

# From Measurement to Mitigation: A review of the evidence

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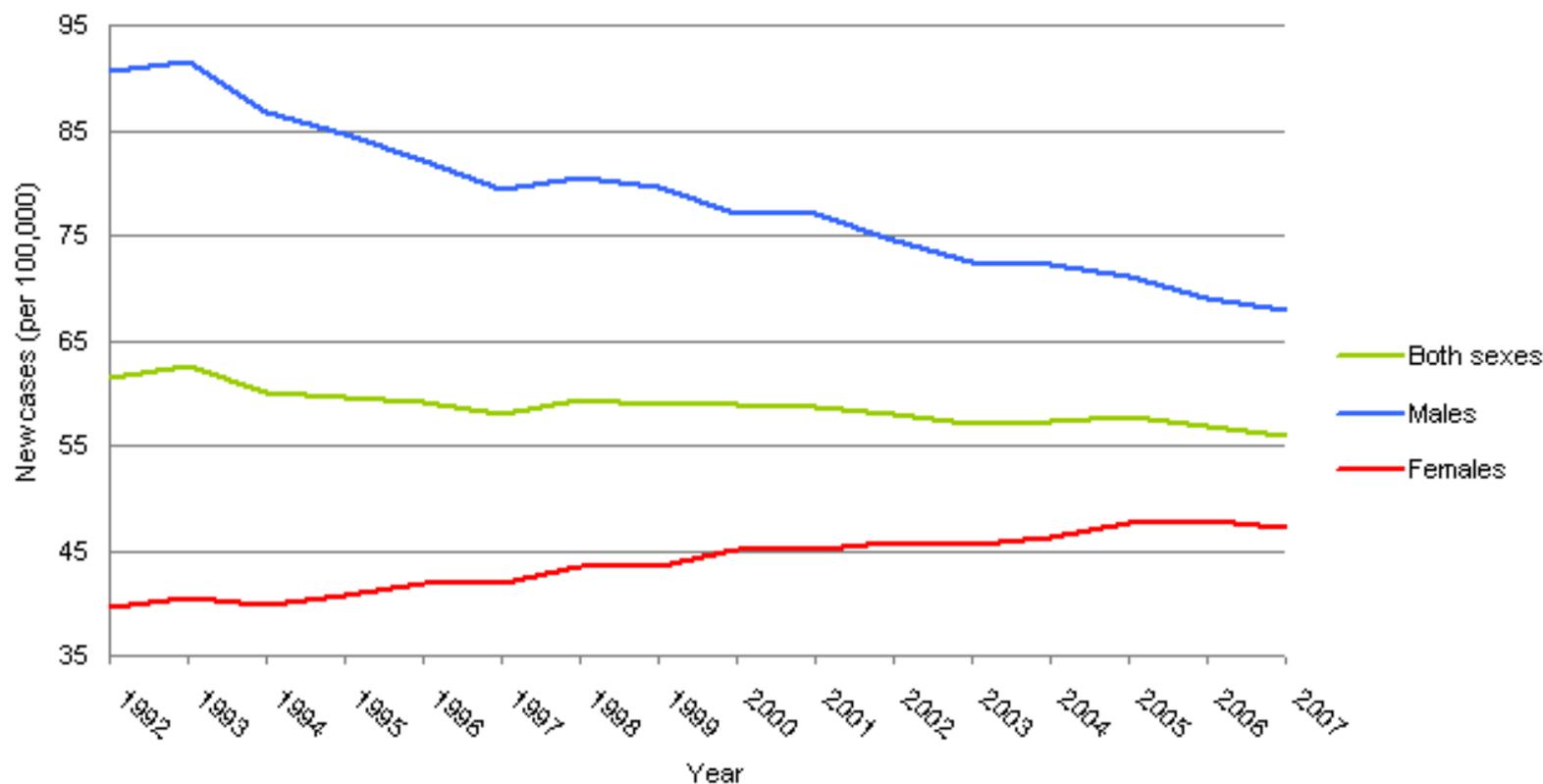
# Lung Cancer in Canada

- 1 in 12 people in Canada will develop lung cancer
  - Most will die, survival is ~6-12% over 5 yrs
- 15% of people who develop cancer never smoked
  - 8<sup>th</sup> leading cause of death in Canada
  - Most of these are women
    - Lung cancer kills more than all other cancer's (breast, reproductive) combined

