

**TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on the '¶' character located in the Paragraph section of the 'Home' Tab in the Microsoft Word ribbon above.

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

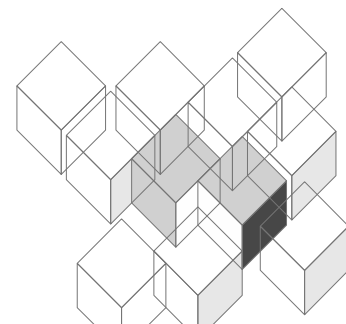
**A. Intent**

1. The rough-in system as described below is considered standard and is not to be altered.
2. The Consultant is to retain a **[National Radon Proficiency Program (NRPP)] [Canadian National Radon Proficiency Program (C-NRPP)]** Certified Mitigation Professional in good standing, to implement this Technical Specification for the void space radon mitigation rough-in system. The **[NRPP] [C-NRPP]** professional is to design the number of extraction points and locations and to inspect, photograph, test and sign off on the completed radon mitigation rough-in system to ensure compliance with this Technical Specification.
3. If, after the building is completed and occupied, long term radon testing results are above the **[EPA] [Health Canada]** guideline limits, the radon rough-in system will need to be activated. Follow **[EPA] [Health Canada]** guidelines for long term radon testing.
4. To activate the radon rough-in system, the Building Owner will need to retain and pay for a **[NRPP] [C-NRPP]** Certified Mitigation Professional in good standing to conduct a feasibility test, to extend the riser pipes from above the floor slab to the outside of the building and mechanically vent the radon to the outside, so that radon levels are controlled within the building.
5. If the system is activated, it must be capable of reducing and maintaining the radon concentration to as low as practicable below **[4 picocuries per Liter of air (pCi/L)] [200 Becquerels per cubic meter (Bq/m<sup>3</sup>)]** within the building, as per **[EPA] [Health Canada]** guidelines.

**B. Section Includes:**

1. Void Space Venting & Membrane Barrier System

**C. References:**



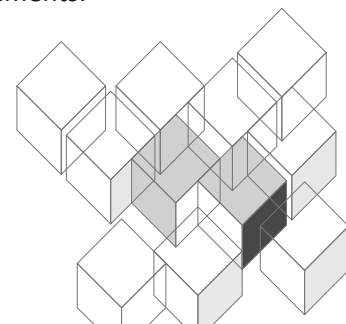
1. The International Residential Code – 2021
2. National Building Code of Canada – 2020
3. American Society for Testing and Materials (ASTM):
  - a. ASTM C33 / C33M - Standard Specification for Concrete Aggregates.
  - b. ASTM E1465 - Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings.
  - c. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
  - d. ASTM E2178 - Standard Test Methods for Determining Air Leakage Rate and Calculation of Air Permeance in Building Materials
  - e. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - f. ASTM E2121 - Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings.
4. Environmental Protection Agency (EPA):
  - a. EPA/625/R-92/016 - 1994 Radon Prevention in the Design and Construction of Schools and Other Large Buildings.
5. Health Canada
  - a. Guide for Radon Measurement in Public Buildings – 2016

### 1.3 DEFINITIONS

- A. Picocuries: Is the derived unit of radioactivity in the Imperial System of Units (IU), symbolized “pCi” and equal to 0.037 disintegration or nuclear transformation per second.
- B. Becquerel: Is the derived unit of radioactivity in the International System of Units (SI), symbolized “Bq” and equal to one disintegration or nuclear transformation per second.
- C. NRPP: Is a Certified Mitigation Professional individual that attained the educational requirements, insurance requirements and has carries current NRPP certification.
- D. CARST: Canadian Association of Radon Scientists and Technologists.
- E. C-NRPP: Is a Certified Mitigation Professional individual that attained the educational requirements, insurance requirements and has carries current CARST membership and C-NRPP certification.

### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [**Project site**] <Insert location>.
  1. Contractor to arrange for a site meeting with the [**NRPP**] [**C-NRPP**] Certified Mitigation Professional to review existing conditions and all requirements related to materials, material handling and storage, installation, scheduling, testing, and quality assurance and control, to confirm compliance with manufacturer and installation requirements.



