**QUALITY ASSURANCE and QUALITY CONTROL PLAN for MEASUREMENT of INDOOR RADON CONCENTRATION with**

***femto*-TECH**

CONTINUOUS RADON MONITORS

Business Name:

Address:

Phone:

Owner:

**Measurement Personnel:**

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| **Name** | **Certification/ID** |
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QAP Approval Date:

Signature of QA/QC Manager: X\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Printed:

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**INTRODUCTION**

This Quality Assurance Plan (QAP) is consistent with the guidance issued from “Radon Measurement Systems Quality Assurance [ANSI-AARST MS-QA 2019]”. This plan is formatted in a way that allows      ’s staff to easily reference pertinent portions of this document. The nomenclature used in this QAP is appropriate for the operations of, and every effort has been made to maintain consistency with ANSI-AARST Protocols for Conducting Measurements or Radon and RDPs in Homes [MAH-2019] and Radon Measurement Systems Quality Assurance [ANSI-AARST MS-QA 2019].

**SECTION 1: BUSINESS MANAGEMENT**

* 1. **Statement of Commitment**Our organization resolves to conduct activities in a manner that complies with the quality assurance plan set forth herein.
	2. **Commitment to Annual Review**This QAP is reviewed and approved on an annual basis. A written report is also maintained that includes audit findings; written assessment of whether quality goals are being reached; and suggestions to improve the program due to changes such as in technology, quality concepts and standards or regulations.

**Distribution List**

This report reflects current operations, and therefore is often updated and revised. The QA Manager/Officer has responsibility for incorporating changes and ensuring that the changes are reviewed and approved by the management, as indicated by their dated signature(s) on the signature page.

After significant revisions, revised copies of this QAP are distributed to the following key personnel:

[ ]  QA Manager/Officer [ ]  Person(s) ultimately responsible (e.g., President) [ ]  Field Manager(s)

[ ]  Office oversight/manager [ ]  Installers [ ]  Procurement Manager [ ]  State or Regulatory Agencies

* 1. **Description of the Business and Work**Our organization provides radon measurement services primarily for:

[ ]  Homeowners or real estate transactions [ ]  Multifamily buildings [ ]  Schools

[ ]  Large buildings [ ]  Other:

* 1. **Management and Organization**

The names of individuals in our organization are listed below where (X) indicates all those authorized to stop inadequate quality or unsafe work.

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| --- | --- | --- |
|  | **Names** | **Responsibilities** |
| [ ]  |  | QA Manager/Officer (Measurement) |
| [ ]  |  | QA Manager/Officer (Mitigation) |
| [ ]  |  | Ultimate Responsibility (e.g., President) |
| [ ]  |  | Office Manager |
| [ ]  |  | Procurement Manager |
| [ ]  |  | Office Oversight |
| [ ]  |  | Field Supervisor |
| [ ]  |  | Measurement Staff |
| [ ]  |  | Other |
| [ ]  |  | Other |

* 1. **Personnel Qualifications and Training**

Our organization resolves to establish training and qualification requirements for staff and to maintain evidence of all training for the duration of employment and to retain such records for five years past the end of employment.

* All staff members are to be qualified for their apportioned task.
* Measurement tasks are to be conducted by individuals who have obtained training, skills, and knowledge for conducting radon measurements, as demonstrated by certification for radon measurement services.
* All uncertified staff laborers work under the responsible charge of a certified staff member.
	1. **Procurement of Items and Services**

To assure resources and materials are available to fulfill quality goals: Written procedures instruct field staff in providing timely notice of procurement needs to staff responsible for procurement duties and budget ramifications.

Examples of procurement needs when conducting radon measurements include calibration of testing instruments, test device purchases based on written technical and quality specifications and notices, signs, non- interference agreements and other equipment or paperwork for daily needs.

* 1. **Documents and Records**

Our organization resolves to control documents and store records so that they are legible, retrievable, protected from fire, water, theft, and deterioration. Computer software commonly associated with business management is employed and customized for needs related to radon services. Project records are retained for no less than 6 years and, as applicable, staff radon exposure records are retained for no less than 20 years.

* 1. **Planning**

Our organization resolves that: Efficient use of technology, personnel, and materials requires our commitment to planning; The elements of this quality program serve as the basic structure of staff quality commitments; and planning is to be considered an opportunity to ensure functions that are consistent with and fulfill specified requirements of quality goals and procedures.

