Journal of the Roof Consultants Institute

Interface

April 2004
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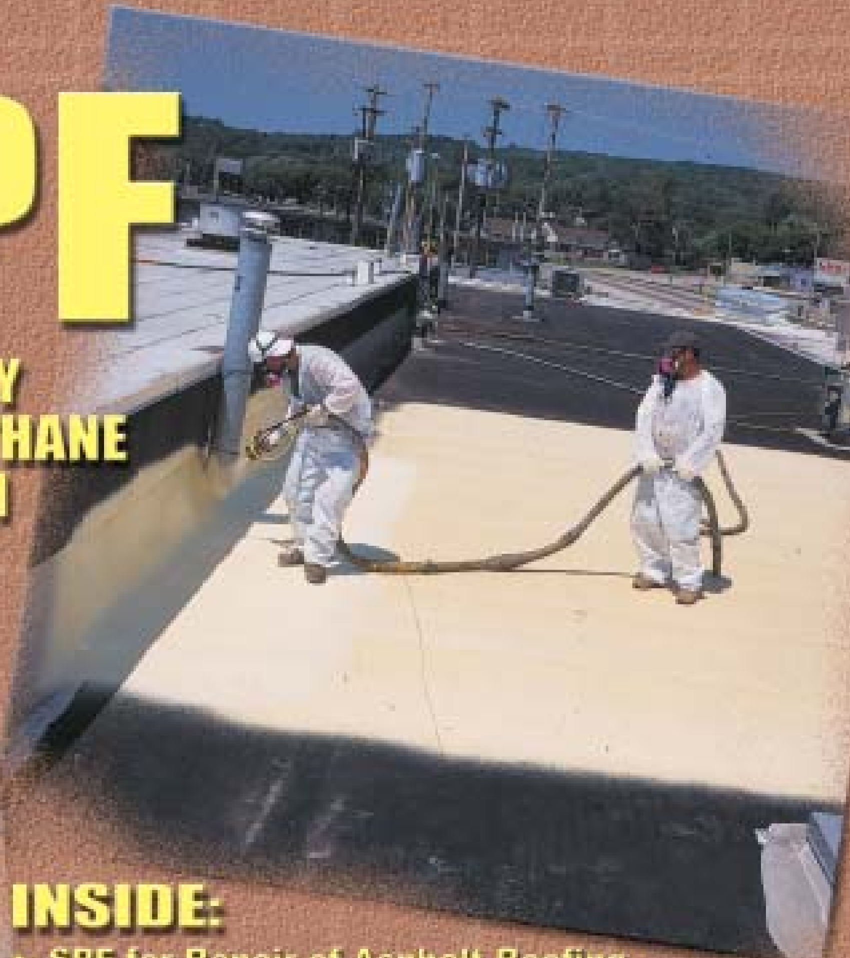
SPF

SPRAY POLYURETHANE FOAM



INSIDE:

- SPF for Repair of Asphalt Roofing
- Field Performance of SPF Flashings
- Sustainability of SPF
- Use of SPF in Masonry Cavity Walls
- SPF Proves its Worth

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In This Issue
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Features

Special Interest

About This Issue: Sometimes discounted during roof systems selection, spray polyurethane foam (SPF) clearly has a time and place. When configured properly, SPF can yield excellent service life. This issue concentrates on technology, maintenance, and attributes of sprayed foam roofing.

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PRESIDENT'S MESSAGE

A Productive Year

This is my last president's message before I hand the gavel to the able hand of Luther Mock. I appreciate the opportunity RCI's members have given me to serve as their president. Many things have happened during the past year that I believe are important.

We have completed the role delineation for the position of roof consultant and have accordingly rewritten the RRC examination to test prospective registrants on the knowledge deemed necessary through this process. Our RRC exam is now legally defensible and, while the examination that we have been using for the past few years has served us well, the revised exam positions our institute for even greater recognition of the RRC program and the profession of roof consultants.

Volume III of our *Manual of Practice* is complete (if you haven't ordered yours yet, I encourage you to do so) and Volumes I and II should be ready soon. In my opinion, these documents will quickly become very important to the roofing industry, and I plan on incorporating them in my own business practice as soon as possible.

The Waterproofing Exam Committee has been formed and has begun work on the examination for that registration. I anticipate that that exam will be ready for the Miami Convention in 2005.

A Marketing Committee has been formed to promote the recognition of RCI internationally. While many people have put a lot of effort towards this goal over the years, the effort will now be a more organized one.

A taskforce has been established to study the governance of the Institute. Members of the taskforce will be reviewing the makeup of regions, the board of directors, the executive committee, and committees in general. Their report is due to the board of directors next year.

While we have not completely erased our retained earnings deficit, we are closer than we have ever been and I believe that at the end of 2004, our retained earnings will be a positive for the first time ever.

During the past year, I have relied heavily on the efforts of our member volunteers. It is hard to believe that so many volunteers continually step forward to assist RCI in achieving its goals, but they do. In one of my previous columns, I estimated that our member volunteers donated approximately 15,000 hours annually. We would not be where we are today without the commitment of so many of our dedicated members.

I have also relied heavily on the staff at RCI. Some adjustments have been made to the staff, and I personally can't imagine how we could have accomplished all that we have this year without the efforts of our outstanding group of people.

By the time you read this, I will be a past president, which I am told is the best job at RCI. It may be, but I will sure miss the job I have now.

I want to extend my sincere thanks to each of you for your involvement and support this past year.

W. Nelson Hall, RRC,
President

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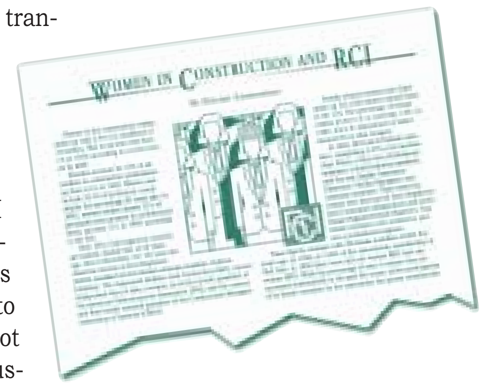
NEW ASSOCIATION FORMED BY XPS SUPPLIERS

The makers of extruded polystyrene foam insulation (XPS) have formed an association to promote the use and benefits of the product and serve as a leadership voice on applications for XPS foam insulation. Susan Herrenbruck is its executive director. For more information, visit **www.xpsa.com** or call 800-978-9772.

New Member Questions

Dear Editor:

I read with interest your recent article concerning women in the industry and in RCI. As a woman who has come from a nontraditional career and is transitioning into another somewhat less, though still nontraditional career as the marketing person for a commercial roof consulting firm, I am interested in qualifying as an RRO. What is the correct route for me to do so? While I have not been in the roofing industry previously, I was the first woman to ever achieve the distinction of Jaguar Master Technician in Jaguar Corporation history, so technical reading does not put me off! Let me know the steps, and I will get started. Thanks and have a great New Year.



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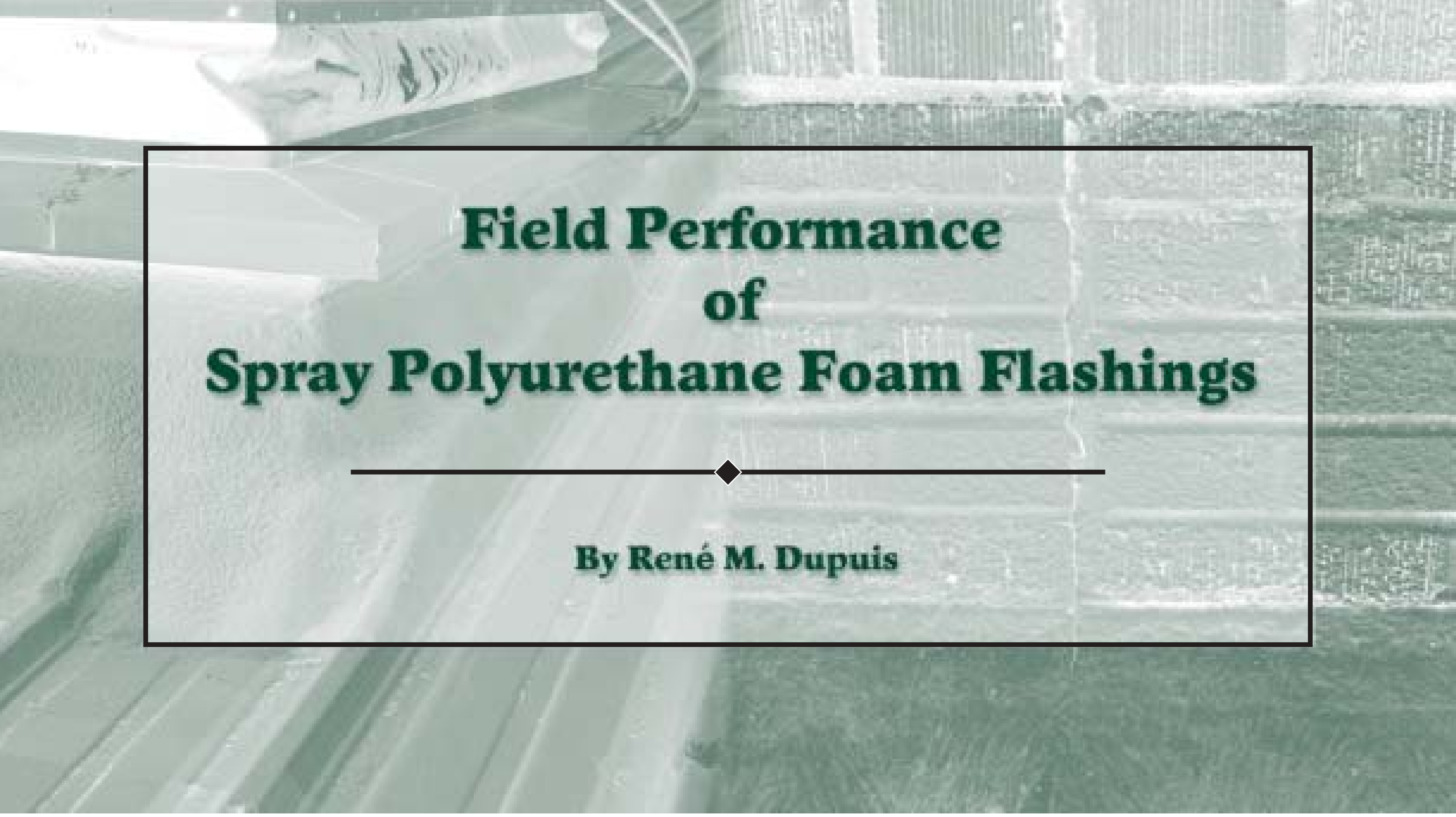


Field Performance of Spray Polyurethane Foam Flashings

By René M. Dupuis

In September of 2003, The National Roofing Foundation completed its second field study of Spray Polyurethane Foam (SPF) roofing systems. The study, which began in 2001, examined 188 SPF roofs of various sizes and shapes. The roofs ranged in age from new to 31 years, with an average age of 11.75 years.

This study was a follow up to the original study completed in 1998, which examined performance characteristics of in-place SPF roofs. While the first study dealt with physical properties of the aged roofs, the second survey was chartered to determine the viability of the SPF material as a flashing material over a wide range of substrates.

Unlike other roofing systems, the mechanic applying SPF materials literally goes up the wall, curb, or roof-mounted penetrations. Flashing sheets and fasteners are not required. The *NRCA Manual of Roofing and Waterproofing Construction Details* calls for the use of metal counterflashings. The study examined what is actually happening in the field with SPF flashing details that do not incorporate metal flashings. *Table 1* details the information for both the 1998 and 2003 study of SPF roofs.

	Phase I (1998)	Phase II (2003)
Number of roofs in study	140	188
Oldest age of roof(s)	27 Years	31 Years
Number of recoated roofs	39	40
Percentage of recoated roofs in study	28%	21%
Average age of roof at recoat	11.3 Years	15.0 Years
Number of roofs of unknown age at recoat	11	3
Average age of all roofs	11.0 Years	11.75 Years

Table 1: Comparative Data on SPF Roof Studies

While flashing details are the most likely cause of roof leaks in virtually all roofing systems, they are often overlooked during the membrane selection process by the roof owner and the consultant or architect. Most conventional systems utilize metal, bituminous, or polymeric membrane to solve a variety of flashing details. Sometimes these materials are manufactured in the factory, and sometimes the roofing contractor relies on experience to field manufacture the proper solution to the problems.

All SPF details are essentially field manufactured. This allows for an easier seamless transition around roof-mounted equipment, parapets, and roof penetrations. The spray application allows for thicker applications to slope away from potential leak problems, such as walls or penetrations. After the application of foam, the protective coating usually extends 4 to 6 inches up projections and vertical walls.

A note of caution on thicker applications of SPF: industry standards call for maximum lifts of 1-1/2 inches. When foam is applied in thicker lifts, the exothermic reaction can cause thermal degradation, creating poor cell structure and foam with low compressive strength. Caution must still be used when applying greater thickness in multiple lifts as the heat must be given time to escape.

Spray foam has the unique ability to adhere to virtually all exterior building materials. However, certain non-ferrous metal flashings should be primed prior to application of SPF.

During the field study, we learned that spray polyurethane

Left: Figure 1 - Standard metal counterflashing.

Below: Figure 2 - Metal roof expansion joint.

foam, when correctly applied to surfaces and then coated, does not require metal counterflashings. The survey examined roofs in California, Texas, Wisconsin, Kentucky, Illinois, New Jersey, New York, and Connecticut. SPF flashings, including roof-to-wall, roof-to-roof transition, penetrations, termination points, and equipment supports were found to work well in each of these climates. The National Roofing Foundation released the report, "Performance of Spray Polyurethane Flashings" earlier this year.

Following are pictures and descriptions of various roofing details examined during the study. Special thanks to the NRCA for allowing their reprint.

