Hodgkin)	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

* The 21,100 radon-induced lung cancer deaths, based on risk estimates using U.S. demographic information from 1995, are included in the estimate of lung and bronchus cancer deaths.



NORTH CAROLINA
**Comprehensive Cancer Control
ACTION PLAN**

2020-2025



RISK FACTORS

Exposure to some environmental substances like radon, ultraviolet rays and asbestos can cause cancer.

While people can reduce their exposure to the sun, other hazards may be harder to avoid. They are in the air, drinking water, food or materials at work. Many factors, like the amount and length of exposure and a person's background, influence whether a person develops cancer.

- Radon is a naturally occurring gas that can only be detected by testing. It is found in all North Carolina counties. According to the National Cancer Institute, long-term radon exposure is the second leading cause of lung cancer in the United States. It is the leading cause of lung cancer in non-smokers.¹⁶
- Ultraviolet rays can cause early aging of the skin and some skin cancers. Ultraviolet rays come from the sun and from artificial exposures like tanning beds and sun lamps. There are three types of skin cancer: melanoma, basal cell and squamous cell. Melanoma is the most serious form of skin cancer. It accounts for about one percent of all skin cancers but causes the most skin cancer deaths.¹²
- Arsenic is a naturally occurring element which is odorless and tasteless. It can be found in smoking tobacco and contaminated water. Long-term exposure can cause bladder, skin, lung, liver, kidney and other types of cancers.
- Cancer from benzene, beryllium, asbestos and vinyl chloride may occur from industrial exposures. Benzene is also found in cigarette smoke.



PREVENTIVE ACTIONS

Minimizing exposure to environmental risk factors will reduce cancer risk.

Individuals

- Test homes, worksites and schools for high levels of radon. Mitigate, if necessary.
- Avoid exposure to pesticides and other chemicals at home.
- Reduce exposure to cancer-causing substances at work.
- Use sunscreen and protective clothing when outdoors.
- Protect children from sunburns as early sunburns may increase the risk of skin cancer in adulthood.

Communities

- Urge employers, school administrators and business leaders to test buildings for high levels of radon. Mitigate, if necessary.
- Follow health and safety rules to avoid exposures to cancer-causing substances.
- Urge employers to survey their worksites to determine the workers' exposure to chemical hazards. Correct those exposures, as necessary.
- Urge employers to provide sun protection clothing for employees who work outside.
- Provide shaded areas for recreation and work.
- Use signage to encourage sunscreen use and sun protection.

**Environmental exposures
Increase cancer risk.¹²**

lung • skin • bladder • liver • kidney

2
0
2
5

NORTH CAROLINA
**STATE HEALTH
ASSESSMENT**



A Mid-Cycle Review of
HNC 2030

HEALTHY NORTH CAROLINA 2030: A PATH TOWARD HEALTH (HNC 2030)



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Public Health



INDICATOR 21: LIFE EXPECTANCY

- Assess and increase access to medical and community services for people with Alzheimer's disease and related dementia through improved transportation services, telehealth services, and incentives for new models of care
- Build and expand key metrics, reporting, and dashboards that identify and monitor health disparities in key health outcomes to drive action and provide transparency into health equity initiatives
- Cultivate collaboration between multidisciplinary professionals to reduce falls and fall-related injuries
- Establish and fund a comprehensive, integrated state data infrastructure using a population health model to assure the timely identification, collection, analysis, integration, visualization, and dissemination of data from global, national, state, and local resources
- Foster partnerships to increase awareness of fall risk factors and advance access to fall prevention interventions
- Improve access to free **radon** test kits, particularly to historically marginalized populations
- Support the North Carolina Housing Finance Agency by increasing grant funds to support the installation of **radon** mitigation systems among homeowners financially eligible

