

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

PART 421  
REGULATIONS FOR RADON MITIGATION 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 421.10 Purpose and Scope**

- a) This Part establishes licensing requirements for individuals who perform mitigation services to reduce the concentration of radon or radon progeny.
- b) 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 421.15 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, 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 at the Illinois Emergency Management Agency, 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 421.20 Definitions

As used in this Part:

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

“Accessible” means an area with sufficient space for a person to safely enter the entire area to conduct required work safely.

“Accessible Cracks” means accessible without destructive or significant disassembly of building components or finishes.

"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 (IEMA).

"Active Soil Pressurization (ASP)" means a mitigation system that establishes positive pressure in the gas permeable layer or airspace between occupiable spaces and the soil. The positive pressure can, under certain conditions, be effective to stop radon entry when natural sub-slab aggregates are so porous that establishing a vacuum under the foundation is not possible.

"Altering" means to change or modify a building or building design, or to revise, rather than repair, a mitigation system or mitigation system design.

"ANSI" means American National Standards Institute.

"As Low As Is Reasonably Achievable" or "ALARA" means making every reasonable effort to maintain exposures to radiation as far below the dose limits in 32 Ill. Adm. Code: Chapter II, Subchapters b and d as is practical consistent with the purpose for which the licensed or registered activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed or registered sources of radiation in the public interest.

"ASTM" means ASTM International, formerly known as American Society for Testing and Materials.

"Attic" means the space between the ceiling beams of the top story and the roof rafters. The attic can be a storage space, but is not a living-conditioned space.

"Backdrafting" means a condition where the normal movement of combustion products up a flue, resulting from the buoyant forces on the hot gases, is reversed, so that the combustion products can enter the house. Backdrafting of combustion appliances (such as fireplaces and furnaces) can occur when depressurization in the house overwhelms the buoyant force on the hot gases. Backdrafting can also be caused by high air pressures or blockage at the chimney or flue termination.

"Backer Rod" means a semi-rigid foam material resembling a rope of various diameters used to fill around pipes, etc., and to assist in making a sealed penetration. For example, where a pipe is inserted through a concrete slab, a length of backer rod is jammed into the opening around the pipe. Caulking is then applied to the space above the backer rod and between the outside of the

pipe and the slab opening. The purpose of the backer rod is to hold the semi-fluid caulk in place until it sets or hardens. It is most important that a sealant only adhere to the 2 sides of the joint and not the base of the joint (third side). Adhesion to all 3 sides will prevent the sealant from elongating properly and will cause sealant failure.

“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 foot, 6 inches. It is typically considered a living area whether it is finished or unfinished.

"Block Wall Depressurization" or “BWD” means a radon mitigation technique that depressurizes the void network within a block wall foundation by drawing air from inside the wall and venting it to the outside.

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

“Collateral Mitigation” means when a mitigation system may intentionally or inadvertently extend influence to multiple areas within a shared building.

“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.

"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 designed for commercial use, but not limited to office buildings, warehouses, retail facilities, schools, recreational facilities, assisted living facilities and buildings that combine these uses.

"Communication Test" means a diagnostic test designed to qualitatively measure the ability of a suction field and air flow to extend through the material beneath a concrete slab floor and thus evaluate the potential effectiveness of a sub-slab depressurization system. This qualitative test is commonly conducted by applying suction on a centrally located hole drilled through the concrete slab and simultaneously observing the movement of smoke downward into small holes drilled in the slab at locations separated from the central suction hole. (See also Pressure Field Extension.)

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

for instructing an approved CE course.

“Continuous Radon Monitor” or “CRM” means an electronic device that is capable of automatically recording a retrievable time series of numeric measurements of radon concentration averaged over time intervals of one hour or less. If a device is not capable of these functions or is not set to record readings each hour, it is functioning as a passive device and is not considered a continuous monitor under this protocol.

"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 foot, 6 inches tall and, if not currently used as a living area, is not typically considered a living area. ~~with an open area beneath the livable space of a dwelling that typically has either a concrete slab or earthen floor. The crawlspace can have an open height of a few inches to several feet. The crawlspace may or may not be ventilated to the outdoors. The crawlspace can be a storage space, but is not a living space.~~

“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/].

"Crawlspace Depressurization" means a radon control technique designed to achieve lower air pressure in the crawlspace relative to indoor air pressure by use of a fan-powered vent drawing air from within the crawlspace. (See also Mechanically Ventilated Crawlspace System.)

“Diagnostic Procedures means one or multiple procedures for identifying or characterizing conditions under, beside and within buildings to project the effects of various system designs. Diagnostic procedures can include sub-slab pressure field extension tests or analysis; visual observations; characterization of pressure or air exchange rates between indoors and outdoors and also between floors or adjoining air spaces; and diagnostic radon measurements at locations of interest (e.g. common areas, mechanical spaces and spaces not in ground contact).

"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.

“Do-It-Yourself Continuous Radon Monitor” means an electronic device that is capable of automatically recording a retrievable time series of numeric measurements of radon concentration averaged over time intervals of one hour or less and is designed by the manufacturer for unlicensed users.

"Drain Tile Depressurization" or "DTD" means a type of active soil depressurization (ASD) system where the suction point piping attaches to a drain tile or is located in the gas-permeable material near the drain tile. The drain tile may be inside or outside the footings of the building.

"Drain Tile Loop" means a continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a basement or crawlspace footing.

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

"Eave" means the border of a roof that overhangs any wall.

"Exhaust Trajectory" means the angle of the pipe or elbow at the point of exhaust. The angle of the exhaust trajectory from the open end of the pipe or elbow is geometrically defined as the straight or center-line axis that extends outward from the geometric center of the exhaust opening and is perpendicular to the plane of the exhaust opening.

"Exhaust spread" means the exhaust spread extends outward from the point of exhaust in the shape of a circular cone. The tip or apex of the cone is at the geometric center of the exhaust opening and the cone profile grows larger as distance from the point of exhaust increases. The total directional spread of the exhaust or cone is defined in degrees by the offset-axis angle of the cone profile compared to the cone's center-line axis. Expanding outward from the point of exhaust an exhaust spread radius of  $45^\circ$  equals an exhaust spread diameter of  $90^\circ$ . An exhaust spread radius of  $11^\circ$  equals an exhaust spread diameter of  $22^\circ$ .

"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 technician by a licensed 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 short term or long term measurement of radon in a single family home, duplex or an individual condominium unit.

"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.

"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 or an enclosed porch with little or no heat, that an occupant or homeowner could use for living space without renovations.~~means any area in a building that is, or could be, adapted for human habitation whether the area is located in a basement, over a crawlspace, or situated on a slab on grade.~~

"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.

"Mechanically Ventilated Crawlspace System" means a radon control technique designed to increase ventilation within a crawlspace, achieve higher air pressure in the crawlspace relative to air pressure in the soil beneath the crawlspace, or achieve lower air pressure in the crawlspace relative to air pressure in the living spaces, by use of a fan. (See also Crawlspace Depressurization.)

"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 or steps designed to reduce radon concentrations in the indoor air of a building.

"Multi-Family Building" 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)~~building with two or more attached dwellings.~~

"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]

"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

"Openings In Structure" means openings created in structural walls or roofs for the purpose of mounting windows, skylights, doors or other assemblies that might open to outdoor air.

"Operable Openings" means operable or constantly open portion of windows, skylights, doors and other openings designed to readily operate for increasing ventilation with outdoor air.

"Operation, Maintenance and Monitoring Plan (OM&M)" means a document that includes information on the operation maintenance and monitoring of installed mitigation systems and guidance for monitoring the effectiveness of the system in the future.

"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.

"Perimeter Channel Drain" means a system for collecting water in a basement by



means of a large gap or channel between the concrete floor and the wall. Collected water may flow to aggregate beneath the slot ("French Drain") or to a sump where it can be drained or pumped away.

"Permeance" refers to a product's ability to resist vapor migration, and is measured in perms, which is defined in the US as one grain of water vapor per hour, per square foot, per inch of mercury (pressure differential) [gr/(ft<sup>2</sup>\*hr\*in-Hg)].

"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.

"Pressure Field Extension" means the distance that a pressure change is induced in the sub-slab area, measured from a single or multiple suction points. (See also Communication Test.)

"Puncture Resistance" means how well the vapor retarder material withstands impact with blunt objects. Vapor retarders are subjected to impact by a rounded falling dart, which is intended to roughly simulate some of the hazards of construction.

"QAP" means Quality Assurance Program.

"Qualified Ventilation Professional" is an individual qualified, at a minimum, to conduct and evaluate airflow dynamic measurements as required. The appropriate technical knowledge requires hands-on experience and training as obtained by: trade-specific courses such as for energy auditing; specific radon training courses; design of HVAC; or mechanical engineering.

"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]

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

"Re-Entrainment" means the unintended re-entry into a building of radon that is being exhausted from the vent of a radon mitigation system.

"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]

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

"Sealing and Caulking" means to plug and make tight to reduce the passage of gas. Sealing and caulking enhances radon reduction techniques; however, sealing and caulking alone has not been shown to lower radon levels significantly or consistently.

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

"Soil Gas Collection Plenum" means a 3-dimensional enclosure for collecting radon and other soil gases from under slabs, soil gas retarders or from behind walls that surrounds a void or gas permeable layer. There are at least six sides to this enclosed airspace, and none are perfectly sealed, especially at the side facing soil.

"Soil Gas Retarder" means a continuous membrane of 6 mil (3 mil cross-laminated) polyethylene or equivalent flexible material used to retard the flow of soil gases into a building.

"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.

"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.

~~"Suitable for Occupancy" means a structural area in a home currently lived in or an area not currently used for occupancy, such as a basement, that an occupant or homeowner could use for living space without renovations. This includes an unfinished basement that could be used regularly as, for example, a recreation room, playroom, exercise room or workshop.~~

"Tensile Strength" is measured in pounds (force) per inch, and is tested by applying stress to the material that simulates some of the loads a vapor retarder will face during installation.

"USEPA" means the United States Environmental Protection Agency.

"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  $1.3 \times 10^5$  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 421.30 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) A residential building contractor or his or her subcontractor that installs radon resistant construction.

AGENCY NOTE: Only a radon contractor may install a radon vent fan or upgrade a passive new construction pipe to an active mitigation system.

- h) 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 5/10-20.48 and 34-18.39].

#### **Section 421.40 Categories of Licenses**

- a) Radon Mitigation Professional license.
- b) Radon Mitigation Technician license.

#### **Section 421.45 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 421.50 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, mitigation or laboratory analysis services shall:

- 1) Submit a complete and legible application through the IEMA Radon Licensing Portal; and
  - 2) Pay the appropriate non-refundable fee prescribed in Section 421.100; and
  - 3) Meet the licensing requirements, as applicable, and as set forth in Section 421.60.
  - 4) Provide proof of certification for any entity operating a personnel certification body in accordance with ISO/IEC 17024: “Conformity assessment - General requirements for bodies operating certification of persons” used as part of the application process.
- b) Any person who anticipates conducting radon-related measurement, mitigation, or laboratory analysis 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 421.80, 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 421.100.

#### **Section 421.60 Requirements for Issuance or Renewal of Licenses**

- a) The Agency shall issue a Radon Mitigation 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 of the following criteria:

- A) At least 4 years of design and construction of buildings, or associated heating, ventilation and air conditioning (HVAC), or closely related activities approved by the Agency;
  - B) Documented work history approved by the Agency demonstrating completion of 50 radon mitigation installations; or
  - C) No experience. A new license performance audit will be performed by the Agency.
- 3) Provides proof of successful completion of the USEPA Radon Mitigation 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 Mitigation 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 diagnostic tests that may be performed to determine the mitigation strategy and any other radon related services offered;
  - G) A description of all mitigation system designs or strategies offered.

Materials and design controls shall be included in the professional licensees' Quality Assurance Program description;

- H) A worker protection program description acceptable to the Agency, to be followed when performing mitigation installations, that includes, but is not limited to, methods to reduce or minimize the radon or radon progeny concentrations in the work area;
- 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) Provides proof of insurance as specified in Section 421.70(p).
- 7) Submits standard operating procedures for the performance of mitigations in each of the following categories for which they offer services:
  - A) Home environment and residential real estate.
  - B) Schools, daycares, multifamily building, and commercial building mitigation.

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



ANSI/AARST Soil Gas Mitigation Standards for Existing Homes (SGM-SF-2017 with 12/2020 REVISIONS)

ANSI/AARST Radon Mitigation Standards for Multifamily Buildings (RMS-MF-2018 with 12/2020 REVISIONS)

ANSI/AARST Radon Mitigation Standards for Schools and Large Buildings (RMS-LB-2018 with 12/2020 REVISIONS)

- 8) For an individual requesting renewal, evidence of meeting the continuing education requirements in Section 421.80.
  - 9) Professionals applying for or renewing a Schools, Multi Family and Commercial Building Certification shall provide proof of completion of an Advanced Certificate Course.
- d) The Agency shall issue a Radon Mitigation Technician license to any individual authorizing work under the general supervision of a Radon Mitigation 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 Mitigation 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 Mitigation Examination, an Illinois Qualification Examination previously provided by the Agency, a professional or technician 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.
  - 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 421.80.

### **Section 421.65 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.
  - 3) The location where records will be maintained in compliance with Section 421.45.
- 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 421.70 Conditions of Licenses**

- a) No unlicensed individual shall perform radon mitigation activities without the direct on-site supervision of a licensed individual.
- b) 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.

- c) Records of radon mitigations, 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.
- d) No person shall interfere with, or cause another to interfere with the installation or operation of a radon mitigation system.
- ~~e) A licensee shall return the original license document to the Agency within 15 days after ceasing to provide licensed services unless the license has expired. The licensee shall also comply with Section 421.65 for termination of the license.~~
- ~~f)e) 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, unless a measurement has been made by another independent person in accordance with 32 Ill. Adm. Code 420.~~
- ~~g)f) 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.~~
- ~~h)g) 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.~~
- ~~i)h) The licensee shall comply with all the applicable provisions of this Part.~~
- ~~j)i) The licensee shall comply with its Agency-approved Quality Assurance Program.~~
- ~~k)j) Professional licensees shall provide general supervision of technician licensees working under their Quality Assurance Program.~~
- ~~k)p) A Radon Mitigation Professional engaged in the business of radon mitigation shall obtain and maintain in full force and effect during the operation of the business public liability and property damage insurance that meets the requirements of the Home Repair and Remodeling Act [815 ILCS 513]. The licensee or applicant for a license shall provide proof of this insurance to the Agency annually. Illinois Radon Mitigation System tags will not be issued without valid proof of insurance.~~

#### **Section 420.75 Requirements for Variance Approval**

- a) Radon contractors deviating or varying from the requirements in this Part shall

notify the Agency in writing.

- 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 radon contractor plans to deviate from the requirements of this Part;
  - 2) The specific requirement the radon contractor is varying from:
  - 3) The technical bases for the mitigation technique and description of the functional accomplishments that will be achieved; and
  - 3) The identity of the client and the address of the building, including the zip code.

#### **Section 421.80 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 Mitigation Professional           6 credits
  - 2) Radon Mitigation 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 421.85.

- 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 421.85.
- g) All applicants seeking renewal shall complete the continuing education requirements in Section 420.80 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 420.60 as an alternative to the required CE.

**Section 421.85 Agency Approval of Radon Courses**

- a) Courses previously approved by the Agency will expire on January 1, 2025.
- 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 421.100 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 Mitigation~~ Professional license \$500
  - 2) Radon ~~Measurement Mitigation~~ 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 421.65, 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.
- f) The fee for an Illinois Mitigation System Tag shall be \$50. Only Radon Mitigation Professionals shall purchase Illinois Mitigation System Tags from the Agency. Illinois Mitigation System Tags shall be purchased in amounts not less than 5 per transaction.

### **Section 421.110 Reports to the Agency**

- a) All individuals licensed to perform radon mitigations and former licensees shall submit to the Agency annually on or before February 1st all radon and radon progeny mitigations performed in the preceding year. The following information shall be submitted by a method prescribed by the Agency:
  - 1) Address, city, state and zip code where mitigation was conducted.
  - 2) Date mitigation system was installed.
  - 3) Indication of whether an active soil depressurization system was installed.
  - 4) Indication of whether radon resistant new construction techniques were used.
  - 5) The Illinois Mitigation System Tag number issued by IEMA installed on the system.
  - 6) Building Use (i.e., single family, multi-family, daycare, school or commercial building)

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 and 422 to the Agency ~~in writing~~ within 45 days upon discovery.