* 1. **Suggestions and Complaints**

Our organization commits to a timely and professional process for accepting, assessing, and responding to suggestions and complaints. Records of suggestions or complaints are evaluated during routine review of the QAP for determining how alternative resolutions are considered and implemented.

* 1. **Corrective Actions**

Records of corrective actions are to be included in routine internal assessments of the QAP and evaluated for how the proposed remedies were implemented and how their effectiveness is verified.

* 1. **Standard Operating Procedures (SOP)**

Our organization resolves to standardize relevant aspects of services provided in written procedures.

* 1. **Calibration**

Our organization resolves to control quality for instruments and test equipment employed in conjunction with radon measurement services to include, among other quality checks, the use of calibrated test equipment and laboratory services who demonstrate calibration when achieving and maintaining certifications.

* 1. **Worker Protection Plan**

Our organization resolves to maintain a worker protection program.

* 1. **Other**

**SECTION 2: MEASUREMENT SERVICES**

**2.1** **QUALITY POLICY FOR MEASUREMENT SERVICES**

a) **Measurement Quality:** Our organization resolves to conduct measurements that comply with approved standards including standards for quality control as prescribed in ANSI/AARST MS-QA.

b) **Measurement Quality Objectives:** Our organization resolves to consistently produce, to the extent possible, reliable radon measurements to determine if radon mitigation is necessary to protect current and future occupants.

**2.2** **STANDARDS OF PRACTICE**

Our organization resolves to comply with NRPP recognized standards of practice when providing radon measurement and/or mitigation services, except as superseded by local statutes. ***Our Measurement Standard Specifications:***

**For measurement of single-family homes:**

[ ]  ANSI/AARST MAH: *Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes*

[ ]  EPA: *Protocols for Radon and Radon Decay Product Measurements in Homes (EPA 402-R-93-003, June 1993).*

**For measurement of multifamily buildings:**

[ ]  ANSI/AARST: *Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily Buildings*

**For measurement of schools and large buildings:**

[ ]  ANSI/AARST: *Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings*

**For quality assurance of measurement devices or systems:**

[ ]  ANSI/AARST MS-QA: *Radon Measurement Systems Quality Assurance*

**2.3** **JOBSITE STANDARD OPERATING PROCEDURES (SOP)**

Our organization resolves to collect and retain evidence of quality control. The following practices are standard practice for our organization. Deviations from these specifications and site-specific information are tracked and retained for review on jobsite tracking sheets.

**2.3.1** **TEST DEVICES**

All test devices used for deciding if mitigation is warranted are to be devices that are listed for having proven to meet minimum quality requirements by one of the following authorities:

a)  the National Radon Proficiency Program (NRPP); the National Radon Safety Board (NRSB); or

b)  as required by local statutes for jurisdictions that have a program for evaluating and approving devices.

**Instrument Calibration:** Each continuous radon monitor is calibrated annually.

***Tracking:*** Devices, calibrations, and laboratories that may change from time to time are shown in Appendix 2-E.

**2.3.2** **ONSITE PERSONNEL**

Staff members conducting onsite radon measurement activities are individually trained and certified for radon measurement services.

***Tracking:*** Individuals that may change from time to time along with evidence of applicable training and certification numbers are shown in Appendix 2-D.

**2.3.3** **INITIAL CONTACT WITH THE CLIENT**

Initial testing activities are to include determining the purpose of the test and whether the building is new, occupied, and who will be responsible for closed- building conditions prior to and during the measurement period.

Closed-building protocols: Communications to clients or parties responsible for the property include essential elements required for compliance with closed-building protocols. Information about required test conditions are to be communicated when practicable to the person responsible for the home prior to when the pre-test 12-hour closed-building requirements are to be initiated.

Report distribution: Information from the client regarding their choices for where reports are sent and who is authorized to receive reports should be obtained when practicable.

***Tracking:*** Information collected on initial contact with a confirmed client is to be recorded on test project tracking sheets and maintained in records.

**2.3.4** **TEST LOCATIONS AND PROTOCOL OPTIONS**

Test locations are to comply with the standards of practice listed in Section 2.2 as appropriate for the building or situation.

***Onsite Tracking:*** Information is to be recorded by the onsite technician(s) for the exact location and serial number of each test device. Information recorded is to provide an indication of which floor, room, and location within the room where the test is conducted.

**2.3.5** **CHAIN OF CUSTODY**

Chain-of-custody procedures and records are to be maintained to help verify responsible practices.