## Chart 2

### Lung cancer, age-standardized incidence rates per 100,000, by year and sex, Canada, 1992 to 2007

#### [Description](#)



# Lifetime Excess Cancer Risk by Substance – Indoor Air

## Average Risk:

based on average intake X cancer potency or unit risk factor from:

- Health Canada
- CA OEHHA
- US EPA

## Maximum Risk:

based on maximum intake X highest cancer potency factor or unit risk factor

## IARC 1 - KNOWN CARCINOGENS

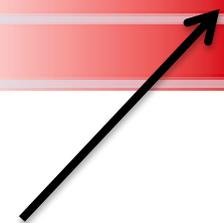
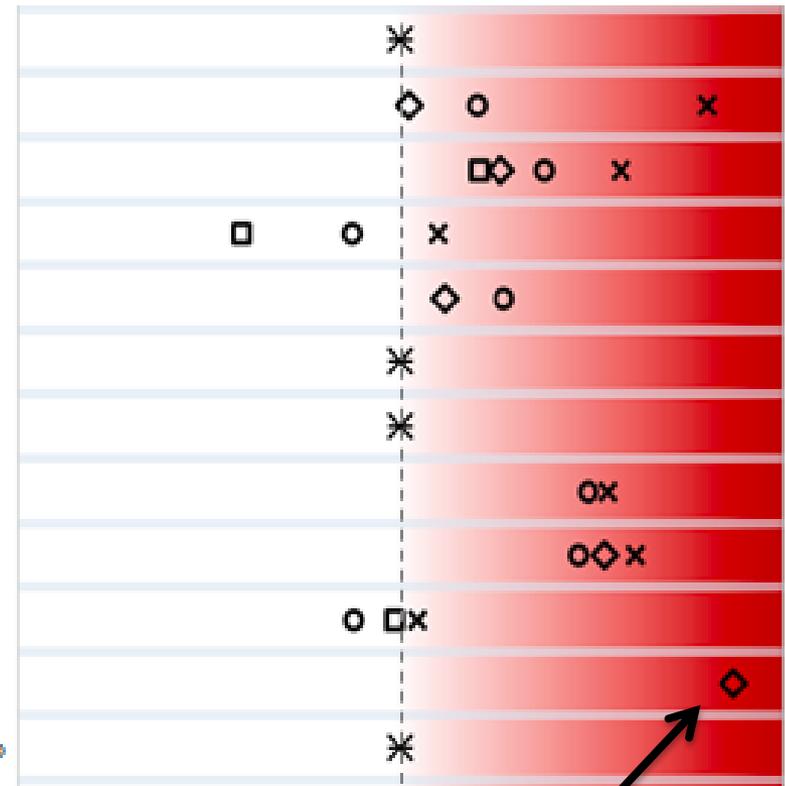
Substance	IARC Category
Arsenic and arsenic compounds	GAP
Asbestos	VL
Benzene	M
Benzo[a]pyrene	VL
1,3-Butadiene	L
Cadmium and cadmium compounds	GAP
Chromium (hexavalent)	GAP
Diesel engine exhaust*	VL
Formaldehyde	L-M
Nickel and nickel compounds	L
Radon	M-H
2,3,7,8-Tetrachlorodibenzo-para-dioxin	GAP

