

RADON 201



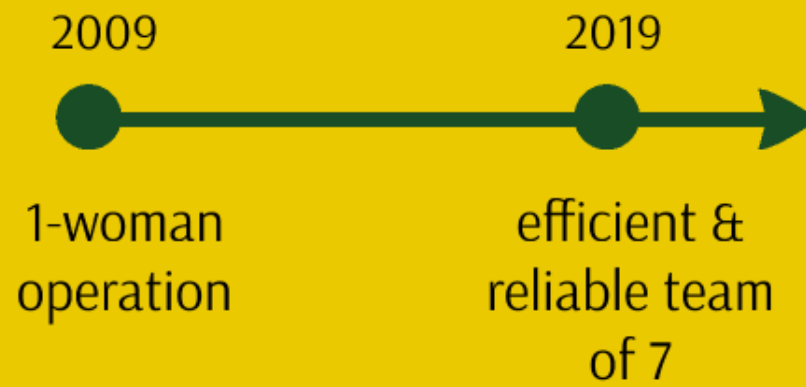
Client
FAQs

Inspector
Insights

Future of
Radon

About
Raleigh Radon

2019: Raleigh Radon's
10th anniversary!



Office
Team

Field
Team

Office Team



Angie



Brendan

routes, schedules, emails,
reports, payments, questions



Megan



Sally Claire



Charlie

Field Team



Justin



Lindsay

- Licensed home inspectors
- AARST-NRPP certified
- TMLS subscribers

RADON 201



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Questions
Raleigh Radon or inspectors
get from clients

Motion
Errors

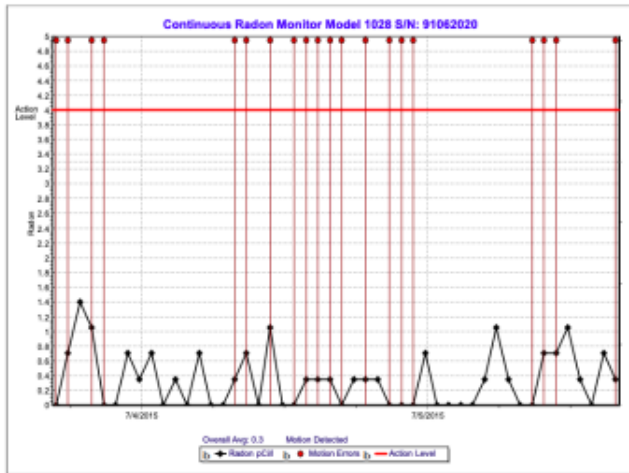
Fluctuations

Spikes

Rain

Variation

Re-testing



Motion Errors

monitor/table is touched, bumped, or moved

Common in any occupied home or new construction

- active children
- curious pets
- contractors

measurements are not affected

may suggest tampering, but can't distinguish cause

don't invalidate/validate test → look at measurements

sensors = deterrents for sellers, don't prove/disprove tampering
= questions & concerns for buyers without additional value

Fluctuations

normal, occur during every test

Caused by anything that impacts pressurization/airflow

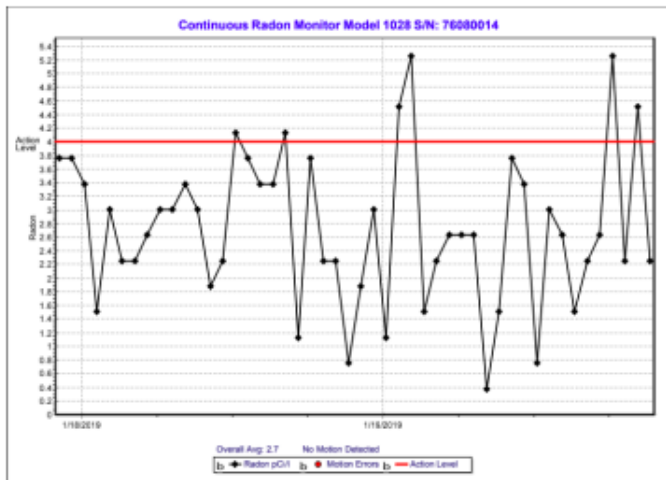
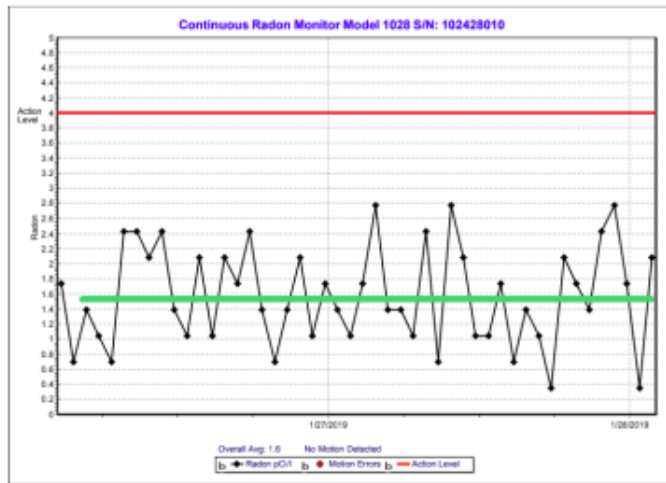
- barometric pressure
- cycling of HVAC system
- wind
- exhaust fans
- precipitation

scale of graph → relatively dramatic

overall average

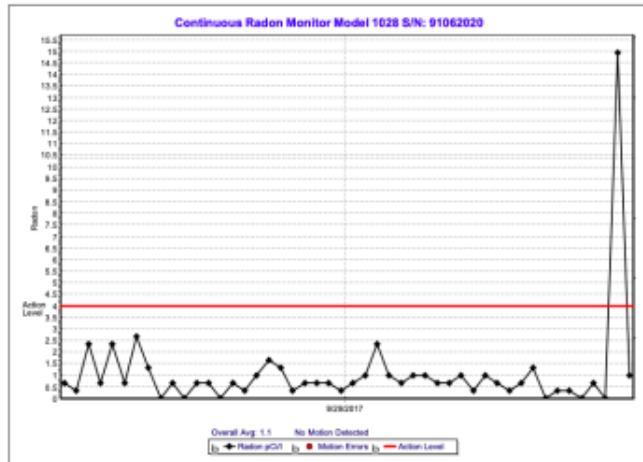
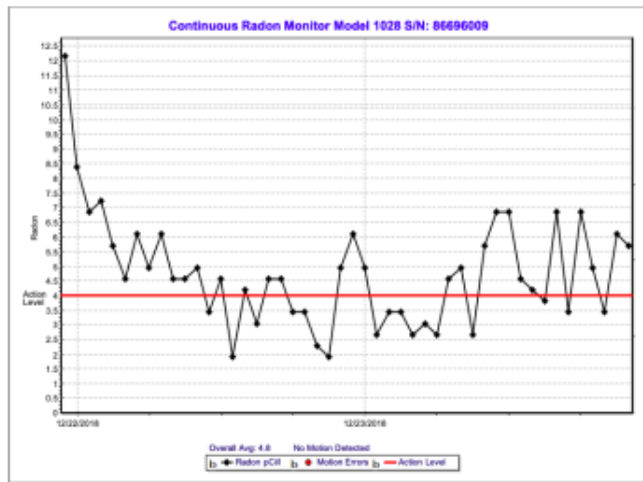
vs.

