HUNTSMAN
BUILDING SOLUTIONS

September 9, 2022

**Subject: Under Slab Insulation / Radon**

Energy efficiency requirements are constantly increasing in all types of buildings. Many states now require insulation below the basement slab or slab on grade. There are now also requirements to protect the occupant from soil gas like radon in IRC Appendix F.

It is often very complicated and costly to get a perfectly sealed under slab system. Huntsman Building Solutions' Heatlok closed-cell spray polyurethane foam products (HL ccSPF) can provide a quick and simple solution for any under slab insulation. A solution that can be adapted easily to any shape or details in all types of construction. Heatlok HFO Pro, Heatlok HFO High Lift, Heatlok XT High Yield, Heatlok XT High Lift or Heatlok Soya HFO (Canada) can be sprayed directly on crushed stones or dirt to provide a perfectly sealed under slab insulation system. The concrete slab can then be poured directly on the product.

## Insulation, Air Barrier and Vapor Barrier Properties

HL ccSPF is one of the most effective insulation products on the market with an R-Value ranging from R-6.3 to R-7.4 per inch and can be applied to any thickness desired to meet energy code requirements. HL ccSPF is applied in a continuous, seamless application that also provides an air barrier assembly underneath the slab. It seals any penetration, such as plumbing or mechanical pipes, without the use of tape or sealant. HL ccSPF has been tested in accordance with ASTM E2178, to be considered an air-impermeable insulation, with an air permeance result of less than 0.02 l/s-m$^2$ at 75 Pa pressure differential. It can also provide a Class II Vapor Retarder with a water vapor permeance less than 1 perm, in accordance with ASTM E96. No other vapor barrier is required when applied to the minimum required thickness.

HL ccSPF provides all three necessary components for a high-performance assembly: insulation, an air barrier and a vapor retarder. This would require 3 or 4 products with other systems. Not only that, the quality of the product and its installation is superior to other systems.

* Note that if a Class 1 Vapor Retarder, such as 6 mil polyethylene, is requested, it can be installed on top of the foam before pouring the concrete slab. It should not be installed prior to the spray foam installation.

## Radon Barrier

HL ccSPF is one of the only set of products to have been tested for radon diffusion. Radon protection is usually provided by an air barrier material, since radon travels primarily through air. However, there can be radon diffusion through some air barrier materials, which is the reason why HL ccSPF has been tested in accordance with K124/02/95 (method C of ISO/TS 11665-13) for radon diffusion. At only 1'', HL ccSPF performs better than 6 mil polyethylene for radon protection. Furthermore, the product is often installed at a thickness of 1 ½ '' to 2'' and is

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therefore, much harder to puncture than 6-mil polyethylene when workers are walking on it during construction.

Our Heatlok Canadian product has also been evaluated by a CNRPP (Radon Specialist) officer in Canada (AARST in the US) and has been characterized to outperform 6-mil poly for this application.

**Compressive Strength/Durability**

As mentioned above, HL ccSPF can be sprayed directly to gravel or dirt to act as an insulation, air barrier, vapor retarder and radon protection. To add to all of this, the products also have excellent compressive strength for this type of application.

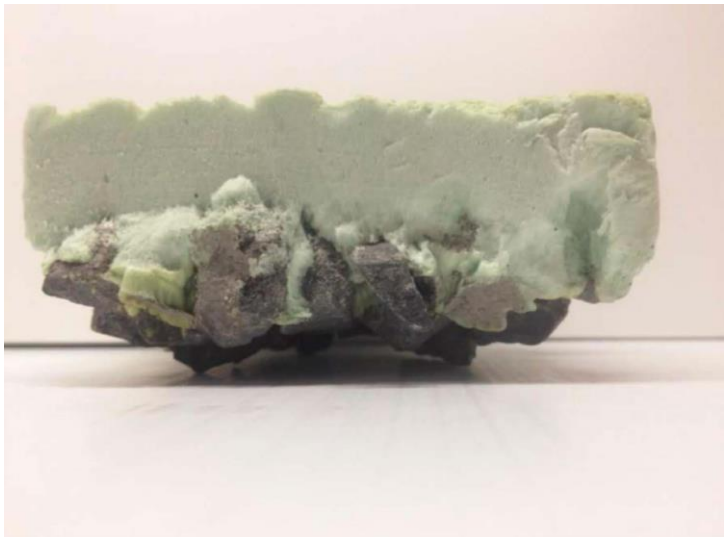
The test method used for compressive strength, ASTM D1621 *''Standard Test Method for Compressive Properties of Rigid Cellular Plastics",* is the same for all plastic insulation products on the market and measures how much force must be exerted to compress the material by 10%.

