

The logo for ICYNENE LAPOLLA, featuring the company name in a bold, sans-serif font with a stylized cube icon between the two words.

ICYNENE LAPOLLA®

A photograph showing two construction workers in white protective suits and hard hats on a blue scissor lift. They are applying a thick, white spray polyurethane foam to the exterior of a building. The background is a clear blue sky.

Spray Polyurethane Foam

as a Continuous Insulation (CI) Solution

Program Registration

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Learning Objectives



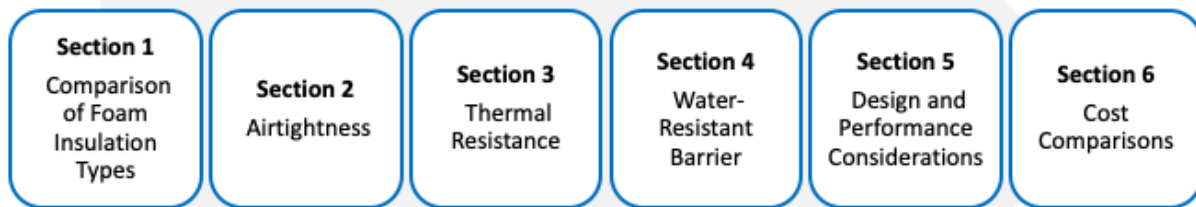
Upon
conclusion of
this course,
you should
be able to:

1. Define both types of foam insulation products—spray polyurethane foam (SPF) and rigid foam board—for exterior CI project application.
2. Understand the installation and performance advantages of SPF versus rigid foam board.
3. Investigate the use of SPF to achieve multiple performance traits in one product, including thermal, air, and water resistance.
4. Recognize the installed cost advantages of SPF versus rigid foam board.

Welcome to spray polyurethane foam as a continuous insulation solution. Upon completion of this course you should be able to:

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Course Outline

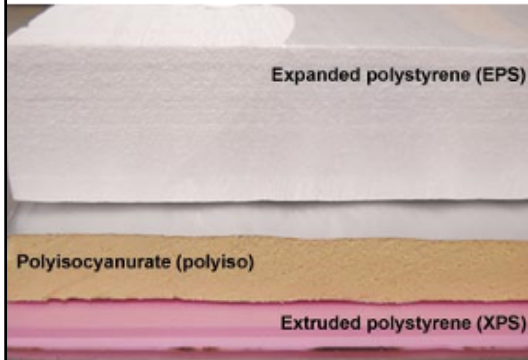


This presentation is divided into six sections, as outlined here, with a conclusion.



Section 1: Comparison of Foam Insulation Types

Comparison of Foam Insulation Types



There are three basic types of rigid foam board insulation. All are typically produced in 4 foot x 8 foot sheets and delivered to the job site. Expanded polystyrene, or EPS, is a white beaded board that is also commonly seen as a packaging material. Extruded polystyrene, or XPS, is a smooth finish foam plastic sheet that is typically pink, blue, or green in color. And, finally, the third type is polyiso foam board. Polyiso foam board is a yellow foam that often features a foil facer on both sides.

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Comparison of Foam Insulation Types

Rigid foam board is produced, cut, and shipped from a plant facility.

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Comparison of Foam Insulation Types



Low Density
R-3.7 per inch
Open-cell composition
Soft, flexible foam
Sponge-like texture



Medium Density
R-6.5 per inch
Closed-cell composition
Hard, rigid foam

Moving to spray foam insulation produced for commercial walls, there are two common types available on the market: open-cell, half-pound, light-density spray foam and closed-cell, 2-pound, medium-density spray foam. Each has separate and unique product and performance attributes. For the purposes of this presentation, we are going to focus on medium-density closed-cell insulation.

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Spray Foam Insulation Is Produced On-site



Now, let's look at some comparisons of foam insulation types.

1 Insulation

2 Full air barrier
Eliminating the need for a separate product to perform this function

3 Class II vapor retarder
Meaning it has low water vapor permeance

4 Water-resistant barrier (WRB)

Four Key Attributes of Spray Foam Insulation

There are four key attributes of medium-density spray foam:

1. It has a high thermal insulation value, usually around R-5 to R-7.1.
2. It is an integral air barrier.
3. It serves as a Class II vapor retarder.
4. Many are classified as a water-resistant barrier (WRB).

