QUALITY CONTROL WITH SPRAY FOAM INSULATIONS:
Safety Compliance, Industry Myths and Contractor Selection
Today’s Presenters

- Brian Oman, Marketing Applications Specialist, LEED BD & C
  - Residential / Light Commercial Spray Foam Insulations
Who is BASF?

• BASF is the largest Construction Chemical Company in the world. BASF is also:
  • The market leader for spray polyurethane foam in the United States and in the world.
  • An ISO 9002 certified manufacturer. This quality assurance program and certification ensures that the processes that develop the product are documented and executed in a quality manner.
  • With the Center for Building Excellence, BASF now provides core expertise in residential and commercial Building Science, with disciplines in architecture, building planning, energy modeling, building forensics, and plan analysis.
Learning Objectives

After completing today’s course, you will be able to:

- Explain the various types of spray polyurethane foams (SPF) used in residential construction. Identify the different physical / performance properties of open- and closed-cell SPF materials.

- Describe the industry myths about each type of SPF insulation, and explain the misnomers.

- Explain the importance of proper handling and safe use of SPF materials, understanding the implications of OSHA's National Emphasis Program (NEP) on isocyanates

- Determine how to select a Qualified SPF Contractor & prevent misapplication

- Distinguish the features and benefits of using spray polyurethane foam for residential construction, and identify the various areas of the residential building envelope where SPF is best used.
SPF Application Markets Today

- Low-slope Roofing
- Commercial Industrial-Ag
- Retrofit Residential
- Commercial Air Barrier
- Residential
What is Spray Polyurethane Foam?

- SPF Insulation is created by the reaction of two liquids
  - 2 component, 1:1 ratio mixture to create finished foam insulation on the jobsite
  - Not a DIY product – takes trained, qualified applicators to properly install
  - Product quality and finished material is highly dependent on ability of applicator to follow manufacturer and industry guidelines
- 35+ year performance history in commercial construction
- 25+ year performance history in residential construction
- Can be used safely when wearing proper protection equipment
SPF Chemistry and “Green” Content

- SPF chemistry is nearly ALL the same:
  - Component A- Isocyanate: MDI-PMDI (Adhesive/Hardener)
  - Component B- Polyol resin: Polyols, catalysts, blowing agents, flame retardants, smoke suppressants & surfactants
- “Green” or sustainable components make up only a portion of the polyols in the B drum – all other components remain fairly equal
  - Post-scrap plastics reprocessed (recycled soda & water bottles)
  - Renewable or plant-grown materials (sugar beets, soy, cane products)
- Based upon the total percentage of all polyols that have the capacity of being recycled or renewable in content, spray foams contain no more than 15-20% of these materials total
Spray Foam Equipment & SPF Reaction

- Both liquids stay apart until they meet at the tip of the spray nozzle
- “Exothermic” chemical reaction when the two components meet
  - Added heat and pressure creates more heat
Spray Foam Rig

- Most often a trailer or truck
- Can be self contained with onboard generator
- May use shore power from jobsite
- Crucial that foam rigs are in working order and maintained
Foam Chemistry Basics

• It’s the Blowing Agent (BA)...
  • Open-cell, low-density foams
    • No chemical gas blowing agent
    • Use water which heats up and reacts with Iso or “A” to create steam and CO2
  • In closed-cell foams, the BA gives most of the valuable properties that come with the premium price for ccSPF
    • Blowing agent is a gas called 245fa, supplied by Honeywell
    • EPA Approved, Non-Ozone Depleting material
    • 245fa is twice as efficient as a thermal insulator as air
    • Closed-cell foams have a microscopic cell structure created in this fashion, filled with blowing agent
      • Over One Million closed cells per cubic inch
What You Need To Know about SPF

- **Open-Cell Spray Foam**
  - “½-lb” density
    - Semi-rigid spray foam
    - Low density
  - Fills up the wall cavity
    - High expansion
    - Shaving required
  - Water blowing agent
    - Expands & leaves open air pockets
  - R-value = 3.5-4.0/inch
  - No structural value

- **Closed-cell Spray Foam**
  - “2-lb.” density
    - Rigid SPF
    - High/medium density
  - Not full wall thickness
    - Controlled expansion
    - Hybrid system applications
  - Non-ozone depleting (HFC) blowing agent
    - Millions of tiny closed-cells trap this high-efficiency gas
  - R-value = 6.0-7.0 per inch
  - Offers up to 300% increased structural value (over 2”)
What You Need To Know about SPF

• **Open-Cell Foam**
  - Air Barrier at 3.5”
    - Meets sealant requirement of IECC
  - Additional vapor retarder over open cell foam typically required in cold climates
    - 5” application = 10 perms
  - Water can absorb (up to 40% by volume)
    - Do not use below grade or on ductwork
  - Offers sound absorption and barrier performance