Risk factors



Smoking
Secondhand smoke



Family history



Air pollution
Radon gas
Asbestos

LUNG CANCER

Symptoms



Cough



Coughing up blood



Wheezing



Fatigue



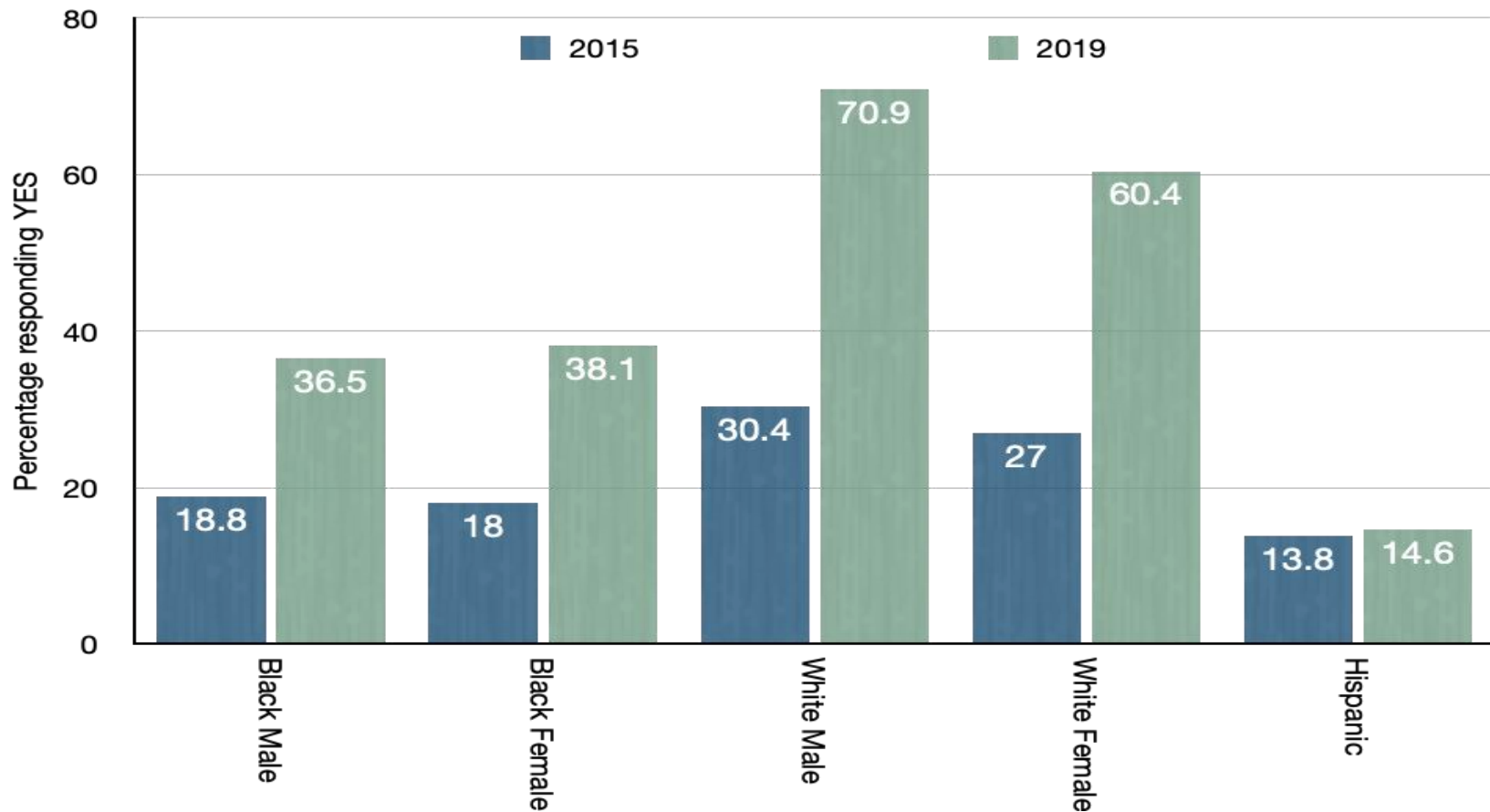
Chest pain



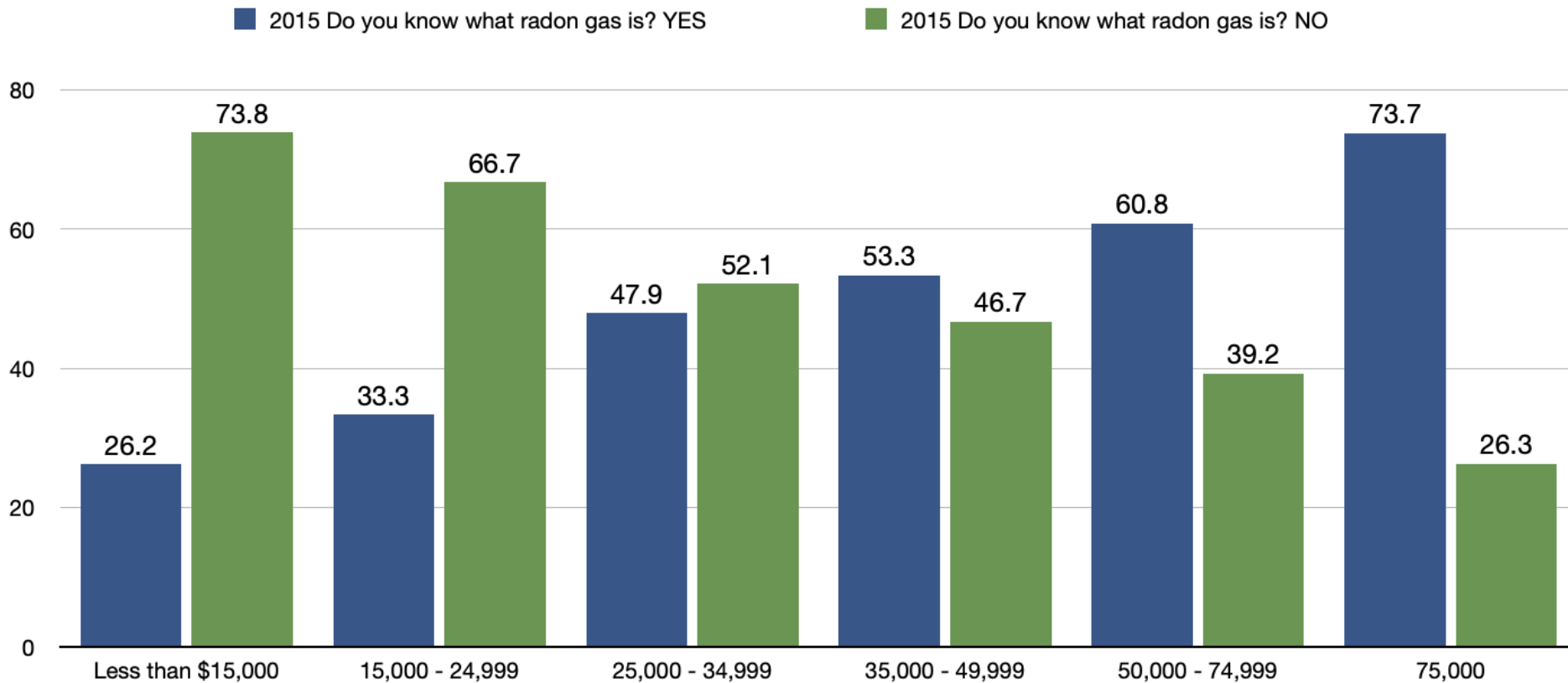
Weight loss

Health disparity

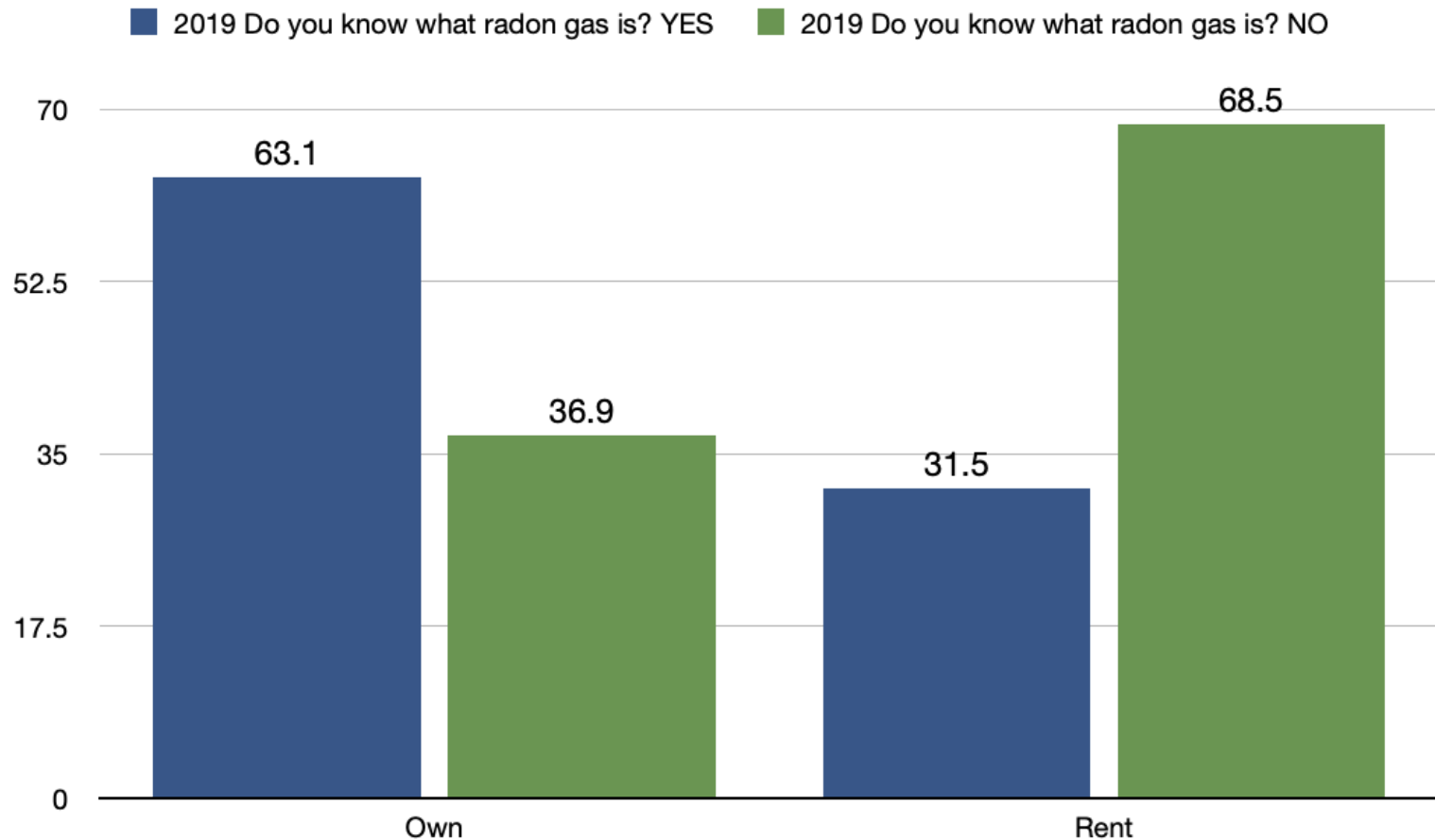
BRFSS Responses to Question “Do you know what radon gas is?”



Health disparity



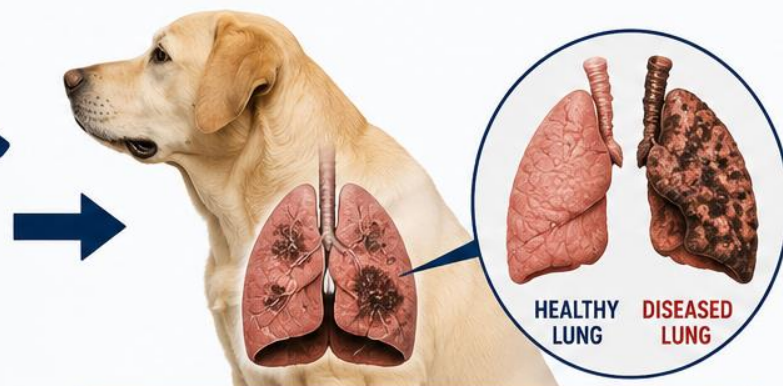
Health disparity



**LUNG CANCER INCIDENCE
IN DOGS AND CATS IS
APPROXIMATELY
2-FOLD HIGHER
IN AREAS WITH HIGH
RADON POTENTIAL.**



**EMPHYSEMA AND FIBROSIS
ARE MORE PREVALENT AND
SEVERE IN DOGS EXPOSED TO
SECOND-HAND-SMOKE
AND RADON.**



**INCREASED RISK OF EMPHYSEMA AND FIBROSIS
MORE PREVALENT AND MORE SEVERE**



**RADON AND SECOND-HAND SMOKE ARE HIDDEN THREATS
THAT CAN SERIOUSLY IMPACT THE LUNG HEALTH OF OUR PETS.**



**PROTECT YOUR PETS.
TEST YOUR HOME.**

RADON TESTING IN NORTH CAROLINA

KNOW YOUR LEVEL. PROTECT YOUR HEALTH.



Radon testing and mitigation are **NOT REQUIRED** during real estate transactions, but testing is **HIGHLY RECOMMENDED**.



The NC Radon Program recommends a **LICENSED RADON PROFESSIONAL** conduct testing during real estate transactions when an unbiased third-party is desired.



The NC Radon Program website provides guidance for consumers.



www.radon.ncdhhs.gov



The North Carolina Radon Program and the Environmental Protection Agency recommends that you **hire certified professionals** that follow the national Testing and Mitigation Standards.



www.standards.aarst.org



Testing is the only way to know your radon level.

A simple test can protect you and your family.





AN AVERAGE INDOOR RADON LEVEL OF

4 pCi/L

OR MORE

**IS REGARDED AS
A MATERIAL FACT**

BY THE NC REAL ESTATE COMMISSION



NC REAL ESTATE COMMISSION

Real estate licensees are required to disclose a known average indoor radon level of **4 pCi/L** or more as a material fact.



**BUT THIS IS
NOT
A PUBLIC HEALTH
STANDARD.**



THERE IS **NO**
PUBLIC HEALTH STANDARD
for radon in air or water.



THERE IS **NO**
"SAFE LEVEL" OF RADON.



**ANY LEVEL OF RADON
MAY POSE SOME RISK.**



TEST YOUR HOME.

KNOW YOUR LEVEL.

REDUCE YOUR RISK.



IT IS IMPORTANT FOR THE CERTIFIED PROFESSIONAL

— TO FOLLOW THE ANSI AARST STANDARDS —



The ANSI/AARST Standards provide nationally recognized requirements for the proper measurement of radon and radon decay products in indoor environments.

ANSI/AARST

MAH 2023



An American National Standard



Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes

AARST CONSORTIUM ON NATIONAL STANDARDS
www.standards.aarst.org



Copyright © 2023 AARST 527 N Justice Street, Hendersonville, NC 28739

Note—ANSI/AARST MAMF and MALB consolidated into a single publication

ANSI/AARST

MA-MFLB 2023



An American National Standard



Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Mixed-Use Buildings

AARST CONSORTIUM ON NATIONAL STANDARDS
www.standards.aarst.org



Copyright © 2023 AARST 527 N Justice Street, Hendersonville, NC 28739

WHEN THE CERTIFIED PROFESSIONAL FOLLOWS THE ANSI/AARST STANDARDS, YOU CAN TRUST THAT:



Measurements are
conducted correctly
and consistently.



Results are accurate
and reliable.



Procedures meet
nationally recognized
requirements.



Work is performed
to the highest
professional
standard.



You and your family
are better
protected.



Ask your certified radon professional how they
follow the ANSI/AARST Standards for measurement.

**FOLLOW THE STANDARD.
PROTECT HEALTH.**



HOW TO TEST FOR RADON

1. WHERE TO TEST

A test is to be conducted in the **lowest level** that could be occupied when quick results are needed.



LOWEST LEVEL
(Could be occupied)



If the lowest level is not finished but could serve as a **work area, playroom, or additional bedroom** at some time in the future, a test is to be conducted in this level of the home.

2. CHOOSE THE RIGHT ROOM

Choose test locations where **people are more likely to spend time.**



LIVING ROOM



BEDROOM



HOME OFFICE / DEN

AVOID THESE ROOMS



NOT BATHROOM



NOT KITCHEN



NOT CLOSETS



Follow the test kit or monitor instructions carefully for accurate results.



NCDHHS
North Carolina Department of
Health and Human Services



**TEST. KNOW YOUR LEVEL.
PROTECT YOUR HEALTH.**

This course was developed by the NC Radon Program.

TIPS FOR ACCURATE RADON TESTING



HOMES CAN BE TESTED
AT ANY TIME OF THE YEAR.



TESTING PERIOD SHOULD
BE NO LESS THAN
48 HOURS.



AVOID TESTING DURING
UNUSUAL LOCAL
SEVERE WEATHER.



IF TESTING DURING
SEVERE WEATHER,
TESTING PERIOD SHOULD
BE NO LESS THAN 4 DAYS.



CONDUCT NORMAL
OPERATION OF HEATING
AND COOLING SYSTEM.



ENSURE EXISTING
RADON MITIGATION SYSTEM
IS IN OPERATION.



ENSURE HOME FULLY OPERATIONAL (ELECTRICITY IS ON).



Following these tips helps ensure your radon test results are accurate and reliable.

RADON TESTING: WHAT YOU NEED TO KNOW



ANY RADON TESTING REQUIRES CLOSED-HOUSE CONDITIONS.

- ✓ Keep all windows and doors closed, except for normal entry and exit.
- ✓ The home is completely built, ready for operation.



OPERATE HOME HEATING OR COOLING SYSTEMS NORMALLY DURING THE TEST.



IN REAL ESTATE TRANSACTIONS THE **LOWEST LIVABLE AREA** OF EACH FOUNDATION OF THE HOME NEEDS TO BE TESTED.



The lowest level may be the **BASEMENT**, whether finished or unfinished.

Depends on intended use of buyer.

AN EXAMPLE OF TESTING ANOTHER FOUNDATION IN THE HOME:



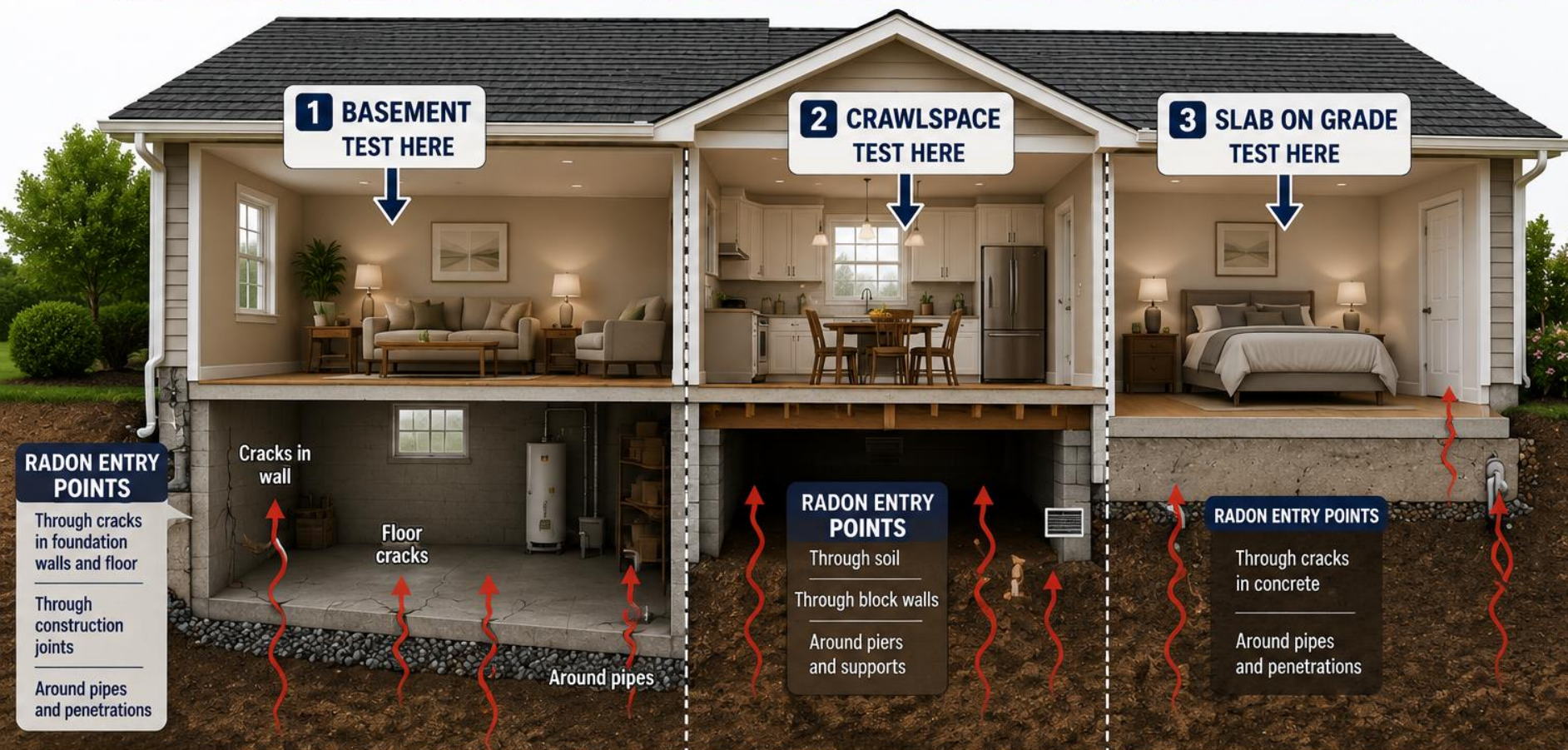
INCLUDES A LIVABLE AREA ABOVE A CRAWL SPACE.

This is considered the lowest livable area and should be tested.

ONE HOME. THREE FOUNDATIONS. THREE PLACES TO TEST.

If your home has multiple foundation types, radon can enter in different ways.

