



# Closed Cell Spray Foam Excels

Single product provides thermal insulation, air, water & moisture barrier for high performance cavity wall designs *by Steve Loftis*

Closed Cell Spray Polyurethane Foam gives full coverage and expands in place, which allows it to air seal construction gaps, plumbing and electrical penetrations, as well as joints of dissimilar materials such as roof deck/wall junctions.

Today's masonry structures require a higher level of performance. Building envelopes must be designed to control the transfer of heat, air and moisture to control energy costs, occupant comfort and health. Temperature is controlled with thermal insulation and sealing to eliminate air leakage. Water leaks must be prevented and moisture vapor diffusion controlled to prevent mold and mildew, optimizing healthy indoor air quality.

While masonry can be shaped and sized to provide any geometric shape retaining strength and durability, it needs a clear drainage cavity to act as an effective barrier to heat and moisture transmission. Joints can lead to air leakage. To capitalize on the best properties of masonry designs and overcome inherent weaknesses, designers and builders recognize spray foam insulation as a solution to heat, air and moisture control.

## Expands in Place

Closed cell spray polyurethane foams (ccSPF) were developed in the 1950s and quickly became the insulation of choice

for extreme temperature vehicles, buildings and tanks. Freezers, refrigerated trucks, wood kilns, controlled atmosphere storage and temperature controlled tanks were many of the early applications. Spray polyurethane foam (SPF) fully adheres to common building materials. Since SPF is spray-applied as a liquid which expands in place, the shape of the area to be insulated does not matter: odd-shaped gaps and joints can all be filled, covered, air sealed and insulated.

When a building is continually conditioned to a higher or lower temperature than the exterior air temperature, condensation control is always of major concern. For modestly insulated buildings of the 1960s, '70s and '80s, this was not typically considered. As energy cost and usage became a greater concern, thermal, air and moisture controls became more important to the building science world.

## R-/"

A nominal density of 2.0 pounds per cubic foot provides optimal R-value per inch of thickness (R-value varies by

manufacturer and product, but most exceed R-6 per inch) while providing the moisture and structural physical properties that make it a multi-functional product. The applied product has a compressive strength greater than 25 psi or 3600 psf, strong enough to support a concrete slab floor and the load that will be applied to that floor. It can also support below grade exterior applications with soil backfilled against the foam.

A continuous layer of SPF forms a membrane which, by its closed cell structure, will not permit water penetration under hydrostatic pressure. It can water-seal a masonry building assembly and is certified as an exterior water-resistive barrier.

Just as water will not penetrate SPF, air is also blocked by the physical performance of the foam membrane. SPF can air seal construction gaps, plumbing and electrical penetrations as well as joints of dissimilar materials such as roof deck/wall junctions. Its ability to air seal stops heat bypass of

These coatings have also been approved by the International Code Council Evaluation Service to meet the code requirement for water-resistive barriers on sheathing. Although this is a sheathing requirement, it is an important stamp of approval and proof that a coating need not be as thick as roofing material to be effective on a backup wall. These systems render block water-resistive. They apply with typical paint equipment at typical paint thicknesses.

Every day thousands of people jump out of airplanes in reliance on parachute fabric 3 mils thick. A material does not have to be thick to be effective.

Acrylic-based systems are part of the family of coatings technologies recently awarded historic landmark status by the American Chemical Society for durability and environmental safety.

Acrylic aggregate emulsions have such low solvent content that they pass

the most stringent Southern California solvent restrictions.

Demonstration applications can be done on mock-up walls inside distributor and contractor offices because participants do not even notice any odor or fumes. The UV window is six months. This means application contractors can mobilize one time per project – with all the time and money savings that can mean.