Standard Metal Counterflashing

Figure 1 shows a typical wall with SPF and coating applied up the wall and covered by the metal counterflashing. Galvanized sheet metal was formed and surface mounted with a drip edge. The use of metal as a counterflashing is consistent with detail SPF-4, which can be found in the 5th Edition of the N*RCA Roofing and Waterproofing Manual.*

Metal Roof Expansion Joint

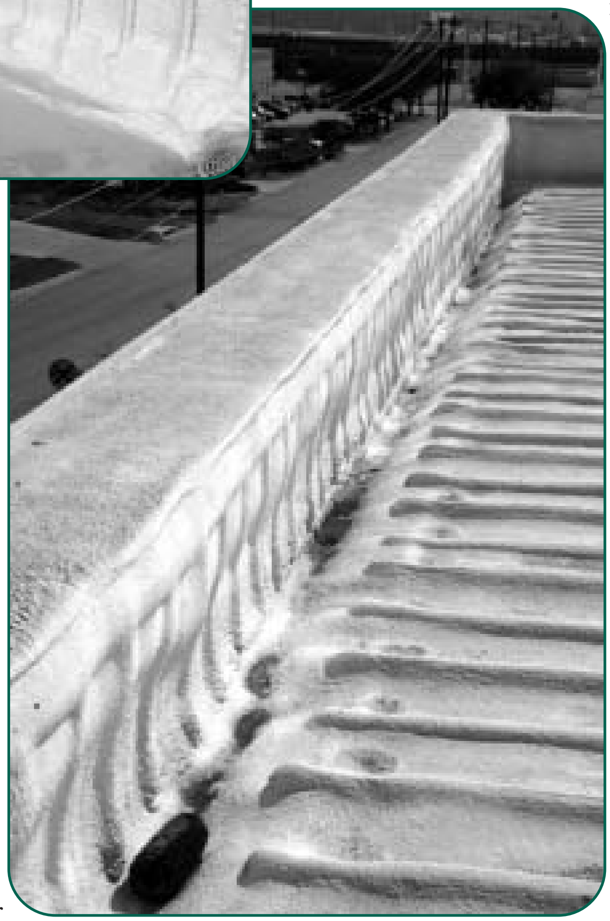
Figure 2 shows how SPF flashing can be used with a flexible bellows to handle differential and cumulative movement in a large metal roof. Note that the elastomeric bellows has been anchored in SPF and coated. This deck runs along a second-story wall that uses SPF as a transition between roof and wall.

Roof to Short Wall Transition

Figure 3 illustrates how SPF can make roof transitions to a wall along with a short transition to the adjoining lower roof. A light-gage metal wall panel and cap previously formed this transition. This detail was installed in 1977.

Figure 3 - Roof to short wall transition.

Above: Figure 4 - SPF roof to high roof transition.



Right: Figure 5 - Interior gutter system.

SPF Roof to High Roof Transition

A roof-to-roof transition is shown in *Figure 4* that details how SPF was used to solve a difficult tie-in for two different roof systems. The existing metal flashing was covered with spray foam and coated. The SPF transition detail also covers a short wall that has metal panels and window units. The SPF tie-in was installed in 1991.

Interior Gutter System

A large existing warehouse complex was re-roofed with SPF in 1991. The existing metal roof and interior gutter system were overlaid with 1.5 inches of spray polyurethane foam and coating. All of the existing metal flashing system was secured and covered with spray foam. No new metal flashing or counterflashings were added. The interior gutters were also covered with SPF as shown in *Figure 5*.

SPF Roof and Wall Transition

A complete roof and wall transition with SPF is shown in *Figure 6*. No metal flashing has been used on this 1997 installation. All of the pre-existing metal flashing is now encased in SPF. No new metal was used.

SPF Wall Flashing

The large lower main roof of this distribution center is broken up by a three-story brick wall. As seen in *Figure 7*, the expansion joint in the brick wall is active. The SPF re-roof covers all pre-existing metal flashing. The SPF flashing now reaches above the original metal counter flashing. There are no cracks or spalling of the SPF. The coating is functioning as a counterflashing over the SPF at the top of the pre-existing metal.

SPF Low Wall Flashing Application

In some instances, walls may be completely covered by the SPF system with no adverse performance. *Figure 8* shows a low masonry parapet wall and metal cap system with SPF and coating in a 1998 installation. Wall construction – especially how moisture is handled from the outside brick veneer – must be thoroughly understood before covering with SPF.

Equipment Support Curbs

Both low and high equipment support curbs were observed as shown in *Figures 9* and *10.* The high curb appears to have been extended up with a slightly smaller curb from the original base *(Figure 9)* and flashed with SPF and coating. Low curbs *(Figure 10)* were observed to have been treated the same way with no functional difference, using SPF and coating. No metal counterflashing was used, nor does it appear to be needed.

Left: Figure 6 - SPF roof and wall transition.

Below: Figure 7 - SPF wall flashing.

Equipment Support Columns

SPF roofs were often found to have no need for pitch pans or for separating support columns that are structurally sound and tied to a wall. *Figure 11* shows a heavy steel support stand that is directly flashed with spray foam and coating into the SPF roof/wall detail. The 1992 flashing installation detail appears to be watertight and serving its intended purpose.

SPF Flashing

The NRF studies observed numerous flashing details where pre-existing metal flashing had been installed. As shown in *Figures 12* and *13*, SPF can easily adapt to many rooftop details by being overlaid onto the existing prepared substrate. Existing metal flashings may remain and be totally enclosed or left open as the need dictates.

Just as the Phase I study demonstrated the performance value of SPF roofing systems when properly applied, Phase II has demonstrated that the use of SPF as a flashing system easily accommodates virtually all termination details. The study specifically identified:

- Masonry units.
- Metal wall panels.
- Metal flashing of all types.
- Concrete pre-cast panels.
- Wood sheathing and board products.
- Asphaltic flashing systems.
- Single-ply flashing systems.

SPF may require primers when applied over thermoplastic, single-ply membranes. The use of a wash primer is recommended when spraying over EPDM.

Figure 8 - SPF low wall flashing application.

Figure 9 - Equipment support – high curb.

It is important that all substrates receiving SPF should be properly prepared, cleaned, (and, if necessary), primed. When SPF is used as a recover over old membranes, it is important to thoroughly examine the existing assembly. If edge metal is not replaced, it may need to be reattached. Any wood nailers or other materials that have surpassed their service life should be removed and replaced.

SUMMARY

The use of SPF and appropriate coatings were observed to work quite well as singular flashing systems. The use of metal counterflashing was not seen to be required as part of an SPF roof system.

SPF as a flashing material in concert with an SPF roofing system offers the following advantages:

- No seams or joints to allow for water penetration.
- No differential movement between materials.

Figure 10 - Equipment support – low curb.

- A fully insulating system with no thermal shorts to allow energy transfer.
- Ability to conform to any angle on penetrations, terminations, or vertical walls.

It is easy to envision a future where this material is used with conventional membranes in a "hybrid" system, allowing for the benefits of SPF as flashing material on roofs of other types. This already is occurring on liquid-applied coating systems where penetrations and terminations are foamed, while the field of the roof is coated. ■

Figure 11 - Equipment support with columns.

Above: Figure 12 - SPF flashing on a metal roof.

REFERENCES:

1. Alumbaugh, R.L., "Maintenance of Sprayed Polyurethane Foam (PUF) Roofing Systems," *Proceedings of the Second International Symposium on Roofing Technology,* National Roofing Contractors Association, Rosemont, Illinois, 1985, pp. 89.
2. Kashiwagi, D.T., "The Development of an Expert System and Historical Database for PUF Roof System Specification, Design and Analysis," *Proceedings of the Third International Symposium on Roofing Technology,* National Roofing Contractors Association, Rosemont, Illinois, 1991, pp. 189.
3. Dupuis, R.M., "A Field and Laboratory Assessment of Sprayed Polyurethane Foam Based Roof Systems," National Roofing Foundation, Rosemont, Illinois, 1998.

Figure 13 - SPF flashing, roof-to-wall.

About the Author

René M. Dupuis

René M. Dupuis obtained his B.S., M.S., and Ph.D. degrees in civil engineering from the University of Wisconsin at Madison. He has worked for the National Science Foundation, the University of Wisconsin, and was also an assistant professor at the State University of New York at Buffalo. He is a professional engineer and a principal and president of Structural Research, Inc., a consulting engineering firm located in Middleton, Wisconsin. Since 1974, Dr. Dupuis has been involved in materials research with much of this effort devoted to the roofing industry as a consultant. He has written and presented many articles and research reports on roofing materials technology and has conducted numerous investigations for building owners, architects, contractors, and manufacturers. Dupuis is a member of ASTM, CSI, NSPE, and ASCE. He is a member of the CIB/RILEM International Committee on Single Layer Roofing; has served on the Roof Advisory Panel for the DOE/Oak Ridge National Laboratory's Roof Test Center; and as chairman of the Board of Regents for the Roofing Industry Educational Institute (RIEI). He has served as technical advisor to the Midwest Roofing Contractors Association (MRCA) and the National Roofing Contractors Association (NRCA) and as the ASTM Task Group Chairman on Roof Performance. Dr. Dupuis received the James Q. McCauley Award from the MRCA and the Distinguished Service Award from the University of Wisconsin at Madison College of Engineering in 1995.

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Sustainability Characteristics of SPF Roofing and Insulation Systems

– A Review of Work to Date

By Mason Knowles

INTRODUCTION

Building owners have used spray polyurethane foam (SPF) as a roofing, insulation, and sealing product for many years. Recent research and performance studies on SPF applications demonstrate many sustainable characteristics of the material. This article is divided into two sections. The first section addresses SPF roofing and presents investigative research by René Dupuis and Dean Kashiwagi, Spray Polyurethane Foam Alliance (SPFA) sponsored projects at Factory Mutual and Underwriters Laboratory, cool roof research by Lawrence Berkeley Labs, and articles written by roofing experts such as Thomas Smith and Patrick Downey. Energy studies are courtesy of Texas A&M University.

The second section addresses SPF applications to the interior of a building. The article includes research by Mark Bomberg, W.C. Brown, Robert Alumbaugh, M.K. Kumaran, N.V. Schwartz, Anthony Woods, and others, in addition to SPFA sponsored projects with NAHB Research Center and Oak Ridge National Laboratories (ORNL) and field investigations by private companies.

SECTION 1

Roofing

Between 1983 and 1996, Dean Kashiwagi surveyed and documented the performance of more than 1,600 SPF roofing systems.[1] In 1998, René Dupuis published results of his inspection and evaluation of more than 160 SPF roofing systems in six different climates of the United States.[2] The surveys conducted by Dupuis and Kashiwagi are very similar in their conclusions that SPF roofing systems are highly sustainable. In Kashiwagi's 1996 report, the oldest performing SPF roofs were more than 26 years old, 97.6% did not leak, 93% had less than 1% deterioration, and 55% were never maintained. Kashiwagi and Dupuis also noted the physical properties of the SPF did not diminish over time and that more than 70% of the SPF roofs were applied over existing systems.[1, 2]

Energy Savings

Many large companies and institutions have documented energy savings from the use of SPF roofing systems. Texas A&M calculated the energy consumption of its buildings before and after the application of SPF roofing systems. According to the study of more than eight million square feet of SPF roofing, energy savings paid for the cost of Texas A&M's SPF roof applications in three to four years.[3] How do SPF roofs so dramatically show results of this type?

As shown on *Chart 1*, black-surfaced roofs have measured peak temperatures up to 190˚F on a 90˚F day. If the interior temperature is maintained at 78˚F, the resultant temperature difference is 112˚F.[4]

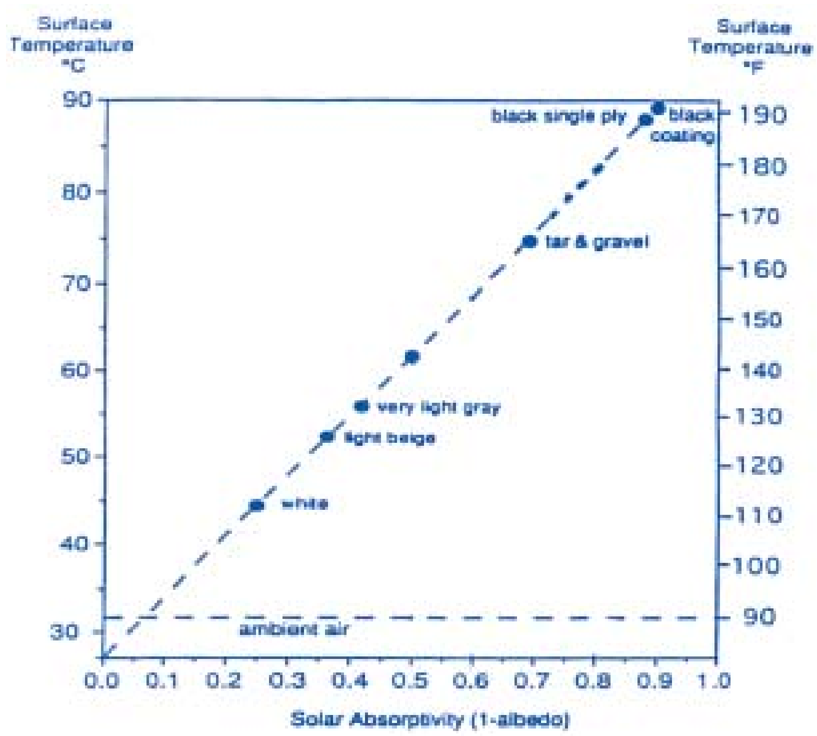
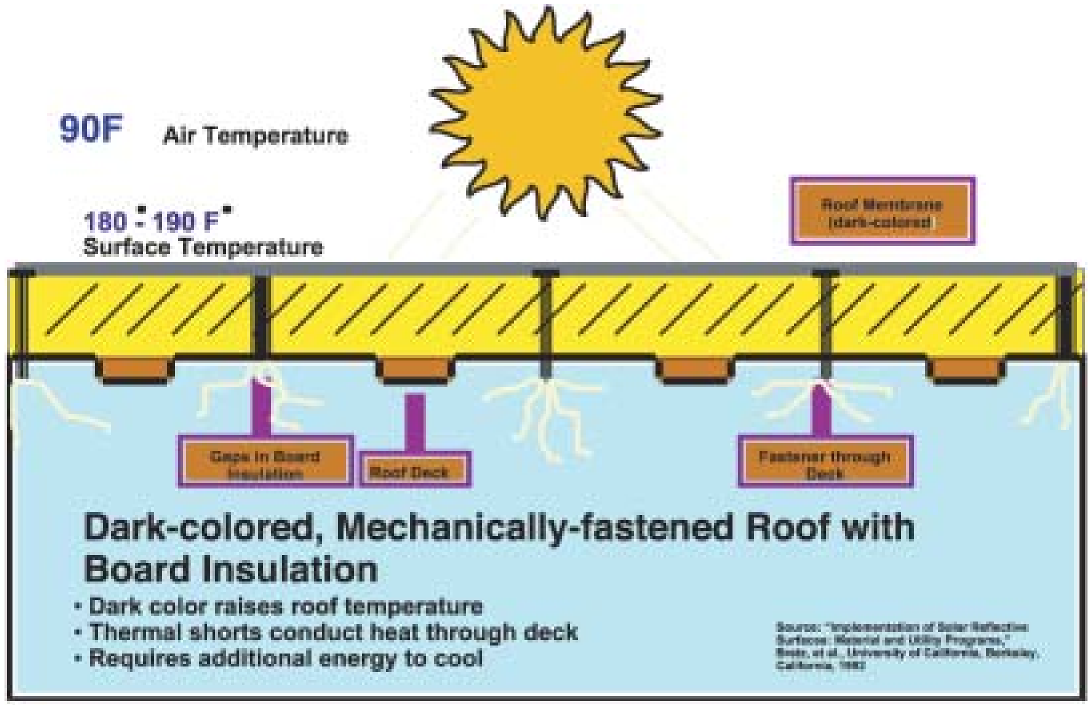


Chart 1: Solar absorbtivity.

