



# Radon in Canada – Protecting Canadians in their Indoor Environment

9<sup>th</sup> International Conference NORM IX



- September 2019

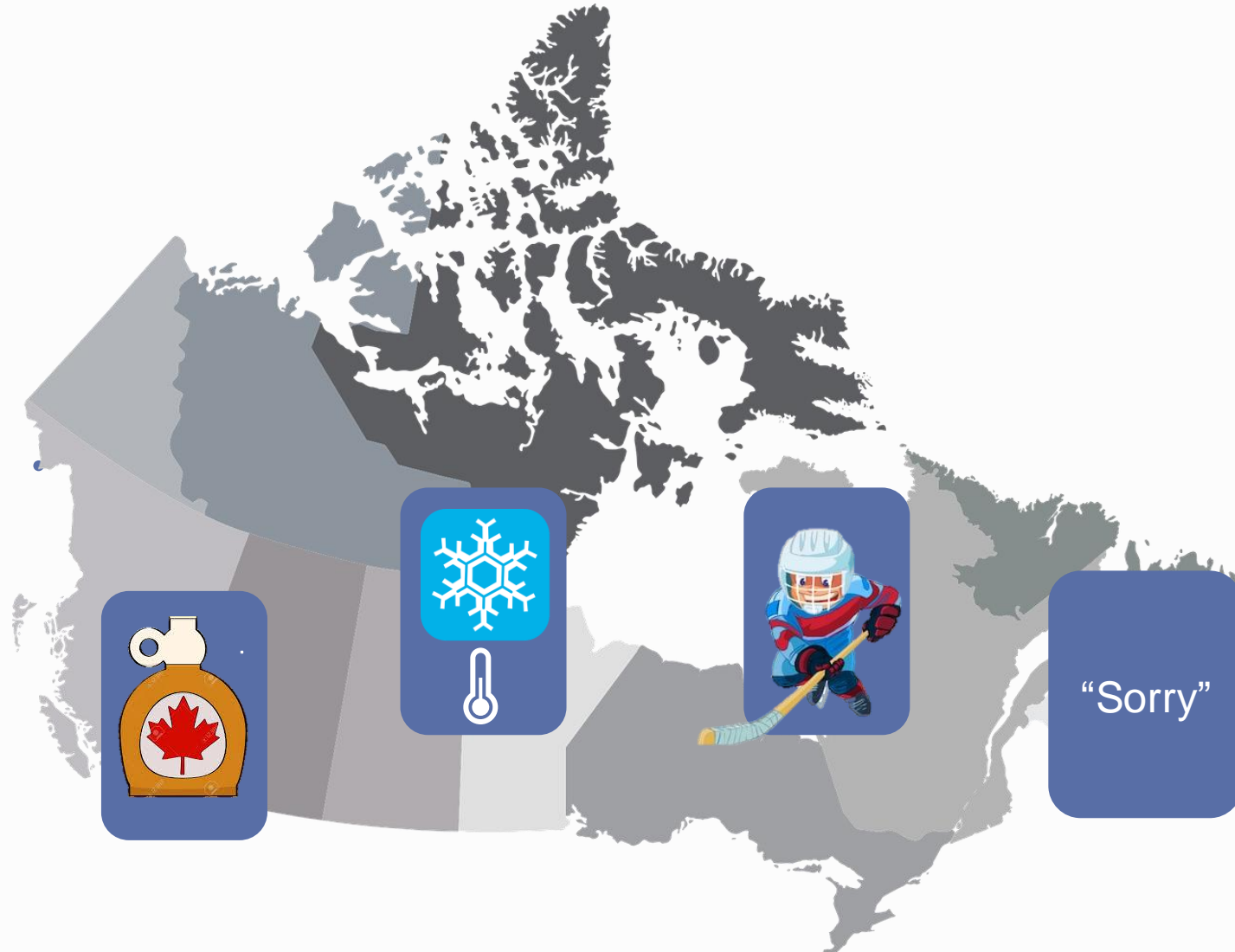


## Radon in Canada:

# Protecting Canadians in their Indoor Environment

### Overview:

- Canada 101
- Radon from our perspective; buildings/radon levels
- Growing a strong Foundation
  - Strong collaboration
  - Measurement in Existing Buildings - Workplaces
  - Measurement in Existing Buildings - Homes
  - Unique perspectives – Working with the Real Estate Community
  - Mitigating existing building stock
  - New Construction



You may know a little about Canada.