• **Closed-cell Foam**
  - Air Barrier at 1”
    - Meets sealant requirement of IECC
  - Code defined class II vapor retarder at 1”-2.5” or greater
    - Typically 1.5”-2” application = Less than 1 perm
  - Difficult for water to absorb (less than 4% water absorption) - Hydrophobic
    - FEMA Flood Resistant
  - Offers sound barrier performance only (will not absorb noise)
SPF and the International Codes

- Code Sections relevant to SPF in the “I-codes” or baseline codes of each State code
  - International Residential Code (Most states using 2006 or 2009 IRC)
    - Section R314/6 Foam Plastic in Building Planning (Chapter 3), R320 Protection Against Subterranean Termites, R806.4 Unvented Attics (from 2009)
  - International Building Code (Most states using 2006 or 2009 IRC)
    - Chapter 26 Section 2603 Foam Plastic Insulation
- Code Focus
  - Fire Protection – 15-minute thermal barriers required and ignition barriers / alt. assemblies allowed in limited access areas such as non-storage attics and crawlspace
  - Thermal Performance – Must claim and use Aged R-values at installed thickness – not linear
  - Moisture Control – Vapor control layers must be consic
  - Fire performance of commercial assemblies
    - Hourly rated walls or ceiling / floor configurations
    - NFPA 285 for exterior walls containing SPF
Safety with Spray Polyurethane Foam

- New Government Oversight Committees and National Emphasis Program from OSHA on Isocyanates

- Support from American Chemistry Council’s Center for the Polyurethanes Industry (CPI)

- Full details for safe handling of Spray Foam, including Respiratory Protection and other Personal Protection Equipment (PPE) found at:

  www.spraypolyurethane.org

- Contractor training and certification available at above site – All companies should use this!
Many different helpful tools on it for SPF health and safety for everyone involved.

On the right hand side of the page you will see the Health & Safety Training:
- When contractors complete the program, they receive a certificate of completion and a wallet card to carry.
- Ask for their ID # and you can look up on this site to validate their training.
Safety with SPF Applications

• New standards from EPA, OSHA, NIOSH…..
  • BASF was a leader on the joint committees and will continue to support efforts

• OSHA National Emphasis Program
  • Much more active on SPF jobs – Areas of concern:
    • Keep two copies of MSDS on truck at all times, in cab and box
      • Not just for foam but all chemicals
    • Employees must know how to read and tell inspector about MSDS, fall protection, mask maintenance, eye wash stations, fit testing & respirator training, etc.
  • Written Hazard Communication Program
  • Medical Surveillance Program
    • Yearly testing
  • Model Respirator Program
    • Respirator Fit Testing
Application Safety – Importance of Protection

Why is it important to protect yourself from the MDI component (A / Iso) when around the application of SPF insulation?

- Contact with excessive amounts can be harmful to your health
- Overexposure due to material that is sprayed and/or heated comes from the following:
  - Breathing airborne concentrations
  - Getting MDI on your skins
  - Getting MDI in your eyes
- Continued overexposure lead to sensitization
  - Once sensitized, very limited exposure will create health effects

Other components such as catalyst, polyols and blowing agent also have potential health effects
Safety with SPF Applications

- REQUIRED Personal Protection Equipment (PPE)
  - Respiratory Protection
    - Full Face Supplied Air Respirator for both applicator and helper during application
    - Clean up crews after installation - cartridge mask can be utilize with approval by your respiratory program administrator (subject to change)
  - Body Protection  NO SKIN SHOWING!!
    - Chemical Resistant Suit (HOT!!!)
    - Chemical Resistant Boots/Booties
    - Nitrile Gloves to protect hands from absorbing chemicals
    - Head masks
  - Eyewear with side shields
    - To protect from chemical splashes and absorption of mists into eyes
Other Safety Considerations

- Safety Gear for Insulation Jobsites (in addition to SPF PPE)

  - Fall Arrest (if applicable)
  - Fire Extinguisher
  - Spill Kit
  - First Aid Kit
  - Wind Screens

  Lines, Tapes, Spotter, Rails Systems and/or combination

  Near spray unit and spray area

  To absorb spills and neutralize per MSDS

  Eye wash and minor injuries

  For external work or large open areas, to prevent overspray
Applications –
Health & Safety Warning Sign

WARNING
Breathing Hazard During
The Application of Insulation
Materials

DO NOT ENTER
Without Proper Respiratory Protection

NO SMOKING
Applications – Safety on the Jobsite

• TDS and MSDS must be on the job site / readily accessible in truck

• Quality controls start at the estimation & bidding processes

• After SPF is sprayed on jobsite:
  • Protect foam from accidental ignition by other trades

  • NO HOT WORK Signs should be posted
Applications – Fire Safety

**CAUTION**

NO HOT WORK!
No open flames, torches or other hot surfaces should come in contact with Spray Foam surface. Protect with fire resistant material!
Other OSHA Programs which may be reviewed on jobsites...