According to figures reported by Mike Watts in 1996, fasteners alone can reduce the effective insulation value between 1.5% to 31.5%, depending on the number and type of fasteners.[6]

Detail 1 shows what happens to a typical roof on a hot summer day. Dark-colored membranes absorb radiant heat. The roof's surface temperature rises. Thermal bridges such as fasteners and gaps in insulation boards transport the heat within the building.

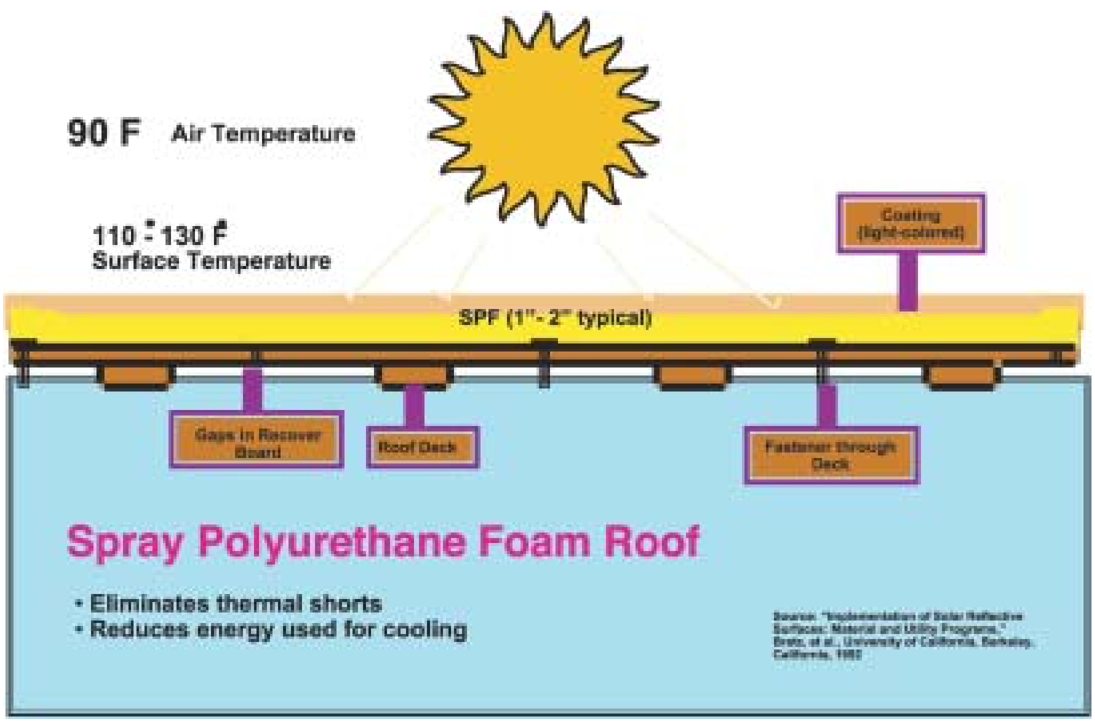


Detail 1

How does SPF reduce energy costs?

As shown in *Detail 2*:

- SPF roofing systems are applied above the roof deck.
- SPF eliminates thermal bridging by providing a continuous layer of insulation over existing thermal bridges in the roof deck and/or roof assembly.
- SPF has a very high aged R-value of between 6 to 7 per inch.
- SPF roofing systems typically are coated with light-colored, reflective coatings.



Detail 2

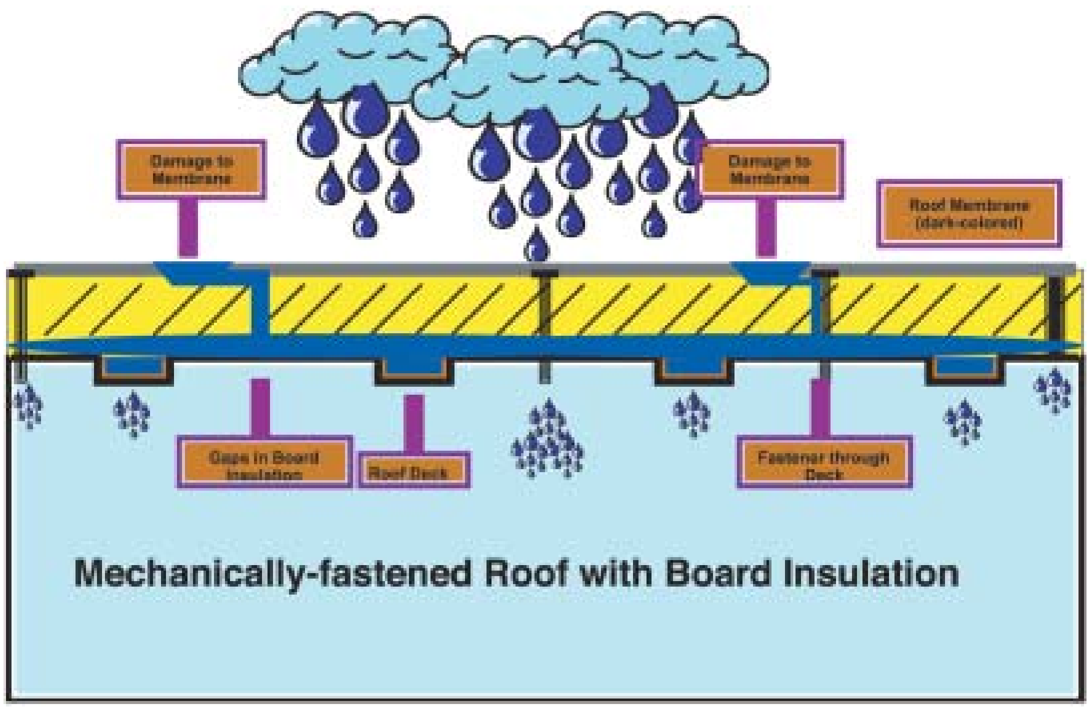
Durability

Performance studies and research suggest that SPF roofing systems can last 30 years or more. Additionally, they require low maintenance, are resistant to leaks caused by hail and wind-driven debris, are resistant to high wind blow-off, can add structural strength, and minimize moisture damage within the building envelope.[7]

ORNL reported, "The principal causes of premature roof failure are moisture intrusion and lack of wind resistance. Moisture accumulation in roofing systems leads to dripping, accelerated failure of the insulation and membrane, roof structure deterioration, depreciation of assets, and poor thermal performance. [See *Detail 3*.] Similarly, the loss of a roof during a major windstorm not only causes structural damage but also exposes the building contents to the elements. The insurance industry identifies roofing as the primary contributor to disaster-related insured losses."[8]

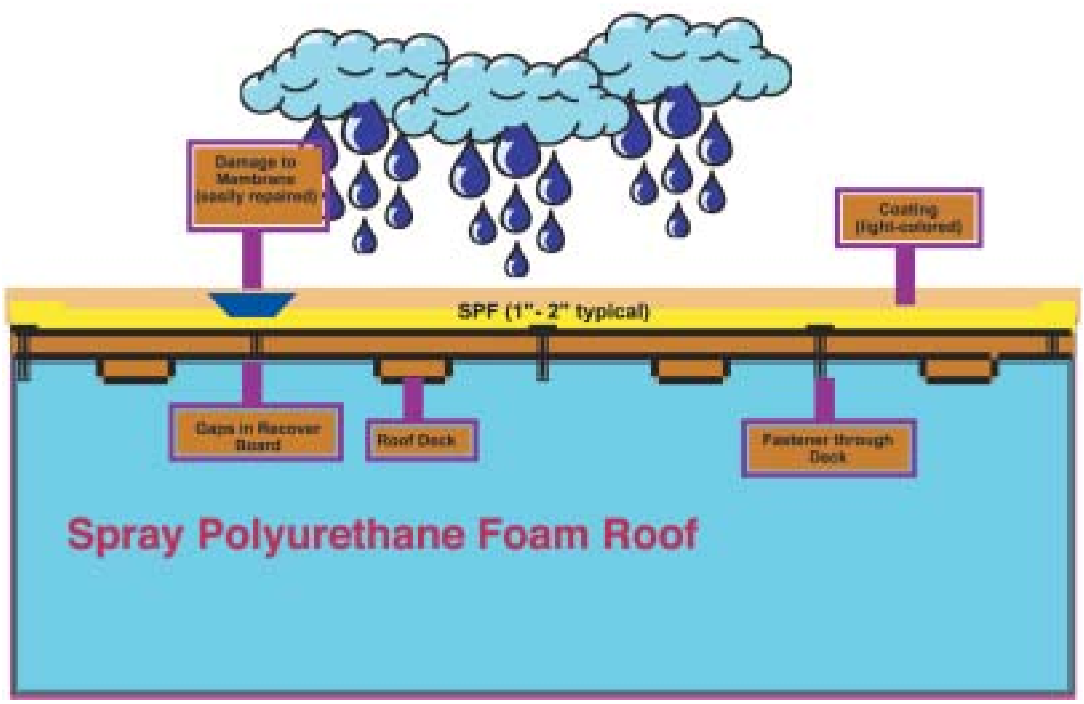
SPF roofing systems limit moisture intrusion because of their 90% closed cell properties. Damage to the system typically does not cause leaks into the building, and moisture intrusion is isolated to the areas of damaged foam cells (see *Detail 4*). As reported by Dr. Dupuis, "One unique aspect of SPF roofs…is that they are not in immediate danger of leaking, providing the penetration does not extend all the way through the foam."[2]

SPF roofing systems have exceptional wind uplift resistance. Field observations of SPF performance during Hurricanes Allen, Hugo, and Andrew led the industry to conduct laboratory testing of SPF systems at Underwriters Laboratories and Factory Mutual. SPF's wind uplift resistance exceeded the capacity of UL's testing equipment. UL also observed that SPF roofs applied over BUR and metal increased the wind uplift resistance of those roof coverings. Factory Mutual's testing showed similar results over concrete, metal, and wood.[9, 10]



Detail 3

According to Dr. Dupuis and other industry experts such as Thomas Smith and Richard Fricklas, SPF is a very good impact absorbing material. Hail and wind-driven missile damage rarely cause leaks in an SPF roof. The damage typically can be repaired at a later date without compromising the long-term performance of the SPF roofing system.[11] One of the most famous examples is the New Orleans Superdome. A severe hailstorm damaged areas of the SPF roof in 1978. For the next 10 years, the city debated how best to repair the damaged roof. Finally, in 1992, the roof was repaired and re-coated. However, prior to the repairs, the roof never leaked from the hail damage. (Some leaks were reported that were actually caused from bullets fired at the roof during Mardi Gras.)[12]



Detail 4

SPF Reduces Construction Debris

ORNL also reported, "The need for multiple roofs makes roofing one of the largest contributors of solid waste."[8] According to the National Roofing Contractors 1999 Survey, more than 68.5% of the 11.3 billion dollar low slope re-roofing market includes tear-off and replacement of the existing roof membrane.[13] SPF roofing systems have excellent adhesion to a variety of substrates, including BUR, modified bitumen, concrete, wood, asphalt shingles, clay tile, and metal. Since SPF adds little weight and can be applied in various thicknesses to add slope and fill in low areas, SPF roofing systems are often used as a recover system over existing roofs without tear-off. Therefore, the application of SPF roofing systems over existing roof coverings greatly reduces the amount of construction debris in our landfills.[7]

So to conclude this section, SPF roofing systems demonstrate significant sustainable characteristics. SPF roofing systems have a long life, are renewable, save energy, add durability to buildings, control moisture in buildings, and contribute very little to the waste stream. SPF roofing systems greatly reduce tear-offs in many re-roofing projects, which also decreases the amount of materials entering the waste stream.