## 1.5 SUBMITTALS

- A. As per Section 01 33 00 – Submittal Procedures.
- B. Submit component product information to the **[NRPP]** **[C-NRPP]** Certified Mitigation Professional related to the system design drawings and specifications. This includes the void space venting & membrane barrier system layer, riser piping, and sealing methods for the slab perimeters and penetrations.
- C. Provide final as-building drawings to the **[NRPP]** **[C-NRPP]** Certified Mitigation Professional that indicate the final locations of the riser pipes.

## 1.6 QUALITY ASSURANCE

- A. Component installation for the radon mitigation rough-in system is to be done by competent and skilled workers having a minimum of three (3) years' experience installing vapor barriers, sealants and waterproofing membranes.
- B. Installation workers are also to obtain appropriate training on radon mitigation systems from the **[NRPP]** **[C-NRPP]** Certified Mitigation Professional and the component product manufacturers.
- C. **[NRPP]** **[C-NRPP]** Certified Mitigation Professional to have on-going meetings with the Contractor to discuss and confirm compliances with the system design drawings and specifications.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Ensure all products delivered to the site meet manufacturer's quality requirements. Remove and do not use any defective products. Store and handle materials as per manufacturer's requirements, recommendations and safety data sheets. Protect materials from construction and weather related damage using appropriate coverings and adequate ventilation.

## 1.8 SITE CONDITIONS

- A. All products and materials are to be stored at temperatures and environmental conditions that conform to manufacturer guidelines.
- B. Perform installation work only when the weather conditions are within installation guidelines established by manufacturer.
- C. Do not proceed with membrane barrier system installation until confirmation by the **[NRPP]** **[C-NRPP]** Certified Mitigation Professional that the substrate preparation and condition is suitable.
- D. Do not proceed with the concrete slab pour until confirmation by the **[NRPP]** **[C-NRPP]** Certified Mitigation Professional that the membrane barrier system preparation and condition is suitable.



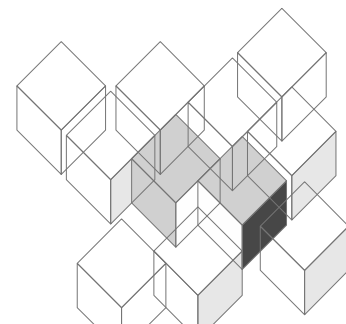
## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Installation of the gas venting & membrane barrier layer, riser pipe, and sealing methods for the slab perimeters and penetrations for the building concrete in contact with the soil, is to comply with manufacturers' requirements, system design, and the requirements of this specification.
- B. All system components are to be chemically compatible with the soil environment (ASTM E154-88).
- C. Gas venting and radon membrane barrier system is to be sealed at all joints, perimeters and floor slab penetrations to provide a continuous seal of the building area in contact with the soil, as per manufacturer requirements, system design, and the requirements of this specification.
- D. Install and seal floor drains, void space venting layer and riser pipes in accordance with EPA/625/R-92/016 - 1994 Radon Prevention in the Design and Construction of Schools and Other Large Buildings.

### 2.2 VOID SPACE VENTING LAYER & MEMBRANE BARRIER SYSTEM

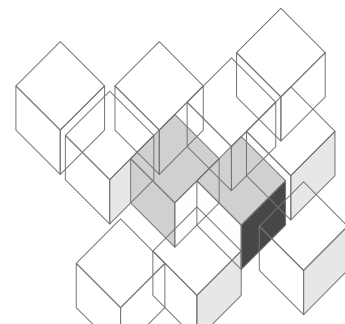
- A. The void space venting layer & membrane barrier system is to be signed off by the **[NRPP] [C-NRPP]** Certified Mitigation Professional.
- B. Ensure that a vertical collection riser pipe extends to 12 inches (305 mm) above the finished floor slab. Horizontal collection/extension pipes may be required in the system design.
- C. Under Slab Ventilation Panel & Membrane Barrier System - Polystyrene Insulation with High Impact Polystyrene (HIPS) film on top surface:
  - 1. Alleguard.; Amrad
  - 2. Insulation: **[ASTM C578, Type II] [CAN/ULC S701, Type 2]** expanded polystyrene.
    - a. Thickness: **[3-1/2 inches (89 mm)] [4-1/2 inches (114 mm)]**
    - b. Thermal Resistance: **[R12 (RSI 2.11)] [R16 (RSI 2.82)]**
    - c. Compressive Strength: 20 psi (152 kPa)
    - d. Water Vapor Permeance:  $\leq 0.1$  Perm (5.4 ng/Pa x s x m<sup>2</sup>)
  - 3. Air Permeance:  $\leq 0.004$  cfm/ft<sup>2</sup> (0.02 L/m<sup>2</sup>)
- D. All venting layer and membrane barrier system seams are to be prepared, overlapped and sealed as per the manufacturer's recommendations.



