

## Short Communication

# A test of radon service providers available on the Internet

**Abstract** With the announcement of the Government of Canada's Radon Guideline and increased public awareness of radon risk, more and more Canadians wish to test their homes for radon. Radon service providers available on the Internet have attracted many homeowners' attention. These services provide an easy and less expensive way for homeowners to test radon levels in their homes. However, a question has frequently been asked, 'How reliable are the radon testing services available on the Internet?' To answer this question, we ordered 36 radon testing kits from 10 service providers on the Internet. The test results showed that online radon testing services could collectively meet the performance requirement. However, the quality of a few service providers needs to be improved.

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### Practical implications

Indoor radon tests were performed with detectors ordered from 10 service providers available on the Internet. The results showed that online radon testing services could collectively meet the performance requirement. However, the quality of a few service providers needs to be improved.

### Introduction

The recent publication of the combined analyses of radon studies in residential locations in Europe (Darby et al., 2005) and North America (Krewski et al., 2006) have shown that there is a significant risk of lung cancer at residential radon levels. Radon has been identified as the second leading cause of lung cancer after tobacco smoking (World Health Organization, 2005). Based on scientific evidence, a new Government Canada Radon Guideline was announced in June 2007 (Health Canada, 2007). With increased public awareness of radon risk, more and more Canadians wish to test their homes for radon. Services available on the Internet provide an easy and less expensive way for homeowners to test radon levels in homes. However, a question has frequently been asked, 'How reliable are the radon testing services available on the Internet?' This study tried to answer the question.

Ten radon testing services for use by Canadian homeowners were identified on the Internet. A total of 36 radon detectors were ordered from those 10 radon testing laboratories. Evaluation results are presented

here. Measurements near the lower limit of detection for the measurement systems often have large and varying errors. This is also true for radon measurements at very low radon concentrations. However, measurement results that are equal to the Canadian action level ( $200 \text{ Bq/m}^3$ ) or greater are expected to exhibit certain agreement. The tests were, therefore, performed at radon concentrations near to or greater than the Canadian action level.

### Results

All 36 radon detectors were received by regular mail. Among them, 34 were activated charcoals for tests of a few days duration, and two were alpha-track detectors for tests of a few weeks duration. All detectors were placed side-by-side on tables in two vacant houses under closed-window conditions. Radon concentrations in those rooms were determined with a Pylon AB4 (Pylon Electronics Inc., Ottawa, Canada) continuous radon monitor and/or the average value of several short-term E-PERM (Rad Elec, Inc., Frederick, MD, USA) detectors. After the exposure, detectors were sent

back to the service providers for analysis. Results of the tests were received either by regular mails or accessed online. Reported radon concentrations are listed in Tables 1 and 2 for 3-day tests at an average radon concentration of 199 and 396 Bq/m<sup>3</sup>, respectively. The test results of two detectors from company D and two from company H were 'invalid' as declared by the companies. Their explanations were the excessive delay in receipt of test kits. Two alpha-track detectors from company I required longer test period. Those two detectors were exposed to two different radon concentrations for 26 days. The test results are given in Table 3.

**Table 1** Reported radon concentrations and errors relative to the reference value of 199 Bq/m<sup>3</sup> determined by E-PERMs (199 ± 11 Bq/m<sup>3</sup>)

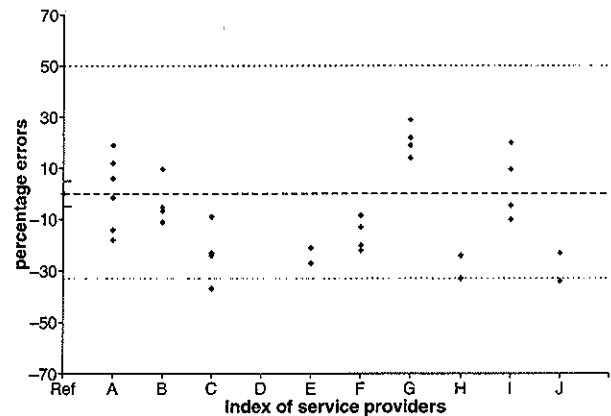
Company index	Detector index	Reported value pCi/l (Bq/m <sup>3</sup> )	Relative error (%)
A	1	5.7 (211)	+6.0
	2	5.3 (196)	-1.5
B	1	5.1 (189)	-5.0
	2	5.9 (218)	+9.5
C	1	4.9 (181)	-8.9
	2	4.1 (152)	-24
E	1	3.9 (144)	-28
F	1	4.7 (174)	-13
G	1	6.1 (226)	+13
	2	6.4 (237)	+19
H	1	4.1 (152)	-24
	2	3.6 (133)	-33
I	1	5.9 (218)	+9.5