individual measurement



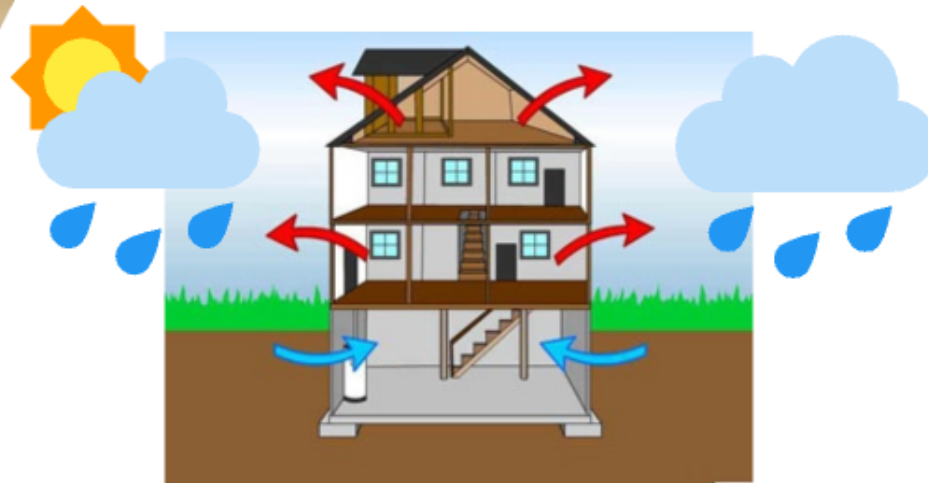
Spikes

Most "spikes" are normal fluctuations or weather related



Single-measurement spikes are rare, likely a fluke

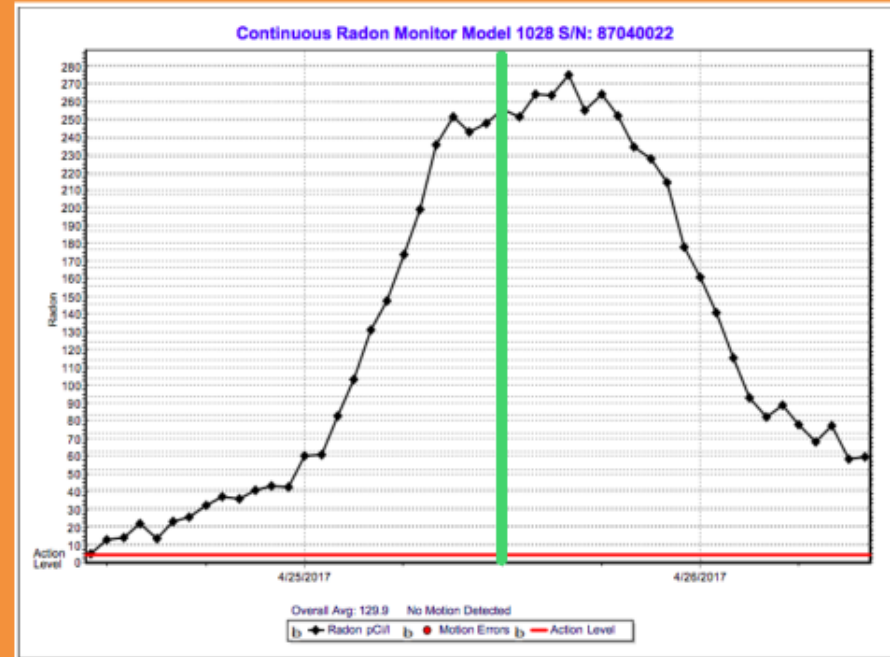
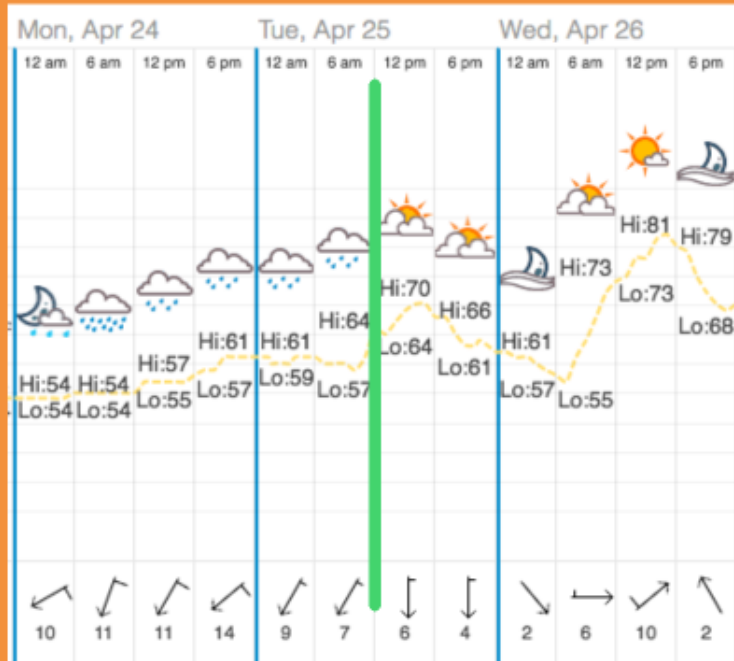
Rain can have a significant impact



wet/rainy  clear/dry

Example

Ideal to test when weather isn't perfectly clear/dry



Rain helps create a better worst-case scenario,
which is the goal of the short-term test

Room-to-Room Variation

Fairly consistent room to room
on same floor

More variation in larger homes

- 1 monitor per 2,000 SF footprint
- basement front wall

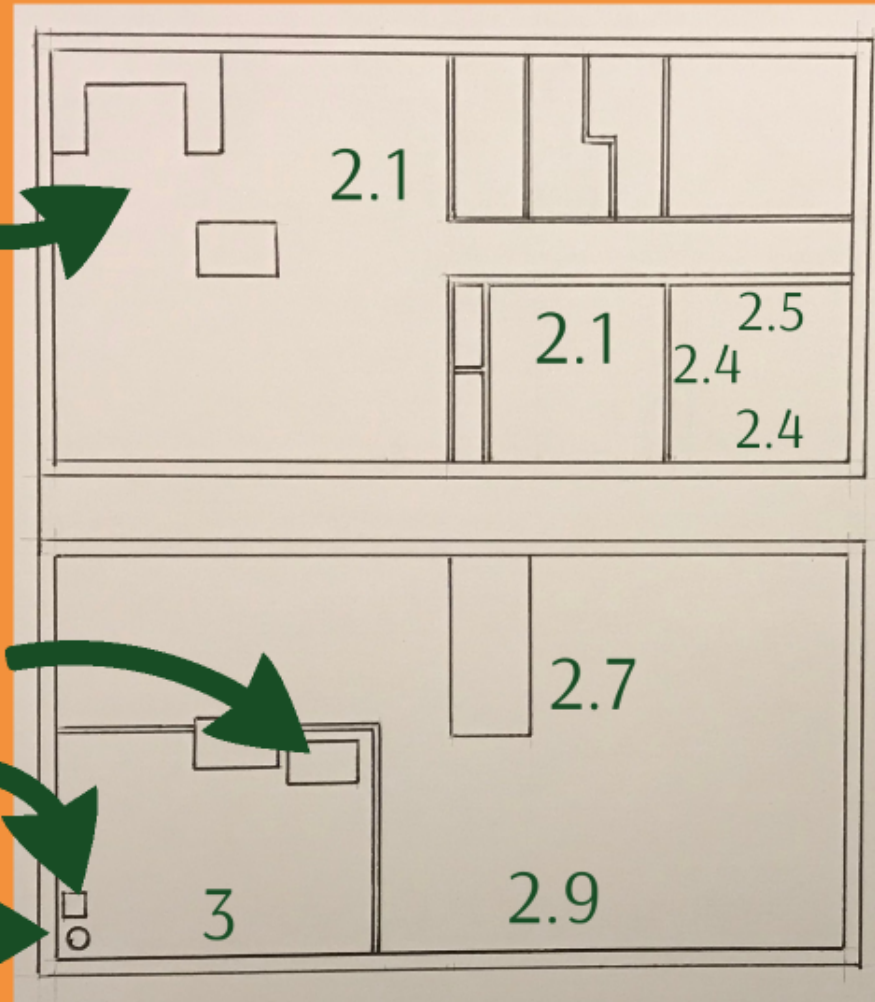
Radon levels decrease by 40-60% each floor you go up

- test where levels should be highest, knowing they should be lower elsewhere



Example

kitchen
main floor



basement furnace
dehumidifier
sump

Re-testing: typically not helpful

NC: radon isn't regulated - sellers have options if buyer requests mitigation

Surprised sellers like to re-test

- might have lower results
- verify high levels

1. Sellers *always* want low results

- re-test may be biased
- builders know enough to skew

2. Outcome typically doesn't change

- added expense for seller
- delays a resolution
- buyer isn't comfortable without mitigation

Protocol

Re-test Protocol

Average the results of the 1st and 2nd test to determine whether to mitigate

Test 1
5 pCi/L

Test 2
2.8 pCi/L

Average: 3.9 pCi/L

Buyer comfortable?

