Radon in the North Carolina Cancer Plan

Impacting Lung Cancer Mortality with a focus on Prevention & Policy/Systems Change

Vickie Fowler, MD, FAAFP

Chair, North Carolina Advisory Committee on Cancer Coordination and Control

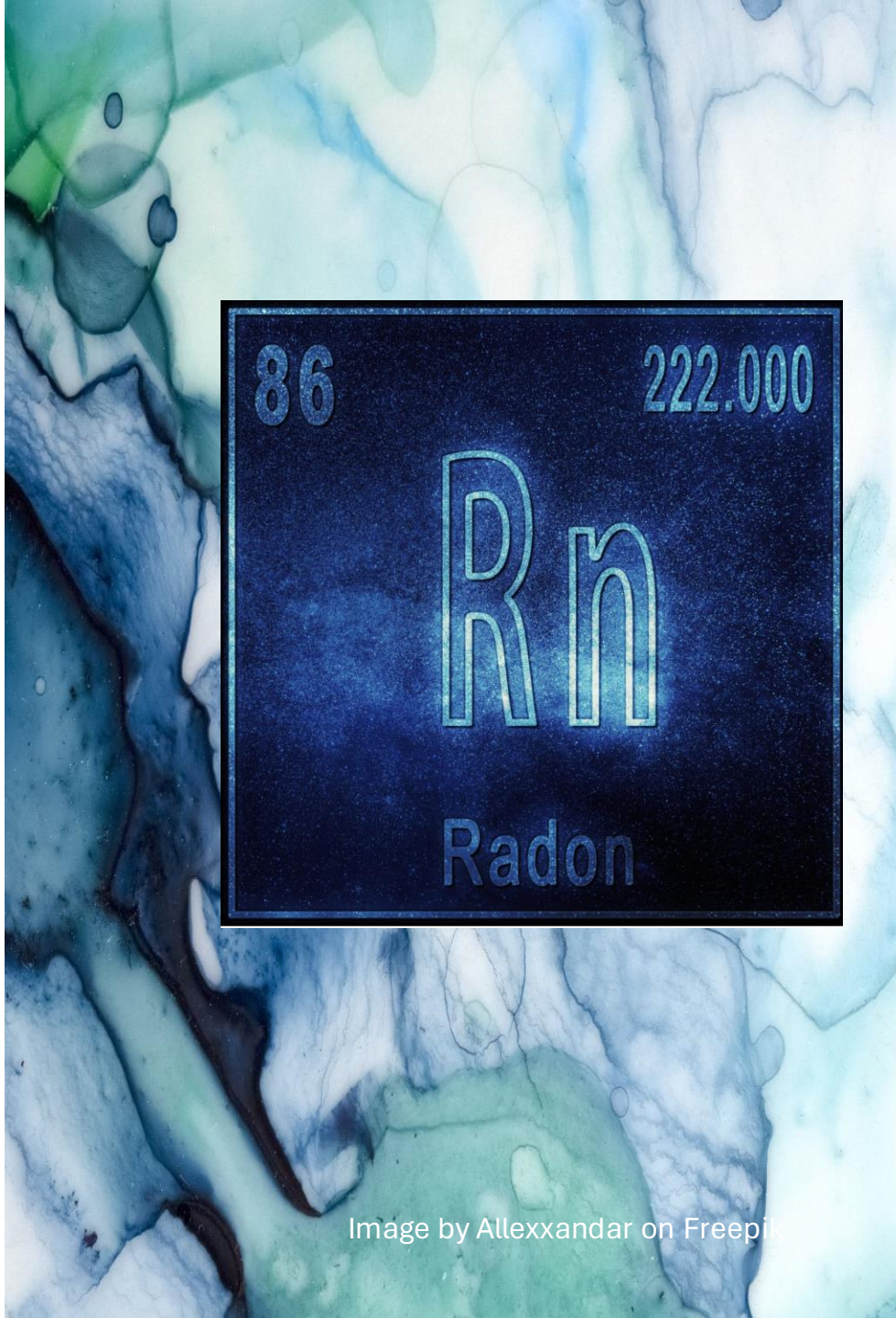
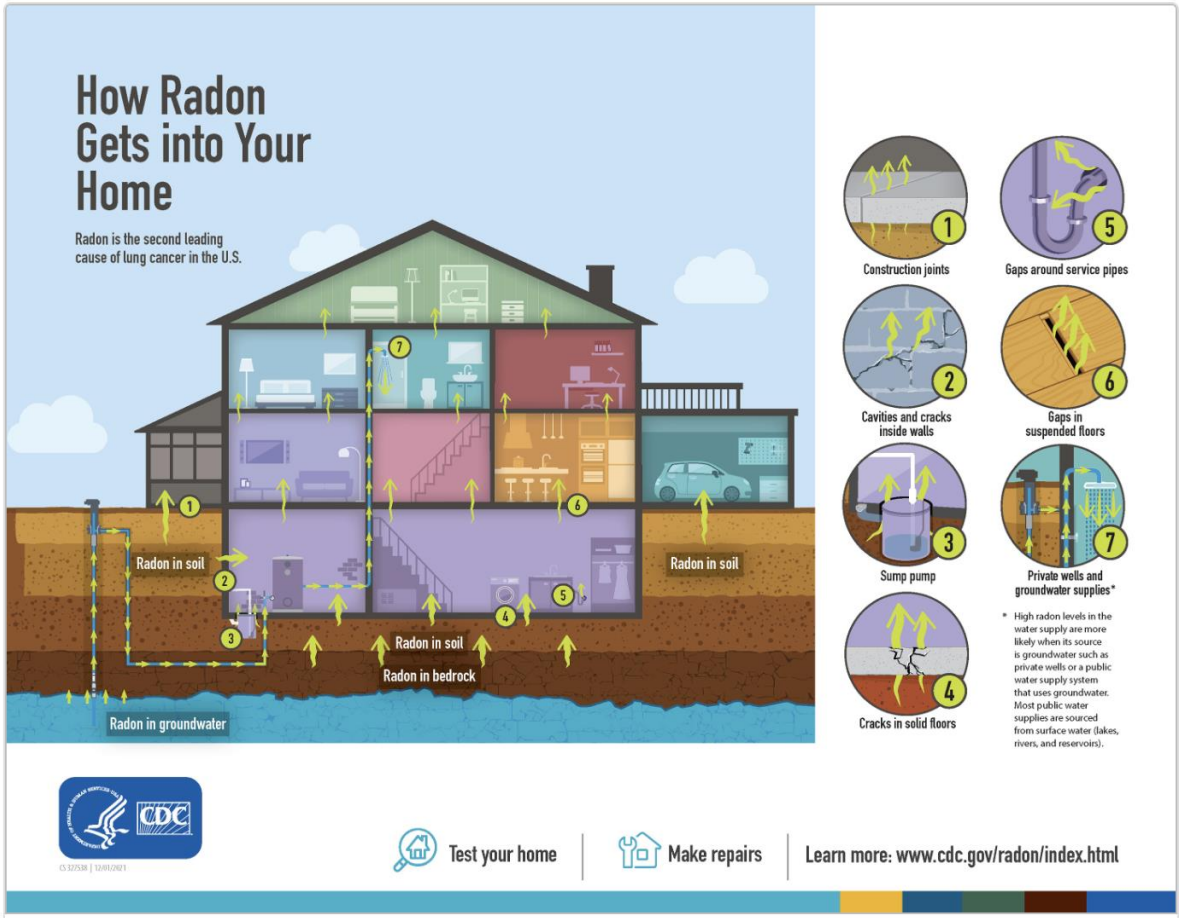


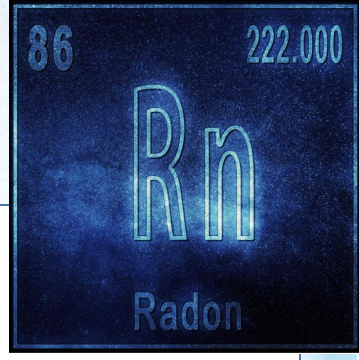
Image by Allexxandar on Freepik

Radon

Odorless, Invisible, and Tasteless Gas



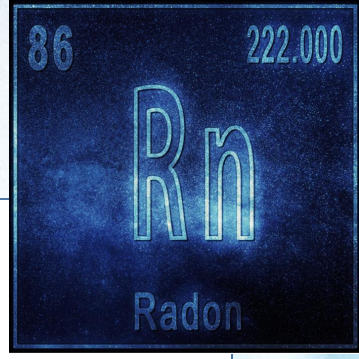
Cancer and Radon Facts



- Cancer is the leading cause of death in North Carolina.
- Cancer is the second leading cause of death in the US.
- Lung cancer is the leading cause of cancer death in NC and the US.

Image by Allexxandar on Freepik

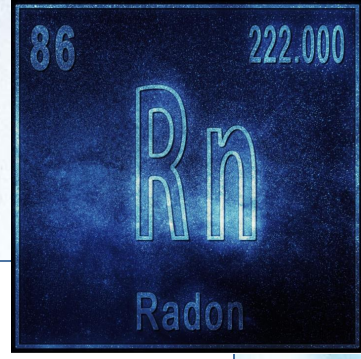
Cancer and Radon Facts



- Cancer is the leading cause of death in North Carolina.
- Cancer is the second leading cause of death in the US.
- Lung cancer is the leading cause of cancer death in NC and the US.

- Radon is the second leading cause of lung cancer.
- Radon is the leading cause of lung cancer in lung cancer patients who never smoked.
- Radon is the leading environmental cause of any cancer.