IT MAY BE NECESSARY TO CONDUCT A TEST IN EACH AREA WHERE A FOUNDATION TYPE IS FOUND.



Test the lowest livable level in each foundation type.

The lowest level may be a basement, crawlspace, or slab-on-grade area.



Multiple foundation types may require multiple tests.

Test Result: Pass

Overall Average:

3.6 pCi/l

EPA Average:

3.8 pCi/l

Test Device Details:

Serial Number: 204255067
Model Number: 1028
Last Calibration: 10/10/2020
Next Calibration: 10/10/2021
Cal-Factors: 2.84
Motion Error: No

Test Site Condition:

Test Summary:

<u>CRM Location:</u>	<u>Start:</u> 04/30/2021 04:20 PM	<u>Stop:</u> 05/02/2021 04:20 PM	<u>Interval:</u> 1 hr	<u>Duration:</u> 48 hr
*First 4 hrs of data excluded	<u>Min:</u> 1.1	<u>Max:</u> 8.1	<u>Average:</u> 3.8	<u>Measurement Units:</u> pCi/l



RADON TEST RESULTS FROM THE SELLER?



If the home has been tested by the seller, the buyer **may consider** using the previous test result.

HERE ARE FACTORS TO CONSIDER:



What was the **radon level**?
Was the test result near the **4.0 pCi/L** action level?



Was the test conducted for the **minimum period**?



Was the test conducted in the **last 2 or 5 years**?



What **level of the home** was tested?



Did the homeowner test for radon or a **certified professional**?



If you are unsure about the previous test or if any of these factors raise concerns, consider having **your own radon test** for peace of mind.



RECOMMENDATIONS FOR TESTING A HOME

DURING A REAL ESTATE TRANSACTION

1

HIRE A CERTIFIED RADON PROFESSIONAL TO CONDUCT THE TEST
so that there is a credentialed third party.



2

WHILE A PASSIVE TEST IS A VIABLE WAY OF TESTING, A CONTINUOUS RADON MONITOR CAN DETECT TAMPERING.



PASSIVE TEST

Provides an average result after the testing period.



CONTINUOUS RADON MONITOR

Provides real-time readings and can alert to tampering.

3

TEST THE LOWEST LEVEL THAT THE BUYER WILL UTILIZE FOR "LIVING".

Note that this "heated square footage" is not a criterion.



ACCURATE TESTING. INFORMED DECISIONS. PEACE OF MIND.



A SMART STEP IN ANY REAL ESTATE TRANSACTION.

RADON TEST RESULTS: WHAT THEY MEAN

RESULT (pCi/L)

ACTION



0 – 1.9*



RETEST

every 2 to 5 years



2 – 3.9



CONSIDER

a radon
mitigation system



**4 or
greater**



HIGHLY RECOMMEND

a radon
mitigation system

* All results are in picocuries per liter of air (pCi/L).

RECOMMENDATIONS WHEN INSTALLING A RADON MITIGATION SYSTEM

The only way to know your radon level is to **TEST**. Test every building. Protect every occupant.



1 HIRE A CERTIFIED RADON MITIGATION PROFESSIONAL

Choose a professional who is trained, certified, and experienced in radon mitigation system design and installation.

A certified professional will evaluate your home or building, design a mitigation system that is right for the structure, and ensure it is installed correctly for maximum effectiveness and safety.



2 ENSURE IN WRITING THAT THE CERTIFIED MITIGATOR IS EMPLOYING THE ANSI/AARST STANDARDS FOR THE BUILDING TYPE

Ask for written confirmation that the system will be designed and installed in accordance with ANSI/AARST standards.

ANSI/AARST standards ensure that the system is properly designed and installed for your specific building type, which helps ensure the system will perform as intended and provides documentation for your records.



3 REFER TO THE CONSUMER AWARENESS QUESTIONS AND TOPICS FOUND ON THE NC RADON PROGRAM WEBSITE

These resources will help you ask the right questions and make informed decisions.

The NC Radon Program website provides consumer friendly information on radon, testing, mitigation, and working with mitigation professionals so you can make informed choices and protect your health.



A properly installed radon mitigation system is an important step toward a safer, healthier home.



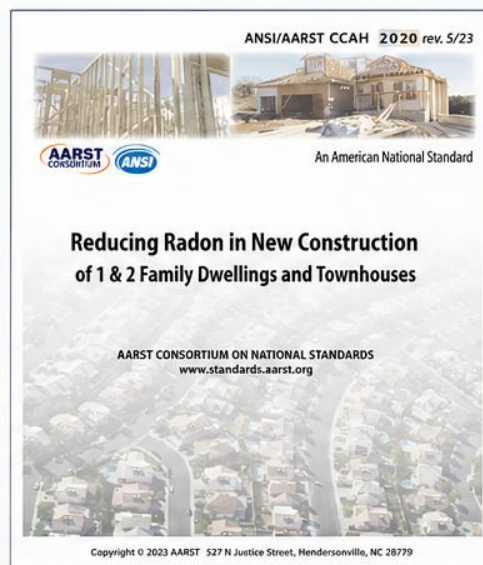
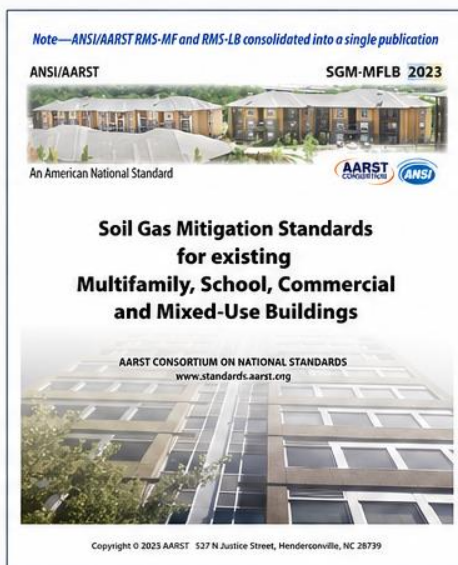
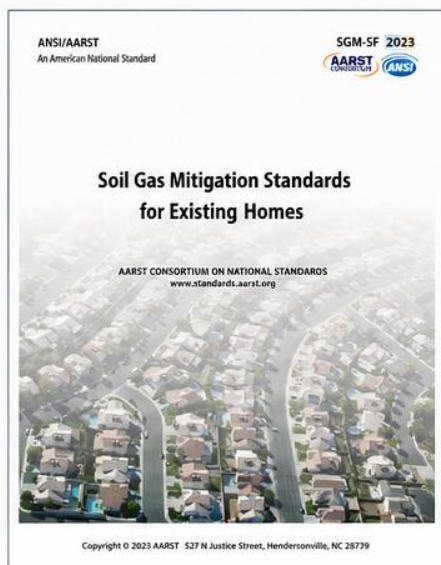
Visit the NC Radon Program website for consumer resources and more information:
www.ncradon.org



IT IS IMPORTANT FOR THE **CERTIFIED PROFESSIONAL** — TO FOLLOW THE ANSI AARST STANDARDS —



The ANSI/AARST Standards provide nationally recognized requirements for the design, installation, and verification of radon mitigation systems.



Following the ANSI/AARST Standards helps ensure systems are effective, safe, and built to the highest professional standard.

**FOLLOW THE STANDARD.
PROTECT HEALTH.**

WHEN THE CERTIFIED PROFESSIONAL FOLLOWS THE ANSI/AARST STANDARDS, YOU CAN TRUST THAT:



The system is designed and installed correctly.



The system will perform as intended to reduce radon.



Documentation meets national requirements.



Work is performed to consistent, professional standards.

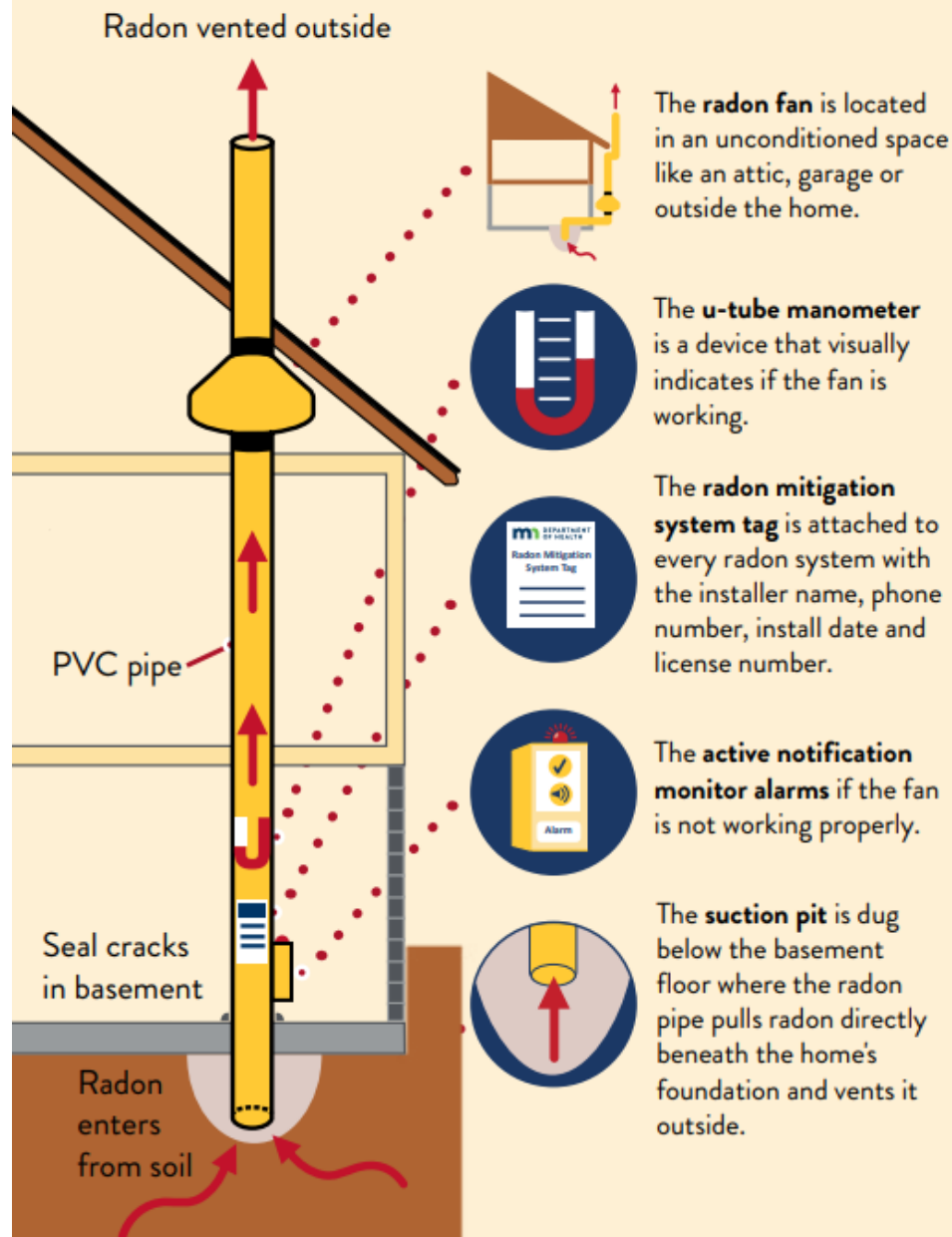


You and your family are better protected.