***Onsite Tracking:*** Technicians are to document each test event where they were the person responsible for onsite activities. This record should be made by way of initialing tracking sheets next to the date of the testing event.

**2.3.6** **INSTRUMENT/DETECTOR QC CHECKS**

Onsite technicians are to conduct checks of instrument functionality and checks on the integrity of any detector at the beginning and at the end of each test.

***Onsite Tracking:*** Information is to be recorded by the staff technician for each incident where instrument functionality appears to be impaired or damaged is observed to detectors or their packaging. In addition, the technician should additionally bring concerns observed to the attention of the QA manager.

**2.3.7** **BUILDING INVESTIGATIONS**

To attempt verification of required test conditions, the following procedures are to be employed:

a)  Inform the person responsible for building operation of the required test conditions.

b)  Post notification of a Radon Test in Progress in conspicuous locations stating the required conditions of the test.

c)  Request a signature on a noninterference agreement and note in the report if this document was not signed.

d)  Conduct visual inspections.

Visual inspections of the dwelling that evaluate observed conditions and document deviations from protocol and temporary conditions that might affect the test result are conducted by a Certified measurement professional:

1. Upon detector placement to help ensure all closed-building conditions and other protocol requirements are met; and
2. Upon detector retrieval of the detector(s) to help verify that:
	1. Closed-building conditions and other protocol requirements are still being maintained.
	2. Detector placement has not changed.
	3. Tamper seals, if present, have not been broken.

***Onsite Tracking:*** The onsite technician is to document each incident where deviations from protocol and temporary conditions might affect the test result. This information along with any other quality concerns such as observations relative to noninterference controls or unsigned noninterference agreements are to be brought to the attention of the QA manager or person responsible for approving the release of measurement reports.

**2.3.8** **RADON SYSTEMS**

Where a mitigation system or efforts to mitigate radon are observed, the onsite technician is to record general description of the mitigation system observed and whether it appeared to be operating. The onsite technician should also record a description of any temporary radon mitigation strategies that are not permanent installations.

**2.3.9** **COLLOCATED (SIDE-BY-SIDE) DUPLICATE/COMPARISON QC CHECKS**

***Onsite Tracking:*** The onsite technician is to document the location and serial numbers of collocated (side-by-side) devices, including duplicate or comparison QA check devices.

**2.3.10** **BLANK QC CHECKS**

***Onsite Tracking:*** The onsite technician is to document the location and serial numbers of blank detectors placed in the field.

**2.3.11** **WEATHER**

***Onsite or Office Tracking:*** The onsite technician or designated staff member is to document a description of weather conditions during the test to include the range of outdoor temperatures, precipitation, wind and any storms or high winds that are unusually severe for the location being tested.

**2.3.12** **HEALTH INFORMATION**

Onsite technicians that describe radon risk in writing or verbally are to provide health risk information in accordance with the EPA's Citizens Guide, EPA's Home Buyers and Sellers Guide, and in accordance with State Radon Program requirements as applicable.

***Office Tracking:*** Evidence of training (classroom and annual staff review) is to be documented and confusion or complaints by clients should be reviewed to add consistency to clarity on information provided by all technicians.

**2.4** **DEVICE QUALITY CONTROL**

Our organization resolves to control quality by collecting, analyzing, and retaining evidence of quality control for each device/detector model or type.

**2.4.1** **ALL DEVICES – DUPLICATE/COMPARISON QC CHECKS**

Duplicates or crosschecks are deployed at a rate of 10% of all measurement locations. Evaluations verify that there have been no increases in the measurement system imprecision since the last passing QC check or calibration.

***Corrective Action****:* If these evaluations indicate the *relative percent difference* between the two devices have exceeded established warning and control limits, an investigation to identify the cause may be warranted and could include repeating the measurements. If analysis reveals repeated results at a rate that is outside established control limits, corrective action is required.

**2.4.2** **PASSIVE DETECTOR BLANK QC CHECKS**

Blanks are detectors that are not exposed or left open for measuring the air in a room. Blanks are conducted and processed at a rate of 5% of test locations or a maximum required of 25 per month for each detector type or model. Blank detectors placed in the field and those processed for evaluation of storage or shipping are to be identified in records. Evaluations are made to verify the absence of effects on test results from sources other than the air being tested.

***Corrective Action:*** If analysis of blanks reveals measurements that exceed minimum detectable concentration limits for the measurement system, investigation to identify the cause and corrective action is required and could include repeating measurements previously conducted.