SECTION 2: INSULATION AND AIR BARRIER SYSTEMS

"Environmental control within a building envelope depends on strong interaction [among] heat, air, and moisture transport collectively." In order to control these factors, there must be "effective air barriers, rain screens, weather barriers, and thermal insulation of a continuous nature so that gaps do not compromise the climate control design."[14]

"The durability of a material in a building envelope depends on the outdoor and indoor climate, type of construction, and conditions of service. A small change in one of these variables may result in material failure during the first year or a flawless performance for forty years."[15]

The use of SPF systems can significantly affect the durability and climate control of a building. Three SPF systems are used within the building envelope: high density (1-1/2 to 2 lb/ft^3), low density (less than 1/2 lb/ft^3), and sealant foams. High density SPF is used when strength, high moisture resistance, and high insulating value are desired. Low density SPF is used when insulation, air barrier, and sound control are desired. Sealant foams are used to caulk around windows, doors, sill plates, and other locations to seal against unwanted air infiltration.

R-Value

SPF's aged R-value varies, depending on the formulation, type of blowing agent used, and type of application. Aged R-values of SPF used in insulation and roofing applications with a density ranging from 1-1/2 to 3 lb/ft^3 typically range between 6 and 7.5 per inch. Factors affecting the R-value include: thickness of application (the thicker the foam the better the aged R-value), and the substrate and covering systems used (the lower the perm rated covering and substrate, the higher the aged R-value).[15] Low-density (1/2 lb), open-celled SPF typically has a stable, aged R-value ranging from 3.4 to 3.6 per inch *(Chart 2)*.

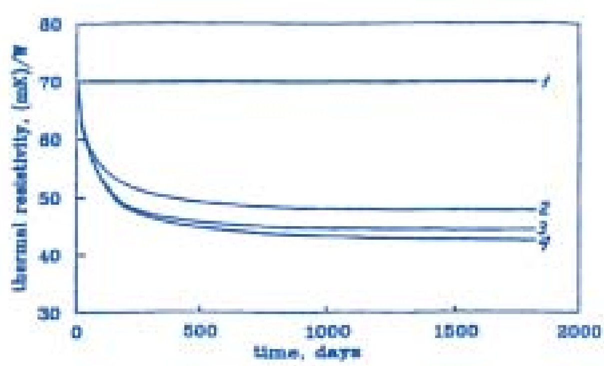


Chart 2: SPFR value aging curve.

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Comparison Results: Assumed System Resistance & U-Value vs. Actual System Resistance & U-Value

Insulation	R-Value		Loss	R-Value		Loss	R-Value		Loss
Thickness	Assumed	Calculated	%	Assumed	Calculated	%	Assumed	Calculated	%
1.0 in.	5.85	5.18	11.5	5.85	4.66	20.27	4.7	3.45	26.49
1.5 in.	8.35	7.34	12.08	8.35	6.57	21.3	6.62	4.75	28.19
2.0 in.	10.85	9.51	12.4	10.85	8.48	21.86	8.54	6.05	29.13
3.0 in.	15.85	13.83	12.73	15.85	12.29	22.44	12.39	8.66	30.13
4.0 in.	20.85	18.16	12.9	20.85	16.11	22.75	16.24	11.26	30.66
5.0 in.	25.85	22.49	13.01	25.85	19.92	22.94	20.08	13.86	30.98
6.0 in.	30.85	26.81	13.08	30.85	23.74	23.06	23.93	16.46	31.2
7.0 in.	35.85	31.14	13.13	35.85	27.55	23.15	27.77	19.06	31.36
8.0 in.	40.85	35.47	13.17	40.85	31.36	23.22	31.62	21.67	31.48

Source: Mike Watts, "Thermal Conduction Based on Isothermal Planes (Series-Parallel Path) Analysis," *Interface*, May 1996.

Chart 3

Roof Connection Comparisons: Fully Adhered Membrane vs. Mechanically Fastened Membrane

System Design	Fasteners @1 per 4 sq. ft.	Fasteners @ 1 per 2 sq. ft.	Fasteners @ 1 per 1 sq. ft.
Insulation Type	Extruded	Extruded	Extruded
Fastener Type	Deck Screw @ 1/4" dia.	Deck screw @ 1/4" dia.	Deck screw @ 1/4" dia.
Fastener Conductivity	365	365	365
Fastener Area	490.87 sq. in.	981.75 sq. in.	1,963.50 sq. in.
Roof Area	5,760,000 sq. in.	5,760,000 sq. in.	5,760,000 sq. in.
Insulation Conductivity	0.2	0.2	0.26
Deck Conductivity	365	365	365
Open Deck Area	0.00 sq. in.	0.00 sq. in.	0.00 sq. in
Surface Resistance	0.85	0.85	0.85
Deck Thickness	0.14 in.	0.14 in.	0.14 in.

Source: Mike Watts, "Thermal Conduction Based on Isothermal Planes (Peries-Parallel Path) Analysis," *Interface*, May 1996.

Chart 4

In 1997, ORNL performed whole and clear wall testing of SPF between metal stud walls. Three quarters of an inch of high density SPF was applied between studs and 1/2" over the metal studs. Results confirmed that the use of SPF greatly reduces the thermal bridging effect of the metal studs.[18]

Typical SPF roof.

By controlling moisture infiltration, SPF also provides greater durability to buildings. The number one cause of building deterioration is moisture within the building envelope. Building performance in hurricanes and other catastrophic events can be adversely affected by moisture damage.[19]

Structural Strength

SPF can add structural strength to buildings. Testing conducted by the National Association of Home Builders Research Center showed that SPF insulation between wood and steel stud wall panels increased rack and shear by a factor of 2 to 3 when sprayed onto gypsum board and vinyl siding and increased racking strength 50% when sprayed onto OSB. According to the NAHB Research Center, "During a design racking event (such as a hurricane), there would be less permanent deformation of wall elements and possibly less damage to a structure that was braced with SPF filled walls."[20]

Providing a continuous air barrier, preventing moisture infiltration through air leakage, minimizing condensation within the building, avoiding thermal bridging, resisting heat movement in all directions, and providing reliable performance under varying climatic conditions, SPF provides better climate and moisture control.[16] Better climate control saves energy and makes the building more comfortable. Better moisture control reduces building deterioration, increasing the life of the building. SPF's climate control

SPF conforms to unusual substrate configurations.

attribute enables a downsizing of the heating and cooling equipment of a building, further reducing energy use. Side-by-side energy efficiency comparisons have shown up to 40% energy savings by using SPF over the commonly specified insulation materials.[17] The use of high density SPF within the building can add significant structural strength, minimizing damage from building movement and racking events.

Ozone Depletion and Global Warming

There are still some groups that consider SPF harmful to the environment due to the blowing agents used in the higher density foams. The following information should dispel that concern.

Before 1992, most high density SPF used CFC 11 as the main blowing agent. From 1992 to the present, HCFC 141b has been the main blowing agent used in SPF. HCFC 141b will be phased out in the next couple of years. The most likely blowing agent candidates are blends of HFC 245fa, Pentane, or water.

"The HCFCs and HFCs are considered environmentally superior to CFCs because they are largely destroyed in the lowest region of the atmosphere. The HFCs do not contain chlorine and have no potential to deplete ozone. HCFCs, however, do contain chlorine, but only a small percentage of that chlorine can affect the ozone layer; this is because most of the HCFCs released at ground level are destroyed in the lower atmosphere before they reach the stratospheric ozone layer."[21]

The global warming potential of a material is calculated by its total environmental warming impact (TEWI). The TEWI of a material is the total effect of the combination of direct (chemical) emissions and indirect (energy-related) emissions on global warming. In the case of insulation systems, the direct effect equals the total greenhouse gases released into the atmosphere. The indirect effect is calculated by estimating the equivalent carbon dioxide emissions based on how long the system remains in place before replacement and the total amount of fuel consumed. Because of the world's dependence on fossil fuels for primary energy needs and the predominant contribution of carbon dioxide to future global warming, energy efficiency is crucial in minimizing contributions to these issues.[22]

SPF helped to seal repairs made to this existing roof.

From 1980 to 1990, carbon dioxide contributed 55% of greenhouse gases that affect future global warming. CFC blowing agents (which were used at that time in SPF insulation) contributed 17% of greenhouse gases during the same time period. Replacing CFC blowing agents in foam insulation with HCFCs reduced the global warming potential of SPF insulations by 92%. SPF's exceptional insulation quality reduces the amount of energy required for heating and cooling, thereby significantly reducing the amount of carbon dioxide released into the atmosphere.

The global warming potential of a gas is calculated from its energy absorbing properties over a specified length of time. The longer it takes for a gas to be purged from the atmosphere, the worse its global warming potential. It takes more than 500 years for carbon dioxide emissions to be purged from the atmosphere. Even after 500 years, 19% of carbon dioxide survives to affect global warming. Most HCFC 141b and HFC 245fa blowing agents have left the atmosphere within 10 years.[22]

While most roofs are replaced within 15 years, the wall insulation systems typically remain in place until the building is remodeled or demolished. The longer the insulation system remains in place, the more reduction to global warming. SPF roofing systems are not replaced as often, thereby increasing their effectiveness in reducing global warming. Utilized as an insulation system, SPF's ability to provide effective air barriers and control moisture increases its effectiveness in reducing global warming.

SPF and Energy Costs of Production

Franklin and Associates Ltd.'s study, "Comparative Energy Evaluation of Plastic Products and Their Alternatives for the Building and Construction and Transportation Industries," compares the total energy requirements for the manufacture of plastic products to the total energy requirements for the manufacture of the alternatives. The unique feature of this type of analysis is its focus on all the major steps in the manufacture of a product, raw material extraction from the earth, fabrication, and even transport, rather than a single manufacturing step.[23]

The study concludes that plastic products in the building and construction industry use less energy from all sources than the alternative materials. According to the Franklin and Associates' study, polyurethane foam insulation saved 3.4 trillion BTUs in manufacturing energy over fiberglass insulation in 1990. One trillion BTUs are equivalent to almost 170,000 barrels of oil and one billion cubic feet of natural gas.

As mentioned earlier, SPF helps reduce tear-off debris in roofing applications. SPF's on-site application process generates very little debris and waste. A typical 10,000 square foot roofing project produces less than 1/2 cubic yard of scrap SPF, tape, and plastic (used for masking) and from one pint to three gallons of waste solvent (depending on the type of protective covering used). Compare this to the typical 10,000-square-foot re-roofing project that produces more than 10 yards of construction debris from tear-off and application waste. At the present time, so little scrap SPF is produced that recycling of the material is not practical.[9] ■

Roof mounted HVAC units should be raised and curbed, but typically don't require additional counterflashing.

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SPF is custom made for roofs with lots of penetrations.

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About the Author

Mason Knowles

Mason Knowles is the Executive Director of the Spray Polyurethane Foam Alliance (SPFA) of the American Plastics Council (APC) and recently served as the Technical Director of the American Plastics Council on building and construction issues. He is a member of ASTM and chairman of D 08.06 Sub-Committee on Spray Polyurethane Foam Roofing Systems and ASTM Task Group Chairman for the revision of ASTM C-1029, Standard Specification for Spray Applied Cellular Polyurethane Insulation. Knowles has been in the polyurethane foam industry 33 years and has an extensive background in SPF roofing, cold storage, industrial, commercial, and residential insulation applications, and has written and/or co-authored dozens of technical papers and articles on plastics and SPF.

ENERGY CONSUMPTION OF BUILDINGS

All of the buildings in the U.S. consume more than twice as much energy as all of the cars in the country (when you consider, in BTUs, the total embodied energy it takes to construct and operate them). They emit twice the amount of carbon dioxide as cars - which make them the leading human-induced cause of global warming. Buildings also consume 80% of the nation's drinking water and 2 million acres of forests and farmland each year.

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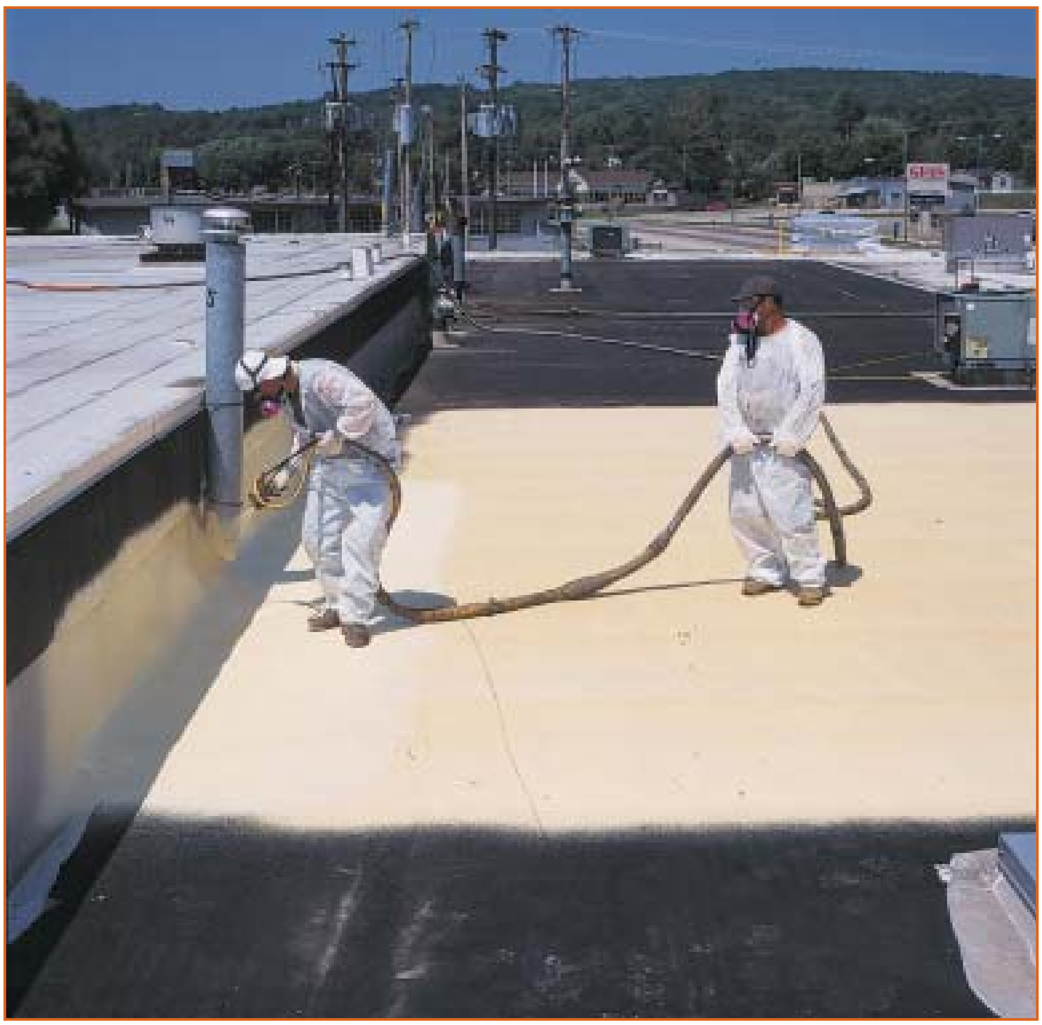
SPF Proves Its Worth

A Look at the Real-world Performance of Spray Polyurethane Foam Roofing Systems

By Tom Harris



SPF manufacturers, equipment manufacturers and trade groups have made a commitment to quality control through training and education in the SPF industry, including hands-on and theoretical training programs.