- Other OSHA Programs may be enforced, including:
  - Spill Prevention Program
  - Lock, Tag and Try
  - Hot Work Permit
  - Fall Protection

- There may be other programs needed that could be examined on a jobsite while the foam operation is being investigated.
How do I get additional information?

- The CPI document library provides a multitude of guidance documents and videos accessible via the following link: http://polyurethane.americanchemistry.com/Resources-and-Document-Library#EHS

- The complete text of OSHA’s NEP on isocyanates is available at: http://www.osha.gov/OshDoc/Directive_pdf/CPL_03-00-017.pdf

- In addition, OSHA’s webpage on isocyanates has info available at: http://www.osha.gov/SLTC/isocyanates/index.html

- Wipe testing or SWYPE test kits can be purchased from CLI Laboratories at: http://www.clilabs.com/products/surface-swypes.html

- Material Safety Data Sheets can be obtained from the local manufacturer’s sales or technical representatives.
Example of SPF Jobsite Safety Plan

8.1) Jobsite Safety Plan

You may have different components to your plan due to your jobsite.

- Verification that all personnel read and understand the MSDS for each material involved with the spray polyurethane foam application process.
- A copy of the most current MSDS should be available at all times (i.e. cab of the truck or in the trailer that is transporting the spray equipment).
- Communication procedures between the crew and customer.
- Overspray mitigation plan.
- Proper start-up and shut-down procedures for both SPF process equipment and the customer’s equipment (i.e. HVAC system) when applicable.
- Review of Manufacturers Technical Data sheets that detail proper application procedures.
- Onsite review of the jobsite; note any potential safety hazards and special needs.
- Controlling access to the spray area.
- Proper set up for all equipment with particular emphasis on ladders or scaffolding which could present fall hazards.
- Proper set up for establishing the work area and restricting access by posting warning signs.
- Emergency procedures with notification procedures.
- Chemical spillage with current remediation procedures and notification procedures.
- Jobsite location and directions to the jobsite from the nearest major intersection.

*Courtesy of Spray Foam Coalition – CPI / ACC*
## Example of SPF Equipment Checklist

### Equipment Inspection [Safety] Checklist

Each jobsite may have unique needs to consider and include in its Jobsite Safety Plan.

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Checklist Details</th>
</tr>
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</table>
| **Air and chemical leaks** | - Inspect air and chemical lines for signs of wear or fatigue.  
- Ensure the compressed air system has the proper OSHA-compliant disconnects. |
| **Proper ventilation of engine exhausts** | - Verify adequate ventilation. The buildup of carbon monoxide from engine exhausts can be deadly. |
| **Ladders, scaffolding, and aerial lifts** | - Improper use of ladders, scaffolding, and aerial lifts can be a source of jobsite injuries or deaths. Proper use of ladders, scaffolding and aerial lifts is a major point of emphasis in the overall jobsite safety plan.  
- Consult the OSHA website along with the manufacturers care and use specifications for this equipment. |
| **Hoses, electrical cords and lights** | - Use properly rated electrical cords and lights.  
- Remove from service cords that are damaged, frayed or spliced.  
- Properly ground/bond plugs and receptacles, including ground wire. |
| **Ventilation fans and ducts** | - Clean fans and check if fully operational.  
- Clean ducts and seal to eliminate leakage. |
| **Chemical storage and handling** | - Proper environmental controls to ensure proper storage conditions.  
- Proper restraining devices to secure chemicals during transportation.  
- Spill control equipment.  
- Decontamination solution. |
| **Emergency equipment** | - A fully stocked and OSHA-compliant first aid kit.  
- Eye wash station. |
| **Fire Prevention** | - Fire extinguishers fully charged and accessible. |
| **Other** | - Tools, spare parts, and equipment manuals.  
- Jobsite Safety Plan. |

- Courtesy of Spray Foam Coalition  
- CPI / ACC
Applications – Job Prep

• SPF Contractor should discuss potential concerns with Builders
  • Either manage yourself or bring to attention in advance of the project
    • Areas should be clear for access to working near walls/roof
    • No other trades in immediate work area – possibly entire home (depending on conditions, ventilations, etc.)
    • Ensure all wiring, plumbing, vent pipes or any other through-wall penetrations are in place prior to foaming
  • Ensure all air intake is shut down / masked
    • Separate areas to be sprayed from other areas in operation
  • Heating houses in winter
    • Preheat, then shut down
    • No open flames!! Use ducted or radiant heaters only
Applications – Jobsite Preparation

• Shut down HVAC systems during application of primers, spray polyurethane foam, and coatings to stop the drawing of dusts, aerosols and/or vapors into adjacent spaces
  • Seal the air intakes with plastic sheeting and tape, which will prevent dust and spray from entering the intakes.
  • Keep the plastic sheeting in place at least several hours after the spray application is completed.
  • System should not be restarted until appropriate time has elapsed and the plastic sheeting and tape is removed.

