Subject: Radon Control/Under Slab Insulation
ICC Codes (IRC Appendix F) AF101

EPA (US Environment Protection Agency) and US Geographical Survey have evaluated the potential egress of radon gas in US homes and buildings. These agencies developed radon mitigation procedures (Radon Control Methods AF101) to assist building officials in deciding radon resistant features in homes and buildings.

The usage of spray foam under slab or basement slabs has a two-fold benefit, insulation (improved energy efficiency), and radon mitigation.

Alpha Polymers 210 HFO Closed Cell can be applied directly to dirt or crushed stone. The application of spray foam insulation can provide adequate seal of radon gas. The usage or French drains can further assist in prevention of radon gas coming into homes and buildings.

3-in-1 Barrier Systems (insulation, air barrier, vapor barrier).

The rigid closed cell spray polyurethane foam is the most efficient insulation on the market today. This type of insulation system with high closed cell content offers low water absorption, air barrier, vapor barrier and High R-Value. The application of this liquid applied adhesive seals penetrations such as plumbing, mechanical vents, etc. without the need of additional tapes and sealers.

- Air Permeance (ASTM 2178) <0.02 L/sm^2
- Water Vapor Permeance (ASTM E96) less than 1.0 perms/inch.

Foams offer High R-Value (6.8 per inch) and can be applied to meet energy code requirements.

These products provide all three components for high performance: Insulation, Air Barrier and Vapor Retarder all in one step.

In the event a Class 1 Vapor retarder is needed, a 6-mil polyethylene can be installed on the foam before pouring the concrete slab. It is not recommended to place vapor retarder below the spray foam insulation.

Flood Resistance

The exceptional properties of spray foam insulation have been quoted in many articles and studies over the usage in coastal areas that are prone to flood.

The excellent water-resistant properties and low water absorption close cell spray foam has received the highest rating (Class 5) by NFIP (National Flood Insurance Program and FEMA (Federal Emergency Management Agency) for flood damage resistant material. This product is accepted by FEMA for usage as insulation in flood zones.

Other international agencies such as NRC (National Research Council Canada) conducted extended studies in below grade basement applications without additional water proofing. It was observed that the spray foam used on exteriors of foundation walls remain completely dry throughout the extended study.

Code Compliance Considerations:

IRC Appendix F - Radon Control Methods

Definitions: Soil-Gas-Retarder: A continuous membrane of 6 mil polyethylene or other equivalent material used to retard the flow of soil gases into a building.

Under Slab Vapor Retarder Requirements:

2018 IRC Section R506.2.3 Vapor Retarder

A 6 mil (.006 inch) polyethylene or approved vapor retarder with joints lapped not less than 6 inches shall be placed between the concrete floor slab and the base course or prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. *Garages, utility buildings and other unheated accessory structures*
2. *For unheated storage rooms having an area of less than 70 square feet and carports*
3. *Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.*
4. *Where approved by the building official, based on local site conditions.*

Note: This section does not require a specific vapor permeance rating but only requires a vapor retarder under the slab. Alpha Polymers Closed Cell Spray Foam can obtain a Class II vapor retarder, <1 perm. Typical thickness of Alpha Spray Foam Closed Cell Spray Foam when used as a radon barrier under slabs is 1.5" or greater.

Additionally, the climate zones requiring Class 1 vapor retarder, polyethylene (6 mils) can be used with 6" overlap or greater. For a polyethylene vapor retarder, this is important to ensure continuity of both the vapor retarder and the air barrier. Alpha Polymers Spray Foam provides a monolithic continuous air and vapor retarder. Continuity of the air barrier is important because radon enters the space primarily through air gaps or cracks in the slab and around penetrations.

Vapor Retarder vs Vapor Barrier

Prior to 2009, the term "vapor barrier "referred to a material that had a vapor permeance of 1 perm or less when tested using the desiccant method with Procedure A of ASTM E96. Beginning in 2009, the code defined three levels of vapor retarder classes.

Class I: $\leq$ 0.1 perm rating
Class II: > 0.1 perm to $\leq$ 1.0 perm rating
Class III: > 1.0 perm to $\leq$ 10 perm rating
Therefore, a Class II vapor retarder has the equivalent permeance of a vapor "barrier".

Additional design information can be obtained from IRC Appendix F (AF101-AF103) for specific zones.

References:

- *Honeywell. Closed-cell spray foam: A better building technology. Severe Weather*

- *FEMA. (August 2008). Flood damage –Resistant Materials Requirements. Technical Bulletin #2*

- *FEMA. (December 2010). Home Builder's Guide to Coastal Construction. Technical factsheet series*

- *FEMA P-499 SCHL. (1999). Basement walls that dry quickly. Research Highlights. Technical series 99-109*

- *Passive Radon Control System for New Construction. (May 1995). United States Environmental Protection Agency*

- *Building Radon Out. A step-by-step Guide on How to Build Radon-Resistant Homes. (April 2001). United States Environmental Protection Agency*

- *2015 International Residential Code, Appendix F.*
- *Building Science Corporation, Insight 101, Rebuilding Houston "Wash and Wear" (November 2017), Joseph W. Lstiburek*

- *Honeywell, Severe Weather and Closed-Cell Spray Foam : A Better Building Technology*

- *NRC-CNRC (November 2000), In-situ Performance Evaluation of Exterior Insulation Basement System `(EIBS) – Spray Polyurethane Foam Summary Report*

- *ICC (2018) EPA Map of Radon Zones – Table AF101* 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) | ICC DIGITAL CODES (iccsafe.org)