DATA QUALITY

LIFETIME EXCESS RISK PER MILLION

0.0001 0.001 0.01 0.1 1 10 100 1,000 10,000

PEOPLE



# Reducing Radon Risk

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Goal: **Reducing Exposure**

**How ?**

Increasing awareness of the problem

**AND**

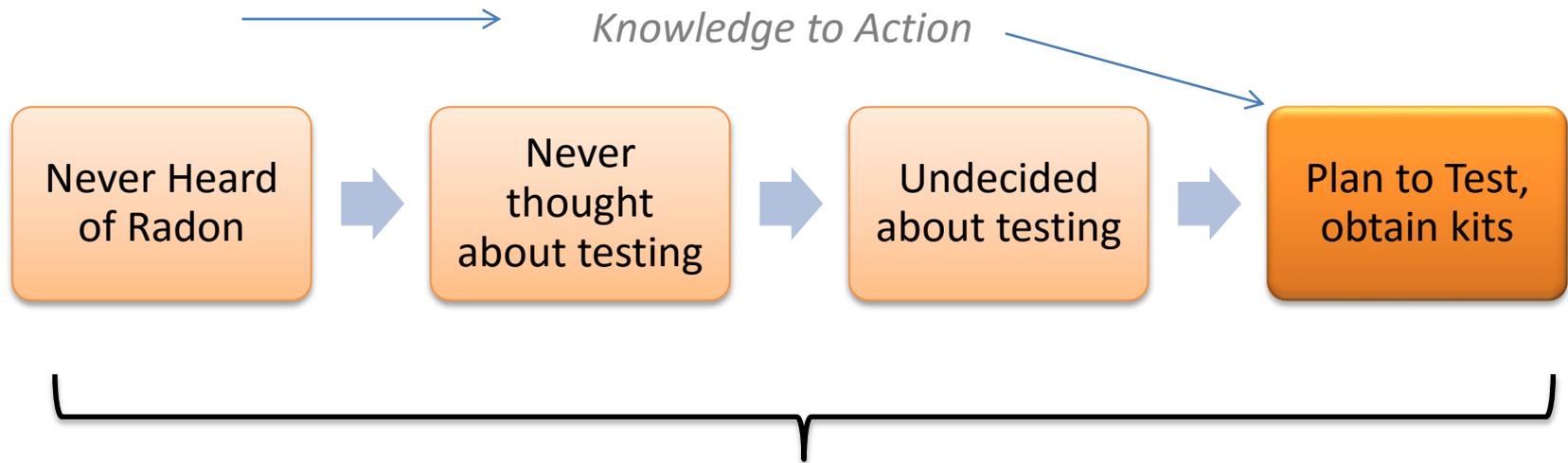
increasing radon removal old and new buildings

Multiple step process with many challenges

Awareness-> Testing -> Remediation

# Radon Framework: First Phase

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Key Features of this Phase: **Raising Awareness**  
**Encouraging Testing**  
**Providing access to test kits**

Tools needed: informational resources, **persuasive campaigns, targeted outreach in high radon regions**

Precaution Adoption Process: Weinstein and Sandman (1992)

# Known First Phase Challenges

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- Increasing awareness