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Section 2: Airtightness

Airtightness

Many people believe that a higher R-value will help make a building more energy efficient. However, this is only part of the equation. The key to optimizing building energy efficiency is airtightness. An effective air barrier will help better control energy efficiency and reduce heating and cooling costs. Energy codes recognize this and have mandatory provisions that address air leakage of wall assemblies with a continuous air barrier. An airtight building is more energy efficient, sustainable, and durable and has lower greenhouse gas emissions.

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Airtightness



Moisture Problems



Indoor Air Quality



Acoustics

An air-barrier system is a combination of building components that are part of the building enclosure. An effective air barrier will also have a positive impact on addressing moisture control, indoor air quality, and acoustics.

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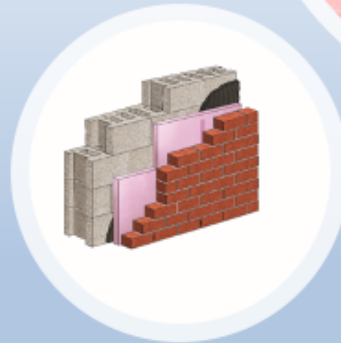
Importance of Compatibility

Compatibility with adjacent materials, including transition membranes, penetrations, and windows, is common. Here are some examples of spray foam insulation in a continuous insulation application and its compatibility with a range of materials.

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Airtightness

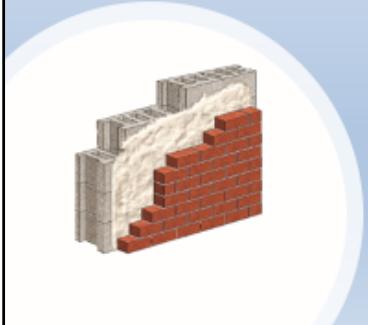
When looking at rigid foam board as an air-barrier system, it is often challenging to achieve continuity. Reasons include the standard cut size of the foam board itself (4 feet x 8 feet) as well as the requirement to tape or seal the board at every joint. The foam board will also need to be mechanically fastened or glued to the studs or the CMU. An air-barrier membrane sheet installed under the ridge board will also add to both the labor required and the complexity of the system.





Airtightness

With regard to spray foam insulation, there are several that have been evaluated as an air-barrier material or assembly by the ABAA. Most of these products are considered to be air impermeable at 1 inch. Medium-density spray-foam insulation also has the added benefit of insulating and air sealing the envelope in one step.



Check with the manufacturer for specific NFPA 285 compliance requirements.



Section 3

Thermal Resistance

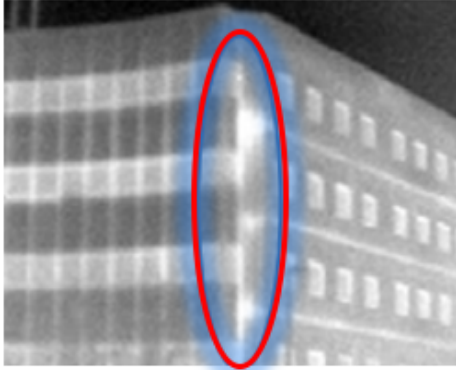
Section 3: Thermal Resistance

Thermal Resistance

The test of a truly effective continuous system is the degree to which it fully covers all areas of a building assembly and eliminates thermal bridges. The proper use of an exterior continuous insulation system can result in the elimination of the most common thermal bridges, such as direct thermal conductivity through metal or wood wall stud framing, perimeter concrete floor edges, and exposed concrete and steel structural columns and beams.

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Thermal Bridging



This infrared photo shows warm air (bright) leaking out at the column enclosure.

A common misconception is that most potential thermal bridging occurs with the steel studs within the wall. While this is partly true, thermal bridging can also occur through non-insulated structural elements such as floor slabs and column corners. This photo shows that warm air is leaking out of the corner of the building at the column enclosure.