Spray Polyurethane Foam (SPF) roofing systems have been around since the 1960s. Yet as recently as the late 1980s, the technology was considered "alternative" and far outside the mainstream of roofing.

Today, the "alternative" label has been shed, and the National Roofing Contractors Association (NRCA) has accepted SPF as a viable system and includes it in its standards and manuals. However, the perception remains that SPF systems are problematic. One member of the Roofing Consultants Institute recently estimated that 50 percent of his peers "would go out of their way to avoid SPF." That attitude is reflected in SPF's market share: 1.3% in the new construction market and 2.8% for the retrofit roofing market.[1]

However, the real world performance of SPF roofing systems refutes the perceptions and market share numbers. Perhaps it is time for us to take another look at SPF.

Basic Performance

In the mid 1990s, the National Roofing Foundation commissioned Structural Research Inc. of Middleton, Wisconsin, to perform an independent field and laboratory assessment of SPF roof systems to establish and verify existing performance attributes.

The study included the inspection of 140 SPF roofs with acrylic, silicone, and urethane coatings, ranging in age from 6 months to 27 years (median age 10.5 years, average age 11 years). Four climates were included in the study: hot, humid summers with moderate winters (Texas); hot, dry summers with wet, cool winters (California); moderate to hot summers with very cold winter temperatures and heavy snow and ice (Illinois and Wisconsin); and moderate to hot summers, cold and damp winters (New York). Key findings include:[2]

- **Compressive Strength (determined using ASTM D 1621) –** the average compressive strength for all samples was 404 kPa (58.6 psi); highest compressive strength was 685 kPa (99.3 psi) from a New York location installed in 1975 with silicone coating. Minimum required compressive strength for SPF roofs is 276 kPa (40 psi).[3]
- **Apparent Core Density (determined using ASTM D 1622) –** the average apparent core density was 51.6 kg/m^3 (3.22 pcf) for all samples; highest apparent core density was 78.0 kg/m^3 (4.87 pcf) from a location in northwestern Wisconsin installed in 1974; the lowest apparent core density was 30.1 kg/m^3 (1.88 pcf). Dr. René M. Dupuis of Structural Research Inc. noted in his report that recommended minimum foam densities had risen over the years, to a minimum of 44.9 kg/m^3 (2.8 pcf) in the 1990s. The newest SPF roof in the study had a core density of 64.1 kg/m^3 (4.0 pcf) with a compressive strength of 448 kPa (65 psi). The oldest had a density of 56.4 kg/m^3 (3.52 pcf), with a compressive strength of 685 kPa (99.3 psi).
- **Moisture Content Values (determined by oven-drying samples at 50˚C [122(F]) –** average moisture content was 1.02 percent by weight. Dr. Dupuis noted that the physical properties of the evaluated roofs were positive regardless of the age of the installation and that these properties point to the durability of SPF.

The Human Factor

No roofing system – regardless of the technology involved – will provide long-term performance unless it is installed properly. The construction industry is one of the riskiest endeavors in the United States in terms of business failures. From 1990-1997, over 80,000 contractors failed, leaving behind $21.8 billion in liabilities.[4]

A possible reason for this high failure rate among contractors is found in a survey conducted by *Engineering News Record (ENR)*: 42% of the projects surveyed finished late, 33% were over budget, 13% had pending claims, and only 53% of the owners would ever use the same contractor again.[5]

Low-bid awarding of contracts, poor workmanship, poor-quality or insufficient training, and minimal attention to customer service can all take partial blame for this abysmal showing by the contractor community in this study.

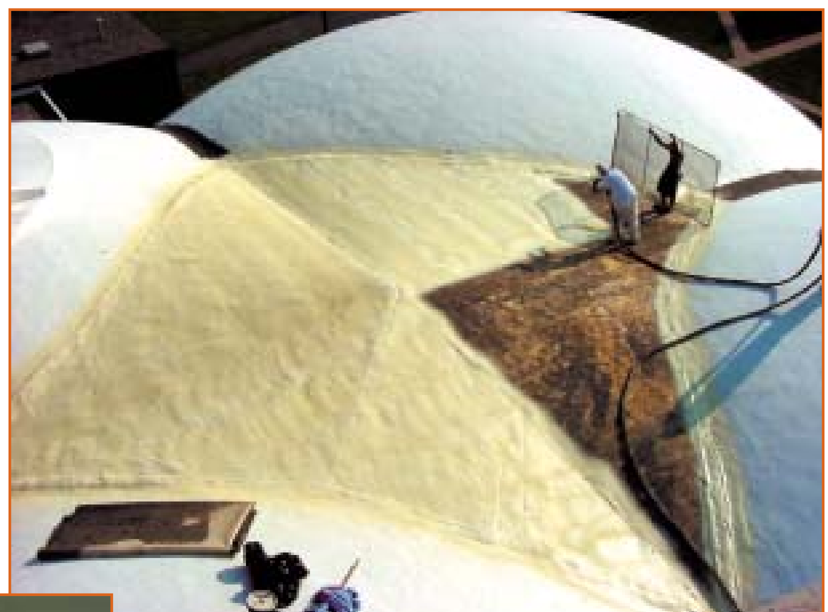
SPF manufacturers, equipment manufacturers, NRCA, RCI, the Society for Protective Coatings, and the Spray Polyurethane Foam Alliance (SPFA, www.sprayfoam.org) have all made a commitment to quality control through training and education in the SPF industry. The SPFA Accreditation Program provides the industry with up-to-date training in the application of spray polyurethane foams, coatings, and good business practices.

State-of-the-art training facilities (such as the SPF Center in Hudson Falls, New York) offer hands-on and theoretical training programs from the history of SPF roofing to final inspection of a new roof, including chemicals, safety, equipment, construction details, application techniques, and maintenance.

The joint training efforts of trade groups, associations, and manufacturers have contributed to a reduction of over 60% in the typical failure modes of early SPF roofs.

Another contributing factor to quality control is third-party inspection of installed roofs. Independent inspectors measure new installations against minimum standards: surface texture, foam thickness and consistency, coating thickness and consistency, and evidence of ponding (< 10 x 10 feet of ponded water, 48 hours+ after rainfall). Deviations are subtracted from the score.

One major SPF manufacturer currently shows 3,076 roofs with an inspection score of 10 out of 10 in its warranty database. Analysis of the same manufacturer's warranty database indicates current failure modes such as blistering have dropped by over 60%



Above: One leading SPF manufacturer reports that its system has been installed directly on top of existing substrate in 95 out of 100 reroofing projects, eliminating costly tear-off, landfill fees, interior exposure, and down time.

Left: SPF roofs are seamless and self-flashing for improved resistance to lifting and peeling failure during high wind events. The SPFA reports that SPF's wind uplift resistance exceeded the capacity of UL's equipment during testing.

New application technologies, such as the RoboRoofer (left and below), have contributed to a reduction of familiar failure modes such as blistering and cracking at edge details.

and cracking at edge details has been reduced by over 80% in recent years.

The ALPHA System

The Performance Based Studies Research Group (PBSRG, www.pbsrg.com) was developed by Dr. Dean Kashiwagi at Arizona State University's Del E. Webb School of Construction in 1994. The PBSRG, a non-profit research group, developed the ALPHA Research Project to analyze performance information and identify high performance roofing systems, specialty contractors, and facility systems in the construction industry.

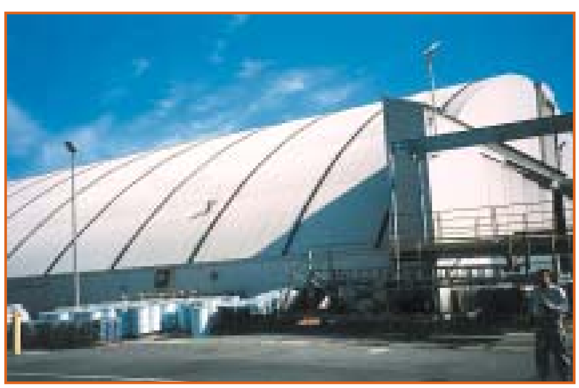
For the purposes of the ALPHA project, an "ALPHA Roof System" is defined as any low-slope roofing system with a documented performance that meets or exceeds that of a conventional, 20-year life-expectancy, low-slope, built-up roof (BUR) assembly.

The program is open to all roofing systems. Any manufacturer, product, or group of contractors that can demonstrate – when randomly sampled by PBSRG every other year – that 98% of its customers are satisfied with their roofs, 98% of their roofs don't leak, and are willing to have all newly installed roofs over 5,000ft^2 surveyed yearly, qualifies for inclusion in the program.

Since its inception in 1996, only one system has qualified for ALPHA: Spray Polyurethane Foam.

There are ten ALPHA contractors across the United States. To date:

- 484 roofs have been inspected.
- 341 customer responses have been received.
- The oldest installation is 30 years old.
- The average installation is 10 years old.



In the mid 1990s, a National Roofing Foundation-commissioned independent field and laboratory assessment of SPF roof systems showed that the physical properties of the evaluated roofs were positive, regardless of age, and that these properties point to the durability of SPF.

- 99% of the jobs are completed on time.
- 99% of the roofs do not leak.
- 99% of the customers are satisfied.
- The average contractor performance rating is 9.7 out of 10.

The ALPHA system offers a 15-year warranty with almost no exclusions.

Storm Warning

Inclement weather is the toughest test for any roof system. Underwriters Laboratories (UL) and FM Global test various roofing systems for wind uplift performance and then publish the results in their directories. Designers can then look for systems that meet the UL designations class 30, class 60, and class 90 or FM1-60, FM1-90, or higher where needed.

The SPFA reports that, during laboratory testing of SPF systems, SPF's wind uplift resistance exceeded the capacity of UL's equipment. UL also observed that SPF roofs applied over BUR and metal increased the wind uplift resistance of those roof coverings. FM Global testing showed similar results over concrete, metal, and wood.

In addition to high wind uplift resistance, SPF roof systems are resistant to progressive peeling failure due to missile impact, deck failure, or a

SPF is the only system that has qualified for ALPHA –-the Performance Based Studies Research Group at Arizona State University's research project to analyze performance information and identify high performance roofing systems and contractors.

lifting and peeling failure at the roof edge, along with the ability to resist water infiltration after being impacted by missiles.[6]

Hail resistance field testing and documentation have shown proven service periods of over 20 years and proven hail resistance for the entire 20-year service period. Testing results show the ALPHA system exceeds the warranted FM-SH performance, accommodating 2.75-inch hailstones without breaking the coating.[7]

More than Marketing Hype

In addition to long service life and high performance indicators – including 99% leak-free and a commitment to customer service and contractor certification – SPF roofing offers other factors often regarded as mere marketing buzz, but in actuality, they are documented benefits.

- **Energy Efficiency –** The main campus of Texas A&M University boasts over 7 million square feet of SPF roofing. In 1985, Gerald Scott, PE, monitored energy savings on 27 different buildings on the campus that had received an SPF roof from 1980 to 1984. The results showed the university was able to cover the complete cost of the roof application through energy savings in an average of 4.5 years.[8]
- **Low Cost Reroofing –** One leading SPF manufacturer reports that its system has been installed directly on top of an existing substrate in 95 out of 100 reroofing projects, eliminating costly tear-off, landfill fees, interior exposure, and down time.
- **Lowest Lifecycle Cost –** When factors such as life cycle performance, maintenance cost, ecological footprint, energy and raw material consumption, health effect potential, risk potential, emissions, and evaluation of land use and transportation fuel usage are taken into consideration, SPF is shown to be one of the lowest lifecycle cost systems available today.[9]
- **Environmentally Responsible –** Prior to 1992, most high-density SPF used CFC 11 as the main blowing agent. For the past 10 years, HCFC 141b has been used, for a 92% reduc-

tion in SPF's global warming potential. The current move to zero-ozone depleting blowing agents such as HFC-245fa and VOC-free coatings also increases SPF's environmental responsibility.

CONCLUSION

Independent, third-party field and laboratory studies show that SPF is a viable roofing system deserving of consideration from roof consultants. The numbers prove the SPF industry's commitment to providing a high-quality system installed by highly trained and skilled professional applicators. ■

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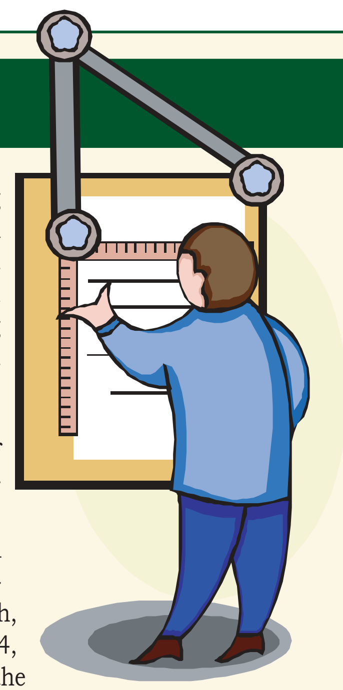
About the Author

TOM HARRIS

Tom Harris is currently the product manager for BASF's Spray Foam Group in the United States. Over his 20-year career in the polyurethane systems business, he's chaired eight technical committees within the SPI, Canadian General Standards Board, National Research Council of Canada, and the Canadian Urethane Foam Contractors Association. Tom is currently contributing to two ASTM committees, one NRCA committee, and the SPFA's Building Envelope Committee. He also represents BASF as a founding member of the Air Barrier Association of America. Tom is originally from Canada and is a chemical engineering graduate of Ryerson Polytechnical University.

