

TITLE 32: ENERGY
CHAPTER II: ILLINOIS EMERGENCY MANAGEMENT AGENCY
SUBCHAPTER b: RADIATION PROTECTION

PART 422
REGULATIONS FOR RADON MEASUREMENT SERVICE PROVIDERS

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AUTHORITY: Implementing and authorized by Section 20 of the Radon Industry Licensing Act [420 ILCS 44/20] and Section 10 of the Radon Resistant Construction Act [420 ILCS 52/10].

SOURCE:

Section 422.10 Purpose and Scope

- a) This Part establishes licensing requirements for individuals who perform services to measure the presence of radon or radon progeny.
- c) Nothing in the Radon Industry Licensing Act [420 ILCS 44] or this Part shall be construed to limit or affect in any respect the practice of persons properly licensed under other statutes or regulations with respect to their professions.

Section 422.15 Incorporations by Reference

- a) All rules, standards and guidelines of agencies of the United States or nationally recognized organizations or associations that are incorporated by reference in this Part are incorporated as of the date specified in the reference and do not include any later amendments or editions. Copies of these rules, standards and guidelines that have been incorporated by reference are available for public inspection and copying at the Illinois Emergency Management Agency & Office of Homeland Security, 1035 Outer Park Drive, Springfield, Illinois.
- b) In addition, copies of ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories Compliance may be obtained through the American National Standards Institute (ANSI), 1430 Broadway, New York, New York 10018 and directly from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Copies of ISO/IEC 17025 are available for public inspection and copying at the Illinois Emergency Management Agency & Office of Homeland Security, 1035 Outer Park Drive, Springfield, Illinois 62704.
- c) Examples of letters and documents required for compliance pursuant to this Part and guidance for the requirements contained in this Part can be located on the Agency's radon website at <https://iema.illinois.gov/nrs/radon.html>.

Section 422.20 Definitions

As used in this Part:

"AARST-NRPP" means the American Association of Radon Scientist and Technologists National Radon Proficiency Program.

"Act" means the Radon Industry Licensing Act [420 ILCS 44].

"Action Level" means a threshold for when mitigation of exposure to harmful elements is recommended or required. The USEPA and Illinois Action Level is 4.0 pCi/L of radon.

"Active Mitigation System", also known as "Active Soil Depressurization" or "ASD", means *a family of radon mitigation systems involving mechanically driven soil depressurization, including sub-slab depressurization (SSD), drain tile depressurization (DTD), block wall depressurization (BWD), and sub-membrane depressurization (SMD)*. [420 ILCS 52]

"Agency" means the Illinois Emergency Management Agency & Office of Homeland

Security (IEMA-OHS).

“Alpha Track (AT)” means a radon detector constructed from a piece of plastic, typically of either allyl diglycol carbonate or cellulose nitrate, inside a chamber usually made of electrically conducting plastic. Radon diffuses passively into the chamber, where it subsequently decays. Alpha particles emitted from radon and two of its short-lived progeny, polonium-218 and polonium-214, strike the plastic detector and create damaged volumes or “latent tracks.” The plastic is etched in a caustic solution, which produces tracks that are visible with a microscope because the latent tracks are more soluble than the surrounding undamaged material in such a solution.

“ANSI” means American National Standards Institute.

"Batch" means a group of passive detectors manufactured by the same entity at the same time.

“Basement” means a foundation type or a part of a building consisting of rooms that are partially or fully below ground and has a minimum height of ~~five~~5 foot, 6 inches. It is typically considered a living area whether it is finished or unfinished.

“Blank Measurements” means a detector deployed to verify and document the absence of effects on the measurement resulting from sources other than the air being tested. Since blanks are not exposed (i.e., not left open to permit radon to enter the detector), their measurement value should be below the minimum detectable concentration of the measurement system. See field blanks, office blanks, and lab-transit blanks.

"Calibration" means the determination of the response or reading of an instrument relative to a series of known radiation values over the range of the instrument; or the strength of a source of radiation relative to a standard.

“Activated Charcoal” or “AC” means a class of device that employs a material such as activated charcoal that adsorbs radon from the air. The amount of radon adsorbed depends on the design of the device, the type of charcoal, the exposure time and the radon concentration, temperature and relative humidity in the surrounding air. This class of device can provide an accurate representation of the average radon concentration during the exposure period if there are no large changes in radon concentration or the environment (e.g., temperature, humidity) during the exposure.

"Calibration Measurement" means any radon or radon progeny tests, laboratory analysis, or exposure in a known radon or radon progeny environment, as in a radon chamber.

"Client" means any person who contracts for measurement or mitigation services.

"Collocated" means two or more simultaneous measurements within 4-8 inches of each other in the same location or side-by-side.

"Conditioned Space" means areas within the heated and cooled envelope of the building where HVAC systems maintain temperatures to facilitate comfort of occupants. Basement areas that maintain occupiable temperatures by virtue of ambient sources of heat or cooling, such as from the earth or adjoined air spaces are considered conditioned spaces within the heated and cooled envelope of the building.

"Constant Air Volume" or "CAV" means a type of heating, ventilating, and air-conditioning (HVAC) system. In a simple CAV system, the supply air flow rate is constant, but the supply air temperature is varied to meet the thermal loads of a space. Most CAV systems are small, and serve a single thermal zone. However, variations such as CAV with reheat, CAV multizone, and CAV primary-secondary systems can serve multiple zones and larger buildings.

"Combination Foundations" means buildings constructed with more than one foundation type, e.g., basement/crawlspace or basement/slab-on-grade.

"Commercial Building" means a type of building that is used for commercial purposes, and include but are not limited to office buildings, warehouses, retail buildings, convenience stores, 'big box' stores, shopping malls civic centers, arenas, religious facilities, factories, for fabrication or manufacturing, medical facilities, hospitals, nursing homes, and prisons. In urban locations, a commercial building may combine functions, such as offices on upper levels and retail space on the first level.

"Continuing Education Credits" or "CE Credits" means those continuing education credits received for documented successful completion of approved continuing education courses or for instructing an approved continuing education course.

"Continuous Monitor" or "CM" ~~means a~~ means a measurement tool that can integrate, record and produce reviewable readings in time increments of 1 hour, and can be recalibrated periodically.

"Crawlspace" means a foundation type or a part of a building, especially under the bottom floor, that is not high enough for a person to stand in that typically has either a concrete slab, gravel, or earthen floor. It is less than ~~five~~5 foot, 6 inches tall and, if not currently used as a living area, is not typically considered a living area.

“Daycare” means an institution that provides supervision and care of infants and young children during the daytime that is licensed in accordance with the Child Care Act of 1969 [225 ILCS 10/].

"Diagnostic Tests" means procedures used to identify or characterize conditions within buildings that may contribute to radon entry or elevated radon levels or may provide information regarding the performance of a mitigation system.

“Diurnal Variation” means radon concentrations fluctuating on a daily cycle that are typically caused by a building’s mechanical or HVAC systems.

“Duplicates” means collocated, simultaneous measurements conducted with instruments or devices that are identical, including manufacturer, model, and, for continuous monitors, the same most recent calibration facility, for the purpose of assessing and monitoring the measurement system imprecision.

"Dwelling" means a single family home or a single unit within a multiple family complex.

"Electret Ion Chamber” or “EIC" means a device that uses an ion chamber made of, or lined with, an electrically conductive material with an electret as the detecting mechanism. The surface voltage of the positively charged electret is measured before and after the exposure to radon. During the exposure, radon passively diffuses into the ion chamber and subsequently decays. The radon decay and its short-lived progeny ionize the air inside the chamber. Electrons are attracted to the electret and discharge it. From the surface voltage of the electret measured before and after the exposure, and the duration of the exposure, the average radon concentration during the exposure can be calculated using calibration factors determined through exposures of devices in a STAR. Ambient gamma rays also ionize air inside the chamber, and the effects of ambient gamma radiation must be taken into account. Different electret sensitivities and chamber sizes can be used in combination to measure a range of radon concentration ranging from 2 days to 1 year. The EIC QA requirements apply to all combinations of electrets and chambers used to measure radon concentration in ambient air.

“Extended Testing” means a measurement strategy for situations where an extended time period for making a mitigation decision is available, such as within several weeks or months. The strategy involves an initial short term measurement which, if a radon concentration is found to be elevated, is followed by a short term measurement or long term measurement. The decision to mitigate is based on the average of two short term measurements or the result of the long term measurement.

“Field Blanks” means an unopened detector placed to reveal any unexpected exposures that might result onsite or from handling procedures.

"Footprint" means each foundation type in direct contact with soil or other material.

"Foundation Type" means basement, crawlspace, slab-on-grade or any other construction technique approved by local building code.

“General Supervision” means the directing of the authorized activities of a licensed measurement technician by a licensed measurement professional and shall not be construed to require the physical presence of the supervisor when directing such activities.

"Government Entity" means any agency of State or local government.

“Ground-Contact” means any indoor locations that are habitable, or could be made habitable, and have floors or walls in contact with ground, or are closest to ground, such as rooms over a crawl space, utility tunnel, or parking garage.

"HVAC" means heating, ventilation and air conditioning.

"Home Environment Measurement" means a measurement of radon in a single family home, duplex or an individual condominium unit which is not involved in and not done in anticipation of a real estate transaction. Since there is only one party and there is no real estate transaction in process or expected, the extended testing measurement strategy is appropriate.

"Individual" means any human being.

“Intended to be Occupied” means a location where there are plans to occupy rooms even though unoccupied at the time of the testing procedure. Examples include vacant locations being leased or sold and locations where renovation or repurposing is planned.

"Interfere" means *to adversely or potentially adversely impact the successful completion of an indoor radon measurement by changing the radon or radon progeny concentrations or altering the performance of measurement equipment or an indoor radon mitigation system installation or operation.* [420 ILCS 44/15]

“ISO/IEC” means International Organization for Standardization and International Electrotechnical Commission.

“Lab-transit Blanks” means an unopened detector placed to evaluate the quality of

the laboratory and to look for unexpected exposures that might result from shipping or handling.

"Laboratory" means any organization that analyzes or calibrates radon or radon progeny measurement devices or detectors.

"Laboratory Analysis" means *the act of analyzing the radon or radon progeny concentrations with passive devices, or the act of calibrating radon or radon progeny measurement devices, or the act of exposing radon or radon progeny devices to known concentrations of radon or radon progeny as a compensated service.* [420 ILCS 44/15]

"Living Area" means a structural area in a home currently lived in or an area that has sufficient heat and height to enable reasonable year round occupancy, such as a unfinished basement with a concrete floor or an enclosed porch ~~with little or no heat~~, that an occupant or homeowner could use for living space without renovations.

"Long Term Measurement" means measurements lasting 91 days or more; closed building conditions are not required, but are recommended.

"Measurement" means any radon or radon progeny tests, laboratory analysis, or exposure ~~in a known of~~ radon or radon progeny in the environment, ~~as in a radon chamber.~~

"Mitigation" means *the act of repairing or altering a building or building design for the purpose in whole or in part of reducing the concentration of radon in the indoor atmosphere.* [420 ILCS 44/15]

"Mitigation System" means any system designed to reduce radon concentrations in the indoor air of a building.

"Multifamily" means a classification of buildings where multiple separate housing units (three or more) for residential inhabitants are contained within one building or several buildings within one complex. Units can be next to each other (side-by-side units) or stacked on top of each other (top and bottom units).

"New Residential Construction" means *any original construction of a single-family home or a dwelling containing 2 or fewer apartments, condominiums, or town houses.* [420 ILCS 52]

"NIST" means the United States Department of Commerce, Technology Administration, National Institute of Standards and Technology (formerly National Bureau of Standards).

“NRSB” means the National Radon Safety Board.

“Normal Occupied Operating Condition” means the operating condition for the building or unique sector of the building that exists during the greatest amount of occupied time.

“Occupied” means any area of the building that is occupied or could be occupied on a regular basis for more than four hours a day

“Office Blank” means an unopened detector placed to reveal any unexpected exposures that might result from storage or handling.

“Passive Devices” means a measurement tool that collects a time- weighted average and does not provide hourly readings, that does not require external power or batteries to operate.

"Passive New Construction Pipe" or "PNC" means *a pipe installed in new construction that relies solely on the convective flow of air upward for soil gas depressurization and may consist of multiple pipes routed through conditioned space from below the foundation to above the roof.* [420 ILCS 52]

"Performance Audit" means an examination of a program, function or operation or of the management systems, procedures and records of a radon contractor to assess whether the entity is complying with the Radon Industry Licensing Act [420 ILCS 44], this Part and its Quality Assurance Program.

"Person" means *entities, including, but not limited to, an individual, company, corporation, firm, group, association, partnership, joint venture, trust, or government agency or subdivision.* [420 ILCS 44/15]

"Picocurie Per Liter" or "pCi/L" means 2.2 disintegrations per minute of radioactive material per liter of air.

“Project” means radon measurements in an individual building, in multiple units in a building, in multiple buildings in a complex, or multiple buildings on the same parcel that is carefully planned in accordance with a Quality Assurance Program that includes Quality Controls.

“Quality Assurance Program” or “QAP” means the overall program or management system established to assign responsibilities and authorities, define policies and requirements, and provide for the performance and assessment of work.

“Quality Control” or “QC” means the system of activities to ensure a quality measurement is made. This includes calibrations, backgrounds, duplicates, blank and spiked measurements; inter-laboratory comparisons; audits; and other control activities.

"Radon" means a *gaseous radioactive decay product of uranium or thorium*. [420 ILCS 44/15]

"Radon Chamber" means a standard test atmosphere for radon. See STAR.

"Radon Contractor" or "Contractor" means *a person licensed to perform radon or radon progeny mitigation or to perform measurements of radon or radon progeny in an indoor atmosphere*. [420 ILCS 44/15]

"Radon Progeny" means *any combination of the radioactive decay products of radon*. [420 ILCS 44/15]

"Radon Resistant Construction" means *the installation of passive new construction pipe during new residential construction*. [420 ILCS 52/15]

"Radon Service Provider" means a radon contractor, laboratory, or person who performs laboratory analysis.