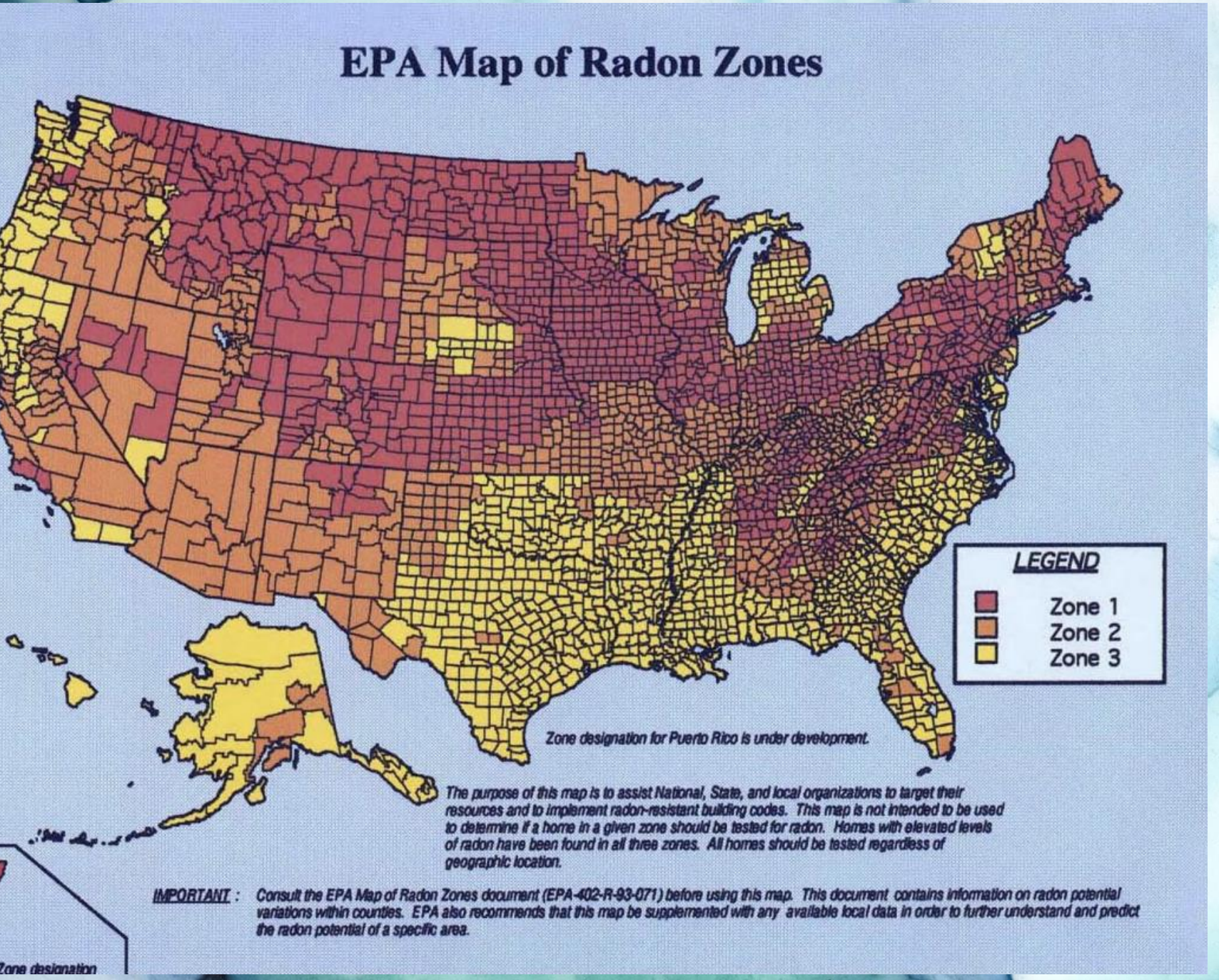
Cancer and Radon Facts

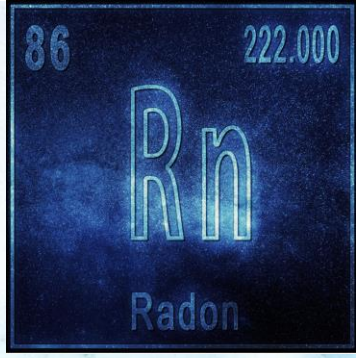


- Cancer is the leading cause of death in North Carolina.
- Cancer is the second leading cause of death in the US.
- Lung cancer is the leading cause of cancer death in NC and the US.

- Radon is the second leading cause of lung cancer among all patients.
- Radon is the leading cause of lung cancer among those who never smoked.
- Radon is the leading environmental cause of any cancer.

- Radon was declared a carcinogen by the WHO in 1987.
- Radon was declared a carcinogen by the US EPA in 1988.
- NC ACCCC identified radon as a priority in the NC Cancer Plan in 2020.
- NC DHHS State Health Improvement Plan listed radon-induced lung cancer as a priority health issue in 2023.





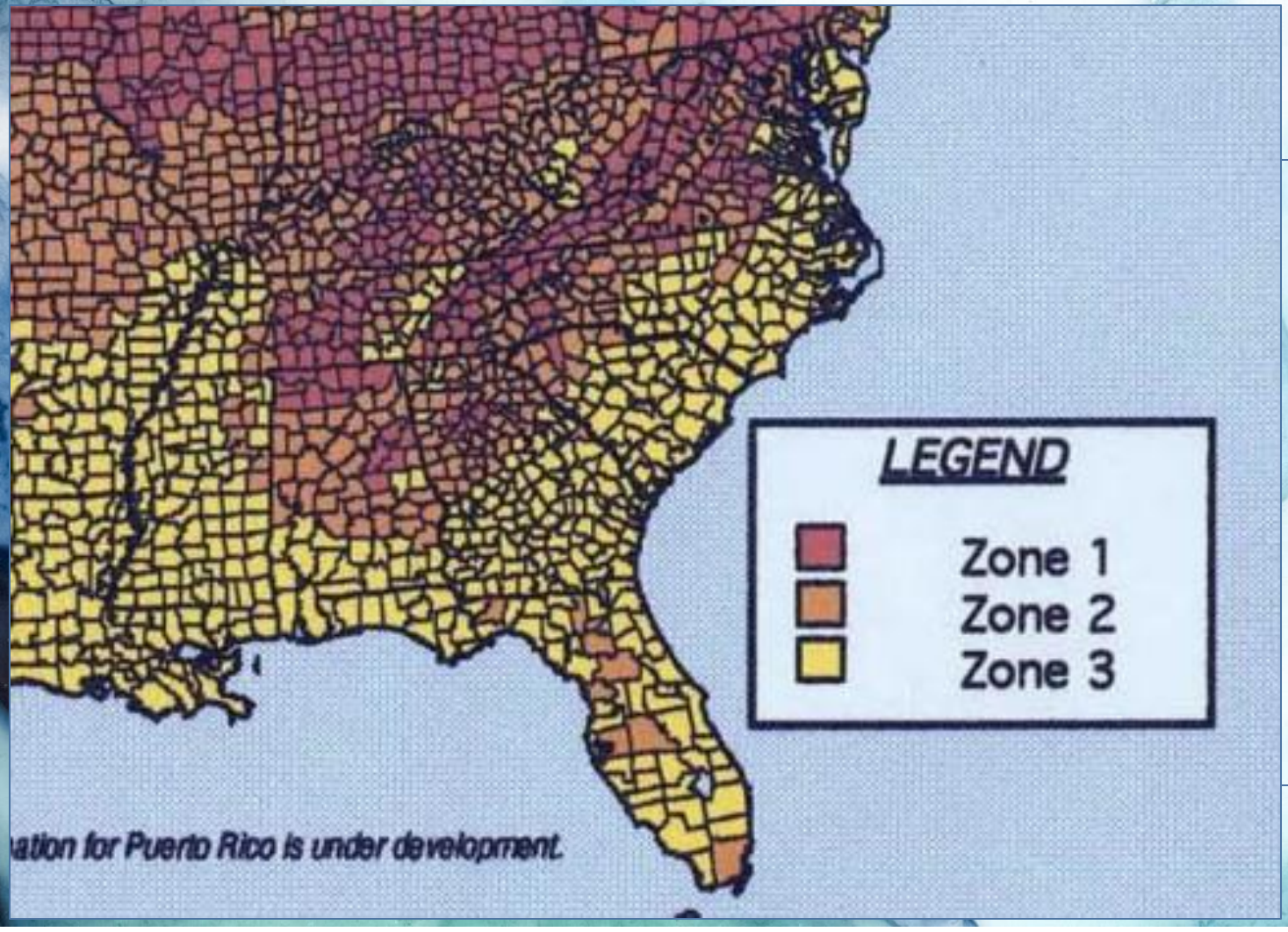
Zone 1 (red): Highest potential risk; avg indoor radon levels > 4 pCi/L

Zone 2 (orange): Moderate potential risk; avg. indoor radon 2 to 4 pCi/L

Zone 3 (yellow): Low potential risk; avg indoor radon < 2 pCi/L

EPA Region 4

Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee



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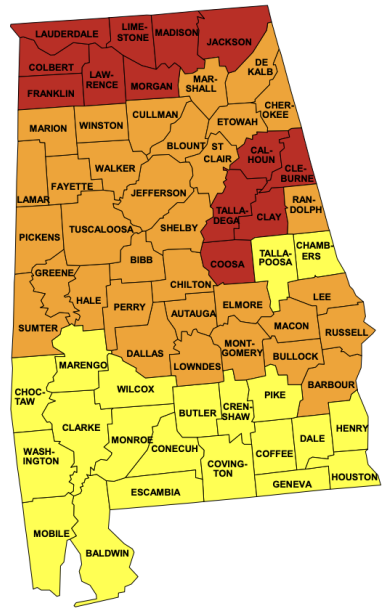
ALABAMA - EPA Map of Radon Zones

http://www.epa.gov/radon/zonemap.html

The purpose of this map is to assist National, State and local organizations to target their resources and to implement radon-resistant building codes.

This map is not intended to determine if a home in a given zone should be tested for radon. Homes with elevated levels of radon have been found in all three zones.

All homes should be tested, regardless of zone designation.



IMPORTANT: Consult the publication entitled "Preliminary Geologic Radon Potential Assessment of Alabama" (USGS Open-file Report 93-292-D) before using this map. http://energy.cr.usgs.gov/radon/grpinfo.html This document contains information on radon potential variations within counties. EPA also recommends that this map be supplemented with any available local data in order to further understand and predict the radon potential of a specific area.

