# Evaluation of the Health Canada Model for Determining Design Slab Pressure

Colin Dumais, Andrew Heshka
CARST Conference 2019

## Introduction

The official guidance for designing an active soil depressurisation system in Canada was developed by Arthur Scott in collaboration with Health Canada (HC). This guidance is unique in that it revolves around a prediction of slab pressure that can be taken at any outdoor temperature and extrapolated to design conditions (i.e. cold winter conditions). This gives the mitigation professional a minimum pressure design target for the system. The guidance for a temperature correction factor based on outdoor temperature is shown below in Table 1.

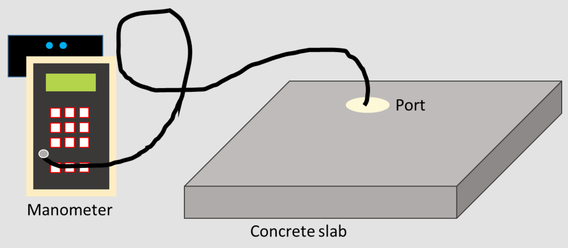
**Table 1 – Design Suction Temperature Adjustment Factors**

| Suggested Adjustment Factor for Design Suction vs. Exterior Temperature | | | |
|---|---|---|---|
| Exterior Temperature During Test | Winter Climate Zone | | |
| | Mild | Moderate | Severe |
| > 0°C | 2.0 | 2.2 | 2.5 |
| 0 to -10°C | 1.4 | 1.5 | 1.6 |
| -10 to -20°C | 1.0 | 1.0 | 1.2 |
| < -20°C | 1.0 | 1.0 | 1.0 |

Other guidelines in the world are either silent on the concept of a target slab pressure, or they have an unofficial static target pressure based on some building characteristic, such as number of stories. The issue with having a static pressure target based on building height is that it can over- or under-shoot the required slab pressure. This is because the thermodynamic mechanisms that create a differential across the slab are manifold, and cannot be adequately estimated knowing only the building height. Since the pressure change observed at the test holes is directly related to the airflow from the suction hole, an arbitrary target pressure based on building height may suggest significantly more airflow than what is actually required to overcome slab pressure. This results in increased energy use and unwanted noise. Alternatively, the slab pressure may be under estimated and the system may not lower radon levels sufficiently.

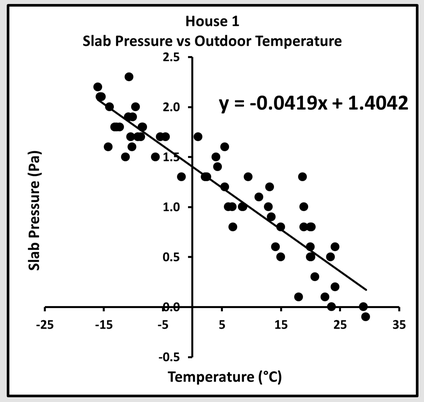
## Methods and Materials

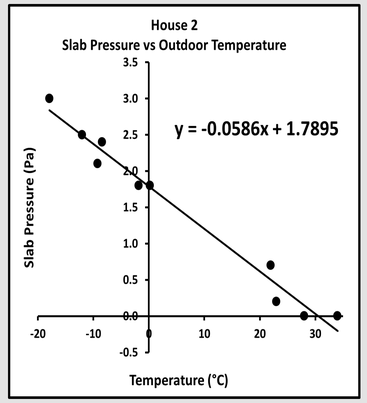
- Data was collected from two homes in Southern Alberta
- Temperature data was collected from a local weather station
- The homes were placed under closed home conditions (all windows and doors closed and intermittent exhaust fans were off)
- To measure the slab pressure a pilot hole was drilled through the slab and the slab pressure was read with a manometer