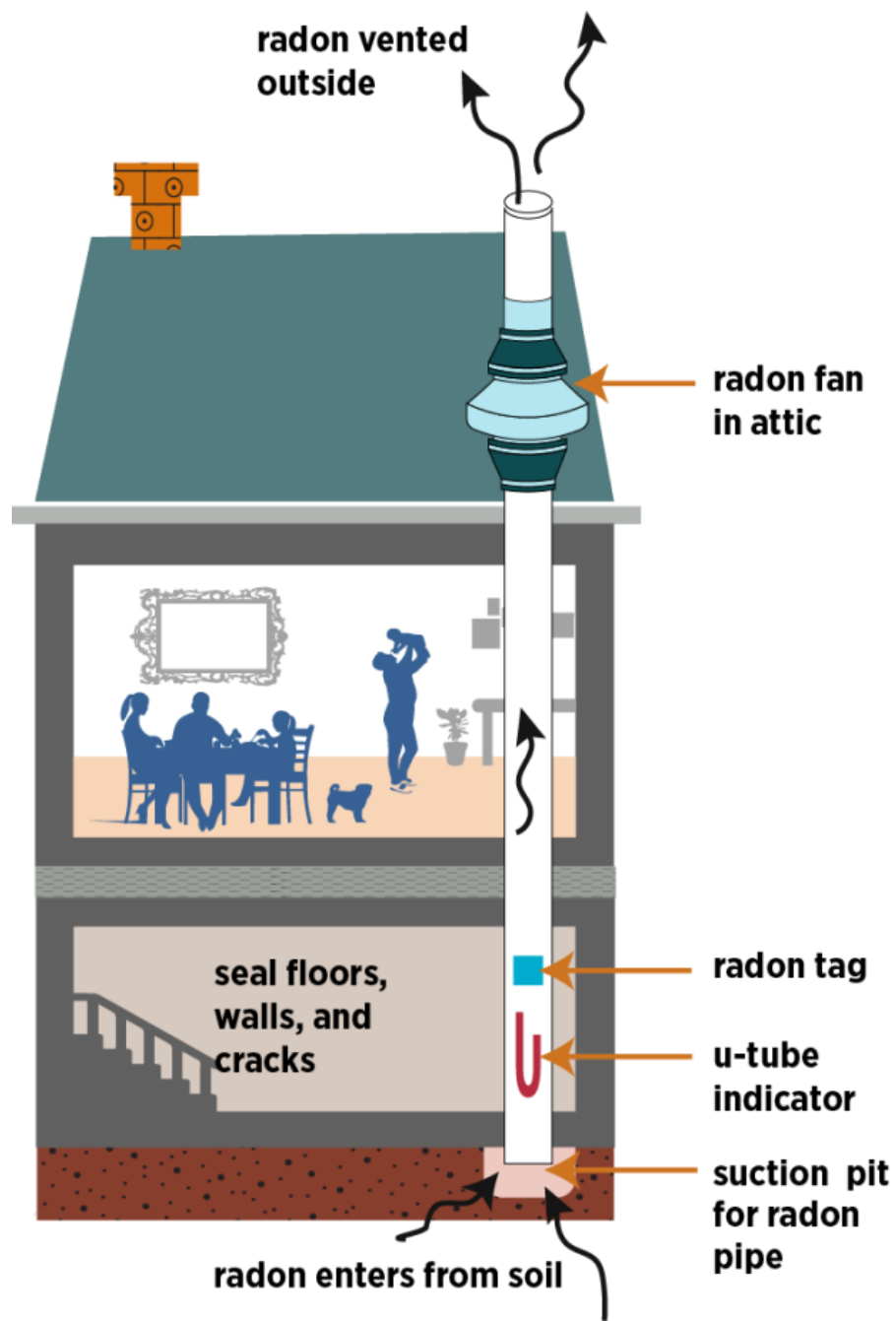


Ask your certified radon professional how they follow the ANSI/AARST Standards.

A Radon mitigation system



Radon mitigation components



Radon mitigation systems



SOURCE:

THINGS TO CONSIDER IN YOUR CONTRACT WITH THE CERTIFIED MITIGATOR



A clear written contract helps ensure your radon mitigation system is designed, installed, and verified to meet standards and protect your home.

CONSIDER HAVING THE FOLLOWING IN YOUR CONTRACT:



DIAGNOSTIC TESTING

Will diagnostic testing be performed to determine how the system should be designed?
Will it be included in the cost?



WARRANTIES?

What components are covered?
What is the length of the warranty?



GUARANTEES?

Is there a guarantee the system will perform?
What radon level is guaranteed?



POST MITIGATION TESTING?

Will post mitigation testing be conducted?
Who is responsible for ensuring the system meets the standard?



WHO MANAGES ANY PERMITS?

Who is responsible for obtaining any required permits and scheduling inspections?



AND MORE...

Consider including timelines, payment schedule, access requirements, homeowner responsibilities, and dispute resolution.



REFER TO THE NC RADON PROGRAM WEBSITE

for guidance on what to ask or expect from your certified mitigation professional.

- ✓ Questions to ask your mitigator
- ✓ What to expect before, during, and after installation
- ✓ Consumer awareness resources and more



Visit
www.ncradon.org
for more information.



A well-written contract protects you and helps ensure your radon mitigation system is installed to the **ANSI/AARST Standards** and performs as intended.



WHAT INFLUENCES THE COST OF A RADON MITIGATION SYSTEM?



The cost of a radon mitigation system can vary based on several factors.

1 TYPE OF FOUNDATION

Different foundation types affect the complexity of installation.



CRAWLSPACE



BASEMENT

\$ Basements and tight crawlspaces typically cost less than slab-on-grade homes.

2 AESTHETICS & LANDSCAPING

Landscaping and exterior considerations can impact the cost of installation.



\$ More extensive landscaping, hardscaping, or custom routing to maintain curb appeal can increase the cost.

3 LOCATION OF INSTALLATION

The ease of access and distance for running pipe affect labor and materials.



\$ Longer or more complex pipe runs, multiple floors, or tight access areas can increase cost.

4 LOCATION OF DISCHARGE

Where the system exhausts outdoors can affect the cost.



\$ Discharging above the roof is most common and often most cost-effective. More difficult or restrictive discharge locations can increase cost.



EVERY HOME IS DIFFERENT.

A certified radon professional can evaluate your home and recommend the most effective solution for your needs and budget.



INVESTING IN A PROPERLY DESIGNED AND INSTALLED SYSTEM protects your home and your health.

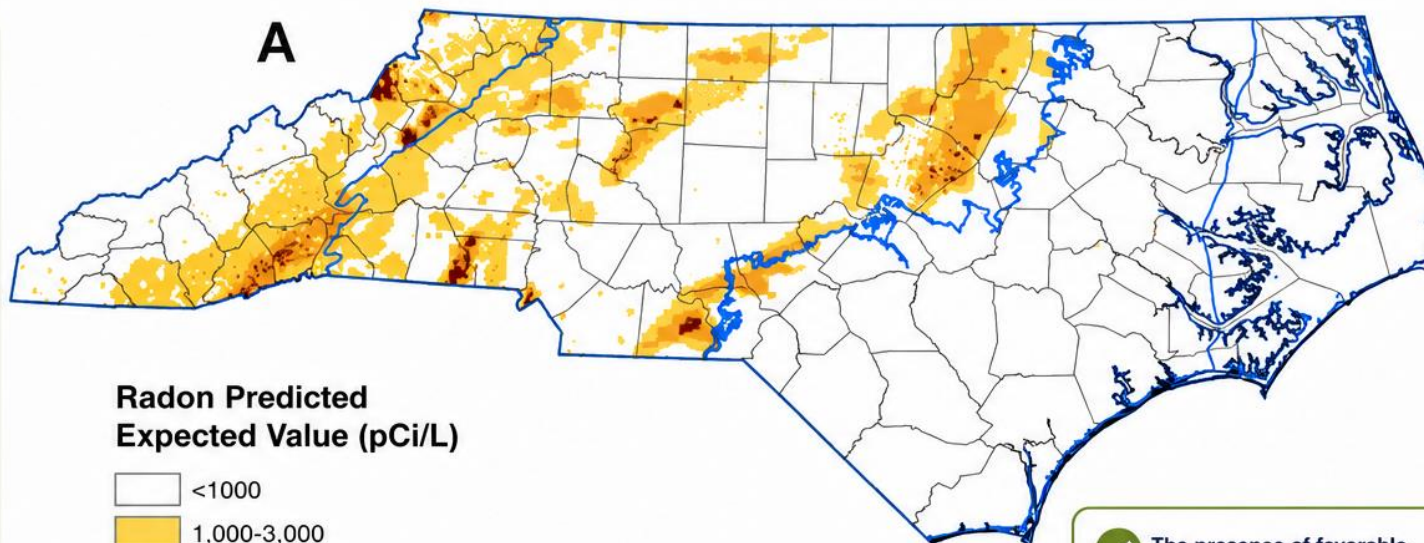
61

counties in North Carolina have the geology necessary to have naturally occurring radionuclides in private well water:



These areas have geology associated with elevated levels of naturally occurring radionuclides in groundwater, which may include:

- ✓ Radon
- ✓ Uranium
- ✓ Gross Alpha
- ✓ Gross Beta



✓ The presence of favorable geology does not mean every well is affected, but it does indicate areas where testing may be especially important.

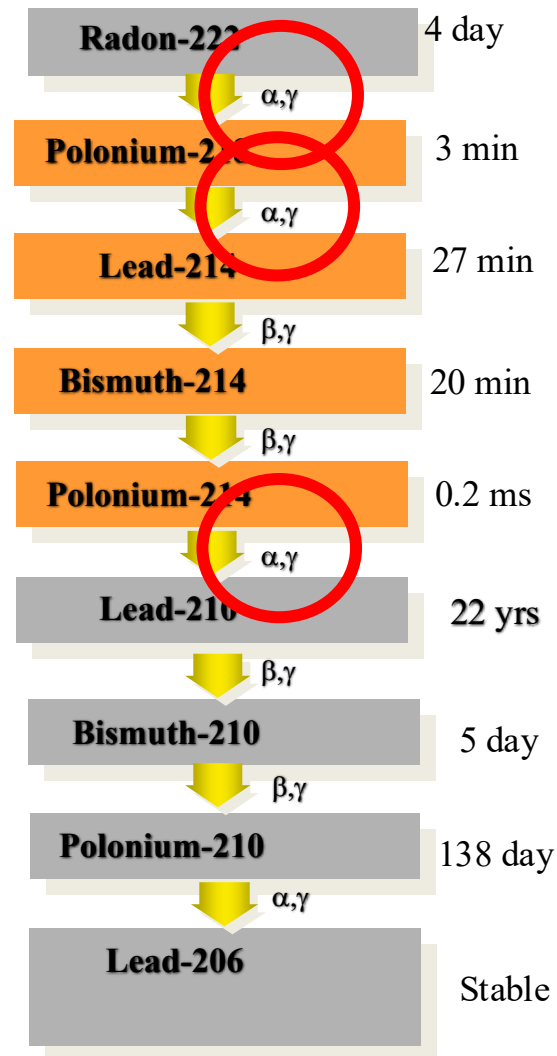


The only way to know what is in your well water is to test.

Test for Gross Alpha • Gross Beta • Radon • Uranium

Messier, K. P., Campbell, T., Bradley, P. J., & Serre, M. L. (2015). Estimation of groundwater Radon in North Carolina using land use regression and Bayesian maximum entropy. *Environmental science & technology*, 49(16), 9817-9825.

Testing private well water





TESTING PRIVATE WELL WATER FOR RADON, URANIUM, OR OTHER RADIONUCLIDES



This is not typically part of a regular well inspection or test.

Standard well inspections typically do not include testing for radon, uranium, or other radionuclides.

WHEN TESTING PRIVATE WELLS FOR RADON,
THE HOMEOWNER OR BUYER SHOULD ALSO
CONSIDER TESTING FOR:



**GROSS
ALPHA**

A measure of
alpha particle
emitting
radioactivity.



**GROSS
BETA**

A measure of
beta particle
emitting
radioactivity.



RADON

A radioactive
gas that can
dissolve in
well water.



URANIUM

A naturally
occurring
radioactive
mineral.



Testing is simple.

Certified lab kits are available and
analyze all four of these important
radionuclides in one sample.



Safe water. Healthy home. Knowledge is protection.



For more information on private well testing,
contact your **local health department**.



HOW TO COLLECT A WELL WATER SAMPLE AT HOME



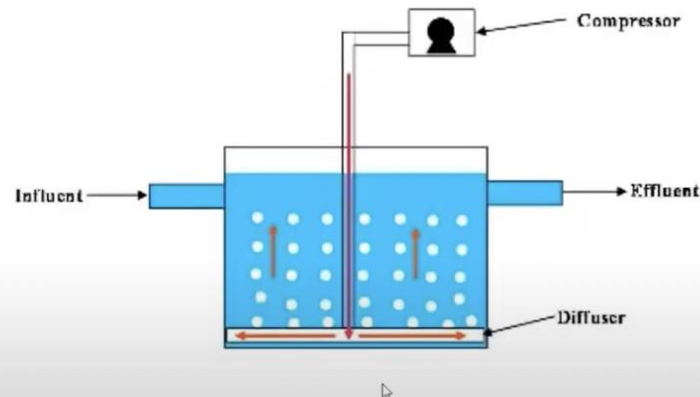
TREATMENT	URANIUM	RADIUM	RADON	GROSS ALPHA	GROSS BETA
Anion Exchange	✓	✓			✓
Reverse Osmosis	✓	✓		✓	✓
Surface and Decay Storage			✓		
Aeration System			✓		
Granular Activated Carbon			✓		

Mitigation of private well-water

Diffuse Bubble Aeration Method



A tank is filled with water, and a powerful blower forces air through tiny holes in diffuser located in the bottom of the tank creating thousands of small bubbles in the water.



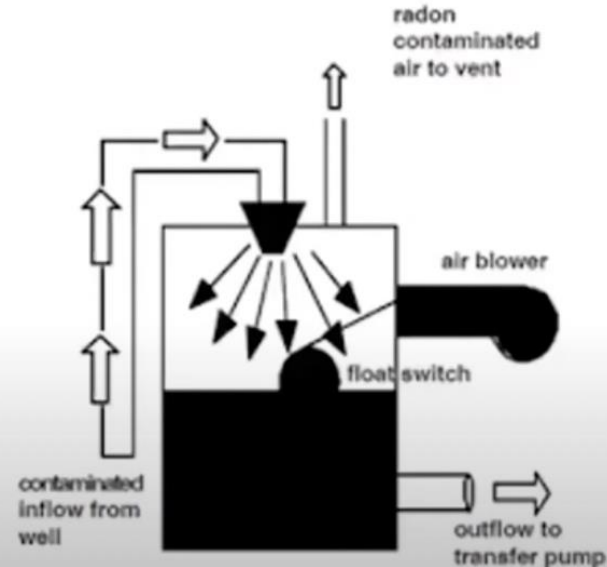
Mitigation of private well-water

Spray Aeration Method



Water is sprayed into a tank with air blowing through the spray.