“Relative Percent Difference” or “RPD” means a statistic used to evaluate the difference between two measurements when there is no evidence to support one being more accurate than the other. The RPD normalizes the difference between two measurements by dividing by the best estimate of the true value, which in this case is the mean of the two results. The difference is normalized, compared as a fraction, to the mean of the two results as there is no reason to assume that one measurement is more accurate than the other, and over time a set of RPD values can be used as an estimate of precision.

"Renewal" means issuance of a license that is expiring, has expired or has been previously terminated.

"Research" means Agency-approved scientific investigation by testing and/or mitigating for radon or radon progeny.

"Residential" means a single-family home or a dwelling containing 2 or fewer apartments, condominiums, or town houses.

"Residential Building Code" means *an ordinance, resolution or law that establishes standards applicable to new residential construction*. [420 ILCS 52/15]

"Residential Building Contractor" means *any individual, corporation or partnership that constructs new residential buildings*. [420 ILCS 52/15]

"Residential Real Estate Measurement" means a measurement of radon in a single family home, duplex or an individual condominium unit that may be requested by a party not residing in the dwelling and that are performed in, or as a result of, or in expectation of, a real estate transaction. Based on the time sensitive nature and multiple stake-holder dynamic of real estate transactions, only the time sensitive testing measurement strategy is appropriate.

"School" means an educational institution designed to provide learning spaces and learning environments for the teaching of students under the direction of teachers in accordance with the Illinois School Code [105 ILCS 5/]. Schools include facilities for religious educational purposes, school business offices, colleges, universities, and professional training centers.

"School Screening Measurement" means a measurement of radon performed by school district staff in accordance with the Illinois School Code [105 ILCS 5/10-20.48].

"Severe Storm" means a storm that generates winds of 58 mph, and/or 1-inch diameter hail and that produces tornadoes, not necessarily in that order.

"Short Term Measurement" means measurements conducted for at least 48 hours and up to 90 days; closed building conditions are required for measurements lasting 7 days or less. In measurements lasting more than seven days and less than 90 days, closed building conditions shall be maintained as much as possible while the measurement is in progress.

"Soil Gas" means the gas mixture present in soil that may contain radon.

"Soil Gas Retarder" means a continuous membrane that at a minimum complies with ASTM E1745 class A, B or C of 6 mil (3 mil cross-laminated) polyethylene or equivalent flexible material used to retard the flow of soil gases into a building. The ASTM E1745 class A, B or C specifications include permeance, tensile strength, and puncture resistance.

"Stack Effect" means the overall upward movement of air inside a building that results from heated air rising and escaping through openings in the building envelope, thus causing indoor air pressure in the lower portions of a building to be lower than the pressure in the soil beneath or surrounding the building foundation.

"Standard Test Atmosphere for Radon" or "STAR" means a standard test

atmosphere for radon, often called a radon chamber and termed STAR by ISO/IEC standards, including the standard for generating reference radon atmospheres..

"Subfloor" means a concrete slab and other approved permanent floor system that directly contacts the ground and is within the walls of the living spaces of the building.

"Sub-Membrane Depressurization" or "SMD" means a radon control technique designed to achieve lower air pressure in the space under a soil gas retarder membrane laid on the crawlspace floor and sealed, relative to air pressure in the crawlspace, by use of a vent or fan-powered vent drawing air from beneath the membrane.

"Sub-Slab Depressurization (Active)" or "SSD (Active)" means a radon control technique designed to achieve lower sub-slab pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the concrete slab.

"Sub-Slab Depressurization (Passive)" or "SSD (Passive)" means a radon control technique designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a vent pipe (without a fan) routed through the conditioned space of a building and connecting the sub-slab area to the outdoor air. This system relies primarily on the convective flow of warmed air upward in the vent to draw air from beneath the concrete slab.

"Time Sensitive Testing" means a measurement strategy that involves a single phase of testing, requiring enhanced quality control measures. Time-sensitive tests include simultaneous and continuous monitor testing. The decision to mitigate is based upon the results of the simultaneous measurements or the single continuous monitor test.

"USEPA" means the United States Environmental Protection Agency.

"Variable Air Volume" or "VAV" means a type of heating, ventilating, and/or air-conditioning (HVAC) system. Unlike constant air volume systems, which supply a constant airflow at a variable temperature, VAV systems vary the airflow at a constant or varying temperature. The advantages of VAV systems over constant volume systems include more precise temperature control, reduced compressor wear, lower energy consumption by system fans, less fan noise, and additional passive dehumidification.

"Variance" means an officially granted exception to a regulation. Such exceptions may be granted on a case-by-case basis for some persuasive reason shown.

"Working Level" or "WL" means any combination of short-lived radon progeny in 1 liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha particle energy. The short-lived radon progeny for radon-222 are: polonium-218, lead-214, bismuth-214 and polonium-214.

"Working Level Month" or "WLM" means a unit of exposure used to express the accumulated human exposure to radon decay products. It is calculated by multiplying the average working level to which a person has been exposed by the number of hours exposed and dividing the product by 170.

Section 422.30 Exemptions from Requirements for a License

The Agency may, upon application or upon its own initiative, grant such exemptions or exceptions from the requirements of this Part as it determines are authorized by law and will not result in a hazard to public health and safety. The following persons are exempt from the licensing requirements of this Part:

- a) A person performing radon measurements or mitigation on a dwelling in which the person resides.
- b) A person temporarily practicing in Illinois who possesses a license granted by another state's regulatory authority that is recognized by this State under principles of mutual reciprocity.
- c) Retail stores that only sell or distribute radon sampling devices but are not engaged in a relationship with the client for other services such as home inspection or representation as in a real estate transaction and that do not perform laboratory analysis, measurement or mitigation services.
- d) Persons who do not perform radon measurements or mitigation, but who are working under a grant from the Agency for the purpose of disseminating beneficial information to the public, such as educational institutions, the American Lung Association, and local public health officials who disseminate radon measurement devices to the public.
- e) A person performing diagnostic tests for the purpose of assessing site decontamination in accordance with a radioactive materials license granted by the Agency. Diagnostic tests shall not be used as a basis for a decision to, or not to, mitigate the radon level within a building.
- f) Employees of the Agency performing measurements or mitigations as part of their official duties.
- g) School district employees performing radon screening measurements in

accordance with the exemptions outlined in Sections 10-20.48 and 34-18.39 of the School Code [105 ILCS 5/].

Section 422.40 Categories of Licenses

- a) Radon Measurement Professional license
- b) Radon Measurement Technician license

Section 422.45 Form, Location and Retention of Records

- a) Each record required by this Part and other applicable Parts of Title 32 shall be legible throughout the specific retention period. The record may be the original or a reproduced copy provided that the copy is authenticated by authorized personnel and legible. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records such as letters, drawings, and specifications shall include all pertinent information, stamps, initials and signatures. Adequate safeguards against tampering with and loss of records shall be maintained throughout the retention period, even if the license expires or is terminated.
- b) Each professional licensee shall maintain the records required by this Part and, at the request of the Agency, make his or her records required in accordance with this Part, and make himself or herself, available during normal business hours, in the offices of the Agency, for a performance audit of the license.
- c) At the time of application for a license or renewal, the applicant shall specify, for Agency approval, a location where records required by this Part and other applicable Parts of Title 32 Ill. Adm. Code shall be maintained for inspection by the Agency.
- d) Records required by this Part or other Parts of Title 32, including but not limited to records of radon measurements, mitigations, Quality Assurance Programs, calibration measurements, equipment repairs and worker protection plans, shall be retained by the licensee for at least 5 years or the length of time of any warranty or guarantees, whichever is longer.

Section 422.50 Application for Licenses

- a) Any person applying to the Agency for a new license or a renewal of a license to perform radon-related measurement services shall:
 - 1) Submit a complete and legible application through the ~~HEMAIEMA-~~
OHS Radon Licensing Portal; and

- 2) Pay the appropriate non-refundable fee prescribed in Section 422.100; and
 - 3) Meet the licensing requirements, as applicable, and as set forth in Section 422.60; and
- b) Any person who anticipates conducting radon-related measurement services shall receive the license prior to providing such services in Illinois.
 - c) The Agency may at any time after the filing of the original application, and before the expiration or termination of the license, require further statements in order to enable the Agency to determine whether the application should be granted or denied or whether an existing license should be modified or revoked.
 - d) An application for renewal of a license shall be submitted at least 30 days prior to the expiration date of the license. An application shall be deemed filed on the date that it is received by the Agency. A radon service provider shall not provide radon services after the expiration date of a license.
 - e) The application for renewal shall demonstrate successful completion of continuing education requirements as specified in Section 422.80, as applicable, satisfactory inspection or audit results, submittal of a complete and accurate application form for renewal and the payment of the appropriate fee as specified in Section 422.100.

Section 422.60 Requirements for Issuance or Renewal of Licenses

- a) The Agency shall issue a Radon Measurement Professional license to any individual who fulfills the following requirements:
 - 1) Is at least 18 years of age.
 - 2) Provides evidence of relevant work experience and education that meets any one of the following criteria:
 - A) Documented work history approved by the Agency demonstrating completion of 50 radon measurements; or
 - B) No experience. A new license performance audit will be performed by the Agency.
 - 3) Provides proof of successful completion of the USEPA Radon Measurement Operators Course, qualification courses approved by the

AARST-NRPP, NRSB, any entity operating a Personnel Certification Body in accordance with ISO/IEC 17024: Conformity assessment - General requirements for bodies operating certification of persons or an equivalent indoor radon and radon progeny measurement course approved by the Agency.

- 4) Has successfully completed a USEPA Radon Measurement Examination, a professional qualification exam approved by the AARST-NRPP, NRSB, and any entity operating a Personnel Certification Body in accordance with ISO/IEC 17024: Conformity assessment - General requirements for bodies operating certification of persons or an equivalent examination approved by the Agency.
- 5) Submits a complete and accurate application form prescribed by the Agency that includes, but is not limited to:
 - A) Home address;
 - B) Home phone number;
 - C) Work address;
 - D) Work phone number;
 - E) Email address;
 - F) A description of all types of indoor radon measurements performed and any other related services offered;
 - G) A description of all measurement devices the applicant or licensee plans to use;
 - H) A worker protection program description acceptable to the Agency that includes, but is not limited to, methods to reduce or minimize the radon or radon progeny exposures in the work area; and
 - I) A Quality Assurance Program description acceptable to the Agency that includes, but is not limited to:
 - i) A policy statement committing to provide quality work;
 - ii) A description of management and structure of the organization;

- iii) A listing of personnel, their qualifications and training;
 - iv) Procedures for procurement of items and services;
 - v) Procedures for maintaining documents and records;
 - vi) A description of relevant computer hardware and software;
 - vii) A planning process for radon and radon progeny services;
 - viii) Procedures for calibration and testing of instruments;
 - ix) A corrective action program; and
 - x) Standard operating procedures.
- 6) Submits standard operating procedures for the performance of radon or radon progeny measurements in each of the following categories for which they offer services:
- A) Home environment and residential real estate.
 - B) Schools, daycares, multifamily, and commercial buildings.

AGENCY NOTE: The Agency recommends using the following national standards to assist in the development of standard operating procedures:

ANSI/AARST Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes (MAH-2019).

ANSI/AARST Standard: Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings (MAMF-2017 with 1/2021 REVISIONS)

ANSI/AARST Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings (MALB-2014 with 1/2021 REVISIONS)

ANSI/AARST Radon Measurement Systems Quality Assurance (MS-QA-2019)

- 7) For an individual requesting renewal evidence of meeting the continuing education requirements in Section 422.80.

- 8) Professionals applying for or renewing a schools, daycares, multi family and commercial building certification shall provide proof of completion of an advanced certificate course.
 - 9) Measurement Professionals planning on performing radon measurements in water treatment facilities in accordance with 32 Ill. Adm. Code 622 shall submit specific standard operating procedures for the performance of those measurements.
- b) The Agency shall issue a Radon Measurement Technician license to any individual authorized to work under the general supervision of a Radon Measurement Professional licensee, if the applicant meets the following requirements:
- 1) Is at least 18 years of age.
 - 2) Provides proof of successful completion of the USEPA Radon Measurement Operators Course, qualification courses previously approved by the Agency, qualification courses approved by the AARST-NRPP, NRSB, any entity operating a Personnel Certification Body in accordance with ISO/IEC 17024: Conformity assessment - General requirements for bodies operating certification of persons or an equivalent indoor radon and radon progeny measurement course approved by the Agency.
 - 3) Has successfully completed a USEPA Radon Measurement Examination, an Illinois Qualification Examination previously provided by the Agency, a professional or technician qualification exam approved by the AARST-NRPP, NRSB, any entity operating a Personnel Certification Body in accordance with ISO/IEC 17024: Conformity assessment - General requirements for bodies operating certification of persons or an equivalent examination approved by the Agency
 - 4) Submits a complete and accurate application form prescribed by the Agency that includes, but is not limited to:
 - A) Home address;
 - B) Home phone number;
 - C) Work address;
 - D) Work phone number; and
 - E) Email address.

- 5) For an individual requesting renewal, evidence of meeting the continuing education requirements in Section 422.80.

Section 422.65 Terminating a License

- a) Any person licensed by the Agency may cease licensed activities and terminate his or her license at any time.
- b) The licensee desiring to terminate his or her license shall submit to the Agency, within 15 days after ceasing to provide licensed services, the following information:
 - 1) A request in writing stating the last date of any licensed activity;
 - 2) The original license document; and
 - 3) The location where records will be maintained in compliance with Section 422.45.
- c) The licensee shall allow the Agency to perform an audit that was scheduled before the licensee submitted a request to terminate the license.

