REDUCING RISK ON COMMERCIAL SPRAY FOAM JOBS

The comments and opinions in this presentation do not necessarily represent or reflect those of SPFA.
MASON KNOWLES

- More than 43 years of experience in the polyurethane industry as a contractor, material/supplier manufacturer, equipment manufacturer, and trade association professional
- Chairman of ASTM Subcommittee on Spray Polyurethane Foam Roofing
- Chairman of SPFA Consultant’s Committee
- Chairman of ASTM Task Group for the spray polyurethane foam standard specification
TYPES OF COMMERCIAL BUILDINGS

- Office buildings
- Warehouses
- Manufacturing facilities
- Hospitals
- Schools
- Government buildings
- Specialty
  - Food processing
  - Cold storage
  - Swimming pools
SPF COMMERCIAL INSULATION APPLICATIONS
BIDS & PROPOSALS

- Scope of work
- Plans & specifications
- Equipment and resources
- Scheduling & staging issues
- Contract Issue
- Estimating
SCOPE OF WORK

- Purpose of spray foam application
  - Insulation (energy efficiency)
  - Air sealing
  - Moisture vapor retarder
  - Sound proofing
  - Structural enhancement
  - Secondary rain barrier
  - Other
IS SPRAY FOAM RIGHT CHOICE FOR THE JOB?

- Physical properties required for the task
- Code compliant?
- Conditions favorable for successful application?
  - climate/environment,
  - space limitations,
  - Scheduling or logistic problems
PLANS & SPECIFICATIONS

- Blue Prints
  - Can you read them?
  - Are they accurate?
  - What do they leave out?
  - Are design details complete?
  - What assemblies or rooms
What are you bidding on?
- Sprayfoam application only
- Fiberglass
- HVAC

Other materials
- Thermal/ignition barriers, primers, vapor retarders, flashing, transition membrane, etc.
**DETERMINE SPF INSULATION THICKNESS**

- Average, minimum & tolerances for each assembly
- Calculate based on minimum requirements to:
  - Provide adequate energy performance
  - Provide condensation control
  - Meet building code requirements
EXAMPLES OF DESIGN DETAILS

Details provided courtesy of BASF & NCFI (for reference use only)
EXTERIOR MASONRY WALL
LOWER SECTION

COMPOSITION
1. Concrete block
2. Flashing membrane
3. Transition membrane
4. Type 1 vapour barrier
5. Caulking
6. Weep hole
7. Architectural masonry
8. Masonry tie
EXTERIOR MASONRY WALL
LOWER SECTION

COMPOSITION

1. Concrete block
2. Flashing membrane
3. Transition membrane
4. Type 1 vapour barrier
5. Waterproofing coating (optional)
6. Weep hole
7. Architectural masonry
8. Masonry tie
9. Caulking

WALLTITE
EXTERIOR WALL OPENING
EXTERIOR WALL OPENING

COMPOSITION
1. Concrete block
2. Caulking
3. Wood blocking
4. Architectural masonry
5. Masonry tile
6. Transition membrane
7. Window
8. Flashing membrane

WALLTITE

WALLTITE
EXTERIOR MASONRY WALL
UPPER SECTION

COMPOSITION

1. Waterproofing membrane
2. Fiber board
3. Roofing insulation
4. Vapour barrier
5. Gypsum board
6. Transition membrane
7. Steel structure
8. Plate cushion
9. Concrete block
10. Masonry tie
11. Architectural masonry
12. Air vent
EXTERIOR STRUCTURE/WALL ASSEMBLY

COMPOSITION
1. Concrete block
2. Steel structure
3. Masonry tie
4. Architectural masonry
5. Transition membrane / Flashing membrane
6. Caulking
COMPOSITION

1. Concrete block
2. Steel structure
3. Masonry tile
4. Architectural masonry
5. Transition membrane

WALLTITE

WALLTITE
INTERIOR CMU WALL

- Exterior Wall (Masonry, concrete, stone or other)
- Air space between Spray Foam and Interior Finish Surface
- Interior Finish Surface (1/2-inch Sheetrock)
- 2 x 4 or 2 x 6 Studs offset from exterior wall 3/4" to 1"
- InsulStar, InsulBloc or ThermalStop Spray Foam
CROSS SECTION
WOOD FRAME WALL