### **Section 421.120 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 421.150 Radon Mitigation of Existing Housing**

- a) This Section includes the minimum requirements for reducing soil gas entry into existing housing in order to mitigate occupant exposures to radon gas. These requirements address a wide range of mitigation methods and include requirements for health and safety, system design, system installation, and maintenance. This Section is applicable to existing homes that are rented or owned, including but not limited to timeshare properties and condominiums. The requirements in this section do not apply to the following;

- 1) Radon mitigation practices associated with radon in water, building materials or other less common sources of radon gas.
- 2) Mitigating hazards from gases or substances in outside air and does not address mitigation of potentially combustible soil gases.
- 3) Schools, daycares, multifamily and commercial buildings. See Section 421.155 for requirements for schools, daycares, multifamily and commercial buildings.

- b) Limitations

- 1) Where discrepancies exist between requirements of this section and municipal codes, the municipal codes shall take precedence, except that the municipal codes shall not take precedence with regard to alterations that may adversely impact the radon reduction functions for which such systems were originally designed and may adversely impact public health and safety regarding exposure to a radioactive element.
- 2) It is the responsibility of the radon contractor to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.
- 3) Compliance with this section does not guarantee reduction of indoor radon concentrations to any specific level.
- 4) When altering a mitigation system, it shall be upgraded to the requirements of this Section. Altering radon mitigation systems does not include activities such as replacing worn out equipment or providing new

filters, while leaving the remainder of the system unchanged. When maintenance is performed by a licensee on a mitigation system that does not comply with this Part, the client shall be notified in writing that the mitigation system does not comply with the mitigation standards of this Part. In addition, the professional licensee shall provide a written estimate of the upgrades needed and the cost to bring the system into compliance.

- c) Quality Assurance. Radon contractors shall follow the procedures specified in the Quality Assurance Program as required by Section 421.60(a)(5)(I).
- d) Contacts between radon contractors and clients.
  - 1) Compiling Information
    - A) The radon contractor shall review any available results from previous radon measurements to assist in developing an appropriate mitigation strategy.
    - B) If the radon measurement was not performed in accordance with 32 Ill. Adm. Code 420, the client shall be advised that a retest is recommended.
    - C) The radon contractor shall inform the client of or provide to the client, Agency-approved documents that discuss interpretation of indoor radon test results and the health risk associated with the radon level found in the building. These documents are available on the Agency's website.
  - 2) Initial Building Inspection
    - A) The radon contractor shall conduct a thorough visual inspection of the building prior to initiating any radon mitigation work.
    - B) The visual inspection shall be conducted to help identify any specific building characteristics, hazards and configurations that may affect the design, installation and effectiveness of a mitigation system including but not limited to.
      - i) Significant slab openings, crawlspaces, adjoining slabs, slab floor and exterior wall integrity, and potential footing locations.
      - ii) The design nature of heating, ventilation and cooling (HVAC) systems that may cause significant building

depressurization or have ducting in contact with the soil.

- iii) Identification of fire-rated assemblies or separation required (including for fire-rated party walls between different occupied spaces and fire-rated floor assemblies).
  - iv) Identification of general safety concerns that may warrant precautions for worker or occupant health.
- C) As part of this inspection, the radon contractor shall request from the client any available information on the building, such as construction specifications, pictures, drawings, etc., that might be valuable in determining the radon mitigation strategy.
- D) A floor plan diagram or series of diagrams shall be developed for retention in quality control records or provided to a client and should be complemented with photographic documentation of areas of the building to be mitigated.
- E) The radon contractor shall provide timely documented notice to the client for conditions found that present safety concerns or unexpected challenges to envisioned mitigation designs.
- F) The proposed layout of the mitigation system shall be annotated on the diagram to include components of the mitigation system, such as ASD fans, piping and suction points.
- 3) Proposals
- A) No mitigation activity shall be undertaken before a proposal for the work is accepted by the client and documented by the radon contractor.
  - B) Radon contractors shall provide clients with the following information in writing prior to initiation of the work:
    - i) the Radon Mitigation Professional licensee's Illinois license number, name, address, and phone number;
    - ii) A description of the proposed mitigation system, the long-term operation, maintenance, and monitoring plan (OM&M) applicable for the proposed mitigation design, and an estimated completion date;

- iii) A statement that the mitigation system will comply with this Part;
- iv) Radon Mitigation licensees shall inform the client in writing that post- mitigation testing should be conducted no sooner than 24 hours nor later than 30 days following completion and activation of the mitigation system and that the test may be conducted by an independent Radon Measurement licensee or by the resident of the dwelling.~~A statement that if post-mitigation testing is to be conducted, it shall be conducted by an independent third party;~~
- v) A statement that the system is guaranteed to reduce and maintain the average radon concentration to less than 4.0 pCi/L and the conditions thereof; or a statement explaining that there is no guarantee and the reasons why there is no guarantee; ~~and~~
- vi) A firm price of the installation cost. The firm price may include stepped approaches; ~~and~~
- vi)vii) All mitigation system proposals shall include the optional cost of a system monitoring mechanism to indicate if the fan is operating within the established operating range in accordance 422.150 (m)(2).

4) Notifications

- A) The radon contractor shall notify the client, prior to starting work, of the need for the radon contractor to ventilate work areas during and after the use of sealants, caulks, or bonding chemicals containing volatile solvents.
- B) Whenever the occupant of the dwelling is not the client, the radon contractor shall request that the client provide notice including instructions, warnings, or guidance for specific disruptive or hazardous situations. Notices should be provided to occupants a minimum of 24 hours before entering the dwelling.
- C) The radon contractor shall post or leave notices for affected occupants of the dwelling when using sealants. Material Safety Data Sheets (MSDS) shall be made available to the client upon request.

e) Systems Design

- 1) Mitigation systems shall be designed and installed to avoid the creation of health or safety hazards.
- 2) The following design features shall be considered, but are not limited to:

A) All radon mitigation systems shall be designed to reduce a radon concentration in each area within the footprint of the building as low as reasonably achievable (ALARA).

i) Buildings with a basement, crawlspace and slab on grade foundations, mitigation techniques shall be applied to all foundations regardless of the need to run exposed pipe through finished areas.

ii) All accessible crawlspaces shall be sealed with membranes over exposed soil. ~~Additionally, whenever reasonably achievable (ie. the crawlspace is adjacent to an unfinished area of the basement) a~~Active sSoil dDepressurization shall be applied under the membrane.

~~B) All accessible crawlspaces shall be sealed with membranes over exposed soil. Additionally, whenever reasonably achievable (ie. the crawlspace is adjacent to an unfinished area of the basement) ASD shall be applied under the membrane.~~

~~C) B~~Aesthetics including system appearance, noise, and occupant comfort.

~~D) C~~ Ease of service.

~~E) D~~ Long-term cost that includes power consumption, conditioned air loss, and maintenance and future replacement costs of system components.

~~F) E~~ Mitigation systems shall be designed and installed to avoid compromising the function of any mechanical system or ground water control system.

~~G) F~~ Mitigation systems shall avoid obstructing doorways or

windows and accessibility to switches, controls, electrical boxes, or equipment requiring maintenance.

H)G) Mitigation systems shall be designed and installed as an integral, permanent addition to the building.

- 3) All components of the mitigation work shall be in compliance with applicable mechanical, electrical, building, plumbing, energy, and fire prevention codes, or any other regulations of the jurisdiction where the work is to be performed. Licenses and permits required by local ordinances shall be obtained.
- 4) Diagnostic procedures are recommended and may be required to enable appropriate and effective system design. Diagnostic procedures may include : sub-slab pressure field extension (PFE) tests or analysis; communication tests, visual assessment; characterization of pressure or air exchange rates between indoors and outdoors and also between floors or adjoining air spaces; and diagnostic radon measurements.

A) If a PFE analysis is conducted, the following procedures are required:

- i) PFE testing needs to be conducted under closed-building and normal operating conditions for the building; and
- ii) Identify the distance potential of PFE across the soil gas collection plenum (e.g., airspace under slabs or soil gas retarder) by taking and recording measurements at locations distant from each suction point to verify intended design.

B) The PFE analysis shall be conducted using a differential pressure gauge that is Capable of reading to 1/1000-inch water column.

f) Active Soil Depressurization (ASD)

1) ASD Suction Points

A) A cleared void space (i.e., suction pit) shall exist or be created below all suction points through slab floors and to the side of all suction points through walls. The cleared void space shall be greater than 2.0 US gallons of excavated sub-slab soil/aggregate.

- i) Where multiple suction points are installed, secondary suction pits designed for condensate drainage or airflow

balance are permitted to have a smaller cleared void space.

AGENCY NOTE: Where sub-slab material exhibits poor permeability, larger suction pits are recommended.

- ii) Gaps in concrete surrounding suction pipes shall be sealed in a permanent, airtight manner. When using caulk, the gap opening shall be cleaned and sealed with caulk in accordance with Section 421.150 (g). To support caulk while it cures, gap openings greater than 1/2 inch in width shall be pre-filled as needed with backer rod or comparable material prior to applying caulk.
  - iii) Where the suction pit or suction piping directly draws soil air from a drain-tile, the configuration shall not compromise the water drainage system.
- B) Sump pits shall not be used as the ~~primary~~ only suction point for mitigation systems.
- i) Where sumps are used as a secondary suction point, sump lids shall be sealed in an airtight manner in accordance with Section 421.150 (g).
  - ii) Flexible coupling disconnects for suction piping shall be installed to ease sump lid removal in accordance with Section 421.150 (g). The suction pipe shall not extend lower than 1 inch below the sump lid.
  - iii) Visual access to conditions in the pit is required.
  - iv) Sump lids shall be labeled in accordance with Section 421.150 (o).
- C) For sub-membrane depressurization (SMD), the suction pipe inlet configuration shall be open to soil air in a manner that allows PFE under the entire expanse of the membrane.
- i) To prevent membrane material from obstructing suction pipes, the radon contractor shall install a plumbing tee or other device manufactured for this purpose fitted with not less than ~~5 feet~~ 18 inches of perforated pipe or geotextile matting extending from each horizontal opening of the tee or other device horizontally beneath the membrane.

Drain sleeves, filter socks, or similar materials that would impede airflow into the radon mitigation system are prohibited from use.

- ii) The opening around penetrations of a soil gas retarder shall be sealed in a permanent, airtight manner. Appropriate seal materials shall be applied for all penetrations through the membrane.
  - iii) The soil gas retarder, including seams and edges, shall be sealed to resist air movement between soil and air above the membrane in accordance with Section 421.150 (g).
  - iv) Membranes or crawl space access locations shall be labeled in accordance with Section 421.150 (o).
- D) When ASD systems depressurize a space not used or constructed for habitation, the following are required:
- i) Sealing all surfaces of the space that adjoin both indoor and outside air shall be performed in accordance with Section 421.150 (g).
  - ii) Crawlspace depressurization without the use of a soil gas retarder membrane shall only be used when the crawlspace is inaccessible. When crawlspace depressurization is used for radon mitigation, openings and cracks in floors above the crawlspace that would permit conditioned air to pass out of the living spaces of the building, shall be identified, closed and sealed. Sealing of openings around hydronic heat or steam pipe penetrations shall be done using non-combustible materials.
  - iii) If a radon contractor has concerns about backdrafting potential at a particular site, the contractor shall recommend that a qualified person inspect the natural draft combustion appliances and venting systems for compliance with local codes and regulations. The radon contractor shall recommend that the building owner bring into compliance any combustion appliance or venting system found to be non-complying.
  - iv) Radon Contractors shall not install a fan-powered radon reduction system in any building wherein confirmed



spillage from any natural combustion appliance occurs, until the licensee has confirmed that the problem has been corrected by the client.

- E) When sealing block walls for block wall depressurization, all accessible openings and gaps in the wall that surround the hollow void network being depressurized shall be closed in accordance with Section 421.150 (g) to resist air movement between the depressurized void network and both indoor and outdoor air. If the top or wall surfaces of the void network cannot be closed to resist air entry into the voids, depressurization of the block wall shall not be utilized.
- 2) ASD Piping. The main run of vent pipe, from primary suction point to exhaust point, shall be a minimum 3 inches in diameter to avoid excessive flow noise inside the pipe and noise when the exhaust jet is released.
- A) All duct piping and fittings shall be air and watertight, except at soil gas intake locations, exhaust locations, and fan monitor test ports.
  - B) Above-ground duct piping shall have a continuous downward slope toward the suction point of not less than 1/8 inch per foot to allow condensation or rainwater within the pipes to drain downward into the ground beneath the slab or soil-gas retarder membrane.
  - C) Positively pressurized ASD duct piping or other positively pressurized components of an ASD system shall not be installed in, pass through, or pass under the conditioned space of the building.
  - D) All ASD duct piping, except piping routed below concrete slabs or under soil gas retarder membranes, shall be rigid, non-perforated, PolyVinyl Chloride (PVC) plastic pipe. Pipe wall thickness shall be Schedule 40 with solid, cellular core or composite wall. PVC pipe joints shall be solvent welded with solvent cement in accordance with the pipe manufacturer's instructions;
  - E) All ASD plastic pipe fittings shall be of the same material as the plastic piping they are joined to and solvent welded unless joined with flexible couplings in accordance with this Part;
  - F) Flexible coupling disconnects that comply with ASTM D5926 or ASTM C1173 are permitted as an alternative for joining two portions of ASD duct piping if they establish a secure watertight connection.

- G) Flexible coupling disconnects are permitted for situations that include:
- i) Where piping disassembly may be required in the future for maintenance purposes, such as required at sumps and where connecting an ASD fan.
  - ii) Where joining duct piping materials that are incompatible for solvent welding.
  - iii) Where physical constraints inhibit the ability to join duct pipe materials by means of a solvent weld.
  - iv) Where intended to minimize noise by breaking the direct transfer of fan vibration to duct piping.
- H) When transitioning from one material or shape to another, an adapter specifically designed for the transition shall be used.
- I) Duct piping shall be fastened securely to the structure of the building with hangers, strapping, or other supports that meet the following requirements:
- i) When employed outdoors, mechanical hardware or fasteners shall be durable and rated for outdoor use by the manufacturer;
  - ii) The anchoring method and fastening materials shall be suitable to secure in a durable manner to whatever building surface is chosen;
  - iii) Existing plumbing pipes, ducts, or mechanical equipment shall not be used to support or secure duct piping;
  - iv) Fastening systems that rely only on extending a nail or screw through the duct piping and into a supporting surface shall not be used; and
  - v) Supports for ASD plastic piping shall be installed no less than every ~~10~~8 feet on vertical piping and ~~4~~6 feet on horizontal piping.

- J) As installed, the mitigation system shall operate at a reasonable noise level:
    - i) Duct piping, fans, and support configurations shall be installed in a manner that minimizes vibrations: and
    - ii) Suction pipe openings shall be configured to minimize air-rushing noise.
  - K) Duct pipe routing shall not:
    - i) Block access to the building;
    - ii) Compromise effectiveness of fire suppression systems; or
    - iii) Block access to any areas requiring maintenance or inspection such as mechanical equipment or a crawl space. Flexible coupling disconnects or equivalent methods are permitted where allowed by local building code to provide access by temporary removal and airtight replacement of ASD pipe sections.
  - L) To prevent blockage of air flow into the bottom of radon vent pipes, these pipes shall be supported or secured in a permanent manner that prevents their downward movement to the bottom of suction pits or sump pits, or into the soil beneath an aggregate layer under a slab.
  - ~~M) When a radon mitigation system is designed to draw soil gas from a perimeter drain tile loop (internal or external) that discharges water through a drain line to daylight or a soak away, a one-way flow valve, water trap, or other control device shall be installed if diagnostic testing indicates that outside air is entering the system.~~
  - N)M) Where portions of structural framing material must be removed to accommodate radon vent pipes, material removed shall be no greater than that permitted for plumbing installations required by local building code.
- 3) ASD Pipe Sizing. ASD duct piping shall be sized and configured for adequate capacity to transport the volume of air required for radon reduction.
- A) ASD duct piping from the ~~primary~~ suction point to the exhaust point shall be a minimum of a 3-inch inside diameter (ID) pipe.