• Containment and ventilation methods may help prevent migration of SPF to other areas.

• If local exhaust ventilation and containment methods are not used, establish a work zone around the work area to protect adjacent workers.
  • Distance is typically 25 feet, but depends on several factors, including but not limited to volume of SPF applied, area covered, and air movement.
  • Signage should be used to communicate access restrictions. Limit access to persons wearing proper personal protective equipment or trying to schedule other trade workers at times when SPF application is not underway.

• Before beginning work, a designated area should be established for putting on and removing PPE.

• Determine in advance the potential for overspray damages. Have a plan in place to address overspray damages to adjacent property. All employees should be trained in overspray prevention.

• Identify and protect surfaces that could be damaged (e.g., windows, doors, equipment, or building exterior) in advance of application and ensure proper masking is conducted.
Applications – Job Prep

- Masking of all non-foam surfaces that would be subject to overspray
  - Windows / Doors / Bathtub/shower surrounds / Garage doors / Masonry/Fireplaces
- Cover outlet boxes to ensure SPF stays out
- Check all air intakes to ensure furnace is not running and drawing fumes / particulate
Applications – Substrates / Primers

• Must be a clean, dry, sound surface to spray
  • Suitable to Wood, Concrete, and Metal surfaces - Consult manufacturer for any questionable applications
  • Surface must be free of grease, wax, oil, loose particles, moisture or other foreign matter
    • Questionable surfaces include:
      • Gluelams, LVL’s or Microlams = Wood with a wax coating
      • The “wrong” side of the OSB (outside smooth surface)
      • Certain powder-coatings on metal surfaces
  • Primers may be necessary on many surfaces, such as concrete or metal = cold, smooth or wet surfaces that may affect adhesion
    • Typically acrylic or epoxy based primers – Consult manufacturer for recommendation
Applications – Thickness

- Closed-cell SPF (ccSPF) should be sprayed between $\frac{1}{2}''$ MIN and 2'' per PASS thickness MAX.
- Allow time to cool between passes
  - 15-30 mins., depending on ambient/substrate temps.
- Open-cell SPF should be sprayed between 4’’ and 6’’ per PASS, building up to total thickness in ceilings
  - Less voids or pockets are created when managing thickness and building up to total installed amount.
- Testing has been completed to allow for greater thicknesses which may be accepted by code
  - ccSPF = 8’’ in walls / 12’’ in cathedral ceilings, protected by sheetrock
  - ocSPF = 12’’ in walls / 16’’ in cathedral ceilings, protected by sheetrock.
Hot SPF Topic Breakout – Exotherm

• Impact of Spray Polyurethane Foam Exotherm (Heat!) & Pressure on Surfaces and Building Materials
  • Metal Buildings
  • Gypsum Board – Ceilings/Knee Walls
  • Wiring
  • cPVC Sprinkler Pipes & Water Pipes
SPF Applications to Metal Buildings

- Warping may occur if sprayed too thick, too fast
- Must control exotherm (heat) and expansion
  - Especially concerning on lighter weight metal surfaces
- Use spray techniques
  - Flash coat to isolate heat (1/2” – 1” max – let cool 10 mins)
  - Use flash coat when picture framing to get good adhesion at framing or purlins, and limit volume of SPF creating pressure behind these against metal
  - Lay additional passes after
SPF Applications to Gypsum Board

- Applicators must use caution
  - Warping may occur if sprayed too thick, too fast
  - Must control exotherm (heat) and expansion
    - Use spray techniques
      - Flash coat to isolate heat (1/2” – 1” max – let cool 10 mins)
      - Use flash coat when picture framing to limit volume of SPF creating pressure between framing and sheetrock
      - Lay additional passes after
SPF Applications over Wiring & Plumbing

- SPF to Wiring: Melting-brittleness may occur if sprayed too thick, too fast
  - Standard Romax is not an issue with less than 2” passes
  - Low voltage wiring (Cat-5, security, door bells, garage doors) are very heat sensitive and inner liner can become brittle and short

- SPF to Plumbing: Bursting may occur if sprayed too thick, too fast
  - NOT an issue of chemical incompatibility…industry testing dismissed concerns – SPF CAN be in contact
  - Concern is with heat over pressurized sprinkler pipes, closed off with water, glycol or air – CAN burst due to expansion of contents within the pipe.