Zone 1 Zone 2 Zone 3

GEORGIA - EPA Map of Radon Zones

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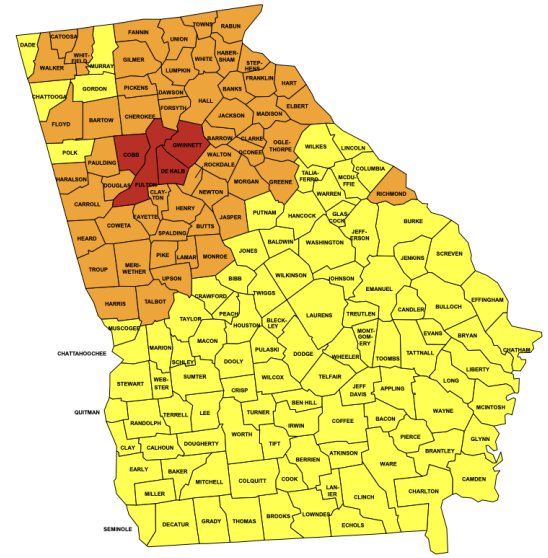

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Zone 1 Zone 2 Zone 3

MISSISSIPPI - EPA Map of Radon Zones

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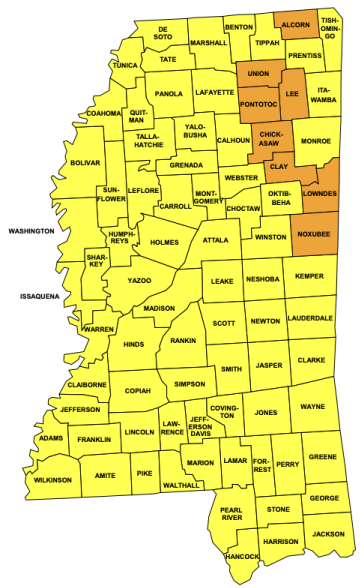

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FLORIDA - EPA Map of Radon Zones

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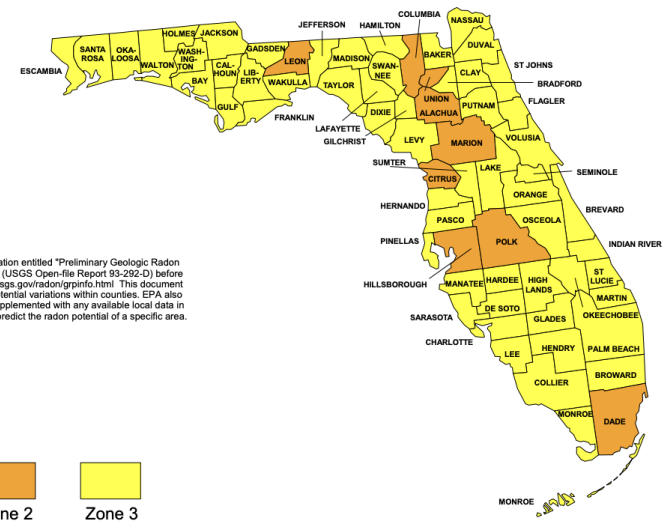

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Zone 1 Zone 2 Zone 3

KENTUCKY - EPA Map of Radon Zones

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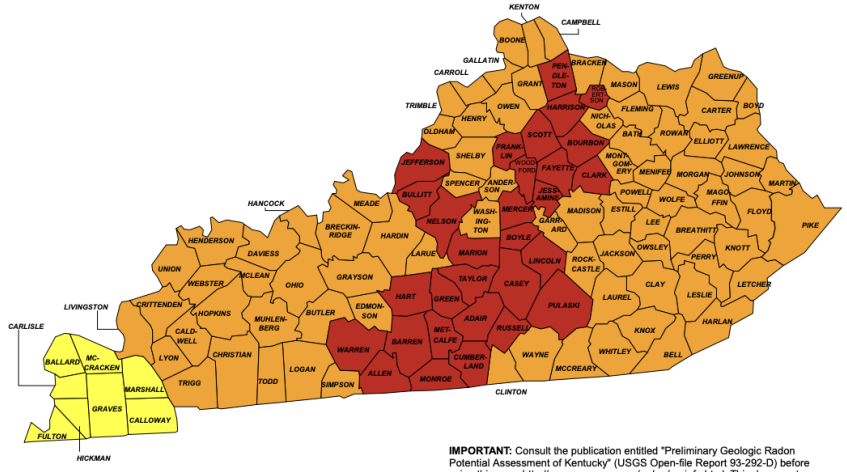

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Zone 1 Zone 2 Zone 3

TENNESSEE - EPA Map of Radon Zones

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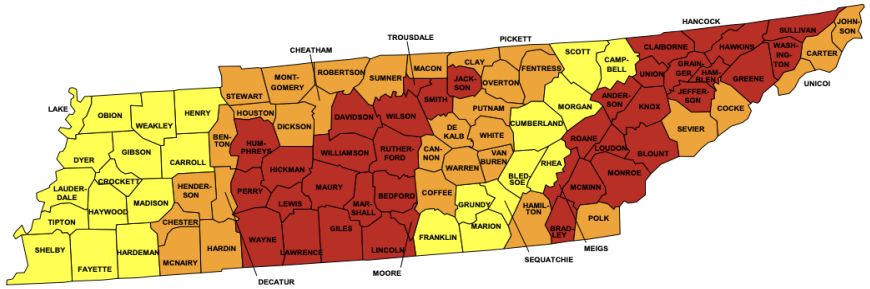

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NORTH CAROLINA - EPA Map of Radon Zones

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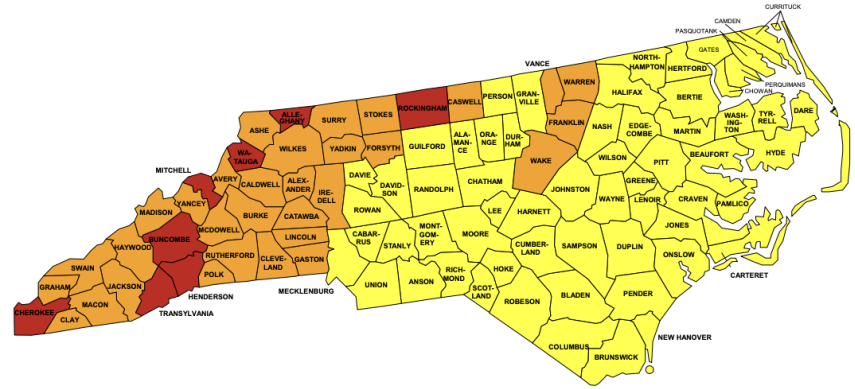

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Zone 1 Zone 2 Zone 3

SOUTH CAROLINA - EPA Map of Radon Zones

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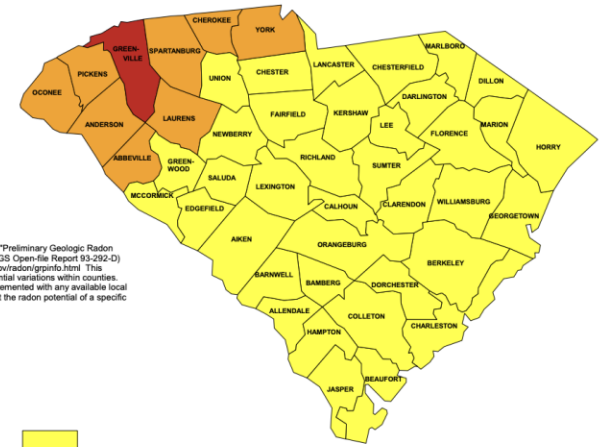

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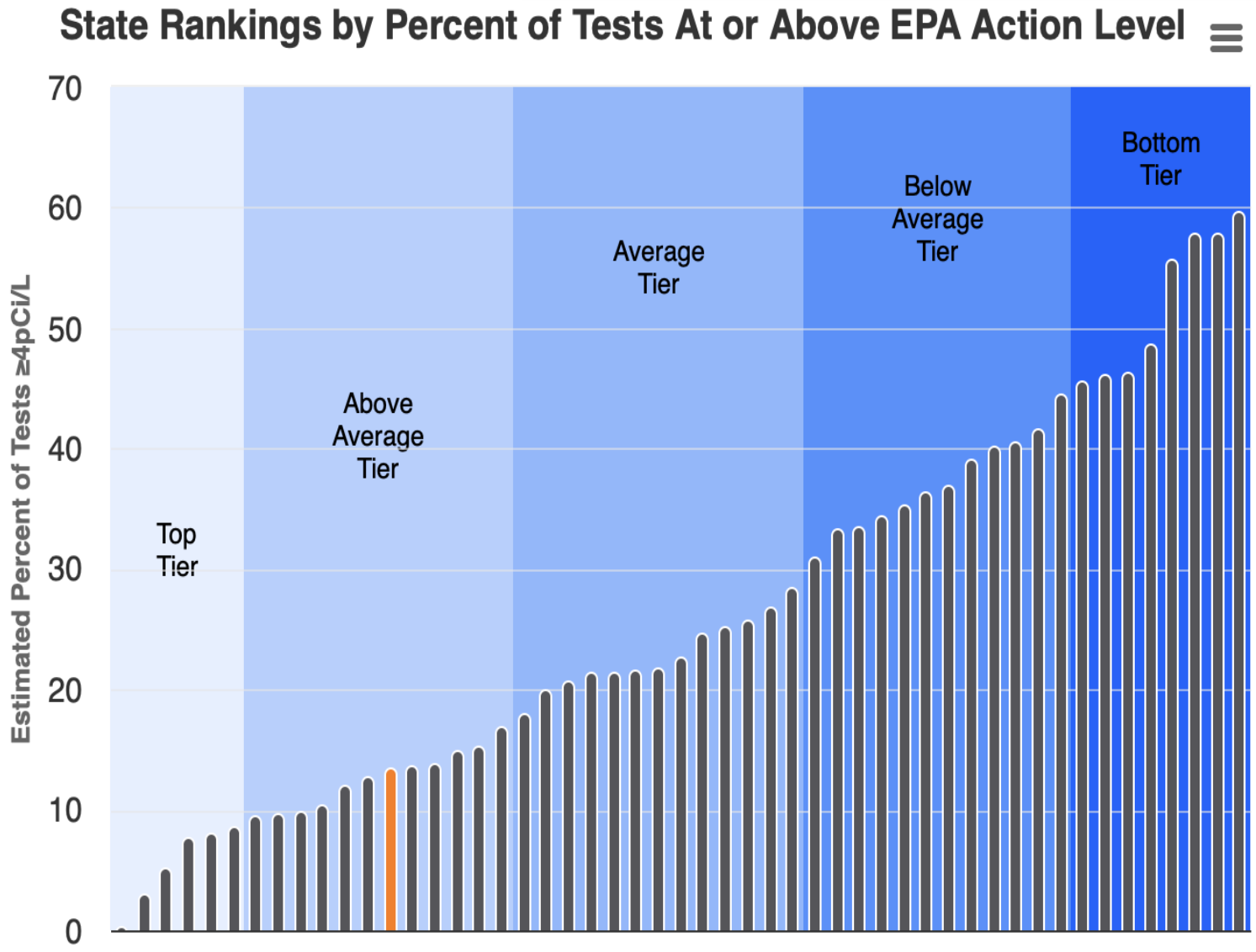


Radon:

- In North Carolina, **13.5%** of radon tests results were at or above the action level recommended by EPA.
- It ranks **13th** among all states, placing it in the **above average tier**.

American Lung Association, State of Lung Cancer, 2023

Tobacco Exposure and Radon Exposure

Radon Mitigation System is recommended when the average indoor radon level is >/= 4 pCi/L.