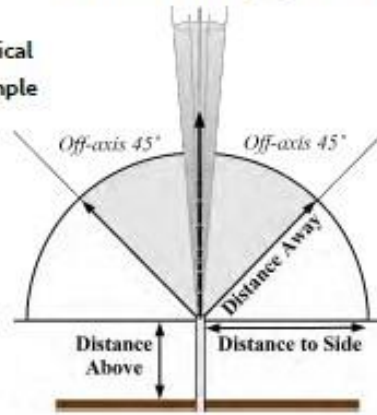
- B) When smaller air volume is needed, a ~~2~~1.5-inch ID pipe from a secondary suction point to the soil gas collection plenum is permitted.
- C) Each suction pipe shall be sized to provide air volume capacity sufficient to establish a vacuum under each slab or membrane and within each airspace being depressurized by the ASD system.
- D) Where air valves, dampers, or baffles are used to adjust airflow balance:
  - i) Their location, settings, and design shall be included in records for the system; and
  - ii) They shall be marked or labeled “Radon System Air Valve. Do Not Alter From Marked Setting,” to indicate their purpose, settings, and instructions.
- E) When multiple suction points are utilized, piping extended to secondary suction points exclusively designed for condensation or rainwater drainage do not require any specific pipe diameter.
- G) ~~3 x 4 inch Mmetal downspout material with a minimum size of 3 x 4 inch is~~Downspouts are permitted for duct piping use exteriorly and on the pressure side of the ASD system.~~, if all the following requirements are met:~~
  - ~~i) Gutter downspout material that is less than 3 x 4 inches shall not be permitted.~~
  - ~~ii) A minimum 3 x 4 inch metal downspout material to meet capacities stipulated in this section for 3-inch ID pipe.~~
  - ~~iii) A minimum 4 x 5 inch metal downspout material to meet capacities stipulated in this section for 4-inch ID pipe. When even larger air volume needs are indicated, duct size shall increase respectively.~~
- H) ~~Maximum airflow speed/velocity within duct piping shall be less than 2,000 feet per minute (fpm) to prevent condensed vapor from being drawn upward within piping rather than naturally falling by~~

~~virtue of gravity to its intended destination (e.g., soil).~~

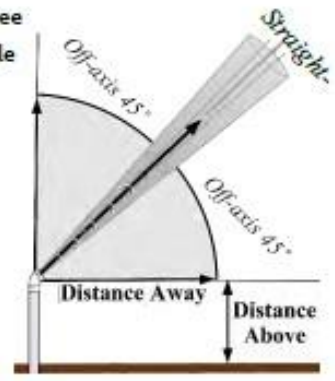
- 4) ASD Exhaust Discharge. The discharge from vent stack pipes of active soil depressurization systems shall prevent re-entrainment of radon, prevent vent stack blockage due to heavy snowfall, and prevent the direct exposure of individuals outside of buildings to high levels of radon by meeting the following requirements:
- A) Distances shall be measured between the closest point of the exhaust opening to the closest point of all location requirements specified in this Section using the shortest distance, as if a string were stretched between them;
  - B) The point of exhaust for all soil gas vent systems shall be located outdoors;
  - C) The discharge from vent stack pipes of ASD systems shall be above the eave of the roof and may discharge within 10 feet of composite or otherwise layered water-tight roofing materials.
  - D) The point of exhaust shall be directed upward without obstruction at an angle that does not deviate more than 45 degrees from a vertical exhaust trajectory. The exhaust discharge shall not exhaust downward or horizontally.
  - E) The exhaust trajectory with an exhaust spread radius of 45° shall not encounter openings in any structures, building materials, or the breathing space where individuals congregate or traverse within 10 feet from the point of exhaust.

Grey areas cannot contain: *Openings in structures, building materials and the breathing space where people congregate or traverse.*

Vertical  
Example



45 Degree  
Example



- F) The point of exhaust shall be located not less than 10 feet above grade nearest to the point of exhaust.
- G) The point of exhaust shall be not less than 10 feet horizontally from any operable window, door, or other opening into conditioned spaces of the structure and not less than 42 feet above operable openings in structures.
- H) 10 feet or more from any opening into an adjacent building.
- I) The point of exhaust shall be not less than 1 foot above a pitched roof at the point penetrated, not less than 1 foot above the edge of the roof when ASD piping is attached to the side of a building, and not less than 18 inches 1 foot above a flat roof.
- J) The point of exhaust is permitted to be located below the edge of the roof if the following occur:
  - i) The edge of the roof exceeds 30 feet above grade nearest to the point of exhaust;
  - ii) An exhaust trajectory with an exhaust spread radius of 45° shall be installed to direct the exhaust away from the side of the structure.
  - iii) The justification for not locating the exhaust above the edge of the roof is recorded in the OM&M plan;
- K) Rain caps shall not be installed on the discharge.
- M) Vent stack discharge points that are directed vertically shall have no obstruction in the discharge except for a rodent screen of wire mesh no smaller than 1/2-1/4 inch. The rodent screen or wire mesh shall be installed in a manner that allows for easy removal for cleaning.
- N) When the ASD system is designed for larger airflow capacities with duct piping larger than 4-inch ID, the distance shall be increased in accordance with the Table below.

Table for Increased Distances for Large Capacity Systems			
Pipe ID 3" – 4" Pipe	Distance Away Directional Spread	Distance Away Straight Line	Distance Above, Below or To Side Grade, Operable Openings and People
	10 ft	20 ft	
For Larger Pipe ID	Increase to	Increase to	Increase by
6"	12 ft	25 ft	2 ft
8"	18 ft	30 ft	4 ft
10"	20 ft	40 ft	6 ft
>10"	Requires a variance submittal with documentation for justification of distances.		

~~Q) Installation of an ASD system shall meet the following:~~

- ~~i) Support shall be provided within 3 feet of the point of exhaust or within 18 inches above and below fans located in attics when pipe configurations might otherwise allow lateral or vertical movement of duct piping; and~~
- ~~ii) Locate or configure the exhaust point to avoid blockage or damage from weather;.~~
- ~~iii) Secure and meet local building code for any piping that extends high enough to require tethering or other means of lateral stability.~~

~~P)O) The penetration of each radon vent pipe through the roof shall be made watertight by a flashing designed for the purpose an approved flashing. Lead vent flashings or any other flashing or cap that would impede the exhaust from the radon vent are prohibited from use.~~

5) ASD Fan Installation

A) Vent fans used in radon mitigation systems shall be designed or otherwise sealed to reduce the potential for leakage of soil gas from the fan housing and shall meet the following:

- i) ASD fans shall originate from a manufacturer that lists ASD (radon mitigation) as one of the fan's intended uses.



ii) ASD fans mounted on the exterior of buildings shall be rated for outdoor use or installed in a weatherproof protective housing that results in a code compliant configuration with protection against electrical shock.

~~iii)~~ ASD fans shall be designed to allow rainwater or condensation from within ASD piping to pass through or around the fan when activated.

~~iii)iv)~~ ASD fans shall be supported within 3 feet of the point of exhaust or within 18 inches above and below fans located in attics when pipe configurations might otherwise allow lateral or vertical movement of duct piping.

~~iv)~~ ASD fans shall be designed to accommodate continuous activation over a durable life span.

B) ASD fans shall be installed as follows:

i) ASD fans shall be installed in attics, on the exteriors of buildings, or in garages that are not beneath conditioned spaces.

ii) ASD fans shall not be installed below ground, in the conditioned space of a building, nor in any basement, crawlspace, or other interior location directly beneath the conditioned spaces of a building.

iii) ASD fans shall be sized to provide the pressure difference and airflow capacity necessary to achieve the mitigation goals.

iv) ASD fans shall be installed in a configuration that avoids condensation buildup in the fan housing.

v) ASD fans shall be installed on vertical runs of ASD piping.

vi) ASD fans shall be mounted to piping using flexible couplings that comply with ASTM D5926 or ASTM C1173 or a method specified by the ASD fan manufacturer that achieves a watertight connection.

- vii) Radon vent fans shall be mounted and secured in a manner that minimizes transfer of vibration to the structural framing of the building.

g) Sealing

- 1) The use of sealing alone has not been shown to significantly or consistently reduce radon entry into buildings. Sealing shall not be used as a permanent, stand-alone mitigation method.

- A) All accessible cracks shall be cleaned, prepared and sealed in a permanent, air-tight manner using compatible caulks or other sealants in accordance with this Section.
- B) Inaccessible openings or cracks shall be disclosed to the client and included in the OM&M if they may compromise the performance of a mitigation system and are determined to be beyond the ability of the contractor to seal.

- 2) Sealant Materials

- A) When sealing cracks in slabs or foundation walls, the caulk or sealant shall be a durable material designed for this purpose, such as urethane or polyurethane, applied in accordance with the manufacturer's recommendations, and:
  - i) When using such products, radon contractors shall notify occupants of related hazards and
  - ii) Radon contractors shall make Material Safety Data Sheets (MSDS) available upon request by the client.
- B) For larger gaps where a crack or joint is greater than 1/2 inch in width, foam backer rod or other comparable filler material shall be inserted into the existing gap prior to applying caulk or sealant.
- C) The caulk or sealant shall be durable, such as non-shrink cementitious products; expanding foam; plastic; or other comparable materials and methods appropriate for the application.
- D) When sealing openings around combustion appliance flues and hydronic heat or steam pipes, noncombustible materials shall be used.
- E) For sump lids and hatchway doors or other items that require

access in the future, nonpermanent sealant materials, designed for this purpose, such as silicone caulk, and gasket materials, shall be used and applied in accordance with the manufacturer's recommendations.

- 3) Sealing Accessible Cracks and Openings.
  - A) Openings to soil around suction piping, utility penetrations, and where the slab meets the foundation wall shall be closed or sealed to resist air movement between soil and indoor air.
  - B) Cracks across a slab and expansion or control joints in the interior slab shall be sealed.
  - C) Gaps at perimeter channel drains and foundation drainage boards shall be closed or sealed to the extent practical without compromising water control capability of the perimeter drainage system.
- 4) Other accessible openings to soil shall be sealed to resist air movement between soil and indoor air, such as support posts, electrical conduits, and openings for plumbing fixtures.
- 5) When Block Wall Depressurization is installed, all accessible openings and gaps being depressurized shall be closed to resist air movement including the following.
  - i) Open blocks at the top course of hollow block masonry walls and open blocks under door or window openings; and
  - ii) Cracks or openings on the interior block walls.
- 6) All downspout joints and connections in radon mitigation systems used on the exterior of a building shall be permanently sealed with appropriate sealants.
- h) Sump Pit Requirements
  - 1) Sump pits or other accessible pit openings in the interior slab that connect to soil air shall be covered and sealed to the extent possible without compromising the water control capability of the sump. Covers are not required for pits that do not connect to soil air.
  - 2) Sump pits shall not be used as the primary suction point for mitigation

systems except in accordance with the following requirements when the basement has radiant heat lines installed in or below the floor.

~~A) — When the basement of the home being mitigated has radiant heat lines installed in or below the floor, the sump pit may be used as the primary suction point.~~

~~B) — The radon contractor shall include provisions for the removal of the sump lid for maintenance of the sump pump.~~

3) The radon contractor shall include provisions for the removal of the sump lid for maintenance of the sump pump. ~~Sump pits that require a sump pump shall have a submersible sump pump installed.~~

~~4) — When the sump pit is used as a secondary suction point, a submersible pump shall be installed in the sump pit.~~

~~5)4) In situations where a areas where the water table is near the surface, causing flooding of the basement or interfering with the effectiveness of the mitigation system, pedestal pumps with a higher pumping capacity may be is installed in accordance with all the radon contractor shall meet the following conditions:~~

~~A) The pump is installed in accordance with the manufacturer's instructions.~~

~~B) The sump lid can be sealed airtight with the exception of a 3/4 inch or larger the tiny opening necessary to permit free operation of the pedestal pump's float or connecting rod.~~

~~C) The design does not create noise, through the float opening, that is objectionable to the client.~~

~~D) The pump or its attached piping needs to be additionally secured to avoid side to side movement likely to cause the lid to impede movement of the float or connecting rod.~~

~~E) The pump motor shall not be below the lid unless the motor is designed for a high moisture environment.~~

~~6)5) Sumps in interior floors that connect to soil air shall have a rigid lid made of sturdy and durable plastic such as polycarbonate plastic or other rot-resistant, rigid material sufficient to support anticipated loads. The lid~~

shall be sealed and mechanically fastened in a manner to facilitate removal for maintenance. Penetrations through the lid such as gaps around electrical wiring, water ejection pipes, and ASD piping shall be sealed.

7)6) Sump covers shall include a removable port or section of the lid no less than 4 inches in diameter ~~or equivalent method when a sump pump is installed in the pit~~ to allow physical access for routine verification that pumps are operational. The removable port or section shall not be sealed or caulked and shall be easy to remove and re-install without the use of tools.

8)7) The covers on sumps that previously provided protection or relief from surface water collection shall be fitted with a water or mechanically trapped drain. Water traps shall be fitted with an automatic supply of priming water.

9)8) If flexible rather than rigid water discharge piping is found, the radon contractor shall recommend in the proposal that rigid pipe for water discharge from permanent sump pumps be installed.

i) Membranes Over Exposed Soil.

- 1) To break the connection between soil gas and indoor air, soil, and other fill material in accessible foundations, i.e., crawl spaces, shall be covered with concrete or a soil gas retarder membrane.
- 2) Soil gas retarders shall comply with ASTM E1745 class A, B or C. These specifications include permeance, tensile strength, and puncture resistance. Thicker sheeting or other means to protect the membrane are recommended where accessible foundations are used for storage or frequently entered for maintenance of utilities or equipment.
- 3) Seams where membrane materials are joined shall overlap at least 12 inches and sealed with a compatible sealant or a caulk in accordance with section 421.150(g) or a method such as membrane tape recommended by the manufacturer that results in an equivalent durable bond.
- 4) Tears or punctures in the membrane shall be sealed by one or more of the following methods:
  - A) A tape recommended by the membrane manufacturer; or
  - B) An additional sheet of the membrane material that covers and overlaps the tear or puncture at least 6 inches on all sides and that is sealed with a caulk in accordance with section

421.150(g).

- 5) Membranes or the crawl space access port shall be labeled in accordance with this with Section 421.150 (g) (7).
- 6) When water is likely to collect on the surface of a membrane, the radon contractor shall install drainage for surface water in the lowest location of the foundation.
- 7) The membrane shall be secured to the walls or other surfaces in accordance with Section 421.150 (j).
- 8) Any wood installed as part of a mitigation system that directly contacts masonry or soil, such as when used to secure a membrane, shall be resistant to decay and insects or otherwise protected.

j) Sub-Membrane Depressurization (SMD).

- 1) The opening around penetrations of a soil gas retarder for ASD duct piping and other utility pipe penetrations shall be fully closed using materials and methods that result in permanent closure.
- 2) Membranes attached to foundation walls and foundation support components shall be attached with furring strips or other durable materials and sealed as follows:
  - A) For flat wall surfaces, the membrane shall be sealed to the foundation walls and supports with a ~~caulk~~ sealant in accordance with subsection 421.150(g).
  - B) For irregular surfaces, alternative materials and methods are permitted so long as durable closure of the soil gas collection plenum is achieved.
- 3) When portions of any foundation cannot be accessed or has insufficient height to work in a safe manner, the edges of the membrane within the boundaries of accessible areas shall be closed. 421

k) Drains

- 1) A one-way flow drain or equivalent method with adequate flow capacity shall be installed for any drain that discharges directly into the soil. Considerations for use of one-way flow valves include:

- A) Potential for debris to clog the valves and designed capacity of the valve to drain adequate volumes of water.
  - B) Whether the airflow leaks between soil and indoor air could contribute to backdraft of atmospherically vented combustion appliances or defeat efforts to establish PFE.
- 2) Openings in the slab or sumps that serve for drainage shall be modified to retain drainage capability and prevent airflow, such as the use of a one-way flow valve, re-routing the drain line into a condensate pump or floor drain, or a trap in the drain.
- ~~3) A one way flow valve or other mechanical means shall be installed when a mitigation system is designed to draw soil gas from drain tiles (internal or external) that discharge water to daylight.~~
- l) Sealed Isolation Assemblies. Sealed isolation assemblies are not regarded as a permanent, stand-alone mitigation method. Sealed isolation assemblies are critical for appropriate implementation of crawl space depressurization (CSD).
- 1) Any accessible openings between the isolated space and areas surrounding the isolated space shall be sealed to resist air movement between the isolated airspace and both indoor air and outdoor air.
  - 2) Access doors or hatches that are not to be permanently sealed shall be fitted with airtight gaskets and a means of positive closure.
  - 3) Access ports into sealed isolation assemblies shall be labeled in accordance with Section 421.150(o).
- m) System Monitors.
- 1) All mitigation systems incorporating a fan shall include a system monitoring mechanism to indicate if the fan is operating within the established operating range. Design and installation of such monitors shall comply with the following:
    - A) The ~~system monitoring mechanism monitoring device~~ shall provide continuous display of a measured value within the established operating range, such as displayed on a manometer pressure gauge or electrical amperage gauge. The system monitoring mechanism~~monitor~~ shall be located where it can be

readily seen and protected from damage or degradation.