- Must control exotherm (heat) and expansion using spray techniques
  - Flash coat to isolate heat (1/2” – 1” max – let cool 10 mins)
  - Use flash coat when picture framing to limit volume of SPF creating pressure between framing and sheetrock
  - Lay additional passes after
SPF Applications over other Hot Surfaces

• Recessed Lighting
  • No direct contact with IC- or non-IC rated recessed lights
  • 3-inch separation required
    • Gypsum or foil faced boxes
    • Cover with fiberglass batt

• Masonry Fireplaces and Hot Air Flues
  • No direct contact with fireplace or flue surfaces
  • 3-inch separation required
    • Airspace or fiberglass batt separation
Applications – Fire Protection

• ALL interior SPF must be covered by a thermal barrier, i.e. sheetrock
  • Exceptions
    • Rim joist (Class 1, Less than 3.25” thick)
    • Attics & Crawlspaces – Ignition Barrier
      • Lesser requirement – mineral fiber/fiberglass, other products listed in code
      • Check foam products ICC-ES Report for tested and accepted alternatives
      • ALSO applies to all commercial applications
  • Pole barns, sheds, airplane hangars, garages
    • Must have sheetrock OR spray-applied thermal barrier – cannot leave exposed!
      • K-13 (Ure-K) Cellulose by International Cellulose or Monokote Z3306 by WR Grace
Applications – SPF Removal and Disposal

• Removal Guidelines
  • Spray foam overspray (small foam particles) can damage many surfaces
    • Ensure that the SPF contractor is properly protecting anything that is not to be foamed.
  • SPF is VERY difficult to remove, only a few products work on a few surfaces
    • Clay Magic-car detailing clay bar for smooth surfaces such as glass, metals, vinyl, etc.
    • Silicone & Foam Remover from Home Depot – breaks bond of SPF from surface
Field Quality Control

• The Foam Supplier is the Chemical Manufacturer of the:
  • “A” Isocyanate/Hardener component
  • “B” Resin/Polyol component

• As the Applicator:
  • They are the manufacturer of the end product by blending the Isocyanate and Resin components in the field.
  • The installer is the quality control inspector as well:
    • Brittle & Friable Foam is “A-Rich” or Lacking Resin
    • Soft & Spongy Foam is “B-Rich” or Lacking Isocyanate
Quality Control Procedures

• Before applying, test spray on a disposable surface to check for pattern and proper blend of chemical.
  • After SPF has suitable round pattern, spray 1-2” thickness, allow to cool & cut open to view foam
    • Looking for even, consistent cell structure, no large blown, elongated cells
    • Looking for even color & texture

• Test the surface to be applied to, ensuring the moisture content does not exceed limit to allow for spraying
  • Wood moisture content – less than 18%
  • Moisture strips / Kleenex
Job Site Quality Control Forms

- Each job should have a quality control sheet to record:
  - Job Name/Number
  - Date of application
  - Weather conditions
  - Batch / lot numbers, manufactured date and product name taken from drums
  - Area and Thickness where applied
  - Substrate type
  - Ambient and substrate temperature
Applications - Good Job
Applications - Good Job
Applications - Good Job
Measuring Depth of Insulation
Applications

Good Job
Closed-Cell Processing & Application Problems

- Shrinkage due to over-fill per pass.
- Sprayed at 5” to 6”s at one time.
Applications - Bad Job: Too thick / scorched
Applications - Bad Job: Shrinkage and scorched material – blow holes show excessive exotherm
Applications - Bad Job: Scorching and poor cell structure
Applications - Bad Job

Equipment problems Light and Dark Color Foam
Applications - Bad Job
Open-cell Processing and Application Issues
Applications - Bad Job: Poor Mixing / Heats
Applications - Bad Job: Poor mixing / temps
Weather Effects on the SPF: MOISTURE

- Creates crystals in ISO drums
- Changes Resin chemical make-up
- Creates poor adhesion on the substrate
- Creates blisters
Weather Effects on the SPF: COLD

- Colder (thicker) material is harder to process
- Foam proportioner may not be able to heat chemicals to recommended temperatures
- Substrate temperatures will slow down the thermal reaction and could cause thermal shock and shrinkage
- Loss of yield, means more material and more cost
Troubleshooting Guidelines - When having a problem with SPF

- Questions the contractors should ask themselves
- Questions we will ask THEM!
  - What is the temperature of the material in the drum?
    - Is the material too cold?
  - What is the surface you are spraying onto?
  - What temperature is the surface you are spraying onto?
    - Is the substrate too cold or moist?
  - What is the manufacturing date and lot # on the drums?

- Remember when there are problems in the field, they should always STOP and fix it!!!

Anything that is sprayed off-ratio, too thick or too fast will need to be removed and replaced with good material.
Where can you use SPF in residential construction?