AGENCY NOTE: Failure to pay the annual fee DOES NOT automatically terminate an Illinois radon license. The Agency must be notified in writing if a license is to be terminated.

Section 422.70 Conditions of Licenses

- a) Any person licensed by the Agency to perform radon measurements shall comply with the requirements provided in Sections 422.130 and 422.135, as applicable, to the measurement type performed and the devices used.
- b) Any person licensed by the Agency to perform radon measurements shall use devices approved by AARST-NRPP, NRSB, any entity operating a Personnel Certification Body in accordance with ISO/IEC 17024: Conformity assessment - General requirements for bodies operating certification of persons.
- c) No unlicensed individual shall perform radon measurement activities without the direct on-site supervision of a licensed individual.
- d) Within 45 days after providing radon measurements, the person providing the service shall report the results in picocuries per liter (pCi/L) to the client or their representative.

- e) Upon written request, the person providing the service shall report the results in picocuries per liter (pCi/L) to the owner or occupant of the building.
- f) Licensees shall comply with 32 Ill. Adm. Code 340. This means that the radiation exposure shall not exceed 30 pCi/L or 0.3 WL, based on continuous workplace exposure for 40 hr/week, 52 weeks per year and shall not exceed 4 working level months (WLM) over a 12 month period, using an equilibrium ratio of 50 percent to convert radon exposure to WLM.
- g) Records of radon measurements, Quality Assurance Programs, calibration measurements, equipment repairs and worker protection plans shall be retained by the licensee for a least 6 years or the length of time of any warranty or guarantees, whichever is longer.
- h) No person shall interfere with, or cause another to interfere with, the successful completion of a radon measurement.
- i) Mitigators who are also licensed to perform measurements shall not perform radon measurements before or after the installation of a mitigation system at the same address as the mitigation installation. Measurements by the mitigator may be performed after the decision to mitigate occurs if for purposes of system design or troubleshooting, but not as final verification to the owner of mitigation success.
- j) When radon measurements are performed before or after mitigation at the same address by a radon contractor, there shall be no material financial interest between the respective measurement radon contractor and mitigation radon contractor.
- j)k) Licensees shall inform the Agency of changes in contact information, such as addresses, email address, and telephone numbers within 10 days after the change is effective.
- k)l) Substantive changes to license application representations require an amendment to the license and Agency approval. Licensees shall request amendments to documents at least 30 days prior to the effective date of the desired revision.
- l)m) The licensee shall comply with all the applicable provisions of this Part.
- m)n) The licensee shall comply with its Agency-approved Quality Assurance Program.
- n)o) Professional licensees shall provide general supervision of technician licensees working under their Quality Assurance Program.

Section 422.75 Requirements for Variance Approval

- a) Radon contractors deviating or varying from the requirements ~~standards~~ in this Part shall notify the Agency ~~in writing~~ via the Radon Licensing Portal.
- b) Approval from the Agency in writing must be received prior to the commencement of work.
- c) Written notification to the Agency shall include:
 - 1) Written acknowledgement signed by the client stating that the client understands the reasons the contractor plans to deviate from the standards of this Part;
 - 2) The specific requirement the radon contractor is varying from;
 - 3) The technical basis for the measurement technique and description of the functional accomplishments that will be achieved; and
 - 34) The identity of the client and the address of the building, including the zip code.

Section 422.80 Continuing Education Requirements

All applicants for renewal of individual licenses shall provide evidence of having participated in an Agency-approved program of continuing education as indicated in this Section:

- a) The required continuing education per year for categories of licenses issued pursuant to this Part is as follows:
 - 1) Radon Measurement Professional 6 credits
 - 2) Radon Measurement Technician 6 credits

AGENCY NOTE: An individual who is licensed for both Measurement and Mitigation needs 6 credits per year for each license (i.e., 12 credits per year).

- b) Continuing education (CE) credits may be obtained via participation in courses or teaching approved courses.
- c) Licensed individuals shall receive CE credits for an approved radon course only once during a 5 year interval.

- d) The basis for a unit of continuing education credit shall be the contact hour (50 minutes) of lecture. Activity other than lecture shall be submitted to the Agency for evaluation in accordance with Section 422.85.
- e) Licensees shall submit required documentation for CE as part of the application for renewal.
- f) CE credit shall be given for courses approved in accordance with Section 422.85.
- g) All applicants seeking renewal shall complete the continuing education requirements in Section 422.80 except, when the license has been expired or terminated, the person may take the appropriate qualification course and radon licensing exam in accordance with Section 422.60 as an alternative to the required CE.

Section 422.85 Agency Approval of Radon Courses

- a) Courses previously approved by the Agency will expire on January 1, ~~2025~~2026.
- b) The Agency shall accept “Category I” courses approved by the AARST-NRPP, NRSB, and any entity operating a personnel certification body in accordance with ISO/IEC 17024: Conformity assessment - General requirements for bodies operating certification of persons.

Section 422.100 Fees

- a) Application fees shall be submitted as follows:
 - 1) Initial application for professional or technician license \$125
 - 2) Reinstatement application for expired professional license \$250
 - 3) Reinstatement application for expired technician license \$125
 - 4) New application for terminated, suspended, or revoked professional license \$500
 - 5) New application for terminated, suspended, or revoked technician license \$250
- b) Annual fees
 - 1) Radon Measurement Professional license \$500
 - 2) Radon Measurement Technician license \$250

- c) Billing year is May 1 through April 30 for annual fees. Fees assessed in accordance with this Section are non-refundable.
- d) Annual fees will continue to accrue until license expiration, unless the license is terminated in accordance with Section 422.65, suspended, or revoked. Failure to terminate the license prior to the start of the billing year will result in that year's fees to be owed the Agency.
- e) The appropriate fees shall be paid within 60 days of the date on the invoice issued by the Agency.

Section 422.110 Reports to the Agency

- a) All individuals licensed to perform radon measurements and former licensees shall submit to the Agency annually on ~~February~~ March 31st all radon and radon progeny measurements performed in the preceding year. The following information shall be submitted by a method prescribed by the Agency:
 - 1) Address, city, state, zip code.
 - 2) Start date and stop date.
 - 3) Mitigation System
 - 4) Measurement Value
 - 5) Real Estate
 - 6) Floor level
 - 7) Location type
 - 8) Location other description
 - 9) Device type
 - 10) Valid test
 - 11) Invalid reason
 - 12) Active or passive mitigation

- 13) Tag number
- 14) Building type

AGENCY NOTE: Instructions for the specific information and formatting are available from the Agency or on the Agency website.

- d) All licensees shall report apparent non-compliances with either the Radon Industry Licensing Act, this Part, or 32 Ill. Adm. Code [421-420](#) and [422-421](#) to the Agency within 45 days upon discovery [via the Radon Licensing Portal](#).

Section 422.120 Disciplinary Action by the Agency

- a) The Agency may refuse to issue or to renew, or may suspend or revoke, a person's license, or take other disciplinary action as the Agency may deem proper, including fines not to exceed \$1,000 for each violation, with regard to any license for any one or a combination of the following causes or those listed in Section 45 of the Radon Industry Licensing Act [420 ILCS 44/45]:
 - 1) Knowingly causing a material misstatement or misrepresentation to be made in the application for a license, if such misstatement or misrepresentation would impair the Agency's ability to assess and evaluate the applicant's qualifications for a license pursuant to this Part, such as a misstatement or misrepresentation regarding training or experience;
 - 2) Willfully evading the statute or regulations pertaining to a license, or willfully aiding another person in evading the statute or regulations pertaining to a license;
 - 3) Conviction of a crime under the laws of any United States jurisdiction that is a felony or of any crime that directly relates to the practice of detecting or reducing the presence of radon or radon progeny. Consideration of such conviction of an applicant shall be in accordance with 420 ILCS 44/46;
 - 4) Misrepresenting the capabilities of a device for detecting and measuring radon or radon progeny or misrepresenting the results of a test to detect or measure radon or radon progeny;
 - 5) Gross and willful overcharging for professional services, including filing false statements for collection of fees or moneys for which services are not rendered;
 - 6) A person knowingly makes a false material statement to an Agency employee during the course of official Agency business;

- 7) Failure to make records available for audit or inspection at all reasonable times, such as during usual business hours;
 - 8) *Failing, within 60 days, to provide information in response to a written request made by the Agency that has been sent by mail to the licensee's last known address [420 ILCS 44/45(g)];*
 - 9) *Failure to file a return or to pay the tax, penalty or interest shown in a filed return, or to pay any final assessment of tax, penalty, or interest, as required by a tax Act administered by the Department of Revenue, until such time as the requirements of any such tax Act are satisfied [420 ILCS 44/45(q)]; or*
 - 10) Failing to meet child support orders as required in Section 10-65 of the Illinois Administrative Procedure Act [5 ILCS 100/10-65]. The action will be based solely upon the certification of delinquency made by the Department of Healthcare and Family Services, Division of Child Support Enforcement, or the certification of violation made by the court. Further process, hearing or redetermination of the delinquency or violation by the Agency shall not be required (see IAPA Section 10-65(c)).
- b) If, based upon any of the grounds in subsection (a) of this Section or Section 45 of the Radon Industry Licensing Act, disciplinary action is initiated, the Agency shall notify the person and shall provide an opportunity for a hearing in accordance with 32 Ill. Adm. Code 200. An opportunity for a hearing shall be provided before the Agency takes action to suspend or revoke a person's license, unless the Agency has evidence of imminent danger as provided in subsection (d) of this Section.
 - c) If the Agency finds that removal or refusal to issue or renew accreditation is warranted, the usual action shall be a suspension or denial of licensure for up to one year. The term of suspension or denial may be reduced by the Director, based upon evidence presented, if the conditions leading to the Preliminary Order for Suspension can be cured in less than 1 year. However, if the Agency finds that the causes are of a serious or continuous nature, such as past actions that posed an immediate threat to public health or safety, deficiencies that cannot be cured within one year or frequent child support arrearages, the Agency shall revoke the person's license or deny the application.
 - d) The Director may summarily suspend the license of a licensee without a hearing, simultaneously with the institution of proceedings for a hearing, if the Director finds that evidence in his or her possession indicates that continuation of the contractor in practice would constitute an imminent danger to the public. *If the*

Director summarily suspends a license without a hearing, a hearing by the Agency shall be held within 30 days after the suspension has occurred and shall be concluded without appreciable delay. [420 ILCS 44/50] The hearing shall be held in accordance with 32 Ill. Adm. Code 200.

- e) When a person's license is suspended or revoked, the person shall surrender the license to the Agency and cease licensed activities.
- f) A person whose license has been revoked may seek reinstatement of the license by filing with the Agency a petition for reinstatement. Petitions may be filed one year or more after the beginning of the revocation period. The person shall be afforded a hearing in accordance with 32 Ill. Adm. Code 200 and shall bear the burden of proof of establishing that the license should be reinstated due to rehabilitation or other just cause.
- g) A person who violates any provisions of this Part shall be guilty of a business offense and shall be assessed a penalty in accordance with Section 35 of the Act.

Section 422.130 Conducting Measurements of Radon in Homes

This Section provides minimum requirements for measuring radon in a residential building for both home environment measurements and residential real estate measurements.

- a) Testing Devices
 - 1) All test devices used shall be listed by one of the following authorities:
 - A) The ~~National Radon Proficiency Program (AARST-NRPP)~~.
 - B) The ~~National Radon Safety Board (NRSB)~~.
 - C) Any entity operating a personnel certification body in accordance with ISO/IEC 17024: "Conformity assessment - General requirements for bodies operating certification of persons".
 - 2) Test devices shall be used in compliance with both this Part and instructions provided by the manufacturer that relate to device-specific needs. Devices shall be used that are designed for conditions and duration of deployment.
- b) Summary of Testing Procedures

- 1) Testing shall begin with a short term measurement under closed building conditions to quickly identify if a radon hazard is present.
- 2) Testing is to be conducted in accordance with procedures required in either:
 - A) Time Sensitive testing where a single testing event is used to quickly determine if mitigation is necessary. This method is for situations where mitigation decisions are needed relatively quickly, such as within several days or weeks to accommodate the time sensitive nature of home sales. Short term testing is a measurement strategy that requires enhanced quality control measures and includes simultaneous and continuous monitor testing.
 - B) Extended testing where an initial short-term test is followed by confirmatory short-term or long-term test. This method is for situations where an extended time period for making a mitigation decision is available, such as within several weeks or months.

Agency Note: Additional requirements are provided in Section (e)(4) for testing individual dwellings within a shared building and Section (g)(2) for post-mitigation testing.

c) Choosing a Test Location

- 1) Choosing a Floor or Level of a Home
 - A) Short term or long term measurements shall be made, at the same time, in each lowest structural living area. For example, a split-level building with a basement, a slab-on-grade room and a room over crawlspace shall have measurements made in each of the foundation types: the basement, a slab-on-grade room and a room over the crawlspace.
 - B) Additional test locations shall be included for large homes, where the footprint on the level of the home being tested is over 2,000 square feet.
- 2) Choosing a Room
 - A) Measurements shall be made in rooms that can be regularly occupied by individuals, such as family rooms, living rooms, dens, playrooms and bedrooms.

- B) Activated charcoal and liquid scintillation devices of any type shall not be placed in bathrooms, kitchens, laundry rooms, spa rooms or other areas of high humidity.

3) Choosing a Location Within a Room

- A) Detectors shall be located in the general breathing zone, undisturbed during the measurement period and shall be located not less than:
 - i) Three feet from exterior doors, windows to the outside;
 - ii) One foot from the exterior wall of the building;
 - iii) Twenty inches above the floor;
 - iv) One foot below the ceiling but not to exceed 6 feet from the floor;
 - vi) Four inches away from other test detectors and objects that are above or to the side of the detector;
 - vii) Seven feet from sump pits.

AGENCY NOTE: In rooms above two different foundations, if the room is less than 2,000 square feet, only one device needs to be placed centrally in the room.