Interior Partition

Interior Finished Surface
(1/2-inch Sheetrock)

InsulStar Spray Foam
Thickness determined by
design R-value

Exterior Sheathing

Stud Wall: Thickness
by Design R-Value
AIR BARRIER DETAIL
WOOD FRAME WALLS

LEGEND

1. Sealant between polyethylene air / vapour barrier and wall plate.
2. Airtight gasket between wall plate and subfloor. Seal subfloor joints.
3. Sealant between subfloor and floor header.
4. Sealant between plate and concrete foundation wall.
5. Moisture barrier up to level of grade.

WALLTITE

Air barrier system continuity.
BELOW GRADE FOUNDATION WALL

NOTES:
1. CHECK WITH LOCAL BUILDING AUTHORITY REGARDING TERMITE INFESTATION POTENTIAL BEFORE USING THIS DETAIL
2. LEAVE AN INSPECTION GAP (6 INCHES MIN) BETWEEN SPRAY FOAM AND WOOD FRAMING.
Bid mistakes

- Failure to include overhead
- Unrealistic production estimate
- Optimistic yield estimate
- Lowering price to match low bid
- Failure to list specifics:
  - Tolerances, work included & excluded from bid, conditions of payment, staging issues, services required of GC and not required of GC, etc.
- Not accounting for delays
  - Weather, equipment problems, shipping, other trades, permits, etc.
ICAA CONTRACT DOCUMENTS

- ICAA Standard Bid Terms and Conditions
- ICAA Standard Exclusions and Clarifications
- ICAA Alerts: Contract Killer Clauses
ICAA BID TERMS AND CONDITIONS

- Right to stop work
- Retainage
- Interest payment & cost of collection
- Lien/Bond rights
- Claims against Subcontractor
- Liquidated damages
- Force Majeure
- Indemnification
- Additional Insured
- Change Orders
- Cooperation
- Other contract documents
- Right to claim against owner
- Subrogation
- Delays
- Dispute resolution
- No different terms
- Back charges & surcharges
OTHER CONTRACT ITEMS

- Payments
  - Materials paid for up front
  - Progress payments upon completion of specific portions
  - Final payment upon successful final inspection

- Storage and staging area

- Specify service/equipment charges that are not needed, (insurance, trash removal, etc)

- Provisions for multiple set ups
CONTRACT KILLER CLAUSES

- Contingency payment clause
- No damages for disruption
- Agreement to continue work in face of non-payment
- Indemnification
- Additional insured
- Dispute resolution
- Change order procedures
- Attorney’s fees
- Liquidated damages clauses
- No waivers by incorporation by reference
STANDARD EXCLUSIONS & CLARIFICATIONS

- Not responsible for hoisting charges, (labor only)
- Exclude trash removal charges
- Not responsible for fire rating design
- Insist on 30 days written notice to proceed
- Quotation good for 30 days
- Shop drawings not included
- Scope limited to proposal
- Subcontractor not responsible for design flaws or work out of sequence
- Not responsible for weather delays

- Assume areas to be insulated are free of obstructions and safe
- Not responsible for damage after completion
- Cost of repair (not fault of subcontractor) paid by owner, GC
- Retainage due within 30 days of acceptance of work
- Terms contained herein supersede any contract conditions, schedules or conflicting terms
BUILDING CODE COMPLIANCE

- **IBC**
  - Fire resistance
  - Moisture control
  - Ventilation
  - Termite

- **IECC**
  - R-value or U factors

- **IMC**
  - HVAC and ductwork
Figure 2603.1
FOAM PLASTIC COMPLIANCE

25.4 mm.