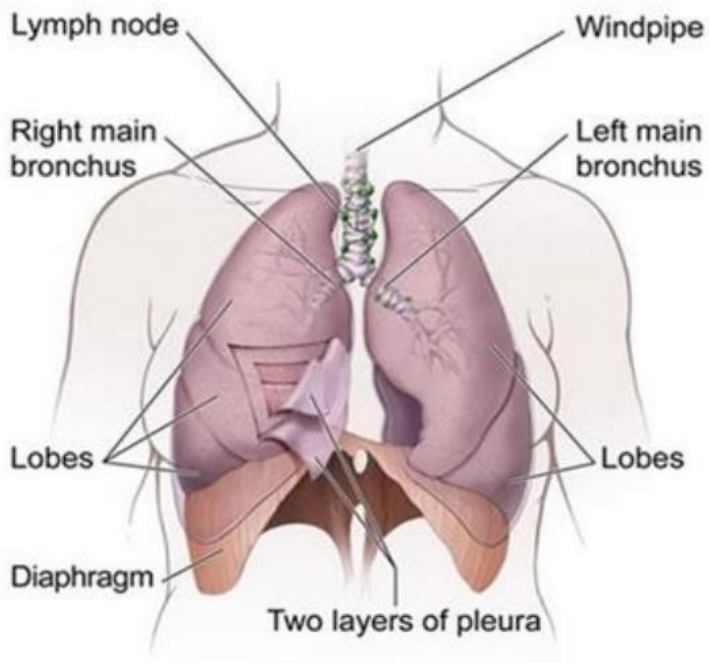
Tobacco and Radon are synergistic in their carcinogenic effects.

- **Exposure to tobacco and radon increases an adult's risk by 10X.**
- **Exposure to second-hand smoke and radon increases a child's risk by 20X.**

- **Risk for a non-smoking adult at 4 pCi/L is 7 out of 1000 in their lifetime.**
- **Risk for an adult who smokes or has a history of smoking is 70 out of 1000 in their lifetime.**
- **Risk for a child exposed to radon and second-hand smoke is 140 out of 1000 in their lifetime.**

Lung Cancer

- There are **2 main types** of lung cancer: non-small cell lung cancer (80%) & small cell lung cancer (10-15%)
- Lung cancer mainly occurs in older people, but it can be diagnosed in adults of any age
- While the risk of dying from lung cancer is higher in people who smoke, **20%** of people who die from lung cancer have never smoked
- Lung cancer accounts for more than **1 in 5** cancer deaths each year



Burden of Lung Cancer

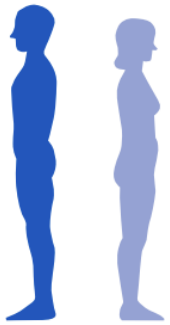
Second most common cancer diagnosis in the US

Leading cause of cancer death in the US

Figure 3. Leading Sites of New Cancer Cases and Deaths – 2024 Estimates

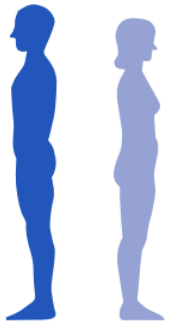
Estimated New Cases

Male			Female		
Prostate	299,010	29%	Breast	310,720	32%
Lung & bronchus	116,310	11%	Lung & bronchus	118,270	12%
Colon & rectum	81,540	8%	Colon & rectum	71,270	7%
Urinary bladder	63,070	6%	Uterine corpus	67,880	7%
Melanoma of the skin	59,170	6%	Melanoma of the skin	41,470	4%
Kidney & renal pelvis	52,380	5%	Non-Hodgkin lymphoma	36,030	4%
Non-Hodgkin lymphoma	44,590	4%	Pancreas	31,910	3%
Oral cavity & pharynx	41,510	4%	Thyroid	31,520	3%
Leukemia	36,450	4%	Kidney & renal pelvis	29,230	3%
Pancreas	34,530	3%	Leukemia	26,320	3%
All sites	**1,029,080**		**All sites**	**972,060**	



Estimated Deaths

Male			Female		
Lung & bronchus	65,790	20%	Lung & bronchus	59,280	21%
Prostate	35,250	11%	Breast	42,250	15%
Colon & rectum	28,700	9%	Pancreas	24,480	8%
Pancreas	27,270	8%	Colon & rectum	24,310	8%
Liver & intrahepatic bile duct	19,120	6%	Uterine corpus	13,250	5%
Leukemia	13,640	4%	Ovary	12,740	4%
Esophagus	12,880	4%	Liver & intrahepatic bile duct	10,720	4%
Urinary bladder	12,290	4%	Leukemia	10,030	3%
Non-Hodgkin lymphoma	11,780	4%	Non-Hodgkin lymphoma	8,360	3%
Brain & other nervous system	10,690	3%	Brain & other nervous system	8,070	3%
All sites	**322,800**		**All sites**	**288,920**	



Estimates are rounded to the nearest 10, and cases exclude basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder. Estimates do not include Puerto Rico or other US territories. Ranking is based on modeled projections and may differ from the most recent observed data.

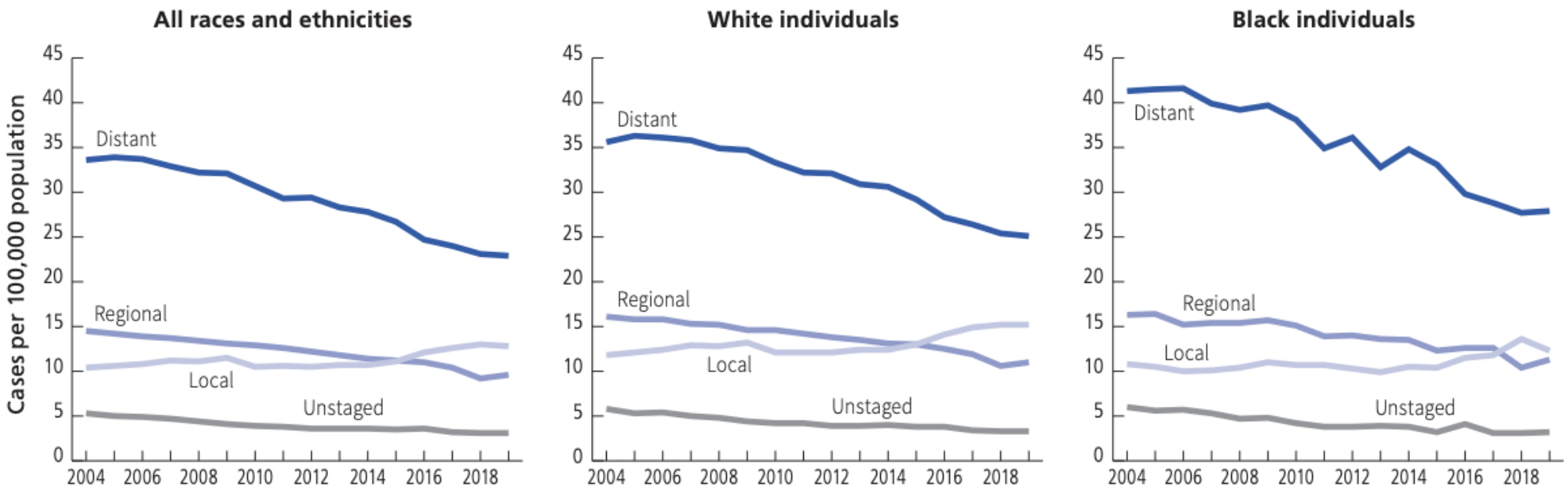
Burden of Lung Cancer in US

Estimated new cases, 2024	Estimated deaths, 2024	Incidence rates, 2016-2020	Death rates, 2017-2021
234,580	125,070	55.0	33.6
		Average annual rate per 100,000, age adjusted to the 2000 US standard population	Average annual rate per 100,000, age adjusted to the 2000 US standard population

SOURCE: American Cancer Society. Cancer Statistics Center. https://cancerstatisticscenter.cancer.org/types/lung-and-bronchus | Accessed 1/23/2024.

Incidence of Lung Cancer, US

Figure S12. Trends in Lung Cancer Incidence Rates* by Race and Stage, US, 2004-2019

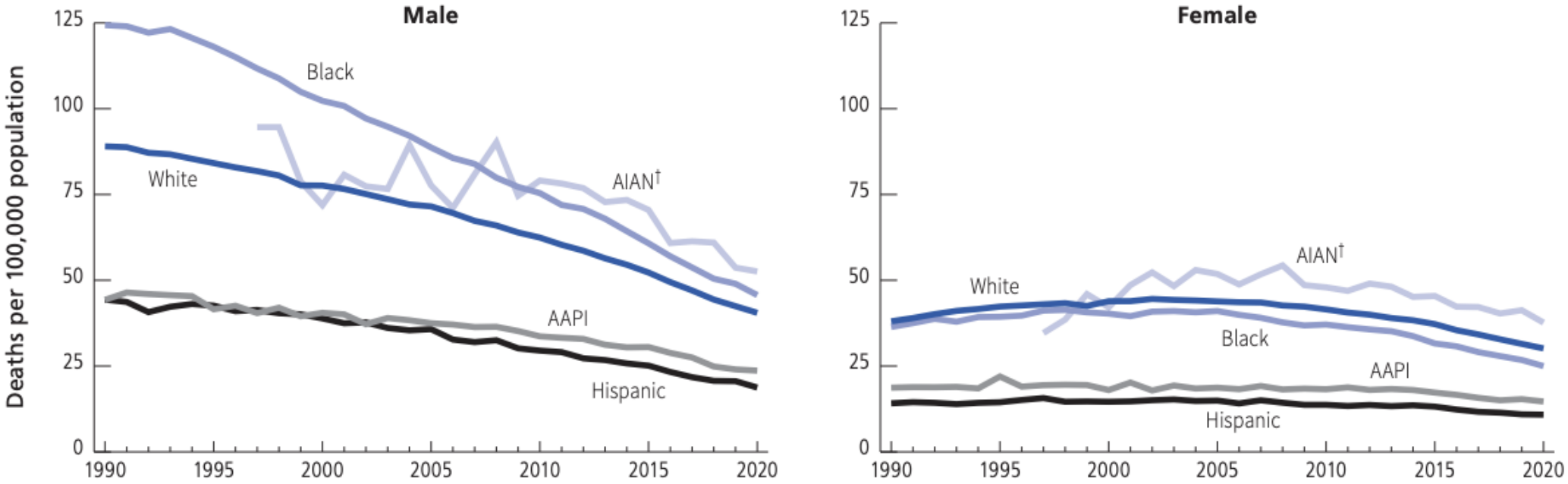


*Age adjusted to the 2000 US Standard Population and adjusted for delays in case reporting. Rates for White and Black individuals are exclusive of individuals identifying as Hispanic.

Source: Surveillance, Epidemiology, and End Results 17 Registries, 2022.

