

Closed-Cell Spray Foam Insulation

Performance in Residential and Commercial Buildings During Adverse Weather

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Honeywell

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- This document summarizes lab and field evidence showing that use of closed-cell spray polyurethane foam (SPF) insulation and roofing materials can reduce damage to residential and commercial buildings resulting from wind, rain, flooding, and other adverse weather effects.
- Honeywell is one of several leading companies who supplies materials used to manufacture SPF systems. Compared with traditional insulation materials, SPF provides superior thermal insulation and air sealing for improved building energy and moisture performance (not covered in this document), and also imparts structural benefits due to its physical rigidity*, tenacious adhesion, and waterproofing properties.
- The objective of this document is to create awareness that use of SPF in new and retrofit construction can be an effective way to reduce building damage resulting from severe weather situations.

* Closed-cell foams are sometimes referred to as 'rigid' foams in contrast to open-cell foams which are also called 'soft' or 'flexible' foams

SPF Benefits in Adverse Weather – Residential

KEY FINDINGS

SOURCE

WIND



- SPF increases racking strength (resistance to structural failure under wind force) by approximately 2X to 3X (compared to fiberglass) in 16” 2x4 stud frame walls
- “During a “design” racking event such as a hurricane, there would be less permanent deformation of these wall elements and possibly less damage to a structure that has been braced with SPF-filled walls” (page 23)
- SPF increased racking strength by over 2X (compared to fiberglass) in 24” on-center 20-gauge light structural steel framing walls

NAHB Research Center
1992

NAHB Research Center
1996

FLOOD

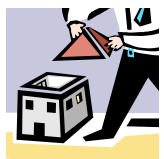


- Closed-cell foam is the only type of insulation classified as an “acceptable flood-resistant material”
- Batt or blanked insulation types and all other insulation types are classified as “unacceptable”
- “To address flood [situations], we should look to common sense:...Build with materials that can become wet....” (page 13)

FEMA
Technical Bulletin 2-93

Joseph Lstiburek, Ph.D.
“Rebuilding After Katrina”
ASHRAE Journal, 11/2005

ROOF



UPLIFT

- SPF in sealed attics “has significant advantages...with respect to rainwater control, energy conservation, moisture and humidity control, wind uplift and fire performance over standard attic roof technology”
- Unvented roofs outperform vented roofs during hurricanes – they are safer. SPF is ideally suited for unvented conditioned roofs where it is applied directly to the underside of roof sheathing. In wildfire zones unvented roofs and attics have significant benefits in terms of fire safety over vented roof assemblies

Building Science Corporation, 2004

Building Science Corporation, 2006

Structural Strength, Flood-Resistance, Improved Safety

Residential Facts – Pictures

SPF Residential Standard Wood Frame:

- SPF is sprayed in place, forming a monolithic seamless seal that fills all the cracks and crevices
- SPF increases racking strength 2X-3X (compared to fiberglass)
- Homes insulated with SPF use 30-50% less energy than traditionally insulated homes



SPF:

- Critical air seal around band joist blocks air and moisture intrusion
- Insulates and strengthens walls

Conditioned Attic: SPF (applied from the underside) reduces moisture load and provides superior wind lift performance



Fiberglass Batt: Allows for air and moisture infiltration, provides no structural reinforcement



Structural Strength, Energy Savings

SPF Benefits in Adverse Weather – Commercial Roofing



KEY FINDINGS

SOURCE

SEVERE



WEATHER

- SPF is the only roofing system described by NIST officials as having “sustained the winds [of hurricanes Katrina and Rita] extremely well without blow-off of the SPF or damage to the flashings” (pages 55-69; 176-177)
- SPF roofing wind uplift resistance exceeded the capacity of UL’s test equipment
- UL also observed that SPF re-roofs applied over traditional roof systems increased the wind uplift resistance of those roof coverings
- Factory Mutual Global roof wind testing showed similar results over concrete, metal, and wood decks
- SPF offers increased resistance to hail, flying debris or “missiles” [wind-blown projectiles] during high wind events
- Gouged spray foam roofs can remain without repairs for months without leaking both during and after severe storms
- SPF roof systems have a proven track record for protecting buildings against severe storms, tornados, and hurricanes
- SPF is one of the best ways to temporarily repair damaged roofs – adheres to a broad range of substrates, seals against water inflow, and is easy to transport into storm damaged areas (liquid drums cover large area when sprayed)