- Large Land Mass
- Sparsely populated areas with large remote areas

Canada vs USA  
35.8 million vs 321 million



- Broad range of geographical and Physical conditions

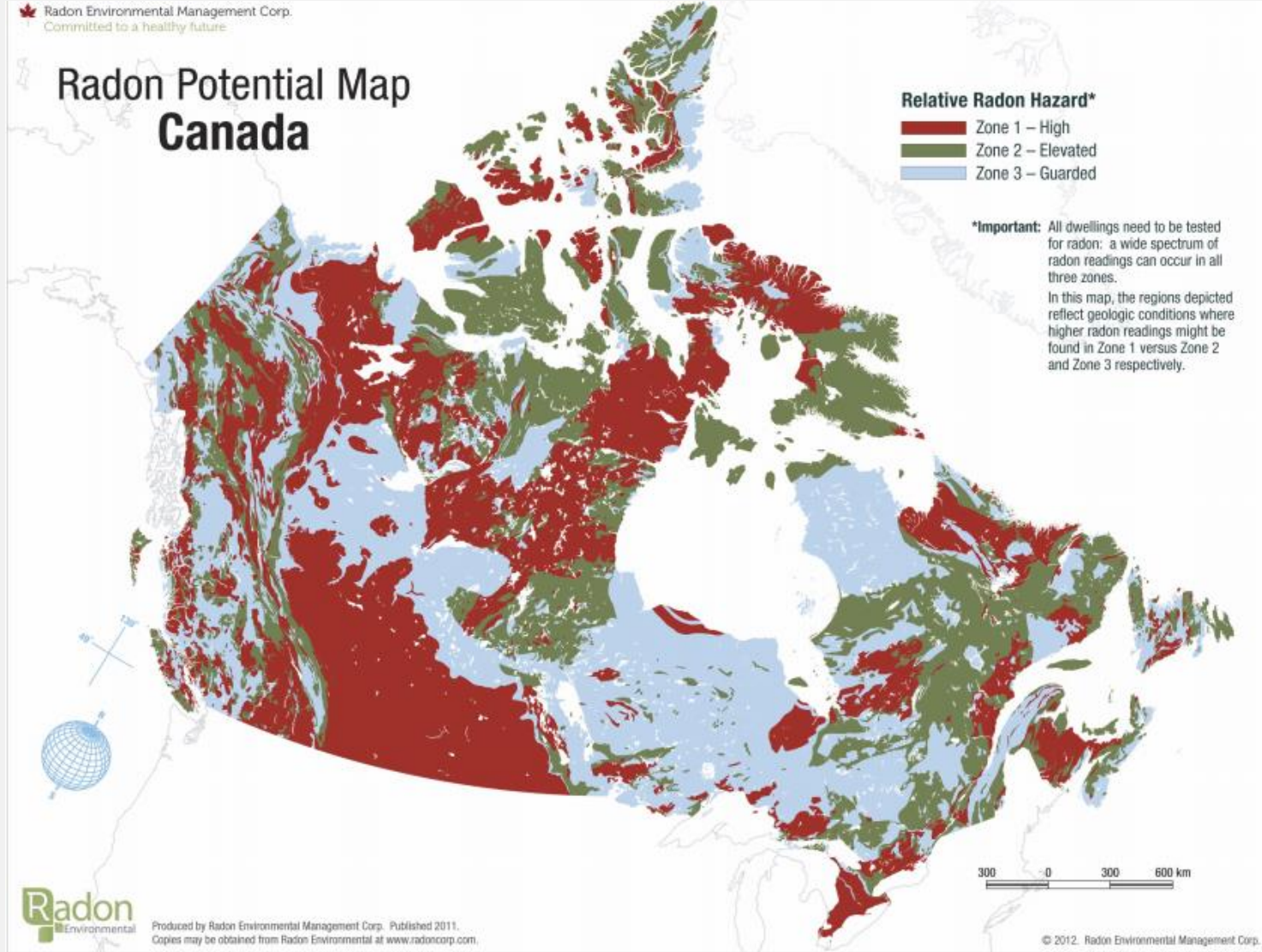
# Radon Potential Map Canada

### Relative Radon Hazard\*

- Zone 1 – High
- Zone 2 – Elevated
- Zone 3 – Guarded

**\*Important:** All dwellings need to be tested for radon; a wide spectrum of radon readings can occur in all three zones.

In this map, the regions depicted reflect geologic conditions where higher radon readings might be found in Zone 1 versus Zone 2 and Zone 3 respectively.