Mortality from Lung Cancer, US

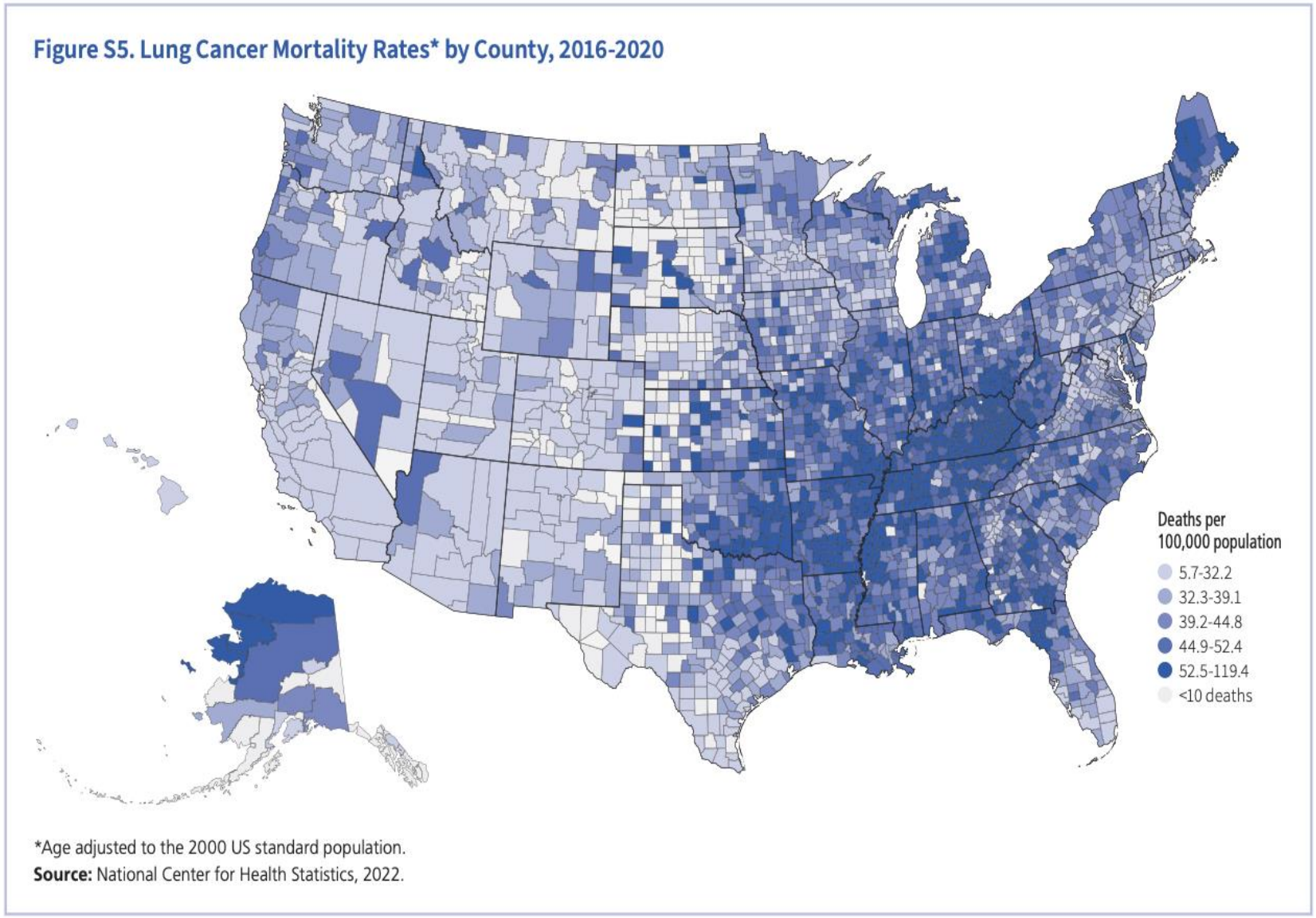
Figure S7. Trends in Lung Cancer Mortality Rates* by Sex, Race, and Ethnicity, US, 1990-2020



AAPI: Asian American and Pacific Islander individuals; AIAN: American Indian and Alaska Native individuals. *Age adjusted to the 2000 US standard population. †Data for AIAN individuals begin with 1997 to include Oklahoma and are adjusted for racial misclassification on death certificates. All racial groups are exclusive of individuals identifying as Hispanic.

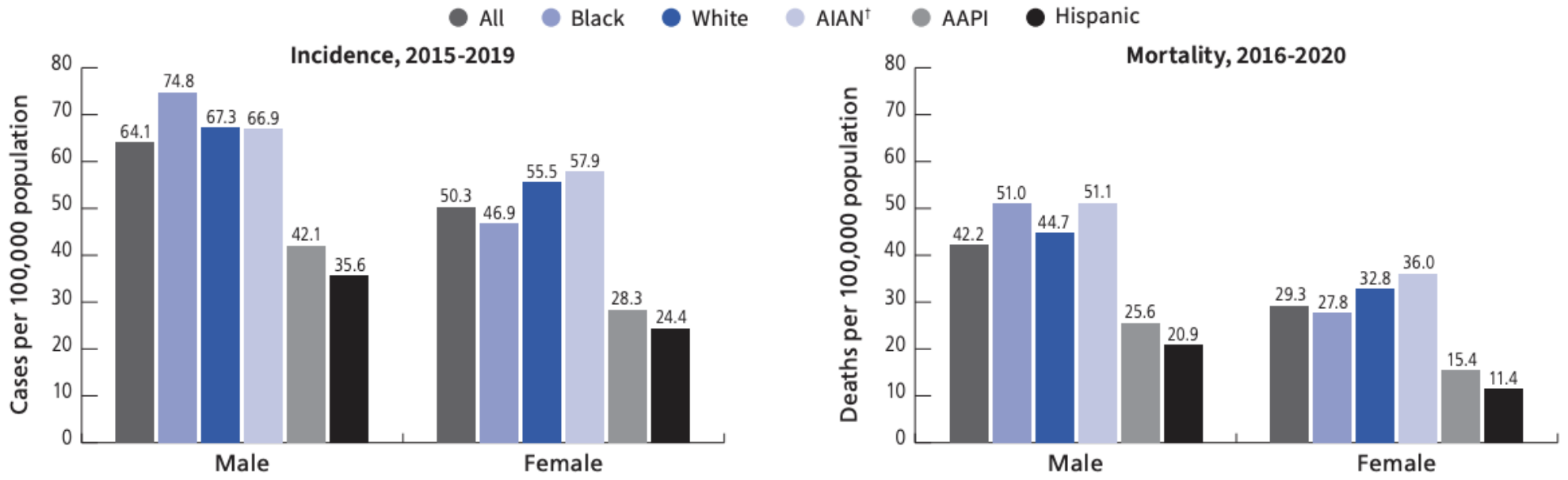
Source: National Center for Health Statistics, 2022.

Lung Cancer Mortality Rates Across the US



Gender, Racial and Ethnic Disparities, US

Figure S3. Lung Cancer Incidence and Mortality Rates* by Sex, Race, and Ethnicity, US



AAPI: Asian American and Pacific Islander individuals; AIAN: American Indian and Alaska Native individuals. *Age adjusted to the 2000 US standard population. †For AIAN individuals, incidence data are restricted to Purchased/Referred Care Delivery Area counties, and mortality data are adjusted for misclassification on death certificates. All racial groups are exclusive of individuals identifying as Hispanic.

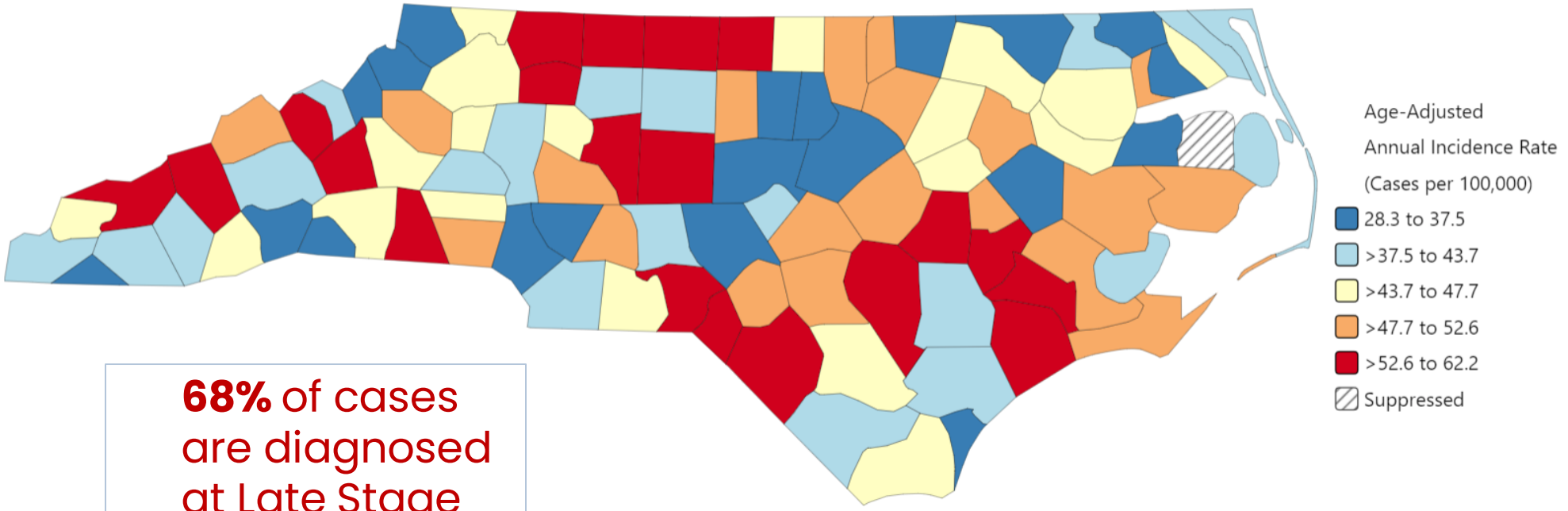
Sources: Incidence, North American Association of Central Cancer Registries 2022; Mortality, National Center for Health Statistics 2022.

Burden of Lung Cancer in NC

Estimated new cases, 2024	Estimated deaths, 2024	Incidence rates, 2016-2020	Death rates, 2017-2021
8,920	4,640	62.8	38.5
		Average annual rate per 100,000, age adjusted to the 2000 US standard population	Average annual rate per 100,000, age adjusted to the 2000 US standard population

SOURCE: American Cancer Society. Cancer Statistics Center. https://cancerstatisticscenter.cancer.org/types/lung-and-bronchus | Accessed 1/23/2024.

Incidence Rates: Lung & Bronchus (Late Stage) 2016-2020 | North Carolina



68% of cases are diagnosed at Late Stage

Created by statecancerprofiles.cancer.gov on 02/26/2024 9:42 am.

