



Third Party Validation by University of Michigan



Intercomparison of commercially available active radon measurement devices in a “discovered” radon chamber


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Abstract

An unventilated room, with an inner set of concrete walls to damp vibrations in the laboratory directly above it, was discovered to have relatively stable radon levels of roughly 1,000 Bq m⁻³ over a 1-y time period. While unsuitable for precise calibrations, this 70 m³ space with 2.1 m high ceilings was placed into function as a radon chamber adequate for general research and teaching without significant modification other than removal of stored items. The addition of radium sources was not required to achieve the radon levels, as these arise naturally in the space. Several commercially available active radon monitoring devices designed for homeowners, radon screeners, radon mitigation professionals, and researchers were chosen for initial testing in the newly “commissioned” radon chamber. These devices are variable in both cost and intended user sophistication. Radon concentration data were collected at the minimal time intervals of 15 min, as possible, for each device. A cellphone was deployed with an available camera application to periodically capture photographs of the displays of devices not capable of automatic temporal recording. Attempts were made to lower the radon concentration using fans, increase the radon level by the placement of radium-laden objects, and stabilize the radon level using radon impermeable sheets. Statistics were employed to compare the performance of the various devices under the minor radon transients encountered during the test period. While not purpose-built, the unoccupiable space serving as the radon chamber had a sufficiently high and stable radon concentration to be useful. A means of easily altering the radon level in the space in a significant way was not apparent. However, it was previously demonstrated that higher levels of radon may be readily generated by placing radium dials within a 0.2 m³ steel drum when needed for future research. The evaluation of the overall calibration accuracy, noise, and response to transients revealed weaknesses for some devices and exceptional performance for others.


Sample Lapse It Image



Radon Eye

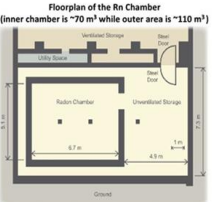


Radon measuring devices in Rn Chamber during the test



Floorplan of the Rn Chamber

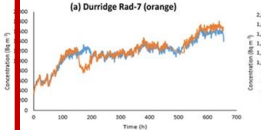
(inner chamber is ~70 m³ while outer area is ~110 m³)



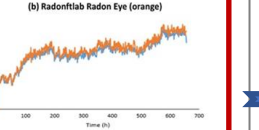
Results

Measured Rn concentration as a function of time over 28 d period, compared to AlphaGuard (blue) results

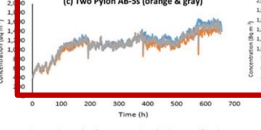
(a) Durridge Rad-7 (orange)



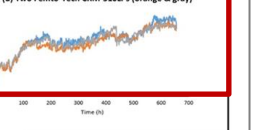
(b) Radonfab Radon Eye (orange)



(c) Two Pylon AB-55 (orange & gray)



(d) Two Fento-Tech CRM-510LPs (orange & gray)




Company	Device	Price	Manufacturer	Model#	Response	Accuracy*	Stability*	Range*	Ch/Guard
AlphaGuard	AlphaGuard	\$220	AlphaGuard	AG-55	15	±1.0%	±0.0001	0-2000	Yes
AlphaGuard	AlphaGuard	\$220	AlphaGuard	AG-55	15	±1.0%	±0.0001	0-2000	Yes
Durridge	Rad-7	\$7000	Durridge	Rad-7	15	±1.0%	±0.0001	0-2000	Yes
Radonfab	Radon Eye	\$179	Radonfab	RE-200	15	±1.0%	±0.0001	0-2000	Yes
Pylon	AB-55	\$15	Pylon	AB-55	15	±1.0%	±0.0001	0-2000	Yes
Fento-Tech	CRM-510LP	\$15	Fento-Tech	CRM-510LP	15	±1.0%	±0.0001	0-2000	Yes

* Indicates a manufacturer reported value


Conclusions

- The research grade devices, the Rad-7 and the AB-55, agreed generally best with the AlphaGuard, possessing $4.6 \leq \chi^2 \leq 8.3$.
- The Radon Eye performed significantly better than expected for an extremely affordable device, with $\chi^2 = 6.7$. It demonstrated performance comparable to all the research grade devices.
- All of the devices possessed strong correlations with the AlphaGuard, with none performing particularly poorly.
- The Radon Eye was identified as a potential candidate to be implemented for the University of Michigan Radiation Weather Station due to its low cost and high accuracy.

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Consortium for Verification Technology



National Nuclear Security Administration

RadonEye RD200 (\$179) performed identically to Durridge RAD7 (\$7,000)

“RadonEye performed significantly better than expected for an extremely affordable device”