Buyers: ask seller to mitigate or consider mitigating at own expense

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Insights & Advice for Home Inspectors



Granite
Countertops

Kitchens

Water

Mobile
Homes

New
Construction

Monitors

Inspector
Advantages

Say
Yes

Granite Countertops

Typically, no significant difference between radon levels on granite countertops vs. elsewhere on same floor



surface area
countertops vs. foundation

Kitchens

Sometimes the best location for the monitor

- narrow house, lots of furniture
- no suitable space to avoid exterior walls/windows/doors/HVAC
- curious children/pets - out of sight/reach

Avoid enclosed, galley kitchens - moisture/humidity

- most are open to living area
- vacant/new construction - sink/stove/exhaust fan not in use

Radon in Water

Potential issue for well water, not municipal

- ship sample of tap water to laboratory
- \$35 kit online - Accustar Labs
- 3rd party: well inspection company add-on
 - Agri Waste Technology, Inc. - no excessive levels found

Concern is off-gasing into air, more than drinking

- 10,000 pCi/L in water → 1 pCi/L in air
- 90% indoor radon comes from foundation
 - remainder is building materials & water

Mobile Homes - depends on foundation

Completely open airflow



Likely low radon

Recommend testing later if plans to
enclose foundation

Enclosed, reduced airflow



Similar levels to crawlspace in area

Definitely test due to blocked airflow/
accumulation

New Construction



1

2

3

New construction is the best time to test!

before anyone lives
in the home
+
access to
construction plans



builder pays
for easy fix
+
fixed forever

Builder's contract: what's allowed/covered?

before closing?
after closing?
1-year warranty?
no coverage?

After closing is always best!

- closed-house conditions maintained
- reliable results

**** schedule in advance****

Before closing: weekends are almost always best



send PM's phone number, please!

Avoid weekday tests whenever possible

- punch list items
- final touch ups
- cleaning crew

**Last weekend prior to closing,
unless house is *totally*
complete in advance**

LIMITED VISUAL HOME INSPECTION

Exploratory: discover as many glaring issues as reasonably possible during limited time

- procedure
- tools
- experience & education

Limitations: access, furniture, specialization, etc.

Comprehensive: hire system-specific specialists for further investigation

SHORT-TERM RADON TEST

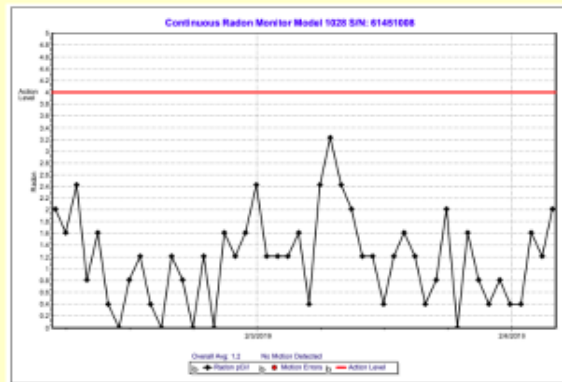
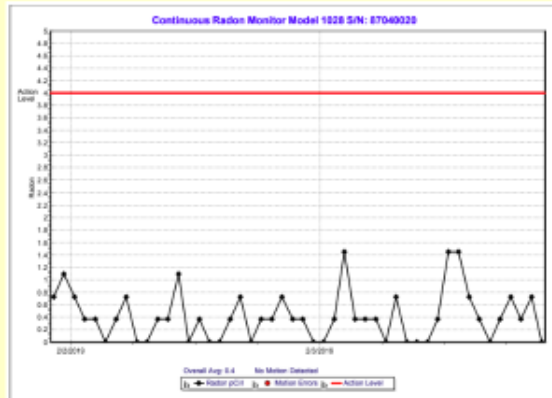
Exploratory: determine the extent of radon issue, as best as reasonably possible during limited time

- procedure
- tools
- experience & education

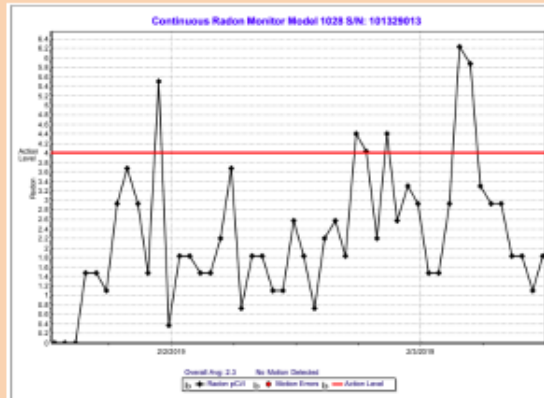
Limitations: weather, occupants, tampering, etc.

Comprehensive: conduct long-term radon test (3-12 months)

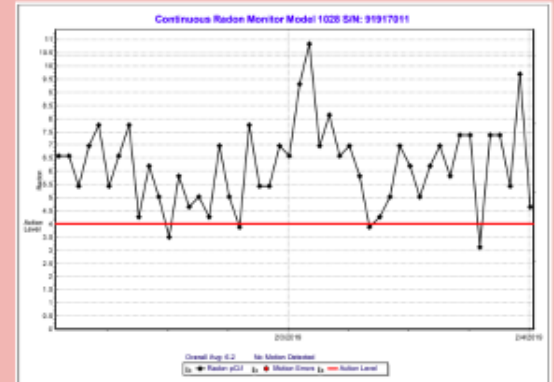
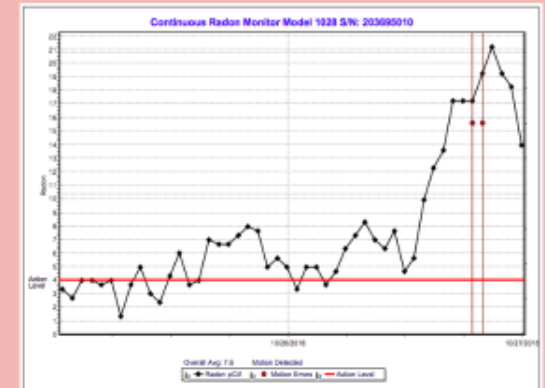
Low



Moderate



High



Machine Precision

67 AARST-NRPP approved radon testing devices (31 are CRMs)

QA/QC plan requires duplicate testing: 10% or 50/month max
Ensure any 2 devices have low Relative Percent Difference (RPD)

most recent 600 duplicate tests:
median avg: **1.4 pCi/L**
median RPD = **10.5%**

Since November 2018

226 duplicate tests
1028 vs. 1028
Difference: **0.1 pCi/L**

50 duplicate tests
1028 vs. 1030
Difference: **0.1 pCi/L**

WARNINGS	In-Control Level	Warning Level	Control Limit
Avg 4.0 or Greater	14%	28%	36%
Avg 2.0 - 3.9	25%	50%	67%
Avg < 2	No Control Limits		

Machine Accuracy

Sun Nuclear calibration reports
monitor's test result vs known radon level in chamber



SUN NUCLEAR
corporation

Your Most Valuable QA & Compliance Tools

Radon Certification of Calibration

The radon monitor was placed in SNC calibration chamber number: **1028**

SNC Serial No: 88756815
Model No: 1030

The calibration is automatically incorporated in the displayed value on the monitor, no correction needs to be manually applied.

The accuracy of this radon monitor is $\pm 25\%$ or 1 pCi/L , whichever is greater, after a 24 hour period of deployment.

The measured gas concentration in the chamber, over the measurement interval was:
 $159.99 \text{ pCi/L} \pm 10\%$ as measured with 100ml scintillation cells.

The accuracy of this radon monitor per EPA and Proficiency recommendations is $\pm 25\%$ or 1 pCi/L , whichever is greater, after a 24 hour period of deployment.