Is the product labeled according to Section 2603.27?
Yes

Does the application meet Section 2603.3 – FS 275 & SD 450 at 4" thick max, or is it covered by one of the five exceptions?
Yes

Is there a thermal barrier in place per Section 2603.4 or is the application covered by one of the exceptions in Sections 2603.4.1.1 to 2604.4.1.137?
Yes

Is the application an exterior wall of building Type I, II, III or IV?
Yes

Is the application an exterior wall of building Type V?
Yes

Is the application a roof?
Yes

Is the application a plenum?
Yes

Is the application in a "very heavy" termite infestation area according to Figure 2603.87?
Yes

Does the application meet the requirements of Section 2603.87?
Yes

Is the application meet Section 2603.97?
No

Not code compliant

Does the application meet the requirements of Section 2603.3 and 2603.97?
Yes

Does the application meet the requirements of Section 2603.67?
Yes

Does the application meet the requirements of Section 2603.77?
Yes

Meets Code

Not code compliant
Minimum requirements (general use) Class II (ASTM E-84, UL 263)
- 75 or less flame spread
- 450 or less smoke developed

Class I required in sill plates, exterior walls
- 25 or less flame spread
- 450 or less smoke developed
IBC requires thermal barriers over foam plastic in inhabited spaces
APPROVED THERMAL BARRIERS

- Code listed materials
  - 1/2” gypsum drywall
  - 1” concrete/masonry
- Products tested and approved in accordance with NFPA 275
  - Tests fire retardence of assembly (E-119)
  - Confirms thermal barrier will remain in place during a fire
THERMAL BARRIER EXCEPTIONS

- Covered with 1 inch masonry or concrete
  - Cavity of a hollow masonry wall
  - Core of a concrete-faced panel
  - Exterior face of a masonry wall (covered with an exterior finish)
  - Within cores of hollow masonry wall
  - Encapsulated within a minimum of 1 inch masonry or concrete such as insulated tilt-up or pour-in-place concrete panels
Cooler and freezer walls up to 10 inches

- Flame spread of 25 or less, smoke no more than 450
- Flash ignition and self-ignition temperatures not less than 600 F and 800 F respectively
- Have covering of not less than 0.032 inch aluminum or corrosion resistant steel not less than 0.016 inch
- Protected by an automatic sprinkler system
Walk-in Coolers

- Foam no thicker than 4 inches
- Aggregate floor area no more than 400 sq ft.
- Covered with aluminum facing not less than 0.032 inch or corrosion resistant steel not less than 0.016 inch
Exterior walls-one-story buildings

- Thickness no more than 4 inches
- Class 1 Foam (25 flame spread, 450 smoke)
- Covered with specified metal facings
- Building equipped with automatic sprinkler system
Roofing

- When foam plastic in a roof assembly or roof covering is installed in accordance with the code and is separated from the interior by tongue-and-groove wood planks or structural sheathing not less than 0.47 inch”.

- AND is part of a Class A, B, or C roof covering assembly provided the assembly passes FM 4450 or UL 1256
Ignition barriers allowed in attics and crawlspaces where;

- Space is used only for service of utilities
- Limited access
- No storage
- Doesn’t require utilities to be in space to require ignition barrier
IGNITION BARRIERS

- 1.5” mineral fiber insulation
- 1/4” wood structural panel
- 3/8” particle board
- 1/4” hardboard
- 0.016” corrosion resistant steel
Exposed sprayfoam allowed provided

- 3.25 inch maximum thickness
  - Code change pending

- Class I sprayfoam
  - 25 or less flame spread
  - 450 or less smoke developed
THERMAL BARRIER EXCEPTIONS

- Floors
  - Foam plastic covered by 1/2 inch wood or equivalent
  - If underside of floor is exposed to the interior of the building, a thermal barrier is required over the foam
**EXTERIOR WALLS**

- Types I, II, III or IV required to have fire resistive rating
- Fire resistive wall w/foam must be tested in accordance with ASTM E-119 or UL 263
- Wall assembly tested in accordance with NFPA 268 (tests sustained flaming)
- Exterior walls tested in accordance with NFPA 285 (flames from exterior source)
- Potential heat of foam in assembly not to exceed potential heat of the foam measured as tested in accordance with NFPA 259
- Class 1 foam required
- Covered with thermal barrier
PLENUMS

- Foam not permitted as interior wall or ceiling finish in plenums except when protected by a thermal barrier
Assemblies approved in accordance with specific fire tests on assemblies that are related to the end use configuration

Fire tests:
- UL 1715
- FM 4880
- UL 1040
- NFPA 286 (w/acceptance criteria of R316.2-R316.4)
TERMITE PROTECTION