^ Late Stage is defined as cases determined to be regional or distant. Due to changes in stage coding, Combined Summary Stage (2004+) is used for data from Surveillance, Epidemiology, and End Results (SEER) databases and Merged Summary Stage is used for data from National Program of Cancer Registries databases. Due to the increased complexity with staging, other staging variables maybe used if necessary.

Source: NCI & CDC State Cancer Profiles. https://statecancerprofiles.cancer.gov | accessed:2/26/2024

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

Mission of the NC Advisory Committee on Cancer Coordination and Control

- Facilitate the reduction of cancer incidence & mortality for all North Carolinians
- Enhance statewide access to quality cancer treatment and support services
- Maximize quality of life for all North Carolina cancer survivors, patients, and their loved ones through educating and advising…
  - government officials,
  - policy makers,
  - public and private organizations,
  - and the general public.

NORTH CAROLINA

Comprehensive Cancer Control ACTION PLAN

2020-2025

CALL TO ACTION: INDIVIDUALS

Call to Action: Doing Your Part

YOU are vital in the fight against cancer whether you are a cancer survivor, caregiver, policymaker, employer, school staff or student, community leader or public health or healthcare professional. Your contribution and participation are vital in the fight against cancer.

INDIVIDUALS

PREVENTION	EARLY DETECTION	CARE/SURVIVORSHIP	POLICY/SYSTEMS CHANGE
PERSONALLY • Stop smoking or vaping or never start. Avoid secondhand smoke. • Plan and fix healthy meals and snacks. • Eat more healthy foods. • Maintain a healthy weight. • Be more active. • Protect skin and eyes from sun/UV radiation. • Stay up to date on vaccines - especially the HPV vaccine for children and youth. • Test your home for radon. Eliminate high levels. **COMMUNITY** • Support healthy food and drink standards for schools and community buildings. • Sponsor tobacco prevention and cessation programs. • Support public recreation programs.	**PERSONALLY** • Get recommended screenings. • Discuss your family health history with other family members and your health care providers. **COMMUNITY** • Encourage family, friends and coworkers to get recommended screenings. • Support screening programs in your community.	**PERSONALLY** • Support individual cancer survivors and caregivers in your community with transportation, meals, and childcare. • Encourage cancer patients to explore clinical trials. **COMMUNITY** • Volunteer with and/or support agencies and organizations that help cancer survivors.	**PERSONALLY** • Urge grocery stores, bodegas, corner stores, etc. to include healthy food options. **COMMUNITY** • Educate legislators and/or policymakers about community cancer needs. • Be an advocate for funding needed for cancer prevention, screening, treatment and research. • Educate staff of local governments and agencies about the need for healthy lifestyle programs and expanded clean air initiatives in schools, communities, work places and places of worship.

- **Test your home for radon.**
- **Eliminate high levels.**

Educate... local governments and agencies about... clean air initiatives in schools, communities, work places, and places of worship.

CALL TO ACTION: COMMUNITY

Call to Action: Doing Your Part

YOU are vital in the fight against cancer whether you are a cancer survivor, caregiver, policymaker, employer, school staff or student, community leader or public health or healthcare professional. Your contribution and participation are vital in the fight against cancer.

COMMUNITY ORGANIZATIONS

PREVENTION	EARLY DETECTION	CARE/SURVIVORSHIP	POLICY/SYSTEMS CHANGE

ORGANIZATIONS
• Adopt a smoke-, tobacco- and vape-free policy inside and outside of buildings.
• Provide healthy food at events, meals and in vending machines.
• Encourage employees and volunteers to take time during the day for physical activity.
• Provide safe spaces for physical activity.
• Provide sun protection to …unteers
…ation
…l activity …ubs or other …s.
…e behaviors … physical environments.
• Educate others about the need for radon testing and mitigation in homes, schools, workplaces and public buildings.
	ORGANIZATIONS
	• Provide health screening events.
	• Encourage employees and volunteers to get regular health screenings.
	
	PARTNERSHIP
	• Partner with others in the community to sponsor health screening events.
		ORGANIZATIONS
		• Provide support for employees and volunteers during cancer treatment.
		• Provide survivorship information and services to employees and volunteers.
		
		PARTNERSHIP
		• Promote patient navigation and community health worker programs.
		• Provide community services like support groups and counseling.
		• Set up programs to help individual cancer survivors, e.g., provide transportation to treatment, meals, respite care for care givers, childcare, etc.
			ORGANIZATIONS
			• Adopt policies that:
			  • make all facilities smoke-, tobacco- and vape-free;
			  • encourage healthy eating;
			  • encourage physical activity;
			  • provide safe spaces for physical activity; and
			  • provide sun protection.
			• Provide health insurance coverage and access to care, if possible.
			
			PARTNERSHIP
			• Educate legislators/ policymakers about the need for cancer prevention, screening, treatment and research.
			• Encourage local government agencies to develop healthy living programs and clean-air policies.
			• Establish programs to provide cancer prevention, education, screening/follow-up and support for cancer patients.

Educate others about the need for radon testing and mitigation in homes, schools, workplaces, and public buildings.

Encourage local government agencies to develop… clean-air policies.

CALL TO ACTION: SCHOOLS

Call to Action: Doing Your Part

YOU are vital in the fight against cancer whether you are a cancer survivor, caregiver, policymaker, employer, school staff or student, community leader or public health or healthcare professional. Your contribution and participation are vital in the fight against cancer.

SCHOOLS

PREVENTION	EARLY DETECTION	CARE/SURVIVORSHIP	POLICY/SYSTEMS CHANGE

CLASSROOM
• Provide healthy foods and drinks.
• Provide daily recess and incorporate physical activity into regular classroom lessons.
• Encourage sun-safe behaviors.
• Incorporate healthy living messages in classes.
SCHOOL WIDE
• Maintain smoke-, tobacco- and vape-free campuses.
• Adopt a campus-wide policy promoting healthy foods and drinks.
• Increase physical education requirements and physical activity opportunities.
• Offer sun-protected play areas for children.
• Educate students and parents about the HPV vaccine.
• Provide educational opportunities for parents to learn about the importance of healthy food and physical activity for their family.
• Test buildings for radon.
	CLASSROOM
	• Educate students about the importance of age-appropriate cancer screenings.
	SCHOOL WIDE
	• Provide educational opportunities for parents to learn about the HPV vaccine to prevent cervical cancer.
		CLASSROOM
		• Work with students on how to ease a student's return to school after cancer treatment.
		SCHOOL WIDE
		• Educate staff and faculty about patients' rights in the *Americans with Disabilities Act*.
		• Educate school personnel about cancer treatment and survivorship issues.
		• Educate school personnel on how to ease a student or staff member's return to school after cancer treatment.
		• Provide counseling services for students whose parents are going through cancer treatment.
			SCHOOL WIDE
			• Adopt policies that:
			  • make all facilities smoke-, tobacco- and vape-free;
			  • encourage healthy eating;
			  • encourage physical activity;
			  • provide safe spaces for physical activity; and
			  • provide sun protection.
			• Provide health insurance coverage and access to care, if possible.
			PARTNERSHIPS
			• Educate policymakers about the need for healthy lifestyle programs on campus.
			• Educate legislators and/or policymakers about the funding needed for cancer prevention, screening, treatment and research.

Test buildings for radon.

Educate legislators and/or policymakers about the funding needed for cancer prevention...

CALL TO ACTION: BUSINESSES

Call to Action: Doing Your Part

YOU are vital in the fight against cancer whether you are a cancer survivor, caregiver, policymaker, employer, school staff or student, community leader or public health or healthcare professional. Your contribution and participation are vital in the fight against cancer.

BUSINESSES

PREVENTION	EARLY DETECTION	CARE/SURVIVORSHIP	POLICY/SYSTEMS CHANGE
BUSINESSES • Adopt a smoke-, tobacco- and vape-free policy inside and outside of buildings. • Encourage employees to adopt a healthy lifestyle including healthy meals and physical activity. • Provide healthy food at events, meals and in vending machines. • Provide safe spaces for physical activity. • Provide sun-protective clothing and sunscreen for outside workers. • Educate employees about home radon testing. **PARTNERSHIP** • Team up with other businesses to start tobacco cessation programs. • Encourage physical activity through walking clubs or other activities. • Encourage sun-safe behaviors and sun-protected physical environments.	**BUSINESSES** • Provide full financial coverage for recommended cancer screenings. • Allow paid time off for cancer screenings. • Promote QuitlineNC to tobacco users. **PARTNERSHIP** • Partner with others in the community to support out-reach education and health screening events.	**BUSINESSES** • Educate employees about patients' rights in the *Americans with Disabilities Act*. • Carry or offer short-and long-term disability insurance. • Educate employees on how to help a coworker return to work after cancer treatment. **PARTNERSHIP** • Participate with partners in community events that sponsor cancer screening opportunities and support cancer survivors.	**BUSINESSES** • Adopt policies that support healthy behaviors. • Adopt a smoke-, tobacco- and vape-free policy inside and outside of buildings. • Provide health insurance coverage to all employees. **PARTNERSHIP** • Educate legislators and/or policymakers about the funding needed for cancer prevention, screening, treatment and research. • Ensure all evidence-based treatment is provided by insurance with no cost to the patient.

Educate employees about home radon testing.

Educate legislators and/or policymakers about the funding needed for cancer prevention...

PROBLEM: Radon testing in NC ranks 42nd in the nation
15.4 tests per 1000 housing units (American Lung Association, 2022)

PART of the SOLUTION: NC ACCCC Prevention Subcommittee
Lung Cancer and Radon Toolkit
https://www.dph.ncdhhs.gov/programs/chronic-disease-and-injury/cancer-prevention-and-control-branch/nc-comprehensive-cancer-control-program-resource-hub#Toolkits-438

Lung Cancer and Radon Toolkit (.zip folder)

Includes:

- NC Lung Cancer Fact Sheet
- Safe at Home: Preventing Lung Cancer Flyer
- Radon Mitigation Systems flyers:
  - Home System is Installed – What's Next?
  - Reducing Radon in the Home
- Real Estate Sellers/Buyers Flyer

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



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.

Why should I buy a radon resistant home?

Radon-resistant techniques work. When installed properly and completely, these simple and inexpensive passive techniques can help to reduce radon levels.

- Every home should be tested for radon as soon as possible after occupancy even if built to be radon-resistant.
- 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 and completely, radon-resistant techniques can also make your home more energy efficient and help you save on your energy costs.

What are radon resistant features?