The water is resprayed into the tank several times to increase removal efficiency.

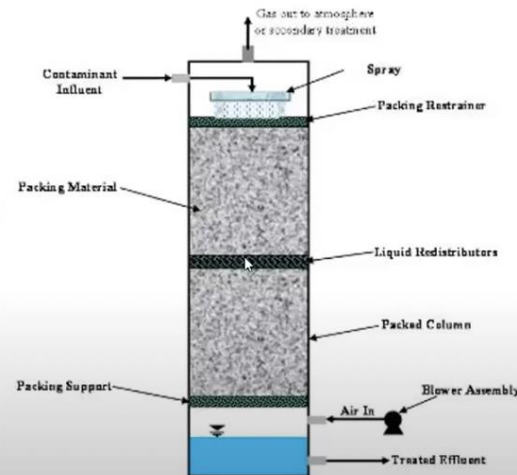


Mitigation of private well-water

Packed Column Aeration Method



Water trickles down through a column that contains loosely filled packing. The water forms a film on the packing which increases the surface area that is exposed to the air being blown up from the bottom.

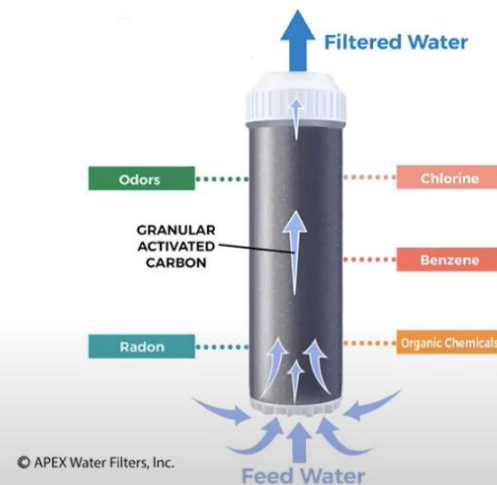


Mitigation of private well-water

Granular Activated Carbon (GAC) Method



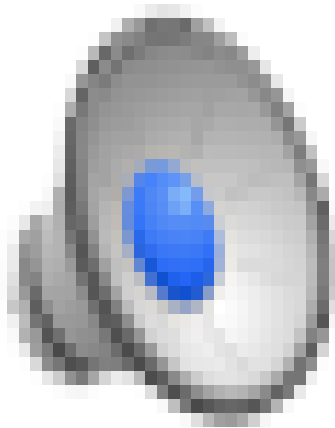
When water flows through the tank, any radon contained in the water moves into the adjacent pores until the concentration between the pores and the flowing water is equal. This process is called “adsorption” because the radon is not permanently attached to the carbon but rather “trapped”.



Mitigation of private well-water

- **Costs**
 - **GAC systems begin at approximately \$2,500**
 - **Aeration systems begin at approximately \$5,000**

Real estate concerns - HOAs



Real estate concerns – material fact

The Commission found that in March 2019, Ms. Taylor acted as listing agent for residential property.

The seller informed Ms. Taylor that she had applied DRYLOCK to the basement walls but did not tell her that the basement walls had a history of leaking water, and the seller indicated “no” on the RPOADS in response to the question asking whether there were any problems or defects in the property’s foundation.

The property went under contract and the buyer’s home inspection determined that previously patched cracks in the basement walls had reappeared, and that the reappearance of the cracks was due to hydrostatic pressure on the outside of the walls pushing the walls inward. The inspector recommended that the basement walls be examined by a professional engineer and repairs made, if necessary.

Real estate concerns – material fact

A radon inspection ordered by the buyer also indicated that the radon levels averaged 8.3 pCi/L well above the recommended 4.0 maximum. After receiving the first buyer's home inspection report, Ms. Taylor discussed the report with her seller-client who declined to hire anyone to inspect the basement walls but had a radon mitigation system installed.

No subsequent radon test was performed to confirm the radon levels had lowered. After the first buyer terminated the contract,

Ms. Taylor put the property back on the market without advising her seller-client to revise the RPOADS and without otherwise disclosing the information from the previous home inspection or radon inspection.

Real estate concerns – what not to say

The house tested “safe”

- No measurable level is safe. A level of 4.0 pCi/L is not a public health standard

I am not aware of a problem in this area

- Radon is quite variable from house to house.
- The only way to know is to have the home tested.

Radon isn't as bad as some people think.

- This implies an expert opinion and introduces concerns of negligent misrepresentation.

Educational opportunities

Distribute social media

Distribute brochures and fact sheets

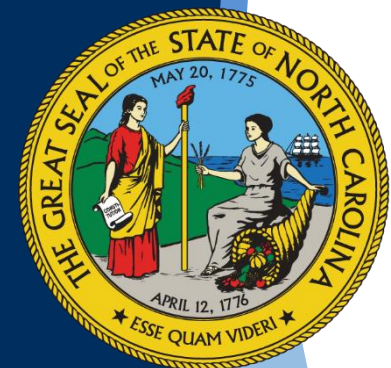
Organize a real estate firm presentation from the NC Radon Program

Communication Tools

- Basic radon fact sheet (16 languages)
- Videos (7 languages – including ASL)
- Guidance document created for each of the 100 NC counties
- Fact sheet regarding children and radon
- Fact sheet regarding pets and radon

SOURCE:

<https://radon.ncdhhs.gov>



Basic radon fact sheet

WHAT IS RADON?

The two main causes of lung cancer in North Carolina are smoking tobacco and breathing high levels of radon. The North Carolina Radon Program wants you to know about the importance of testing for radon in your home and how to get radon levels in your home reduced.

What is radon?



Radon is a type of gas that you can't see, smell, or taste. It forms when certain radioactive materials, like uranium, thorium, and radium, break down in soil, rocks and water.

Why should I be concerned about radon?



Radon is the number one cause of lung cancer among non-smokers, according to EPA estimates. Overall, radon is the second leading cause of lung cancer, behind smoking. Inhaling radon is estimated to cause over 21,000 lung cancer deaths annually in the United States. In 2020, lung cancer was the primary cause of cancer-related deaths in North Carolina.

How does radon cause lung cancer?



Radon gas breaks down into radioactive particles that attach to your lungs as you breathe. These particles release bursts of energy, which can harm lung tissue and cause lung cancer over time. While not everyone exposed to high radon levels develops lung cancer, the risk of lung cancer increases as the level gets higher.

Where is radon found in North Carolina?

About 1 of every 15 homes in the US is probably affected by high levels of radon. In North Carolina, some homes in all 100 counties have been found to have high radon levels. The only way to find out if your home has a radon issue is by testing it. Maps and neighbor's radon levels cannot predict if your home has high radon levels. Every home and building is different.

1 IN 15 HOMES AFFECTED IN THE UNITED STATES

What are your chances of getting lung cancer from radon?

That depends on a few factors:

1. The level of radon in your home: Higher levels of radon increase your risk.
2. How much time you spend in your home: More time spent in a place with high radon levels raises your risk.
3. Whether you smoke or have smoked before: People who smoke and are exposed to radon have a 10 times greater risk of lung cancer.
4. If you're exposed to secondhand tobacco smoke: Being around secondhand smoke adds to your risk of lung cancer, especially if you're also exposed to radon.

How does radon get into a home?



Radon seeps up from rocks underground, through the soil, and into the air above. It enters your home through cracks and gaps in the foundation and becomes trapped inside. This can occur in both new and old homes, with or without basements, and even in high-rise buildings or apartment complexes. Radon can also enter homes through well water that comes from underground, bringing radon into the house.

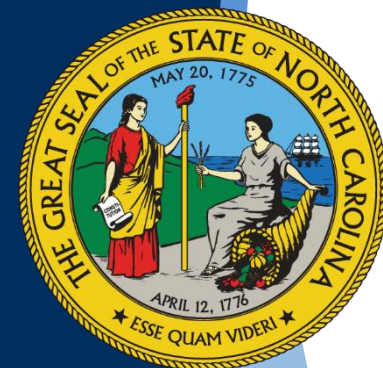
Is radon only in homes?



Radon can increase in any type of building. However, since people typically spend most of their time at home, that's where they're most likely to be exposed to radon. But you may be exposed to radon in all types of buildings.

SOURCE:

<https://radon.ncdhhs.gov>







Children, whose lungs are still developing, may be two times more sensitive to radon than adults;

Buyer's & Seller's Guide



Real Estate Seller's/Buyer's Guide REGARDING RADON IN THE HOME



WHY SHOULD I TEST FOR RADON?

Elevated radon levels are found throughout North Carolina: Radon comes from the natural breakdown of uranium in soil, rock, sand, and water and gets into the air you breathe. Radon is the cause of over 21,000 lung cancer deaths in the United States each year.

The U.S. Environmental Protection Agency, the U.S. Surgeon General, and the North Carolina Department of Health and Human Services recommend that you test your home: Testing is the only way to know whether you and your family are at risk from radon. You cannot predict radon levels based on state, local, or neighborhood radon measurements.



Home buyer's and seller's guide to radon

This guide answers questions about radon and lung cancer risk, as well as questions about testing and fixing a radon problem for anyone buying or selling a home.

You cannot see, smell or taste radon. When you breathe air containing radon, you increase your risk of getting lung cancer. If you smoke and your home has high radon levels, your risk of getting lung cancer is even higher.

I'm SELLING a home. What should I do?

If Your Home Has Already Been Tested for Radon...

Ensure that the test was done correctly. If so, provide your test results to the buyer.

If Your Home Has Not Yet Been Tested for Radon...

Testing is the only way to know if you or your family are at risk from radon. You cannot predict radon levels based on state, local, and neighborhood radon measurements.

I'm BUYING a home. What should I do?

If the Home Has Already Been Tested for Radon... If you are thinking of buying a home, you may accept an earlier test result from the seller or conduct a test by a certified radon professional. If you decide that a new test is needed, discuss it with the seller as soon as possible.

If the Home Has Not Yet Been Tested for Radon...

Make sure that a radon test is conducted by a certified radon measurement professional as soon as possible.

Types of radon measurement devices

Passive Devices: Passive radon testing devices do not need power to function. These include charcoal canister, alpha track detectors, charcoal liquid scintillation devices, and electret ion chambers, which are available in hardware, drug, and other stores. They can also be ordered by mail or phone.

Active Devices: Active radon testing devices require power to function and are used by certified professionals. These include continuous radon monitors and continuous working level monitors.

There are two general ways to test your home for radon

Short-Term Testing: The quickest way to test is with short-term tests. Short-term tests remain in your home usually for two to seven days, or up to 90 days. This varies depending on the device.

Long-Term Testing: Long-term tests remain in your home for more than 90 days. Alpha track and electret ion chamber detectors are commonly used for this type of testing.

Doing a short-term test...

If you are testing in a real estate transaction and you need results quickly, the following options for short-term tests are acceptable in determining whether the home should be fixed.

SHORT-TERM TESTING OPTIONS

Passive: Take two short-term tests at the same time in the same location for at least 48 hours. Fix the home if the average of the two tests is at or above 4 picocuries per liter (pCi/L).

Active: Test the home with a continuous monitor for at least 48 hours. Fix the home if the average for the test is at or above 4 pCi/L.

Mitigation Guidance



Radon Mitigation Systems REDUCING RADON IN THE HOME

This flyer is for people who tested their home indoor air for radon and have elevated radon levels of 4 picocuries per liter (pCi/L) or higher.

Buying or selling a home?

If you are buying or selling a home and need to make decisions about radon, consult the North Carolina Radon Program website at radon.ncdhhs.gov.

If you are selling a home that has a radon reduction system, inform potential buyers and supply them with information about your system's operation and maintenance.

The North Carolina Real Estate Commission regards a level of 4 pCi/L or more to be a "material fact" and has stated that "if a licensee [licensed real estate broker] knows that dangerous levels of radon are present in any structure which will be occupied regularly by people, then the licensee must disclose that to all prospective buyers or tenants."

What do your radon test results mean?

Any radon exposure has some risk of causing lung cancer. The lower the radon level in your home, the lower your family's risk of lung cancer. The Environmental Protection Agency (EPA) recommends fixing your home if the results of one long-term test or the average of two short-term tests show radon levels of 4 pCi/L or higher.

You can determine your radon levels by using a short-term test usually lasting from two to seven days or up to 90 days, or a long-term test from 90 days to one year. Radon tests should be conducted for a minimum of 48 hours, but longer tests provide a better estimate of exposure.

How to select a certified mitigator

Visit the NC Radon Program website at radon.ncdhhs.gov for details about radon and your home. The web page includes links to help you identify a certified radon professional near you.

Choose a certified radon mitigator to fix a radon problem just as you would choose any other professional to do other home repairs. It is recommended that you seek more than one estimate. Ask for their warranty and guarantee that they will reduce the radon to an acceptable level. Request references. Contact some of those references and ask if they are satisfied with the mitigator's work.