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# Radon from our perspective

# Geological Radon Potential



Radon from our  
perspective

Measurement

- Canada's Radon Action level is  $200 \text{ Bq/m}^3$ 
  - Currently, Canada Labour Code is legislated at  $800 \text{ Bq/m}^3$   
(will be harmonized with Health Canada level of  $200 \text{ Bq/m}^3$ )
- Long-term radon tests 91 days or longer (alpha track)  
during the heating season







## Collaboration – A Canadian Success Story



Health  
Canada

Santé  
Canada

- Represents, supports and assists radon professionals
- Provides outreach and awareness to all Canadians
- A certification program that establishes guidelines, standards of excellence and best practices
- Created National Radon Program and Survey
- Developed guidance on measurement and mitigation
- Established the C-NRPP
- Provides funding to C-NRPP
- Maintains communication and provides input on direction



Growing a strong  
Foundation

Collaboration



Growing a strong  
Foundation

Collaboration

# TAKE ACTION ON RADON

National Stakeholder Program  
*funded by Health Canada*

Recruit, motivate, engage and bring together stakeholders  
to increase radon awareness

Motivate Canadians to take action to reduce radon and to  
promote radon action month.

# Collaboration – A Canadian Success Story

## Government Organizations (Federal, Provincial/Territorial and Municipal)



## Health-based Organizations



## Other Industry Associations



## Not-for-Profit Organizations



## Private Sector Companies

## Driving forces...Why do Canadians care about radon? - **Workplaces**

### **Motivations:**

- Legislation (limited)... Canadian Labour Code
- Reduce liability/Risk averse companies
- Strong health and safety policy/culture
- Strong union presence
- BOMA Best and LEEDS certification points



Growing a strong  
Foundation –  
Measurement in  
Workplaces



## Driving forces...Why do Canadians care about radon? - **Workplaces**

### **Challenges:**

- Lack of awareness
- Cost
- Deciding how to prioritize a large number of buildings
- Cooperation with employees, access to spaces or disappearing detectors



Growing a strong  
Foundation –  
Measurement in  
Workplaces



## Driving forces...Why do Canadians care about radon? - **Workplaces**

### **Of Note:**

- Action level
  - It's their choice...100 or 200 Bq/m<sup>3</sup>.
  - Some still abide by Canada Labour Code level of 800 Bq/m<sup>3</sup>
- Use certified professionals to conduct testing to limit liability and reduce potential for failure



Growing a strong  
Foundation –  
Measurement in  
Workplaces





Growing a strong  
Foundation –  
Measurement in  
Homes



Driving forces...Why do Canadians care about radon? - **HOMES**

### **Motivations:**

- Personal health
- Protect ones they love (Grandkids, children, pets)



Growing a strong  
Foundation –  
Measurement in  
Homes



Driving forces...Why do Canadians care about radon? - **HOMES**

### Challenges:

- Lack of awareness
- Indifference
- Cost
- “If I have a high level then I’ll have to fix it”





Growing a strong  
Foundation –  
Measurement in  
Homes



Driving forces...Why do Canadians care about radon? - **HOMES**

**Of Note:**

- Community testing projects successful at a municipal level
- Real estate agents



Growing a strong  
Foundation –  
Measurement in  
Homes



## CARST Real Estate Assessment Guideline

- Short-term test, minimum 4 days, closed-house conditions



- **Green** – result  $\leq 75$  Bq/m<sup>3</sup> (50 in summer) suggests annual average below 200 Bq/m<sup>3</sup>



- **Yellow** – 75 Bq/m<sup>3</sup> (50 in summer) to 400 Bq/m<sup>3</sup> suggests annual average above 200 Bq/m<sup>3</sup>



- **Red** – 400 Bq/m<sup>3</sup> and above, suggests annual average below 200 Bq/m<sup>3</sup>

- Yellow/Red – funds in escrow
- Always recommends follow-up long-term test in next heating season



## Initially:

- No Canadian Guidance
- Relied on NRPP for guidance

Photo credit:  
[Utah Department of Environmental Quality - Utah.gov](http://Utah.gov):