### Application

Use conventional airless paint sprayers and or rollers and brushes as desired. Mason contractors are expanding their contract scope and taking advantage of their in-place scaffolding by taking the half-day training to apply these systems. (One contractor reports making more money applying the coating than in erecting the block backup wall.) Two spray coats on CMU at a typical coverage rate correspond to 15 wet mils per coat. ■■■



concrete floors, unlike carpet

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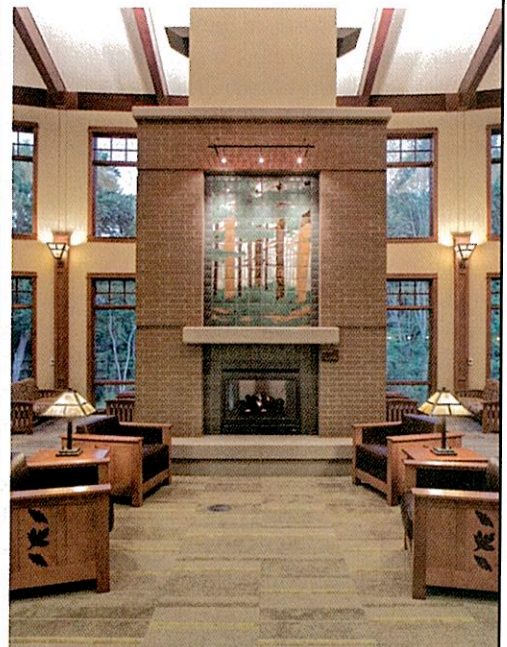
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the insulation membrane and allows thermal performance of the R-value at maximum efficiency, thereby lowering energy requirements to control interior temperature.

## Water Vapor

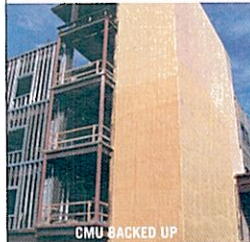
With water sealed out, air leaks eliminated and thermal boundary established, the next concern is water vapor diffusion. Movement of water, a liquid, is well understood. Water vapor, on the other hand, is a gas and its transport mechanisms are subtle and less understood. Its control is very important to ensure indoor air quality and building longevity. Where air and water may be blocked from passage by solid building planes and sealed joints, moisture vapor has the ability to diffuse through a solid material, thereby moving moisture from areas of high moisture content to areas of lower moisture content. In normal situations, warm air holds more moisture than cold air, so moisture vapor tends to be movement from hot to cold areas. Therefore, water vapor control must be managed in conjunction with the thermal boundary.

Generally speaking, buildings in warm climates have a vapor retarder installed on the exterior side of the insulation and buildings in cold climates have a vapor retarder installed on the interior side. Common in both situations is the vapor retarder on the warm or higher humidity side of the insulation. However, this is simplistic: It does not take into account buildings in mixed climates or buildings with both high cooling and high heating loads. Because the closed cell foam is both the thermal boundary and the moisture vapor retarder, the vapor retarder is never on the wrong side.

## Application Guidelines

Scheduling and construction issues that should be considered with the SPF can normally be addressed in pre-bid and pre-construction meetings. Brick ties need to extend out from the base wall enough to permit the foam application without covering the eyelets. If foam is to be 2" thick, the eyelets should extend at least 2.5". All wall penetrations for electrical and plumbing should be

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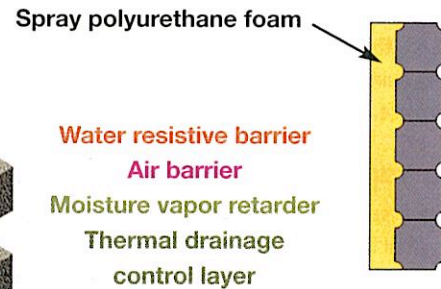
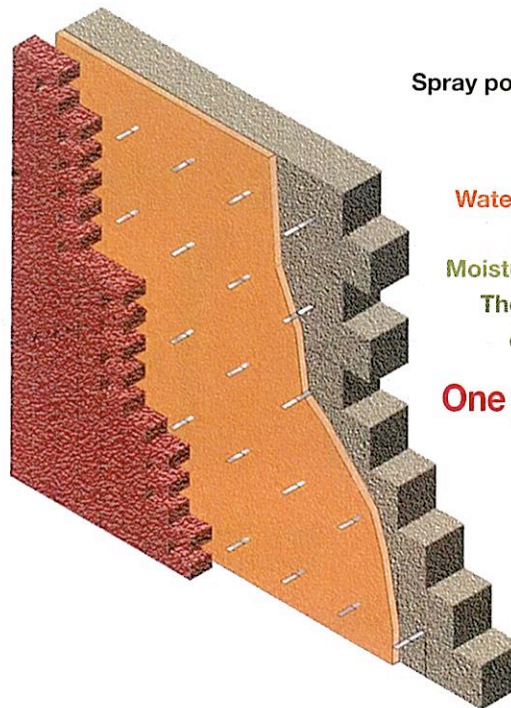
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►► **Closed Cell Spray Foam**