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Smooth Application



Medium-density spray foam insulation can be applied smoothly on the assembly. This image shows how the medium-density spray foam insulation can completely insulate and create a smooth seal around brick ties and other attachments to allow for full thermal performance.

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Thermal Resistance

When looking at rigid foam board for thermal resistance, mechanical fastening is required, which adds labor to the project. Plus, mechanical fastening can compromise the continuity and integrity of the insulation. Rigid foam boards need to be cut and fitted around penetrations or cut into unique shapes to cover the exterior. Cutting and fitting rigid board can lead to potential gaps along joints, which can affect and compromise performance in the long run.

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Video

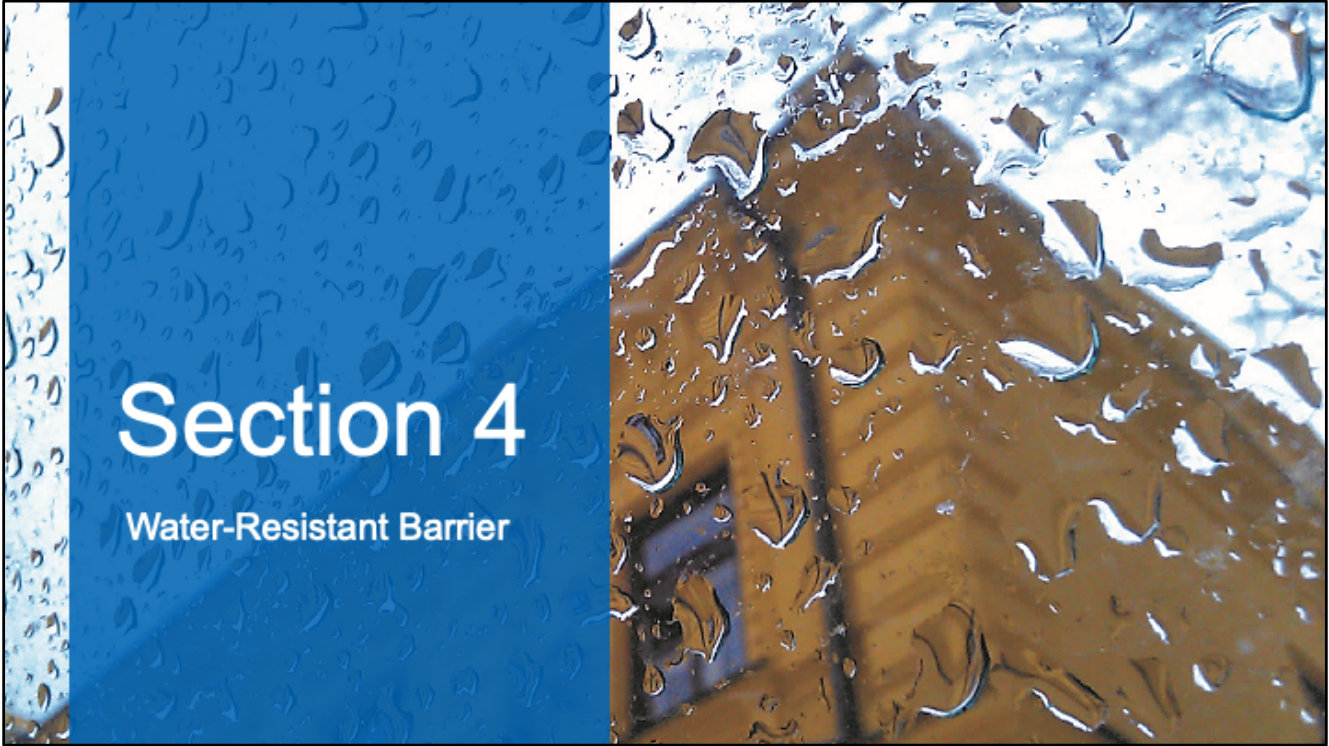




Thermal Resistance

However, spray foam insulation offers a superior alternative. When the material is sprayed, it adheres to the wall, completely sealing around all connections and attachments. Greater flexibility and attachment placement is also possible. Overall, spray foam insulation covers the wall construction completely and creates a much more uniform layer of continuous insulation.