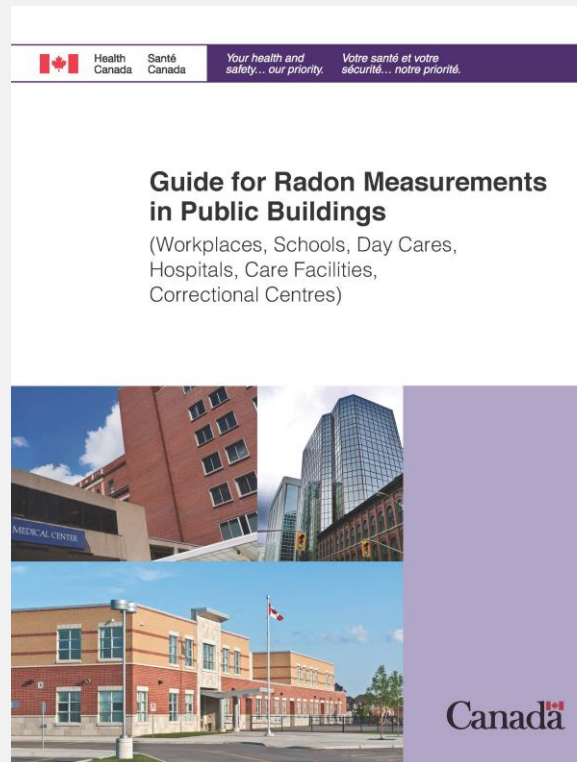
# Canadian Mitigation

# History

In 2010 Health Canada created our first mitigation guideline

### Canadian Approach:

- A **design** process to address unique Canadian climate
- Priority on quiet, energy efficient systems
- Priority on reducing radon levels to as low as possible