**2.4.3** **PASSIVE DETECTOR STORAGE**

Storage locations are to be monitored for high radon concentrations, high humidity or extreme temperatures and blanks are also used to ensure against the potential of introducing detector error.

**2.4.4** **PASSIVE DETECTOR SPIKE QC CHECKS**

Spikes are conducted in coordination with an approved radon chamber at a rate of 5% of the devices deployed for field measurements with six per month being the necessary maximum and no less than three per year for each detector type or model. Evaluations are made to provide evidence of a continued accurate measurement system operation by comparing reported spike analyses results to approved radon chamber results that correlate to a recognized reference authority for radon concentration.

***Corrective Action*:** If analysis of spike reveals measurements that exceed acceptable limits for disagreeing with an approved radon, investigation to identify the cause and corrective action is required and could include repeating measurements previously conducted.

**2.5** **QUALITY CONTROL IN REPORTING MEASUREMENT RESULTS**

Our organization resolves to control quality of reported measurement results.

**2.5.1** **PERSONNEL**

Staff members authorized for oversight and release of radon measurement reports are to be individually certified for radon measurement services.

**2.5.2** **DATA VALIDATION**

Valid data must be bracketed in time by documented, within-limits QC checks, and instrument checks, data flagging and reporting for unusual results.

**2.5.3** **STANDARDS COMPLIANCE**

Reports are to contain all content required by the standard associated with the test project.

**2.5.4** **OPINIONS**

When opinions and interpretations are included, the laboratory or field professional’s report shall document the basis upon which the opinions and interpretations have been made. Opinions and interpretations, including initials and date, shall be clearly marked as such in a test report.

**2.6** **ONGOING ASSESSMENTS, OVERSIGHT AND RESPONSE (MEASUREMENT)**

**2.6.1** **ONGOING EVALUATION**

Evaluation for achieving successful quality for both the measurement quality and the objective of health protection is an ongoing process. Ongoing evaluation allows timely response to the cause of failed quality. The cause of failed quality can include a poor process needing improvement or poor practices conducted.

Evidence of failed quality can also come in the form of customer suggestions and complaints. Customer complaints are responded to immediately or in a timely manner.

**2.6.2** **CORRECTIVE ACTION**

Failure of quality control within the defined limits of this QA plan is to result in timely action to identify, correct and document the problem. Corrective actions are quickly communicated to staff.

**2.6.3** **QUALITY ASSURANCE AUDITS AND REPORTS**

The QA Officer audits operations on an ongoing basis and is responsible to convene staff meetings no less than yearly to review operational actions and results with the goal of improving existing quality procedures. Changes in procedures are written and distributed to management and affected staff.

**2.6.4** **TRAINING FOR QUALITY ASSURANCE**

Training plans for new staff and the plans for retraining when procedures change are regularly reviewed. Adequate training is given high priority, since the implementation of this QA plan is dependent upon the staff’s understanding of its requirements.

**2.7** **CORRECTION, REVIEW, AND VERIFICATION OF EFFECTIVENESS**

Corrective actions and changes to procedures are monitored and reviewed no less than annually to verify that corrections have achieved the desired quality improvements.

**Appendix 2-A**

**RADIOLOGICAL SAFETY PLAN and MITIGATION “SOP” GUIDELINES**

**for**

**MONITORING WORKER RADON EXPOSURE**

**by**

**Business:**

**Address:**

 APPROVED BY:

 President:       Date:

 QA/QC Manager:       Date:

**1.0** **PURPOSE**

The intended purpose of our Radiological Safety Plan for Monitoring Worker Radon Exposure is to provide a working environment for all      ’s employees, both present and future, which complies with the limits established by the Nuclear Regulatory Commission and regulated by OSHA.

**2.0 PRINCIPLE RESPIRATORY CONSIDERATIONS**

The as low as reasonably achievable principle is followed in consideration with all work practices and procedures during any radon related activities. Diagnostics and/or follow-up radon testing is often performed in homes suspected of having elevated radon concentrations. Testing devices are to be deployed and retrieved spending a minimum amount of time in the lower areas (basements, etc.), while still obtaining the needed information (floor layout, HVAC description, etc.). Recording of data and any discussions with homeowner or others should be conducted in areas less likely to have elevated radon concentrations.

Workers performing diagnostics\applications must participate in      ’s employee monitoring program. Total dose records on individual personnel will be maintained on file at our offices. On-site monitoring data will be done with a CRM and exposure will be recorded from hard copy tapes. Workers will not be exposed to more than (4) WLM per year. Investigational level is set at 10% of the maximum exposure level.

