**Quality Assurance Plan for Conducting Radon Measurement**



53 Memorial Drive Unit 346

Mountain Home, TN 37684

(423) 360-4089

[www.histenn.com](http://www.histenn.com)

histenn@omcast.net

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A.1 Approval Sheet

1. This Quality Assurance plan shall be utilized by radon measurement technician employed by Home Inspection Services (H.I.S.) for the conduct of radon measurements. The followng Certified Radon Measurement Technicians are currently emplyoed by H.I.S.
	* + - 1. Jimmy Guinn
2. This quality assuance plan shall be reviewed and reissued annually.

Submitted by Jimmy Guinn (Quality Assurance Officer) on \_\_\_\_\_\_\_\_\_\_\_\_\_\_2018

Signature:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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A.2 – Distribution List

1. This plan shall be distributed to all certified radon measurement technicians via email. The current version of this procedure is on H.I.S. website under “Radon/QAP”.
2. This plan shall be reissued after approval of any revision. Certified Radon Technicians listed in this document shall submit recommmended changes to the Quality Assurance Officer. Copies of this document shall be distributed to all parties identified above upon completion of such changes

A.3 – Work to be Accomplished

1. H.I.S. offers radon measurement services both with and independent of a home inspection.

A.4 – Quality Objectives

1. The quality objective for radon measurements by the Tennessee Radon Program is to produce radon measurements which are accurate, consistent and reproducible.

A.5 – Personnel

1. Jimmy Guinn is the designated Quality Assurance Officer.
2. The Quality Assurance Officer will be responsible for:
3. Drafting and updating this QAP on an annual basis.
4. Assuring compliance with this procedure.
5. At the time of the publication of this procedure, Jimmy Guinn is the only personnel involved in the radon measurement. Jimmy Guinn will also be responsible for:
6. Performing all residential measurement activities.

A.6 – Documents and Records

1. Client measurement resports will be kept in digital format in H.I.S. business PC/external backup folder.
2. Quality Assurance and control record and logs will be kept in digital format in H.I.S business PC/external backup in the Operations/Radon/QA Docs folder.
3. Records above with be maintained for a minimum of three years.

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B.1 – Measurement Generation

1. Radon will be measured using continuous radon monitors .
2. Continous radon monitors will be operated according to the applicable manufacturer’s operating manual. Continiuous radon monitors employed by H.I.S. are as follows:
3. Airthings Corentium Home serial number 2302052182

Appendix E contains Standard Operating Procedures for each device

B.2 – Sampling Methods

1. Radon measurement/sampling will be performed in accordance with EPA Publications “Indoor Radon and Radon Decay Product Measurement Device Protocols” and “Protocols for Radon and Radon Decay Product Measurement in Homes”.
2. The radon measurement technician shall advise the client of the necessity for closed house conditions. A sign or label stating the need for maintenance of closed house conditions and advising against tampering with the measurement device shall be displayed at the measurement site.

B.3 – Instrument Calibration

1. Instruments requiring calibration shall be returned to the manufactureer or a facility approved by the manufacturer for calibration.
2. Calibrations will be performed on an annual basis.
3. Any instrument whose calibration date is greater than one year will be removed from service until calibration is performed

B.4 - Quality Control

1. Quality control measurements will be taken in accordance with EPA National Radon Proficiency Program Guidance on Quality Assurance, EPA 402-R-95-012, October 1997.
2. The following warning and control limits shall be utilized:
3. For spiked samples, warning limit relative percent error of 20%, control limit relative percent error of 30%
4. Perform the measurement of the spiked sample (This is the measured value).