This instrument has been calibrated in accordance with the specifications set forth by the manufacturer. Radon gas calibrations are traceable to NIST SRM 4873 Radon emission standard.

The error of the chamber concentration is a best estimate based upon typical inter-comparison results with Bureau Weir Reference Laboratory. The most recent inter-comparison in which Sun Nuclear participated, 2/16/2015, resulted in a 0.6% error in our reported measurement.

Frequency of re-calibration may vary depending upon local, state, or federal requirements.

Sun Nuclear Corporation has successfully met the established and published requirements for Accreditation by the National Radon Safety Board as an accredited chamber. Accreditation No. NRSS-TRC0001 expiring December 2018.

Please save this document for record purposes.

Calibration Date: 11/2/2018
Next Calibration Date: 11/2/2019

Technician:

Corporate Headquarters:
2015 Sunset Blvd.
Bismarck, ND 58101 USA
Tel: +1 815 229-4500
Fax: +1 815 229-1775
Web: www.sun-nuclear.com

SUN NUCLEAR
corporation

Your Most Valuable QA & Compliance Tools

Radon Certification Of Calibration

The Radon Monitor was placed in SNC calibration chamber number: **1030**

SNC Serial Number: 234127004 Model Number: 1030

The calibration is automatically incorporated in the displayed value on the monitor, no correction needs to be manually applied.

The accuracy of this radon monitor is $\pm 25\%$ or 1 pCi/L , whichever is greater, after a 24 hour deployment.

The measured gas concentration in the chamber over the measurement interval was:
148.1 pCi/L $\pm 10\%$ as measured with 100ml scintillation cells.

The accuracy of this radon monitor per EPA and Proficiency recommendations is $\pm 25\%$ or 1 pCi/L , whichever is greater, after a 24 hour period of deployment.

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Next Calibration Date: 10/2/2019

Technician:

Corporate Headquarters:
2015 Sunset Blvd.
Bismarck, ND 58101 USA
Tel: +1 815 229-4500
Fax: +1 815 229-1775
Web: www.sun-nuclear.com

Sun Nuclear rates both models
with equal accuracy

Duplicate testing demonstrates
both models operate at the same
precision

1 sensor vs. 6 sensors
no measurable difference

Model 1030™

Reliable. Accurate. Efficient.

pressure, temperature, humidity

potential deterrents to tampering
(if seller is aware)

without significant local experience,
create doubt or artificial confidence among clients

suspicion vs. evidence

requires skillful analysis of radon measurements
and visual inspection of house

1028™ XP

Reliable. Accurate. Efficient.

**pressure, temperature, humidity
+ VOC, CO2**

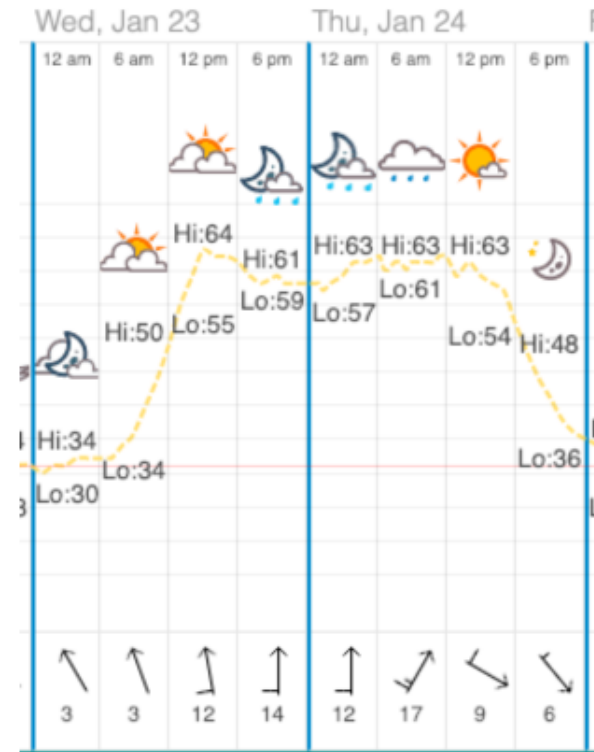
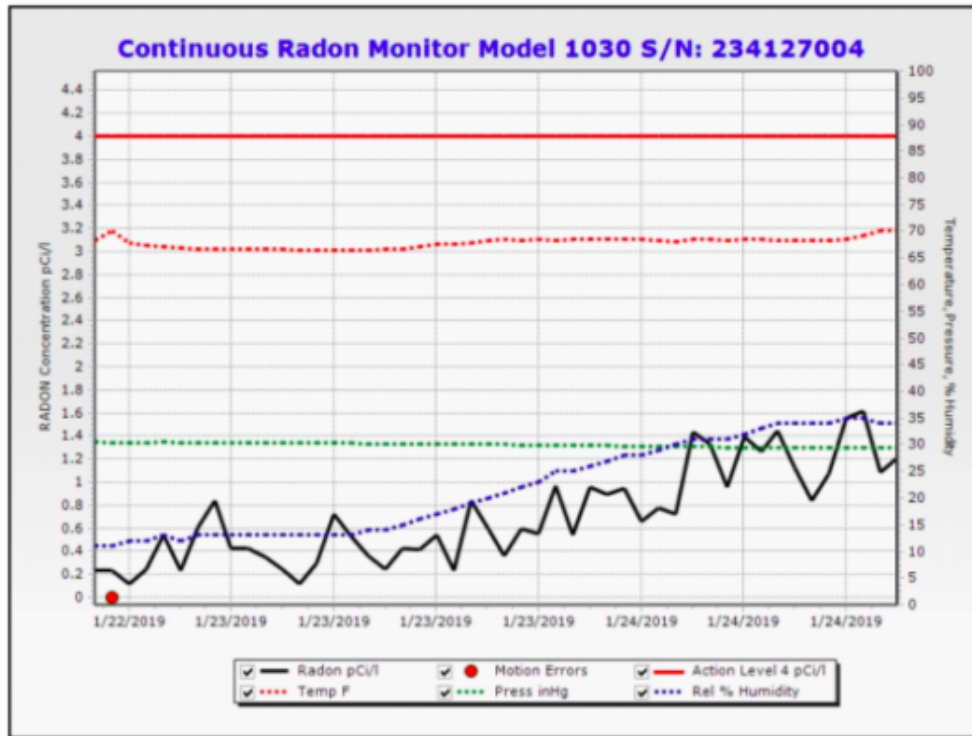
**Cloud Connectivity:
live, remote data access/monitoring
remote start/re-start**