- B) ~~System monitoring mechanism~~ ~~Monitoring devices~~ that continuously display a viewable operating range shall be clearly marked or labeled to indicate the measured pressure, airflow volume, or amperage readings that existed at the time mitigation goals were achieved.

- 2) In addition to viewable ~~system monitoring mechanism~~ ~~operating range-monitors~~, ~~radon contractors shall include in their proposals an optional a-~~ monitoring mechanism ~~that could~~ ~~shall~~ be installed that actively alerts occupants or other responsible individuals in the event of fan ~~or other-~~ ~~mechanical-~~ failure. The alert mechanism shall include one or more of the following warning signals:

- A) Audible notification that is clear and distinct.
- B) Visual light notification that is vividly observable.
- C) Notification by telemetric means, such as by email or other electronic communication.

AGENCY NOTE: Permissible sensors that trigger active notification include, but are not limited to, air pressure sensors, airflow sensors, circuits that detect electrical flow, or do-it-yourself continuous radon monitors.

- 3) All mechanisms or systems that monitor fan or airflow functionality shall provide:

- A) Protection from the elements.
- B) Labeling in accordance with subsection 421.150(o).
- C) Battery operated monitors are equipped with a low-power warning feature.
- D) Monitors requiring electricity for indication of system failure shall be on non-switched circuits and designed to reset automatically when power is restored after power supply interruptions.
- E) That monitors requiring electricity for indication of system failure shall not be powered by the same branch circuit as the mitigation system fan.



n) Electrical Requirements

- 1) All electrical components of radon mitigation systems shall conform to provisions of the National Electrical Code and any additional local building codes.
- 2) Wiring shall not be located in or chased through the radon vent piping or any heating or cooling ductwork.
- 3) For ASD fans, a means of electrical disconnect shall be provided in the line of sight and within 6 feet of the mitigation system fan.
- 4) All outdoor wiring for ASD fans shall be protected in conduit, unless otherwise permitted by local building code.

AGENCY NOTE: Low voltage fans should be installed in accordance with local building codes.

- 5) Any plugged cord used to supply power to a radon vent fan shall be a maximum of 6 feet in length.
- 6) No plugged cord shall penetrate a wall or be concealed within a wall.
- 7) Radon mitigation fans installed on the exterior of buildings shall be hard-wired into an electrical circuit. Electrical disconnects shall be installed within line of sight and within 6 feet of the fan. Exteriorly, plugged fans shall be used only inside of weather-proofed fan housings or weather-proofed receptacles.
- 8) If the rated electricity requirements of a radon mitigation system fan exceeds 50 percent of the circuit capacity into which it will be connected, or if the total connected load on the circuit (including the radon vent fan) exceeds 80 percent of the circuit's rated capacity, a separate, dedicated circuit shall be installed to power the fan.
- 9) An electrical disconnect switch or circuit breaker shall be installed in radon mitigation system fan circuits to permit deactivation of the fan for maintenance or repair. Disconnect switches are not required with plugged fans.

o) Labeling Requirements

- 1) All labels shall be made of durable materials. All label lettering and

other annotation on systems shall be of a color in contrast to the color of the background on which the lettering is applied.

- 2) An Illinois Mitigation System Tag shall be placed ~~on the vent pipe~~ next to the mitigation system monitor. This label shall be purchased from the Agency and include the following information: "Radon Reduction System"; the installer's name, phone number and the Illinois license number; the date of installation; and an advisory that the building should be tested for radon at least every 2 years.
- 3) A "Radon Reduction System" label shall be placed on all primary components of each system, such as on duct piping near the manometer, mechanical equipment, ASD fans, system monitors, and system controls.
- 4) For systems installed where system maintenance and monitoring will be the responsibility of the owner or occupant of the dwelling, the "Radon Reduction System" label shall include instructions for obtaining a copy of the OM&M plan and the OM&M plan shall be permanently affixed to the radon vent pipe.
- 5) The OM&M plan shall provide a recommendation for the responsible party to maintain the plan and provide the plan to any future owner/occupant.
- 6) ~~All exposed and visible interior radon mitigation system vent pipe sections shall be identified with at least one label on each floor that reads "Radon Reduction System". Interior duct piping shall be marked "Radon Reduction System" with not less than one label at each floor level. Duct piping labels should be affixed at intervals not greater than 10 feet along the developed length of piping.~~
- 7) Electrical disconnects, such as switches or outlets providing power to plugged connections for mitigation system fans, shall be labeled or marked "Radon Fan – Do Not Turn Off" or "Radon Fan – Do Not Unplug."
- 8) The circuit breaker protecting the mitigation system fan circuit shall be labeled "Radon Reduction System".
- 9) Components that are sealed to prevent air movement between soil and indoor air shall be labeled in accordance with the following:
  - A) Sump pits that are depressurized by the mitigation system or

covered to minimize radon entry shall be identified with a label that reads "Radon Reduction System – Removal of this cover may result in failure of the Radon Reduction System. Consult (radon contractor's name and phone number) before removing this cover and for instructions on the correct procedure for replacing it."

- B) Where soil gas retarder membranes have been installed, a label or marking shall be located in a conspicuous place, at access panels, or immediately visible once entering the crawl space, such as on membrane material near the access location. The label shall read "Radon Reduction System – Removal of this membrane will result in failure of the Radon Reduction System. Consult (radon contractor's name and phone number) before removing this membrane and for instructions on the correct procedure for replacing it."

- 10) Fans mounted exteriorly, and exterior vent pipe shall be identified with a label that reads "Radon Reduction System" in a weatherproof manner.

11) All systems shall are to have a maintenance placard attached to a suction pipe or a wall within 5 feet of the system monitoring mechanism. The placard shall include;

- A) Be made from 110 lb cardstock or thicker.
- B) Explain the need for weekly checking of the system monitoring mechanism and the need for radon testing every two years.
- C) Be designed to attract attention by having the words "Weekly" and "Every 2 Years" in fonts that are at least 1 inch in size.
- D) All other text shall be in 12 pt to 16 pt font size.
- E) The phrase "Do Not Remove This Placard". 11) — All systems are to have a maintenance placard attached to a suction pipe or a wall within 5 feet of the system monitoring mechanism. The placard is to be of 110 lb cardstock or thicker and is to explain the need for weekly checking of the system monitoring mechanism and the need for radon testing every two years. It is to be designed to attract attention by having the words "Weekly" and "Every 2 Years" in fonts that are at least 1 inch in size. All other text is to be in 12 pt to 16 pt font size. It is to include the phrase "Do Not Remove This Placard".

124) ~~To ensure should~~ If the maintenance placard ~~is~~ removed by error, ~~Bbeneath the maintenance placard~~ a sticker shall be placed ~~beneath the maintenance placard~~ that indicates the maintenance placard has been removed and to contact the radon contractor for a replacement maintenance placard.

p) System Functional Evaluation

- 1) Once all sealing, piping and other components of the ASD system are complete, system performance may need to be evaluated. If the radon mitigation professional determines Pressure Field Extension (PFE) measurements or communication tests are necessary, the following requirements shall be completed.
  - A) The air pressure differences between soil air and indoor air shall be ~~measured-analyzed~~ and recorded in jobsite logs ~~for each soil gas collection plenum addressed by each suction point. Measurements using a differential pressure gauge that is capable of reading 1/1000 inch water column differences in air pressure shall be conducted and recorded~~ at locations that will best characterize:
    - i) The full expanse of the soil gas collection plenum,
    - ii) Other locations where evidence suggests that large volumes of soil gas are susceptible to enter the building as a result of indoor air pressures.
    - iii) Where PFE or communication test locations cannot be ~~created-conducted~~ due to building materials that are virtually irreplaceable, the reason why shall be noted in jobsite logs and alternative locations or methods for verifying system effectiveness are permitted.
  - B) The vacuum within the main trunk duct piping on the negatively pressured side of the fan shall be measured and recorded in jobsite logs. If the measurement meets or exceeds the manufacturer recommended maximum for vacuum, further investigation is required.
  - C) The volume of air exhausted by the system shall be measured and recorded in jobsite logs.
  - D) A summary of conditions for materials and permeability under

slabs, as visually and physically observed, and sizable unclosed openings between soil and indoor air shall be recorded in jobsite logs.

- E) Other Lines of Evidence. Other observations and tests deemed pertinent to establishing or maintaining effective mitigation shall be recorded in jobsite logs that can include diagnostic measurements to evaluate changes to indoor radon concentrations.
- 2) Once mitigation efforts that include non-ASD mitigation systems or methods are complete, performance evaluations shall be conducted in compliance with requirements in Section 421.150(p).
- q) Inspection for Compliance
  - 1) Prior to delivery and release of the completed system for use, a radon contractor shall verify:
    - A) Compliance with this Part:
    - B) Conformance with the intended design criteria; and
    - C) Compliance with local building codes, including work conducted by other licensed professionals.
  - 2) Any items found not in compliance with this Part, the intended design criteria, or local building codes shall be corrected.
  - 3) Radon Mitigation licensees shall inform the client in writing that post-mitigation testing should be conducted no sooner than 24 hours nor later than 30 days following completion and activation of the mitigation system and that the test may be conducted by an independent Radon Measurement licensee or by the resident of the dwelling.
  - 4) For each mitigation system installation, at a minimum, the radon contractor shall photograph, store, and make available for review, at a minimum, photos of locations as follows:
    - A) Sump pit before removing the cover;
    - B) Sump pit after removing the cover;
    - C) Sump pit sealed, labeled and sump pump plugged in;

- D) Suction pit after coring and excavation, but prior to attaching pipe;
- E) Full height for each suction pipe;
- F) U-tube & Illinois Mitigation Tag;
- G) All mitigation system piping;
- H) Circuit breaker and label that power the mitigation system fan;
- I) Radon mitigation fan and electrical connection;
- J) Fan housing, if installed; and
- K) Full height exterior photo or pipe and roof flashing.

r) Operation, Maintenance and Monitoring Plan (OM&M)

- 1) To provide the tools essential for occupant efforts in long-term risk management, the radon contractor shall provide to the client an OM&M that prominently includes essential components for operation, maintenance, and monitoring (~~OM&M~~) of the mitigation system as installed.
- 2) Instructions to obtain a copy of ~~the~~ OM&M shall be securely attached to the system in a visible location ~~or otherwise provided to the client~~. If no portion of the system is installed in the livable space, the instructions to obtain a copy of the OM&M shall be installed in an appropriate interior location, such as the mechanical room.
- 3) -The OM&M shall prominently include all the following information.
  - A) A recommendation to retest at least every 2 years.
  - B) A description of the active system failure notification monitor and a recommendation to check the monitor monthly.
  - C) Documented startup parameters including pressure gauge readings that existed at the time successful mitigation was initially achieved.
  - D) A list of actions for the resident to take if the fan monitor indicates system degradation or failure.

- E) A description of the mitigation system as installed to include.
  - i) Basic operating principles.
  - ii) The finalized drawing that includes illustration of the building foundation, the location of all walls, drain fixtures, HVAC systems and radon entry points, results of any diagnostic testing, the layout of any radon mitigation system piping, and the location of any vent fan and system warning devices. The floor plan sketch that may include photographic documentation.;
  - iii) A description of any deviations from ~~the MS and~~ applicable regulations of this Part;
  - iv) A description of the proper operating procedures of the mitigation system installed and any mechanical or electrical systems installed, including manufacturer's operation and maintenance instructions and warranties;
  - v) The address of the building mitigated, including the zip code, the mitigation system type, the mitigation date, whether radon resistant new construction techniques were used, and the Illinois Mitigation System Tag number.
- F) A description of any important observations that might adversely affect the mitigation system or other building systems and a copy of the approved variance for deviations from this standard.
- H) The justification for not locating the exhaust above the edge of the roof is recorded in the OM&M plan;
- I) Contact information for service inquiries and identification of the qualified mitigation professional responsible for adherence to protocols to include.
  - i) Name, address and phone number.
  - ii) Radon Mitigation Professional licensing number.
- J) In addition to a retest every two years to ensure the mitigation system effectiveness, radon concentrations should also be retested

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 home is newly occupied.
  - iii) Heating or cooling systems are altered with changes to air distribution or pressure relationships.
  - iv) Ventilation is altered by extensive weatherization, changes to mechanical systems or comparable procedures.
  - v) Sizable openings to soil occur due to groundwater or slab surface water control systems are added or altered (e.g., sumps, drain tiles, shower/tub retrofits, etc.), natural settlement causing major cracks to develop.
  - vi) Earthquakes, construction blasting, or formation of sink holes nearby.
  - vii) An installed mitigation system is altered or repaired.
  - K) Other information for future reference and operation or repair considerations shall be provided to include:
    - i) Pre-and post-mitigation test data, if available.
    - ii) Copies of ~~contracts and~~ warranties.
    - iii) Copies of building permits when required.
    - iv) An estimate of the annual operating costs.
  - L) The radon contractor shall identify when system maintenance and monitoring are the responsibility of someone other than the occupant or future occupants.
- ~~43~~) After installation, the contractor shall review with the client the OM&M and the operating principles, operation, and maintenance of the system.
- s) Records and Documentation



- 1) Records of all mitigation work performed shall be kept for a minimum of 6 years or for the period of any warranty, whichever is longer.
  - 2) Health and safety records, including radon contractor exposure logs and other appropriate medical monitoring records, shall be maintained for a minimum of 20 years.
  - 3) A complete copy of the OM&M for all mitigation methods.
  - 4) A floor-plan drawing shall be finalized from preliminary inspection sketches and shall include illustration of the building foundation, the location of all walls, drain fixtures, HVAC systems, radon entry points, results of any diagnostic testing, the layout of any radon mitigation system piping, and the location of any vent fan and system warning devices.
  - 5) The finalized drawing shall be an auditable part of the mitigation file and shall be available to the occupant, the owner of the building, his/her representatives, or the client, upon request.
  - 6) Fan model number shall be recorded when installed or altered.
  - 7) Compliance and performance evaluation results shall be recorded.
  - 8) Qualified control tracking. At a minimum, it is required that quality control efforts be retained on pertinent details to include:
    - A) Identification of staff responsible for standards compliance for each specific installation.
    - B) Descriptions of conditions found under slabs and resulting suction pit description after actions were taken to comply with requirements for suction pit size in accordance with this part.
  - 9) For systems not individually maintained by the individual owner and occupier of the home, the radon contractor shall provide the client an OM&M.
- t) Health and Safety
- 1) The radon mitigation professional shall ensure all licensees and unlicensed individuals are advised of the hazards of exposure to radon and the need to apply protective measures when working in areas of

elevated radon concentrations.

- 2) The radon mitigation professional shall ensure all licensees and unlicensed individuals exposure to radon at each work site shall be recorded and maintained.
  - 3) Working Level Month (WLM) calculations shall be based upon the exposure hours times radon measurements (pCi/L) divided by 100, divided by 170.
  - 4) Calculations for pCi/L/day shall be based on the exposure hours, divided by 24. These calculations shall apply to one of the following radon measurements for the exposure at each work site:
    - i) The highest pre-mitigation indoor radon measurement.
    - ii) Actual jobsite measurements of radon.
    - iii) The measurements from a radon dosimeter such as an alpha track or comparable device consistently worn at the job site by a mitigation installer. The radon dosimeter shall be stored in a low-radon environment during nonworking hours, and thereby all exposure to the radon detector is assumed to be the mitigation installer's exposure.
  - 5) A licensee and unlicensed individuals exposure shall be limited to as low as reasonably achievable.
  - 6) Radon Contractors shall comply with all federal, state and local standards or regulations relating to mitigation installer safety and health. Publications from Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) shall be reviewed and incorporated into work practices.
  - 7) Upon request, Radon Contractors ~~shall provide to and~~ clients ~~shall be provided with~~ all the applicable Material Safety Data Sheets (MSDS) for all hazardous materials used upon request ~~and be informed of the safety procedures required for each.~~
- u) Non ASD Systems and Methods
- 1) Active Soil Pressurization (ASP). ASP systems might resemble inversely applied ASD systems. These upside-down systems have more

often been employed for special conditions. When ASP systems are employed the radon contractor will ensure the following requirements are met:

- A) Sealing shall be in compliance with Section 421.150(g) in order to help break the connection between soil air and living spaces.
- B) Radon contractors shall verify after installation that radon is not transported to another airspace or occupiable portion of the building.

