



150 YEARS
OF ADVANCING
PUBLIC
HEALTH

Massachusetts Department of Public Health

INTRODUCTION TO RADON

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**Bureau of Climate and Environmental Health
Indoor Air Quality Program**

Agenda

- Background
 - About radon
 - Health risks associated with exposure
 - Radon in Massachusetts
- Reducing risks from exposure
 - Testing procedures
 - Radon Resources



About Radon

Radon is a gas that is:

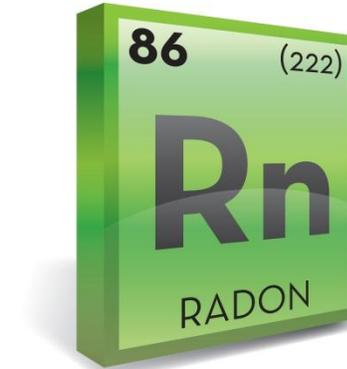
Tasteless

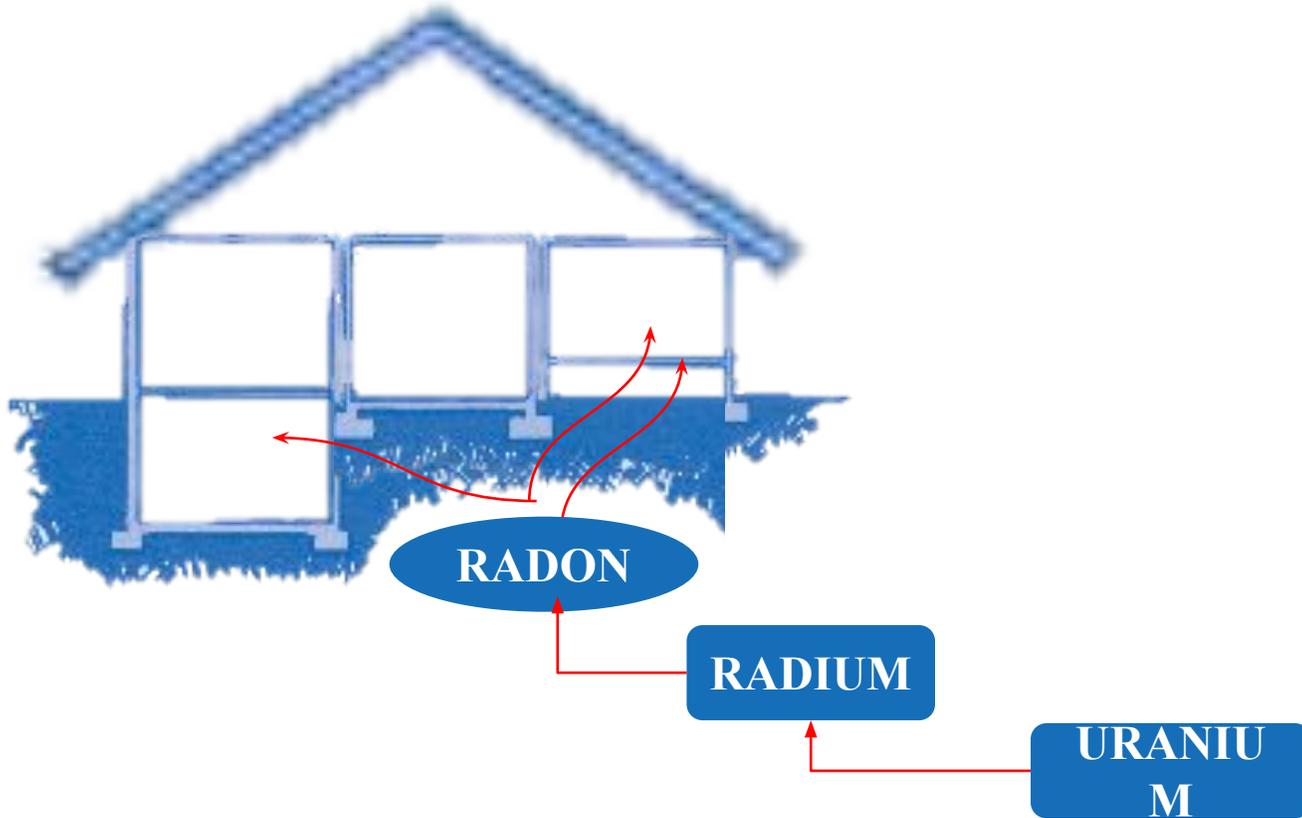
Odorless

Colorless

Naturally occurring

Radioactive

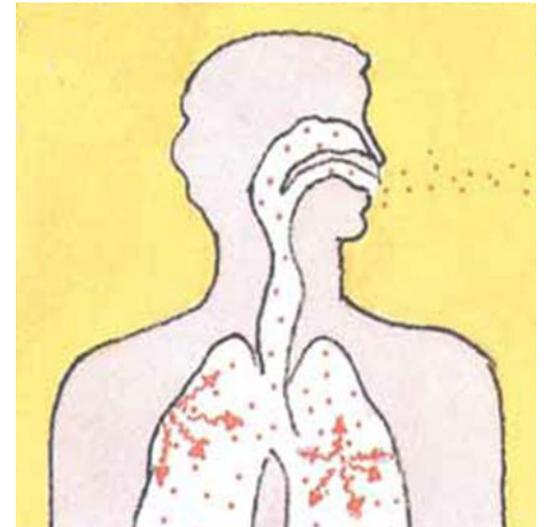




Average outdoor air radon concentrations are 0.4 pCi/L

Health Risks from Radon Exposure

- Radon decay particles can enter and become trapped in your lungs when you breathe
- Risks from radon exposure depend on two factors:
 - How much
 - How long