Areas of heavy termite infestation
- Foam plastic, EPS, XPS, Polyiso, SPF not allowed to interior or exterior foundation walls or slab foundation below grade

Exceptions
- Walls, floors, ceiling, roofs made of non-combustible materials or treated wood
- Foam plastic and structure is provided with approved termite damage protection
- Interior of basement walls
IBC requires ventilation in attics and crawlspaces

- Non-vented attics and crawlspaces not specifically addressed in the IBC
- Use of non-vented attics and crawlspaces would require specific approval from code official in writing
MOISTURE PROTECTION
INTERIOR WALLS

- Class 1 or II Vapor Retarders on interior of frame walls in all climate zones
- Class III vapor retarders not permitted in zones marine 4, & 5-8
  - Unless complies with Table 1405.3.1
VAPOR RETARDER CLASSES

- **Class 1:** 0.1 perms or less
- **Class II:** Greater than 0.1 perms up to 1.0 perms
- **Class III:** Greater than 1.0 up to 10 perms
- **Class IV:** Greater than 10 perms
VAPOR RETARDER CLASSES OF SPRAYFOAM

- Closed cell sprayfoam
  - Class III @ 1/2 to 1 inch
    - 1-2 perms at 1 inch
  - Class II at 2 inches or more
    - Less than 1 perm at 2 inches

- Open cell sprayfoam
  - Class III or IV at 3.5 inches depending on formula
    - 8-15 perms per 3.5 inches
### MINIMUM SPRAYFOAM FOR CONDENSATION CONTROL IN WALLS

<table>
<thead>
<tr>
<th>Marine 4</th>
<th>2 x 4</th>
<th>2 x 6</th>
<th>R – 2.50</th>
<th>R – 3.75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 5</td>
<td>2 x 4</td>
<td>2 x 6</td>
<td>R – 5.00</td>
<td>R – 7.50</td>
</tr>
<tr>
<td>Zone 6</td>
<td>2 x 4</td>
<td>2 x 6</td>
<td>R – 7.50</td>
<td>R – 11.25</td>
</tr>
<tr>
<td>Zone 7 &amp; 8</td>
<td>2 x 4</td>
<td>2 x 6</td>
<td>R – 10</td>
<td>R – 15</td>
</tr>
</tbody>
</table>

MINIMUM SPRAYFOAM FOR CONDENSATION CONTROL IN WALLS
## IECC R VALUE REQUIREMENTS

**Wood frame walls**

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Ceiling</th>
<th>Wall</th>
<th>Floor</th>
<th>Basement</th>
<th>Crawl Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R-30</td>
<td>R-13</td>
<td>R-13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>R-38</td>
<td>R-13</td>
<td>R-13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>R-38</td>
<td>R-20 or 13 + 5</td>
<td>R-19</td>
<td>0</td>
<td>5/13</td>
</tr>
<tr>
<td>4</td>
<td>R-49</td>
<td>R-20 or 13+5</td>
<td>R-19</td>
<td>10/13</td>
<td>10/13</td>
</tr>
<tr>
<td>5 &amp; Marine 4</td>
<td>R-49</td>
<td>R-20 or 13+5</td>
<td>R-30</td>
<td>15/19</td>
<td>15/19</td>
</tr>
<tr>
<td>6</td>
<td>R-49</td>
<td>R-20 +5 or 13+10</td>
<td>R-30</td>
<td>15/19</td>
<td>15/19</td>
</tr>
<tr>
<td>7 &amp; 8</td>
<td>R-49</td>
<td>R-20 +5 or 13+10</td>
<td>R38</td>
<td>15/19</td>
<td>15/19</td>
</tr>
</tbody>
</table>
## 2012 MAJOR R VALUE CHANGES

<table>
<thead>
<tr>
<th>Zone</th>
<th>Ceiling R-Value</th>
<th>Wood-Frame Wall-R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>2</td>
<td>R-30 to R-38</td>
<td>No change</td>
</tr>
<tr>
<td>3</td>
<td>R-30 to R-38</td>
<td>R-13 to R-20/R-13+5</td>
</tr>
<tr>
<td>4</td>
<td>R-38 to R-49</td>
<td>R-13 to R-20/R-13+5</td>
</tr>
<tr>
<td>marine 4 and 5</td>
<td>R-38 to R-49</td>
<td>No change</td>
</tr>
<tr>
<td>6</td>
<td>No change</td>
<td>R-20/R-13+5 to R-20+5/R-13+10</td>
</tr>
<tr>
<td>7-8</td>
<td>No change</td>
<td>R-21 to R-20+5/R-13+10</td>
</tr>
</tbody>
</table>
## 2012 IECC- MAJOR CHANGES