2) Indoor Air Dilution.

- A) The introduction of outdoor air to a building or airspace can, under certain conditions, be effective to dilute concentrated radon. The high volumes of added outdoor air required to dilute radon gas to acceptable concentrations will often result in unacceptable energy penalties, especially when accounting for occupant comfort. When indoor air dilution is employed the radon contractor shall submit a variance request in accordance with Section 421.75.~~comply with the following:~~

- ~~i) Mechanical or passive components that are newly installed or augmented shall result in a configuration with adequate capacity to continually provide the required volume of dilution air needed to achieve desired goals for radon reduction.~~

- ~~ii) Radon contractors shall verify after installation that radon is not transported to another airspace or occupiable portion of the building.~~

- ~~B) Prior to indoor air dilution system installation or augmentations:~~

- ~~i) A qualified ventilation technician shall conduct pressure and airflow measurements as needed to evaluate system capacity requirements, energy penalties and feasibility for the design. Blower door measurements during system design are required to quantify the capacity needs of the system.~~

- ~~ii) Sources for air to be delivered to the airspace shall be evaluated.~~

~~C) — After installation or augmentations.~~

~~i) — A qualified ventilation technician shall verify with pressure and airflow measurements that adequate capacity for required operating parameters were achieved. These measurements shall be recorded, reported, and include: total airflow in and total airflow out, temperature in and temperature out, air density, altitude and other operating parameters.~~

~~ii) — Sources for air delivered to the airspace shall be verified.~~

3) HVAC Repairs or Modifications.

A) When an incidental failure is suspected of causing radon entry and it can be repaired in a permanent fashion, diagnostic radon tests after completing incidental repairs are allowed. An inspection regimen shall be included in the OM&M.

B) Modifications to HVAC systems and controls shall comply with appropriate ventilation standards and local building codes.

4) Where it has been determined that building materials are a primary source of elevated radon concentrations, indoor air dilution may be a consideration. Other considerations currently beyond the scope of this document include encapsulation, isolation or removal of building materials.

5) Where it can be determined that radon from a water supply is a primary source of elevated radon concentrations in air, aeration and charcoal filtration are common methods employed to achieve radon reductions. Such methods are currently not regulated in Illinois.

### **Section 421.155 Radon Mitigation Standards for Schools, Daycares, Multifamily and Commercial Buildings**

a) This Section includes the minimum requirements for mitigation of radon in schools, daycares, multifamily and commercial buildings. These requirements address a wide range of mitigation methods and include requirements for health and safety, system design, system installation, and maintenance. This Section is applicable a wide range of buildings including, but not limited to:

1) A wide range of schools including, among others, educational occupancies including for religious and educational purposes through the 12th grade.

- 2) Daycare facilities, including day care centers, licensed day care homes, and licensed group day care homes.
- 3) Multifamily buildings including, among others, townhouses, apartment houses, convents, dormitories, congregate residences, fraternities and sororities, non-transient boarding houses, hotels, monasteries, motels and vacation timeshare properties.
- 4) Business occupancies including for offices, educational and training facilities, professional services, service-type transactions, for the gathering of persons for purposes such as civic, social or religious functions.
- 5) Factories including for fabrication or manufacturing, repair or processing.
- 6) Institutions including for where people are cared for or live in a supervised environment be it under restraint or security, detained in a penal institution, or for medical, surgical, psychiatric, nursing, custodial care, for the sale of merchandise, goods, wares or merchandise.
- 7) Multi-use buildings or structures that are divided into any combination of occupancies including educational, commercial or residential.
- 8) This section addresses a wide range of mitigation methods and is applicable to structures rented, leased or owned including condominiums, co-ops and timeshares.
- 9) The requirements in this section do not apply to the following;
  - A) Radon mitigation practices associated with radon in water, building materials or other less common sources of radon gas.
  - B) Mitigating hazards from gases or substances in outside air and does not address mitigation of potentially combustible soil gases.
  - C) Practices or techniques associated with removal of contaminated source materials.
  - D) Existing homes that are rented or owned, including but not limited to timeshare properties and condominiums. See Section 421.150 for requirements for mitigation of existing housing.

b) Limitations

- 1) Where discrepancies exist between requirements of this section and municipal codes, the municipal codes shall take precedence, except that the municipal codes shall not take precedence with regard to alterations that may adversely impact the radon reduction functions for which such systems were originally designed and may adversely impact public health and safety regarding exposure to a radioactive element.
  - 2) It is the responsibility of the radon contractor to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.
  - 3) Compliance with this section does not guarantee reduction of indoor radon concentrations to any specific level.
  - 4) When altering a mitigation system, it shall be upgraded to the requirements of this Section. Altering radon mitigation systems does not include activities such as replacing worn out equipment or providing new filters, while leaving the remainder of the system unchanged. When maintenance is performed by a licensee on a mitigation system that does not comply with this Part, the client shall be notified in writing that the mitigation system does not comply with the mitigation standards of this Part. In addition, the professional licensee shall provide a written estimate of the upgrades needed and the cost to bring the system into compliance.
- c) Quality Assurance. Radon contractors shall follow the procedures specified in the Quality Assurance Program as required by Section 421.60(a)(5)(I).
- d) Contacts between radon contractors and clients.
- 1) Compiling Information
    - A) The radon contractor shall review any available results from previous radon measurements to assist in developing an appropriate mitigation strategy.
    - B) If the radon measurement was not performed in accordance with 32 Ill. Adm. Code [422429](#), the client shall be advised that a retest is recommended.
    - C) Retests are required when existing tests are insufficient to characterize dynamics of radon entry into the building. Conditions that warrant the retest requirement include:
      - i) Tested locations were of insufficient quantity.

- ii) Time periods do not reflect average conditions for building occupancy.
  - iii) The latest test data are older than 12 months and thereby comparisons of current and previous operating conditions for the building are not quantifiable.
  - iv) Testing practices do not comply with this Part including for lack of appropriate test locations, test durations, closed-building conditions or approved test devices.
- D) The radon contractor shall inform the client of or provide to the client, Agency-approved documents that discuss interpretation of indoor radon test results and the health risk associated with the radon level found in the building. These documents are available on the Agency's website.

2) Initial Building Inspection

- A) The radon contractor shall conduct a thorough visual inspection of the building prior to initiating any radon mitigation work.
- B) The visual inspection shall be conducted to help identify any specific building characteristics, hazards and configurations that may affect the design, installation and effectiveness of a mitigation system including but not limited to.
  - i) Significant slab openings, crawlspaces, adjoining slabs, slab floor and exterior wall integrity, and potential footing locations.
  - ii) The design nature of heating, ventilation and cooling (HVAC) systems that may cause significant building depressurization or have ducting in contact with the soil.
  - iii) Identification of fire-rated assemblies or separation required (including for fire-rated party walls between different occupied spaces and fire-rated floor assemblies).
  - iv) Identification of general safety concerns that may warrant precautions for worker or occupant health.
- C) As part of this inspection, the radon contractor shall request from

the client any available information on the building, such as construction specifications, pictures, drawings, etc., that might be valuable in determining the radon mitigation strategy.

- D) A floor plan diagram or series of diagrams shall be developed for retention in quality control records or provided to a client and should be complemented with photographic documentation of areas of the building to be mitigated.
- E) The radon contractor shall provide timely documented notice to the client for conditions found that present safety concerns or unexpected challenges to envisioned mitigation designs.
- F) The proposed layout of the mitigation system shall be annotated on the diagram to include components of the mitigation system, such as ASD fans, piping and suction points.
- G) The radon contractor shall request that the client provide information regarding all known safety hazards for the building and adjacent or nearby buildings that might be related to design and installation of the mitigation systems. Information of concern, among others, includes for asbestos, lead paint or other hazards.

3) Proposals

- A) No mitigation activity shall be undertaken before a proposal for the work is accepted by the client and documented by the radon contractor.
- B) Radon contractors shall provide clients with the following information in writing prior to initiation of the work:
  - i) The Radon Mitigation Professional licensee's Illinois license number, name, address, and phone number;
  - ii) A description of the proposed mitigation system, the long-term operation, maintenance, and monitoring plan (OM&M) applicable for the proposed mitigation design, and an estimated completion date;
  - iii) A statement that the mitigation system will comply with this Part;
  - iv) [Radon Mitigation licensees shall inform the client in](#)



writing that post- mitigation testing should be conducted no sooner than 24 hours nor later than 30 days following completion and activation of the mitigation system and that the test should be conducted by an independent Radon Measurement Professional licensee~~A statement that if post mitigation testing is to be conducted, it shall be conducted by an independent third party;~~

- v) A statement that the system is guaranteed to reduce and maintain the average radon concentration to less than 4.0 pCi/L and the conditions thereof; or a statement explaining that there is no guarantee and the reasons why there is no guarantee; ~~and~~
- vi) A firm price of the installation cost. The firm price may include stepped approaches.
- vii) Prior to installation the contractor shall provide the client a written communication that includes the system's annual electrical costs specifically calculated for each system based upon current local rates.
- vii) All mitigation system proposals shall include the optional cost of a system monitoring mechanism to indicate if the fan is operating within the established operating range in accordance with subsection 421.155(m)(2).

4) Notifications

- A) The radon contractor shall notify the client whenever disruptive procedures are required to complete building investigations, installations or other work that might include entrance to rooms for drilling into concrete floors and other installation or maintenance needs.
- B) The radon contractor shall notify the client, prior to starting work, of the need for the radon contractor to ventilate work areas during and after the use of sealants, caulks, or bonding chemicals containing volatile solvents.
- C) Whenever the occupant of the dwelling is not the client, the radon contractor shall request that the client provide notice including instructions, warnings, or guidance for specific

disruptive or hazardous situations. Notices should be provided to occupants a minimum of 24 hours before entering the dwelling.

- D) The radon contractor shall post or leave notices for affected occupants of the dwelling when using sealants. Material Safety Data Sheets (MSDS) shall be made available to the client upon request.

e) Systems Design

- 1) Mitigation systems shall be designed and installed to avoid the creation of health or safety hazards.

- 2) The following design features shall be considered, but are not limited to:

- A) All radon mitigation systems shall be designed to reduce a radon concentration in each area within the footprint of the building as low as reasonably achievable (ALARA).

- i) Buildings with a basement, crawlspace and slab on grade foundations, mitigation techniques shall be applied to all foundations regardless of the need to run exposed pipe through finished areas.

- ii) All accessible crawlspaces shall be sealed with membranes over exposed soil. ~~Additionally, whenever reasonably achievable (ie. the crawlspace is adjacent to an unfinished area of the basement) a~~Active sSoil dDepressurization shall be applied under the membrane.

- ~~B) All accessible crawlspaces shall be sealed with membranes over exposed soil. Additionally, whenever reasonably achievable (ie. the crawlspace is adjacent to an unfinished area of the basement) ASD shall be applied under the membrane.~~

- B) Aesthetics including system appearance, noise, and occupant comfort.

- C) Ease of service.

- D) Long-term cost that includes power consumption, conditioned air loss, and maintenance and future replacement costs of system components.

E) Mitigation systems shall be designed and installed to avoid compromising the function of any mechanical system or ground water control system.

F) Mitigation systems shall avoid obstructing doorways or windows and accessibility to switches, controls, electrical boxes, or equipment requiring maintenance.

G) Mitigation systems shall be designed and installed as an integral, permanent addition to the building.

3) All components of the mitigation work shall be in compliance with applicable mechanical, electrical, building, plumbing, energy, and fire prevention codes, or any other regulations of the jurisdiction where the work is to be performed. Licenses and permits required by local ordinances shall be obtained.

4) Diagnostic procedures are recommended and may be required to enable appropriate and effective system design. Diagnostic procedures may include: sub-slab pressure field extension (PFE) tests or analysis; [communication tests](#), visual assessment; characterization of pressure or air exchange rates between indoors and outdoors and also between floors or adjoining air spaces; and diagnostic radon measurements.

A) If a PFE analysis is conducted, the following procedures are required:

i) PFE testing needs to be conducted under closed-building and normal operating conditions for the building; and

ii) Identify the distance potential of PFE across the soil gas collection plenum (e.g., airspace under slabs or soil gas retarder) by taking and recording measurements at locations distant from each suction point to verify intended design.

B) The PFE analysis shall be conducted using a differential pressure gauge that is Capable of reading to 1/1000-inch water column.

2) Identify unique sectors. The following is required to evaluate mitigation design needs for each portion of a building.

A) Within ground contact areas of the building, identify each addition to the original building and each structurally isolated airspace.

- B) For ground contact areas, identify the general design and intended purpose of each active HVAC component.
- C) Each ground contact area of the building where the multiple rooms are served by individual, yet similar basic heating and cooling technology and each ground contact area of the building served by a central HVAC air handling system shall be classified as a unique

sector.

D) The HVAC design group that serves each unique sector of the building shall be documented with either narrative descriptions or annotated on the diagram. HVAC operational parameters to include:

- i) HVAC setback schedules.
- ii) Exhaust systems designed to intentionally cause negative pressure in a unique area of the building (i.e., kitchen, shop or laboratory areas).
- iii) Ventilation airflow measurements and pressure.

E) Diagram(s) or documentation shall identify the occupancy use for each unique area and the following additional information.

- i) The number of months per year that the building or individual portions of the building are significantly occupied.
- ii) The hours of the day that each individual portion of the building is significantly occupied
- iii) Other areas where occupants or workers may spend more than 4 hours per day.
- iv) Areas that are not occupied yet can potentially become occupied.

f) Repairs or modifications to HVAC systems recommended because of building investigations shall be conducted by a certified HVAC Contractor or Mechanical Engineer.in accordance with local building codes.

f) Active Soil Depressurization (ASD)

1) ASD Suction Points

A) A cleared void space (i.e., suction pit) shall exist or be created below all suction points through slab floors and to the side of all suction points through walls. The cleared void space shall be

greater than 2.0 US gallons of excavated sub-slab soil/aggregate.

- i) Where multiple suction points are installed, secondary suction pits designed for condensate drainage or airflow balance are permitted to have a smaller cleared void space.

AGENCY NOTE: Where sub-slab material exhibits poor permeability, larger suction pits are recommended.

- ii) Gaps in concrete surrounding suction pipes shall be sealed in a permanent, airtight manner. When using caulk, the gap opening shall be cleaned and sealed with caulk in accordance with Section 421.150 (g). To support caulk while it cures, gap openings greater than 1/2 inch in width shall be pre-filled as needed with backer rod or comparable material prior to applying caulk.
- iii) Where the suction pit or suction piping directly draws soil air from a drain-tile, the configuration shall not compromise the water drainage system.

B) Sump pits shall not be used as the primary only suction point for mitigation systems.

- i) Where sumps are used as a secondary suction point, sump lids shall be sealed in an airtight manner in accordance with Section 421.150 (g).
- ii) Flexible coupling disconnects for suction piping shall be installed to ease sump lid removal in accordance with Section 421.150 (g). The suction pipe shall not extend lower than 1 inch below the sump lid.
- iii) Visual access to conditions in the pit is required.
- iv) Sump lids shall be labeled in accordance with Section 421.150(o).

C) For sub-membrane depressurization (SMD), the suction pipe inlet configuration shall be open to soil air in a manner that allows PFE under the entire expanse of the membrane.

- i) To prevent membrane material from obstructing suction pipes, the

radon contractor shall install a plumbing tee or other device manufactured for this purpose fitted with not less than 5 feet 18 inches of perforated pipe or geotextile matting extending from each horizontal opening of the tee or other device horizontally beneath the membrane. Drain sleeves, filter socks, or similar materials that would impede airflow into the radon mitigation system are prohibited from use.