Compare the mitigator's proposed costs and consider what you get for your money. Consider the following:

- A less expensive system may cost more to operate and maintain;
- A less expensive system may have less aesthetic appeal;
- A more expensive system may be best for your home; and
- The quality of the building materials will affect how long the system lasts.



The contract

Ask the mitigator to prepare a contract before any work starts. Read the contract before you sign it. Make sure everything in the contract matches the original proposal. The contract should describe exactly what work will be done prior to and during the installation of the system, what the system consists of, and how the system will operate.

What to look for in a radon reduction system

In selecting a radon reduction method for your home, you and your mitigator should consider: how high your initial radon level is, the costs of installation and system operation, your home size, and your foundation type. The system must be labeled and have a visual or audible alarm to let you know it is working. Exhaust fans must never be in or below the living space or vent into the living space or attic.



Radon reduction techniques

Some radon reduction techniques prevent radon from entering your home while others reduce radon levels after it has entered. The EPA generally recommends methods that prevent the entry of radon. However, each home requires a unique mitigation system specifically designed for that building.

HOME FOUNDATION TYPES

Homes have different types of foundation. Some have a combination of foundation types. Foundation type will determine the type of mitigation system installed. Foundation types include: basement, slab-on-grade, and crawlspace.

Basement & Slab-on-Grade Homes

Active sub-slab suction, also called sub-slab depressurization, is the most common and usually most reliable radon reduction method.

Passive sub-slab depressurization is the same as active sub-slab suction except it relies on natural pressure differentials and air currents and is usually associated with radon resistant features installed using radon resistant new construction techniques.

Drain tiles or perforated pipes are used to direct water away from the foundation of the home and suction on these tiles or pipes is often effective in reducing radon levels.

Block-wall suction can be used in homes with hollow block foundation walls. This method removes radon and depressurizes the block wall.



Home With Mitigation Guidance



Living in a Home with Radon Mitigation Systems

REDUCING RADON IN THE HOME

WHAT IS RADON?

- Radon is the leading cause of lung cancer for non-smokers.
- Radon is a natural radioactive element that is a result of the natural decay of Uranium found in most soils throughout the United States.
- Radon enters home and all other buildings.



Why does your home have a radon system?

- Your home was tested for radon and a high level was discovered.
- A radon mitigation system was installed to lower the radon level and your risk for lung cancer.
- Even if built to be radon-resistant, every home should be tested for radon as soon as possible after occupancy.
- Building radon-resistant features into the house during construction is easier and less expensive than fixing a radon problem after the home is constructed.
- When installed properly, radon-resistant techniques can also make your home more energy efficient and help you save on your energy costs.

- Obtain copies of your guarantees and radon system warranties. Fans may last five years or more — manufacturer warranties tend not to exceed five years — and may then need to be repaired or replaced.

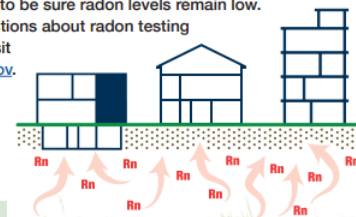
Remember, the fan should NEVER be turned off; it must run continuously for the system to work correctly.

Remodeling your home after radon levels have been lowered

- If you decide to make major structural changes to your home after you have had a radon reduction system installed, such as converting an unfinished basement area into living space, ask a certified radon professional whether these changes could void any warranties.
- If you are planning to add a new foundation for an addition to your home, ask a certified radon professional what measures should be taken to ensure reduced radon levels throughout the home.
- After you remodel, retest in the lowest lived-in area to make sure the construction did not reduce the effectiveness of the radon reduction system.

Most importantly, measure the radon level in your home every two years to be sure radon levels remain low.

If you have questions about radon testing or mitigation, visit radon.ncdhhs.gov.



Now that you have a radon system, what do you do?

Owning a home with safety features, like a radon reduction system, is a benefit to those living in the home. Like any safety device, however, a bit of maintenance is required to make sure that it is operating properly.

- It is recommended that you measure the radon level in your home every two years to be sure radon levels remain low.
- Radon reduction systems need occasional maintenance. You should contact a certified radon mitigator to discuss how to maintain your radon system. Visit the NC Radon Program website at radon.ncdhhs.gov for details about radon and your home, and to find a link to help you identify a certified radon professional near you.
- If you have a fan powered (or active) system, you should look at your warning device, usually a manometer, on a regular basis to make sure the system is working correctly.



REMEMBER Test for Radon every 2 years!
Learn more at radon.ncdhhs.gov



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation
Radiation Protection Section
radon.ncdhhs.gov • NCDHHS is an equal
opportunity employer and provider. • 11/22

IN COLLABORATION WITH



NORTH CAROLINA
Advisory Committee
on Cancer Coordination and Control

advanced
energy

Self-Help
Credit Union

DukeHealth

NORTH CAROLINA
**HOUSING
FINANCE
AGENCY**

Healthcare Provider Booklet



CRCPD Publication
Revised September 2018

Reducing the Risk from Radon: Information and Interventions

A Guide for Health Care Providers

RadonLeaders.org



Radionuclide Fact Sheet

Radionuclides in North Carolina – FAQs for Local Health Departments

July 23, 2019

1. What are radionuclides?

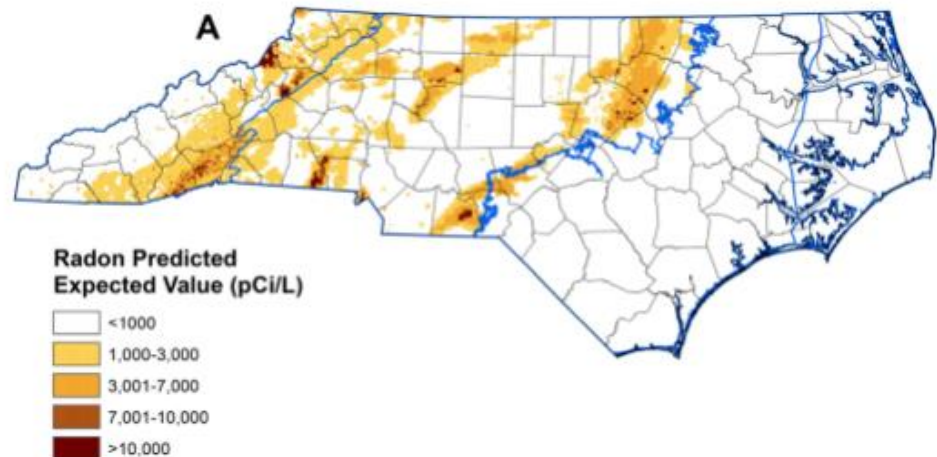
Radionuclides are elements that give off radiation as they break down. In nature, radionuclides can be found in rocks and soil and can get into ground water and into wells.

2. How do radionuclides get into well water?

Radionuclides can get into ground water and into wells if you live in an area where they are naturally present in the rocks and soil.

3. What areas of the state are more likely to have high levels of radionuclides in groundwater?

There are limited data on the occurrence of radionuclides in North Carolina. We do know that these elements are associated with certain types of rock formations deep underground. The following map shows areas that are more likely to have elevated radon in groundwater based on the location of these rock formations. Radon co-exists with uranium, radium and other radionuclides, so this map also indicates where other radionuclides might be elevated in groundwater. Areas in or around the colored portions of this map may be impacted by radionuclides.



Messier, K. P., Campbell, T., Bradley, P. J., & Serre, M. L. (2015). Estimation of groundwater Radon in North Carolina using land use regression and Bayesian maximum entropy. *Environmental science & technology*, 49(16), 9817-9825.

Uranium Well Water Fact Sheet

Uranium & PRIVATE WELLS



What is uranium?

Uranium is a radioactive metal that occurs naturally throughout the environment in rocks, soil, water, and air. Uranium can be introduced into the environment through industrial processes including mining, milling and uranium enrichment processes. Uranium can also be introduced into the environment through the production of phosphate fertilizers as phosphate rocks containing uranium are crushed.

How does uranium get in my private well water?

Low levels of uranium in well waters are mostly attributed to the underlying bedrock composition. Some geologic areas may cause well water to be higher than normal in uranium. Uranium can also enter groundwater through areas with a history of uranium mining and related facilities.

How can uranium affect my health?

All the following health effects come from the chemical interactions of uranium in target organs and not the radioactivity uranium exhibits. Uranium has not been classified as to its carcinogenicity because of limited and inconclusive studies.

Uranium exposure, at high exposure levels, can cause a variety of symptoms depending upon the route of exposure. All exposure routes of uranium can result in kidney damage. There is limited evidence in animals of uranium exposures affecting reproductive processes and causing developmental effects. However, these effects have not been observed in

humans. Additionally, children are not considered more sensitive to uranium exposures than adults

Dermal absorption from naturally occurring uranium in groundwater is not a primary exposure route. The general public primarily intakes naturally occurring uranium via food and drinking water.

What level of uranium should I be concerned about?

The **U.S. Environmental Protection Agency** developed a public drinking water standard of **30 micrograms of uranium per liter of groundwater (ug/L)**. Public drinking water standards are based on public health protection and cost of treatment/testing at large utilities.

Where is uranium found in NC?

Groundwater uranium is generally found in the geologic areas known as the Raleigh Belt, Carolina Slate Belt, and the Charlotte and Milton belts. The Raleigh Belt was found to have the highest naturally occurring uranium water levels. The general range of uranium in North Carolina is from 0 to 30 ug/L, with a small amount as high as 250 ug/L.

Radon and Pets

RADON FACTSHEET

Radon is a naturally occurring radioactive gas and the leading cause of lung cancer in humans that do not smoke.

Most exposure to radon occurs in buildings. The only way to know if a building has high radon levels is by testing for radon. All buildings should be tested for radon.

When radon levels are equal to or greater than 4 picoCuries per liter of air then a certified contractor should be hired to lower the radon level.

>4
picoCuries
per liter

Radon and Pets

Lung cancer incidence in dogs and cats is approximately 3-fold higher in areas with high radon potential. Like children, pets have smaller lungs and breathe faster than adult humans.



Thus, pets may receive a higher dose of radiation from breathing radon than adult humans. Exposure to both cigarette smoke and radon increases the risk of lung cancer. Emphysema and fibrosis are more prevalent and severe in dogs exposed to second-hand-smoke and radon.

Secondhand Smoke

Secondhand smoke is a mixture of smoke exhaled by the smoker and smoke from the burning end of tobacco products.



Cigarette smoke contains over 7,000 chemicals and 69 of these are known carcinogens. Pet owners are motivated to create smoke-free homes for their pet's health.

OVER
7,000
chemicals & 69
carcinogens

Pets and Secondhand Smoke

Respiratory cells of dogs with chronic bronchitis exhibit DNA damage from secondhand smoke.



Exposure to secondhand smoke results in pulmonary emphysema, fibrosis, and chronic bronchitis as well as bronchitis in dogs.



Medium- to long-nosed animals may be at higher risk of nasal cancer from secondhand smoke.

Secondhand smoke may exacerbate chronic cough in dogs with respiratory disease.

Are Pets at Risk
in North Carolina?

Yes!

Pets rely on humans to protect them! We are hopeful that this information will assist humans in knowing the risks from secondhand smoke and radon on dogs and cats.

Radon and Secondhand Smoke Exposure in Pets

Veterinarians Can Help:

- Encourage pet owners to take action.
- Educate pet owners about the dangers of radon and secondhand smoke.
- Test your own home for radon and share how easy it was to do so.
- Advise owners to contact the North Carolina Radon Program for details about how to address high radon levels.



Social Media

**CONCIENTIZACIÓN
SOBRE EL RADÓN**

Conoce los Riesgos

Invisible, sin olor, sin sabor... y peligroso



**NC DEPARTMENT OF
HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

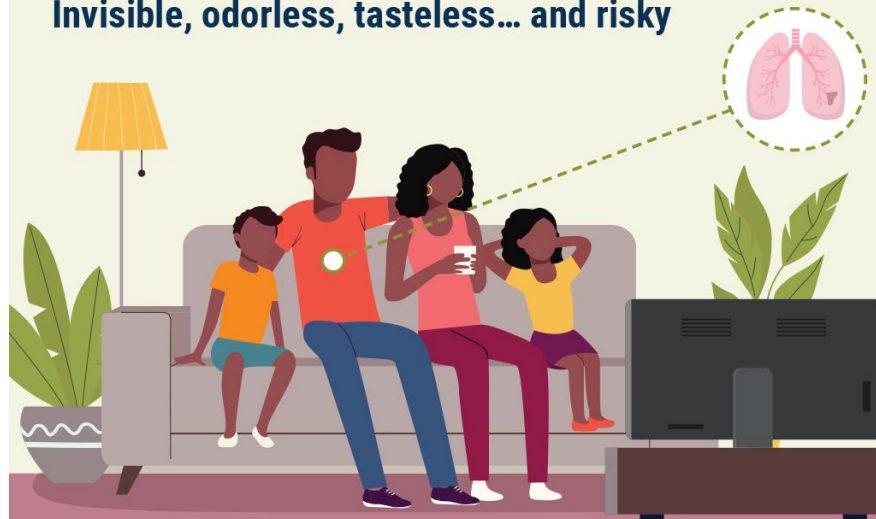
radon.ncdhhs.gov

Adaptado de un gráfico de los CDC.