improved convenience

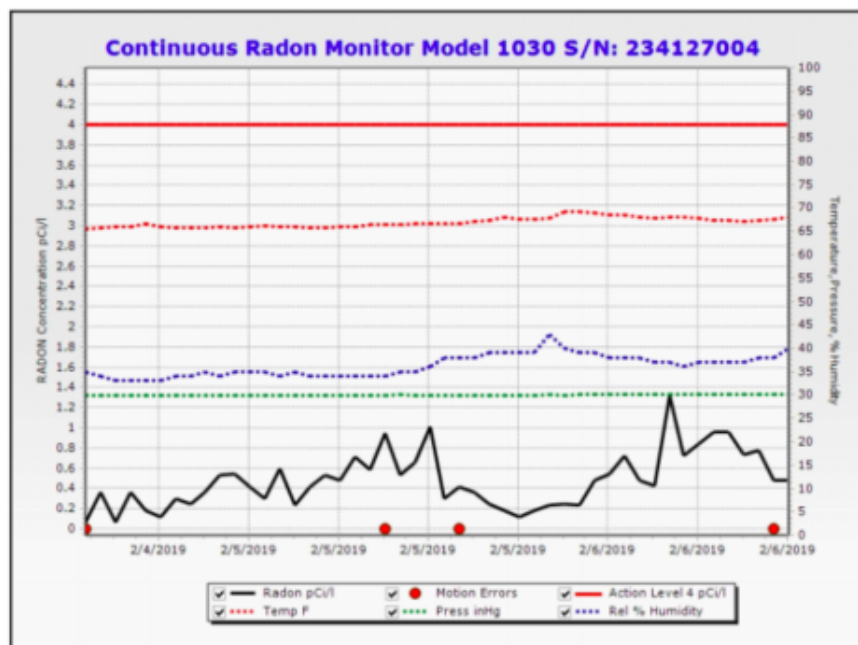
quicker report turnaround

functionalities not yet available

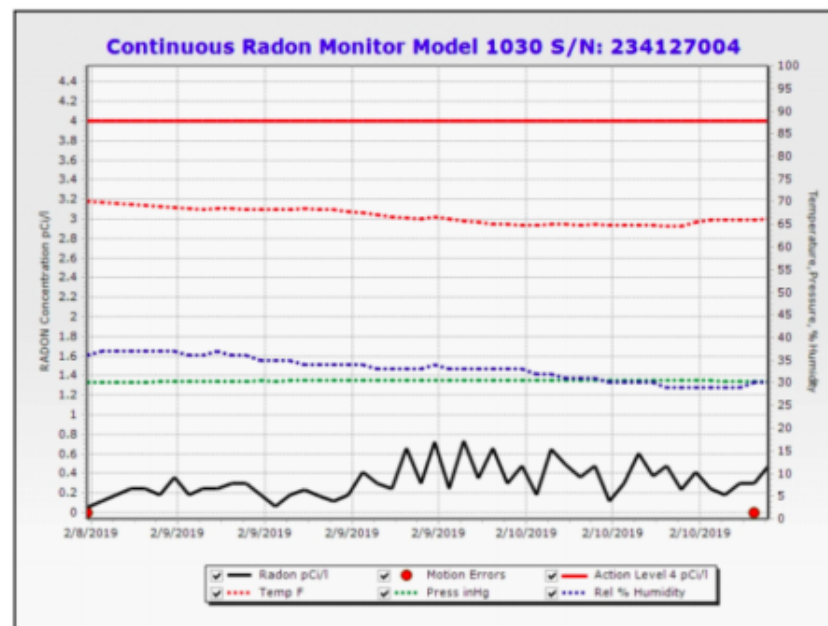
Rain explains increasing humidity/radon levels



Sensors don't make tampering obvious



windows opened each day,
closed each night



closed-house
conditions maintained

Competing w/ radon companies

3 advantages
ordering through
home inspector vs. RR

Access

Convenience

Priority

Direct contact with clients

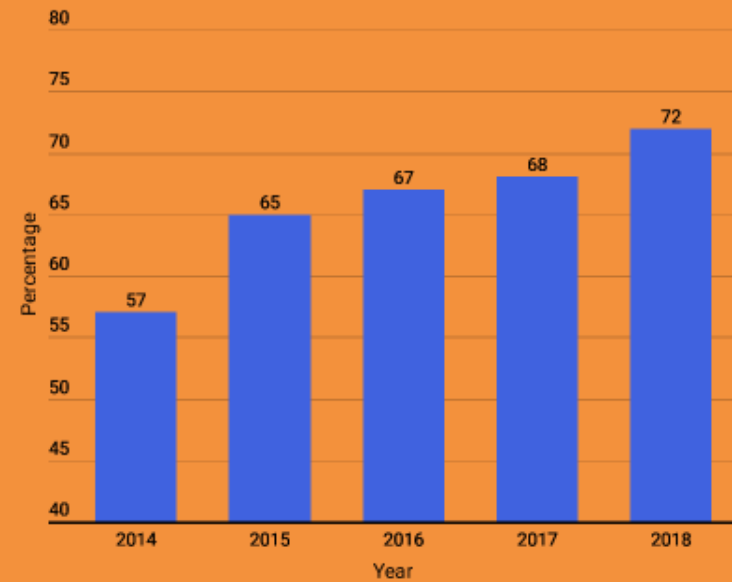
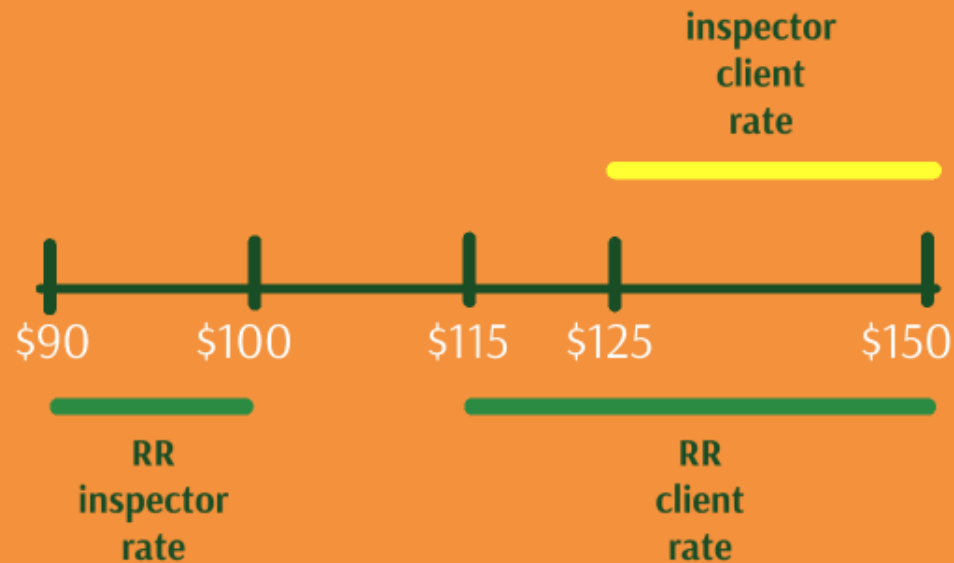
Inspectors:

- **initiate** conversation
- introduce radon
- offer add-on service
- encourage & discuss risks

Raleigh Radon:

- **respond** to inquiries


Clients/agents prefer convenience



Research/coordinate/pay 3-4 providers vs. 1

Inspectors get priority scheduling

	Clients	Inspectors
Slow Season	same-day availability	same-day availability
Busy Season	1-3 week lead time	0-3 day lead time
Suggestion	order through inspector	order through RR
Why?	priority scheduling	share the pie



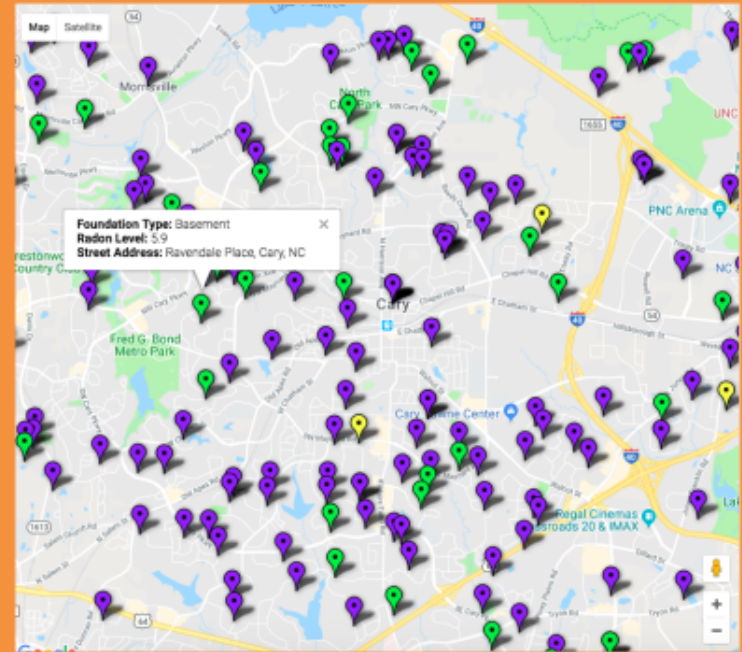
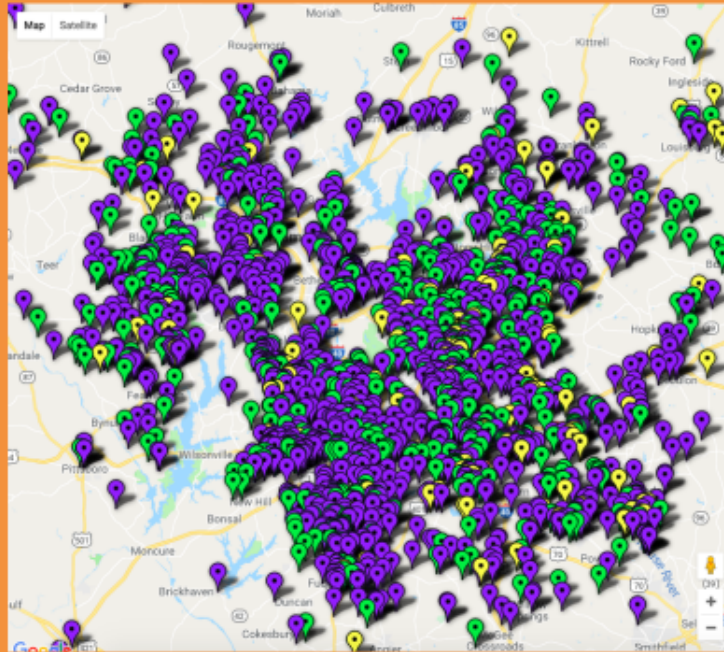
Resources to get
clients to say
"yes"
to radon testing