- B) ~~Where d~~ Detectors shall not be located inside closets, cabinets, sumps, crawl spaces, mechanical/furnace closets, or nooks within the building foundation.
 - ~~i) Inside closets, cabinets, sumps, crawl spaces, or nooks within the building foundation.~~
 - ~~ii) Four Feet from heat sources, such as appliances, radiators, fireplaces, or in direct sunlight.~~
 - ~~iii) Four Feet from drafts caused by fans, heating and air conditioning vents, or in enclosed areas of high air velocity such as mechanical/furnace closets.~~
- C) Placing detectors four feet from heat sources, such as appliances, radiators, fireplaces, four feet from drafts caused by fans, heating and air conditioning vents, or in direct sunlight shall be avoided.

d) Test Conditions Required

- 1) Closed building conditions are required for measurements lasting 7 days or less. In measurements lasting more than seven days and less than 90 days, closed building conditions shall be maintained as much as possible while the measurement is in progress. Closed building conditions are required to be:
 - A) Initiated 12 hours prior to the test for tests lasting less than 4 days;
 - B) Maintained throughout the test period and
 - C) The following conditions shall be complied with during closed-building conditions:
 - i) All windows shall be kept closed on all levels of the building including areas not being tested. Individuals licensed in accordance with the Home Inspector License Act [225 ILCS 441] may momentarily open and reclose windows when performing an inspection, after informing the measurement licensee of the inspection.
 - ii) All external doors shall be closed except for normal entry and exit.
 - iii) Heating and cooling systems shall be set to normal occupied operating conditions with temperature settings between 65° and 80° F.
 - iv) HVAC system fans to be set to the lowest circulation volume and frequency.
 - v) Systems that temporarily ventilate with outdoor air for seasonal comfort or energy savings shall be set to the lowest seasonal ventilation condition that occurs during the year.
 - vi) Whole-house fans shall not be operated.
 - vii) Fireplaces that burn solid, liquid or gas fuels (unless a primary/normal source of heat for the building) shall not be operated.
 - viii) Clothes dryers, range hoods, and bathroom fans operation should not be ~~avoided~~ operated in excess of normal living

conditions.

- 2) Additional clarification on closed building conditions requirements for specific components.
 - A) Broken windows or doors shall be sealed closed in an air tight manner.
 - B) Interior partition or stairway doors have no special requirement.
 - C) Doors leading into a garage, garage doors, and pet doors (includes flap openings) shall be kept closed except for momentary entry and exit.
 - D) Ceiling fans and portable fans shall not be operated in rooms where measurements are in progress.
 - E) Window fans shall be removed or sealed shut and not operated.
 - F) Humidifiers, dehumidifiers, and central vacuum cleaner systems may be operated normally.
 - G) Crawl space humidity control systems shall be operated normally.
 - H) Passive vents for combustion air makeup shall be left open.
 - I) Radon Contractors shall document the position of Passive-crawl space vents on placement and pickup of measurement devices shall be closed, if operable.
 - J) Radon Contractors shall document the position of Fireplace dampers and doors on placement and pickup of measurement devices shall be closed.
 - K) Combustion appliance fans and fans installed in attics to ventilate only attic air and not air within the building can be operated normally.
 - L) When return air ducts from forced air heating or cooling systems are under concrete floors, testing shall be conducted with the air handlers active.
 - M) Window air conditioners shall be operated in recirculation mode only.

- N) Operation of permanently installed ventilation systems (i.e., energy recovery or heat recovery ventilators) that bring outdoor air into the home throughout the year is permitted to continue during the test so long as:
 - i) The system is set to the lowest ventilation condition that occurs for any season; and
 - ii) All thermostats in the building are set to normal occupiable temperature.
- 3) Additional requirements for new construction, renovations, and repairs.
 - A) All openings to the exterior due to incomplete construction, structural defect, or disrepair, shall be closed or sealed at least 12 hours prior to initiating the test.
 - B) The following items shall be completed or installed at least 12 hours prior to initiating the test:
 - i) Heating/cooling systems set to normal occupied operating conditions with temperature settings between 65° and 80° F.
 - ii) All windows and exterior doors installed with hardware and seals.
 - iii) All insulation and exterior siding.
 - iv) All wall and ceiling coverings to be completed including interior drywall or paneling.
 - v) All fireplaces and fireplace dampers installed.
- e) Testing Procedures
 - 1) Detector Deployment Periods
 - A) Short term measurements shall be at least 48 hours of valid sampling time and be conducted under closed building conditions in accordance with subsection 422.130(d).
 - B) Long term measurements for test durations greater than 91 days, closed building conditions are not required.

- 2) Time Sensitive Testing Requirements
 - A) Option 1: Simultaneous Testing. Simultaneous tests shall be conducted using two short-term test devices at the same time in the same location, 4 to 8 inches apart.
 - B) Option 2: Continuous Monitor. Continuous monitor tests shall be conducted using a monitor that records retrievable hourly measurements.
- 3) Extended Testing Requirements
 - A) Testing shall begin with short term testing under closed building conditions to quickly identify if a radon hazard is present. Testing is conducted using a detector at each test location in accordance with section 422.130(c)(1)(A).
 - B) Retest all locations in the home if any of the initial short-term tests meet or exceed the action level of 4.0 pCi/L.
 - i) If the first short-term test is equal to or greater than 8.0 pCi/L, a second short-term test should be conducted without delay.
 - ii) If the first short-term test is equal to or greater than 4.0 pCi/L, but is 7.9 pCi/L or less, either a second short-term test or a long-term test should be conducted.
- 4) Shared Building Testing
 - A) When testing individual dwellings within a shared building, testing is permitted if closed-building conditions in other dwellings are not achieved when it is beyond the control of the person conducting the test. However, this situation requires that the conditions, circumstances, and appropriate recommendations are described in writing for inclusion with reports when distributed.
 - B) Testing a sizable portion of dwellings within a shared building. If the purpose of testing is to assess radon hazards for an entire building or a sizable portion of a building, testing shall be conducted in accordance with Section 422.135.
 - C) Shared heating and cooling systems. Where heating and cooling

systems add outdoor air ventilation to a residential building or where a single air handler distributes air to multiple dwellings, testing is to be conducted in accordance with Section 422.135.

f) Conducting the Test

- 1) Short term tests shall not be conducted if closed building conditions in accordance with this Part cannot be maintained across the test period.
- 2) If closed building conditions were not maintained for 12 hours prior to deployment, the radon test shall be conducted with one of the following options:
 - A) The radon test is postponed until at least 12 hours of closed-building conditions have been maintained prior to initiating the test; or
 - B) The test period is extended to 4 days or more after closed building conditions are initiated; or
 - C) If testing with a continuous monitor, the test period is extended. For this option, device features or other methods are to be employed to obtain an average reading that represents no less than 48 hours of contiguous data collected after 12 hours of closed-building conditions have been maintained.
- 3) If closed conditions are observed to pose a health hazard, radon testing shall not be conducted and shall be rescheduled for a time when conditions are safe.
- 4) When temporary or unexpected conditions are encountered that might adversely influence test results, test reports shall include descriptions of such concerns.

g) Actions Based on Test Results

- 1) Requirements for Side by Side (Duplicate) Test Results
 - A) When two test devices were deployed to test the same testing location, the results shall be considered valid if:
 - i) Side by side measurement results that are both equal to or greater than 4.0 pCi/L shall agree with a Relative Percent Difference (RPD) of less than 36 percent. If the RPD is greater than 36 percent, the radon contractor shall

investigate, document, and correct the sources of the error.

- ii) Side by side measurement results that are both less than 4.0 pCi/L shall agree with an RPD of less than 67 percent. RPD is the difference between the 2 results divided by the average of the 2 results times 100. If the RPD is greater than 67 percent, the licensee shall investigate, document, and correct the sources of the error.

- B) When two test devices were deployed to test the same testing location and one test result is above the action level and the other test result is below the action level the following criteria shall be used to determine the validity of the measurements:

- i) If one of the measurements is equal to or greater than 4.0 pCi/L and one is less than 4.0 pCi/L and the higher result is less than twice the lower result, the average of the test results shall be considered valid.

- ii) If one of the measurements is equal to or greater than 4.0 pCi/L and one is less than 4.0 pCi/L and the higher result is greater than twice the lower result, the client shall be informed of the discrepancy and the simultaneous measurements repeated at no additional cost to the client.

- 2) The following requirements for post mitigation testing shall be followed to determine the effectiveness of mitigation efforts.

- A) Buildings constructed with radon-resistant features that have not been activated with a fan shall be tested in accordance with this Part.

- B) Where radon resistant features include an active mitigation system, the following additional procedures are required:

- i) Measurements shall be conducted in accordance with this Part.

- ii) Short term measurements shall be conducted no sooner than 24 hours after activation of a mitigation system fan or completion of other mitigation efforts.

- C) Testing shall be conducted in the same location as the pre-mitigation test, whenever possible.

D) When an ASD system exhausts below the roof, an additional test in the rooms immediately adjoining the outside exhaust location shall be conducted.

h) Additional Requirements for Professional Services

1) For tests conducted during a home sale, testing strategies outlined in this Part for time sensitive testing are required.

2) Non-Interference Agreement. Failure to comply with required testing conditions often occurs when residents are not properly informed about the necessary conditions; therefore, a written notice shall be provided to:

A) The buyer, seller, occupant, real estate professional or other individual in control of the property shall sign a non-interference agreement indicating an understanding of the testing conditions, the penalties for interference with an in-progress radon measurement, and that any test interference that is detected will be documented in the report and will invalidate the measurement results.

B) If such an agreement cannot be or will not be signed by the buyer, seller, occupant, real estate professional or other individual in control of the property, the radon measurement licensee shall document in the measurement report why the signature was not obtained

C) Communications to individuals in control of the property shall include essential elements required for compliance with closed building conditions.

3) To fulfill minimum requirements for verifying test conditions, all of the following steps are required:

A) Inform the person responsible for building operation of the required test conditions;

B) The licensee shall post at every building entry and in a conspicuous location a Radon Test in Progress notification. The notice shall be posted upon initiation of a radon measurement;

C) The radon contractor shall request a signature on a non-

interference agreement from the buyer, seller, occupant, real estate professional or other individual in control of the property. The non-interference agreement shall include a listing of the testing conditions, the penalties for interference with an in-progress radon measurement, and that any test interference that is detected will be documented in the report and will invalidate the measurement results. The agreement shall be retained for inspection by the Agency, and note in the report if this document was not signed;

⇨D) If the agreement cannot be or will not be signed by the buyer, seller, occupant, real estate professional or other individual in control of the property, the radon contractor shall document why the signature was not obtained.

⇨E) Visual inspections shall be conducted by a radon contractor of the dwelling to evaluate observed conditions and document deviations from protocol and temporary conditions that might affect the test result:

- i) Upon detector placement to help ensure all closed-building conditions and other protocol requirements are met; and
- ii) Upon retrieval of the detector to help verify that closed-building conditions and other requirements are still being maintained, detector placement has not changed, and tamper seals, if employed, have not been broken.

Agency Note: It is recommended that tests include methods to prevent or attempt to detect interference with testing conditions or the testing detector.

E)F) It is not required to inspect for closed building conditions during the 12-hour period prior to the test or between placement and retrieval of the detectors.

~~i) Temporary Radon Reduction Measures~~

~~1) Temporary radon reduction measures include:~~

~~A) The introduction of unconditioned air into the building; or~~

~~B) Closure of normally accessible areas of the building; or~~

~~C) Lowering the thermostat below its normal use range, such as 65° and 80° F.~~

~~2) Any of the conditions listed in subsection (i) of this Section shall invalidate measurement results. The Radon Measurement licensee shall not conduct a measurement until the conditions have been corrected. The Radon Measurement licensee shall inform the client and other parties involved in a real estate transaction that these conditions invalidate the measurement results.~~

~~3) Any improper radon reduction efforts that may affect the measurement results identified prior to, during, or after initial, follow up, or post-mitigation measurements shall invalidate the measurement results. The Radon Measurement licensee shall not conduct a measurement until the improper conditions have been corrected.~~

~~4) Post mitigation measurements shall not be conducted if any improper radon reduction efforts that may affect the measurement results are identified.~~

ji) When Radon Measurements Shall Not Be Made

1) Short-term radon measurements of less than 96 hours shall not be conducted during severe thunderstorms or periods of sustained high winds (40 miles per hour or more for one hour). Radon Measurement licensees shall check and document local weather forecasts prior to placing short-term measurement devices when the measurement period is less than 96 hours.

AGENCY NOTE: The National Weather Service defines severe thunderstorms as storms that ~~are capable of~~ producing, a tornado, winds of at least 58mph, and/or hail that is an inch or larger in diameter with wind gusts over 58 mph. High Winds means that sustained winds of 40 mph for one hour.

2) Radon measurements of any duration shall not be made during renovation of a building, especially renovations involving structural changes, or during renovations of the HVAC systems or any change that disturbs the normal airflow of the building.

AGENCY NOTE: When renovations are planned, radon measurements should be made prior to renovations and immediately upon the completion of renovations.

3) Any improper radon reduction efforts performed by a radon contractor

that may affect the measurement results identified prior to, during, or after initial, follow-up, or post- mitigation measurements shall invalidate the measurement results. The Radon Measurement licensee shall not conduct a measurement until the improper conditions have been corrected.

j) Measurements of Home Mitigated by the Homeowner

- 1) Observed noncompliance by homeowners installing radon mitigation systems with the requirements of 32 Illinois Administrative Code 421, Regulations for Radon Mitigation Service Providers shall be documented in the measurement report.
- 2) Any improper radon reduction efforts performed by a homeowner that may affect the measurement results identified prior to, during, or after initial, follow-up, or post- mitigation measurements shall be documented in the measurement report.

k) Quality Assurance for Radon Measurements.