- ii) The opening around penetrations of a soil gas retarder shall be sealed in a permanent, airtight manner. Appropriate seal materials shall be applied for all penetrations through the membrane.
  - iii) The soil gas retarder, including seams and edges, shall be sealed to resist air movement between soil and air above the membrane in accordance with Section 421.150 (g).
  - iv) Membranes or crawl space access locations shall be labeled in accordance with Section 421.150 (o).
- D) When ASD systems depressurize a space not used or constructed for habitation, the following are required:
- i) Sealing all surfaces of the space that adjoin both indoor and outside air shall be performed in accordance with Section 421.150 (g).
  - ii) Crawlspace depressurization without the use of a soil gas retarder membrane shall only be used when the crawlspace is inaccessible. When crawlspace depressurization is used for radon mitigation, openings and cracks in floors above the crawlspace that would permit conditioned air to pass out of the living spaces of the building, shall be identified, closed and sealed. Sealing of openings around hydronic heat or steam pipe penetrations shall be done using non-combustible materials.
  - iii) If a radon contractor has concerns about backdrafting potential at a particular site, the contractor shall recommend that a qualified person inspect the natural draft combustion appliances and venting systems for compliance with local codes and regulations. The

radon contractor shall recommend that the building owner bring into compliance any combustion appliance or venting system found to be non-complying.

- iv) Radon Contractors shall not install a fan-powered radon reduction system in any building wherein confirmed spillage from any natural combustion appliance occurs, until the licensee has confirmed that the problem has been corrected by the client.
- E) When sealing block walls for block wall depressurization, all accessible openings and gaps in the wall that surround the hollow void network being depressurized shall be closed in accordance with Section 421.150 (g) to resist air movement between the depressurized void network and both indoor and outdoor air. If the top or wall surfaces of the void network cannot be closed to resist air entry into the voids, depressurization of the block wall shall not be utilized.
- 2) ASD Piping. The main run of vent pipe, from primary suction point to exhaust point, shall be a minimum 3 inches in diameter to avoid excessive flow noise inside the pipe and noise when the exhaust jet is released.
  - A) All duct piping and fittings shall be air and watertight, except at soil gas intake locations, exhaust locations, and fan monitor test ports.
  - B) Above-ground duct piping shall have a continuous downward slope toward the suction point of not less than 1/8 inch per foot to allow condensation or rainwater within the pipes to drain downward into the ground beneath the slab or soil-gas retarder membrane.
  - C) Positively pressurized ASD duct piping or other positively pressurized components of an ASD system shall not be installed in, pass through, or pass under the conditioned space of the building.
  - D) All ASD duct piping, except piping routed below concrete slabs or under soil gas retarder membranes, shall be rigid, non-perforated, PolyVinyl Chloride (PVC) plastic pipe. Pipe wall thickness shall be Schedule 40 with solid cellular core or composite wall. PVC pipe joints shall be solvent welded with solvent cement in accordance with the pipe manufacturer's instructions;



E) All ASD plastic pipe fittings shall be of the same material as the plastic piping they are joined to and solvent welded unless joined with flexible couplings in accordance with this Part;

F) Flexible coupling disconnects that comply with ASTM D5926 or ASTM C1173 are permitted as an alternative for joining two portions of ASD duct piping if they establish a secure watertight connection.

G) Flexible coupling disconnects are permitted for situations that include:

- i) Where piping disassembly may be required in the future for maintenance purposes, such as required at sumps and where connecting an ASD fan.
- ii) Where joining duct piping materials that are incompatible for solvent welding.
- iii) Where physical constraints inhibit the ability to join duct pipe materials by means of a solvent weld.
- iv) Where intended to minimize noise by breaking the direct transfer of fan vibration to duct piping.

H) When transitioning from one material or shape to another, an adapter specifically designed for the transition shall be used.

I) Duct piping shall be fastened securely to the structure of the building with hangers, strapping, or other supports that meet the following requirements:

- i) When employed outdoors, mechanical hardware or fasteners shall be durable and rated for outdoor use by the manufacturer;
- ii) The anchoring method and fastening materials shall be suitable to secure in a durable manner to whatever building surface is chosen;
- iii) Existing plumbing pipes, ducts, or mechanical equipment shall not be used to support or secure duct piping;

- iv) Fastening systems that rely only on extending a nail or screw through the duct piping and into a supporting surface shall not be used; and
  - v) Supports for ASD plastic piping shall be installed no less than every 10 feet on vertical piping and 4 feet on horizontal piping.
- J) As installed, the mitigation system shall operate at a reasonable noise level:
- i) Duct piping, fans, and support configurations shall be installed in a manner that minimizes vibrations; and
  - ii) Suction pipe openings shall be configured to minimize air-rushing noise.
- K) Duct pipe routing shall not:
- i) Block access to the building;
  - ii) Compromise effectiveness of fire suppression systems; or
  - iii) Block access to any areas requiring maintenance or inspection such as mechanical equipment or a crawl space. Flexible coupling disconnects or equivalent methods are permitted where allowed by local building code to provide access by temporary removal and airtight replacement of ASD pipe sections.
- L) To prevent blockage of air flow into the bottom of radon vent pipes, these pipes shall be supported or secured in a permanent manner that prevents their downward movement to the bottom of suction pits or sump pits, or into the soil beneath an aggregate layer under a slab.

~~M) When a radon mitigation system is designed to draw soil gas from a perimeter drain tile loop (internal or external) that discharges water through a drain line to daylight or a soak away, a one-way flow valve, water trap, or other control device shall be installed if diagnostic testing indicates that outside air is entering the system.~~

~~N)M) Where portions of structural framing material must be removed to~~

accommodate radon vent pipes, material removed shall be no greater than that permitted for plumbing installations required by local building code.

3) ASD Pipe Sizing. ASD duct piping shall be sized and configured for adequate capacity to transport the volume of air required for radon reduction.

A) ASD duct piping from the primary suction point to the exhaust point shall be a minimum of a 3-inch inside diameter (ID) pipe.

B) When smaller air volume is needed, a 21.5-inch ID pipe from a secondary suction point to the soil gas collection plenum is permitted.

C) Each suction pipe shall be sized to provide air volume capacity sufficient to establish a vacuum under each slab or membrane and within each airspace being depressurized by the ASD system.

D) Where air valves, dampers, or baffles are used to adjust airflow balance:

i) Their location, settings, and design shall be included in records for the system; and

ii) They shall be marked or labeled “Radon System Air Valve. Do Not Alter From Marked Setting,” to indicate their purpose, settings, and instructions.

E) When multiple suction points are utilized, piping extended to secondary suction points exclusively designed for condensation or rainwater drainage do not require any specific pipe diameter.

G) Metal downspout material, with a minimum size of 3 x 4 inch, is permitted for duct piping use exteriorly and on the pressure side of the ASD system., if all the following requirements are met:

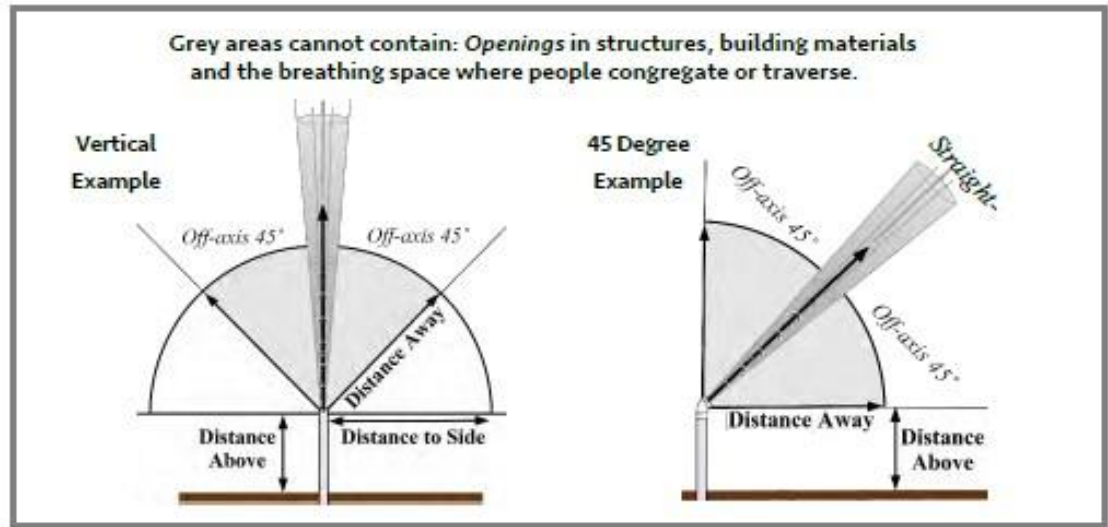
~~i) Gutter downspout material that is less than 3 x 4 inches shall not be permitted.~~

~~ii) A minimum 3 x 4 inch metal downspout material to meet capacities stipulated in this section for 3-inch ID pipe.~~

~~iii) — A minimum 4 x 5 inch metal downspout material to meet capacities stipulated in this section for 4 inch ID pipe. When even larger air volume needs are indicated, duct size shall increase respectively.~~

~~H) — Maximum airflow speed/velocity within duct piping shall be less than 2,000 feet per minute (fpm) to prevent condensed vapor from being drawn upward within piping rather than naturally falling by virtue of gravity to its intended destination (e.g., soil).~~

- 4) ASD Exhaust Discharge. The discharge from vent stack pipes of active soil depressurization systems shall prevent re-entrainment of radon, prevent vent stack blockage due to heavy snowfall, and prevent the direct exposure of individuals outside of buildings to high levels of radon by meeting the following requirements:
- A) Distances shall be measured between the closest point of the exhaust opening to the closest point of all location requirements specified in this Section using the shortest distance, as if a string were stretched between them;
  - B) The point of exhaust for all soil gas vent systems shall be located outdoors;
  - C) The discharge from vent stack pipes of ASD systems shall be above the eave of the roof and may discharge within 10 feet of composite or otherwise layered water-tight roofing materials.
  - D) The point of exhaust shall be directed upward without obstruction at an angle that does not deviate more than 45 degrees from a vertical exhaust trajectory. The exhaust discharge shall not exhaust downward or horizontally.
  - E) The exhaust trajectory with an exhaust spread radius of 45° shall not encounter openings in any structures, building materials, or the breathing space where individuals congregate or traverse within 10 feet from the point of exhaust.



- F) The point of exhaust shall be located not less than 10 feet above grade nearest to the point of exhaust.
- G) The point of exhaust shall be not less than 10 feet horizontally from any operable window, door, or other opening into conditioned spaces of the structure and not less than 42 feet above operable openings in structures.
- H) 10 feet or more from any opening into an adjacent building.
- I) The point of exhaust shall be not less than 1 foot above a pitched roof at the point penetrated, not less than 1 foot above the edge of the roof when ASD piping is attached to the side of a building, and not less than 1 foot 8 inches above a flat roof.
- J) The point of exhaust is permitted to be located below the edge of the roof if the following occur:
  - i) The edge of the roof exceeds 30 feet above grade nearest to the point of exhaust;
  - ii) An exhaust trajectory with an exhaust spread radius of 45° shall be installed to direct the exhaust away from the side of the structure.
  - iii) The justification for not locating the exhaust above the edge of the roof is recorded in the OM&M plan;

K) Rain caps shall not be installed on the discharge.

L) Vent stack discharge points that are directed vertically shall have no obstruction in the discharge except for a rodent screen of wire mesh no smaller than  $\frac{1}{2}$  1/4 inch. The rodent screen or wire mesh shall be installed in a manner that allows for easy removal for cleaning.

M) When the ASD system is designed for larger airflow capacities with duct piping larger than 4-inch ID, the distance shall be increased in accordance with the Table below.

Table for Increased Distances for Large Capacity Systems			
Pipe ID 3" – 4" Pipe	Distance Away Directional Spread 10 ft	Distance Away Straight Line 20 ft	Distance Above, Below or To Side Grade, Operable Openings and People
For Larger Pipe ID	Increase to	Increase to	Increase by
6"	12 ft	25 ft	2 ft
8"	18 ft	30 ft	4 ft
10"	20 ft	40 ft	6 ft
>10"	Requires a variance submittal with documentation for justification of distances.		

~~N) Installation of an ASD system shall meet the following:~~

- ~~i) Support shall be provided within 3 feet of the point of exhaust or within 18 inches above and below fans located in attics when pipe configurations might otherwise allow lateral or vertical movement of duct piping; and~~
- ~~ii) Locate or configure the exhaust point to avoid blockage or damage from weather;.~~
- ~~iii) Secure and meet local building code for any piping that extends high enough to require tethering or other means of lateral stability.~~

~~Θ)N) The penetration of each radon vent pipe through the roof shall be made watertight by a flashing designed for the purpose an approved flashing. Lead vent flashings or any other flashing or cap that would impede the exhaust from the radon vent are prohibited from use.~~

5) ASD Fan Installation

A) Vent fans used in radon mitigation systems shall be designed or otherwise sealed to reduce the potential for leakage of soil gas

from the fan housing and shall meet the following:

- i) ASD fans shall originate from a manufacturer that lists ASD (radon mitigation) as one of the fan's intended uses.
- ii) ASD fans mounted on the exterior of buildings shall be rated for outdoor use or installed in a weatherproof protective housing that results in a code compliant configuration with protection against electrical shock.
- iii) ASD fans shall be designed to allow rainwater or condensation from within ASD piping to pass through or around the fan when activated.
- iv) ASD fans shall be supported within 3 feet of the point of exhaust or within 18 inches above and below fans located in attics when pipe configurations might otherwise allow lateral or vertical movement of duct piping~~ASD fans shall be designed to accommodate continuous activation over a durable life span.~~

B) ASD fans shall be installed as follows:

- i) ASD fans shall be installed in attics, on the exteriors of buildings, or in garages that are not beneath conditioned spaces.
- ii) ASD fans shall not be installed below ground, in the conditioned space of a building, nor in any basement, crawlspace, or other interior location directly beneath the conditioned spaces of a building.
- iii) ASD fans shall be sized to provide the pressure difference and airflow capacity necessary to achieve the mitigation goals.
- iv) ASD fans shall be installed in a configuration that avoids condensation buildup in the fan housing.
- v) ASD fans shall be installed on vertical runs of ASD piping.
- vi) ASD fans shall be mounted to piping using flexible couplings that comply with ASTM D5926 or ASTM C1173

or a method specified by the ASD fan manufacturer that achieves a watertight connection.

- vii) Radon vent fans shall be mounted and secured in a manner that minimizes transfer of vibration to the structural framing of the building.

g) Sealing

- 1) The use of sealing alone has not been shown to significantly or consistently reduce radon entry into buildings. Sealing shall not be used as a permanent, stand-alone mitigation method.

- A) All accessible cracks shall be cleaned, prepared and sealed in a permanent, air-tight manner using compatible caulks or other sealants in accordance with this Section.
- B) Inaccessible openings or cracks shall be disclosed to the client and included in the OM&M if they may compromise the performance of a mitigation system and are determined to be beyond the ability of the contractor to seal.

2) Sealant Materials

- A) When sealing cracks in slabs or foundation walls, the caulk or sealant shall be a durable material designed for this purpose, such as urethane or polyurethane, applied in accordance with the manufacturer's recommendations, and:
  - i) When using such products, radon contractors shall notify occupants of related hazards and
  - ii) Radon contractors shall make Material Safety Data Sheets (MSDS) available upon request by the client.
- B) For larger gaps where a crack or joint is greater than 1/2 inch in width, foam backer rod or other comparable filler material shall be inserted into the existing gap prior to applying caulk or sealant.
- C) The caulk or sealant shall be durable, such as non-shrink cementitious products; expanding foam; plastic; or other comparable materials and methods appropriate for the application.