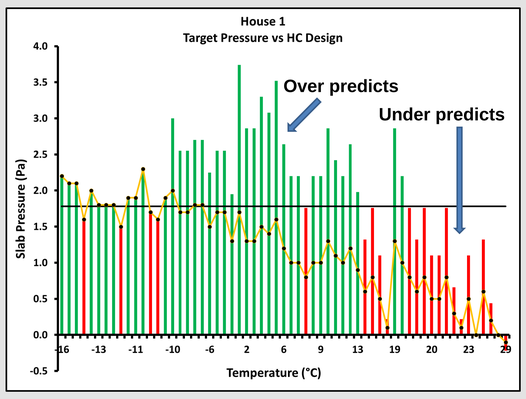

## Results

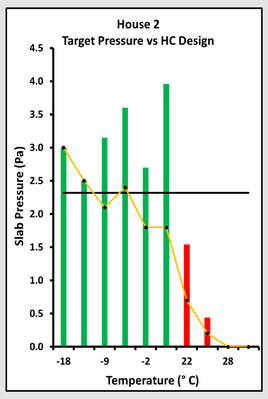
- Pressure versus temperature plotted
- Both homes had a similar best fit line equation




- In the charts below, the HC adjustment factors were applied as per Table 1
- Southern Alberta is in the “moderate” zone so that column of the table was used
- Target pressure was set at the average temperature for Southern Alberta (during the winter) of -9°C

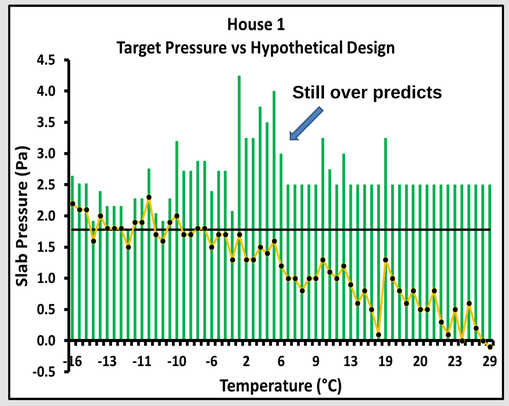

- The HC model is able to meet the target pressure between +10°C and -10°C, with slight over prediction
- For temperatures > +10°C the pressure starts approaching zero, causing under prediction
- For temperatures < -10°C, the model slightly under predicts, due to a multiplication factor of only 1 in the HC design

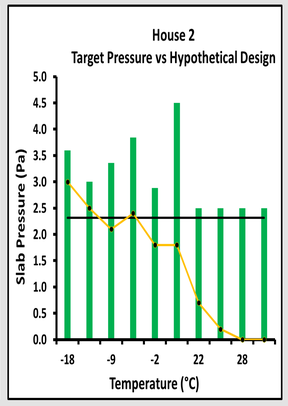
## Hypothetical Solution

**Table 2 – Hypothetical Design Suction Temperature Adjustment Factors**

| Hypothetical Adjustment Factor for Design Suction vs. Exterior Temperature | |
|---|---|
| Exterior Temperature During Test | Adjustment factor |
| > 0°C *see note | 2.5 |
| 0 to -10°C | 1.6 |
| -10 to -20°C | 1.2 |
| < -20°C | 1.0 |
| *For readings <1 Pa round up to 1 Pa | |

- When the slab pressure reading is below 1 Pa for temperatures above 0°C, round it up to 1 Pa before applying the HC guidance
- The different climate zones were replaced with one adjustment factor
- The charts below reflect these modifications


## Conclusion

- Proper design is essential when mitigating for radon
- The current HC model fails at high outdoor temperatures because slab pressures approach zero
- The hypothetical model corrects the under prediction at higher temperatures
- One potential solution was proposed but there may be other approaches to correctly predict winter slab pressure

**Future work**

- Examine the robustness of the hypothetical model with more data
- Create new categories for temperatures above 0°C to fix over prediction
- Investigate if a blower door can be used to determine the slab pressure

## Acknowledgements

John Horning for providing home data.