Map

2018
Data

Changes

www.RaleighRadon.com/radon-map



Only levels of 2 pCi/L or higher are marked - one per street
Lots of people test for radon, high levels found everywhere

Raleigh Radon's 2018 Data

~5,800 tests + duplicates

REMOVED: 215 known mitigation systems, re-tests, multiple locations

5,484 houses for analysis

Average: **1.4** pCi/L

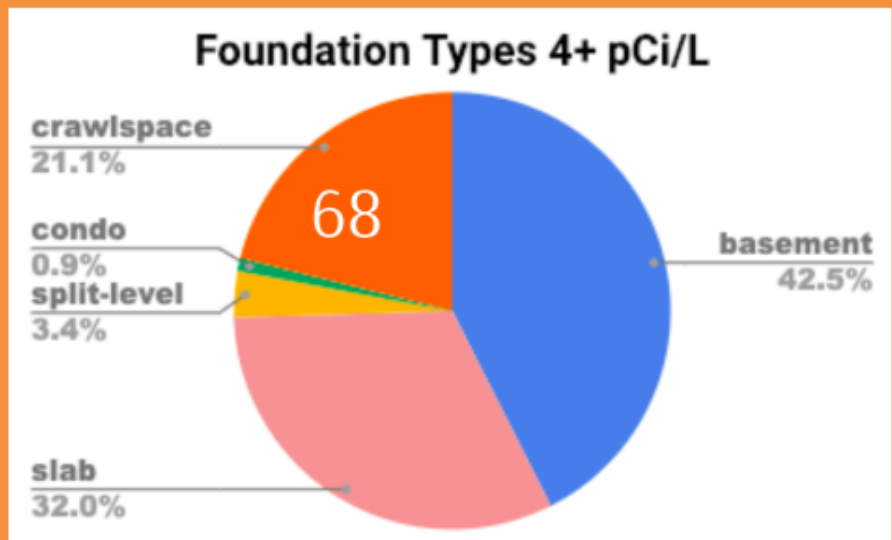
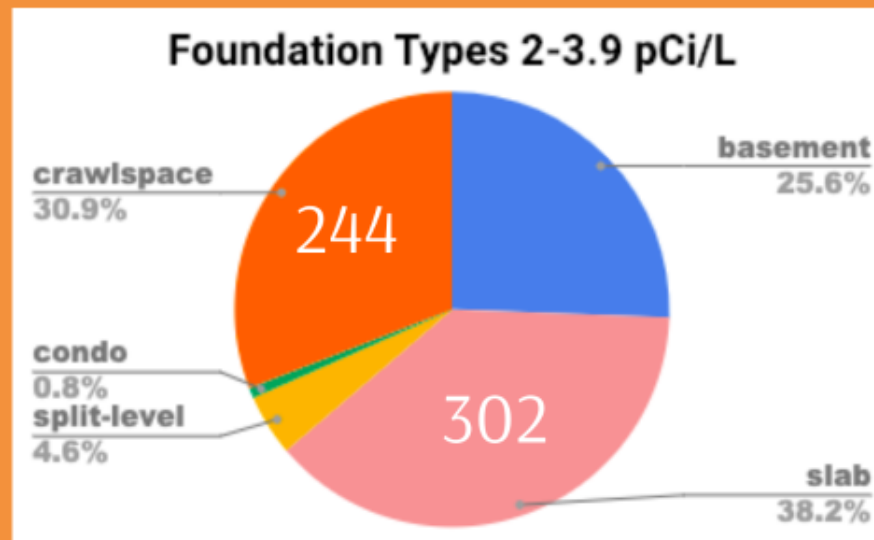
14% levels 2 - 3.9 pCi/L (consider mitigating)

Median: **0.9** pCi/L

6% levels 4 pCi/L and above (mitigate)