- D) When sealing openings around combustion appliance flues and hydronic heat or steam pipes, noncombustible materials shall be used.
  - E) For sump lids and hatchway doors or other items that require access in the future, nonpermanent sealant materials, designed for this purpose, such as silicone caulk, and gasket materials, shall be used and applied in accordance with the manufacturer's recommendations.
- 3) Sealing Accessible Cracks and Openings.
- A) Openings to soil around suction piping, utility penetrations, and where the slab meets the foundation wall shall be closed or sealed to resist air movement between soil and indoor air.
  - B) Cracks across a slab and expansion or control joints in thea interior slab shall be sealed.
  - C) Gaps at perimeter channel drains and foundation drainage boards shall be closed or sealed to the extent practical without compromising water control capability of the perimeter drainage system.
- 4) Other accessible openings to soil shall be sealed to resist air movement between soil and indoor air, such as support posts, electrical conduits, and openings for plumbing fixtures.
- 5) When Block Wall Depressurization is installed, all accessible openings and gaps being depressurized shall be closed to resist air movement including the following.
- i) Open blocks at the top course of hollow block masonry walls and open blocks under door or window openings; and
  - ii) Cracks or openings on the interior block walls.
- 6) All downspout joints and connections in radon mitigation systems used on the exterior of a building shall be permanently sealed with appropriate sealants.
- h) Sump Pit Requirements

- 1) Sump pits or other accessible pit openings in the interior slab that connect to soil air shall be covered and sealed to the extent possible without compromising the water control capability of the sump. Covers are not required for pits that do not connect to soil air.
- 2) Sump pits shall not be used as the primary suction point for mitigation systems except when the basement of the home being mitigated has radiant heat lines installed in or below the floor in accordance with the following requirements.
  - ~~A) When the basement of the home being mitigated has radiant heat lines installed in or below the floor, the sump pit may be used as the primary suction point.~~
  - ~~B) The radon contractor shall include provisions for the removal of the sump lid for maintenance of the sump pump.~~
- 3) The radon contractor shall include provisions for the removal of the sump lid for maintenance of the sump pump. ~~Sump pits that require a sump pump shall have a submersible sump pump installed.~~
- ~~4) When the sump pit is used as a secondary suction point, a submersible pump shall be installed in the sump pit.~~
- 5)4) In situations where areas where the water table is near the surface, causing flooding of the basement or interfering with the effectiveness of the mitigation system, a pedestal pump is with a higher pumping capacity may be installed the radon contractor shall meet in accordance with all the following conditions:
  - A) The pump is installed in accordance with the manufacturer's instructions.
  - B) The sump lid can be sealed airtight with the exception of ~~the tiny~~ a 3/4 inch or larger opening ~~necessary~~ to permit free operation of the pedestal pump's float or connecting rod.
  - C) The design does not create noise, through the float opening, that is objectionable to the client.
  - D) The pump or its attached piping needs to be additionally secured to avoid side to side movement likely to cause the lid to impede movement of the float or connecting rod.

E) The pump motor shall not be below the lid unless the motor is designed for a high moisture environment.

~~6)5)~~ Sumps in interior floors that connect to soil air shall have a rigid lid made of sturdy and durable plastic such as polycarbonate plastic or other rot-resistant, rigid material sufficient to support anticipated loads. The lid shall be sealed and mechanically fastened in a manner to facilitate removal for maintenance. Penetrations through the lid such as gaps around electrical wiring, water ejection pipes, and ASD piping shall be sealed.

~~7)6)~~ Sump covers shall include a removable port or section of the lid no less than 4 inches in diameter ~~or equivalent method when a sump pump is installed in the pit~~ to allow physical access for routine verification that pumps are operational. The removable port or section shall not be sealed and shall be caulked be easy to remove and re-install without the use of tools.

~~8)7)~~ The covers on sumps that previously provided protection or relief from surface water collection shall be fitted with a water or mechanically trapped drain. Water traps shall be fitted with an automatic supply of priming water.

~~9)8)~~ If flexible rather than rigid water discharge piping is found, the radon contractor shall recommend in the proposal that rigid pipe for water discharge from permanent sump pumps be installed.

i) Membranes Over Exposed Soil.

- 1) To break the connection between soil gas and indoor air, soil, and other fill material in accessible foundations, i.e., crawl spaces, shall be covered with concrete or a soil gas retarder membrane.
- 2) Soil gas retarders shall comply with ASTM E1745 class A, B or C. These specifications include permeance, tensile strength, and puncture resistance. Thicker sheeting or other means to protect the membrane are recommended where accessible foundations are used for storage or frequently entered for maintenance of utilities or equipment.
- 3) Seams where membrane materials are joined shall overlap at least 12 inches and sealed with a compatible sealant or a caulk in accordance with section 421.150(g) or a method such as membrane tape recommended by the manufacturer that results in an equivalent durable bond.

- 4) Tears or punctures in the membrane shall be sealed by one or more of the following methods:
    - A) A tape recommended by the membrane manufacturer; or
    - B) An additional sheet of the membrane material that covers and overlaps the tear or puncture at least 6 inches on all sides and that is sealed with a caulk in accordance with subsection 421.150(g).
  - 5) Membranes or the crawl space access port shall be labeled in accordance with this with subsection 421.150(g)(7).
  - 6) When water is likely to collect on the surface of a membrane, the radon contractor shall install drainage for surface water in the lowest location of the foundation.
  - 7) The membrane shall be secured to the walls or other surfaces in accordance with subsection 421.150(j).
  - 8) Any wood installed as part of a mitigation system that directly contacts masonry or soil, such as when used to secure a membrane, shall be resistant to decay and insects or otherwise protected.
- j) Sub-Membrane Depressurization (SMD).
- 1) The opening around penetrations of a soil gas retarder for ASD duct piping and other utility pipe penetrations shall be fully closed using materials and methods that result in permanent closure.
  - 2) Membranes attached to foundation walls and foundation support components shall be attached with furring strips or other durable materials and sealed as follows:
    - A) For flat wall surfaces, the membrane shall be sealed to the foundation walls and supports with a caulk-sealant in accordance with subsection 421.150(g).
    - B) For irregular surfaces, alternative materials and methods are permitted so long as durable closure of the soil gas collection plenum is achieved.
  - 3) When portions of any foundation cannot be accessed or has insufficient height to work in a safe manner, the edges of the membrane within the boundaries of accessible areas shall be closed.

k) Drains

- 1) A one-way flow drain or equivalent method with adequate flow capacity shall be installed for any drain that discharges directly into the soil. Considerations for use of one-way flow valves include:
  - A) Potential for debris to clog the valves and designed capacity of the valve to drain adequate volumes of water.
  - B) Whether the airflow leaks between soil and indoor air could contribute to backdraft of atmospherically vented combustion appliances or defeat efforts to establish PFE.
- 2) Openings in the slab or sumps that serve for drainage shall be modified to retain drainage capability and prevent airflow, such as the use of a one-way flow valve, re-routing the drain line into a condensate pump or floor drain, or a trap in the drain.
- ~~3) A one-way flow valve or other mechanical means shall be installed when a mitigation system is designed to draw soil gas from drain tiles (internal or external) that discharge water to daylight.~~

l) Sealed Isolation Assemblies. Sealed isolation assemblies are not regarded as a permanent, stand-alone mitigation method. Sealed isolation assemblies are critical for appropriate implementation of crawl space depressurization (CSD).

- 1) Any accessible openings between the isolated space and areas surrounding the isolated space shall be sealed to resist air movement between the isolated airspace and both indoor air and outdoor air.
- 2) Access doors or hatches that are not to be permanently sealed shall be fitted with airtight gaskets and a means of positive closure.
- 3) Access ports into sealed isolation assemblies shall be labeled in accordance with subsection 421.150(o).

m) System Monitors.

- 1) All mitigation systems incorporating a fan shall include a system monitoring mechanism to indicate if the fan is operating within the established operating range. Design and installation of such monitors shall comply with the following:

- A) The system monitoring mechanism ~~monitoring device~~ shall provide continuous display of a measured value within the established operating range, such as displayed on a manometer pressure gauge or electrical amperage gauge. The system monitoring mechanism ~~monitor~~ shall be located where it can be readily seen and protected from damage or degradation.
  - B) System monitoring mechanism ~~Monitoring devices~~ that continuously display a viewable operating range shall be clearly marked or labeled to indicate the measured pressure, airflow volume, or amperage readings that existed at the time mitigation goals were achieved.
- 2) In addition to viewable system monitoring mechanism ~~operating range monitors~~, radon contractors shall include in their proposals an optional a- monitoring mechanism ~~shall that could~~ be installed that actively alerts occupants or other responsible individuals in the event of fan ~~or other mechanical~~ failure. The alert mechanism shall include one or more of the following warning signals:
- A) Audible notification that is clear and distinct.
  - B) Visual light notification that is vividly observable.
  - C) Notification by telemetric means, such as by email or other electronic communication.
- AGENCY NOTE: Permissible sensors that trigger active notification include, but are not limited to, air pressure sensors, airflow sensors, circuits that detect electrical flow, or do-it-yourself continuous radon monitors.
- 3) All mechanisms or systems that monitor fan or airflow functionality shall provide:
- A) Protection from the elements.
  - B) Labeling in accordance with subsection 421.150(o).
  - C) Battery operated monitors are equipped with a low-power warning feature.
  - D) Monitors requiring electricity for indication of system failure shall be

on non-switched circuits and designed to reset automatically when power is restored after power supply interruptions.

E) That monitors requiring electricity for indication of system failure shall not be powered by the same branch circuit as the mitigation system fan.

4) When an intentional collateral mitigation system is installed one of the following options is required:

A) Fan monitors are installed in each separate ground contact unit by the mitigation system.

B) A program is instituted for routine inspection onsite or by remote telemetric management system regardless of monitor locations.

C) A fan monitor is installed in a location that is accessible and visible or audible for all occupants of the building.

n) Electrical Requirements

1) All electrical components of radon mitigation systems shall conform to provisions of the National Electrical Code and any additional local building codes.

2) Wiring shall not be located in or chased through the radon vent piping or any heating or cooling ductwork.

3) For ASD fans, a means of electrical disconnect shall be provided in the line of sight and within 6 feet of the mitigation system fan.

4) All outdoor wiring for ASD fans shall be protected in conduit, unless otherwise permitted by local building code.

AGENCY NOTE: Low voltage fans should be installed in accordance with local building codes.

5) Any plugged cord used to supply power to a radon vent fan shall be a maximum of 6 feet in length.

6) No plugged cord shall penetrate a wall or be concealed within a wall.

7) Radon mitigation fans installed on the exterior of buildings shall be hard-

wired into an electrical circuit. Electrical disconnects shall be installed within line of sight and within 6 feet of the fan. Exteriously, plugged fans shall be used only inside of weather-proofed fan housings or weather-proofed receptacles.

- 8) If the rated electricity requirements of a radon mitigation system fan exceeds 50 percent of the circuit capacity into which it will be connected, or if the total connected load on the circuit (including the radon vent fan) exceeds 80 percent of the circuit's rated capacity, a separate, dedicated circuit shall be installed to power the fan.
  - 9) An electrical disconnect switch or circuit breaker shall be installed in radon mitigation system fan circuits to permit deactivation of the fan for maintenance or repair. Disconnect switches are not required with plugged fans.
  - 10) When a single mitigation system is intentionally designed for collateral mitigation to reduce radon concentrations in more than one unit, dwelling or area within a shared building, power provided to the system shall be from a source that is electrically metered independent from individual units unless the meter is common to all units.
  - 11) If the mitigation system cannot be powered from a common power source a stand-alone mitigation system shall be installed in each ground contact unit or dwelling that is independently electrically metered.
- o) Labeling Requirements
- 1) All labels shall be made of durable materials. All label lettering and other annotation on systems shall be of a color in contrast to the color of the background on which the lettering is applied.
  - 2) An Illinois Mitigation System Tag shall be placed ~~on the vent pipe~~ next to the mitigation system monitor. This label shall be purchased from the Agency and include the following information: "Radon Reduction System"; the installer's name, phone number and the Illinois license number; the date of installation; and an advisory that the building should be tested for radon at least every 2 years.
  - 3) A "Radon Reduction System" label shall be placed on all primary components of each system, such as on duct piping near the manometer, mechanical equipment, ASD fans, system monitors, and system controls.



- 4) For systems installed where system maintenance and monitoring will be the responsibility of the owner or occupant of the dwelling, the “Radon Reduction System” label shall include instructions for obtaining a copy of the OM&M plan and the OM&M plan shall be permanently affixed to the radon vent pipe.
- 5) The OM&M plan shall provide a recommendation for the responsible party to maintain the plan and provide the plan to any future owner/occupant.
- 6) All exposed and visible interior radon mitigation system vent pipe sections shall be identified with at least one label on each floor that reads “Radon Reduction System”. ~~Interior duct piping shall be marked “Radon Reduction System” with not less than one label at each floor level. Duct piping labels should be affixed at intervals not greater than 10 feet along the developed length of piping.~~
- 7) Electrical disconnects, such as switches or outlets providing power to plugged connections for mitigation system fans, shall be labeled or marked “Radon Fan – Do Not Turn Off” or “Radon Fan – Do Not Unplug.”
- 8) The circuit breaker protecting the mitigation system fan circuit shall be labeled “Radon Reduction System”.
- 9) Components that are sealed to prevent air movement between soil and indoor air shall be labeled in accordance with the following:
  - A) Sump pits that are depressurized by the mitigation system or covered to minimize radon entry shall be identified with a label that reads "Radon Reduction System – Removal of this cover may result in failure of the Radon Reduction System. Consult (radon contractor's name and phone number) before removing this cover and for instructions on the correct procedure for replacing it."
  - B) Where soil gas retarder membranes have been installed, a label or marking shall be located in a conspicuous place, at access panels, or immediately visible once entering the crawl space, such as on membrane material near the access location. The label shall read "Radon Reduction System – Removal of this membrane will result in failure of the Radon Reduction System. Consult (radon contractor's name and phone number) before removing this membrane and for instructions on the correct procedure for

replacing it."

10) Fans mounted exteriorly, and exterior vent pipe shall be identified with a label that reads "Radon Reduction System" in a weatherproof manner.

11) All systems shall have a maintenance placard attached to a suction pipe or a wall within 5 feet of the system monitoring mechanism. The placard shall:

A) Be ~~made from~~ 110lb cardstock or thicker;

B) Explain the need for weekly ~~review~~checking of the system monitoring mechanism and the need for radon testing every two years;

C) Be designed ~~so to attract attention by having~~ the words "Weekly" and "Every 2 Years" ~~are~~ in fonts ~~that are~~ at least 1 inch in size and all other text shall be in 12 point to 16 point font size; and

~~D) All other text shall be in 12 pt to 16 pt font size.~~

DE) Include ~~the~~ phrase "Do Not Remove This Placard".

12) If the maintenance placard is~~be~~ removed by error, a sticker shall be placed beneath the maintenance placard that indicates the maintenance placard has been removed and to contact the radon contractor for a replacement maintenance placard.

~~11)~~13) Where systems include controls for any mechanical equipment, including dampers, a label shall be installed that includes general instructions for operation and system control settings that existed at the time mitigation goals were achieved.

p) System Functional Evaluation

1) Once all sealing, piping and other components of the ASD system are complete, system performance may need to be evaluated. If the radon mitigation professional determines Pressure Field Extension (PFE) measurements or communication tests are necessary, the following requirements shall be completed.