Specific to spray polyurethane foams, they are tested using only the core of the foam. Because the skin is not included, the reported density is lower, and the parameters of the test give conservative results. Therefore, the actual overall density on site is higher than laboratory test conditions, which results in higher compressive performance.

The compressive strength of HL ccSPF ranges from 18 – 35 psi. As mentioned, the test results are typically lower than the actual installed product. This range of compressive strengths is also comparable to other commonly installed products for under slab application.

With a minimum compressive strength of 18 PSI (± 2500 lbs per square foot) and considering that the average weight of concrete is 150 lbs per cubic foot, a typical 6" slab of concrete would weigh approximately 75 lbs per square foot. This is well below the structural capability of the foam.

Another advantage of this application is the fact that HL ccSPF will penetrate the crushed stone sub-base for about ½''. The foam when applied is liquid and will penetrate the gravel (see pictures below) to provide a complete seal. In certain areas, there will be more foam and the insulation value will therefore be increased. It makes the assembly very compact without leaving any air space between the insulation and the crushed stone sub-base, thus preventing the foam from cracking when walked upon. This is one of the problems of other systems that make them weak and often break or tear with the traffic of workers during construction.



HL ccSPF is in 100% contact with its substrate making it very solid to walk on. Different thickness can be applied depending on the required R-value. 2'' as demonstrated above is a common application.

## Flood Resistance

Many studies and articles have described the exceptional performance of spray foam insulation in coastal areas or hurricane and flood zones. For example, due to its excellent water-resistant properties, closed-cell spray foam has received the highest rating (Class 5) by FEMA and NFIP (National Flood Insurance Program) for flood damage-resistant materials. Also, it is the only product accepted by FEMA for use as insulation in flood zones. It is highly resistant to floodwater, as demonstrated by its very low water absorption characteristics and its rapid drying capability.

The Canadian Heatlok product was also studied by NRC in Canada for a period of 2 years in a below grade (exterior foundation walls) application without additional water proofing. The spray foam and foundation walls remained completely dry throughout the study.

During the spring of 2017, there was a major flood in many areas of the Quebec province in Canada. Huntsman Building Solutions (formally Demilec) was involved in a case study with one flooded home where our closed-cell spray foam product had been installed years prior. There was approximately 4 feet of dirty water filling the entire basement for multiple days. After the water was removed, only the gyprock was taken off and the basement was cleaned with power washers. After the basement was dried for about 5 days, HBS officials inspected and tested the humidity content of the wall. Only a few small areas still showed a humidity level of more than 15%. In the end, the basement completely dried out and the foam remained in place and only the gyprock needed to be replaced. This saved a lot of time and money for the complete restoration.

**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. HL ccSPF, at a minimum specified thickness (dependent on specific product), provides a Class II vapor retarder, <1 perm. Typical minimum thickness of HL ccSPF when used as a radon barrier under slabs is 1.25" or greater.

Additionally, the section requires that the vapor retarder be lapped 6 inches or greater. For a polyethylene vapor retarder this is important to ensure continuity of both the vapor retarder and the air barrier. HL ccSPF 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: ≤ 0.1 perm rating
Class II: > 0.1 perm to ≤ 1.0 perm rating
Class III: > 1.0 perm to ≤ 10 perm rating
Therefore, a Class II vapor retarder has the equivalent permeance of a vapor "barrier".

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Under Slab Insulation Requirements:

The International Building Code and International Residential Code require various insulation values for slabs on grade (12'' or less below grade). These requirements vary based on code edition, climate zone, and whether the slab is heated. It is important to verify the code requirements prior to planning and installation.

Note: For areas prone to termites verify with the local code requirements.

For any further information, please don't hesitate to contact us.

Thank you,

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