  - Colorless, odorless gas problems- easy to ignore
  - Radon lack “appeal”
- Optimistic Bias (Weinstein, 1991 Duckworth, 2002)
  - It won’t happen to me
  - How to get people to personalize the risk?
- No-one to blame
- Chronic versus acute health effects

## My \$1,200 Radon Job

*The Least Sexy Home Improvement Could Be a Lifesaver*

Article

Comments



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A

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It might be the ugliest home improvement. Last month, I finally did something about my radon problem.

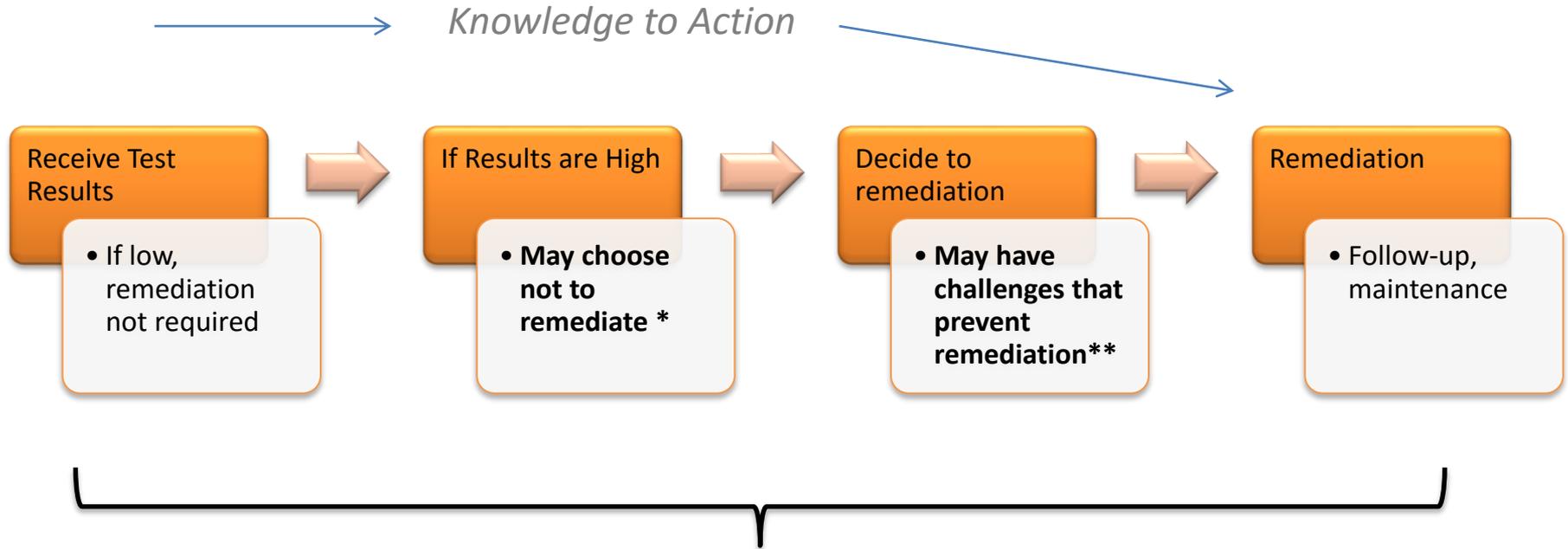
Two men came and drilled a five-inch-wide hole in my home's bottom floor. They attached a suction system of white pipes and a big round fan to draw air -- and radon -- from underneath the house and vent it out through a black pipe stuck in the roof. The work took six hours and cost \$1,200 -- about what I paid a pro to retile my bathroom.