Radon-resistant techniques may vary for different foundations and site requirements. If you're having a house built, ask your builder to use the latest version of ANSI/AARST standards for the following best practices:

- **Gas Permeable Layer –** This layer is placed beneath the slab or flooring system to allow the soil gas to move freely underneath the house.
- **Plastic Sheeting –** Plastic sheeting is placed on top of the gas-permeable layer and under the slab to help prevent the soil gas from entering the home.
- **Sealing and Caulking –** All below-grade openings in the foundation and walls are sealed to reduce soil gas entry into the home.
- **Vent Pipe –** A 3- or 4-inch PVC pipe (or other gas-tight pipe) runs from the gas-permeable layer through the house to the roof, to safely vent radon and other soil gases to the outside.
- **Junction Boxes –** An electrical junction box is included in the attic to make the wiring and installation of a vent fan easier.

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.

Radon testing checklist

BEFORE CONDUCTING A RADON TEST:

- Notify the occupants of the importance of proper testing conditions. Give the occupant(s) written instruction or a copy of this Guide and explain the directions carefully.
- Determine what the length of the test will be and plan to conduct the radon test for a minimum of 48 hours; some test devices have a longer minimum exposure time.
- When doing a short-term test ranging from 2-7 days, it is important to maintain closed-house condition for at least 12 hours before the beginning of the test and during the entire test period.
- Closed-house conditions mean keeping all windows closed, keeping doors closed except for normal entry and exit, and not operating fans.
- If you conduct the test yourself, use nationally recognized radon measurement devices and follow the laboratory's instructions.
- If you hire someone to do the test, hire only a certified radon measurement professional.
- If the house has an active radon-reduction system, make sure the vent fan is operating properly.

DURING A RADON TEST:

- Maintain closed-house conditions during the entire duration of a short-term test.
- Operate the home's heating and cooling systems normally during the test. For tests lasting less than one week, operate only air-conditioning units which recirculate interior air.
- Do not disturb the test device(s) at any time during the test.

AFTER A RADON TEST:

- If you conduct the test yourself, be sure to promptly return the test device to the laboratory. Be sure to submit the required information, including start and stop times, test location, etc.
- If an elevated radon level is found, fix the home. Contact a certified radon mitigation professional about lowering the radon level. EPA strongly recommends that you fix the home when the radon level is 4 pCi/L or higher.
- Be sure that you or the radon tester can demonstrate or provide information that the testing conditions were not violated during the testing period.

What should I do if the radon level is high?

If elevated levels are found during the real estate transaction, the buyer and seller should discuss the timing and costs of radon reduction.

SELECTING A CERTIFIED RADON MITIGATION PROFESSIONAL

- Select a certified radon mitigation professional to reduce the radon level in your home. Any mitigation measures taken or system installed in your home should follow national consensus-based standards approved by the American National Standards Institute (ANSI).
- EPA recommends that the mitigation contractor review the radon measurement results before beginning any radon reduction work. Ensure you have a warranty as well as a guarantee that the mitigation system will achieve certain reductions on the radon level.

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.

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North Carolina Housing Finance Agency
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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.

Crawlspace Homes

Submembrane suction, when properly applied, is the most effective way to reduce radon levels in homes with crawlspaces.

Mechanical ventilation uses a fan to blow air into the living area from outdoors, which dilutes the concentration of radon in the home and pressurizes the building.

A heat recovery ventilator (HRV), also called an air-to-heat exchanger, can be installed to increase ventilation.

Some natural ventilation occurs in all homes. By opening windows, doors and vents, you can increase the ventilation in your home.

Checking your mitigator's work

- The exhaust pipes of soil suction systems must vent no less than 12 inches above the surface of the roof, 10 feet or more above the ground, and at least 10 feet away from windows, doors or other openings that could allow radon to reenter the home.
- The exhaust fan must not be in or below a livable area because a puncture or leak in the pipe above the fan will cause high amounts of radon to be blown into the house.
- If installing an exhaust fan outside, the contractor must install a fan that meets local building codes for exterior use.
- Electrical connections of all active radon reduction systems must be installed according to local electrical codes.
- A warning device must be installed to alert you if an active system stops working properly. The system must be labeled as a radon mitigation system with information on the certified radon business that installed the system.
- Note the warning device will not tell you if the radon levels increase, just if the mechanical parts of the mitigation system fail.
- A post-mitigation radon test should be conducted within 30 days of system installation but not sooner than 24 hours after your system is in operation with the fan on, if the system includes a fan.
- Make sure your contractor explains your radon reduction system in detail, demonstrates how it operates, explains how to determine if it is not working, and describes how to maintain it.

Living in a home with a radon reduction system

MAINTAINING YOUR RADON REDUCTION SYSTEM

It is recommended that homes with radon reduction systems be tested for radon at least every two years as changes to the building or the ground beneath it may cause significant changes in the radon concentration.

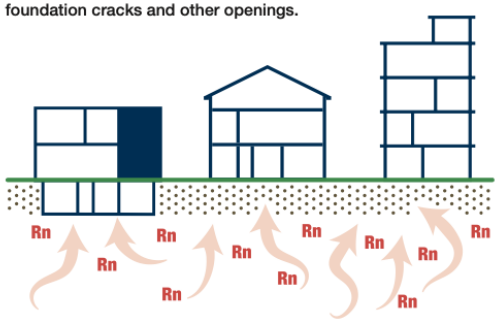
Similar to a furnace or chimney, radon reduction systems need occasional maintenance.

Radon is a cancer-causing, radioactive gas

Radon is colorless, odorless and tasteless. Radon is estimated to cause 21,000 lung cancer deaths each year in the United States. In fact, the US Surgeon General has warned that radon is the second leading cause of lung cancer and the leading cause of lung cancer among non-smokers. Only smoking causes more lung cancer deaths. If you smoke and your home has high radon levels, your risk of lung cancer is especially high.

How radon enters your home

Radon is a naturally occurring radioactive gas produced by the breakdown of uranium in soil, rock, and water. Air pressure inside your home is usually lower than pressure in the soil under your home's foundation. Because of this pressure differential, your home acts like a vacuum, drawing radon in through foundation cracks and other openings.



Learn more at radon.ncdhhs.gov

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IN COLLABORATION WITH
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DukeHealth
North Carolina Housing Finance Agency
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Safe at Home: Preventing Lung Cancer

BY REDUCING RADON IN THE HOME

What is radon? Radon is a gas that you cannot see, smell or taste. It comes from the decay of radioactive elements (such as uranium, thorium and radium) in soil and groundwater.

What are your chances for getting lung cancer from radon? Each one of the following influences your risk:

1. **Level of radon in your home;**
2. **The amount of time you spend in your home;**
3. **If you are a smoker of tobacco or have ever smoked tobacco; and**
4. **If you are exposed to secondhand smoke.**

Why should I be concerned about radon? Breathing in radon is the second leading cause of lung cancer after smoking. Radon is the likely cause of more than 21,000 lung cancer deaths each year in the US. In 2020, lung cancer was the leading cause of cancer deaths in NC.

How does radon cause lung cancer? Radon gas decays into radioactive particles that can get trapped in your lungs when you breathe. These particles break down and release small bursts of energy. This can damage lung tissue and lead to lung cancer over the course of your lifetime. Not everyone exposed to high levels of radon will develop lung cancer, however the risk for lung cancer is increased.

How does radon get into a home? Radon can rise from the rocks in the ground, through the soil, and to the air above. It comes into your home through cracks and holes in the foundation. The radon becomes trapped in your home. This can happen in new and old homes, homes with or without basements, and in high-rise and multi-family buildings. Underground well water can transport radon from the soil into the house.

Where is radon found in NC? Nearly one out of every 15 homes in the US is likely to have a high level of radon. Homes in all 100 counties of NC have tested at high levels for radon. The only way to know if your home has a radon problem is to test it.

Is radon only in homes? No. Radon can get into any type of building. You and your family are most likely to be exposed at home because you spend most of your time there.

What is considered a high level of radon in the home? The amount of radon in the air is measured in "picocuries per liter of air," or "pCi/L." A radon level in the home between **2 and 4 pCi/L** is considered moderate risk and over **4 pCi/L** is considered high risk for your health.

I am buying/selling a home. How do I get a property tested for radon? There are no laws in NC regarding radon testing. The NC Radon Program recommends that you hire a certified radon contractor. This will give you reliable test results quickly. If you get your water from a well, you can test your groundwater for radon with a certified laboratory. Visit **www.ncradon.org** to find a certified radon tester.

What if the radon levels are high in my home? Can my home be fixed? The EPA (US Environmental Protection Agency) recommends fixing homes that have an average radon level **over 4 pCi/L.** The EPA suggests you consider fixing your home if it tests between **2 and 4 pCi/L.** Most homes can easily be fixed to bring the radon levels below 4 pCi/L. Lowering high radon levels requires special knowledge and skills. Pick a contractor who is trained to fix radon problems. The National Radon Proficiency Program or the National Radon Safety Board certifies trained contractors. Visit **www.ncradon.org** for links.

How do I fix my home if the test shows there is a high level of radon in water? The NC Radon Program recommends testing well water for radon. Experts say you should fix well water that tests over 10,000 pCi/L. If the radon level is high in the well water, a second test for other types of radioactive particles like uranium and radium should be done. Select a contractor who is trained to fix radon problems. Contact your county health department's environmental health program for more information.

What will fixing my home cost me? In 2017, the average cost for fixing a radon problem in an existing home was $1,500. The average cost to include a radon reduction system when building a new home was $800. The cost for a private well water radon treatment system ranges between $5,500 - $7,500. Visit **www.ncradon.org** to learn more about building Radon Resistant New Construction.

Will a radon reduction system impact the sale of my home? Builders are installing radon mitigation systems in new homes throughout North Carolina. Radon reduction systems are considered an asset during home sales as it assists in lowering radon levels in the home. Always be sure to test for radon to verify the system is operating properly.

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES Division of Public Health

North Carolina Advisory Committee on Cancer Coordination and Control

North Carolina Cancer Prevention and Control Branch

NC Real Estate Commission

NORTH CAROLINA RADIATION PROTECTION

NC Cancer Plan website: http://publichealth.nc.gov/chronicdiseaseandinjury/cancerpreventionandcontrol/docs/ComprehensiveCancerControlPlan-2014-2020.pdf

NC Department of Health and Human Services | Division of Public Health
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Radon Mitigation Systems Already Installed

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.

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

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.

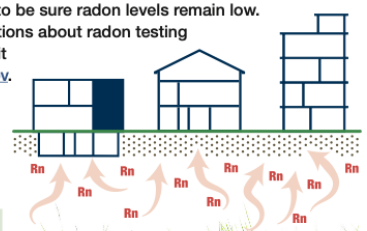
- It is recommended that you measure the radon level in your home every two years to be sure radon levels remain low.
- Radon reduction systems need occasional maintenance. You should contact a certified radon mitigator to discuss how to maintain your radon system. Visit the NC Radon Program website 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.
- 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.