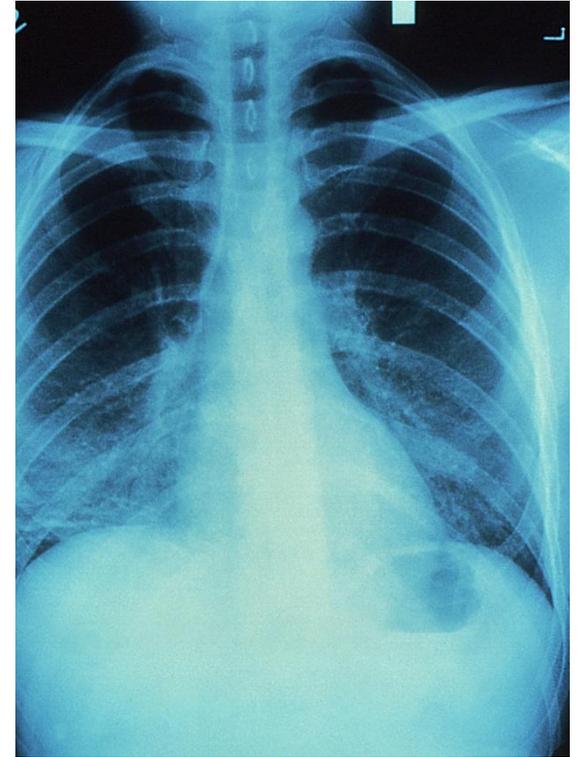
Source: EPA, 2012

Health Risks from Radon Exposure

Radon is a known carcinogen and can increase your risk of lung cancer

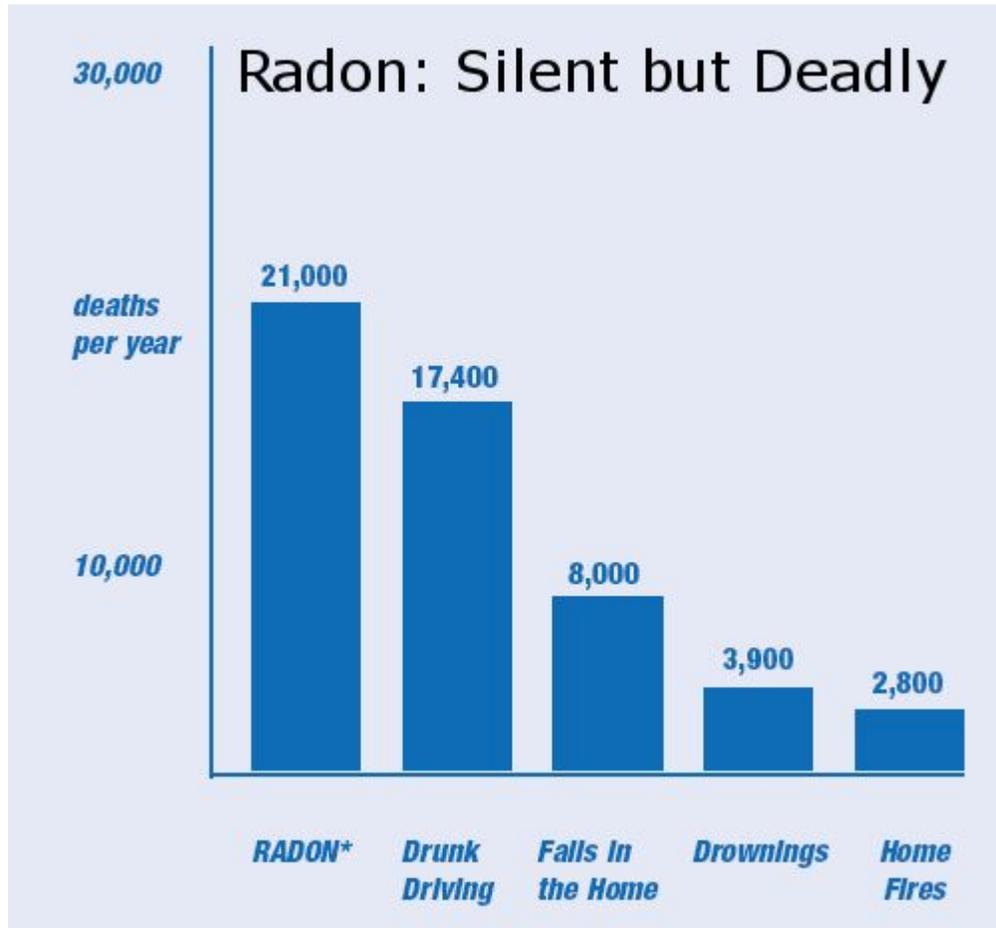
It is the **#1** cause of lung cancer for never smokers

It is the **#2** cause of lung cancer overall



Source: freestockphotos.biz

Health Risks from Radon Exposure



According to the EPA, radon is the leading cause of lung cancer in non-smokers and kills an estimated 21,000 Americans each year.

(EPA, 2003)

Possible Health Risks from Radon Exposure

- Residential radon exposure and hypertensive disorders of pregnancy in Massachusetts, USA: A cohort study
 - Found an association between radon and hypertensive disorders of pregnancy
 - Found a stronger effect in the youngest population, which may be the most susceptible
 - The associations found in this study could be taken into consideration in future radon related public health and environmental policies worldwide
 - [Environment International 146 \(2021\) 106285](#)

Possible Health Risks from Radon Exposure

- Short-term effects of particle gamma radiation activities on pulmonary function in COPD patients
- Radon is a gamma radiation emitter
- Short-term exposures to environmental gamma radiation associated with ambient particles **are associated** with reduced pre- and post-bronchodilator pulmonary function in patients with chronic obstructive pulmonary disorder (COPD)
- In addition to the radiation effects on lung cancer risk described in the literature, results suggest that low-dose environmental radiation **may promote adverse health effects unrelated** to cancer
 - (Environmental Research, [Volume 175](#), August 2019, Pages 221-227)