# Testing

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- How to get people to test?
  - Provide free or subsidized tests (Doyle 1991)
  - Mass media marketing has had success
- People need guidance and support
  - 41% of an Irish cohort did nothing with test results “because they didn’t know what to do” (Ryan 1998)

# Radon Framework Phase 2



Key Features of this Phase: -Helping citizens interpret test results  
\* Recognizing people's rights to NOT remediate  
-is more persuasion key at this point?

\*\* Many challenges

# Getting to Mitigation:

## Evidence from home radon testing: New Jersey USA 1987-1991

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- Research with communities who went through the awareness/testing process.
  - Most testing either free or subsidized
  - Hotline set up, Brochure, Pamphlets available
  - Government provided follow-up for those with high test results
- Results
  - 19% either had or were going to remediate

# US Mass media campaign (Doyle 1991)

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- Washington DC TV campaign
  - Consumer affairs programming called Radon Watch
  - Offered discounted test kits via coupon
- Very good at getting people to buy tests
  - Over 100,000 tests were purchased
    - BUT Just half returned
  - Very low remediation rate

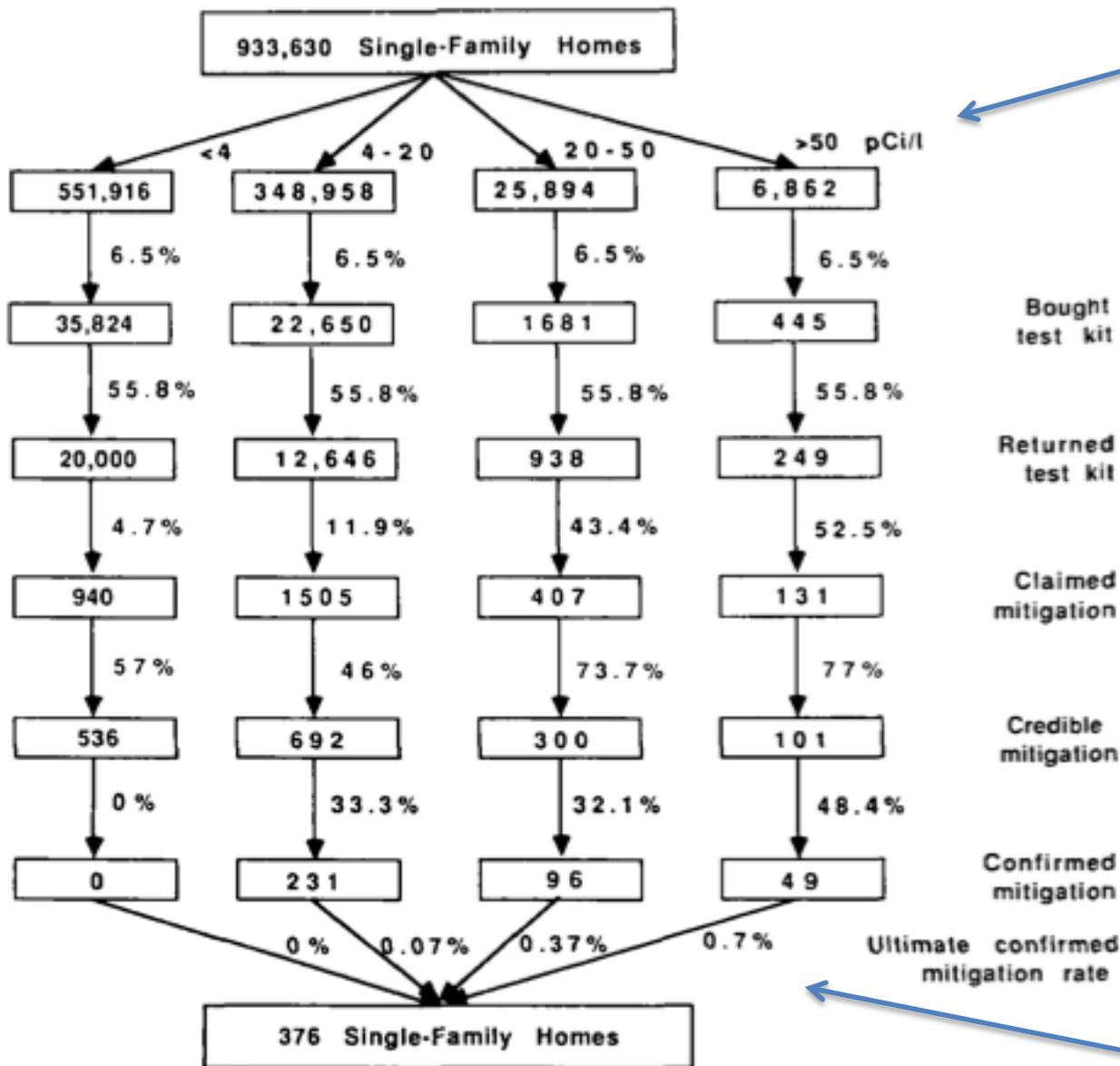


Fig. 4. Summary evaluation of the Washington, D. C. campaign, showing population estimates and transition rates for each stage in the mitigation pathway, by radon level category.

# What helped people move test and remediate?

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- Other people's behaviour's strongly influence how people act
  - Strong peer influence found
  - People wanted to know how high other people's homes were
    - Drive for social comparison
      - Allows people to contextualize what they should be doing
    - People just want to be “normal”
- Having a body or government support people
  - Interpretation, technical issues, costs

# How many people are remediating now?

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- We don't know----- Only a fraction of those who need it
- Canadian data
  - No published data on remediation rates
  - Stats Can Survey: 2011 – 5% of home had been tested (up from 3% in 2009) CANSIM table 153-0098
- Anecdotal evidence suggests around 10-20% of those who test subsequently mitigate
- If you have ideas, please let me know!
- Turn to other countries...

# Northamptonshire UK- Kennedy 2001

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- Homes which tested over 200 bq/m<sup>3</sup>
- 34% of sample carried out some form of remediation
  - Response rate only 47%
  - **Estimate that only about 10% of people are actually following up**
  - Average cost 1,650 €
  - Opening windows and sealing gaps considered remediating
- Important point: 32% of remediated homes retested
  - 64% successful

“The remediation rate in Northamptonshire is abysmally low” – Kennedy 2001

# In-depth audit of UK Radon program 2010 (Zhang 2011)

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- homes  $>195$  Bq/m<sup>3</sup>
- **30% reported some form of remediation**
  - Most within 6 months of testing
    - Sump fitted with fan and natural underfloor ventilation most common
    - 65% used methods considered effective
    - Only half retested their homes
- Why didn't people remediate?