**Appendix 2-B**

**DECLARATION OF VOLUNTARY COMPLIANCE**

**RADON INSPECTION DECLARATION OF VOLUNTARY COMPLIANCE**

As the responsible party for the test location listed below, I hereby acknowledge receipt of the EPA’s “Home Buyer’s and Seller’s Guide to Radon”. I further understand that potential purchasers and/or lenders will be making important decisions pending the outcome of this test. Given this information I hereby certify that:

(1) I agree to keep this house closed (except for normal entry and exit) for approximately       hours prior to the start of the test. (NOTE: Minimum of 12 hours needed)

(2) I agree to keep all doors and windows shut during the entire test period except for normal entry and exit.

(3) I will not knowingly alter the test environment in any way including, but not limited to, raising, or lowering the thermostat(s) or changing HVAC fan controls.

(4) I will not tamper with, remove, or change the location of the test device(s).

(5) I will report any circumstances that occur during the test that may influence the results.

(6) If I have any questions about the test, I will contact the testing firm immediately.

**TEST LOCATION**

Occupant/Responsible Party:       Date:

Address:

City:       State:       Zip:

Technician:       Date:

**Appendix 2-C**

**CAUTION!**

**CONTINUOUS RADON TEST IN PROGRESS**

CLOSED BUILDING

CONDITIONS MUST BE

MAINTAINED:

ALL WINDOW AND DOORS

**MUST** BE CLOSED EXCEPT FOR BRIEF DOOR OPENING FOR ENTRY AND EXIT.

*HEATING AND AIR CONDITIONING SYSTEMS MAY BE OPERATED IN THE AUTO MODE DURING CLOSED BUILDING CONDITIONS.*

PLEASE CALL NUMBER BELOW FOR ADDITIONAL INFORMATION CONCERNING TEST

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**Appendix 2-D**

**STAFF RECORDS**

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| **NAME** | **CERTIFICATION #** | **QUALIFICATIONS** |
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**Appendix 2-E**

**ACTIVE CRM RECORDS**

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| **MODEL** | **SERIAL** | **CALIBRATION DATE** |
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**Appendix 2-F**

**QUALITY CONTROL TRACKING METHODS**

**DUPLICATE/CROSSCHECK TEST LOG**

**DEFINITION:** *Collocated*, simultaneous measurements conducted with instruments or devices that are identical (including manufacturer, model, and, for continuous monitors, the same most recent *calibration* facility and schedule) for the purpose of assessing and monitoring the measurement system imprecision.

**RPD= (1ST RADON LVL - 2ND RADON LVL)**

 **(1ST RADON LVL + 2ND RADON LVL) 2**

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| **DATE** | **1ST SERIAL** | **RADON LVL** | **2ND SERIAL** | **RADON LVL** | **RPD** |
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**BLANK TEST LOG**

**DEFINITION:** A type of *quality control* (QC) check that quantifies detector response due to factors other than the measurement itself. Blanks are devices deployed to measure effects on the measurement result from anything other than the environment tested, i.e., effects caused during storage, shipping, handling and transport. The purpose of blanks for *in-control* operations is to verify and document the lack of influence of factors encountered outside the measured environment; their records are necessary to support data validity.

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| **DATE** | **SERIAL** | **BLANK #** | **REPORTED VALUE** |
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**SPIKE TEST LOG**

**DEFINITION:** Spikes are devices or materials that are exposed in a *STAR* to known radon concentrations for duration or integrated exposures normally encountered in field measurements, and which are recommended by the manufacturer and agreed to between the supplier of the devices and the exposure facility; temperatures between 60–80°F; and relative humidity’s between 10–75%. Spikes are submitted *blind* to the analyst and are not for *calibration* purposes but are necessary to verify and document the accuracy of the continued measurement system. In some cases, spikes can be used as *laboratory control samples*. Typical spiking operations disclose the radon concentration to the sender of the device. However, for a *blind spike*, the radon concentration is withheld until after the client reports the radon value back to the chamber for independent verification.
Results of spikes are assessed using the RPE statistic (also known by IPE, see definition), which is the degree from which each single measured value (spike) deviates from the chamber’s average concentration during the exposure period.

**Individual Relative Percent Error =** **((Reported Value - Target Value) / Target Value) x 100**

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| **DATE** | **SERIAL** | **SPIKE #** | **REPORTED VALUE** | **TARGET VALUE** | **IRPE(%)** |
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