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Section 4: Water-Resistant Barriers



Water-Resistant Barrier

A water-resistant barrier (WRB) works to resist wind-driven rain and redirect water back out of the assembly and prevent water entry. Performance issues to consider include exposure to wind and pressure, structural support, continuity, and durability.

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Water-Resistant Barrier

A WRB is required by building code to maintain the integrity of the wall assembly. Most medium-density spray foam insulation is considered to be a WRB. Other options include felt paper, house wraps, self-adhered membranes, and liquid-applied membranes.

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Water-Resistant Barrier

When comparing rigid foam board and spray foam insulation as WRBs, many rigid foam products are not rated to perform this function, meaning a separate barrier or membrane is needed. However, most medium-density spray foam insulation products are considered to be a WRB since they have very low water-absorption rates and can also shed water. When considering the cost of job-site labor, rigid foam board still requires physical taping or sealing at the joints. On the other hand, as seen in the video earlier, medium-density spray foam insulation is applied continuously and does not contain joints or seams except at predesignated locations.

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Section 5: Design and performance considerations



Design and Performance Considerations

Take a look at this building. Picture insulating this building with a medium-density spray foam insulation and then imagine insulating it with rigid foam board. The curve of this building would likely require a very labor-intensive process for the rigid foam boards to be cut to shape and then excessive taping at each joint. An installation of spray foam insulation would be quick, smooth, and far less labor intensive, as it insulates and air seals in one step while also providing a WRB. Many buildings today feature curved surfaces. Consequently, rigid foam board just may not be a practical solution for buildings where the continuity of the insulation is a key design consideration.

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Spray Foam and Curved Surfaces



Medium-density spray foam conforms directly to the surface regardless of shape, geometry or irregularities. Plus, it fully covers and seals over the underlying construction to provide a truly continuous, uninterrupted insulation layer. The air seal provided by medium-density spray foam is solid and immediate.

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Design and Fire Performance Considerations

- Both rigid foam boards and spray foam insulation are considered combustible materials.
- Permitted if thermal barrier requirements in the building code are met.
- Medium-density spray foam does not melt at high temperatures and also does not sustain a fire when the flame source is removed.

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Design and Fire Performance Considerations

-

Manufacturers must prepare and have independent lab testing of the entire wall assembly to meet NFPA 285 requirements. When a specific assembly is preferred by the architect but has not been duplicated with an official test by any of the manufacturers, an engineering judgment via an analysis by a qualified fire protection engineer becomes an option. Because of the multitude of potential assembly designs, the use of such engineering evaluation judgments has become prevalent among specifiers today as the most effective means for compliance. The use of certain claddings can be subject to NFPA 285 approval considerations.



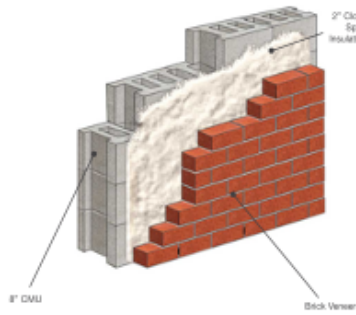
Section 6: Cost comparisons

Cost Comparison

It is important to remember that you must take the whole wall assembly into consideration when evaluating the cost of rigid foam board versus spray foam assemblies.

There is a common misconception that spray foam insulation costs more than rigid foam board in an exterior continuous insulation wall application. Yet it is important to remember that you must take the whole wall assembly into consideration when evaluating the cost of rigid foam board versus spray foam assemblies. The key difference between the two wall assembly systems is that spray foam insulation provides three functions: thermal resistance, air barrier, and a water-resistive barrier. For a complete air-barrier system, the rigid foam board continuous insulation system will require the addition of a separate air-barrier membrane.