CMRC to Survey Architects



In keeping with the Cool Metal Roofing Coalition's (CMRC's) mission to educate stakeholders about the sustainable energy-related benefits of metal roofing, the coalition is supporting a program to gather information from architects about their knowledge base on cool metal roofing. A cross-section of architectural firms will be surveyed for their understanding of cool metal roofing to determine what information they are lacking. The goal of the coalition is to develop an informative presentation tailored to architects for coalition member companies to use when meeting with architects.

At the federal government level, the coalition continues working on several initiatives targeting different audiences. As part of the effort to create a Unified Federal Guide Specification, all government agencies are working to integrate their specifications and guidelines. The General Services Administration is overseeing this effort, and in the case of building construction, the National Institute of Building Sciences is taking on the responsibility of creating a Whole Building Design Guide (WBDG). The CMRC has been invited to develop a resource page on cool metal roofing that will be part of the WBDG. Similarly, the EPA is writing comprehensive procurement guidelines to be used in federal construction projects. Products featured in these guidelines are those that divert materials from the waste stream. The coalition is working toward including cool metal roofing in these EPA guidelines as a material that should be given preferential consideration when choosing materials for government building projects.

Coalition members have presented papers on behalf of the CMRC at the New Roofs for a New Century Conference in New York City, METALCON in Tampa, Greenbuild Conference and Expo in Pittsburgh, and NRCA in Mexico. In 2004, presentations are planned for the ASHRAE Annual Meeting in California, the CIB World Congress in Toronto, the ICBEST Conference in Sydney, Australia, and RCI events throughout the country.

— SCOTT KRINER
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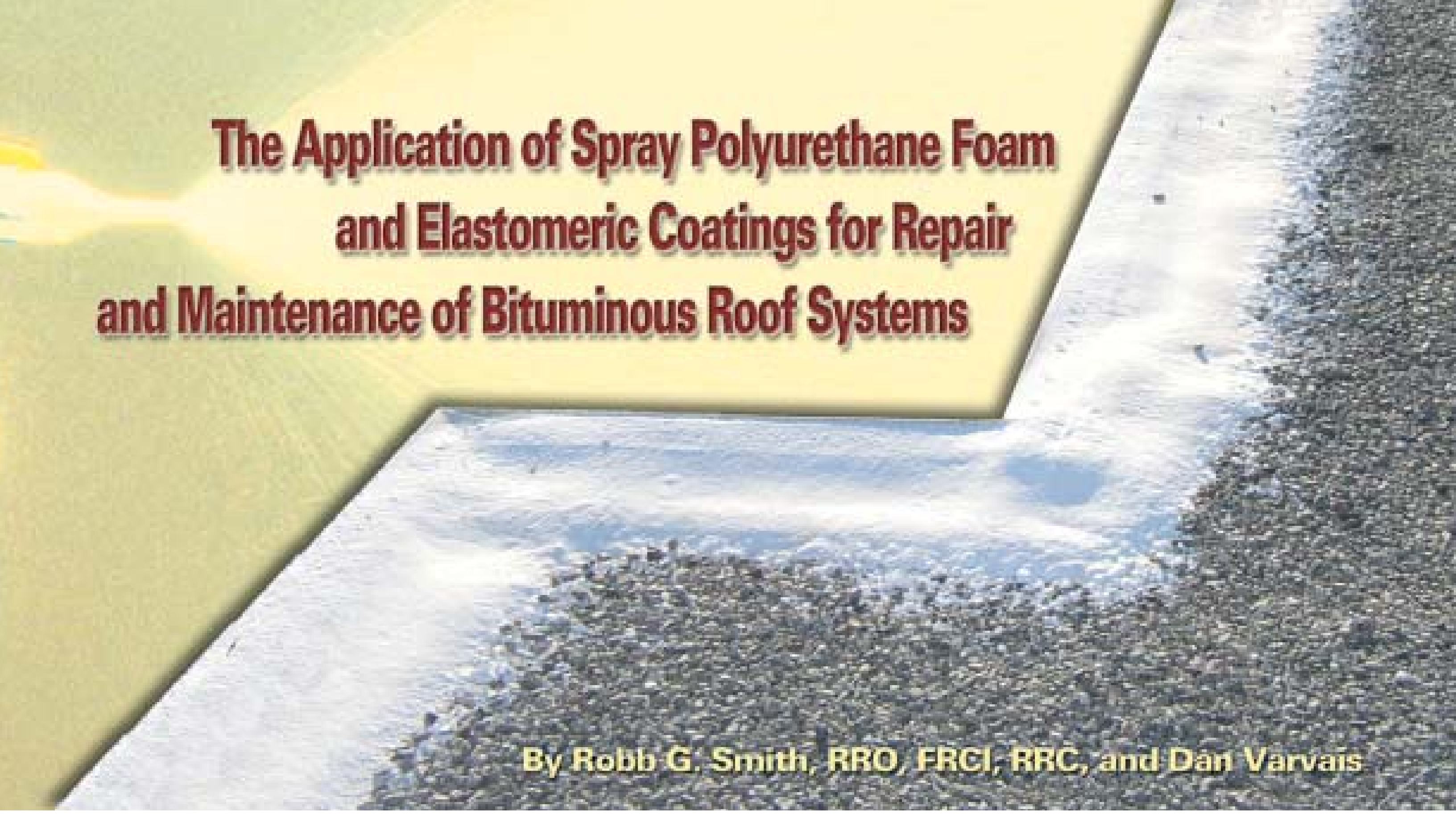

The Application of Spray Polyurethane Foam and Elastomeric Coatings for Repair and Maintenance of Bituminous Roof Systems

By Robb G. Smith, RRO, FRCI, RRC, and Dan Varvais

INTRODUCTION

Bituminous products (asphalt and coal tar pitch) have been widely used for low slope roofing for over a century. Throughout the history of bituminous roofing, irregular or continuous pipe and conduit penetrations have been sealed (flashed) with "pitch pockets," so-named because the sheet metal formed around the penetration became a "pocket" to hold coal tar "pitch." The pocket, or pan as it is now called, is generally 4" high and large enough to provide approximately 2" clearance from the penetration. The base of the pan is typically specified to have a full 4" flange (including inside corners filled with sheet metal) and joints/seams soldered on the typical 24 ga. galvanized steel pan.

SPF gun and foam from a portable foam kit.

While both coal tar and asphalt are viscoelastic materials, only Type I asphalt will exhibit cold flow similar to coal tar. Today, when there is only a limited use of coal tar pitch and Type I asphalt as the interply bitumen, the same Type III or IV oxidized asphalt used for the interply adhesive is poured into the pocket or pan. In lieu of hot asphalt, the pan is filled with a combination of cementitious grout and topped off with either asphalt mastic or polyurethane sealant. All of these materials age through the process of oxidation and/or evaporation, resulting in gaps between the metal surfaces and the filler, thereby requiring periodic maintenance to keep them watertight. Conventional pitch pans have their advantages and disadvantages, with the most common correlation to each being: advantage – low cost; disadvantage – regular maintenance required.

Another high maintenance flashing condition is found on parapets, particularly those over 24" high. These taller parapets present challenges for roofing mechanics to maintain asphalt at its proper equiviscous temperature (EVT) when attempting to adhere mineral-surfaced cap sheets or even ply felt. When asphalt is applied below the EVT, the felt and cap sheet will not properly laminate with the asphalt, resulting in large blisters forming in the wall flashing system. As a result, a variety of conditions can develop that are detrimental to the performance of the wall flashing. These include sagging, open lap seams, and fracturing. Because solar heat gain is accentuated on the west and south faces, these conditions are more severe at those locations.

At raised or canted metal edges and equipment curbs, the conditions are similar, though not as critical when water is not directed to drain across them. Similar to parapets, relative to the orientation with the sun, these areas of flashing will deteriorate

Application of SPF from trailer-mounted spray rig.

more rapidly.

Why do we focus on curbs, penetrations, and perimeter flashing? Because we know that 80% to 90% of all roof leaks originate at roof terminations. Additionally, many roofing manufacturers' warranties exclude leaks from material and workmanship defects located at these points.

Improvement of these conditions can be achieved with application, quality control, and regular maintenance; however, this is more easily said than done. While more and more decision makers understand the benefits of a proactive approach to roofing, the vast majority live in a firefighter's mentality of responding to the greatest emergency first and then moving onto the next. Issues such as full-time application observation and annual maintenance are frequently cut by necessity under tight budget constraints.

Observations by the authors during the application of hundreds of SPF roofs over the last 15 years have furthered our understanding and support for the use of SPF for remediation and maintenance of BUR and modified bitumen roof assemblies and provide the basis for this article. This article will discuss alternative solutions to key flashing conditions, taking into consideration that the ultimate goal is to provide a roof system that requires the least amount of maintenance at a reasonable cost.

AGING OF BITUMINOUS MATERIALS

The advantages of using either asphalt or coal tar as an interply adhesive are not similarly found when used in flashing assemblies. In the long run, the negative performance traits of oxidation and evaporation during aging outweigh the low cost benefit. As described by Ken Brzozowski[1] in an earlier *Interface* article, "The primary weathering mechanism of asphalt on the roof is the same oxidation that takes place in the blowing step. There is, however, also some loss of lighter, more volatile asphalt components due to the high rooftop temperatures membranes experience. Both these mechanisms lead to a hardening of the asphalt." As asphalt oxidizes and

New conduit penetrations.

loses volatiles, it shrinks in mass, leaving gaps between metal components it is supposed to be sealing. Coal tar evaporates during the aging process, but the net result is the same – loss in volume results in gaps between the metal and the bitumen.

LONG-TERM FLASHING SOLUTION

As discussed above, leaks in built-up and modified bitumen roof systems don't typically occur in the field of the roof, but rather at pipe, conduit, and equipment curb penetrations and around the perimeter. Given the inherent aging mechanisms of bituminous materials, it is logical to seal these points with an alternate material that isn't prone to shrinking *en masse* and remains adhered to applied surfaces. SPF, with good quality roof coatings, will typically provide seven to ten years of service with potentially no maintenance.

WARRANTY CONCERNS

Traditionally, roofing manufacturers have required that all repairs to their roof system be completed by one of their approved or licensed applicators, using their materials. It is worth noting that many manufacturers specifically deny warranty claims that are associated with metal flashing they did not supply. This typically applies to all edge metal, counterflashing, lead jacks, and pitch pans. Therefore, if a better solution is available, it should be seriously considered.

Anytime consideration is given to repairing or in some way altering an existing roof, it is prudent to have the owner research its records for the existence of the manufacturer's warranty to determine the limitations or restrictions included therein. This process might be informative on several fronts, and it is suggested that before undertaking any maintenance work, one should have a

Raised edge flashing repair, before (left) and after (right).

release signed by the owner that indicates acknowledgment and acceptance of the proposed work and how it will alter the existing roof system. Legal counsel should be consulted to address specific language and concerns.

SPRAYED POLYURETHANE FOAM

Without getting into detailed chemistry, SPF is the result of mixing two components, known as the "A" and "B" sides, typically in equal proportion. The resulting chemical reaction creates heat that expands the liquid approximately eight times in volume and then cools into a solid, cellular plastic mass. The resultant foam is 90% closed cell, which is the basis of its waterproofing characteristic. Even without coating, SPF will maintain a watertight seal. This fact has been proven over decades with uncoated foam, surfaced only with loose river rock similar to single-ply ballast. Absent the surface cover of stone or coating, SPF will degrade under UV light. Typically, 25 dry mils of a good quality elastomeric roof coating is sufficient to protect SPF from UV light.

New conduit penetrations.

SPF has been successfully used as a roofing system for over three decades. A majority of SPF roof applications consist of spraying foam over existing roof assemblies. SPF provides a number of advantages when reroofing over old roofs. These include: excellent adhesion to prepared surfaces, ease of adding slope to drain on flat roofs, enhancing the dimension of crickets, increasing roof insulation, covering of asbestos roofing materials, and sealing of penetrations and curbs. Importantly, in a study of 188 SPF roofs recently concluded by the National Roofing Foundation and SPFA, Dr. René Dupuis[2] stated that, "The use of metal counterflashing was not seen to be required as part of an SPF roof system." Therefore, consideration of SPF repairs to penetrations and wall

Old pitch pan with dried asphalt mastic.

SPF and acrylic coating with ceramic granules, used to seal the pitch pan in the photo at the top.

flashing on bituminous roofs, particularly where counterflashing is missing or in questionable condition, becomes more compelling and should be used more in the future.

SPF APPLICATION

Most SPF roofing is applied by contractors who have a 30 kW generator, a material and hose metering unit with heater, and high pressure 45:1 hydraulic pumps, all contained within a large, truck-mounted van or fifth wheel trailer. These types of rigs are necessary to supply large volumes of material when completing entire roof restoration projects or when applying entire new SPF roofs. Alternative systems are available for smaller maintenance projects.

The efficient and economical maintenance alternative to the above is found in 39-lb. cartons containing the "A" and "B" materials with disposable spray guns and nozzles. These are ideal for the application of SPF for small roof maintenance projects, repairing burned-out curb and wall flashing, and sealing pitch pans and new penetrations.

For about $400, one kit of material contains approximately 175 board feet of 2.75-pcf-density SPF. This volume will supply enough SPF to seal approximately 100 to 120 typical 6" x 6" pitch pans or 150 to 175 three-inch plumbing vent pipes. SPF in these small kits is also available in lower densities, but lower density foam is used for the packaging industry and wall joint insulation. Importantly, densities below 2.7 pcf are not recommended on roofs. Densities above 3.0 result in a much lower yield of total board feet. While there may be others, the authors' research found that Dow Chemical (http://www.dow.com/pusystems/product/fpport.htm) is the primary manufacturer of a 2.75 pcf density foam that sells to companies with national and regional distribution. Dow purchased Flexible Products Co. and its brands, Insta-Stik (insulation adhesive) and Froth-Pak. Froth-Pak 180 (2.75# density) is the product commonly used for the roofing applications described in this article.