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

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Remodeling Your Home after Radon Levels Have Been Lowered

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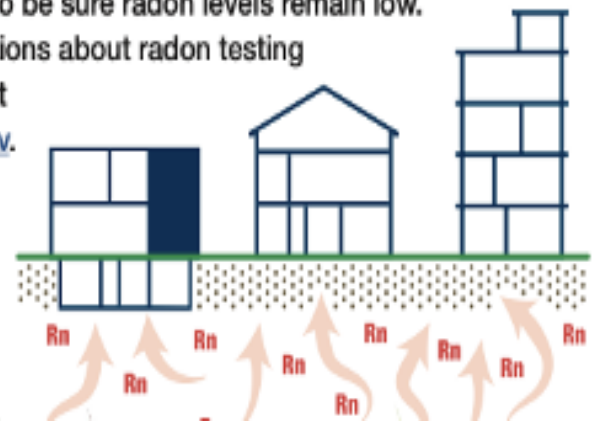
- After you remodel, retest in the lowest lived-in area to make sure the construction did not reduce the effectiveness of the radon reduction system.

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.



Radon in NC Public Schools

- EPA of NC Radiation Protection Program (NCRP) pilot survey
  - 20 NC schools, summer 1989 & winter 1990, 400 measurements
- NC DPI expanded this across the state from 1990-1991
- NCRP compiled this and additional data from 1997-1998
  - 1102 schools, 23,448 classrooms, 94 counties in NC
- Similar to regional radon levels in residential surveys
- Varies room to room & summer to winter
- Test all rooms, close to ground, cooler months

Average level 1.79 pCi/L

11% of tested classrooms had radon concentrations > 4 pCi/L

https://www.ncdhhs.gov/divisions/health-service-regulation/north-carolina-radon-program/north-carolina-schools-and-childcare-facilities

Image by Allexandar on Freepik

Radon in NC Public Schools

North Carolina does not require radon testing or mitigation in schools or childcare facilities

North Carolina Senate Bill 384 (approved April 20, 2023)

2023 NC State Budget Provision

- Requires NC DPI to study the status and cost of radon testing units in public schools.
- Report to the Joint Legislative Education Oversight Committee (anticipated March 2024)

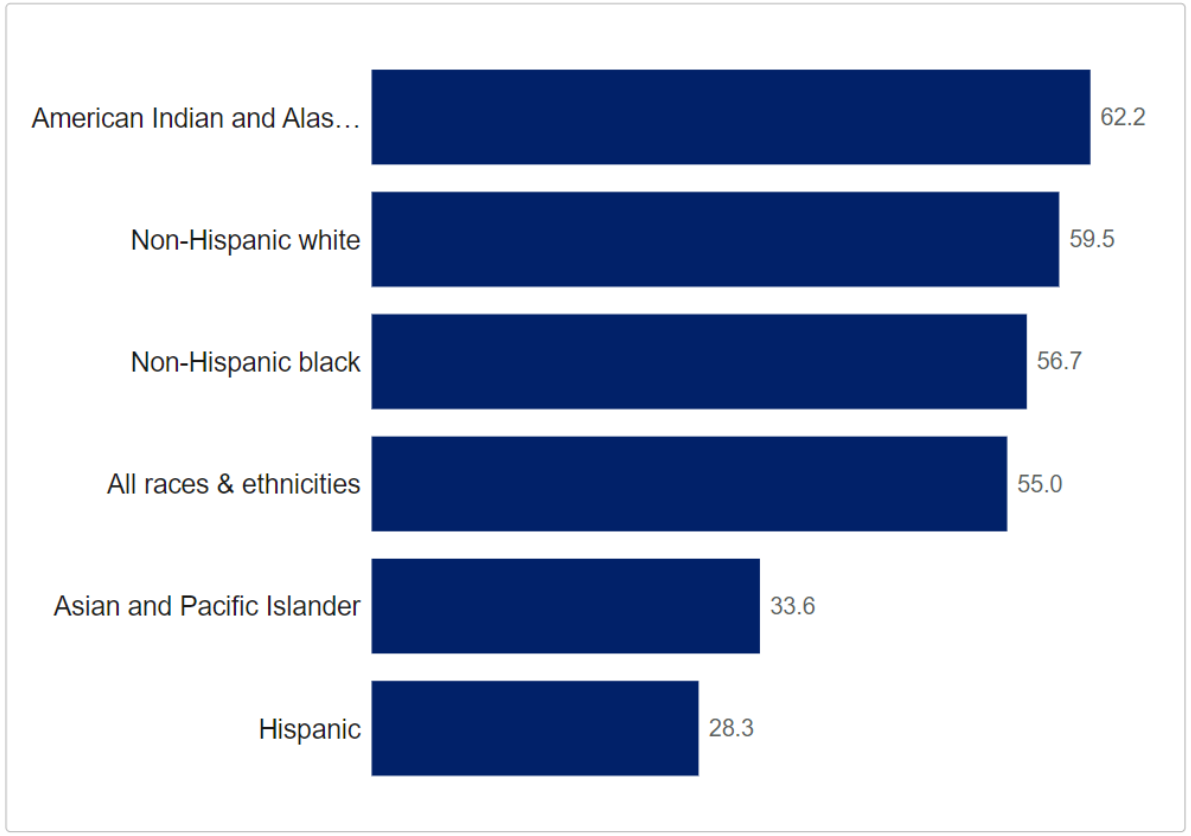
https://ncnewsline.com/briefs/north-carolinas-public-schools-could-be-required-to-install-carbon-monoxide-radon-detectors/

Image by Allexandar on Freepik

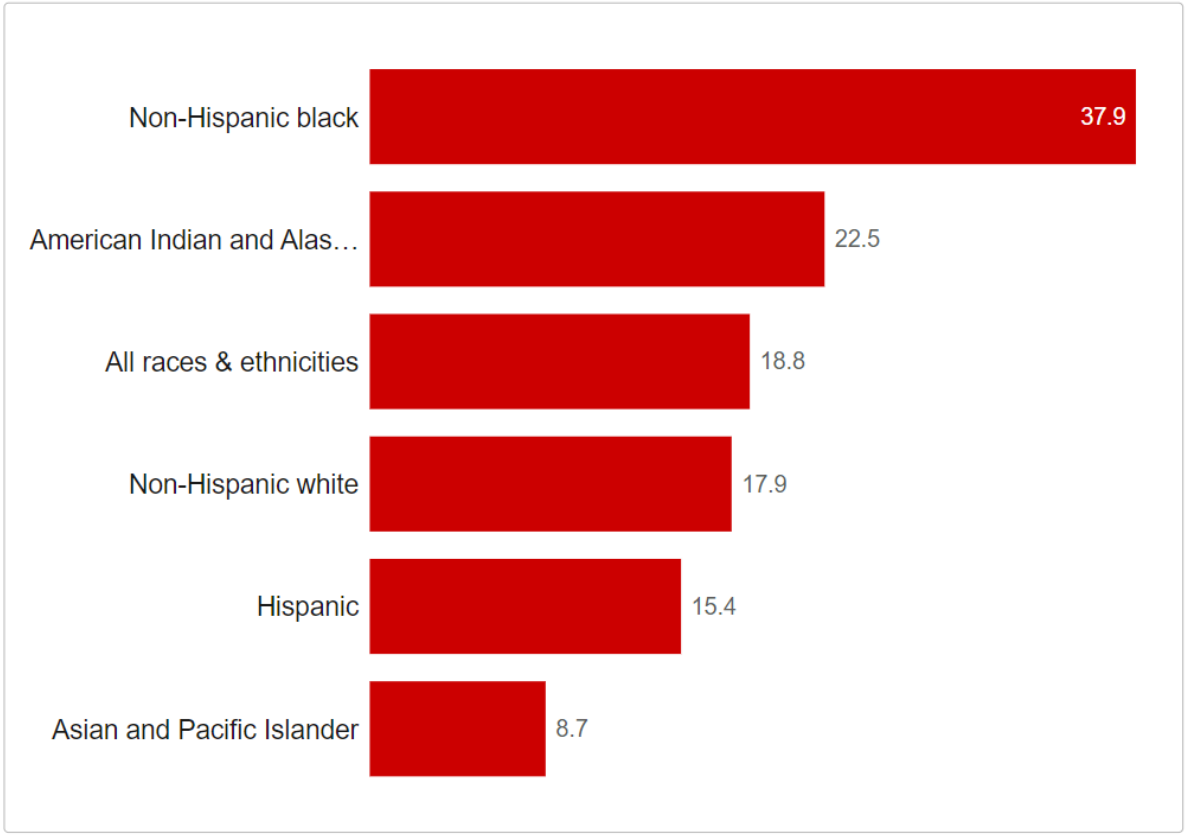
Lung Cancer is a Health Disparity Issue

Lung & Bronchus Cancer Incidence & Mortality Rates by Race & Ethnicity, US

Incidence Rates, 2016 - 2020



Mortality Rates, 2017 - 2021



 Incidence Data Source: North American Association of Central Cancer Registries, 2023. Mortality Data Source: National Center for Health Statistics, Center for Disease Control and Prevention, 2023. Average annual rate per 100,000, age-adjusted to the 2000, US standard population. Incidence is adjusted for delays when possible. Nevada and Puerto Rico are not included in national rates (see Resources page).

American Cancer Society. Cancer Statistics Center. http://cancerstatisticscenter.cancer.org. Accessed 2/5/2024.

Radon Is a Health Disparity Issue

Social Determinants of Health: Radon Exposure and Lung Cancer Incidence

Historically disadvantaged communities are

- **Less likely to know about radon**
- **Less likely to test for radon**
- **Less likely to minimize radon exposure**

New strategies are needed in these populations to

- **increase awareness of the risks of radon**
- **promote radon testing in homes, schools, and businesses**
- **provide access to radon mitigation in these locations**

"Climate Change, Radon Exposure and Lung Cancer."
Akinyemiju, T. Smith, V. Zhang, J. Koch, A. Clarke, J. Gibson, P.

Image by Allexandar on Freepik

THANK YOU FOR YOUR ATTENTION

Thank you to Phillip Gibson for this invitation to speak and for his unwavering efforts in reducing radon exposure to the residents of North Carolina.

Thank you to the NC ACCCC for this opportunity to serve our state.
Thank you to my colleagues at the ACS for help with this presentation.

Thank you to the the US Environmental Protection Agency Region 4 for allowing me to speak on issues that are so important to the health of all who live and work in our region.

Vickie Fowler, MD, FAAFP
WakeMed Physician Practices Primary Care
Chair, North Carolina Advisory Committee on Cancer Coordination and Control (ACCCC)
American Cancer Society, Clinical Champion for the Southeast Region
NCAFP Foundation Board, Physician Trustee