- 1) Radon Measurement licensees shall abide by the Quality Assurance Program described in subsection 422.60(a)(5)(I).
- 2) Measurements not performed in accordance with this Part shall be considered invalid and inappropriate for the purpose of determining the need for mitigation or the effectiveness of a mitigation service.

l) Measurement Reports

- 1) Radon contractors shall issue radon measurement reports in accordance with subsections 422.70(d) and 422.70(e).

Agency Note: It is acceptable for Radon Measurement Licensees, at their discretion, to provide to Radon Mitigation Licensees the results of radon measurements performed in buildings where the Radon Mitigation licensee has been contracted to perform radon mitigation. The Radon Mitigation Licensee shall not release the results provided and refer inquiries for the results to the Radon Measurement Licensee.

- 2) The following essential information shall be included in reports:
 - A) The complete address of the building measured:
 - B) Name of the company, contact information, identification of the radon contractor and radon license number:

- C) Contact information for the Agency Radon Information Line (800) 325-1245 ~~or to speak to an Agency Radon Program staff member call (217)782-1325:~~
- D) The ~~exact~~ locations of all measurement devices deployed and any information that would allow for future data comparisons and interpretations:-
- E) ~~Licenses Radon Contractors~~ shall provide the ~~exact~~ locations by providing a proportional diagram of the footprint of the building showing the configurations of the foundations, identifying the windows and doors, ~~finished and unfinished areas, room use, furnaces, hot water heaters, dryers, combustion appliances, crawlspace vents, fireplaces, mitigation systems, floor drains and foundation types,~~ indicating the front of the home and any other pertinent information that may affect the measurement:-

Agency Note: Providing photographic documentation showing the location of the testing device is acceptable to support the proportional diagram is acceptable. Photos shall be taken from a viewpoint which captures sufficient information to accurately identify the device placement in relation to two walls and height from the floor of the test location.

- F) The final result for each measurement location:
- G) The detector model or type, the detector serial number, and if an AC, AT, LS was used the name and ~~identification license~~ number of the ~~service or organization~~ licensed laboratory used to analyze the detector:
- H) The start and stop dates and times of the exposure period:
- I) Radon gas results shall be reported in pCi/L and to only one digit after the decimal (e.g. 3.2 pCi/L). If the average of two measurements produces a result of ≥ 3.95 pCi/L, standard mathematical rules should be followed, and such average shall be reported as 4.0 pCi/L:
- J) The average of collocated measurement detectors shall be reported as well as the individual results:
- K) Measurements made in separate locations shall not be averaged. Detectors located more than 8 inches from each other shall be

considered to be in separate locations.

- L) The following statement shall be included with all reports: “There is an uncertainty with any measurement result due to statistical variations and other factors such as daily and seasonal variations in radon concentrations. Variations may be due to changes in the weather, operation of the dwelling, or possible interference with the necessary test conditions.”

~~M) Any observed noncompliance’s in homeowner installed radon mitigation systems with the requirements of 32 Illinois Administrative Code 421, Regulations for Radon Mitigation Service Providers. A specific client advisory and description shall be included in the test report of observed temporary building conditions or other factors that may cause the test to not reflect the client’s risk from radon. Advisories’ shall include, but may not be limited to the following:~~

~~M)N) Any improper radon reduction efforts performed by a homeowner that may affect the measurement results identified prior to, during, or after initial, follow-up, or post- mitigation measurements shall be documented in the measurement report.~~

~~i) The property tested was vacant during the test period; or~~

~~ii) Closable passive crawl space vents were open during the test period but are normally closed in cold weather because of energy penalties or the likelihood of frozen water pipes.~~

~~N)O) Whether any Ssub-slab return ducts were observed, and air handler fan activity was minimal during the test period.~~

~~O)P) Radon contractors shall include a copy of all variance approval numbers letters issued by the Agency in accordance with section 422.75.~~

~~P) A description of any noninterference controls used such as tamper seals, control monitors or other methods, as applicable;~~

~~Q) Information on whether the responsible individual signed the noninterference agreement.~~

R-9) Where a mitigation system or efforts to mitigate radon are observed, the test report shall include:

- i) A statement that a mitigation system was observed and whether it appeared to be operating;
- ii) Mitigation Tag Number;
- iii) A statement regarding the condition of any temporary radon mitigation strategies that are not permanent installations.

3) Additional Requirements for Continuous Monitor Reports. The following additional requirements shall be met when reporting continuous radon monitor test results:

- A) Hourly data of the monitor used;
- B) The calibration date of the continuous monitor;
- C) Removal of or “backing out” portions of hourly data imbedded within the contiguous sampling period reported, such as to account for weather or other conditions, shall invalidate the measurement;
- D) The first 4 hours of data may be discarded or incorporated into the result using system correction factors. There shall be at least 44 contiguous hours of usable data to produce a valid average;
- E) The first 12 ~~or more~~ hours ~~are to~~ may be discarded in reported results as required for meeting closed-building requirements. ~~and~~

4) Requirements for reports of time sensitive measurements. The test report shall include equivalent statements for each of the following guidance advisories:

- A) Reporting Elevated Radon Concentrations. Equivalent statements for these advisories shall be included in the report:
 - i) Fix the building. Test results indicate occupants may be exposed to radon concentrations that meet or exceed the action level, 4.0 pCi/L or greater. The higher the radon concentration, the more quickly action should be taken to reduce the concentrations;

- ii) Efforts to reduce radon concentrations are not complete until retests provide evidence of effectiveness;
 - iii) Initiate short-term radon testing no sooner than 24 hours after a mitigation system is operational and within 30 days after installation of the system; and
 - iv) Test again at least every 2 years to ensure the system remains effective.
 - B) Reporting Low Concentrations. Equivalent statements for these advisories shall be included in the report:
 - i) Consider fixing the building if test results indicate radon concentrations are between 2.0 and 4.0 pCi/L. Because the hazards from radon are virtually the same for radon concentrations that are near action level thresholds, the World Health Organization recommends limiting long-term exposures to less than 2.7 pCi/L
 - ii) Retest the building at least every 2 years, including homes with radon mitigation systems.
- 5) Requirements for reports of extended testing measurements. The test report shall include equivalent statements for each of the following guidance advisories:
- A) The first short term test is 8.0 pCi/L or more conduct a second short-term test immediately. While decisions to mitigate at any time are not prohibited, the second test aids confidence that decisions are not being made based on a faulty test result.
 - B) The first short term test is greater than 4.0 pCi/L, but less than 8.0 pCi/L conduct either a short term or a long term test.
 - C) The average of two short-term tests or the result of the long term test is 4.0 pCi/L or greater, fix the building.
 - D) One short term test result is above 4.0 pCi/L and the other test result below 4.0 pCi/L and the higher test result is twice or more than the lower test result, obtaining confirmation on whether mitigation is warranted requires additional testing.
- 6) Measurement reports shall be kept for a minimum of six years.

Section 422.135 Conducting Measurements of Radon in Schools, Daycares, Multifamily, and Commercial Buildings

- a) This section addresses low-rise and high-rise structures and procedures for testing whole buildings, but is also for testing several individual rooms or dwellings within a shared building.
- b) Prior to Testing
 - 1) Radon contractors hired to test multiple units in a building, multiple buildings in a complex, or multiple building on the same parcel shall perform all measurements in a building simultaneously.
 - 2) Radon testing is permitted at any time of the year. For buildings or portions of buildings that are non-residential and not significantly occupied both day and night, the measurements shall be conducted at a time that is representative of normal occupied building operating conditions.
 - 3) Testing Devices
 - A) All test devices used shall be listed by one of the following authorities:
 - i) The ~~National Radon Proficiency Program (AARST-NRPP)~~.
 - ii) The ~~National Radon Safety Board (NRSB)~~.
 - iii) Any entity operating a personnel certification body in accordance with ISO/IEC 17024: “Conformity assessment - General requirements for bodies operating certification of persons”.
 - B) Test devices shall be used in compliance with both this Part and instructions provided by the manufacturer that relate to device-specific needs. Devices shall be used that are designed for conditions and duration of deployment.
 - 4) Determination of Who Should Conduct the Testing.
 - A) A measurement professional licensed to perform radon measurements in schools, daycares, multifamily, and commercial buildings shall be physically present during all onsite activities for

placement and retrieval of radon detectors and shall be immediately available to direct, instruct, oversee, and control activities of any other individuals placing and retrieving detectors.

- B) Names and license numbers of other licensed individuals who assist with the measurement, shall be retained in QC records and made available to the client upon request.
- C) If unlicensed individuals assist in detector placement and retrieval, the licensed measurement professional shall:
 - i) Create and present a written work plan specific to apportioned tasks and obtain evidence that the work plan is understood by all participants; or
 - ii) Verify that individuals have demonstrated, within the last 2 years, appropriate training and skills specific to detector placement and retrieval, such as completion of an approved training class.
- 5) The measurement professional licensee shall recommend in writing to the schools, daycares, multifamily, and commercial buildings management, owners, or representatives of those individuals, that a decision to mitigate should not be based on initial measurement results.
- 6) Client Communications
 - A) Prior to designing a testing plan, the radon contractor shall obtain or attempt to obtain information about the building to identify test locations.
 - B) During initial interactions with the client or in proposals to the client, the following shall be communicated in writing;
 - i) Test plan options that comply with this Section;
 - ii) Required quality control for closed-building conditions;
 - iii) The normal operating condition of the building HVAC system; and
 - iv) The possibility of delays and additional expense when the required closed-building conditions are not met.

- C) Prior to testing, the measurement professional licensee shall obtain a signed statement from the client, or client's authorized representative regarding:
 - i) Commitments to aid in quality control of closed-building conditions;
 - ii) A commitment from the onsite supervisor to distribute notices prior to testing for both occupants and other staff members;
 - iii) A commitment from the onsite supervisor to provide timely access to all test locations; and
 - iv) A commitment from the HVAC or building operations supervisor to ensure that building conditions required to achieve reliable radon tests are met. This commitment shall include, information about the HVAC systems and affirmation prior to testing that the HVAC system has been reviewed and adjusted, as needed, where systems include automated or manual controls or dampers for variable outdoor air ventilation, and variable air volume distribution (VAV) systems.

7) Assemble Building Information

- A) A method to record and track activities for each test location shall be established prior to testing, such as creation or procurement of floor plan diagrams for recording and tracking details. For tested areas, records shall be updated during test procedures:
 - i) To match current addresses;
 - ii) The current use of non-residential rooms; and
 - iii) Building foundation types such as slab-on-grade, basement and crawl space foundations in the building being tested.
- B) Building operating conditions. Testing is required during the normal occupied building operating condition.
- C) Each area served by a unique HVAC system shall be classified as a unique sector. Prior to conducting measurements, the contractor shall document temporary conditions that can adversely affect

reliability of the test result where HVAC systems are designed with:

- i) Variable outdoor air ventilation;
 - ii) Variable air volume (VAV) and Constant Air Volume CAV;
 - iii) Return-air ducts laid in soil; or
 - iv) HVAC setback for non-residential locations.
- D) The number of test devices utilized by the radon contractor shall include all planned test locations as specified in this Part and those required for quality control.
- 8) Test Device Quality Control. Any licensee conducting radon or radon decay product measurements shall establish, maintain, and follow a quality assurance plan that complies with this Part.
- A) All quality control (QC) measurements for duplicates, cross checks, spikes, and blanks associated with a testing project shall be included in report documentation as required in this Part.
 - B) The contractor shall perform all QC measurements in accordance Section 422.140.
 - C) All QC requirements shall be met for each measurement project.
- 9) The contractor shall document in writing that, prior to the measurement, the following was conducted by property management:
- A) Property staff members, such as building supervisors, maintenance staff, teachers, or office managers were notified to comply with subsection (b)(9)(B).
 - B) Property staff members are responsible for distributing notices to both tested and non-tested units and posting notices in publicly viewable locations no less than 24 hours prior to testing. The notices provided shall include:
 - i) Scheduled dates and times for test device placement and retrieval;

- ii) Essential closed-building requirements as outlined in this Part and that the conditions are required to be met no later than 12 hours prior to the test and must be maintained throughout the test period;
- iii) The State radon program website located at www.radon.illinois.gov; and
- iv) The radon contractors contact information for inquiries.

c) Test Location

- 1) A measurement shall be conducted in all dwellings and all nonresidential rooms that are occupied, or intended to be occupied, that:
 - A) Have floors or walls in contact with the ground (ground-contact).
 - B) Are closest to ground over untested ground-contact locations. Examples would include the lowest level of the building over a crawl space, utility tunnel, parking garage, or other non-habitable space that is in contact with ground.
 - C) For each residential ground-contact dwelling or living unit, a measurement shall be conducted in the lowest level that serves or could serve as a living area, sleeping quarters, office, playroom, and other general use areas that are occupied or intended to be occupied.
 - D) For non-residential ground-contact locations, a measurement shall be conducted in all ground-contact rooms, offices, classrooms, and other general use areas that are occupied or intended to be occupied.
- 2) On each upper floor, a measurement shall be conducted in at least one and not less than 10% of all dwellings and non-residential rooms that are occupied or intended to be occupied. These measurements shall be in addition to tests performed in ground-contact locations and rooms or dwellings that adjoin immediately above untested ground-contact locations.
- 3) Unless for investigative purposes, test locations shall not include hallways, closets, bathroom, shower areas, or areas that could not be routinely occupied unless they are open to other rooms that are occupied for other purposes.