**Table 5. Association between reasons for non-remediation and radon level (non-remediation only).**

Radon concentration	Less than 250 Bq m <sup>3</sup>	251- 400 Bq m <sup>3</sup>	401- 800 Bq m <sup>3</sup>	> 800 Bq Bq m <sup>3</sup>	p-Value for trend test
Feel the work will be ineffective	22.87%	23.01%	24.68%	25.98%	0.19
<b>Worried about the cost of the work</b>	<b>54.67%</b>	<b>57.66%</b>	<b>64.91%</b>	<b>71.08%</b>	<0.001
Difficulty in finding someone to do the work	9.80%	14.60%	13.11%	11.29%	0.61
<b>The landlord has refused to pay</b>	1.63%	1.55%	0.99%	2.47%	0.63
<b>Not believe it's a health risk</b>	<b>30.84%</b>	<b>30.38%</b>	<b>24.26%</b>	<b>19.66%</b>	<0.001
Inconvenience/disruption	22.11%	25.65%	22.98%	26.79%	0.29

**Interesting relationship between exposure level and remediation....**

**Zhang et al, 2011**

# Influence of offering grants

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- Households were **16 times more likely to remediate if they received a grant** to do the work (Zhang 2011)
- “..Householders take the lack of a grant to indicate that radon risk need not be taken seriously.” (Bradley 1996 NRPB-M707)



# Vermont homes $>148$ Bq/m<sup>3</sup>

Riesefeld 2007

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- 43% mitigated
  - 67% of work done by contractor
  - Avg. cost \$ 1000-2000
- Significant remediation predictors
  - College education or higher
  - **Concern about property values**
  - People who lived in a newer home

“Associating radon testing with real estate transactions is likely to influence residents to mitigate as home value appears to be a significant concern.”

# USA Radon Programme Summary

Angell 2008

- Number of homes mitigated based on radon fan sales
  - Significant gap between radon control in both new and old housing stock

Significant lack of attention given to low income families and those who rent

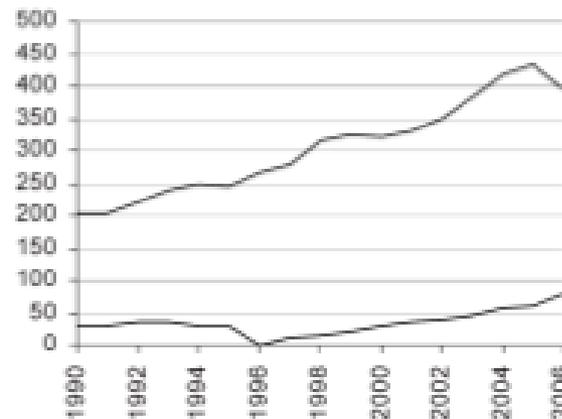


Figure 3. Existing one-family homes sold per year with  $150 \text{ Bq m}^{-3}$  and homes with radon mitigation, 1990–2006 (1000s).

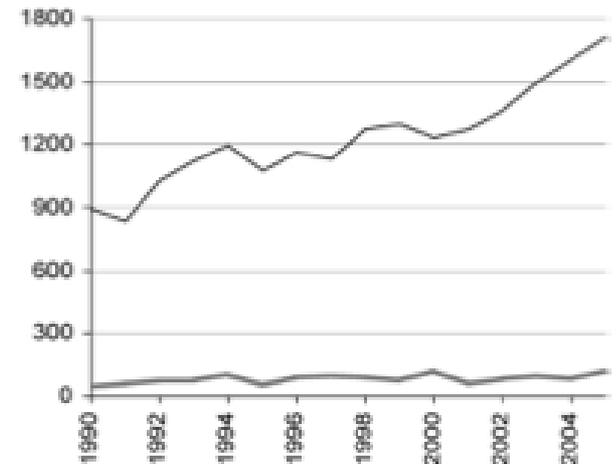


Figure 4. New single family housing starts and estimated new homes with radon control, 1990–2005 (1000s).

# What does all the research tell us?

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- Rates of remediation overall are still fairly low
- Financial incentives have higher remediation rates
- Better tracking of remediation needed
- Low income homes not being addressed
  - Have been given low priority
  - Need to grapple with the issue of tenants/rental units/multifamily dwelling
- Real Estate transaction information is having an effect