<table>
<thead>
<tr>
<th>Zone</th>
<th>Basement Wall R-Value</th>
<th>Crawlspace Wall R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>2</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>3</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>4</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>5 &amp; Marine 4</td>
<td>R-10/13 to R-15/19</td>
<td>R-10/13 to R-15/19</td>
</tr>
<tr>
<td>6</td>
<td>No change</td>
<td>R-10/13 to R-15/19</td>
</tr>
<tr>
<td>7 &amp; 8</td>
<td>No change</td>
<td>R-10/13 to R-15/19</td>
</tr>
</tbody>
</table>
Whole house pressure test

<table>
<thead>
<tr>
<th>Air Leakage Rate</th>
<th>Climate Zone</th>
<th>Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5 ACH</td>
<td>1-2</td>
<td>50 kPa</td>
</tr>
<tr>
<td>≤ 3 ACH</td>
<td>3-8</td>
<td>50 kPa</td>
</tr>
<tr>
<td>COMPONENT</td>
<td>CRITERIA*</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Air barrier and thermal barrier</td>
<td>A continuous air barrier shall be installed in the building envelope.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exterior thermal envelope contains a continuous air barrier.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Breaks or joints in the air barrier shall be sealed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Air-permeable insulation shall not be used as a sealing material.</td>
<td></td>
</tr>
<tr>
<td>Ceiling/attic</td>
<td>The air barrier in any dropped ceiling/soffit shall be aligned with the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>insulation and any gaps in the air barrier sealed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Access openings, drop down stair or knee wall doors to unconditioned attic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spaces shall be sealed.</td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td>Corners and headers shall be insulated and the junction of the foundation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and sill plate shall be sealed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The junction of the top plate and top of exterior walls shall be sealed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exterior thermal envelope insulation for framed walls shall be installed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in substantial contact and continuous alignment with the air barrier.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knee walls shall be sealed.</td>
<td></td>
</tr>
<tr>
<td>Windows, skylights and doors</td>
<td>The space between window/door jambs and framing and skylights and framing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>shall be sealed.</td>
<td></td>
</tr>
<tr>
<td>Rim joists</td>
<td>Rim joists shall be insulated and include the air barrier.</td>
<td></td>
</tr>
<tr>
<td>Floors (including above-garage</td>
<td>Insulation shall be installed to maintain permanent contact with underside</td>
<td></td>
</tr>
<tr>
<td>and cantilevered floors)</td>
<td>of subfloor decking.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The air barrier shall be installed at any exposed edge of insulation.</td>
<td></td>
</tr>
<tr>
<td>Crawl space walls</td>
<td>Where provided in lieu of floor insulation, insulation shall be permanently</td>
<td></td>
</tr>
<tr>
<td></td>
<td>attached to the crawlspace walls.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exposed earth in unvented crawlspace walls shall be covered with a Class</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I vapor retarder with overlapping joints taped.</td>
<td></td>
</tr>
<tr>
<td>Shafts, penetrations</td>
<td>Duct shafts, utility penetrations, and flue shafts opening to exterior or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>unconditioned space shall be sealed.</td>
<td></td>
</tr>
<tr>
<td>Narrow cavities</td>
<td>Batts in narrow cavities shall be cut to fit, or narrow cavities shall be</td>
<td></td>
</tr>
<tr>
<td></td>
<td>filled by insulation that on installation readily conforms to the available</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cavity space.</td>
<td></td>
</tr>
<tr>
<td>Garage separation</td>
<td>Air sealing shall be provided between the garage and conditioned spaces.</td>
<td></td>
</tr>
<tr>
<td>Recessed lighting</td>
<td>Recessed light fixtures installed in the building thermal envelope shall</td>
<td></td>
</tr>
<tr>
<td></td>
<td>be air tight, IC rated, and sealed to the drywall.</td>
<td></td>
</tr>
<tr>
<td>Plumbing and wiring</td>
<td>Batt insulation shall be cut neatly to fit around wiring and plumbing in</td>
<td></td>
</tr>
<tr>
<td></td>
<td>exterior walls, or insulation that on installation readily conforms to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>available space shall extend behind piping and wiring.</td>
<td></td>
</tr>
<tr>
<td>Shower/tub on exterior wall</td>
<td>Exterior walls adjacent to showers and tubs shall be insulated and the air</td>
<td></td>
</tr>
<tr>
<td></td>
<td>barrier installed separating them from the showers and tubs.</td>
<td></td>
</tr>
<tr>
<td>Electrical/phone box on exterior</td>
<td>The air barrier shall be installed behind electrical or communication</td>
<td></td>
</tr>
<tr>
<td>walls</td>
<td>boxes or air sealed boxes shall be installed.</td>
<td></td>
</tr>
<tr>
<td>HVAC register boots</td>
<td>HVAC register boots that penetrate building thermal envelope shall be</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sealed to the subfloor or drywall.</td>
<td></td>
</tr>
<tr>
<td>Fireplace</td>
<td>An air barrier shall be installed on fireplace walls. Fireplaces shall</td>
<td></td>
</tr>
<tr>
<td></td>
<td>have gasketed doors.</td>
<td></td>
</tr>
</tbody>
</table>