Action and Mitigation Levels for Radon in Indoor Air

EPA Action Level

4 pCi/L

EPA also recommends that residents consider fixing their home for radon levels

between 2 pCi/L and 4 pCi/L

Target Radon Level

Less than 2 pCi/L

Radon in Massachusetts

Number of homes with radon levels above **4 pCi/L**:
650,000 homes*

Number of homes with radon levels above **20 pCi/L**:
34,000 homes*

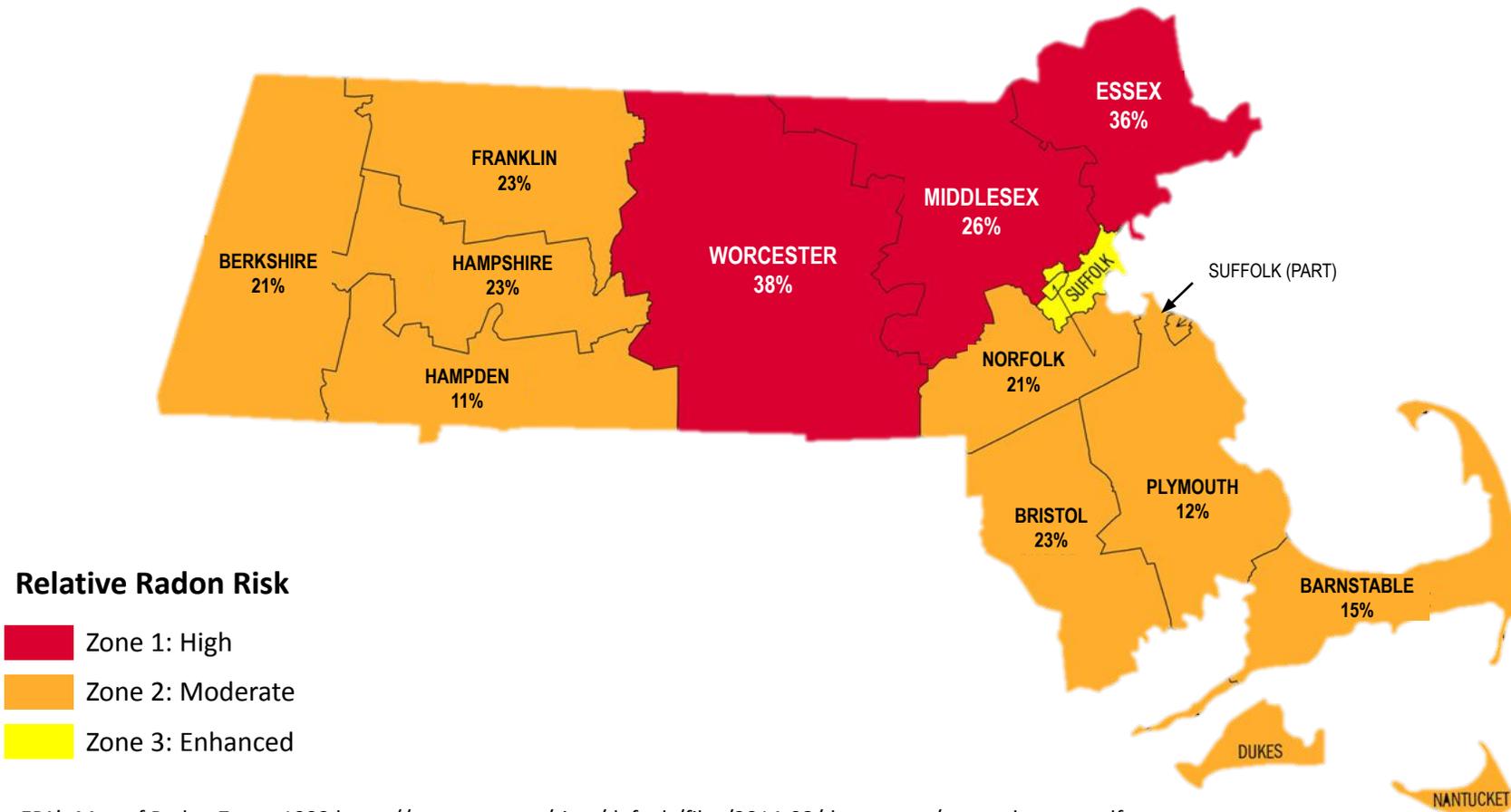
Highest radon level measured in a building:
1,981 pCi/L

*State Indoor Radon Grant (SIRG) final report for Massachusetts 2009

Radon in Massachusetts

Distribution of homes with radon concentrations greater than or equal to 4 pCi/L and relative radon risk by county

1 out of 4
homes may
have radon levels
that exceed the EPA
action level



EPA's Map of Radon Zones 1993 <https://www.epa.gov/sites/default/files/2014-08/documents/massachusetts.pdf>
Residential Radon Survey of 14 States https://aarst.org/proceedings/1988/1988_10_Residential_Radon_Survey_of_Fourteen_States.pdf

Health Risks from Radon Exposure in Massachusetts

In 2005, the US Surgeon General Released a National Health Advisory on Radon

- Test your home every two years
- Test every time you move, make structural changes, or occupy a previously unused level
 - If you have levels of 4.0 pCi/L or above, take steps to fix your home as soon as possible

http://www.adph.org/radon/assets/surgeon_general_radon.pdf

New Radon Requirements in HUD Housing Projects

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT [Docket No. FR-6358-N-01]

- In Feb 2023 HUD began the review process for “Addressing Radon in the Environment.”
- Comments to the review process were posted in the Federal Register in April 2023.