- Cathedralized Ceilings
- Unvented Crawlspace Floors
- Below Grade Walls
- Attic Floors
- Cathedralized Ceilings
- Unvented Attic
- Frame Walls
- Exteriors Walls
- Garages Ceilings
- Combinations
- Basements Walls
- Below Grade Walls

(Images courtesy BASF, Honeywell, and SPFA.)
The same great value we see for homes can go into commercial / industrial buildings and applications....
## Spray Polyurethane Foam Insulation

### Application Areas

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<td>R-value</td>
<td>Walls</td>
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<tr>
<td>Cellulose Wet-Spray</td>
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<td>*</td>
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<tr>
<td>Cellulose Loosefill</td>
<td>3.5 to 3.8</td>
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<tr>
<td>Fiberglass Batts</td>
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<tr>
<td>Fiberglass Loosefill</td>
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<tr>
<td>Open-Cell SPF</td>
<td>3.4 to 3.8</td>
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<tr>
<td>Closed-Cell SPF</td>
<td>5.9 to 7.1</td>
<td>Y</td>
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</table>

Know the best place to use it!
SPF Myths - What about rigidity and long-term adhesion?

- Closed-cell spray foam has been used successfully for residential and commercial construction for over 30 years
  - Exhibited dependable performance, when applied properly, in extreme weather conditions, without loss of adhesion or bond

- Properties that enhance it’s performance…

  - Elasticity
  - Mechanical / Chemical Bond
  - Racking Strength
SPF Myths -
What about Flammability and Fire?

• Most foam systems for residential construction are Class 1 rated construction materials
  • Contains fire retardants and smoke suppressants

• Class 1 exceeds Class 2 requirements of International Residential Code

• ALL FOAM INSULATION applications (open cell, closed-cell spray, rigid board, etc.) for interior use must be covered with thermal barriers, i.e. ½” Gypsum Board, for fire safety, with few exceptions (per IRC and IBC requirements)
SPF Myths - What about Roof Leaks?

- Closed-cell spray foam acts as a secondary rain barrier, ESPECIALLY valuable in a coastal zones and rain prone areas, to keep the elements out of the home prior to repairs during high wind events and damages.
- Open cell foam MAY let the water flow through, but can also retain moisture against the sheathing.
  - Water will also migrate within foam mass before showing up usually.
- Consider the BENEFITS of closed-cell SPF on the underside of your roof..
  - Would you rather have water in your living room, or within one section of the roof sheathing? Easier to identify and repair…
  - Damage is limited to a specific area, not allowed to move or create additional damage and mold potential.
SPF Myths -
What about Outgassing and Air Quality?

- No Urea Formaldehydes in SPF chemistry - Never had them, Never will
- HFC-245fa is a non-flammable that replaced HCFC and CFC blowing agents.
  - Zero Ozone Depletion Potential (ODP)
  - Low Global Warming Potential (GWP)
  - Not considered a Volatile Organic Compound (VOC) in US
- Inert Plastic Remains in place - No outgassing
  - Studies by AMA and others to prove no physical effect
- Locally used in American Lung Association Health House
  - Asthmatic daughter – benefited from a well-sealed assembly
  - Non-fibrous insulation is a bonus
SPF Myths –
Can a new home be built “too tight”? No!

- Fresh Air Ventilation Standards - **ASHRAE 62.2.1**
  - This standard defines the roles of and minimum requirements for mechanical and natural ventilation systems and the building envelope intended to provide acceptable indoor air quality in low-rise residential buildings. It is ASHRAE's IAQ standard for residential buildings.
  - It applies to spaces intended for human occupancy within single-family houses and multi-family structures of three stories or fewer above grade, including manufactured and modular houses.
Build Tight, Ventilate Right

• To address air infiltration and related moisture concerns, many building scientists have concluded that houses should be as tight and seamless as possible¹

• The American Lung Association also recommends that homes need to be as tight as practical²

• Random natural infiltration should be minimized and controlled mechanical ventilation should be employed³

¹.Arnie Katz, Director, Affordable Housing, Senior Building Science Consultant [www.advancedenergy.org/buildings/about/specialists/arnie_katz.html](www.advancedenergy.org/buildings/about/specialists/arnie_katz.html)
³.[www.buildingscience.com](www.buildingscience.com)
Fresh Air Ventilation
Trends in Ventilation and Indoor Air Quality Control

• ERV and HRV are becoming more affordable
• Commissioning of homes is becoming more widespread
• As with all air-tight building approaches, homes built with spray foam should incorporate a method to manage indoor air quality
  • Fresh air should be introduced and exchanged within the home
  • Passive and low cost methods available
    • Home Ventilating Institute [www.hvi.org](http://www.hvi.org)
  • Honeywell and Aprilaire have affordable models
    • Easily adapted onto existing HVAC equipment
SPF Contractor Selection

- Things to look for in a qualified applicator of SPF:
  - Industry Training (SPFA)
  - Manufacturer Training (BASF, Icynene, etc.) for applicators, sales staff, owners, etc.
  - Manufacturer Certification
  - Manufacturer Quality Programs (BASF, Bayer, etc.)
  - Hours of Spraying or Square Footage Sprayed
  - Years of experience
Selecting a SPF Contractor with Experience – Center for Polyurethanes Guidance

Here are some questions you may wish to ask a prospective SPF contractor before selection:

