Canadian National Radon Proficiency Program

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Consumer-Grade Electronic Radon Monitors: Summary of Method and Detailed Results

Radon is a radioactive gas which is naturally occurring in soil and can accumulate to concentrated levels in homes and buildings due to the contact of these homes and buildings with the soil and to construction characteristics. Exposure to elevated levels of radon leads to an increased risk of developing lung cancer. Radon enters through a difference in air pressure between the soil beneath the ground and the air pressure inside the building. Radon levels can change as factors affect the balance including use of home, temperatures, and weather conditions outside.

In order to provide Canadian consumers with an unbiased performance-based comparison of commercially available radon monitors, the Canadian National Radon Proficiency Program (C-NRPP) developed a test procedure and conducted a series of performance tests. This report presents the results of those tests.

Testing of the consumer-grade electronic radon monitors was performed at the Radiation Safety Institute of Canada (RSIC) National Radon Chamber; a C-NRPP reference radon chamber used for testing radon monitors in Canada. The 12 m^3 walk-in radon chamber located in Saskatoon, Saskatchewan, Canada is an approved chamber facility for C-NRPP and is a certified secondary reference radon chamber under the American Association of Radon Scientists and Technologists (AARST) National Radon Proficiency Program (NRPP), certificate number SC 1005.

For this project, C-NRPP reached out to device manufacturers and invited them to participate in the project by providing three of the same model for each of the types of monitors to be tested. All the radon monitors were shipped unopened to the Radiation Safety Institute of Canada (RSIC) National Radon Chamber in Saskatoon, Saskatchewan, Canada.

Prior to exposing the consumer-grade electronic radon monitors under the testing protocol, RSIC staff inventoried each radon monitor, logging the make, model, and serial numbers. They inspected each monitor for any visible damage that may have occurred during shipping, reviewed the operating manual for each monitor and downloaded any required applications and connected to each monitor in order to verify the functioning of each monitor. Any radon monitors that appeared to have been damaged during shipment or did not appear to be operating properly during the initial inspection would have been replaced prior to inclusion in the study. This was not necessary as all the monitors passed the inspection.

The radon monitors were tested using four different sets of conditions, as summarized below. Two sets of test conditions were developed at a target level of 200 Bq/m^3 since this is the Canadian radon guideline level, and the data provided by these monitors is used by consumers to inform their mitigation decision. The temperature and relative humidity for these two sets of test conditions were meant to approximate typical indoor conditions in Canadian homes during winter (Round 1) and summer (Round 2), with the summer conditions representing homes with either no air conditioning or limited air conditioning. The third and fourth sets of conditions were chosen to be at 400 Bq/m^3 (Round 3) and 1,000 Bq/m^3 (Round 4) to test the instrument performance across a range of radon levels at temperature and relative humidity conditions consistent with Round 1.

Round 1

a. Radon concentration : 205 Bq/m^3
b. Temperature: 23° C
c. Humidity: 41% RH
d. Duration: 7 days

Round 2

a. Radon concentration: 205 Bq/m^3
b. Temperature: 29° C
c. Humidity: 69% RH
d. Duration: 7 days

Round 3

a. Radon concentration : 423 Bq/m^3
b. Temperature: 23° C
c. Humidity: 42% RH
d. Duration: 7 days

Round 4

a. Radon concentration: 1048 Bq/m^3
b. Temperature: 24° C
c. Humidity: 45% RH
e. Duration: 7 days

Once the data was obtained from each of the monitors the Measurement Error was calculated for each round of testing. Performance Grades were then assigned to each monitor as per Figure 1, below.

Measurement Error (%)	Performance Grade
≤ 10	A
> 10 and ≤ 20	B
> 20 and ≤ 30	C
> 30 and ≤ 40	D
> 40	E

Figure 1: Radon Monitor Performance Grades

The Performance Grades for each type of monitor were then averaged for each of the four rounds of testing and plotted in Figure 2.

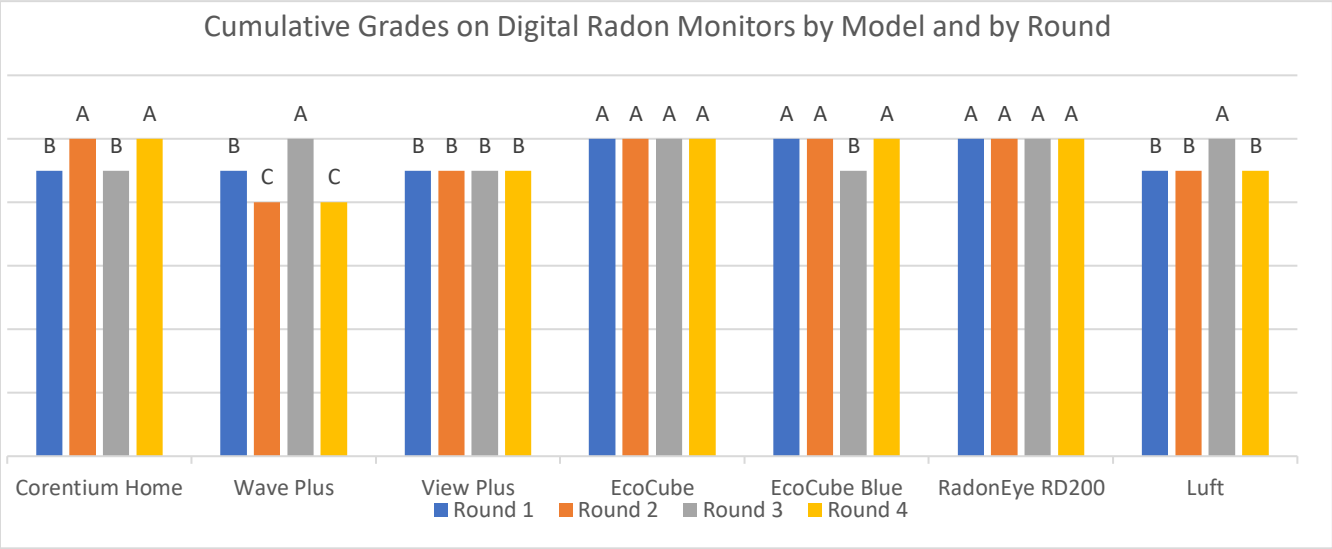

Figure 2: Cumulative Performance Grades

All 7 monitors that were included in this intercomparison received passing grades, as illustrated in Figure 2.