Federal Register: Addressing Radon in the Environmental Review Process; Request for Comment

New Radon Requirements in HUD Housing Projects

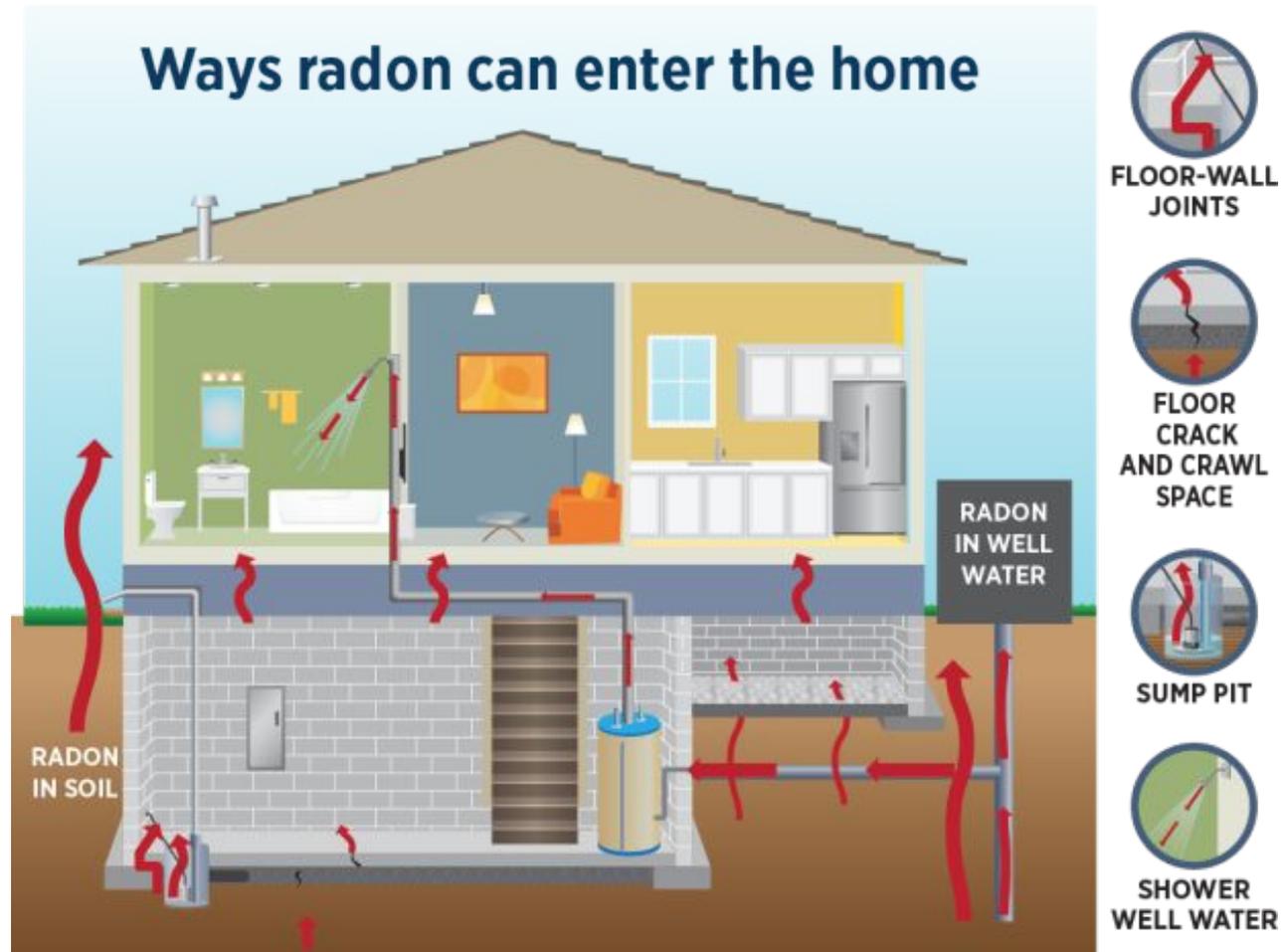
- Clarifies that radon must be considered in the contamination analysis for [24 CFR parts 50](#) or [58](#);
 - PART 50 - PROTECTION AND ENHANCEMENT OF ENVIRONMENTAL QUALITY
 - PART 58 - ENVIRONMENTAL REVIEW PROCEDURES FOR ENTITIES ASSUMING HUD ENVIRONMENTAL RESPONSIBILITIES
 - To provide guidance on recommended best practices for considering radon
 - Identify the HUD programs that have established specific radon guidance