# Need to help homeowners through the process

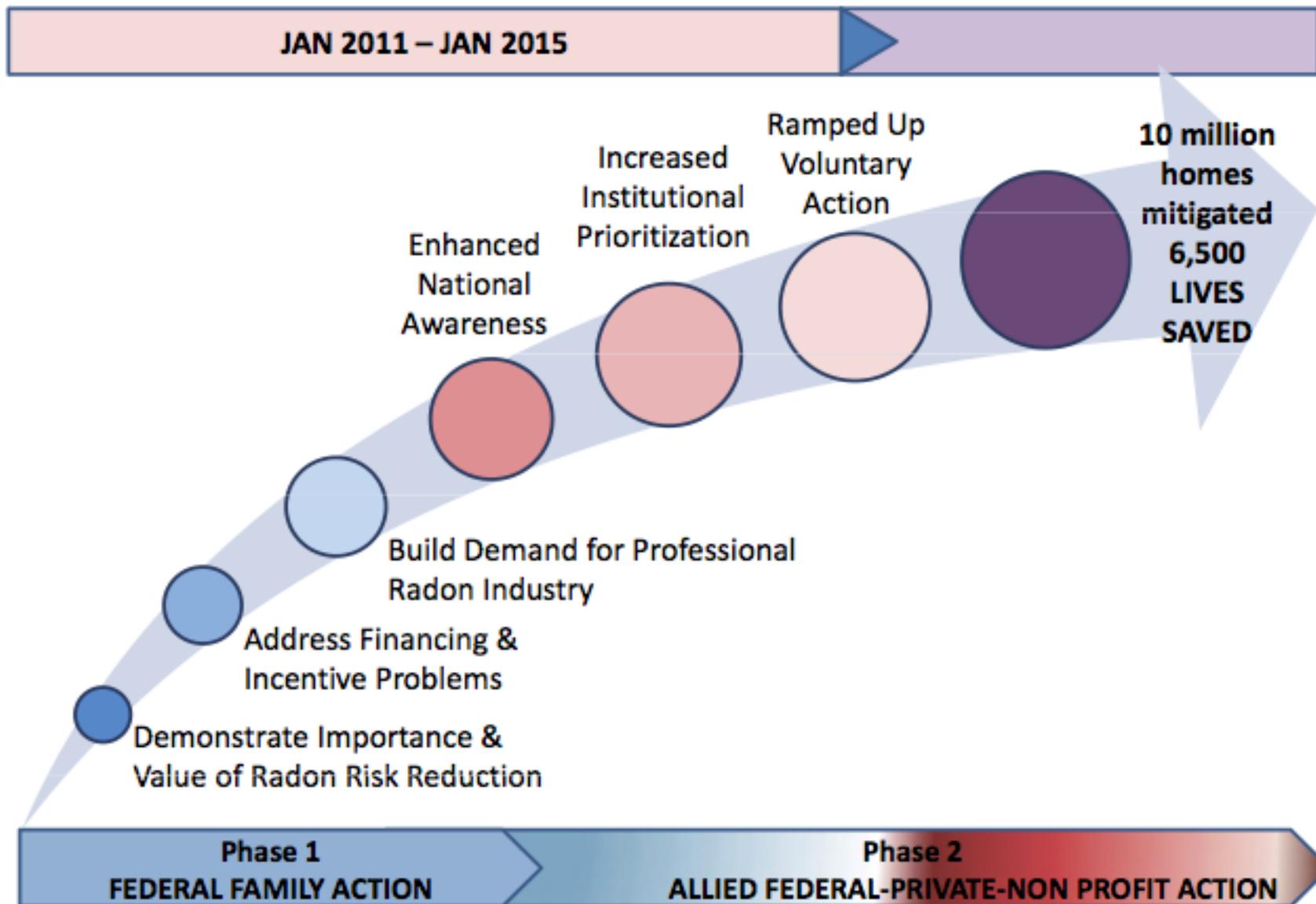
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- Communication and support needed throughout the precaution/adoption phases
  - Different types of information needed at different steps
  - Assistant with understanding results
  - Needs bodies or agencies involved
- Changing what is “normal”
  - Greater discussion about radon in the community may help encourage people to test and remediate
  - Peer influence very important

“Improved radon risk communication together with government financial assistance and legislative changes are needed to reduce the public health risk from radon.” – *James McLaughlin, Chair of the WHO Risk Communication program for Radon, 2011 R.E.M.*

Questions and comments appreciated  
thank you for listening  
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# ELIMINATING PREVENTABLE RADON RISK



# Who remediated in this UK study?

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- More non-smokers and ex-smokers
- People with moderate radon test results
  - Higher the test results, the LOWER the remediation rate- ???
- Shorter length of time in residence
  - Longer people had lived in homes, the less likely that they remediated
- Retired people more likely, unemployed less likely
  - Professionals more than 2x more likely than unskilled
- Mixed age families more likely to remediate