# Canadian Mitigation

## Installation Process:

- **Fan is allowed indoors**
- **Sidewall exhaust allowed**



# Canadian Mitigation

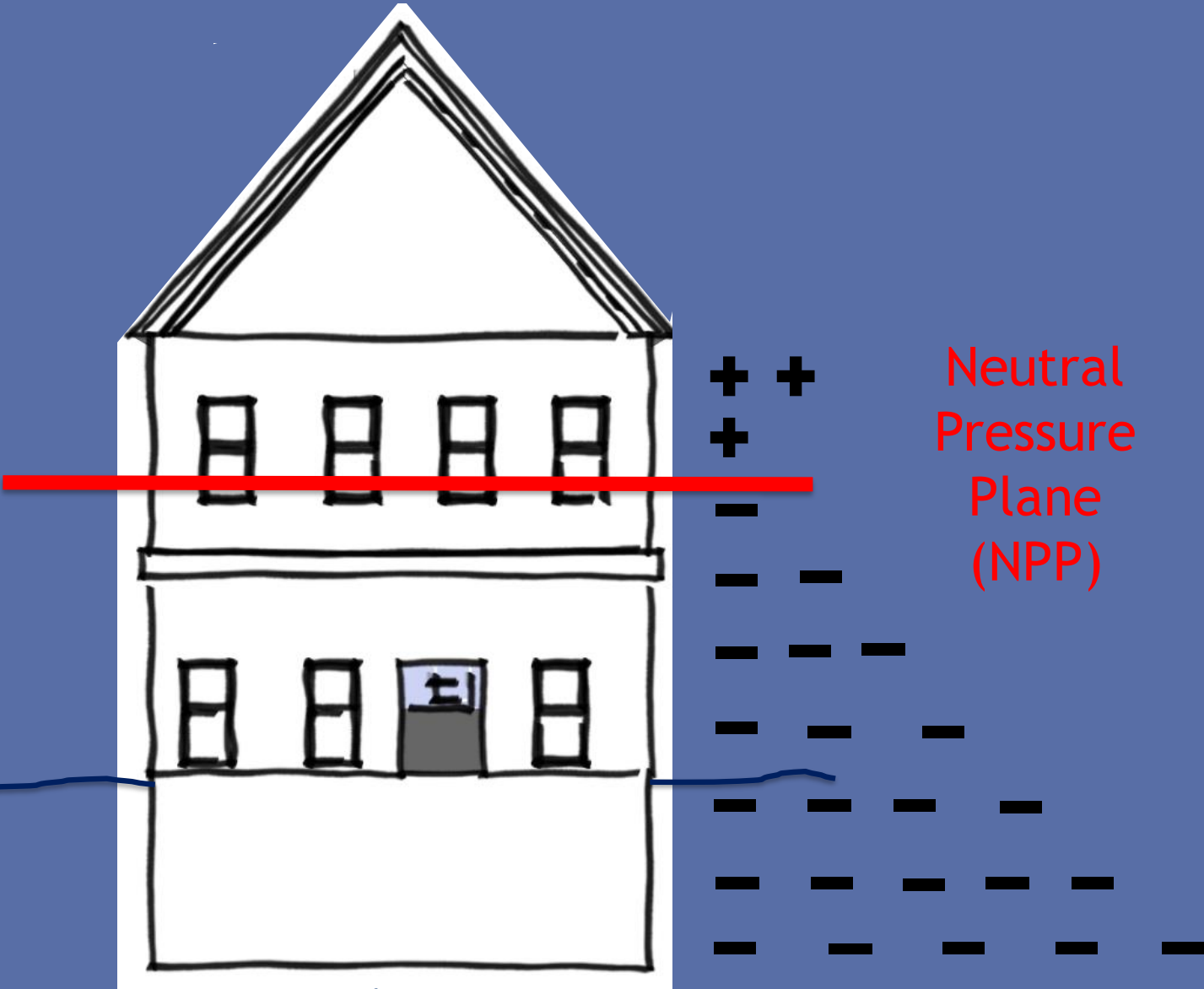


Design Process: Quantitative vs. qualitative



# Canadian Mitigation

Thermal Stack:  
Major Driving Factor  
in Cold Climate

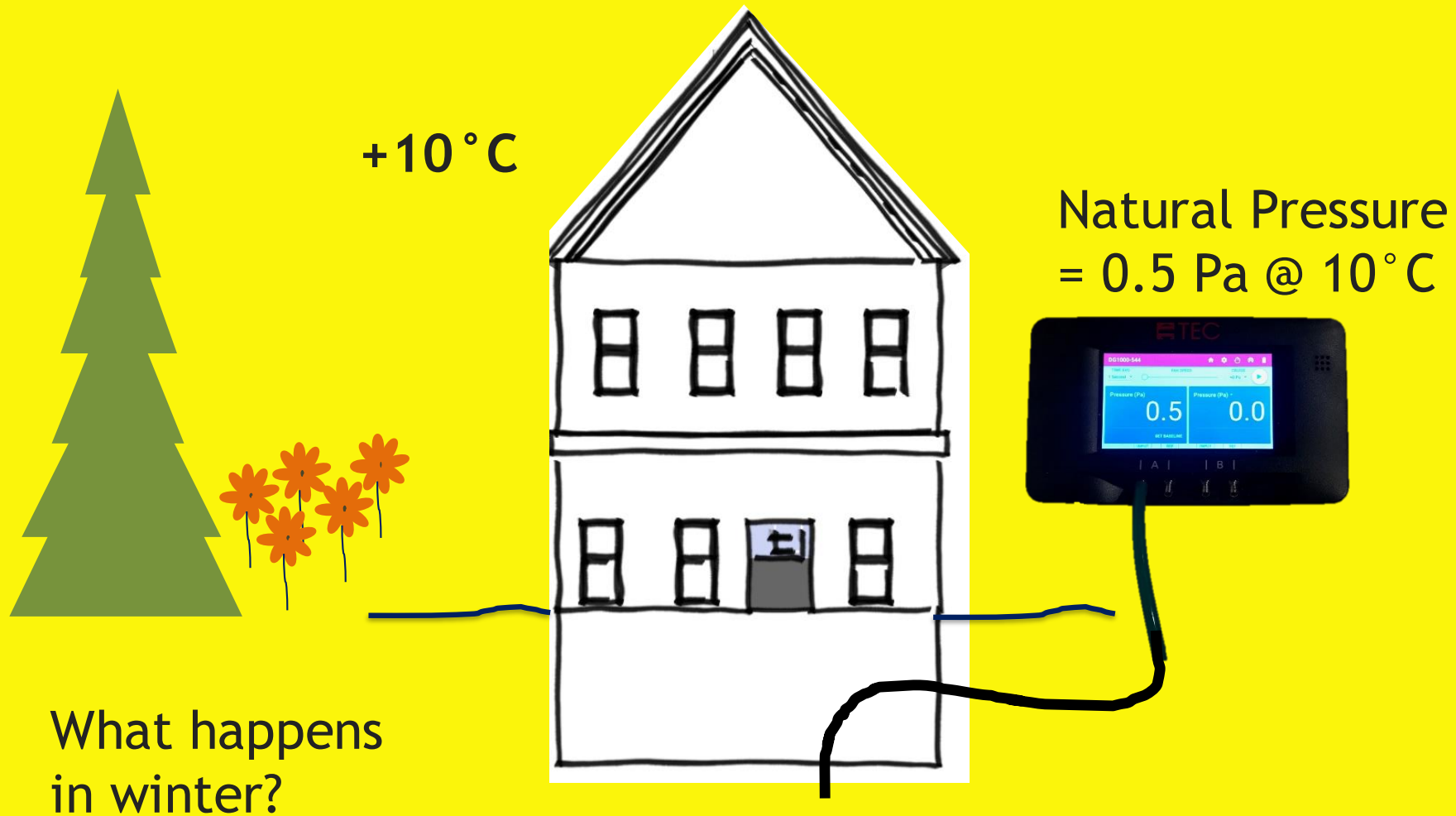


Neutral Pressure Plane (NPP)