New Radon Requirements in HUD Housing Projects

The Proposed Policy requires:

- An **environmental review** at the level of *Categorically Excluded Subject to 50.4 or 58.5 (“CEST”), Environmental Assessment, or Environmental Impact Statement*;
- Involve structures that are occupied or are intended to be occupied at **least four (4) hours a day**
- Radon testing and mitigation costs are eligible program activities for HUD programs and can be financed with most program funds

Radon Sources in a Building



Source: Conference of Radiation Control Program Directors, 2017

Radon Air Testing

Should I test my building?

- Any building that touches the ground should be tested
- A neighbor's radon levels will not predict your radon levels
- Homeowners can contact the MDPH Radon Unit for a test kit (while supplies last; test kits may also be purchased at hardware stores or online retailers)



Image source: bing.com

Radon Air Testing

What should I do if I'm renting a home or apartment?

- If you rent, ask your landlord to test for radon.
- If your landlord doesn't test, you can test yourself. It is easy to do and takes very little time.



Image source: bing.com

Radon Air Testing

DOs of testing

- ✓ During testing season, November 1st to March 31st
- ✓ When weather conditions are typical for the time of year
- ✓ Lowest livable level or spaces where people could spend time
- ✓ Closed home conditions



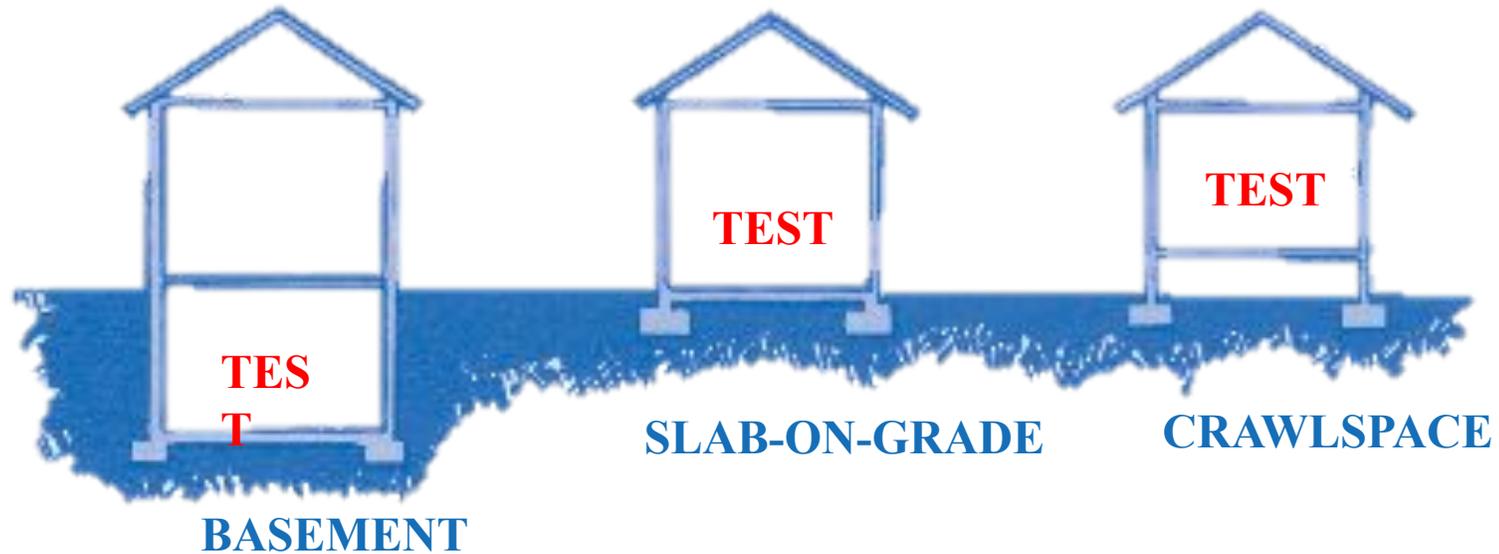
Radon Air Testing

DON'Ts of testing

- ∅ During storms, high wind (above 30 mph), and changes in barometric pressure
- ∅ During unseasonably warm temperatures
- ∅ In kitchen, laundry, bathrooms, or closets



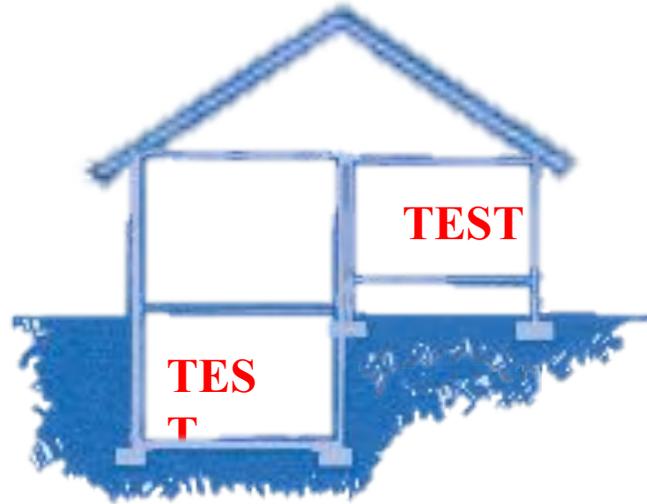
Radon Air Testing



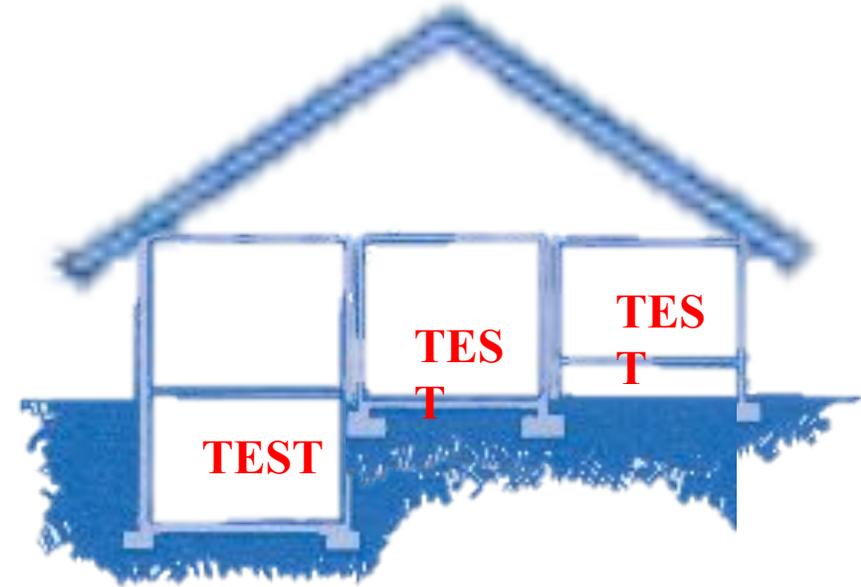
Place tests in lowest occupiable level

- Basement (whether used for living or storage)
- Room on slab
- Room above crawl space