- E. Supply and install an air/vapor barrier membrane (self-adhering type) of minimum 2mm thick approved by the [NRPP] [C-NRPP] Certified Mitigation Professional, as a transition between the radon membrane and upturn onto grade beams, foundation walls, footings or any item that penetrates the finished floor slab. Joints are to be designed to accommodate anticipated movement.
- F. Gas tight seals are to be provided around the surfaces of all vertical penetrations. Such surfaces are to be prepared as per manufacturer's requirements to facilitate membrane adherence. Use an air/vapor barrier membrane (self-adhering type) of minimum 2mm thick, sealants and construction tape as required providing a continuous seal between radon membrane and any pipe, conduit or other item that penetrates the floor slab.
- G. Once concrete floor slab has cured sufficiently to allow work to proceed on it, apply sealant to all penetration junctions on the top side of the finished floor slab.

### 2.3 COLLECTION, EXTENSION AND RISER PIPES

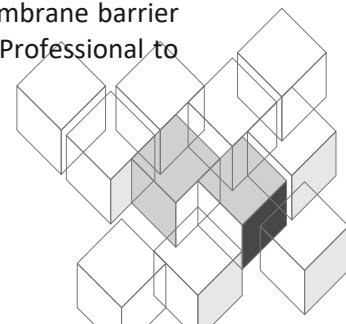
- A. The collection, extension and riser pipe locations are to be designed by the [NRPP] [C-NRPP] Certified Mitigation Professional and shown on the design drawings. Collection pipes having a minimum thickness of 4 inches (102mm) are to be placed into the void space venting & membrane barrier system layer.
- B. The collection, extension and riser pipes are to consist of a minimum Schedule 40 non-perforated smooth walled 4 inches (inside) diameter rigid pipe of PVC, High Density PE or ABS construction.
- C. The collection, extension and riser pipes are to be installed in accordance with the EPA/625/R-92/016 - 1994 Radon Prevention in the Design and Construction of Schools and Other Large Buildings document.
- D. A single vertical riser pipe is to be installed at each location and extend from the void space to a minimum of 12 inches (305mm) above the finished floor slab and capped. As this is a rough-in system, the vertical riser must not be extended through the roof.
- E. The vertical riser pipe above the finished floor slab must be in a feasible location approved by the [NRPP] [C-NRPP] Certified Mitigation Professional that would allow future extension of the riser pipe to the exterior of the building should post occupancy radon testing determine that mitigation is recommended by the EPA.



## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Contractor to review footing, wall and grade beam building construction drawings, and review radon mitigation rough – in system design drawings and specifications to ensure proper understanding before installation. Discuss with the [NRPP] [C-NRPP] Certified Mitigation Professional as required.
- B. All installation work is to be inspected, tested, documented and signed off by the [NRPP] [C-NRPP] Certified Mitigation Professional.
- C. The [NRPP] [C-NRPP] Certified Mitigation Professional will inspect and document all relevant materials and products brought to the site for the purposes of radon mitigation rough-in system (1st inspection).
- D. Prepare sub-grade surface prior to installation of the void space venting & membrane barrier system layer and riser piping, as per the elevations specified in the building construction drawings and radon mitigation rough – in system design drawings and specifications.
- E. Construct and install the riser as per the radon mitigation rough – in system design drawings and specifications and manufacturer's requirements.
- F. Install collection/extension/riser pipes in locations as per the radon mitigation rough – in system design drawings.
- G. The collection pipes are to be placed within the void space venting layer.
- H. All pipe joints are to be solvent welded and fully inserted into coupling or fitting to ensure joint integrity as per manufacturer's instructions.
- I. Riser pipe floor slab penetrations are not to interfere with planned future use of the interior space. Confirm riser pipe penetration locations with the [NRPP] [C-NRPP] Mitigation Professional on site prior to installation.
- J. The space around the riser pipe installations must be considered for possible future pipe extensions. Future exterior exhaust locations are to be located a minimum of 6.5 feet (2 m) from any opening in the building or adjacent building.
- K. Riser pipe installations are to ensure the same sized exhaust pipe extensions can be made to the exterior of the building through the wall or roof system, if required in the future.
- L. The void space venting & membrane barrier system layer is to be constructed by placing, grading and compacting (if required structurally) it over the entire sub-grade surface and riser piping.
- M. At completion of the substrate, component and void space venting layer & membrane barrier system, the Contractor is to contact the [NRPP] [C-NRPP] Certified Mitigation Professional to