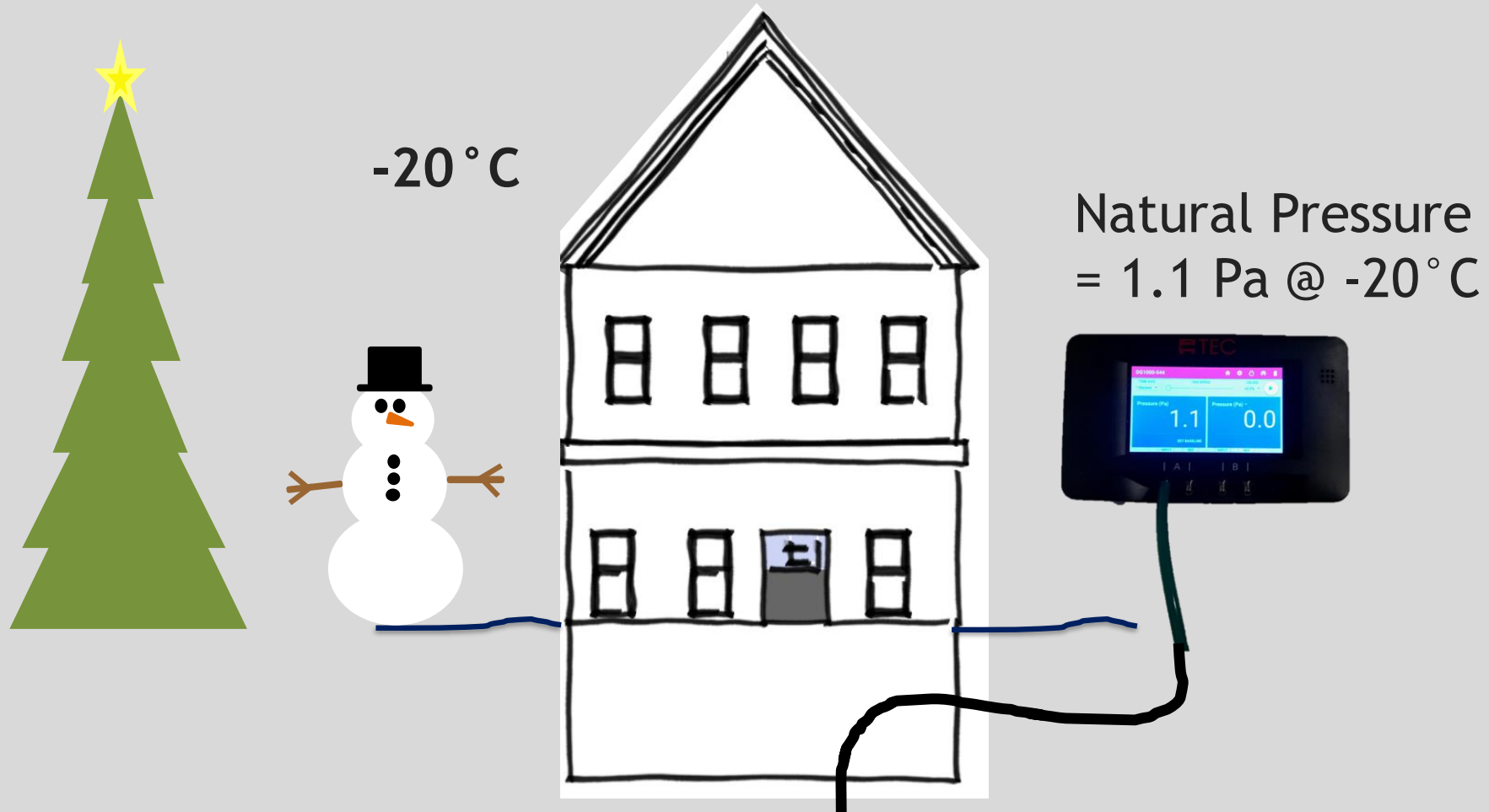
Radon

# Natural Pressure (Spring)





# Natural Pressure (Winter)



# Determine Target Pressure

A person's legs in dark trousers and black shoes are visible on the left side of the image. They are standing on a dark surface with a white chalk outline of a staircase. The person's right foot is on the first step, and their left foot is on the second step. The background is a dark, textured surface, possibly a chalkboard.