As with any roof maintenance activity, if the desired goal is long term durability, then surface preparation is crucial. Rule number one: SPF is not designed to solve active, wet condition leaks. On built-up and modified bitumen roofs, those conditions are still best suited for the application of coal tar mastic and fiberglass mesh. Moisture and SPF in a liquid state during application are not compatible, and blistering of the SPF will result. However, when the roof is dry, most surfaces require only sweeping to remove any dirt, debris, or old coatings that are not well adhered. Gravel should be spudded to provide a smooth surface for the SPF to adhere fully. Some surfaces, such as smooth APP and galvanized sheet metal, may require the application of a primer. The foam manufacturer will offer guidance if contacted.

The skill necessary to apply SPF is more refined than what is needed to apply spray paint, and if the applicator hasn't sprayed foam before, it is recommended that he or she practice on a sheet of plastic. With a cardboard box placed in the center of the plastic, one can gain experience in spraying vertical surfaces as well. This training exercise might consume half of the kit to develop sufficient skill. The goal is to apply the SPF with a fairly smooth surface, as the rougher surface is not conducive to receiving a continuous film of coating. Should some rough surfaces develop, these can be cut down with a long fillet knife or ground off with a powered sanding disk. These tools and practices are commonly used by SPF contractors, and this work can be accomplished quickly and only minutes after the foam is applied.

However, it is a very large leap from sealing pitch pans, other roof penetrations, and base flashing with a small box of foam to making more extensive repairs. It is worth the time and investment to hire a qualified SPF contractor when repairs include a 200' x 6' parapet wall flashing, large mechanical units, 100' of ductwork, and/or building crickets on a flat roof to assist in drainage. Contact the Spray Polyurethane Foam Alliance (SPFA) (www.sprayfoam.org) or call 800-523-6154 for a list of contractors for a particular area.

After the foam is applied and smoothed as necessary, the SPF surface and six inches of the surrounding roof surface should be sealed with a roof coating. The most common coatings for this purpose are formulated from acrylic polymers, though polyurethane and silicone coatings are also widely used. Acrylic exterior house paint will not provide the necessary performance characteristics to survive in this application long term as compared to a quality roof coating. Application by airless spray gun is efficient for a large quantity of repairs; however, painting the coating on by brush or roller is also acceptable for smaller projects and is frequently more efficient. Two coats are recommended to achieve the minimum 25-mil thickness.

Many situations justify the application of a coating system over the entire roof to reduce surface temperatures, decrease the degradation of the membrane, and reduce cooling loads. A quality oriented manufacturer will routinely offer a warranty for such restoration.

CONCLUSIONS

Bituminous-based products have inherent aging properties that require periodic maintenance. SPF is available in portable 39-lb. kits affording the use of SPF for small projects without the need and expense of a large crew and extensive equipment. By fully covering pitch pans or sealing around pipe penetrations with sprayed polyurethane foam and coating, the future maintenance requirement is greatly reduced. The application of foam and coating for sealing of penetration and curb flashing is economical and efficient and will provide durable, watertight flashing for many years of service. ■

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1. Brzozowski, Ken, "Asphalt vs. Coal Tar," *Interface*, October 1995.
2. Dupuis, René M., "Are Counterflashings Needed?" *Professional Roofing,* February 2004.

Editor's Note: This article was presented as part of the Proceedings of the RCI 19th International Convention and Trade Show *on Monday, April 5, 2004, in Reno, Nevada.*

About the Authors

Robb G. Smith, RRO, FRCI, RRC

Robb G. Smith, RRO, FRCI, RRC, is a senior consultant with Amtech Roofing Consultants, Inc., in Seattle, WA. Smith, a past president of RCI, has been working in the roofing industry for over 25 years, 16 years of which he has been an independent roof consultant providing services to institutional and commercial clients. He has served on the Accreditation Committee of the Spray Polyurethane Foam Alliance for over seven years.

For over a decade, **Dan Varvais** has been helping building owners, facility managers, architects, consultants, and other roofing specifiers evaluate roofs for maintenance and repair options. Dan serves on the SPFA Accreditation Committee and has been a keynote speaker for the California Energy Commission and California Public Utility Commission's educational outreach program throughout the state on cool roof technologies.

Dan Varvais

THE USE OF SPRAY POLYURETHANE FOAM IN MASONRY CAVITY WALL CONSTRUCTION

BY ROGER V. MORRISON, PE, RRC

Introduction

Spray polyurethane foam (SPF) insulation is commonly used as a construction material because it performs several functions simultaneously. In the case of masonry cavity wall construction, SPF provides insulation, dampproofing, and air infiltration control. Because one material accomplishes all of these tasks, the cost of SPF is competitive with conventional insulation and dampproofing systems.

Masonry cavity walls consist of two wythes of masonry with an air space between them. (A "wythe" is defined as a vertical wall of masonry units one-unit thick.) Most commonly, the inner wythe is constructed of concrete masonry units (CMU), while the outer wythe is constructed of decorative clay brick. The two wythes are usually tied together with galvanized steel anchors spaced approximately two feet on center. The air space – typically 2 to 4 inches in width – allows for the installation of insulation and dampproofing. The outer wythe acts as a rain shield; the inner (insulated) wythe provides thermal mass. The CMU inner wythe may or may not be load bearing.

With conventional construction techniques, liquid-applied dampproofing is installed on the outside CMU surface. Prior to installing the face brick, board stock insulation – usually expanded or extruded polystyrene – is friction fitted onto the CMU wall surface and held in place by the metal anchors.

An alternative technique of dampproofing and insulating the inner CMU wythe is to use SPF. There are open-cell and closed-cell SPF systems available on the market today. For use in masonry cavity walls, only closed-cell SPF exhibiting physical properties listed below should be specified:

Dampproofing

SPF has been used for decades as a roofing membrane. Its use as a dampproofing material is less known.

SPF is closed-cell and does not readily absorb liquid water. To verify its resistance to moisture penetration, 1/2-inch thick samples (triplicate) were tested using a Suter Hydrostatic Pressure Tester in accordance with AATCC[1] Test Method 127 *Water Resistance: Hydrostatic Pressure Test.* In this particular test, a hydrostatic head of 55 cm (22 in) was maintained for five hours, after which the head pressure was raised at a constant rate of 1 cm/sec (0.4 in/sec) until failure or maximum hydrostatic head pressure was reached (failure is indicated by the appearance of three water droplets on the bottom surface of the specimen). All three samples tested reached the maximum hydrostatic pressure of 184.9 cm (72.8 in) without failure.

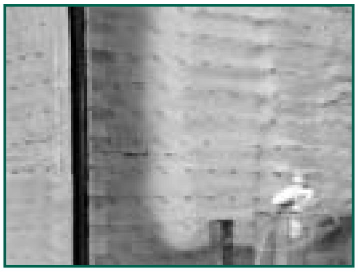

Figure 1: SPF application to CMU wythe.

Figure 2: Conventional dampproofing and insulation.

PROPERTY	TEST METHOD	VALUE	UNITS
Density	ASTM D 1622	2.0 min	lb/ft^3
Compressive Strength	ASTM D 1621	20 min	lb/in^2
Closed Cell Content	ASTM D 2856	90 % min	
R-Value per inch	ASTM C 518, C 236 or C 177	6.5 min	$°F \cdot ft^2 \cdot hr/BTU$
Hydrostatic Pressure Resistance	AATCC 127	No Failure @ 184.9 cm	
Flame Spread	ASTM E 84	75 max	
Smoke Developed	ASTM E 84	450 max	

Table 1

Although the sample thickness was only 1/2 inch, SPF in a masonry cavity wall application would be applied in thicknesses of one inch or more.

Assembly	Air Leakage at 1.57 psf (cfm/ft^2)	Air Leakage at 6.24 psf (cfm/ft^2)
CMU + 1" SPF	0.00	0.00
Gypsum Board + 1" SPF	0.00	0.01

Table 2

Insulation

As an insulation material, SPF offers several advantages in masonry cavity wall applications:

- Low labor requirements for installation
- Seamless
- Conforms to unusual shapes and configurations
- High R-value (6.5 - 7.0 per inch)
- Fills construction gaps

Generally, the thickness of the SPF application will be determined by the specified R-value. Since the R-value per unit thickness of SPF is greater than most board insulations, the insulation thickness can be reduced.

Figure 3: SPF readily fills construction voids.

For example, to achieve an R-10, a 1.5-inch thickness of SPF will provide sufficient R-value to replace 2-inch thick polystyrene board.

Because SPF is spray applied and expands in place, the insulation forms an intimate fit to masonry anchors and wall protrusions. Gaps and seams are eliminated, thereby increasing the effectiveness of the insulation. Additionally, construction voids, commonly left at structural steel to masonry joints at building corners, can be completely filled with spray foam.

Air Barrier

In addition to providing dampproofing and insulation, SPF offers additional benefits as an air barrier. SPF wall assemblies were tested in accordance with ASTM E 283 ("Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen"). The first assembly consisted of CMU blocks with 0.375-in. mortar joints and a one-inch thickness of SPF. The second assembly consisted of exterior drywall sprayed with a one-inch thickness of SPF. ASTM E 283 allows an infiltration rate of 0.06 cfm/ft^2 at a pressure differential of 1.57 psf. (During the test procedure, no leakage was detected at 1.57 psf, so the pressure was increased to 6.24 psf.) Test results of the two assemblies are shown in *Table 2*.

Figure 4: SPF application at the roof-wall juncture. The spray pattern can be seen at the lower right corner of this photo.

Details

Certain construction joints and transition areas are impossible to insulate, air seal, and dampproof with any material other than SPF. Fascias, entryway overheads, eave overhangs, and other features can be designed independently of the building envelope.

Hogan (1996) emphasized the need for air sealing the roof-to-wall juncture. SPF conforms to difficult shapes such as fluted metal roof decking and is an ideal material to accomplish this seal. If the roof trusses extend through the CMU wall, these penetrations can be sealed as well. This creates a continuous and seamless barrier from the roofline to the wall surface along the entire outside perimeter. Thermal, moisture, and air leakage at these tricky architectural features can be totally eliminated.

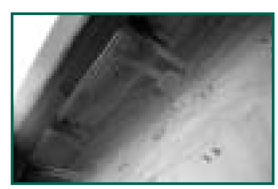

Figure 5: Note the tight seal developed around the roof trusses and the roof-wall juncture.

SPF nicely bridges structural steel column to masonry joints. However, building movement and settlement may crack the SPF at these joints. To avoid potential problems, a self-adhering membrane or tape may be applied across the joint prior to applying SPF.

Alternatively, redundancy could be provided using conventional joint materials (e.g., backer rod and sealant).

At through-wall flashings, SPF is applied down the CMU wall and tied onto the upper lip of the flashing. The SPF application is continued below the through-wall flashing and down onto the footer as appropriate *(see Figure 6)*. SPF forms a tight seal to the flashing system (above and below); weep vents in the outer wythe permit the escape of water that may have penetrated the brick facing.

Thermal Barriers and Code Requirements

Building codes require that foam plastic insulations (including SPF) be separated from building interiors by a thermal barrier. The intent of a thermal barrier is to slow the temperature rise of the foam plastic insulation in the event of a fire. The most commonly used thermal barrier material in use is 1/2-inch gypsum wallboard.

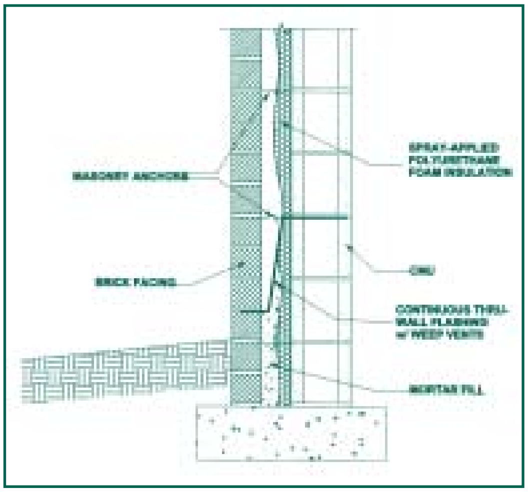

Figure 6: Detail of through-wall flashing and footer.

An exception to the thermal barrier requirement is "in a masonry or concrete wall, floor, or roof system where the foam plastic insulation is covered on each face by a minimum of 1 inch (25 mm) thickness of masonry or concrete" (Code 2003). Therefore, in general, masonry cavity walls do not require thermal barriers. At certain wall joints and construction details, however, masonry may not form a continuous layer between the SPF and the interior (for example, the roof-to-wall juncture). These details may require the addition of a thermal barrier.

Roofing grade SPF should not be used in masonry cavity wall construction because the smoke-developed indices are too high. The 2003 International Building Code requires foam plastic insulation to have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 when tested in accordance with ASTM E 84. However, an exception within the code does not limit the smoke-developed index of roofing-applied foam plastic insulations. Most SPF formulated for roofing applications has smoke-developed indices that exceed 450.

UV Stability

Ultraviolet light will gradually degrade SPF. Once the exterior brick wythe is installed, the SPF is no longer exposed to sunlight, but during construction, SPF may be exposed for days or months. Within hours of its application, SPF will begin to darken. SPF sprayed a few days later will be markedly different in color. In four to six months, the foam skin will begin to deteriorate and a "dusty" surface will develop. (This, of course, depends on the degree of exposure to sunlight.)

If left exposed indefinitely, the dusting SPF surface will wash off, and eventually the thickness of the SPF will begin to diminish. Field studies suggest that the SPF may be left exposed for up to six months without deleterious effects. If the construction schedule suggests that the SPF will be left exposed for longer than six months, the foam may be thinly coated with an acrylic coating or the specified foam thickness can be increased by 1/4 inch.

Figure 7: Effects of UV exposure. Lighter SPF was applied several days after the darker SPF.