**RADON
AWARENESS**

Learn the Risks

Invisible, odorless, tasteless... and risky



**NC DEPARTMENT OF
HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

radon.ncdhhs.gov

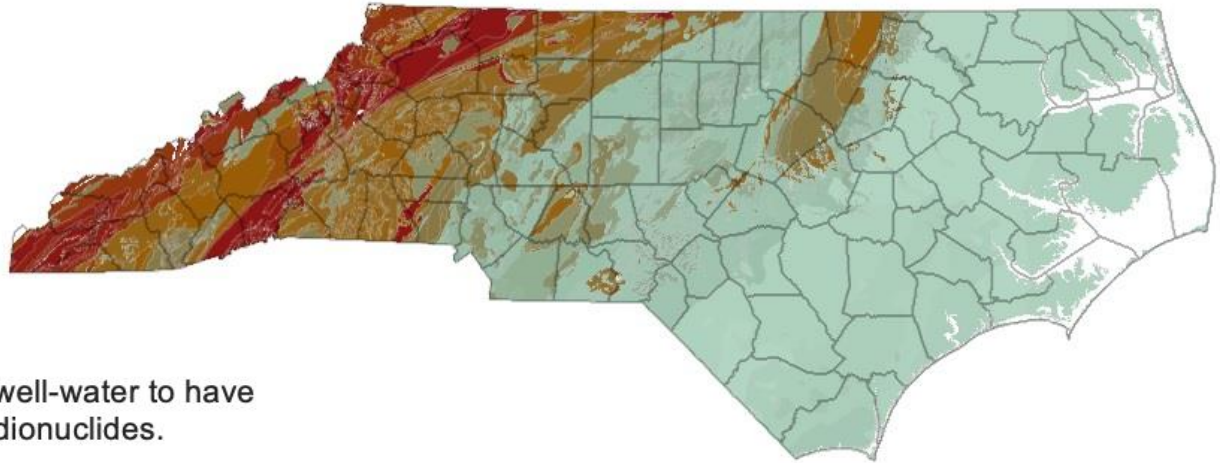
Adapted from a CDC graphic.

Geological map and education

County-specific campaign

- Each county-specific fact sheet, recommendations for testing
- Online interactive map displaying geology, radon levels, and link to county-specific PDFs

Geological map and education



High risk for private well-water to have elevated levels of radionuclides.

Moderate risk for private well-water to have elevated levels of radionuclides.

Very low risk for private well-water to have elevated levels of radionuclides.

RADIONUCLIDE FACT SHEET

STANLY COUNTY

TAKE ACTION

**TEST THE INDOOR AIR OF BUILDINGS.
TEST YOUR PRIVATE WELL WATER.**

SOURCE OF RADON Radon is a gas that is naturally present in rocks and soil in North Carolina. It is created when uranium in the ground decays. Some building materials can also have uranium, and the only way to know if radon is being released indoors is by testing the air. Radon itself cannot be seen, smelled, or tasted.

TEST YOUR INDOOR AIR

It is important to test the air in your home, apartment, or commercial building for radon every two years. Radon is a gas that can be harmful and cause lung cancer if it builds up in the indoor air you breathe.

- If the indoor radon level is between 2 and 3.9 picoCuries per liter of air, the NC Radon Program recommends you consider hiring a certified radon professional to install a system that will lower the radon level and make your air safer to breathe.
- If the radon level in your home or building is equal to or higher than 4.0 picoCuries per liter of air, the NC Radon Program strongly recommends that you hire a certified radon professional. They can install a system that will lower the radon level and make your air much safer to breathe.

PROTECT THE MOST VULNERABLE

Smokers and People Exposed to Secondhand Smoke

While breathing in radon alone can cause lung cancer, the Centers for Disease Control and Prevention (CDC) reports that people who smoked or currently smoke and are exposed to radon are 25 times more likely to get lung cancer.⁽⁹⁾

Children

The CDC reports that children are twice as likely to be affected by breathing in radon than adults. Additionally, if children are exposed to tobacco smoke and elevated radon levels, their risk of developing lung cancer increases at least 20 times.⁽¹⁰⁾

TEST YOUR PRIVATE WELL WATER

Testing the water from your private well is important for making sure it is safe to drink. If your drinking water comes from a private well, the NCDHHS, Division of Public Health suggests testing it for radon, gross alpha, gross beta, and Uranium.^(2,3)

Exposure to radionuclides via drinking water has linked with various health effects^(2,3)

Radon: Stomach cancer

Uranium: Kidney damage, cancer

Radium: Bone cancer

If your radon level in the water is above 4,000 picoCuries per liter, it is recommended that you hire a certified radon professional to install a system that will reduce the radon level.

Owners of buildings built with certain materials, such as large buildings and mid- high-rise condominiums, should consider testing the indoor radon level. The CDC reports that "any buildings built with sandstone, concrete, brick, natural stone, gypsum, and granite contain naturally occurring radioactive elements like radium, uranium, and thorium." The only way to know if these materials increase indoor radon levels is by testing for radon.⁽¹¹⁾

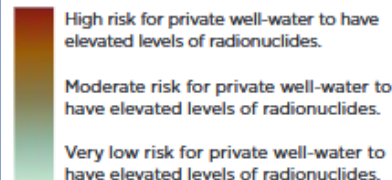
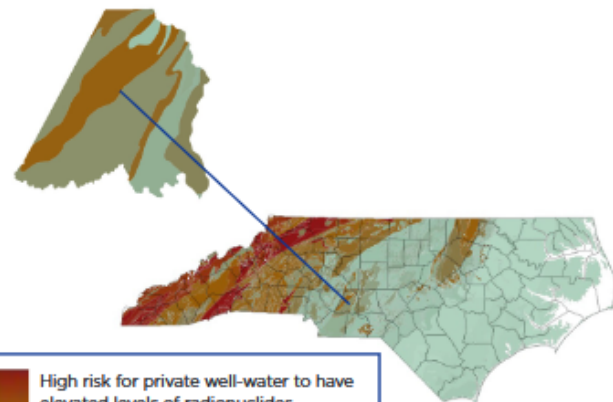


Image source:
North Carolina
Geological Survey.

MORE INFORMATION

1. <http://radon.ncdhhs.gov/>
2. https://epi.dph.ncdhhs.gov/oe/docs/Uranium_WellWaterFactSt.pdf
3. https://epi.dph.ncdhhs.gov/oe/docs/Radionuclides_WellWaterFactSt.pdf
4. www.ncdhhs.gov/buyers-and-sellers-guide-radon/download?attachment
5. www.ncdhhs.gov/installing-radon-mitigation-system/download?attachment
6. www.ncdhhs.gov/homes-radon-mitigation-systems/download?attachment
7. www.dph.ncdhhs.gov/chronicdiseaseandinjury/cancerpreventionandcontrol/index.htm
8. <https://schs.dph.ncdhhs.gov/units/idas/docs/NCSHIP-2022-Full.pdf>
9. [www.atsdr.cdc.gov/csem/radon/health_effects.html#:~:text=The%20lung%20cancer%20risk%20for%20\(Darby%20et%20al](http://www.atsdr.cdc.gov/csem/radon/health_effects.html#:~:text=The%20lung%20cancer%20risk%20for%20(Darby%20et%20al)
10. www.atsdr.cdc.gov/csem/radon/who_risk.html#:~:text=Risk%20of%20lung%20cancer%20in%20increases%20at%20least%2020%20times
11. www.cdc.gov/nceh/radiation/building.html#:~:text=Radioactive%20materials%20in%20sandstone%20C%20concrete%20radium%20C%20uranium%20C%20and%20thorium



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

Radiation Protection Section
radon.ncdhhs.gov
NCDHHS is an equal opportunity
employer and provider. • 10/2023



NORTH CAROLINA
Advisory Committee on Cancer
Coordination and Control
Celebrating 30 Years



ALAMANCE COUNTY

SOURCE OF RADON

Radon is a gas that is naturally present in rocks and soil in North Carolina. It is created when uranium in the ground decays. Some building materials can also have uranium, and the only way to know if radon is being released indoors is by testing the air. Radon itself cannot be seen, smelled, or tasted.

TEST YOUR INDOOR AIR

It is important to test the air in your home, apartment, or commercial building for radon every two years. Radon is a gas that can be harmful and cause lung cancer if it builds up in your indoor air.^(b)

If your indoor air radon level is between 2 and 3.9 picoCuries per liter, the NC Radon Program recommends you consider hiring a certified radon professional. They can install a system that will lower the radon level and make your air safer to breathe.^(b)

If your indoor air radon level is equal to or higher than 4.0 picoCuries per liter, the NC Radon Program strongly recommends that you hire a certified radon professional. They can install a system that will lower the radon level and make your air much safer to breathe.^(b)

PROTECT THE MOST VULNERABLE

Smokers and People Exposed to Secondhand Smoke: While breathing in radon alone can cause lung cancer, the Centers for Disease Control and Prevention (CDC) reports that people who smoked or currently smoke and are exposed to radon are 25 times more likely to get lung cancer.^(b)

Children: The CDC reports that children are twice as likely to be affected by breathing in radon than adults. Additionally, if children are exposed to tobacco smoke and elevated radon levels, their risk of developing lung cancer increases at least 20 times.^(b)

Owners of buildings built with certain materials, such as large buildings and mid- high-rise condominiums, should consider testing the indoor radon level. The CDC reports that "any buildings built with sandstone, concrete, brick, natural stone, gypsum, and granite contain naturally occurring radioactive elements like radium, uranium, and thorium." The only way to know if these materials increase indoor radon levels is by testing for radon.^(b)

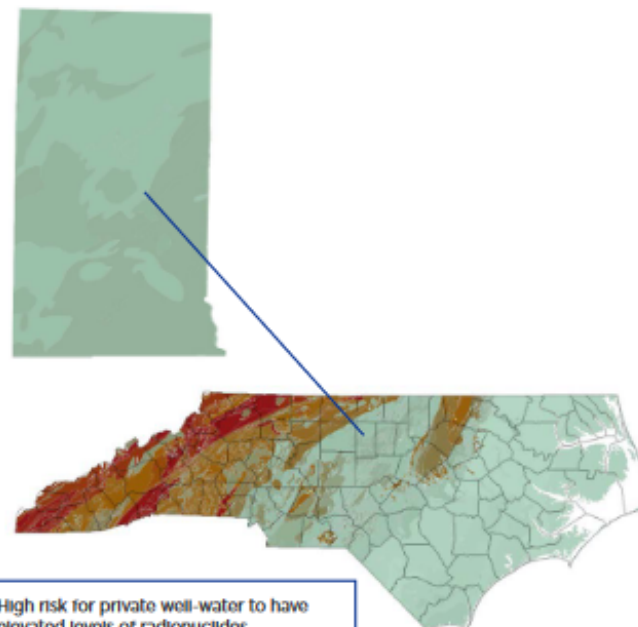


Image source: North Carolina Geological Survey.

MORE INFORMATION

1. <http://radon.ncdhhs.gov>
2. www.dph.ncdhhs.gov/chronicdiseaseandinjury/cancerpreventionandcontrol/index.htm
3. <https://schs.dph.ncdhhs.gov/units/idas/docs/NCSHIP-2022-Full.pdf>
4. www.atsdr.cdc.gov/csem/radon/health_effects.html
5. www.atsdr.cdc.gov/csem/radon/who_risk.html
6. www.cdc.gov/nceh/radiation/building.html#:~:text=Radioactive%20materials%20in%20sandstone%2C%20concrete,radium%2C%20uranium%2C%20and%20thorium



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

Radiation Protection Section
radon.ncdhhs.gov
NCDHHS is an equal opportunity
employer and provider. • 10/2023

NORTH CAROLINA
Advisory Committee
on Cancer Coordination and Control



RADIONUCLIDE FACT SHEET

BUNCOMBE COUNTY

TAKE ACTION

**TEST THE INDOOR AIR OF BUILDINGS.
TEST YOUR PRIVATE WELL WATER.**

SOURCE OF RADON Radon is a gas that is naturally present in rocks and soil in North Carolina. It is created when uranium in the ground decays. Some building materials can also have uranium, and the only way to know if radon is being released indoors is by testing the air. Radon itself cannot be seen, smelled, or tasted.

TEST YOUR INDOOR AIR

It is important to test the air in your home, apartment, or commercial building for radon every two years. Radon is a gas that can be harmful and cause lung cancer if it builds up in the indoor air you breathe.

- If the indoor radon level is between 2 and 3.9 picoCuries per liter of air, the NC Radon Program recommends you consider hiring a certified radon professional to install a system that will lower the radon level and make your air safer to breathe.
- If the radon level in your home or building is equal to or higher than 4.0 picoCuries per liter of air, the NC Radon Program strongly recommends that you hire a certified radon professional. They can install a system that will lower the radon level and make your air much safer to breathe.