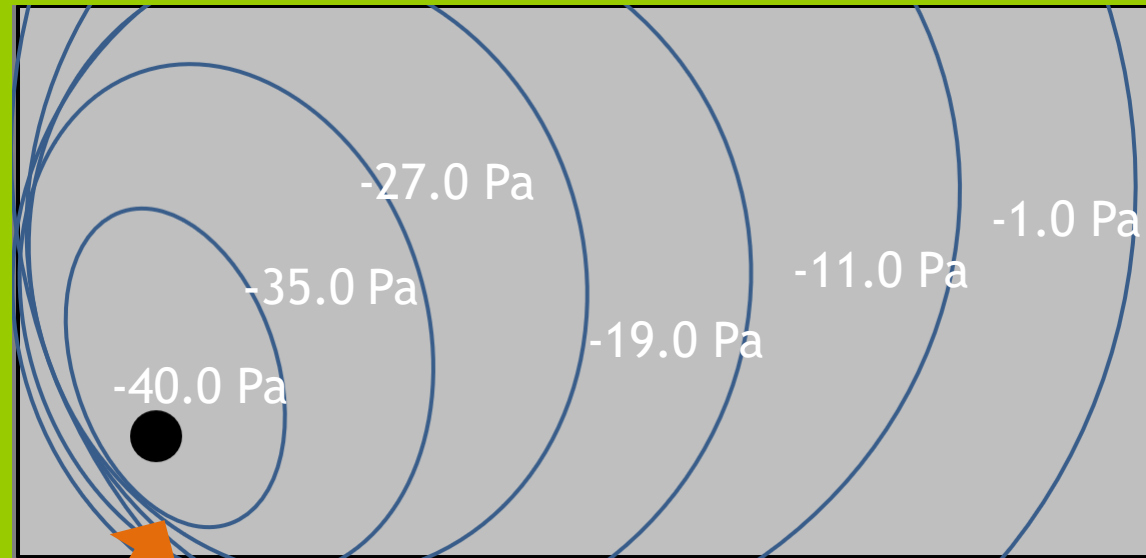
Step 3: Target Pressure  
 $0.5 \text{ Pa} - 1.1 \text{ Pa} = -0.6 \text{ Pa}$

Step 2: Design Pressure  
 $0.5 \text{ Pa} \times 2.2 = 1.1 \text{ Pa}$

Step 1: Natural Pressure  
 $0.5 \text{ Pa} @ 10^\circ \text{ C}$

# Pressure Field Extension

- Need to demonstrate target pressure across entire footprint to protect all year around
- Protect entire building because we don't know where the radon is coming from



Target = -0.6Pa

Suction Point

## Design Process: qualitative vs. quantitative

1. Calculation factor to compensate for Stack Effect in various season of installation
2. Soil resistance
3. Pipe resistance
4. Total system resistance (Soil + Pipe + Stack Effect)
5. Overlay radon fan curves and determine operating points
6. Choose the fan that meets the minimum air flow target



## Canadian Mitigation



## Design Process: qualitative vs. quantitative

1. Calculation factor to compensate for seasonal effect on **STACK EFFECT**
2. Soil resistance
3. Pipe resistance
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## Canadian Mitigation



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## Canadian Mitigation



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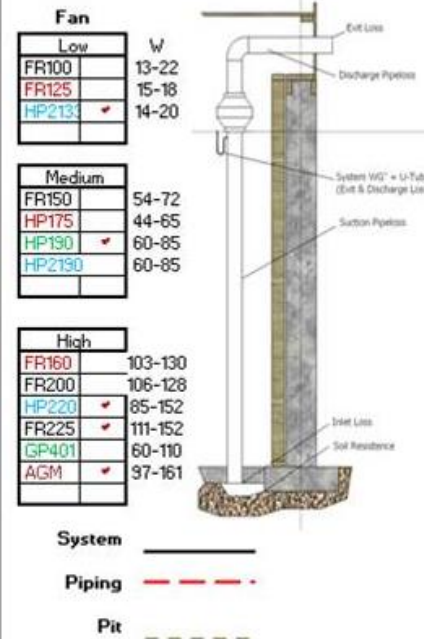
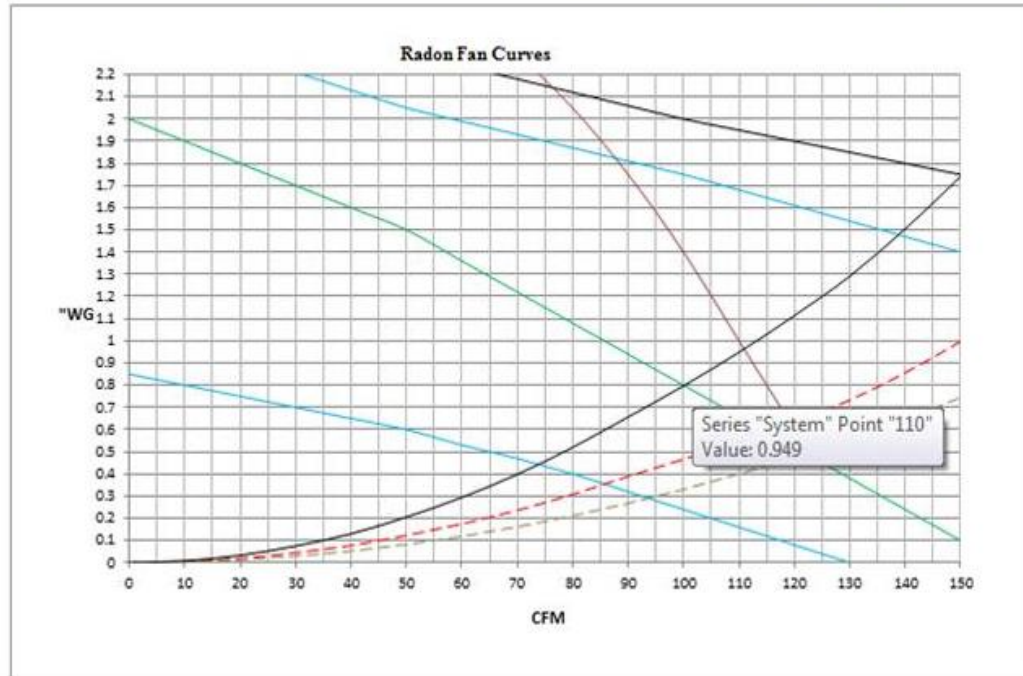
## Canadian Mitigation