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.
CRAWLSPACES
Ventilation:

- Under-floor space: 1 sq ft of vents for each 150 sq ft or underfloor space area
- Class I vapor retarder material on the ground, 1 sq ft of vents per each 1,500 sq ft
Cross ventilation required:

- Total net free ventilated area not less than 1/150 of the area of the space ventilated
- Can be reduced to 1/300 of the area when a Class I or II vapor barrier is installed on the warm-in-winter side of the ceiling
PERFORMING THE WORK

- Personnel
  - Trained to do the work
  - Sufficient number of workers

- Equipment
  - Suitable for the job
  - Good condition
  - Back up rigs readily available
  - Spare parts on site
GENERAL CONTRACTOR ISSUES

- Schedule dependent on other trades & weather
- Work behind schedule before you arrive on the job
- Pushing for completion regardless of weather or other factors that stop production
- Shipping & storage
- Other trades hindering work
- Unrealistic inspection criteria
STAGING

- Storage area for materials
  - Climate controlled and secure
- Dedicated area for foam rigs, other equipment and tools
  - May need multiple staging areas on large jobs
- Secure work zone with warning signs, barricades and safety monitors
- Coordinate GC
- Anticipate staging problems such as uneven terrain, other trades in the area, limited access
SAFETY, HEALTH AND FIRE PRECAUTIONS

- Protect against fumes and mist
  - Ventilate area
  - Use appropriate PPE
- Designate, isolate & contain work areas
  - Enclosures, warning signs & tape, barricades, safety monitor
- Notify other trades
SAFETY AND HEALTH

- Fire prevention plan
  - Warning signs against hot work
  - Fire extinguishers
  - Notify other trades
- Emergency plan
- Hazard communication plan
- Fall protection plan
- Confined space (attics, crawlspace)
MASKING & OVERSPRAY

- Overspray plan specific to each job
  - Move items that can be moved
  - Mask items that can’t be moved
  - Contain spray area
  - Protect items outside of the spray area if overspray can travel
DURING APPLICATION

- Recordkeeping
  - How much foam, where and who sprayed it.
  - Lot numbers and where the foam was installed
  - Temperature/humidity
  - Substrate preparation
  - Equipment settings
  - Foam thickness measurements
  - QC sampling
INSTALLATION

- Follow industry best practices and manufacturer’s written procedures
- Verify substrate and environmental conditions
- Use spray gun configuration appropriate for application
  - Small tip for detail and compartment spraying
  - Larger tip for wide open areas
- Use spray technique appropriate for the foam and application
SPRAY TECHNIQUES
(CLOSED CELL SPF)

- Picture frame
- Overlap 60%, make the foam grow at a steady rate
- Spray parallel to direction of the studs or direction of flutes
- 0.5 – 1.5 inch lifts
- Wait 10-15 minutes between lifts
- Check adhesion and cell structure at regular intervals
PICTURE FRAME AND SPRAY PARALLEL TO STUDS
Spray Techniques