PROTECT THE MOST VULNERABLE

Smokers and People Exposed to Secondhand Smoke

While breathing in radon alone can cause lung cancer, the Centers for Disease Control and Prevention (CDC) reports that people who smoked or currently smoke and are exposed to radon are 25 times more likely to get lung cancer.⁽⁹⁾

Children

The CDC reports that children are twice as likely to be affected by breathing in radon than adults. Additionally, if children are exposed to tobacco smoke and elevated radon levels, their risk of developing lung cancer increases at least 20 times.⁽¹⁰⁾

TEST YOUR PRIVATE WELL WATER

Testing the water from your private well is important for making sure it is safe to drink. If your drinking water comes from a private well, the NCDHHS, Division of Public Health suggests testing it for radon, gross alpha, gross beta, and Uranium.^(2,3)

Exposure to radionuclides via drinking water has linked with various health effects^(2,3)

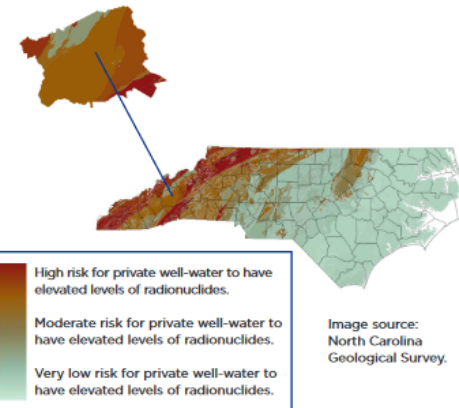
Radon: Stomach cancer

Uranium: Kidney damage, cancer

Radium: Bone cancer

If your radon level in the water is above 4,000 picoCuries per liter, it is recommended that you hire a certified radon professional to install a system that will reduce the radon level.

Owners of buildings built with certain materials, such as large buildings and mid- high-rise condominiums, should consider testing the indoor radon level. The CDC reports that "any buildings built with sandstone, concrete, brick, natural stone, gypsum, and granite contain naturally occurring radioactive elements like radium, uranium, and thorium." The only way to know if these materials increase indoor radon levels is by testing for radon.⁽¹¹⁾



MORE INFORMATION

1. <http://radon.ncdhhs.gov/>
2. https://epi.dph.ncdhhs.gov/oe/docs/Uranium_WellWaterFactSt.pdf
3. https://epi.dph.ncdhhs.gov/oe/docs/Radionuclides_WellWaterFactSt.pdf
4. www.ncdhhs.gov/buyers-and-sellers-guide-radon/download?attachment
5. www.ncdhhs.gov/installing-radon-mitigation-system/download?attachment
6. www.ncdhhs.gov/homes-radon-mitigation-system/download?attachment
7. www.dph.ncdhhs.gov/chronicdiseaseandinjury/cancerpreventionandcontrol/index.htm
8. <https://schs.dph.ncdhhs.gov/units/das/docs/NCSHIP-2022-Full.pdf>
9. www.atsdr.cdc.gov/cssem/radon/health_effects.html#:~:text=The%20lung%20cancer%20risk%20for%20Darby%20et%20al
10. www.atsdr.cdc.gov/cssem/radon/who_risk.html#:~:text=Risk%20of%20lung%20cancer%20in%20increases%20at%20least%2020%20times
11. www.cdc.gov/hcsh/radiation/building.html#:~:text=Radioactive%20materials%20in%20sandstone%20%20concrete%20radium%20%20uranium%20and%20thorium



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

Radiation Protection Section
radon.ncdhhs.gov
NCDHHS is an equal opportunity
employer and provider. • 10/2023



NORTH CAROLINA
Advisory Committee on Cancer
Coordination and Control
Celebrating 30 Years



EPA
United States
Environmental Protection
Agency

WAKE COUNTY

TAKE ACTION

**TEST THE INDOOR AIR OF BUILDINGS.
TEST YOUR PRIVATE WELL WATER.**

SOURCE OF RADON Radon is a gas that is naturally present in rocks and soil in North Carolina. It is created when uranium in the ground decays. Some building materials can also have uranium, and the only way to know if radon is being released indoors is by testing the air. Radon itself cannot be seen, smelled, or tasted.

TEST YOUR INDOOR AIR

It is important to test the air in your home, apartment, or commercial building for radon every two years. Radon is a gas that can be harmful and cause lung cancer if it builds up in the indoor air you breathe.

- If the indoor radon level is between 2 and 3.9 picoCuries per liter of air, the NC Radon Program recommends you consider hiring a certified radon professional to install a system that will lower the radon level and make your air safer to breathe.
- If the radon level in your home or building is equal to or higher than 4.0 picoCuries per liter of air, the NC Radon Program strongly recommends that you hire a certified radon professional. They can install a system that will lower the radon level and make your air much safer to breathe.

PROTECT THE MOST VULNERABLE

Smokers and People Exposed to Secondhand Smoke	While breathing in radon alone can cause lung cancer, the Centers for Disease Control and Prevention (CDC) reports that people who smoked or currently smoke and are exposed to radon are 25 times more likely to get lung cancer. ⁽⁹⁾
Children	The CDC reports that children are twice as likely to be affected by breathing in radon than adults. Additionally, if children are exposed to tobacco smoke and elevated radon levels, their risk of developing lung cancer increases at least 20 times. ⁽¹⁰⁾

TEST YOUR PRIVATE WELL WATER

Testing the water from your private well is important for making sure it is safe to drink. If your drinking water comes from a private well, the NCDHHS, Division of Public Health suggests testing it for radon, gross alpha, gross beta, and Uranium.^(2,3)

Exposure to radionuclides via drinking water has linked with various health effects^(2,3)

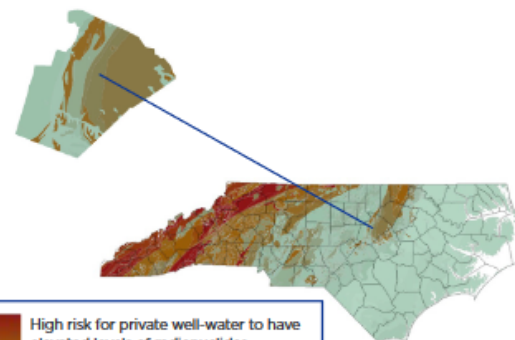
Radon: Stomach cancer

Uranium: Kidney damage, cancer

Radium: Bone cancer

If your radon level in the water is above 4,000 picoCuries per liter, it is recommended that you hire a certified radon professional to install a system that will reduce the radon level.

Owners of buildings built with certain materials, such as large buildings and mid- high-rise condominiums, should consider testing the indoor radon level. The CDC reports that "any buildings built with sandstone, concrete, brick, natural stone, gypsum, and granite contain naturally occurring radioactive elements like radium, uranium, and thorium." The only way to know if these materials increase indoor radon levels is by testing for radon.⁽¹¹⁾



High risk for private well-water to have elevated levels of radionuclides.

Moderate risk for private well-water to have elevated levels of radionuclides.

Very low risk for private well-water to have elevated levels of radionuclides.

Image source:
North Carolina
Geological Survey.

MORE INFORMATION

1. <http://radon.ncdhhs.gov/>
2. https://epi.dph.ncdhhs.gov/oe/docs/Uranium_WellWaterFactSt.pdf
3. https://epi.dph.ncdhhs.gov/oe/docs/Radionuclides_WellWaterFactSt.pdf
4. www.ncdhhs.gov/buyers-and-sellers-guide-radon/download?attachment
5. www.ncdhhs.gov/installing-radon-mitigation-system/download?attachment
6. www.ncdhhs.gov/homes-radon-mitigation-systems/download?attachment
7. www.dph.ncdhhs.gov/chronicdiseaseandinjury/cancerpreventionandcontrol/index.htm
8. <https://schs.dph.ncdhhs.gov/units/idas/docs/NCSHIP-2022-Full.pdf>
9. [www.atsdr.cdc.gov/csem/radon/health_effects.html#:~:text=The%20lung%20cancer%20risk%20for,l%20\(Darby%20at%20a%20lung%20cancer%20in%20increases%20at%20least%2020%20times](http://www.atsdr.cdc.gov/csem/radon/health_effects.html#:~:text=The%20lung%20cancer%20risk%20for,l%20(Darby%20at%20a%20lung%20cancer%20in%20increases%20at%20least%2020%20times)
10. www.atsdr.cdc.gov/csem/radon/who_risk.html#:~:text=Risk%20of%20lung%20cancer%20in%20increases%20at%20least%2020%20times
11. www.cdc.gov/nceh/radiation/building.html#:~:text=Radioactive%20materials%20in%20sandstone%20%20concrete%20radium%20%20uranium%20%20and%20thorium



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

Radiation Protection Section
radon.ncdhhs.gov
NCDHHS is an equal opportunity
employer and provider. • 10/2023



NORTH CAROLINA
**Advisory Committee on Cancer
Coordination and Control**
Celebrating 30 Years



EPA
United States
Environmental Protection
Agency

RADIONUCLIDE FACT SHEET

DARE COUNTY

TAKE ACTION

TEST THE INDOOR AIR OF BUILDINGS.

SOURCE OF RADON: Radon is a gas that is naturally present in rocks and soil in North Carolina. It is created when uranium in the ground decays. Some building materials can also have uranium, and the only way to know if radon is being released indoors is by testing the air. Radon itself cannot be seen, smelled, or tasted.

TEST YOUR INDOOR AIR

It is important to test the air in your home, apartment, or commercial building for radon every two years. Radon is a gas that can be harmful and cause lung cancer if it builds up in your indoor air.⁽¹⁾

- If your indoor air radon level is between 2 and 3.9 picoCuries per liter, the NC Radon Program recommends you consider hiring a certified radon professional. They can install a system that will lower the radon level and make your air safer to breathe.⁽²⁾
- If your indoor air radon level is equal to or higher than 4.0 picoCuries per liter, the NC Radon Program strongly recommends that you hire a certified radon professional. They can install a system that will lower the radon level and make your air much safer to breathe.⁽³⁾

PROTECT THE MOST VULNERABLE

Smokers and People Exposed to Secondhand Smoke

While breathing in radon alone can cause lung cancer, the Centers for Disease Control and Prevention (CDC) reports that people who smoked or currently smoke and are exposed to radon are 25 times more likely to get lung cancer.⁽⁴⁾

Children

The CDC reports that children are twice as likely to be affected by breathing in radon than adults. Additionally, if children are exposed to tobacco smoke and elevated radon levels, their risk of developing lung cancer increases at least 20 times.⁽⁵⁾

Owners of buildings built with certain materials, such as large buildings and mid-high-rise condominiums, should consider testing the indoor radon level. The CDC reports that "any buildings built with sandstone, concrete, brick, natural stone, gypsum, and granite contain naturally occurring radioactive elements like radium, uranium, and thorium." The only way to know if these materials increase indoor radon levels is by testing for radon.⁽⁶⁾

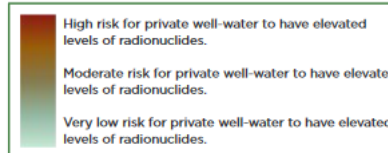
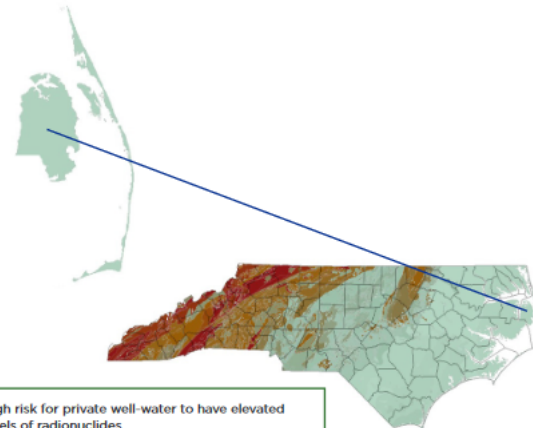


Image source:
North Carolina
Geological Survey.

MORE INFORMATION

1. <http://radon.ncdhhs.gov>
2. www.dph.ncdhhs.gov/chronicdiseaseandinjury/cancerpreventionandcontrol/index.htm
3. <https://schs.dph.ncdhhs.gov/units/ldas/docs/NCSHIP-2022-Full.pdf>
4. www.atsdr.cdc.gov/csem/radon/health_effects.html
5. www.atsdr.cdc.gov/csem/radon/who_risk.html
6. www.cdc.gov/nceh/radiation/building.html#:~:text=Radioactive%20materials%20in%20sandstone%2C%20concrete,radium%2C%20uranium%2C%20and%20thorium



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**
Division of Health Service Regulation

Radiation Protection Section
radon.ncdhhs.gov
NCDHHS is an equal opportunity
employer and provider. • 10/2023



NORTH CAROLINA
Advisory Committee on Cancer
Coordination and Control
Celebrating 30 Years



Understanding Radon in North Carolina Real Estate

Phillip Ray Gibson

Thank you!