Project: ..... Location: .....

Select Fan for minimum Pit Suction of: 0.331 "WG Selection: **FR 150** Estimated Operating Point: **115** CFM @ **0.9** "WG Estimated U-Tube Reading: **0.4** "WG



5. Overlay radon fan curves and determine operating points
6. Choose the fan that meets the minimum air flow target



# Canadian Mitigation





Region	# of Entries	Highest Radon Level	Average Reduced Radon Level	Average Percentage of Reduction	Average Cost	Highest Cost	Lowest Cost	# of Different Mitigation Professionals
<i>BC and Yukon</i>	26	1800	49	92.0	\$ 2,663.93	\$ 4,128.98	\$ 1,381.80	4
<i>Alberta and NWT</i>	165	2281	26	91.0	\$ 2,574.55	\$ 6,720.00	\$ 630.00	8
<i>Manitoba/Saskatchewan</i>	94	3700	42	91.3	\$ 3,072.10	\$ 4,107.00	\$ 1,400.07	9
<i>ON</i>	24	1500	57	90.4	\$ 3,166.19	\$ 9,098.76	\$ 1,412.50	3
<i>QC</i>	25	1200	29	91.9	\$ 2,579.68	\$ 3,766.07	\$ 1,695.88	4
<i>Atlantic and Nunavut</i>	23	1765	39	91.5	\$ 2,988.12	\$ 5,175.00	\$ 1,495.00	4
	357	3700	35	91.2	\$ 2,794.64	\$ 9,098.76	\$ 630.00	
						<i>297 Data points for costs</i>		

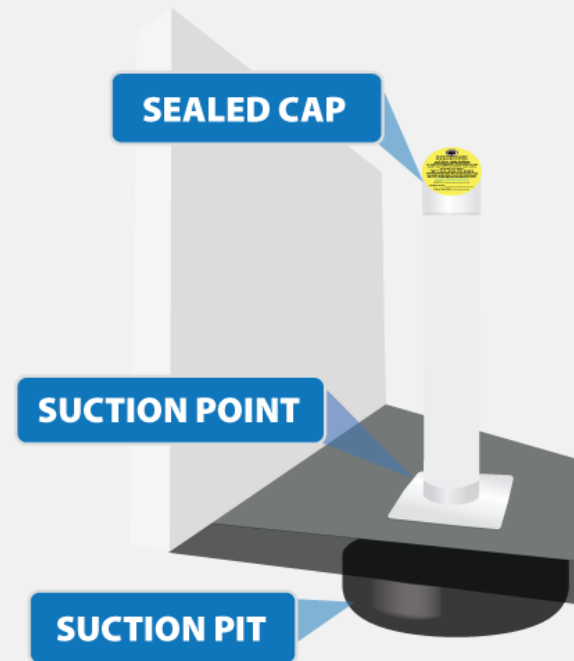
Data from CARST Radon Sweepstakes mitigation program

# Canadian Mitigation



## The National Building Code addresses radon

- Gravel under the slab
- Sealed sump pit
- Well-sealed liner
- Radon rough-in for future installation



# New Construction



# New Construction

- National Building Code is adopted by provinces
- Municipalities can amend

Thank you....Questions?

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