A) The air pressure differences between soil air and indoor air shall be measured-analyzed and recorded in jobsite logs ~~for each soil gas collection plenum addressed by each suction point. Measurements-~~

~~using a differential pressure gauge that is capable of reading 1/1000 inch water column differences in air pressure shall be conducted and recorded~~ at locations that will best characterize:

- i) The full expanse of the soil gas collection plenum,
  - ii) Other locations where evidence suggests that large volumes of soil gas are susceptible to enter the building as a result of indoor air pressures.
  - iii) Where PFE or communication test locations cannot be ~~created-conducted~~ due to building materials that are virtually irreplaceable, the reason why shall be noted in jobsite logs and alternative locations or methods for verifying system effectiveness are permitted.
- B) The vacuum within the main trunk duct piping on the negatively pressured side of the fan shall be measured and recorded in jobsite logs. If the measurement meets or exceeds the manufacturer recommended maximum for vacuum, further investigation is required.
- C) The volume of air exhausted by the system shall be measured and recorded in jobsite logs.
- D) A summary of conditions for materials and permeability under slabs, as visually and physically observed, and sizable unclosed openings between soil and indoor air shall be recorded in jobsite logs.
- E) Other Lines of Evidence. Other observations and tests deemed pertinent to establishing or maintaining effective mitigation shall be recorded in jobsite logs that can include diagnostic measurements to evaluate changes to indoor radon concentrations.
- 2) Once mitigation efforts that include non-ASD mitigation systems or methods are complete, performance evaluations shall be conducted in accordance with this Section.
- q) Inspection for Compliance
- 1) Prior to delivery and release of the completed system for use, a radon contractor shall verify:

- A) Compliance with this Part:
  - B) Conformance with the intended design criteria; and
  - C) Compliance with local building codes, including work conducted by other licensed professionals.
- 2) Any items found not in compliance with this Part, the intended design criteria, or local building codes shall be corrected.
- 3) Radon Mitigation licensees shall inform the client in writing that post-mitigation testing should be conducted no sooner than 24 hours nor later than 30 days following completion and activation of the mitigation system and that the test may be conducted by an independent Radon Measurement licensee or by the resident of the dwelling.
- 4) For each mitigation system installation, at a minimum, the radon contractor shall photograph, store, and make available for review, photos of locations as follows:
- A) Sump pit before removing the cover;
  - B) Sump pit after removing the cover;
  - C) Sump pit sealed, labeled and sump pump plugged in;
  - D) Suction pit after coring and excavation, but prior to attaching pipe;
  - E) Full height for each suction pipe;
  - F) U-tube & Illinois Mitigation Tag;
  - G) All mitigation system piping;
  - H) Circuit breaker and label that power the mitigation system fan;
  - I) Radon mitigation fan and electrical connection;
  - J) Fan housing, if installed; and
  - K) Full height exterior photo or pipe and roof flashing.
- r) Operation, Maintenance and Monitoring Plan (OM&M)

- 1) To provide the tools essential for occupant efforts in long-term risk management, the radon contractor shall provide to the client an OM&M that prominently includes essential components for operation, maintenance, and monitoring (~~OM&M~~) of the mitigation system as installed.
- 2) Instructions to obtain a copy of The OM&M shall be securely attached to the system in a visible location ~~or otherwise provided to the client~~. If no portion of the system is installed in the livable space, the instructions to obtain a copy of the OM&M shall be installed in an appropriate interior location, such as the mechanical room.-
- 2)3) The OM&M shall prominently include all the following information.
  - A) A recommendation to retest at least every 2 years.
  - B) A description of the active system failure notification monitor and a recommendation to check the monitor monthly.
  - C) Documented startup parameters including pressure gauge readings that existed at the time successful mitigation was initially achieved.
  - D) A list of actions for the resident to take if the fan monitor indicates system degradation or failure.
  - E) A description of the mitigation system as installed to include.
    - i) Basic operating principles.
    - ii) The finalized drawing that includes illustration of the building foundation, the location of all walls, drain fixtures, HVAC systems and radon entry points, results of any diagnostic testing, the layout of any radon mitigation system piping, and the location of any vent fan and system warning devices. The floor plan sketch that may include photographic documentation.;
    - iii) A description of any deviations from ~~the MS and~~ applicable regulations of this Part;
    - iv) A description of the proper operating procedures of the mitigation system installed and any mechanical or electrical systems installed, including manufacturer's operation and

maintenance instructions and warranties;

- v) The address of the building mitigated, including the zip code, the mitigation system type, the mitigation date, whether radon resistant new construction techniques were used, and the Illinois Mitigation System Tag number.
- F) A description of any important observations that might adversely affect the mitigation system or other building systems and a copy of the approved variance for deviations from this standard.
- H) The justification for not locating the exhaust above the edge of the roof is recorded in the OM&M plan;
- I) Contact information for service inquiries and identification of the qualified mitigation professional responsible for adherence to protocols to include.
- i) Name, address and phone number.
  - ii) Radon Mitigation Professional licensing number.
- J) In addition to a retest every two years to ensure the mitigation system effectiveness, radon concentrations should also be retested 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 home is newly occupied.
  - iii) Heating or cooling systems are altered with changes to air distribution or pressure relationships.
  - iv) Ventilation is altered by extensive weatherization, changes to mechanical systems or comparable procedures.
  - v) Sizable openings to soil occur due to groundwater or slab surface water control systems are added or altered (e.g., sumps, drain tiles, shower/tub retrofits, etc.), natural settlement causing major cracks to develop.

- vi) Earthquakes, construction blasting, or formation of sink holes nearby.
- vii) An installed mitigation system is altered or repaired.
- K) Other information for future reference and operation or repair considerations shall be provided to include:
  - i) Pre-and post-mitigation test data, if available.
  - ii) Copies of ~~contracts and~~ warranties.
  - iii) Copies of building permits when required.
  - iv) An estimate of the annual operating costs.
- L) The radon contractor shall identify when system maintenance and monitoring are the responsibility of someone other than the occupant or future occupants.

3)4) After installation, the contractor shall review with the client the OM&M and the operating principles, operation, and maintenance of the system.

s) Records and Documentation

- 1) Records of all mitigation work performed shall be kept for a minimum of 6 years or for the period of any warranty, whichever is longer.
- 2) Health and safety records, including radon contractor exposure logs and other appropriate medical monitoring records, shall be maintained for a minimum of 20 years.
- 3) A complete copy of the OM&M for all mitigation methods.
- 4) A floor-plan drawing shall be finalized from preliminary inspection sketches and shall include illustration of the building foundation, the location of all walls, drain fixtures, HVAC systems, radon entry points, results of any diagnostic testing, the layout of any radon mitigation system piping, and the location of any vent fan and system warning devices.
- 5) The finalized drawing shall be an auditable part of the mitigation file and shall be available to the occupant, the owner of the building, his/her representatives, or the client, upon request.

- 6) Fan model number shall be recorded when installed or altered.
  - 7) Compliance and performance evaluation results shall be recorded.
  - 8) Qualified control tracking. At a minimum, it is required that quality control efforts be retained on pertinent details to include:
    - A) Identification of staff responsible for standards compliance for each specific installation.
    - B) Descriptions of conditions found under slabs and resulting suction pit description after actions were taken to comply with requirements for suction pit size in accordance with this part.
- t) Health and Safety
- 1) The radon mitigation professional shall ensure all licensees and unlicensed individuals are advised of the hazards of exposure to radon and the need to apply protective measures when working in areas of elevated radon concentrations.
  - 2) The radon mitigation professional shall ensure all licensees and unlicensed individuals exposure to radon at each work site shall be recorded and maintained.
  - 3) Working Level Month (WLM) calculations shall be based upon the exposure hours times radon measurements (pCi/L) divided by 100, divided by 170.
  - 4) Calculations for pCi/L/day shall be based on the exposure hours, divided by 24. These calculations shall apply to one of the following radon measurements for the exposure at each work site:
    - i) The highest pre-mitigation indoor radon measurement.
    - ii) Actual jobsite measurements of radon.
    - iii) The measurements from a radon dosimeter such as an alpha track or comparable device consistently worn at the job site by a mitigation installer. The radon dosimeter shall be stored in a low-



radon environment during nonworking hours, and thereby all exposure to the radon detector is assumed to be the mitigation installer's exposure.

- 5) A licensee and unlicensed individuals exposure shall be limited to as low as reasonably achievable.
  - 6) Radon Contractors shall comply with all federal, state and local standards or regulations relating to mitigation installer safety and health. Publications from Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) shall be reviewed and incorporated into work practices.
  - 7) Upon request, Radon Contractors shall provide to and clients shall be provided with the applicable Material Safety Data Sheets (MSDS) for all hazardous materials used and be informed of the safety procedures required for each.
- u) Non ASD Systems and Methods
- 1) For general applicability of these methods and impact on other indoor air quality issues the radon contractor shall consult with a mechanical engineer or a heating and air-conditioning contractor.
  - 2) The radon contractor will ensure the reduction of radon concentrations by adjusting the HVAC system operation complies with local codes and "Indoor Air Quality Guide – Best Practices for Design Construction and Commissioning" published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHREA) www.ashrae.org.
  - 3) When mitigating indoor radon concentrations using non ASD systems and methods, radon contractors shall submit a variance request in accordance with Section 421.75.

### **Section 421.160 Mitigation Standard for Original Construction of a Single-Family Home or a Dwelling Containing 2 or Fewer Units**

- a) General Practices. This Section contains the requirements for new construction in Illinois in accordance with the Radon Resistant Construction Act [420 ILCS 52]. The following required construction methods are intended to resist radon entry and prepare the building for post-construction radon mitigation, if necessary. These techniques are required in all areas of Illinois.

- b) **Subfloor Preparation.** A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the buildings, to facilitate future installation of a sub-slab depressurization system, if needed. The gas permeable layer shall consist of one of the following:
- 1) A uniform layer of clean aggregate, a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2 inch (51 mm) sieve and be retained by a ¼ inch (6.4 mm) sieve; or
  - 2) A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick, overlain by a layer or strips of geo-textile drainage matting designed to allow the lateral flow of soil gases. The geotextile matting shall have a cross-sectional area of not less than 12 square inches (77 sq. cm) and shall be placed, at a minimum, along the entire inside perimeter of the foundation at a distance of 12 to 18 inches (30 to 46 cm) distance from the foundation wall to the edge of the drainage matting. Deviation from the 12 to 18 inches (30 to 46 cm) distance to the foundation wall shall be allowed to avoid obstacles such as plumbing and other utilities; or
  - 3) Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.
- c) **Soil Gas Retarder.** A minimum 6-mil (0.15 mm) (or 3-mil (0.075 mm) cross-laminate) polyethylene or equivalent flexible sheeting material shall be placed on top of the gas permeable layer prior to casting the slab or placing the floor assembly to serve as a soil gas retarder by bridging any cracks that develop in the slab or floor assembly and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped at least 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.
- d) **Entry Routes.** Potential radon entry routes shall be closed in accordance with the following:
- 1) Floor openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs or other floor assemblies shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.

- 2) All concrete control joints, isolation joints, construction joints and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a polyurethane caulk. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk applied in accordance with the manufacturer's recommendations.
- 3) Condensate drains shall be trapped or routed through non-perforated pipe to daylight.
- 4) Sump pits open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sump pits shall not be used as a primary suction point in a subslab depressurization system. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.
- 5) Hollow block masonry foundation walls shall be constructed with either a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with polyurethane caulk or equivalent sealant. Penetrations of concrete walls shall be filled.
- 6) The exterior surfaces of concrete and masonry block walls below the ground surface shall be damp-proofed in accordance with Section R406 of the 2021 International Residential Code for One- and Two-Family Dwellings (copyrighted 2021 by the International Code Council, Inc.; incorporated by reference in accordance with Section 421.15).
- 7) Air-handling units shall be sealed to prevent air from being drawn into the unit. Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage are exempted from this requirement.
- 8) Underground and crawlspace duct systems shall be sealed in accordance with Section M1601.4.1 of the 2021 International Residential Code for One- and Two-Family Dwellings (copyrighted 2021 by the International Code Council, Inc.; incorporated by reference in accordance with Section 421.15).
- 9) Openings around all penetrations through floors above crawlspaces shall

be caulked or otherwise filled to prevent air leakage.

- 10) Access doors and other openings or penetrations into crawlspaces shall be closed, gasketed or otherwise sealed to prevent air leakage.
- e) Passive Sub-membrane Depressurization (SMD) System. In buildings with crawlspace foundations or earthen floors, the following components of a passive SMD system shall be installed during construction.
- 1) Crawlspaces shall be provided with vents to the exterior of the building in accordance with Section R408 of the 2021 International Residential Code for One- and Two-Family Dwellings.
  - 2) The soil in crawlspaces shall be covered with a continuous layer of minimum 6-mil (0.15 mm) polyethylene soil gas retarder. The ground cover shall be lapped a minimum of 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the crawlspace area.
  - 3) Any seams in soil gas retarder membranes shall be overlapped at least 12 inches and sealed in a permanent air tight manner using compatible glues. The membrane shall also be sealed around interior piers and to the inside of exterior walls with furring strips and compatible glues or in accordance with specific procedures submitted by radon contractors as part of their license application and approved by the Agency.
  - 4) A plumbing tee or other approved connection fitted with not less than 10 feet (210 m) of perforated pipe extending from each horizontal opening of the tee shall be inserted horizontally beneath the sheeting and connected to a 3- or 4-inch diameter (76 mm or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the penetration in the highest roof in a location at least 2 feet (609.6 mm) above any window or other opening into the conditioned spaces of the building and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.
- f) Passive Sub-Slab Depressurization (SSD) System. Buildings with a basement, crawlspace or slab-on grade concrete floor in contact with the earth or grade shall have the following components of a passive SSD system that shall be installed during construction.
- 1) A minimum 3-inch diameter (76 mm) Schedule 40 PVC shall be embedded vertically into the sub-slab aggregate or other permeable

material before the slab is cased.

- A) A plumbing tee or other approved connection fitted with not less than 10 feet (210 m) of perforated pipe extending from each horizontal opening of the tee shall be inserted horizontally within the sub-slab permeable material to ensure that the pipe opening remains within the sub-slab. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop. The vent pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the penetration in the highest roof in a location of at least 2 feet (609.6 mm) above any window or other opening into the conditioned spaces of the building and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings; or
  - B) A penetration into the sub-slab permeable material may be cored through sub-slab after the slab is cased. A minimum 3-inch diameter (76 mm) Schedule 40 PVD shall be embedded vertically into the sub-slab aggregate or other permeable material and extended up through the building floors, terminate at least 12 inches (305 mm) above the penetration in the highest roof in a location at least 2 feet (609.6 mm) above any window or other opening into the conditioned spaces of the building and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.
- 2) In buildings where interior footings or other barriers separate the sub-slab aggregate or other gas-permeable material, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that shall terminate at least 12 inches (305 mm) above the penetration in the highest roof in a location at least 2 feet (609.6 mm) above any window or other opening into the conditioned spaces of the building and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.
- g) All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil gas retarder.
  - h) Radon vent pipes shall be accessible for fan installation through an attic or other area outside and above the habitable space. The radon vent pipe need not be accessible in an attic space when an approved roof-top electrical supply is provided for future use.
  - i) All exposed and visible interior radon vent pipes shall be conspicuously identified

with at least one label on each floor and in accessible attics. The label shall read "Radon Reduction System".

- j) Combination basement/crawlspace or slab-on-grade/crawlspace foundations shall have separate radon vent pipes installed in each type of foundation area or be connected with a continuous drain tile loop. Vent pipes shall connect to a single vent that shall terminate at least 12 inches (305 mm) above the highest roof in a location at least 2 feet (609.6 mm) above any window or other opening into the conditioned spaces of the building and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.
- k) Joints in air ducts and plenum spaces shall meet the requirements of Section M1601 of the 2021 International Residential Code for One- and Two-Family Dwellings (copyrighted 2021 by the International Code Council, Inc.; incorporated by reference pursuant to Section 421.15). Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11 of the 2021 International Residential Code for One- and Two-Family Dwellings (copyrighted 20121 by the International Code Council, Inc.; incorporated by reference pursuant to Section 421.15). Fireblocking shall be in conformance with the most recent general building code enacted by the appropriate local government or meet the requirements contained in Section R302.11 of the 2021 International Residential Code for One- and Two-Family Dwellings (copyrighted 2021 by the International Code Council, Inc.; incorporated by reference in accordance with Section 421.15).
- l) To provide for future installation of an active SMD or SSD system, an electrical circuit terminated in an approved box shall be installed during construction in the attic in the anticipated location of vent pipe fans. An electrical supply shall be accessible in anticipated locations of system failure alarms.
- m) To provide for future installation of an active SSM or SSD, the piping length in the attic of the building shall have a minimum height of 3 feet to allow for the anticipated installation of a radon mitigation fan in the vent pipe.
- n) The juncture of each radon vent pipe with the roof line shall be made water tight by an approved flashing. Lead vent flashings or any other flashing or cap that would impede the exhaust from the radon vent are prohibited from use.
- n)o) The radon vent pipe system shall be installed to allow for installation of the u-tube manometer and appropriate labels by a licensed mitigation professional. Should all the interior walls be covered so the radon vent pipe system is not visible an access panel shall be installed. The panel shall be a minimum of 12 by 12 inches.

⇒p) Radon testing

- 1) Testing shall be performed after the dwelling passes its air tightness test.
- 2) Testing shall be performed after the radon control system and HVAC installations are complete.
- 3) Testing shall be performed by a licensed radon contractor.
- 4) Testing shall be performed in accordance with 32 Ill. Adm. Code 420.130.
- 5) Where the radon test result is 4 pCi/L or greater, a radon contractor shall install the radon vent fan.
- 6) The final written test report with results less than 4 picocuries per liter (pCi/L) shall be provided to the local code official.