- 4) Large Rooms or Open Areas.
 - A) For large rooms and open areas, one detector shall be placed for every 2,000 square feet.
 - B) Where an open-plan or pod design area has moveable walls that can physically separate an area into individual rooms, the movable walls shall be configured to divide the area into individual rooms and each resulting room shall be measured separately. Where moveable walls are absent or inoperable, the area shall be measured as one room.
- 5) In buildings with multi-zone HVAC Systems additional detectors shall be placed to adequately characterize and record differences between areas or rooms that are served by the different HVAC systems
- 6) Inaccessible Ground-Contact Locations. When restricted access is imposed by independent owners of ground-contact locations, the lowest accessible level of the building that is closest to ground shall be tested in accordance with subsection 422.135(c)(1).
- 7) Choose test locations where people are more likely to spend time, such as a finished or occupied room when this choice exists. When this choice does not exist, preferred choices are areas not currently used or finished but that could serve as a work area, playroom or an additional bedroom at some time in the future.
- 8) Choosing a Location Within a Room
 - A) Detectors shall be located in the general breathing zone, undisturbed during the measurement period and shall be located not less than:
 - i) Three feet from exterior doors, windows to the outside;
 - ii) One foot from the exterior wall of the building;
 - iii) Twenty inches above the floor;
 - iv) One foot below the ceiling but not to exceed 6 feet from the floor;
 - vi) Four inches away from other test detectors and objects that are above or to the side of the detector;

vii) Seven feet from sump pits.

B) ~~Where d~~ Detectors shall not be located inside closets, cabinets, sumps, crawl spaces, mechanical/furnace closets, or nooks within the building foundation.

~~ii) Inside closets, cabinets, sumps, crawl spaces, or nooks within the building foundation.~~

~~ii) Four Feet from heat sources, such as appliances, radiators, fireplaces, or in direct sunlight.~~

~~i) Four Feet from drafts caused by fans, heating and air conditioning vents, or in enclosed areas of high air velocity such as mechanical/furnace closets.~~

C) Placing detectors four feet from heat sources, such as appliances, radiators, fireplaces, four feet from drafts caused by fans, heating and air conditioning vents, or in direct sunlight shall be avoided.

D) Activated charcoal and liquid scintillation devices of any type shall not be placed in bathrooms, kitchens, laundry rooms, spa rooms or other areas of high humidity

d) Test Conditions Required

1) Closed building conditions are required for measurements lasting 7 days or less. In measurements lasting more than seven days and less than 90 days, closed building conditions shall be maintained as much as possible while the measurement is in progress. Closed building conditions are required to be:

A) Initiated 12 hours prior to the test for tests lasting less than 4 days;

B) Maintained throughout the test period and

C) The following conditions shall be complied with during closed-building conditions:

i) All windows shall be kept closed on all levels of the building including areas not being tested. Individuals licensed in accordance with the Home Inspector License Act [225 ILCS 441] may momentarily open and reclose windows when performing an inspection, after informing the measurement licensee of the inspection.

ii) All external doors shall be closed except for normal entry

and exit.

- iii) Heating and cooling systems shall be set to normal occupied operating conditions with temperature settings between 65° and 80° F.
- iv) HVAC system fans to be set to the lowest circulation volume and frequency.
- v) Systems that temporarily ventilate with outdoor air for seasonal comfort or energy savings shall be set to the lowest seasonal ventilation condition that occurs during the year.
- vi) Fireplaces that burn solid, liquid or gas fuels (unless a primary/normal source of heat for the building) shall not be operated.
- vii) Clothes dryers, range hoods, and bathroom fans operation should not be ~~avoided~~ operated in excess of normal living conditions.
- viii) Exhaust systems that temporarily draw air from the building such as laundries, workshops, or community kitchens or for local control of fumes should avoid excessive operation.;

2) Additional clarification on closed building conditions requirements for specific components.

- A) Broken windows or doors shall be sealed closed in an air tight manner.
- B) Interior partition or stairway doors have no special requirement.
- C) Exterior doors into non-residential rooms shall be kept closed except for momentary entry and exit of individuals who customarily enter the building.
- D) Garage doors and doors leading into a garage shall be kept closed except for momentary entry and exit.
- E) Ceiling fans and portable fans shall not be operated in rooms where measurements are in progress.
- F) Window fans shall be removed or sealed shut and not operated.

- G) Humidifiers, dehumidifiers, and central vacuum cleaner systems may be operated normally.
 - H) Crawl space humidity control systems shall be operated normally.
 - I) Passive vents for combustion air makeup shall be left open.
 - J) Radon Contractors shall document the position of Passive-crawl space vents on placement and pickup of measurements shall be closed, if operable.
 - K) Radon Contractors shall document the position of Fireplace dampers and doors on placement and pickup of measurement devices shall be closed.
 - L) Combustion appliance fans and fans installed in attics to ventilate only attic air and not air within the building can be operated normally.
 - M) When return air ducts from forced air heating or cooling systems are under concrete floors, testing shall be conducted with the air handlers active.
 - N) Window air conditioners shall be operated in recirculation mode only.
 - O) Operation of permanently installed ventilation systems (i.e., energy recovery or heat recovery ventilators) that bring outdoor air into the home throughout the year is permitted to continue during the test so long as:
 - i) The system is set to the lowest ventilation condition that occurs for any season; and
 - ii) All thermostats in the building are set to normal occupiable temperatures.
- 3) Additional requirements for new construction, renovations, and repairs.
- A) All openings to the exterior due to incomplete construction, structural defect, or disrepair, shall be closed or sealed at least 12 hours prior to initiating the test.

- B) The following items shall be completed or installed at least 12 hours prior to initiating the test:
 - vi) Heating/cooling systems set to normal occupied operating conditions with temperature settings between 65° and 80° F.
 - vii) All windows and exterior doors installed with hardware and seals.
 - viii) All insulation and exterior siding.
 - ix) All wall and ceiling coverings to be completed including interior drywall or paneling.
 - x) All fireplaces and fireplace dampers installed.
- 4) Requirements for HVAC Ventilation.
 - A) Openings designed to provide outside air for combustion appliances shall be open.
 - B) HVAC operation, including temporarily increasing outdoor air ventilation for seasonal comfort or energy savings, shall be configured to provide only the minimum volume of outdoor air that is required throughout the year when the building is significantly occupied.
 - C) For variable air volume (VAV) systems that temper room temperatures, thermostats shall be set to a normal occupied temperature with settings between 65° and 80° F in all portions of the building being tested.
- 5) When testing dwellings or rooms that are part of a shared building, closed-building conditions in accordance with this section shall be followed.
- e) Testing Procedures
 - 1) All measurement locations in each building shall be tested on the same days for:
 - A) All locations required in subsection 422.135(c); and
 - B) All locations identified for follow-up test procedures.
 - 2) Detector Deployment Periods

- A) Short term measurements shall be at least 48 hours of valid sampling time and be conducted under closed building conditions in accordance with Section 422.135(d).
 - B) Long term measurements for test durations greater than 90 days, closed building conditions are not required.
 - C) Non-residential deployment periods.
 - i) When the building or portion of the building is not occupied 24 hours a day, such as a school, daycare or office building, testing shall only be conducted when the building is occupied; or
 - ii) If testing can only occur when the building is unoccupied, the HVAC system shall be set at normal operation for when the building is occupied.
- 3) A determination of the routinely occupied times shall be made for each building prior to conducting initial testing, follow-up testing, post-mitigation testing, or in a series of sequential tests.
- A) During initial testing, the determination shall be conducted for each unique sector at locations where airflow from HVAC systems is most representative of occupied rooms within the unique sector. For follow-up testing, the evaluation shall be conducted for at least the location of the highest radon concentration found during previous measurements within each unique sector.
 - B) Devices, such as CMs, that can accurately measure the difference between average radon concentrations during occupied compared to unoccupied conditions shall be utilized.
- 4) Time Sensitive Testing Requirements
- A) Option 1: Simultaneous Testing. Simultaneous tests shall be conducted using two short-term test devices at the same time in the same location, 4 to 8 inches apart.
 - B) Option 2: Continuous Monitor. Continuous monitor tests shall be conducted using a monitor that records retrievable hourly

measurements.

5) Extended Testing Requirements

A) Testing shall begin with short term testing under closed building conditions to quickly identify if a radon hazard is present. Testing is conducted using a detector at each test location in accordance with this Section.

B) Retest locations where the initial short-term tests meet or exceed the action level of 4.0 pCi/L.

i) If the first short-term test is equal to or greater than 8.0 pC/L, a second short-term test should be conducted without delay.

ii) If the first short-term test is equal to or greater than 4.0 pC/L, but is 7.9 pCi/L or less , either a second short-term test or a long-term test should be conducted.

6) If testing buildings constructed with radon-resistant features, initial testing shall be conducted in accordance with this Part.

7) Testing after mitigation efforts shall be conducted in accordance with Part.

f) Conducting the Test

1) Short term tests shall not be conducted if closed building conditions in accordance with this Part cannot be maintained across the test period.

2) If closed building conditions were not maintained for 12 hours prior to deployment, the radon test shall be conducted with one of the following options:

A The radon test is postponed until at least 12 hours of closed-building conditions have been maintained prior to initiating the test; or

B) The test period is extended to 4 days or more after closed building conditions are initiated; or

C) If testing with a continuous monitor, the test period is extended. For this option, device features or other methods are to be employed to obtain an average reading that represents no less than

48 hours of contiguous data collected after 12 hours of closed-building conditions have been maintained.

- 3) If closed conditions are observed to pose a health hazard, radon testing shall not be conducted and shall be rescheduled for a time when conditions are safe.
- 4) When temporary or unexpected conditions are encountered that might adversely influence test results, test reports shall include descriptions of such concerns.
- 5) To fulfill minimum requirements for verifying test conditions, all of the following steps are required:
 - A) Inform the person responsible for building operation of the required test conditions;
 - B) The licensee shall post at every building entry and in a conspicuous location a Radon Test in Progress notification. The notice shall be posted upon initiation of a radon measurement;
 - C) Obtain or attempt to obtain a signed statement from the onsite supervisor or other facilitating staff member regarding a commitment to aid in the quality control of closed-building conditions.
 - D) The radon contractor is not required to inspect for closed-building conditions during the 12-hour period before the start of the test or between placement and retrieval of the detectors.
 - F) Visual inspections shall be conducted by a radon contractor of the building to evaluate observed conditions and document deviations from requirements and temporary conditions that might affect the test result:
 - i) Upon detector placement to help ensure all closed building conditions and other protocol requirements are met; and
 - ii) Upon detector retrieval to help verify that closed building conditions and other requirements are still being maintained.
 - iii) Verify detector placement has not changed and tamper seals, if employed, have not been broken.

Agency Note: It is recommended that tests include methods to prevent or attempt to detect interference with testing conditions or the testing detector.

- iv) Outdoor air intakes that do not appear to be configured to provide the minimum volume of outdoor air ventilation needed at all times of the year when a building or unique sector is significantly occupied and a description of any observed thermostats or controls for variable air distribution (VAV) systems that are not set to a normal occupied temperature in portions of the building served by the system(s).
 - v) Return-air ducts laid in soil. Testing records shall include if return-air ducts are observed under slabs or otherwise surrounded by soil where this relates to compliance with reporting requirements or decisions on whether or not an evaluation of occupied versus unoccupied concentrations may be warranted.
 - vi) HVAC setback for non-residential locations. Testing records shall include if non-residential rooms are observed to be operating with HVAC setback temperatures when not significantly occupied that are outside of normal occupied temperatures of 65° and 80° F where this relates to compliance or decisions on whether or not an evaluation of occupied versus unoccupied concentrations may be warranted.
- 6) Required Number of Valid Tests. For all test events in this Section where access problems, test conditions, or other situations prevented achieving a valid test result, follow-up procedures shall include testing all locations that were intended to be tested, but did not result in valid measurements unless:
- A) The client has decided to proceed with mitigation; or
 - B) All other test locations in the building are less than 2.0 pCi/L and the number of invalid or missing tests in ground-contact locations of the building do not exceed the following:

Ground Contact Test Locations	4-7	8-11	12-15	16-19	25 or more
Allowance	1	2	3	4	20% of Total

7) Floor plan diagrams or other records for tracking test locations shall be updated to include:

A) Test locations, addresses, rooms, mechanical systems, or conditions observed that were inadvertently omitted or different than found during initial inspection.

B) Building foundation types such as slab-on-grade, basement, and crawl space being tested.

i) Test location identification or address with any location specific notes.

ii) Detector identification/serial numbers.

iii) The start and stop dates and times of the measurement period.

iv) A record of conditions that are known or suspected to impact the reliability of the test at any location.

v) Annotation for each quality control check measurement to indicate its purpose.

8) Detectors shall be sent to the laboratory as soon as possible to ensure quality of analysis. Information provided to the laboratory shall include:

A) The address of the property tested including street address, city, state and zip code;

B) Detector identification/serial numbers; and

C) The start and stop dates and times of the measurement period.

g) Actions Based on Test Results

1) Requirements for Side by Side (Duplicate) Test Results

- A) When two test devices were deployed to test the same testing location, the results shall be considered valid if:
 - i) Side by side measurement results that are both equal to or greater than 4.0 pCi/L shall agree with a Relative Percent Difference (RPD) of less than 36 percent. If the RPD is greater than 36 percent, the radon contractor shall investigate, document, and correct the sources of the error.
 - ii) Side by side measurement results that are both less than 4.0 pCi/L shall agree with an RPD of less than 67 percent. RPD is the difference between the 2 results divided by the average of the 2 results times 100. If the RPD is greater than 67 percent, the licensee shall investigate, document, and correct the sources of the error.
 - B) When two test devices were deployed to test the same testing location and one test result is above the action level and the other test result is below the action level the following criteria shall be used to determine the validity of the measurements:
 - iii) If one of the measurements is equal to or greater than 4.0 pCi/L and one is less than 4.0 pCi/L and the higher result is less than twice the lower result, the average of the test results shall be considered valid.
 - iv) If one of the measurements is equal to or greater than 4.0 pCi/L and one is less than 4.0 pCi/L and the higher result is greater than twice the lower result, the client shall be informed of the discrepancy and the simultaneous measurements repeated.
- 2) Test results to be regarded as a more accurate reflection of occupant exposure to radon hazards shall be those that most closely align to the predominant normal occupied building operating condition for the location tested. When conducting confirmation testing:
- A) The testing shall be conducted under building conditions that are representative of the predominant normal occupied building operating condition.
 - B) Testing shall be initiated within 1 year subsequent to initial testing unless the evaluation is relative to older, historic test results.