roughed in and the roof deck installed prior to the foam. Spray foam can seal the openings and wall/roof junction to provide the air/water seal. Window details need to be planned. In some cases, jambs are bump outs that can be inserted prior to spraying.

Foam can be sprayed directly to the jambs with no additional flashing. In other cases, the product has to be installed with a space left for the window/door framing to be attached directly to the structural wall where the jamb to membrane seal will need to be finished later. Compatible thru-wall flashing can be laid into mortar between concrete block courses or can be a peel and stick membrane applied after block is laid. Either way, the compatible thru-wall flashing can be raised up by hand and the spray foam applied under it to insulate and seal the lower section of the wall. Then the foam can be applied to the wall above the flashing. This is best accomplished prior to any brick being installed.



**Spray polyurethane foam**

**Water resistive barrier**  
**Air barrier**  
**Moisture vapor retarder**  
**Thermal drainage control layer**

**One product - One application**

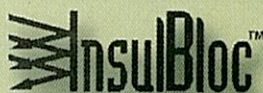
Application of just one product – Spray Polyurethane Foam – in the cavity of a brick and block masonry wall acts as thermal boundary, air, water and moisture vapor barrier.

*Because the closed cell foam is both the thermal boundary and the moisture vapor retarder, the vapor retarder is never on the wrong side.*



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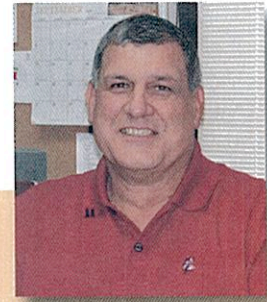
Every construction job has unique aspects. It is just a matter of communication with the applicator to reach the best solution. For the masons and general contractors who have not worked with this method before, the key is to remember the purpose of the foam is to seal the wall as well as insulate it. Sometimes, bracing for scaffolding has to be attached to the base wall. If damage to the foam membrane cannot be avoided with prior planning, the applicator can make the necessary repairs to reseal any damaged areas.

Masonry building materials are the first choice for many designers and builders of commercial and institutional buildings. Masonry can be constructed to provide any required level of structural strength and provides the greatest fire resistance possible for walls and structural elements. As the exterior facing, masonry provides the durability other products cannot match, evidenced by the many historic castles, churches and cathedrals around the world. As an interior finish, masonry provides the

most durable surface to withstand the physical contact that walls will endure from people and moveable equipment.

Multiple functions of the unique foam membrane and ease in dealing with geometric shapes and construction junctions/ gaps ensures the issues of heat, air and moisture are addressed resulting in a superior energy efficient building. This SPF is fully supported with third party testing and has a nationwide network of certified applicators.

With more than 40 years of experience in applications on extreme temperature masonry buildings, the recent growth in applications to build higher energy efficient standard buildings is a natural progression. Designers can be totally free for creative designs with shapes, sizing, wall and roof junctions, arches and window/ door openings and still be able to insulate, air seal, water seal and control moisture vapor drives with SPF. ■■



**Steve Loftis** is the manager of code & compliance with NCFI Polyurethanes in Mount Airy, NC. He has 15 years at NCFI working with spray-in-place polyurethane foam systems for roofing, insulations and specialty applications in all types of construction applications. A retired Lieutenant Colonel, United States Marines, Loftis also has a Bachelor of Science degree in Textile Technology from North Carolina State University.  
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