MASONRY WALLS WITH CLOSED CELL SPRAY FOAM CONTINUOUS INSULATION MAJOR COMPONENTS:



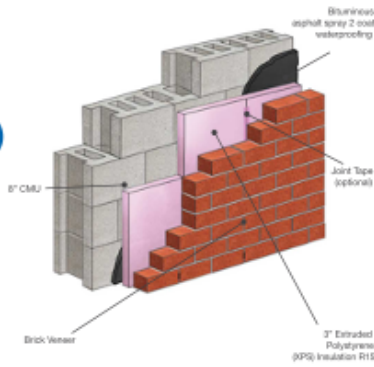
CMU 2" BRICK

8" CMU Backup Wall	\$10.00
2" Closed-Cell ProSeal Spray Foam Insulation (R14)	\$1.89
Brick Veneer	\$16.57

TOTAL PER SQUARE FOOT **\$28.46**

MASONRY WALLS WITH RIGID XPS CONTINUOUS INSULATION MAJOR COMPONENTS:

VS



CMU 3" BRICK WATERPROOFING

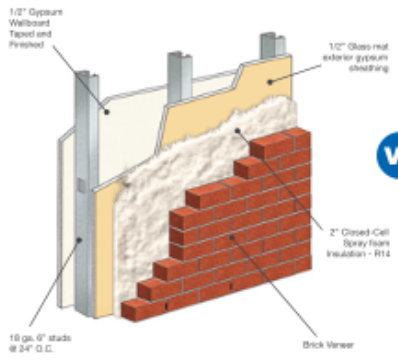
8" CMU Backup Wall	\$10.00
3" Extruded Polystyrene(XPS) Insulation (R15)	\$2.58
Brick Veneer	\$16.57
Bituminous asphalt spray 2 coat waterproofing	\$1.65

TOTAL PER SQUARE FOOT **\$30.80**

Cost Comparison

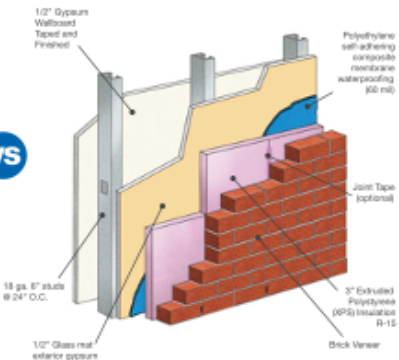
Installed cost reference: RSMMeans 2017.

**CLOSED CELL SPRAY FOAM
STEEL FRAMING (LGMF) WALLS
MAJOR COMPONENTS:**



**RIGID XPS FOAM BOARD
STEEL FRAMING (LGMF) WALLS
MAJOR COMPONENTS:**

VS



**Cost
Comparison**

1/2" Gypsum Wallboard, Taped and Finished	\$1.55
18 ga. 6" studs @ 24" O.C.	\$2.31
1/2" glass mat exterior gypsum sheathing	\$1.87
2" Closed-Cell ProSeal Spray Foam Insulation (R14)	\$1.89
Brick Veneer	\$16.57
TOTAL PER SQUARE FOOT	\$24.19

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18 ga. 6" studs @ 24" O.C.	\$2.31
1/2" glass mat exterior gypsum sheathing	\$1.87
Polyethylene self-adhering composite membrane waterproofing (60 mil)	\$3.08
3" Extruded Polystyrene (XPS) Insulation (R-15)	\$2.58
Brick Veneer	\$16.57
TOTAL PER SQUARE FOOT	\$27.96

Installed cost reference: RSMMeans 2017.

Conclusion



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In conclusion, architectural firms have the opportunity to maximize their energy savings options with a single product, spray foam insulation, which provides four functions: truly continuous installation, a continuous air barrier, a water-resistive barrier, and, finally, a vapor retarder.

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Conclusion

Medium-density spray foam insulation in a continuous insulation application produces a lower installed cost with less labor and less waste than systems relying on rigid board insulation. The design possibilities are endless with medium-density spray foam insulation without compromising performance, particularly for curved or irregularly shaped buildings, since spray foam can adhere to curved, irregular, and unique shapes and conditions. The end result offers greater architectural design flexibility for continuous insulation solutions and better outcomes for building owners and occupants.

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Thank You

This concludes the continuing education unit on
Spray Polyurethane Foam as a Continuous Insulation.

Please take the quiz to receive your credits.



Thank you for your interest in Icynene-Lapolla.

For more information, visit <http://www.icynene-lapolla.com/>

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