- C) The evaluations shall be permitted based on data from short term or long term test devices or data from evaluations of occupied versus unoccupied radon concentrations.

Agency Note: Decisions to mitigate at any time are not prohibited, comprehensive testing aids confidence that decisions are not being made based on a faulty test device or unexpected conditions. Tests conducted under heating season conditions are more likely to provide a clear characterization of potential radon hazards. Longer test durations reduce the chance that short-lived temporary conditions in weather or building operations have adversely influenced test results.

- 3) The following requirements for post mitigation testing shall be followed to determine the effectiveness of mitigation efforts.
 - A) Buildings constructed with radon-resistant features that have not been activated with a fan shall be tested in accordance with this Part.
 - B) Where radon reduction features include an active mitigation system, the following additional procedures are required.
 - i) Measurements shall be conducted in accordance with this Part.
 - ii) Short term measurements shall be conducted no sooner than 24 hours after activation of a mitigation system fan or completion of other mitigation efforts.
 - C) Testing shall be conducted in the same location as the pre-mitigation test, whenever possible.
 - D) When an ASD system exhausts below the roof, an additional test in the rooms immediately adjoining the outside exhaust location shall be conducted.
 - E) Testing shall comply with all requirements in this Part.
 - F) Testing failed locations. Where testing reveals a need for additional mitigation efforts, testing specific locations after additional mitigation efforts shall be sufficient for meeting test requirements if the following requirements are met:

- i) Where the mitigation method is ASD and the mitigated locations are served by individual HVAC systems testing shall include all locations where testing revealed elevated radon concentrations.
 - ii) Where mitigation methods are based on passive mitigation efforts testing shall include all locations where testing revealed elevated radon concentrations.
 - iii) Where mitigation methods rely on HVAC mechanical systems to provide dilution or pressurization of indoor air, testing shall include all locations within each unique sector mitigated and at least one measurement in each adjoining sector served by a different HVAC system.
 - G) Performance testing mitigation systems by testing only locations where elevated radon concentrations have been found shall not be reported as verification that a building has been fixed. Performance testing mitigation systems shall be limited to evaluations of active systems prior to or related to maintenance of active systems.
- h) Measurement Reports
 - 1) Radon contractors shall issue radon measurement reports in accordance with Sections 422.70(d) and 422.70(e).
 - 2) The following essential information shall be included in reports:
 - A) The complete address of the building measured:
 - B) The measurement professional responsible and onsite, during deployment and retrieval activities, and responsible for quality procedures, such as during planning, implementation and reporting to include:
 - i) Their name, address and phone number.
 - ii) Their license number.
 - iii) Their legally binding signature (manual, or electronic).
 - C) Contact information for the Agency Radon Information Line (800) 325-1245 ~~or to speak to an Agency Radon Program staff member call (217)782-1325:~~

D) The ~~exact~~ locations of all measurement devices deployed and any information that would allow for future data comparisons and interpretations.

~~E)~~ Licensees shall provide the ~~exact~~ locations by providing a proportional diagram of the footprint of the building showing the configurations of the foundations, identifying the windows and doors, ~~finished and unfinished areas, room use, furnaces, hot water heaters, dryers, combustion appliances, crawlspace vents, fireplaces, mitigation systems, floor drains, foundation types,~~ and any other pertinent information that may affect the measurement;

Agency Note: Providing photographic documentation showing the location of the testing device is acceptable to support the proportional diagram is acceptable. Photos shall be taken from a viewpoint which captures sufficient information to accurately identify the device placement in relation to two walls and height from the floor of the test location.

~~E)F)~~ The final result for each measurement location:

~~F)G)~~ The detector model or type, the detector serial number, and if an AC, AT, LS was used, the name and ~~license identification~~ number of the licensed laboratory used to analyze the detector:

~~G)H)~~ The start and stop dates and times of the exposure period:

~~H)I)~~ Radon gas results shall be reported in pCi/L and to only one digit after the decimal (e.g. 3.2 pCi/L). If the average of two measurements produces a result of ≥ 3.95 pCi/L, standard mathematical rules should be followed, and such average shall be reported as 4.0 pCi/L:

~~I)J)~~ The average of collocated measurement detectors shall be reported as well as the individual results:

~~J)K)~~ Measurements made in separate locations shall not be averaged. Detectors located more than 8 inches from each other shall be considered to be in separate locations.

~~K)L)~~ At each location where, short-term detectors are used for follow-up testing, the average of initial and follow-up test results shall be

reported.

~~L)M)~~ The following statement shall be included with all reports: “There is an uncertainty with any measurement result due to statistical variations and other factors such as daily and seasonal variations in radon concentrations. Variations may be due to changes in the weather, operation of the dwelling, or possible interference with the necessary test conditions.”

~~M)N)~~ ~~Whether any Ssub-slab return ducts were observed, and air handler fan activity was minimal during the test period.~~

~~N)O)~~ Radon contractors shall include a copy of all variance approval numbers issued by the Agency in accordance with section 422.75.

~~O)P)~~ Reports shall describe locations where test results meet or exceed the action level.

~~P)Q)~~ Reports shall identify all locations that still need to be tested or retested to comply with requirements in this Part.

~~Q)R)~~ Where nonresidential ground-contact locations, that are part of conditioned space, were not tested because they were not occupied, reports shall recommend either testing or that testing be conducted if occupied in the future as applicable.

~~R)~~ ~~A description of any noninterference controls used such as tamper seals, control monitors or other methods, as applicable,~~

S) Reports shall provide statements regarding reliability and shortcomings of the measurement to include the following information.

- i) A statement confirming compliance with QC measurements requirements and descriptions of any QC measurements that were missing or fell outside of control tolerances.
- ii) Where temporary building conditions or other factors are observed that are known or suspected to cause a test to not reflect occupant risk from radon, reports shall recommend retesting the affected location. Temporary conditions subject to this requirement include the property, dwelling or portion of the building tested was not operated under

occupied operating conditions because it was vacant during the test period and systems that were temporarily ventilating with outdoor air for seasonal comfort or energy savings during the test period.

- T) Where a mitigation system or efforts to mitigate radon are observed, the test report shall include:
 - i) A statement that a mitigation system was observed and whether it appeared to be operating;
 - ii) Mitigation Tag Number;
 - iii) It is permitted to provide a statement in the report that the test company offers no findings as to the proper installation and operation of the mitigation system.
- U) Responsible care requires repeating initial testing procedures for all building(s) at least every 5 years and in conjunction with any sale of a building.
- V) Radon testing should also be conducted when any of the following circumstances occur:
 - i) A new addition is constructed or alterations for building reconfiguration or rehabilitation occur;
 - ii) A ground contact area not previously tested is occupied, or a building is newly occupied;
 - iii) Heating or cooling systems are significantly altered, resulting in changes to air pressures or pressure relationships;
 - iv) Ventilation is significantly altered by extensive weatherization, changes to mechanical systems or comparable procedures;
 - v) Significant openings to soil occur due to groundwater or slab surface water control systems that are altered or added (e.g., sumps, perimeter drain tile, shower/tub retrofits, etc.) or, natural settlement causing major cracks to develop;
 - vi) Earthquakes or construction blasting, fracking or formation

of sink holes nearby; or

vii) A mitigation system is altered, modified or repaired.

W) Providing reports to tenants of measured buildings.

i) Radon contractors shall issue radon measurement reports in accordance with 422.70 e) to tenants.

ii) Radon contractors shall issue reports in accordance with 422.135 (h) with all information redacted except for the measurements in which the requesting tenant resides.

3) Additional Requirements for Continuous Monitor Reports. The following additional requirements shall be met when reporting continuous radon monitor test results:

A) Hourly data of the monitor used;

B) The calibration date of the continuous monitor;

C) Removal of or “backing out” portions of hourly data imbedded within the contiguous sampling period reported, such as to account for weather or other conditions, shall invalidate the measurement;

D) The first 4 hours of data may be discarded or incorporated into the result using system correction factors. There shall be at least 44 contiguous hours of usable data to produce a valid average;

E) The first 12 ~~or more~~ hours ~~are to~~may be discarded in reported results as required for meeting closed-building requirements.

4) The test report shall include equivalent statements for each of the following guidance advisories:

A) Reporting Elevated Radon Concentrations. Equivalent statements for these advisories shall be included in the report:

i) Fix the building. Test results indicate occupants may be exposed to radon concentrations that meet or exceed the action level, 4.0 pCi/L or greater. The higher the radon concentration, the more quickly action should be taken to reduce the concentrations;

- ii) Efforts to reduce radon concentrations are not complete until retests provide evidence of effectiveness;
 - iii) Initiate short-term radon testing no sooner than 24 hours after a mitigation system is operational and within 30 days after installation of the system; and
 - iv) Test again at least every 2 years to ensure the system remains effective.
 - v) If not already accounted for, additional testing shall be recommended, no later than within the first year after occupancy or ownership of property management, where testing was not conducted under conditions that are representative of the normal occupied building operating condition.
- B) Reporting Low Concentrations. Equivalent statements for these advisories shall be included in the report:
- i) Consider fixing the building if test results indicate radon concentrations are between 2.0 and 4.0 pCi/L. Because the hazards from radon are virtually the same for radon concentrations that are near action level thresholds, the World Health Organization recommends limiting long-term exposures to less than 2.7 pCi/L
 - ii) Retest the building at least every 2 years, including buildings with radon mitigation systems.
- C) When multiple test locations in close proximity to each other indicate elevated concentrations, recommendations to mitigate are permitted prior to completion of all planned test procedures. When reporting that mitigation could be warranted the recommendations shall include “Decisions on whether to mitigate are more fully informed once all testing is complete and the recommendations shall be disclosed in a manner approved by the client in accordance with a client's pre-established directives on disclosing test data.
- 5) Other Guidance Requirements. Guidance in summary reports and otherwise provided shall comply with all the following requirements.
- A) When opinions and interpretations on any topic are included, the basis upon which the opinions and interpretations have been made

shall be included in test reports. Opinions and interpretations shall be clearly marked as such in a test report.

- B) Health guidance. Health and action level guidance provided in reports or otherwise furnished shall be consistent with federal or state guidance.
 - C) Longer test periods. Longer test periods, such as those greater than 90 days, shall not be reported as a closer evaluation of annual average radon concentrations when heating season conditions during the test were less than the percentage of year when heating systems are active.
 - D) Occupied versus unoccupied evaluations. Evaluations of occupied versus unoccupied radon concentrations shall be permitted in summary reports to aid mitigation decisions.
- 6) Report Attachments. Immediately attached to or otherwise accompanying a summary report, there shall be supplemental clarity provided in accordance with all the following requirements.
- A) Floor plan diagrams shall be provided with reports that show the average of each test result from all locations where valid test results were achieved. Where residential addresses are not expected to change, narrative identification and vicinity within the building shall be permitted in lieu of floor plan diagrams.
 - B) The client shall be informed in writing of their responsibility to identify and comply with local statutes regarding obligations that may exist for disclosing test results to occupants and affected third parties.
- 7) Retention of Records. The detector placement log, floor-plan diagrams, supporting documentation with evidence of compliance with this standard and other records related to the testing shall be maintained for at least ~~6~~5 years after testing.
- i) Radon Sources Other Than Soil Gas
- 1) Where elevated radon concentrations are found in upper floor test locations or other locations where there is evidence that soil gas may not be the cause, an evaluation shall be conducted for whether unusual soil gas migration, building materials, water supplies or inadequate ventilation are

the cause of elevated radon concentrations.

- A) As a step-by-step process of elimination, it shall be permitted to mitigate known or suspected sources of radon gas, such as soil gas in ground contact areas, prior to initiating evaluations of upper floors or other locations. While flexibility is permitted for procedures and the order they occur, the evaluations shall focus on lines of evidence for characterizing radon hazards throughout the building.

- B) Upper Floor Evaluations. Where elevated radon concentrations are found in upper floor test locations, efforts for initial or follow-up measurements to characterize upper floor areas of the building shall include:
 - i) A radon measurement conducted in all dwellings and nonresidential rooms intended for occupancy on the floor closest to ground where elevated radon concentrations were found.

 - ii) A radon measurement conducted in all dwellings and non-residential rooms for no less than one additional upper floor, whether elevated radon concentrations were initially found there. A report shall be provided with test results and recommendations or guidance consistent with the findings of this characterization.

- C) Where initial characterizations for upper floors, indicate inadequate ventilation or building materials specific to certain dwellings or rooms are the problem:
 - i) A visual review shall be conducted and reported in writing for all other locations in the building where lack of ventilation or similar building materials could be the cause of elevated radon concentrations.

 - ii) Confirmation that these conditions are the cause of elevated radon concentrations is not required. However, it shall be permitted to attempt confirmation by simultaneous radon measurements in a room where poor ventilation or building materials are suspected as the cause, and in a nearby room suspected of having radon concentrations that are below the action level.

- D) If measurements indicate building materials common to the entire building or portion of the building are the problem, the measurement evaluation shall be repeated on one or more additional upper floors unless there is reliable evidence to support a different course of action. Where measurements support the likelihood that building materials common to the entire building or portion of the building are the problem, reports shall recommend mitigation for all floors.
- E) Radon in water. Where radon in water is suspected to be the cause of elevated radon concentrations in air, measurements for radon in water shall be conducted.

2) Actions required for ~~clearance testing~~ measurements after efforts to mitigate radon hazards on upper floors due to soil gas, building materials, inadequate ventilation and radon in water shall include the following requirements.

