

# Radon: A Public Health Perspective

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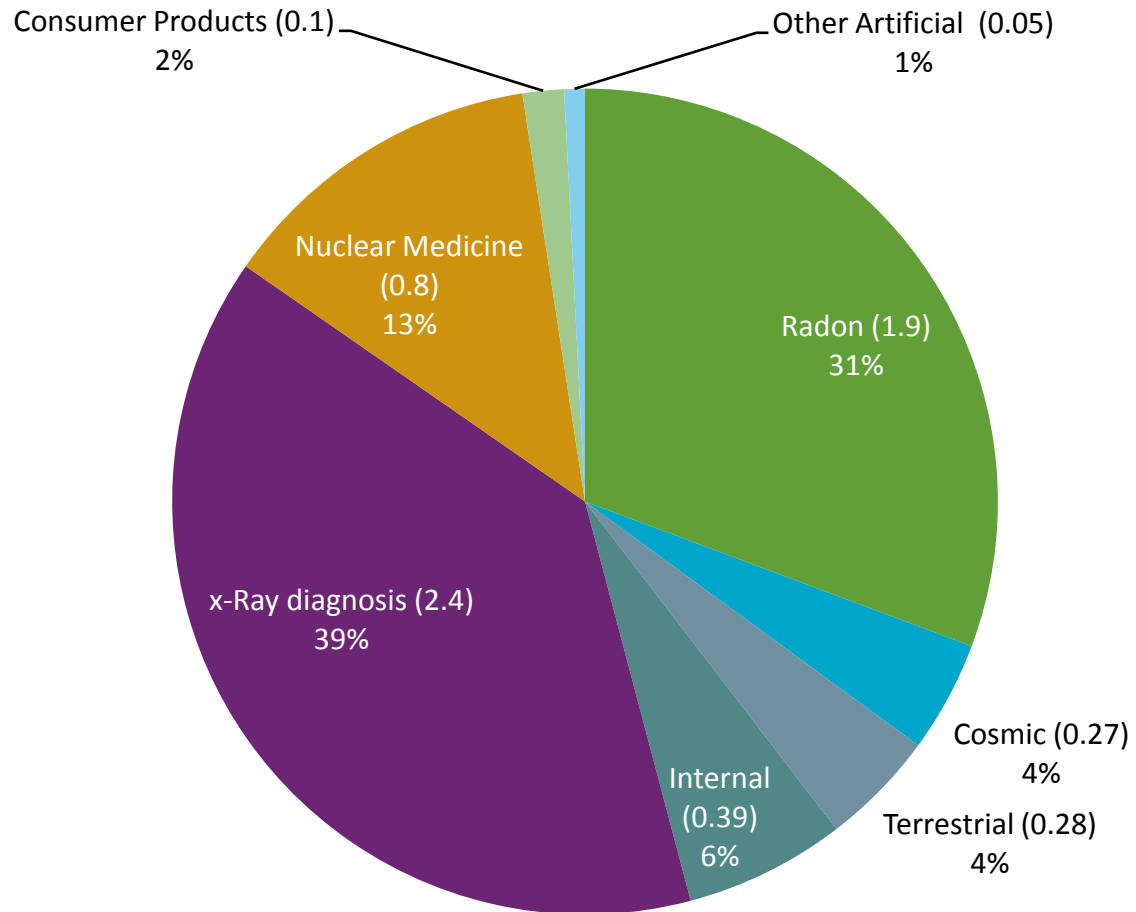


# PUBLIC HEALTH ONTARIO

- Arm's length agency funded by Province of Ontario
- Became operational in 2008
- Provide science and technical advice and support to the health care system (e.g. public health units) and the Government of Ontario
- Also run the Public Health Labs
- Do not have regulatory or statutory powers; do not make policy
- Senior staff engaged in research and teaching; links to, and appointments at, Ontario universities

# Radon in Context as source of Ionizing Radiation Exposure

## Average Amounts of Ionizing Radiation Received Annually by Resident of the United States or Canada (mSv)



Source: Adapted from Upton A C. Radiation. In: Frumpkin H, editor. Environmental Health: from global to local. (2nd Ed). John Wiley & Sons, Inc; 2010

# Radon Guidelines – Implied cancer risk in the context of other cancer protective guidelines

## Lifetime Lung Cancer Risk (Adapted from the US EPA)

Radon Level (Lifetime Exposures)	People who never smoked	People who smoked
740 Bq/m <sup>3</sup>	36/1,000	260/1,000
370 Bq/m <sup>3</sup>	18/1,000	150/1,000
296 Bq/m <sup>3</sup>	15/1,000	120/1,000
148 Bq/m <sup>3</sup>	7/1,000	62/1,000
74 Bq/m <sup>3</sup>	4/1,000	32/1,000
48 Bq/m <sup>3</sup>	2/1,000	20/1,000
15 Bq/m <sup>3</sup> (average outdoor level)		3/1,000

United States Environmental Protection Agency [homepage on the Internet]. A citizen's guide to radon. Washington, DC: United states Environmental Protection Agency; 2013 Jan 10 [cited 2013 Nov 20]. Available from: <http://www.epa.gov/radon/pubs/citguide.html#risk%20charts>. Available at: <http://www.epa.gov/radon/pubs/citguide.html#risk%20charts>.