20% at least consider mitigating

Primary Factors: Foundation Type & Location

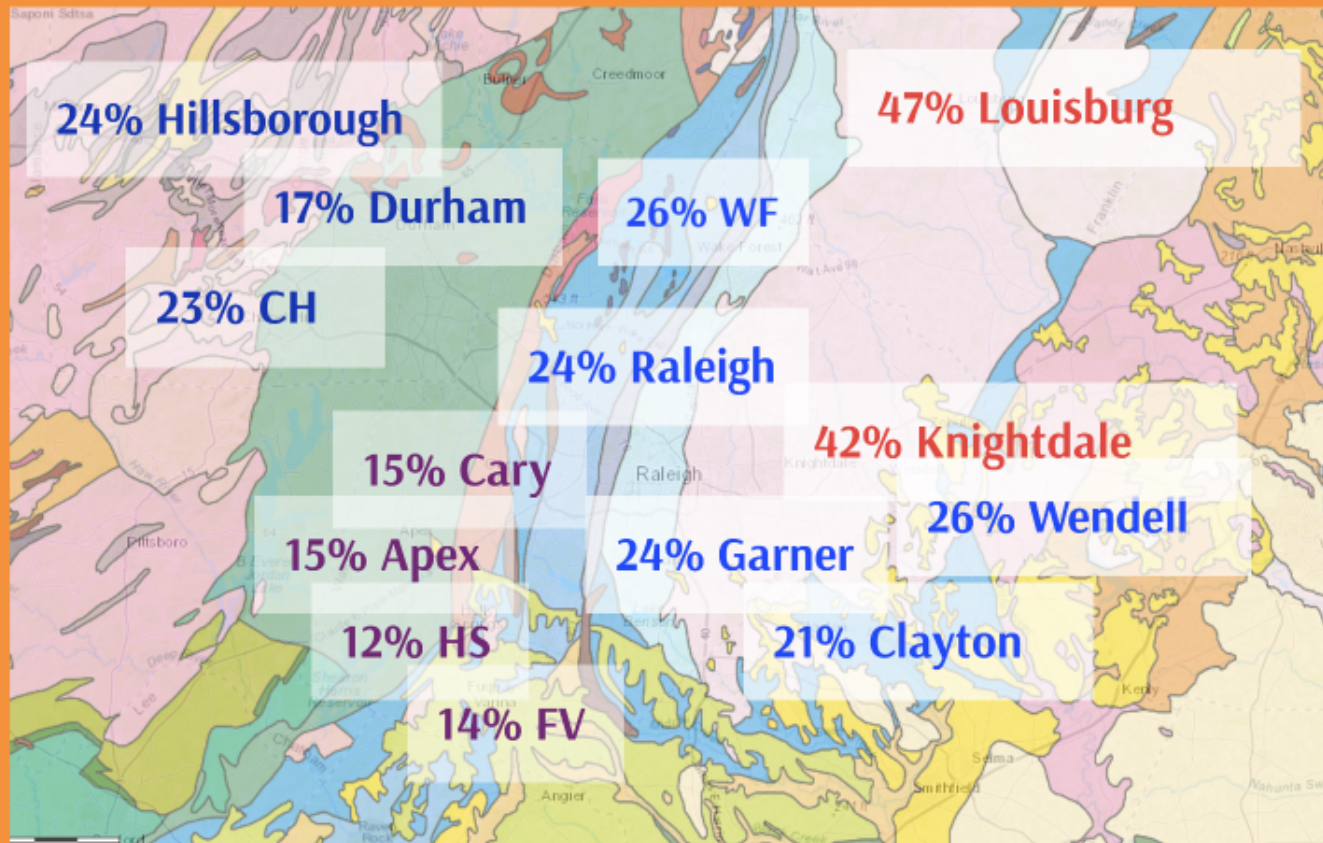


Very few homes have split-level foundations or are condos

2018 Statistics

	Crawlspace	Slab	Basement	Split-Level	Condo
% of homes	59%	28%	11%	2%	<1%
# of homes	3,216	1,550	600	86	32
median	0.7 pCi/L	1.3 pCi/L	2.2 pCi/L	2.1 pCi/L	1.0 pCi/L
% 2-3.9 pCi/L	8%	19%	34%	42%	19%
% 4+ pCi/L	2%	7%	23%	13%	9%
Consider Mitigation	10%	26%	57%	55%	28%
# mitigated	47	63	98	5	2
PM median	0.9 pCi/L	0.9 pCi/L	1.3 pCi/L	1.1 pCi/L	1.9, 5.5 pCi/L

20% of homes had levels of 2 pCi/L +

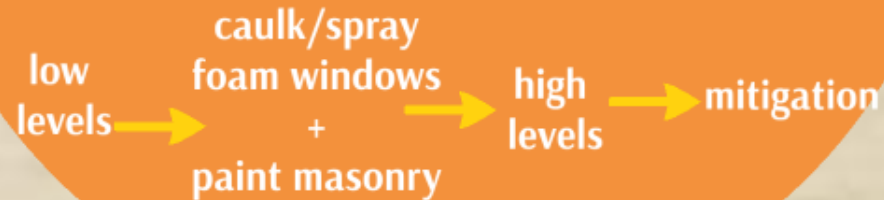


Already tested?

Small changes can have big impact

EPA recommends re-testing every 2-5 years or whenever significant changes are made:

- addition
- HVAC system
- windows/doors/insulation
- seal crawlspace
- caulking/sealing/weatherstripping



RADON 201

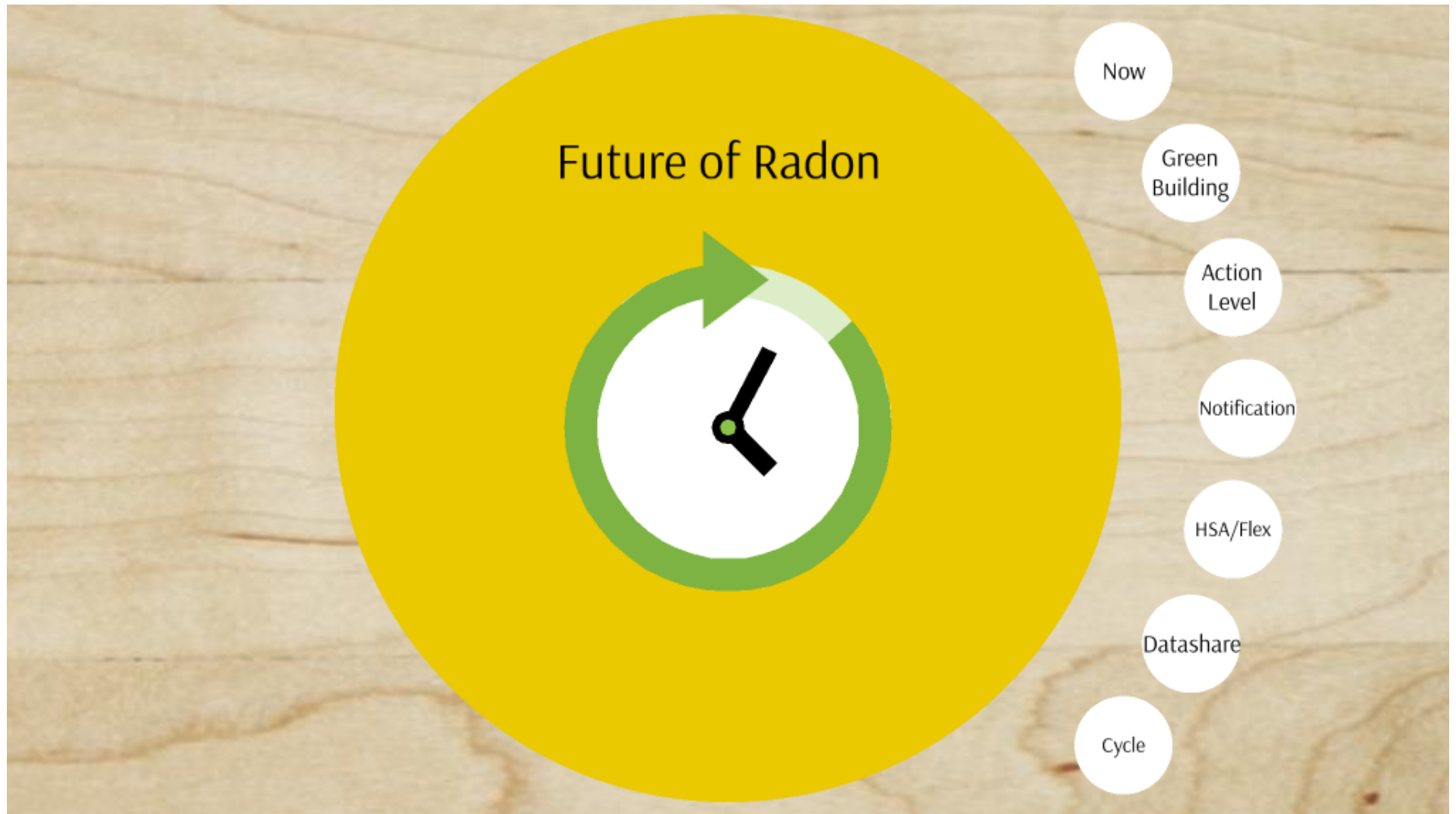


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Current State of the Union

~3,000 US Counties - only **1** requires radon testing for home sales

1/3 of states oversee service providers

70,000+ classrooms estimated to have high levels
no plan, strategy, funding to test/mitigate

Completely up to homeowners to reduce exposure

Exception: multi-family housing
tested w/ substantial refinancing

ASHRAE Standards for Green Building

Require levels of 2.7 pCi/L or below
(World Health Organization's (WHO) Action Level)

Embedded in 2018
International Green Construction Code



American Association of Radon Scientists & Technologists (AARST) - Action Level Changes

2/3 of radon-related deaths occur at radon levels below the 4.0 pCi/L EPA Action Level

2.0 pCi/L: indoor radon level known to cause cancer - consider mitigation 2-4 pCi/L

Current Action Level: 4.0 pCi/L

Lowest level (at the time) that was:

1. Reliably measured with common, portable equipment
2. Reasonably achievable for mitigation



Goal Action Level: ~ 2.7 pCi/L

health-based threshold
for preventive action

similar to international
WHO action levels

Required buyer notification

Goal: before signed contract w/ federal loan, buyer receives:

- signed warning statement about radon
- results of professional test within past year
- any radon-related info about property
- radon info pamphlet