**Table 2** Reported radon concentrations and errors relative to the reference value of 396 Bq/m<sup>3</sup> determined by E-PERMs (396 ± 22 Bq/m<sup>3</sup>). Values beyond the boundary of (-33%, +50%) indicated in bold

Company index	Detector index	Reported value pCi/l (Bq/m <sup>3</sup> )	Relative error (%)
A	3	9.2 (340)	-14
	4	8.8 (326)	-18
	5	12.0 (444)	+12
	6	12.7 (470)	+19
B	3	10.0 (370)	-6.6
	4	9.5 (352)	-11
C	3	6.7 (248)	<b>-37</b>
	4	8.2 (303)	-23
D	1	Invalid	
	2	Invalid	
E	2	8.5 (315)	-21
F	2	8.6 (318)	-20
	3	8.4 (311)	-22
	4	9.8 (363)	-8.4
	4	13.8 (511)	+29
G	4	13.1 (485)	+22
	3	Invalid	
H	4	Invalid	
	3	Invalid	
I	2	12.8 (474)	+20
J	1	7.1 (263)	<b>-34</b>
	2	8.2 (303)	-23

**Table 3** Results of radon concentration measurements for a period of 26 days and errors relative to the reference values determined by E-PERMs (177 ± 4.8 Bq/m<sup>3</sup>) in one location and with Pylon AB4 (337 Bq/m<sup>3</sup>) in another location

Company	Detector index	Reference value Bq/m <sup>3</sup>	Reported value pCi/l (Bq/m <sup>3</sup> )	Relative error (%)
I	3	177	4.3 (159)	-10
	4	337	8.7 (322)	-4.5



**Fig. 1** Percentage errors of reported radon concentrations from the 10 radon service providers available on the Internet

Percentage variations of the reported results are summarized in Figure 1. They are the differences relative to the reference radon concentrations determined with the recently calibrated Pylon AB4 and/or the average value of several short-term E-PERMs (standard deviation ≤ 5%, as indicated at index-zero in Figure 1).

**Discussions**

Radon concentrations were reported for 32 detectors deployed. As shown in Tables 1–3, radon concentrations reported by the service providers varied widely. Based on the regulatory standard S-106 of the Canadian Nuclear Safety Commission (2005), radon gas measurements must be able to produce values within +50% and -33% of the true values, 95% of the time. Among the 32 reported radon concentrations, 30 were able to provide readings within +50% and -33% of the reference values, and two of them were below the -33% boundary. For better visualization, percentage variations from the reference values are summarized in Figure 1. The results correspond to the rate within acceptable boundaries, 94% of the time, slightly below the requirement stated in CNSC S-106.

Four of the 36 detectors were declared invalid because of excessive delay in receipt of tests, which is a rate of 11%. All radon test services including analysis and reporting were paid by homeowners when they ordered the services online. A paid service which

concludes in its report with a result of 'INVALID' is definitely not appreciated by the members of the public. Service providers should provide clear instructions to avoid such invalid results, for example with a statement in the instruction that expedited mail or express delivery is required to return detectors for analysis.

Radon service providers available on the Internet provide an easy and less expensive way for homeowners to test radon levels in their homes. The test results of 10 service providers showed that online radon testing services could collectively meet the performance requirement. However, the quality of a few service providers needs to be improved.

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