- Full thickness in one pass
- Work pass back and forth
- Aim directly at studs to prevent gaps and voids
- Picture frame may be required if studs are set back from the wall
- Check for voids and gaps
INSTALL FOAM TO FULL THICKNESS IN ONE PASS
Change requests
Progress to completion
Delays
  - GC or other trades
  - Weather
  - Shipping or staging
  - Equipment
Safety meetings
Weird stuff and happenings
AFTER APPLICATION

- QC punch list
- Trim foam to spec
- Clean-up
  - Remove all tape/plastic, foam debris, etc
  - Take care of overspray (if any)
- Final walk-thru and inspection
QC PUNCHLIST

- Verify foam quality
  - Adhesion
  - Core samples
    - Cell structure
    - Voids, gaps
    - Physical properties, (compressive strength, density)
  - Check foam depth to spec (min and avg)
QC PUNCHLIST

- Thermal and/or ignition barrier
  - Sufficient thickness
  - Good adhesion
  - Good physical properties
TRIMMING AND CLEAN-UP

- Remember PPE
  - Respirator
  - Protective eyewear
  - Protective gloves
  - Protective footwear
3 levels of PPE depending on circumstances

- 1st level during or immediately after sprayfoam application
  - Air supplied respirator
  - Skin and eye protective clothing and equipment
  - Protective gloves
2\textsuperscript{nd} level

- Foam is set, more than 24 hours after application, but odors are still prevalent
  - Air purifying respirator
  - Eye protection
  - Protective gloves
3rd Level

- No odors, foam is cured, no off ratio or poorly mixed foam
  - HEP dust mask
  - Eye protection
  - Protective gloves
REMOVING & TRIMMING FOAM

- Tools:
  - Reciprocating saw
  - Keyhole saw
  - Drywall saw
LONG AND SHORT HANDLED SCRAPERS
KNIVES
SCRAPERS & PRYBARS
WIRE BRUSHES
CLEAN UP

- Brooms & Vacuums
CLEAN UP

- Vacuum mulcher, debris cart, and trash bags
QUALITY ASSURANCE INSPECTIONS

- Performed by trained and/or certified SPF professional
  - Manufacturer’s rep
  - SPF inspector
  - Knowledgeable owner’s representative
INSPECTION

- Obtain background information
  - Type and brand of foam
  - Lot numbers and where they were installed
  - Technical data sheet and application instructions
  - SDS of foam
  - Specified thickness
INSPECTION

- Obtain photos of representative areas of the application
- Measure and record minimum and average thickness of foam in multiple area
- Record uniformity of application
- Record defects and anomalies
IDENTIFY DEFECTS

- Off ratio or poorly mixed foam
- Insufficient thickness
- Poor adhesion to substrate or interlaminar
- Soft or hard foam
- Color variations
- Foam density irregularities
- Insufficient compressive strength
- Evidence of application over moisture, cold surfaces
- Surface profile & texture over acceptable variation
- Voids, fissures or gaps
- Poor cell structure
- Sloppy work or overspray
UNIFORMITY

- **2 pcf SPF (at 3.5 inches)**
  - Good: 0.25 inch variation
  - Fair: 0.5 inch variation

- **0.5 pcf SPF (at 5.5 inches)**
  - Good, 0.5 inch variation
  - Fair 0.75 inch variation
Itemize agreed upon extra charges (if any) for

- Change orders
- Approved extra work
- Delays due to GC or other trades, etc.

Submit final invoice with cover letter stating all work complete and due date for final payment

Provide warranties (if specified)
CONCLUSIONS

- Identify the scope of work and determine if proposed sprayfoam application is appropriate
- Determine if your company can perform the work
- Identify and address potential contract issue
- Confirm building code compliance of the sprayfoam application
- Bid smart, include clarifications and exclusions
CONCLUSIONS

- Develop & implement safety and health plans specific to project
- Install according to best practices
- Perform QC during application & develop punch list of items to correct before final walk thru or 3rd party inspection
- Keep good job records
- Trim and clean up
- Invoice for all approved work