9 states require buyer notification, others considering



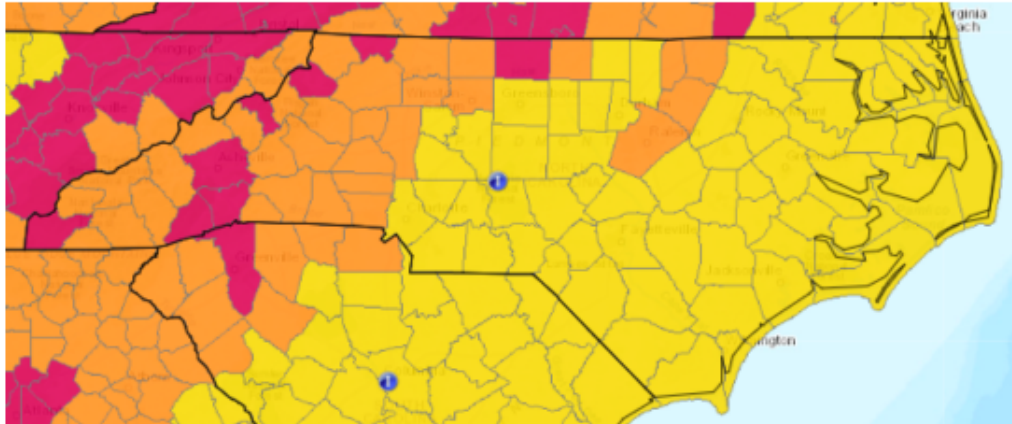
Enable HSA/flex spending

IRS allows funds to be used for
"expenses incurred primarily for the prevention or
alleviation of a physical or mental defect or disability"

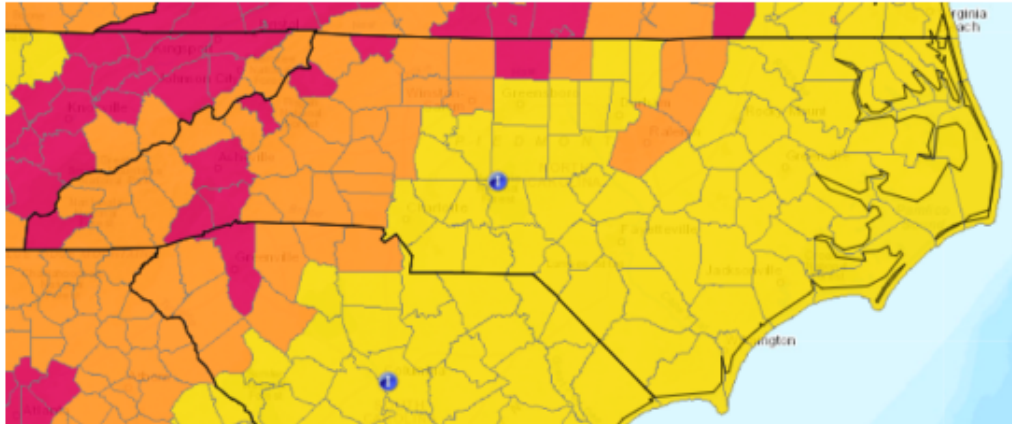
Currently: funds usable for testing & mitigation if
doctor has **already diagnosed** occupant w/lung cancer

Goal: make technical changes to allow use of funds
for testing & mitigation to **prevent cancer**





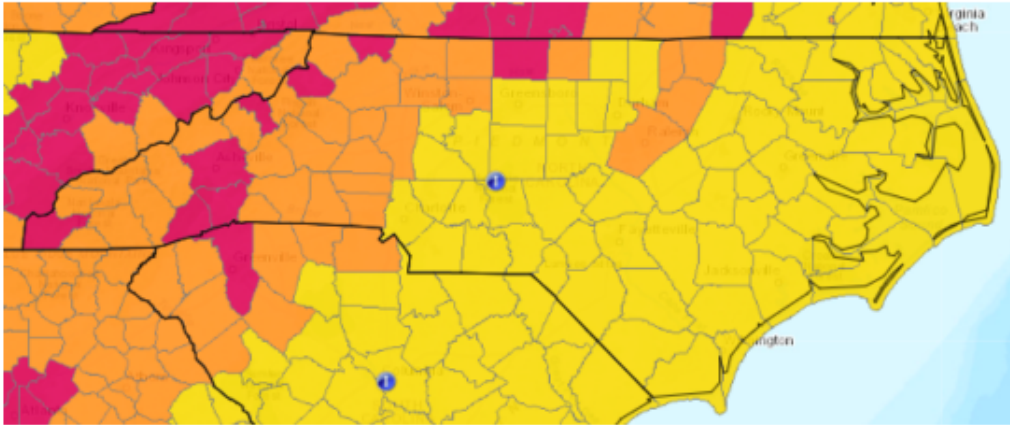
1992
EPA Radon
Potential Map



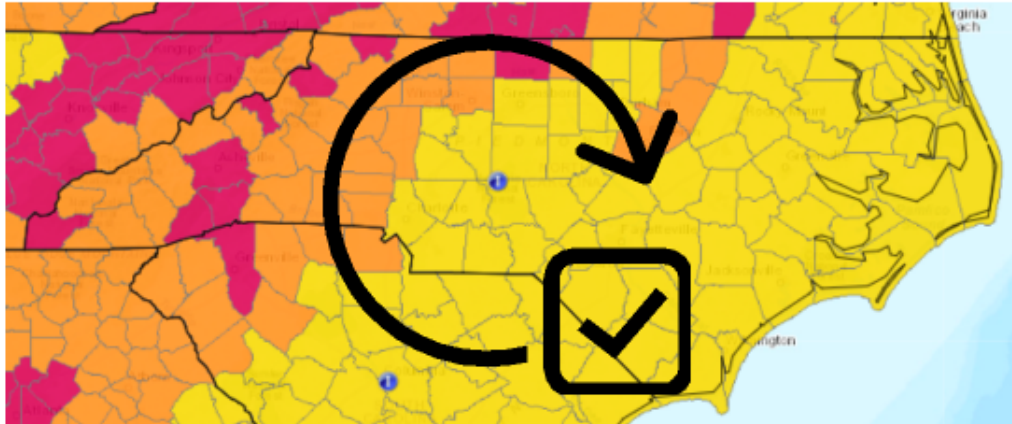
1992 EPA Radon Potential Map

"based on very little actual radon test data"

"appeared to underestimate the radon potential in many areas"



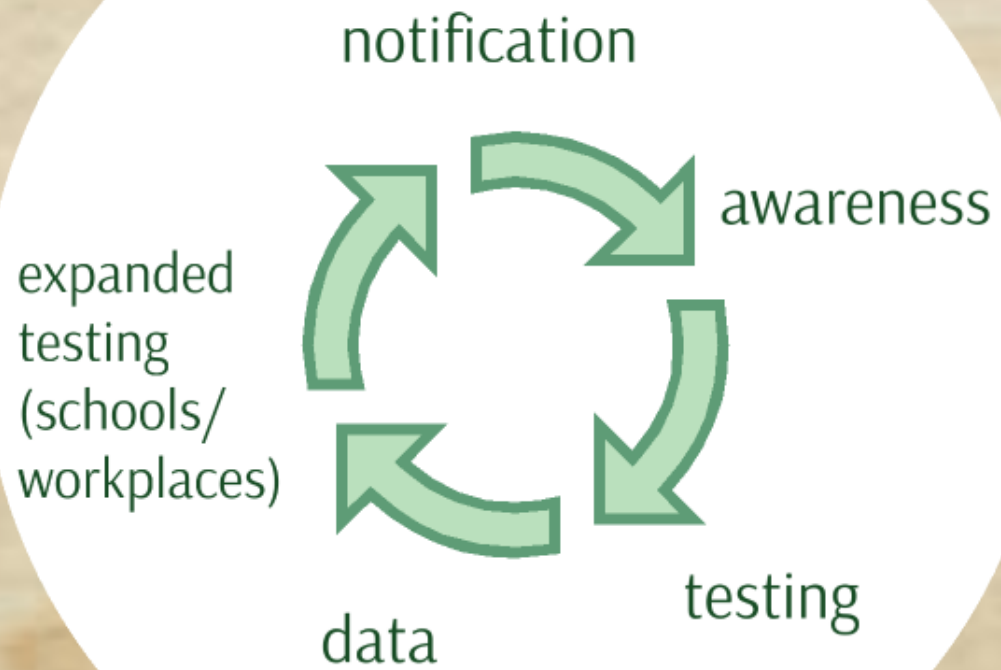
CDC Secure Radon Datashare



Updated
EPA Radon
Potential Map

data from 3 million tests from 5 radon analysis labs

Opt-In: manufacturer collects CRM data to upload to CDC database



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