# Twelve Principal Outrage Components Sandman 1991

## “SAFE”

- Voluntary
- Natural
- Familiar
- Not Memorable
- Not Dreaded
- Chronic
- Knowable
- Individually controlled
- Fair
- Morally irrelevant
- Trustworthy source
- Responsive process

## “RISKY”

- Coerced
- Industrial
- Exotic
- Memorable
- Dreaded
- Catastrophic
- Unknowable
- Controlled by others
- Unfair
- Morally relevant
- Untrustworthy sources
- Unresponsive process

# Why do Burden of Illness Estimates?



## How understandable is?

- IARC Group 1 carcinogen
- Second largest contributor to ionizing radiation exposure
- 200 Bq/m<sup>3</sup> or any other measure of radon
- % of homes above a given level

# How best to communicate to public and public health professionals?

- Context is important
- How do you relate to other worries, priorities?
- “How important is this?” is asked by many people, groups , organizations
- Comparison with smoking
- How many will get sick and/or die?
- Where does this fit? We can't do everything
- WHO Environmental Burden of Disease
- Other national, local efforts directed at all or some hazards

# Public Health System in Ontario

- Highly decentralized service delivery – 36 health units
- Ontario Public Health Standards common to all
- Some flexibility to tailor to local needs priorities
- Health Hazard Prevention and Management Standard
- Permissive not prescriptive
- Level of awareness and interest in radon varied across health units

## Burden of Illness Calculations: Purpose

- Calculate the lung cancer burden of illness attributable to Radon in Ontario
- Estimated number of lung cancer deaths that can be prevented if all homes above 50, 100, 150 and 200 Bq/m<sup>3</sup> were remediated to background levels
- Perform calculations separately for each of the 36 health units in Ontario

# Lung cancer risk from radon in Ontario, Canada: how many lung cancers can we prevent?

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## Abstract

*Purpose* To calculate the burden of lung cancer illness due to radon for all thirty-six health units in Ontario and determine the number of radon-attributable lung cancer deaths that could be prevented.

attributable lung cancer deaths are from exposures below the current Canadian guideline, suggesting interventions that install effective radon-preventive measures into buildings at build may be a good alternative population prevention strategy to testing and remediation. For some

## Data Sources

- Cross-Canada Survey of Radon in Homes (Health Canada)
- Proportion of pop. living in apartment buildings by health unit (Statistics Canada)
- Proportion of pop. ever-smokers by health unit (CCHS)
- All cause and lung cancer mortality by health unit (CCHS)
- RR for lung cancer mortality and all-cause mortality due to smoking (American Cancer Society)

## Results: Ontario Burden Estimates

- 13.6% (95% CI 11.0,16.7) of lung cancer deaths in Ontario attributable to radon
  - = 847 (95% CI: 686, 1039) radon-related lung cancer deaths in 2007
    - 85% of these in ever-smokers

## Results: Ontario Preventable Cancer Estimates

Remediation Level	50 Bq/m <sup>3</sup>	100 Bq/m <sup>3</sup>	150 Bq/m <sup>3</sup>	200 Bq/m <sup>3</sup>
Number of lung cancer deaths prevented	389	233	149	91
Percent of lung cancer deaths prevented	46%	28%	18%	11%



# Results: Individual Health Unit Burden Estimates

Geographic Region	Population Attributable Risk Percent (PAR%)	Lung Cancer Deaths Attributable to Radon	Number (percentage) of radon-attributable lung cancer deaths that can be prevented	
	Mean (95% Confidence Interval)		100 (Bq/m <sup>3</sup> )	200 (Bq/m <sup>3</sup> )
<b>Ontario</b>	13.6 (11.0-16.7)	847	233 (28%)	91 (11%)
<b>Health Unit 1</b>	25.3 (21.7-29.6)	21	9 (42%)	5 (23%)
<b>Health Unit 2</b>	9.1 (6.9-11.6)	24	1 (4%)	0 (0%)

# IMPLICATIONS FOR POLICY

## Is test and remediate the best option?

- Good evidence that remediation is effective
- Literature mixed on effectiveness of education to promote testing and remediation in homes
  - Many barriers, few people remediate
  - Financial incentives may help
- Large portion of burden from exposures below the current Canadian guideline
- Only option for older homes
- What about public buildings?

# Building Codes

- Could reduce levels to well below the current guideline (address larger portion of burden)
- More consistent with ALARA?
- But, takes many years for housing turnover
- More research needed on effectiveness of building codes
- Impact of insurance companies?
  - Tarion now covers new builds with levels above Health Canada Guideline ( $>200\text{Bq/m}^3$ )

# Possible Public Health Responses

- Health Unit education/awareness campaigns?
  - Health Canada education materials available for free upon request
- Incentives for homeowners to test and remediate?
  - e.g. Rebate if provide testing results to HU
- Testing and remediation in public buildings (schools) and group facilities?
- Building codes?
  - National model construction codes

Gray, A., Read, .S., McGale, P., Darby S. (2009) Lunch cancer deaths from indoor radon and the cost effectiveness and potential of polities to reduce them. *BMJ* 338a3110  
Gagnon, F. Courchesne, M., Levesque B., et al. (2008) Assessment of the Effectiveness of Radon Screening Programs in Reducing Lung Cancer Mortality. *Risk Analysis*, 28(5): 1221-1229  
World Health Organization. (2009). WHO Handbook on Indoor Radon: A Public Health Perspective. [http://whqlibdoc.who.int/publications/2009/9789241547673\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241547673_eng.pdf)

## Why so little success to date?

- ‘Natural’, no organoleptic impact
- For private homes- alignment of those bearing risk and those responsible for testing/remediation
- Little ‘Outrage’
- Public Health focus on tobacco as ‘the cause’ of lung cancer
- Is government sending a mixed message ?
- Education, provision of information - Good intentions but need to evaluate effectiveness
- Have we forgotten ALARA?

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