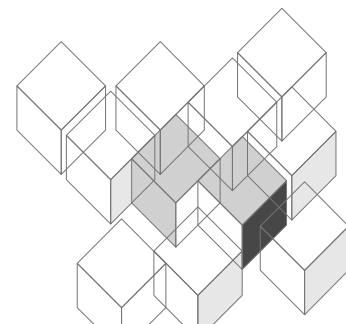


inspect the installation of this portion of the system. Results are to be documented by the [NRPP] [C-NRPP] Certified Mitigation Professional.

- N. When acceptance of the substrate, component and void space venting & membrane barrier system layer installation has been provided by the [NRPP] [C-NRPP] Certified Mitigation Professional, the floor slab construction can commence.
- O. Care must be taken not to puncture the membrane excessively during floor slab construction. To limit membrane puncture during floor slab construction, items such as rebar chair supports designed with a wide base (instead of legs) are to be used to better spread the rebar load.
- P. Once concrete floor slab has cured sufficiently to allow work to proceed on it, clean joint surfaces in accordance with manufacturer's instructions and seal all finished floor slab perimeter cold joints and any other floor slab penetration junctions between dissimilar materials using high quality sealants suitable for use on each subject material surface. Test sealant to confirm adhesion with all surfaces prior to use. Joints are to be pre-designed to accommodate anticipated movement.
- Q. The above slab exposed open top of the riser pipes must be capped and 100% solvent welded to provide a complete seal.
- R. The above slab exposed riser pipe and cap are both to be labeled to identify them as part of the "Radon Mitigation Rough-in System".
- S. At completion of the slab perimeter and penetration sealing and capping and labeling of the exposed riser pipes, Contractor is to contact the [NRPP] [C-NRPP] Certified Mitigation Professional for a final inspection of the installation (4th inspection). Results are to be documented by a [NRPP] [C-NRPP] Certified Mitigation Professional.
- T. When acceptance of the installation of the slab perimeter and penetration sealing, capping, and labeling of the exposed riser pipes has been provided by the [NRPP] [C-NRPP] Certified Mitigation Professional, the radon mitigation rough-in system is considered complete.
- U. Deficiencies in the radon mitigation rough – in system are to be corrected in accordance with this specification and as per instructions from the [NRPP] [C-NRPP] Certified Mitigation Professional.

### 3.2 FIELD QUALITY CONTROL

- A. Four (4) inspections of the system components and rough-in installations will be performed by a [NRPP] [C-NRPP] Certified Mitigation Professional. The results of these activities will be photographed and documented in written inspection reports prepared by the [NRPP] [C-NRPP] Certified Mitigation Professional and provided to the Owner and the Consultant.
- B. The site inspections are as follows:



1. The **[NRPP] [C-NRPP]** Certified Mitigation Professional will inspect and document all relevant materials and products brought to the site for the purposes of radon mitigation rough-in system (1st inspection).
2. The **[NRPP] [C-NRPP]** Certified Mitigation Professional will inspect, document and approve the completed installation of riser pipes and gas void space venting layer, prior to the membrane barrier installation (2nd inspection).
3. The **[NRPP] [C-NRPP]** Certified Mitigation Professional will inspect, document and approve the integrity of the membrane barrier system. They are also to conduct leak testing of the membrane barrier system after completed installation, prior to the concrete slab pour over the membrane to seal it (3rd inspection and testing).
4. The **[NRPP] [C-NRPP]** Certified Mitigation Professional will inspect, document and approve the completed installation of slab perimeter and penetration sealing and capping and labeling of the riser pipes, once the concrete slab pour is completed (4th inspection).

END OF SECTION 31-21-13