- Has the supervisor been trained or accredited for high- and/or low-pressure two-component spray polyurethane foam installation? Is the accreditation current or training recent?
  - Ask for evidence that your contractor has had training by an SPF manufacturer or distributor.
  - The Spray Polyurethane Foam Alliance (SPFA) accreditation program or the Center for the Polyurethanes Industry (CPI) SPF Chemical Health and Safety Training are some other choices.
- Have all the workers, including applicators and helpers had training?
- Do you have adequate insurance?
- How much experience do you have in installing spray polyurethane foam for this application?
- What references do you have for similar jobs?
- Who will be supervising the job?
Selecting a SPF Contractor with Experience – Center for Polyurethanes Guidance

- Here are some additional questions on safety to ask a prospective SPF contractor before selection:
  - Describe your company’s safety record.
  - Do you keep Material Safety Data Sheets (MSDS) for the SPF products readily available?
  - Do you have a Respiratory Protection Program for workers and can you share a copy?
  - Has someone on the worksite received the U.S. Occupational Safety and Health Administration (OSHA) 10-hour training?
  - What safety precautions do you typically undertake to protect the general population and nearby property?
  - When can the general public re-enter the building following application?
  - How can I reach you if I have questions after the job is completed?
Making the correct choice

“The Bitterness of Poor Quality Lingers Long After
The Sweetness of Low Cost is Forgotten”

- Benjamin Franklin
choices
Choices
Choices
Choices
Choices
Choices
Documentation: Insulation Cards for Spray Foam (per IRC N1101.8)

**BASF Corporation Product(s) Installed:**

- **COMFORT FOAM**
- **SPRAYTITE**
- **ENERGIT**

<table>
<thead>
<tr>
<th>Area Insulated</th>
<th>R-value</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attic Area</td>
<td>R-</td>
<td></td>
</tr>
<tr>
<td>Sidewalls</td>
<td>R-</td>
<td>Inches</td>
</tr>
<tr>
<td>Walls (Where:</td>
<td>R-</td>
<td>Inches</td>
</tr>
<tr>
<td>Floors (over an unheated crawl space)</td>
<td>R-</td>
<td>Inches</td>
</tr>
<tr>
<td>Crawlspace Perimeter</td>
<td>R-</td>
<td>Inches</td>
</tr>
<tr>
<td>Basement Exterior Walls</td>
<td>R-</td>
<td>Inches</td>
</tr>
<tr>
<td>Other (Where:</td>
<td>R-</td>
<td>Inches</td>
</tr>
</tbody>
</table>

*Nominal thicknesses are representative of a field-sprayed foam from material.*

**Insulation Card - Do Not Remove**

**Test Agency:** InterET Testing

**Test Report:**
- 3116019-021 (a, b, c)
- 3116019-022 (a, b, c)

**Product Tested:** SPRAYTITE® and COMFORT FOAM®

**Testing and Compliance Criteria:**

- Applicable requirements of NFPA 286 and IBC Section 803.2

**Evaluation Property:**

- Heat Release and Flame Spread

- Calculations:
  - COMFORT FOAM: Class 1 (25 or less)
  - SPRAYTITE: Class 2 (75 or less)

**Test Report Conclusion:**

The sample submitted, installed, and tested as described in this report displays low levels of heat release, and low upper level temperatures. The heat flux on the floor did not reach flashover levels. The sample did not spread flames to the ceiling during the 40 kW exposure. The flames did not spread to the extremities of the 12-foot walls or the 8-foot wall during the test. The sample did not exhibit flashback conditions during the test. NFPA 286 does not publish pass/fail criteria. One must consult the codes to determine pass/fail. This specimen did meet the criteria set forth in the 2006/2008 IBC Section 803.2.

**Caution—No Hot Work—Polyurethane foam is combustible and should be treated as such. No welding or cutting unless foam has been protected from accidental ignition by open flame.**

---

**Insulation Card - Do Not Remove**

**Jobsite Location:**

**Date Installed:**

**Building Contractor:**

**Insulation Contractor:**

**Installed By:**

---

**ISO 9001:2020 Accredited Facilities—Minneapolis, MN and Houston, TX**

March 2011
Recognition of Completion

OMAN, BRIAN
ID Number: 0000000077

successfully completed

HIGH PRESSURE SPF - SAFETY TRAINING

presented by

The Center for the Polyurethanes Industry of the American Chemistry Council

Instructor: ONLINE
Completed: 01/30/2013
Expiration: 01/30/2015
Course Code: ACCSPF001
Documentation: ICC Evaluation Reports

- Use to validate manufacturer and contractor claims.
- Effective February 1st, 2011, all ESR’s were required to be updated with new test protocols including Appendix X for attic and crawlspace applications.
- Go to www.icc-es.org to view updated reports
Documentation: Product Technical Data Sheets