Performance of Physical Structures in Hurricane Katrina and Rita, NIST TN 1476, June 2006

Underwriters Laboratory

Factory Mutual

Roofing Industry Educational Institute

Mason Knowles Roofing Industry Committee on Weather Issues (RICOWI)

ENERGY



ENVIRONMENT

- SPF roof systems’ highly reflective roof coating systems offer enhanced reflectance and emittance properties (for lowered building energy consumption and reduced urban heat-island effect): ASTM E-903 reflectance 76; ASTM E-408 emissivity 91
- SPF roofs are zero ozone depleting and are considered a sustainable roofing material (capable of service life extension with minor upkeep)
- SPF roofs have the highest insulating R-Value (resistance to heat-flow) per inch of any roof insulation product on the market today
- SPF roofs save both energy and the environment by reducing pollution, global warming, and the heat island effect in urban areas...

American Society for Testing and Materials

Environmental Protection Agency

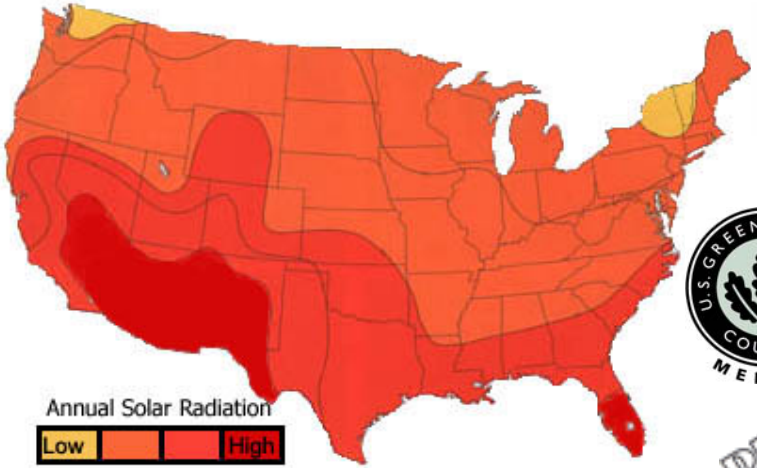
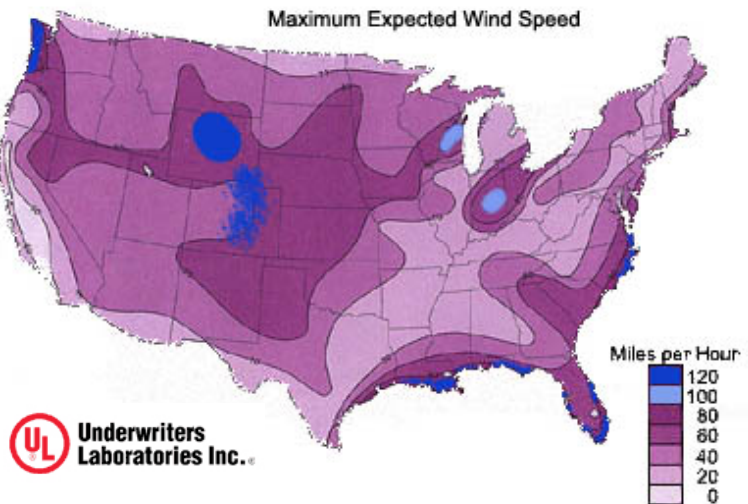
Advanced Roofing System Protects Buildings And Contents

Roofing Facts – Pictures

Traditional Roof System after Katrina
(Louisiana Superdome)



Spray Foam Roof Repair after Katrina
(Louisiana Superdome)



SPF Roofing Systems Provide Exceptional Value & Performance