- A) ~~Radon from soil gas.~~ Where efforts to mitigate elevated radon concentrations on upper floors included mitigation of soil gas entry into the building or other mitigation method for addressed ground-contact locations, ~~clearance testing~~ measurements shall include:
 - i) ~~Clearance testing~~ Measurements as required by this Section.
 - ii) Testing all upper floor locations where elevated radon concentration have been observed.
- B) Where elevated radon is identified to be caused by building materials or inadequate ventilation, post mitigation ~~clearance testing~~ measurements shall be conducted for:
 - i) All dwellings and non-residential rooms where efforts have been made to mitigate radon from building materials or address inadequate ventilation.
 - ii) All locations not tested but that demonstrate similar potential for causing elevated radon concentrations.
 - iii) Where mitigation efforts include enhanced ventilation techniques, post-mitigation ~~clearance testing~~ measurements shall include seasonal verification within the first year of occupancy or ownership of property management.

- C) Where mitigation efforts included reducing radon in water supplies, ~~clearance testing~~ measurements shall include:
 - i) Duplicate measurements of radon in water for both untreated and treated water.
 - iii) Testing indoor air for radon in one or more locations within each unique area where elevated radon has been found.

Section 422.140 Device Protocol

- a) Any person licensed by the Agency to perform radon measurements shall use devices approved by AARST-NRPP, NRSB, any entity operating a Personnel Certification Body in accordance with ISO/IEC 17024: Conformity assessment - General requirements for bodies operating certification of persons.
- b) Quality Assurance
 - 1) Professional licensees providing measurement services using radon and radon product measurement devices shall establish and maintain a Quality Assurance Program (QAP). These programs shall include written procedures for attaining quality assurance objectives and a system for recording and monitoring the results of the quality assurance measurements for each device used. The QAP shall include the maintenance of control charts and related statistical data.
 - 2) The objective of quality assurance is to ensure that data are scientifically sound and of known precision and accuracy. The following 6 categories of quality control measurements shall be addressed in the QAP.
 - A) Instruments providing immediate results, such as continuous working level and radon monitors, shall be operated in a radon chamber to establish individual instrument calibration factors.
 - i) Calibration measurements shall be conducted to determine and verify the conversion factors used to derive the concentration results. These factors are determined normally for a range of concentrations and exposure times, and for a range of other exposure and/or analysis conditions pertinent to the particular device.
 - ii) Licensees providing measurements with active devices are

required to recalibrate their instruments at least once every 12 months.

- B) Known exposure measurements or spiked samples consist of passive detectors that have been exposed to known concentrations in a radon chamber. These detectors, such as charcoal canisters, alpha track detectors and electret ion chambers, shall be labeled and submitted to the laboratory in the same manner as ordinary samples to preclude special processing.
 - i) Licensees using passive monitors shall conduct spiked measurements (i.e., exposure in a radon chamber where the environmental radon level is controlled) to aid the Agency in verifying the accuracy of the entire measurement system. Licensees using passive measurement devices shall conduct spiked measurements at a rate of 3 per 100 measurements, with a minimum of 3 per year and a maximum required of 6 per month.
 - ii) The results of analyses of detectors exposed to known radon concentrations shall be monitored and recorded.
 - iii) Any significant deviation from the known concentration to which they were exposed shall be investigated and corrective action taken.
- C) Background measurements are required for passive detectors requiring laboratory analysis.
 - i) Radon contractors using passive detectors shall employ field blanks equal to approximately 5 percent of the detectors that are deployed, or 25 each month, whichever is smaller.
 - ii) These controls shall be set aside from each detector shipment, kept sealed and in a low radon environment, placed sealed in the field and then returned to the analysis laboratory along with each shipment.
 - iii) These field blanks measure the background exposure that may accumulate during shipment and storage. The results shall be monitored and recorded.
- D) Duplicate measurements provide a check on the precision of the

measurement result and allow the user to make an estimate of the relative precision. Large precision errors may be caused by detector manufacture or improper data transcription or handling by suppliers, laboratories, or technicians performing placements. Precision error can be an important component of the overall error; therefore, licensees performing measurements shall monitor precision.

- i) Duplicate measurements shall be side-by-side measurements made in at least 10 percent of the total number of measurement locations, or 50 each month, whichever is smaller. The locations selected for duplicate measurement shall be distributed systematically throughout the entire population of samples.
 - ii) The precision of duplicate measurements shall be monitored and recorded in the quality assurance records. The analysis of data from duplicates shall be plotted on range control charts. If the precision estimated by the user is not within the precision expected of the measurement method, the cause of the problem shall be investigated.
 - iii) Detectors shall be treated identically in every respect. They shall be shipped, stored, opened, installed, removed and processed together, and not identified as duplicates to the processing laboratory.
- E) Proper functioning of analysis equipment and operator usage require that the equipment and measurement system be subject to routine checks. Regular monitoring of equipment and operators is vital to ensure consistently accurate results. Components of the device, such as a pump, battery or electronics shall be checked regularly and the results noted in a record. Each user shall develop methods for regularly monitoring (preferably daily with use) their measurement system and for recording and reviewing results.
- F) Cross-checks. Professional licensees using active monitors shall check their monitors for bias on a regular basis. It is important to frequently assess the continued satisfactory operation of the instrument response and to ensure damage from shipping has not occurred prior to an instrument being placed into service after calibration. Cross-checks shall be performed prior to placing an instrument being returned to service after calibration and at 6 months (plus or minus a 45 days) after calibration. The following

conditions shall be met:

- i) Where feasible, a cross-check shall begin with an instrument background measurement.
 - ii) The cross-check measurement shall be made in an environment that has been chosen for its stability and radon concentration that is above the lower limit of detection.
 - iii) Cross-checks shall be side-by-side measurements.
 - iv) One of the instruments shall have been calibrated within the last 45 days.
 - v) A measurement of at least 48 hours duration shall be conducted.
 - vi) The bias of cross-check measurements shall be monitored and recorded in the quality assurance records. If the bias estimated by the user is not within the bias expected of the measurement, the cause of the problem shall be investigated and corrective action taken in accordance with the licensee's Agency-approved QAP.
- 3) Default Minimum Criteria for Warning and Control Limits. In all cases, warning and control limits shall be equal to or more stringent than the minimums provided in this Section. When applying more stringent minimums, default warning and control limits shall be updated using the results of QC checks following statistically defensible control limit generation algorithms.
- A) Duplicate Target for Imprecision. The default interim limits presented in this standard were derived assuming a conservative “in-control” target for imprecision that is demonstrated by the average relative percent difference (RPD) of duplicate and comparison checks being not greater than:
 - i) 14% in an environment with a radon concentration ≥ 4.0 pCi/L; and
 - ii) 25% in an environment with a radon concentration between 2 and 4 pCi/L.
 - B) Warning and Control Limits for Duplicates and Cross Checks.

Minimum warning and control limits required are:

- i) In an environment with a radon concentration ≥ 4.0 pCi/L, the warning limit is reached when a duplicate pair or cross check exhibits an RPD $\geq 28\%$ and the control limit is reached when a duplicate pair or cross check exhibits an RPD $\geq 36\%$;
- ii) In an environment with a radon concentration between 2.0 and 4.0 pCi/L, the warning limit is reached when a duplicate pair or cross check exhibits an RPD $\geq 50\%$, and the control limit is reached when a duplicate pair or cross check exhibits an RPD $\geq 67\%$; and
- iii) If the average of a duplicate pair or cross check is less than 2.0 pCi/L, the warning limit is reached when there is a difference between the two results of more than 1.0 pCi/L or if both results are not less than the minimum detectable concentration (MDC).

C) Warning and Control Limits for Spikes. Any single spike result exhibiting a relative percent error (RPE) (or individual percent error [IPE]) outside the range of $0 \pm 20\%$ has exceeded the warning limit, and any single spike result outside the range of $0 \pm 30\%$ has exceeded the control limit.

c) Protocol for using continuous radon monitors (CRCMs) to measure indoor radon concentrations.

- 1) When performing a radon measurement, the CRCM shall be programmed to run continuously, recording periodically (hourly or more frequently) the radon concentration for at least 48 hours. Longer measurements may be required per the continuous monitor type and the radon level being measured.
- 2) If the first 4 hours of data from a 48-hour measurement are discarded because data are produced prior to the establishment of equilibrium conditions in the test device, the remaining hours of data shall be averaged and shall be sufficient to represent a 2-day measurement.
- 3) Every CRCM shall be calibrated in a radon chamber, approved by the Agency, before being placed into service, and after any repairs or modifications that could affect the calibration. Subsequent recalibrations and background checks shall be performed at least once every 12 months.

Each scintillation cell requires an individual calibration factor.

- 4) Background measurements shall be performed after every 1,000 hours of operation of scintillation cell-type ~~CR~~CMs. The background shall be checked by purging the monitor with clean, aged air or nitrogen in accordance with the manufacturer's instructions. In addition, the background count rate shall be monitored in accordance with the manufacturer's instruction.
 - 5) Radon contractors providing measurement services with ~~CR~~CM devices shall perform duplicate measurements. The performance and analysis of duplicates shall be completed in accordance with subsection (a)(2)(D).
 - 6) Pumps and flow meters shall be checked before and after each measurement in accordance with the manufacturer's instruction.
 - 7) Radon Contractors providing measurement services with ~~CR~~CM devices shall perform cross-checks. The performance and analysis of cross-checks shall be completed in accordance with subsection (a)(2)(F).
- d) Protocol for using alpha track (AT) detectors to measure indoor radon concentrations
- 1) Radon Contractors providing measurement services with AT devices shall perform known exposure measurements (spikes). The performance and analysis of spikes shall be completed in accordance with subsection (a)(2)(B).
 - 2) Radon Contractors providing measurement services with AT devices shall perform duplicate measurements. The performance and analysis of duplicates shall be completed in accordance with subsection (a)(2)(D).
 - 3) Radon Contractors providing measurement services with AT devices shall perform background measurements. The performance of background measurements shall be completed in accordance with subsection (a)(2)(C).
 - 4) The results shall be monitored and recorded. If one or more field blanks have concentrations significantly greater than the LLD established by the supplier, it may indicate defective packaging or handling and the licensee shall investigate the cause. If the average value from the field control blanks is significantly greater than the LLD established by the supplier, this average value shall be subtracted from the individual values reported for the other devices in the exposure group.

- e) Protocol for using electret ion chamber radon (ES or EL) detectors to measure indoor radon concentration.
- 1) Every short-term and long-term electret system and the electret reader(s) shall be calibrated in a radon chamber, approved by the Agency. Initial calibration for the system is provided by the manufacturer. Subsequent recalibrations shall be performed at least once every 12 months.
 - 2) Radon Contractors providing measurement services with ES or EL devices shall perform known exposure measurements (spikes). The performance and analysis of spikes shall be completed in accordance with subsection (a)(2)(B).
 - 3) Radon Contractors providing measurement services with ES or EL devices shall perform duplicate measurements. The performance and analysis of duplicates shall be completed in accordance with subsection (a)(2)(D).
 - 4) Radon Contractors providing measurement services with short-term or long-term electrets shall set aside a minimum of 5 percent of the electrets or 10, whichever number is smaller, from each shipment and evaluate them for voltage drift. The electrets shall be kept covered with protective caps in a low radon environment and analyzed for voltage drift over a time period similar to the time period used for those deployed in measurements. Any voltage loss found in the control electrets of more than one volt per week over a 3-week test period for short-term electrets, or one volt per month over a 3-month period for long-term electrets, shall be investigated.
 - 5) Proper operation of the surface voltmeter shall be monitored following the manufacturer's procedures for zeroing the voltmeter and analyzing a reference electret. These checks shall be conducted at least once a week while the voltmeter is in use.
- f) Protocol for using activated charcoal adsorption (AC) devices to measure indoor radon concentrations
- 1) Radon Contractors providing measurement services with AC devices shall perform known exposure measurements (spikes). The performance and analysis of spikes shall be completed in accordance with subsection (a)(2)(B).
 - 2) Radon Contractors providing measurement services with AC devices shall perform duplicate measurements. The performance and analysis of duplicates shall be completed in accordance with subsection (a)(2)(D).

- 3) Radon Contractors providing measurement services with AC devices shall perform background measurements. The performance of background measurements shall be completed in accordance with subsection (a)(2)(C).
 - A) One or a few of the field blanks have concentrations significantly greater than LLD established by the supplier may indicate defective devices or poor procedures and the licensee shall investigate the cause.
 - B) If most of the field blanks have concentrations significantly greater than the LLD, the average value of the field blanks shall be subtracted from the reported field detector concentrations and the supplier notified of a possible problem.
- g) Protocol for using charcoal liquid scintillation (LS) devices to measure indoor radon concentrations
 - 1) Radon Contractors providing measurement services with LS devices shall perform known exposure measurements (spikes). The performance and analysis of spikes shall be completed in accordance with subsection (a)(2)(B).
 - 2) Radon Contractors providing measurements services with LS devices shall perform duplicate measurements. The performance and analysis of duplicates shall be completed in accordance with subsection (a)(2)(D).
 - 3) Radon Contractors providing measurement services with LS devices shall perform background measurements. The performance of background measurements shall be completed in accordance with subsection (a)(2)(C).
 - A) One or a few of the field blanks have concentrations significantly greater than the LLD established by the supplier may indicate defective devices or poor procedures and the licensee shall investigate the cause.
 - B) If most of the field blanks have concentrations significantly greater than the LLD, the average value of the field blanks shall be subtracted from the reported field detector concentrations and the supplier notified of a possible problem.
- h) Protocol for using continuous working level (CW) monitors to measure indoor radon progeny concentrations
 - 1) Radon Decay Product measurements may be appropriate under certain conditions in large buildings, but are not currently routinely performed by

licensees.

- 2) The Agency does not recommend their use for home environment or residential real estate measurements.
- 3) Licensees interested in using CWs for measurement purposes shall submit Standard Operating Procedures, consistent with this Part, specific to the model and design of the CW instrument to the Agency for approval.

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