### Typical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Method</th>
<th>SPRAYTITE 178</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Gravity @ 70°F</td>
<td>ASTM D 1638</td>
<td>1.175</td>
</tr>
<tr>
<td>Viscosity @ 70°F (cps)</td>
<td>Brookfield</td>
<td>500</td>
</tr>
<tr>
<td><strong>Cured Foam</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density, core (pcf @ 2&quot; lifts)</td>
<td>ASTM D 1622</td>
<td>2.0 – 2.3</td>
</tr>
<tr>
<td>Thermal Resistance (aged)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k-factor (Btu in/ft² hr °F)</td>
<td>ASTM C 518</td>
<td>0.149 @ 1-in thick</td>
</tr>
<tr>
<td>R-value (ft² hr °F/Btu in)</td>
<td>Calculated</td>
<td>0.15 @ 4-in thick</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.7 / in @ &lt; 4-in thick</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.9 / in @ ≥ 4-in thick</td>
</tr>
<tr>
<td>Compressive Strength (psi)</td>
<td>ASTM D 1621</td>
<td>26 - 30%^</td>
</tr>
<tr>
<td>Water Vapor Transmission – Permability (perm-inch)</td>
<td>ASTM E 96</td>
<td>1.39</td>
</tr>
<tr>
<td>Water Vapor Transmission – Permeance (perms)</td>
<td>ASTM E 96</td>
<td>0.70 @ 2&quot; thickness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.46 @ 3&quot; thickness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.35 @ 4&quot; thickness</td>
</tr>
<tr>
<td>Water Absorption (vol %)</td>
<td>ASTM D 2842</td>
<td>0.60</td>
</tr>
<tr>
<td>Tensile Strength (psi)</td>
<td>ASTM D 1623</td>
<td>62.4 (Type C)</td>
</tr>
<tr>
<td>Response to Thermal and Humid Aging (% linear change)</td>
<td>ASTM D 2126</td>
<td>4.9</td>
</tr>
<tr>
<td>Closed Cell Content (%)</td>
<td>ASTM D 6226</td>
<td>98</td>
</tr>
<tr>
<td>Surface Burning Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flame Spread Index (2)</td>
<td>ASTM E 84</td>
<td>≤ 25</td>
</tr>
<tr>
<td>Smoke Developed Index</td>
<td>ASTM E 84</td>
<td>≤ 350</td>
</tr>
</tbody>
</table>

The coefficient of thermal expansion varies between 3x10⁻⁵ and 4x10⁻⁴ 1/K or 1.5x10⁻⁵ and 2x10⁻⁴ 1/°F. The lower end of the range relates to closed-cell SPF while the higher values were reported for open-cell foams.
What are the Benefits of SPF?

<table>
<thead>
<tr>
<th>Uses - Benefit</th>
<th>Fiberglass Batts</th>
<th>Cellulose</th>
<th>XPS</th>
<th>EPS</th>
<th>Open Cell SPF</th>
<th>Closed Cell SPF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation (R/inch)</td>
<td>3.0-4.0</td>
<td>3.0-4.0</td>
<td>5.0</td>
<td>3.0-4.0</td>
<td>3.6-4.5</td>
<td>5.8-6.8</td>
</tr>
<tr>
<td>Air Barrier/Air Impermeable</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Water Vapor Retarder</td>
<td>*</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Water Resistant</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Cavity Insulation</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Continuous Insulation</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Low-Slope Roofing (Ext)</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Formaldehyde-Free</td>
<td>*</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Structural Strength</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
Residential / Light Commercial Applications with Open-cell SPF

Open-cell ½# SPF for residential and light commercial structures (garage, barns, etc.)

- 2-4x the installed cost of conventional insulation, but energy savings also allow greater payback than most insulation materials – more than just insulation:
  - High expansion-fills studs
  - Speedy, single pass application
  - Air barrier performance
  - Higher insulation performance (similar R-value to conventional)
  - Moisture & vapor permeable
  - Non-structural
  - Sound absorption & control
Residential / Light Commercial Applications with Closed-cell SPF

- Closed-cell 2# SPF for residential and light commercial structures (garage, barns, etc.)
  - 3-5x the installed cost of conventional insulation, but greater energy savings over time than any other insulation system – more than just insulation:
    - Controlled expansion, can be used in combination approach with other insulations in cavity
    - Adds strength - Straighter, stronger walls
    - Storm resistance in sealed attics
    - Highest insulation performance
  - Moisture and vapor resistance
  - Superior air barrier material
  - Sound barrier
Questions?

- Spray foam product questions?
- Application questions?
- OSHA Compliance and safety questions?

Thank you for your time and attention today!
THANK YOU!

BASF Corporation is committed to sustainable solutions for construction applications.

www.spf.basf.com
888-900-FOAM

Brian Oman – Application Specialist
Brian.Oman@basf.com
612-600-0750 (cell)