Economics

Although SPF insulation is more expensive than insulation boards at equal R-value, economics favor SPF in masonry cavity wall construction. Conventional liquid-applied dampproofing, insulation boards, and air barrier membranes require two or three separate application steps. Because SPF accomplishes all three functions with one material, only one application step is needed. The result is less labor, and often, less material cost.

Summary

SPF's unique characteristics as a closed-cell, spray-applied, fully-adhered foam plastic insulation make it particularly suited to masonry cavity wall construction. It combines the features of high R-value, efficient insulation while providing air sealing and dampproofing. The result is an economical, high performance building envelope assembly. ■

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Code 2003. *2003 International Building Code.* Section 2603.4.1.1.

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1. American Association of Textile Chemists and Colorists.

About the Author

Roger V. Morrison, PE, RRC, is the product manager for roofing and insulation at North Carolina Foam Industries (NCFI), Mount Airy, NC. He has been with NCFI for 15 years. Prior to that, he was a roofing consultant in New Jersey. Roger currently chairs the technical committee of the Spray Polyurethane Foam Alliance. He may be contacted at Roger.Morrison@ncfi.net.

Roger V. Morrison, PE, RRC

construction and the Economy

BLS Projects Slower Construction Employment, Output Growth in 2002-12

By Ken Simonson

The Bureau of Labor Statistics (BLS) recently released 2002-12 employment projections (www.bls.gov/emp). An accompanying article by Jay Berman, "Industry Output and Employment Projections to 2012" (www/bls.gov/opub/mlr/2004/02/artfull.pdf) states, "The construction industry, the only major goods-producing sector expected to post positive employment growth, is projected to increase by 1.0 million jobs, to [7,745,000] in 2012." Construction employment is projected to rise by 15%, matching the overall growth in employment. In contrast, construction employment soared 46% from 1992 to 2002, nearly triple the 17% overall growth rate. By major occupation, growth will be more rapid among electricians (27%); plumbers, pipefitters, and steamfitters (23%); and installation, maintenance, and repair occupations (23%), especially heating, air conditioning, and refrigeration mechanics and installers (37%). Output growth for the construction industry is expected to slow from 2.8% in 1992-2002 (vs. 3.2% for the entire economy) to 1.7% (vs. 3.3%).

The article continues, "Delayed replacement or remodeling of industrial plants and greater demand for aging-population related nursing extended care and high-technology medical treatment facilities will propel nonresidential construction to lead this aggregate segment. However, technology enhancements will dampen demand for new commercial construction, as nontraditional work and retail environments such as teleconferencing, telecommuting, and electronic shopping continue to proliferate. Total nonresidential investment in structures is therefore expected to grow by 1.8% over the 2002-12 period.

"Residential construction, closely tied to demographic factors, will grow at a 2.1% pace throughout the 2002-12 period. As baby-boomers reach their peak earning years, the demand for upgraded homes, second homes, and assisted living housing will increase. In addition, as their children, the echo boomers, augment the younger age groups, and the number of immigrants increases, the demand for single-family housing and rental apartments also is projected to increase."

In a survey for Turner Construction on hospital construction plans, more than of two-thirds of 200 healthcare executives and 89% of larger hospitals polled by Bayer Consulting said, "their institution would begin a major expansion in the next three years," the *Wall Street Journal* reported.

Contractors from around the country have been reporting sharp increases in steel prices. Some suppliers say further increases of 10% a month are on the way. The *Wall Street Journal* corroborates this information, saying, "U.S. steel prices have jumped at least 30% in less than two months and continue to rise with such frequency that suppliers can't predict them from week to week…Economists and industry experts point to a weakened dollar, which makes foreign products more expensive and has helped keep imports at bay, and consolidation among U.S. steelmakers."

Editor's Note: *This series on the economy and its impact on the construction industry is published monthly in* Interface. *This month's column was prepared by Kenneth D. Simonson, chief economist for the Associated General Contractors of America (AGC). Before joining AGC, Simonson spent three years as senior economic advisor in the Office of Advocacy of the U.S. Small Business Administration and 13 years as vice president and chief economist of the American Trucking Association. Simonson may be reached at simonsonk@agc.org.*

PEOPLE

FARRISH APPOINTED AS ATLAS PRESIDENT

Kenneth R. Farrish

Ronald Fredin

The Atlas Roofing Corporation has appointed Kenneth R. Farrish as its new president following the retirement of its current president, Ronald R. Fredin. Farrish comes from RSI Home Products, where he was president of the cabinet company. Prior to RSI, Farrish spent over 10 years at Masco Corporation, where he was senior vice president of operations for Delta Faucet and president of Cambridge Brass and Delta Faucet Canada. Ronald Fredin served as Atlas's only president for more than 20 years. Atlas's manufacturing plant is in Meridian, MI, and its corporate sales and marketing headquarters are in Atlanta, GA.

GARNETT REPLACES HOFF AT PIMA

Alma Garnett, vice president of Hunter Panels, has assumed the chairmanship of the Polyisocyanurate Insulation Manufacturers Association (PIMA), replacing Jim Hoff of Firestone. Garnett was previously vice president of sales and marketing at NRG Barriers and founded Hunter Panels in 1998.

PERFORMANCE SYSTEMS APPOINTS COCHRAN

Performance Roof Systems, Inc. (PRS) has appointed Donald D. Cochran as technical consultant. He comes to PRS from Owens Corning.

VERSICO APPOINTS PALMER

Versico Inc., which markets single-ply roofing systems, has appointed Frank Palmer of Salt Lake City, UT, as western regional manager. For ten years, Palmer managed the sales and marketing for Advance Foam Plastics, a manufacturer of EPS systems.

STEVENS ROOFING SYSTEMS MOVES TOM MARTINELLI OUT WEST

Tom Martinelli, a district sales manager for Stevens Roofing Systems in the southern sales region, has been named the new district sales manager for Stevens Roofing Systems for the areas of Wyoming, Colorado, New Mexico, Utah, and the southern half of Idaho. Prior to joining Stevens he was a sales manager with Nova Systems in Atlanta, and earlier worked with several commercial roofing contractors. Martinelli can be reached at (800) 621-7663, ext. 8666. Headquartered in Holyoke, MA, Stevens Roofing Systems is a producer and global supplier of reinforced thermoplastic roofing systems.

GOREY REPLACES GRASS AT FIRESTONE

Mike Gorey has succeeded David Grass as president and has also been named CEO of BFS Diversified Products LLC, the parent company of Firestone Building Products. Gorey started as a senior auditor with Firestone in 1983. Grass, who is retiring, joined Firestone in 1968 and became president of Firestone Building Products in 1998.

CRUM NEW RGM PRESIDENT

RGM Products, Inc. has named Robert C. "Clay" Crum as president. Crum spent 10 years with General Electric and ten more with three other large manufacturers.

MEHRER RETIRES FROM CERTAINTEED

Mike Mehrer, a CertainTeed employee since 1984, and director of contractor programs and training, has retired. Mehrer created the Professional Roofer Advisory Council and Making Business Better workshops. Jay Butch will take over Mehrer's duties.

SARNAFIL HIRES BRISSETTE AS GM

Sarnafil Ltd. has appointed Richard Brissette as general manager. Based in Mississauga, ON, Brissette will oversee Sarnafil's sales and technical operations across Canada. He replaces Stan Graveline, who was promoted in 2003 to the position of North American vice president, technical sales. Brissette was formerly with Firestone Building Products, Canada.

PRODUCTS

GACO WESTERN UNVEILS POLYFOAM

Gaco Western's PolyFoam, powered with a new, zero-ozone-depleting blowing agent, was recently unveiled. Gaco is a founding partner in the EPA's Energy Star® roofing program.

FOLANSBEE INTRODUCES NEW SHINGLE

Follansbee has introduced a new Stamped Diamond-Pattern Metal Shingle for residential and commercial roofing projects, manufactured from Follansbee's TCR II®, Tern II®, and KlassicKolors®. These shingles can be installed over existing asphalt shingles. For more information, visit **www.follansbeeroofing.com.**

POLYSTICK™ UNDERLAYMENT INTRODUCED

Polyglass has introduced Polystick™ MU Basik, a new generation of metal roofing and waterproofing underlayment. The product is manufactured using patented ADESO™ technology, whereby a "true" APP compound is applied on the top layer and an aggressive self-adhesive compond is applied on the bottom layer.

More

INDUSTRY NEWS

Continued on Page 44

PLANTS

BPB TO BUILD WALLBOARD PLANT

BPB, a manufacturer and marketer of wall and ceiling products, will build a $100 million gypsum wallboard plant in Roxboro, NC, in 2007, adjacent to Progress Energy's coal-fired power generator. The new facility is designed to produce 700 million square feet of wallboard annually from synthetic gypsum, a byproduct of coal-fired power generators.

PARTNERSHIPS/PURCHASES

PACIFIC NORTHWEST CAPITAL BUYS TAYLOR METAL PRODUCTS

Salem, Oregon, headquartered Taylor Metal Products, Inc. (TMP) has been purchased by Pacific Northwest Capital, LLC (PNC). TMP, founded in 1985, manufactures a patented zero-siphoning standing seam roof system and metal ventilated soffit panels, wall and fascia panels, and metal panels for radius roof applications.

ROOFMART PARTNERS WITH WIWA

RoofMart International, Inc. has partnered with WIWA to develop a spray unit that can spray RoofMart's Garna-Flex material, a plural component 8 to 1 ratio waterproof coating. For more information, visit **www.roofrmi.com.**

TASMAN ACQUIRED BY FLETCHER

Decra Roofing Systems manufacturer Tasman Roofing Products has been acquired by Fletcher Building of New Zealand. Tasman produces stone-coated steel roofing.

PROGRAMS

MCA STARTS CERTIFICATION PROGRAM

The Metal Roofing Certification Program, launched recently by the Metal Construction Association (MCA), will certify products to ensure use of correct paint coatings and base metals.

PLAUDITS

DERBIGUM MARKS 25 YEARS

Derbigum Roofing Systems, headquartered in Kansas City, MO, announces its 25th anniversary. Derbigum manufactures modified bitumen membranes. For more information, visit **www.DerbigumUS.com**.

Want your industry news to appear in Interface?

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***Interface* Journal**
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Raleigh, NC 27607

News must fit journal requirements in order to be published.

SolarSmart Roof Alliance Formed

Nine industry groups have formed the SolarSmart Roof Alliance (SSRA) in order to "educate policymakers and the construction marketplace about the environmental performance and economic issues presented when considering the use of reflective roofing." Participants are the Alliance for Polyurethanes Industry (API), the Asphalt Roofing Manufacturers Association (ARMA), the EPDM Roofing Association (ERA), the Polyisocyanurate Insulation Manufacturers Association (PIMA), the Roof Coatings Manufacturers Association (RCMA), the Spray Polyurethane Foam Alliance (SPFA), sheet membrane and component suppliers to the commercial roofing industry (SPRI), the North American Insulation Manufacturers Association (NAIMA), and the National Roofing Contractors Association (NRCA).

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Calendar of Events

APRIL 2004

1 & 6 RCI Board of Directors
Reno, NV

2 RRO and RRC Exams*
Reno, NV

3 Region Meetings
Reno, NV

6 RCI Annual Meeting of the Members
Reno, NV

14 Construction Specs. & the Project Manual
Toronto, ON

14 Carolinas Chapter Meeting
Greer, SC

15-16 Professional Roof Consulting
Toronto, ON

21-23 Construct America (CSI)
Chicago, IL
Info: 800-689-2900

26 SoCal Chapter Golf Tourney
Irvine, CA

30 Ontario Chapter Meeting
Hamilton, ON

MAY 2004

4-6 Roof Asia 2004
Kuala Lumpur, Malaysia
91-44-2440-5493
www.roofasia.com

6 Region I Meeting
Boston, MA

11 Special Program: Mold, A Balanced Approach *(Course material developed and presented by Morrison Hershfield, Toronto, ON)*
Houston, TX

14 Ohio Valley Chapter Meeting
Indianapolis, IN

19 Roof Asset Management
Philadelphia, PA

19-22 Dach + Wand International
Munich, Germany
Info: 312-377-2657

20-21 Rooftop Quality Assurance
Philadelphia, PA

22 RRO Exam*
Philadelphia, PA

30 Ontario Chapter Meeting
Hamilton, ON

JUNE 2004

2-4 Greening Rooftops for Sustainable Communities
Portland, Oregon
Info: www.greenroofs.ca

3 Region IV Meeting
Austin, TX

3-4 Wind & Drainage
New Jersey

5 RRC Exam*
New Jersey

6-8 WSRCA Convention
Las Vegas, NV
Info: 800-725-0333

9 Region VI Meeting
Las Vegas, NV

10-12 AIA Annual Convention
Chicago, IL
Info: 800-242-3837

25 Ontario Chapter Meeting
Hamilton, ON

JULY 2004

10-11 Exec. Comm. Summer Meeting *(tentative)*

28-31 Fla. Roofing, Sheet Metal & AC Contractors Assoc.
Orlando, FL
Info: 407-671-3772

AUGUST 2004

4 Region III - Great Lakes Chapter
Rothbury, MI

5-7 MI Roofing Contractors Assoc.
Rothbury, MI
Info: 586-759-2140

18 Region VI Meeting
San Diego, CA

24 Waterproofing
St. Louis, MO

25 Rooftop Safety for Consultants & Building Owners
St. Louis, MO

26-27 Rooftop Quality Assurance
St. Louis, MO

28 RRO Exam*
St. Louis, MO

SEPTEMBER 2004

9 Region IV Meeting
Dallas, TX

14-15 Roof Tech. & Science I
Baltimore, MD

16-17 Roof Tech. & Science II
Baltimore, MD

17 Region II Meeting
Jacksonville, FL

25-26 Mid-Year Board Meeting *(tentative)*
Miami, FL

Black print: Industry events **Green print: RCI events**

Calendar subject to change without prior notice. Visit **www.rci-online.org** for schedule updates.

*A completed application must be received by Headquarters 90 days prior to sitting for an exam.

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