Radon Air Testing



BASEMENT + CRAWLSPACE

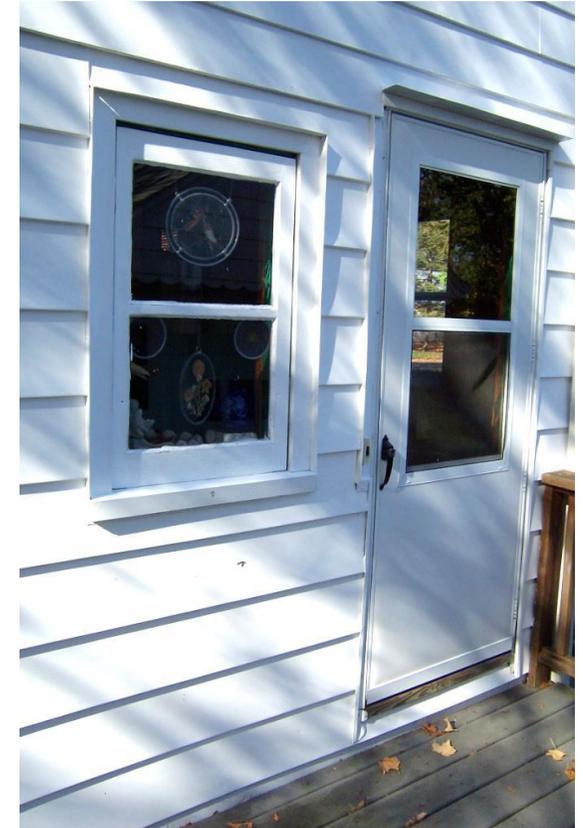


**BASEMENT + SLAB-ON-GRADE
+ CRAWLSPACE**

Place tests in lowest occupiable levels in buildings with multiple types of foundations

Radon Air Testing

- Closed building conditions:
 - **12 hours** before and during test period
 - Close all doors and windows in the building (except for normal entry and exit points)
 - Heat should be on
- Follow manufacturer's instructions
- Use a short-term test



Radon Air Testing

Radon test placement in lowest occupied level:

- ✓ 20 inches off the floor
- ✓ 1 foot from exterior wall
- ✓ 3 feet from exterior wall with openings
- ✓ Nothing within 4 inches of testing vial
- ✓ Away from drafts, heat, or humidity
- ✓ Away from pets or people who can disturb the test



Radon Air Testing

Radon test placement **DON'Ts**



- ∅ **DON'T** place on heaters, washers, dryers, or other equipment that create drafts



- ∅ **DON'T** place too close to other items or where it can get knocked over



- ∅ **DON'T** place directly on the ground or too close to exterior walls

Radon Air Testing

Summary

- ✓ Read manufacturer's directions
- ✓ Test in lowest occupied level
- ✓ If not in heating season, retest in winter
- ✓ Create closed home conditions

Radon Air Testing

Summary

- ✓ Place testing vial accordingly
 - Away from drafts
 - 3 feet from exterior doors, windows, and openings
 - At least 1 foot away from exterior walls without windows
 - At least 20 inches above floor
 - At least 4 inches from other objects
 - Away from the reach of pets and children
- ✓ **Mail promptly**

Radon Mitigation

What to look for in a radon mitigation specialist:

- ✓ Certified by the American Association of Radon Scientists and Technologists or National Radon Safety Board
 - ✓ www.aarst-nrpp.com/wp/
 - ✓ www.nrsb.org
- ✓ Warranty to bring house below 2 pCi/L
- ✓ Conducts home visit



Radon Mitigation

If you rent, *usually the building owner, not the tenant, makes these repairs.* You can take some steps to get the problem fixed:

- Tell the building owner in writing about your test results. Ask what steps the owner will take to fix the problem.
- If you live in an apartment building, you can share your radon information with other residents. Your neighbors might want to test their own units or discuss the issue with the owner.

Radon Mitigation



Example of a typical radon mitigation system

- Outside of the occupied space
- Properly insulated
- Proper signage
- Has pressure gauge

After Mitigation

- ✓ Re-test your home
- ✓ Re-test annually
- ✓ Re-test in the winter



Additional Radon Mitigation Resources

Appendix F of the Massachusetts Building Code:
Reference Data For Repair, Alteration, Addition and
Change of Use of Existing Buildings

ANSI/AARST RRNC 2020:
Rough-In of Radon Control Components in New
Construction of 1 & 2 Family Dwellings and Townhouses

Radon Resources for the Public

Radon Fact Sheets

- English
- Spanish
- Portuguese
- Chinese
- Vietnamese



[Radon: General Information | Mass.gov](#)

Radon Standards : [AARST Radon Standards](#)

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