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1. Obtain the expected result provided by the agency which supplied the spiked sample (This is the reference value).
2. Relative percent error is calculated by dividing the measured value by the reference value and multiplying by 100.
3. For duplicate samples, warning limit of range ratio of 2.2, control limit of range ratio of 3.3.
4. Range ratios are based initially on 14 percent relative percent difference.
5. The smaller result of two measurements is subtracted from the larger result. (This is the observed relative percent difference).
6. The expected relative percent difference is determined by multiplying the average of the two results by 14 percent (0.14) (This is the expected relative percent difference).
7. The range ratio is determined by dividing the observed relative percent difference by the expected relative percent difference.
8. The following device specific QC measurements will be performed:
9. Continuous Radon Monitors:
10. Each continuous radon monitor will be calibrated annually, if applicable.
11. Each continuous radon monitor in service shall have a label affixed which lists the calibration facility, the date of calibration and the date the next calibration is due.
12. Current calibration certificates will be maintained on hand in the business address for each instrument in use.
13. Bachground measurements shall be performed for each continuous radon monitor during calibration.
14. All CRM measurements will be consecutively numbered in the following syntax, CRM\_ [YEAR}\_ [Measurement Number]. For example, the fifth measurement of 2018 will be “CRM\_2018\_005”.
15. Crosscheck measurements (side by side radon comparison measurement using two different types of CRM devices) shall be performed at the rate of ten percent of measurements. Crosscheck measurements will be conducted with another CRM device. A log for documenting crosscheck measurements for continuous radon monitors is illustrated in Appendix E.

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1. Routine instrument checks are performed by the instrument software upon startup.
2. Radon measurements shall be reported usign the report generatd by the continuous monitor which corrects the readings for the measured instrument background.
3. Chain of custody will be maintained as follows:
4. Continuous radon monitor printouts shall be initialed by the radon measurement technician at the date/time for placement and retrieval as applicable. These printouts shall be maintained with the client record.
5. A background radiation measurement shall be accomplished during continuous radon monitor calibration.

C.1 – Assessment and Oversight

1. Measurements performed by H.I.S Radon Measurement Technicians shall be submitted to the Quality Assurance Officer for review.
2. Complaints and suggestions regarding programmatic issues shall be reviewed as directed by the Quality Assurance Officer. Upon resolution of issues, programmatic changes required will be documented and this Quality Assurance plan shall be amended as necessary.

D.1 – Data Validation and Usability

1. Continuous radon data shall be reported using the standard reporting provided by the Corentium Home, which is corrected for instrument to background and transferred to paper report by technician.
2. The radon measurement technician performing the measurement shall adhere to all applicable protocols and standard operating procedures to ensure that measurements are properly conducted. The Quality Assurance Officer or desingee shall routinely review measurement results prior to them being reported to the client.

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**RADON TESTING DEVICE**

**DO NOT DISTURB**

**For questions or concerns contact:**

**H.I.S. Home Inspection Services**

histenn@comcast.net

**423-360-4089**

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Appendix A – CRM Measurement Duplicate Log

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date | Test # | CRM (p/Ci/L) | Dup. (pCi/L) | Ro (A/B) | Re | R=Ro / Re |
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Ro=Larger - smaller result Re=[(A+B)/2]\*0.14 (Based on 14 percent Relative Percent Difference

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Appendix B – Standard Operating Procedures for Radon Measurement Devices

SOP1: Procedure for Airthings Corentium Home

**Placement**

* Sit or hang on solid surface
* Place on lowest occupied level of the home
* Do not place in drafts from heating or air conditioning vents
* Do not place in closets, kitchen, bathroom, laundry room or other closed or high humidity areas (bedrooms are good spots)
* Place at least 20 inches above the floor
* Place at least 10 inches from other objects
* Place at least 36 inches from windows and 12 inches from exterior wall
* Initiate a new test by pressing and holding button 8 from the picture below for 5 seconds. Device will clear.

Image

* The device completes a 45 second self-test.
* A new test is initiated.

**Testing Duration**

* If closed house conditions are known to have been mainitained for the 12 hours leading up to the test, leave the test running for a minimum of 72 hours. Results on the first day must be regarded as a “radon level indication day” only.
* If closed house conditions are unknown or known to not have been mainitained for the 12 hours leading up to the test, leave the rest running for a minimum of 60 hours.

**Retrieval**

* End the current test by pressing the mode button 9 from the picture below until the device changes to screen

Image

* Technician will photograph and record immediately onto paper report device results

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Appendix C – Technical Specifications

* Power Supply – 3AAA alkaline batteries (LRo3)

2 year battery life

* Operation Environment – Temperature: 39oF to 104oF

Relative Humidity: <85%

* Measurement Range: Lowest detection limit: ~~0~~ pCi/L

Upper display limit: 500.0 pCi/L

Accuracy / Precision at: 5.4 pCi/L (Typical)

7 days: 10%

2 months: 5%

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