What to Measure,
The Need to Measure,
And The Impact Not Knowing has on Your SPF Business and Profit

Tom Harris and Vince Kerr
ANTITRUST POLICY STATEMENT FOR SPRAY POLYURETHANE FOAM ALLIANCE MEETINGS

- It is and shall remain the policy of the Spray Polyurethane Foam Alliance ("SPFA"), and it is the continuing responsibility of every SPFA member company, SPFA meeting or event participant, as well as SPFA staff and leadership to comply in all respects with federal and state antitrust laws. No activity or discussion at any SPFA meeting or other function may be engaged in for the purpose of bringing about any understanding or agreement among members to (1) raise, lower or stabilize prices; (2) regulate production; (3) allocate markets; (4) encourage boycotts; (5) foster unfair or deceptive trade practices; (6) assist in monopolization; or (7) in any way violate or give the appearance of violating federal or state antitrust laws.

- Any concerns or questions regarding the meaning or applicability of this policy, as well as any concerns regarding activities or discussions at SPFA meetings should be promptly brought to the attention of SPFA’s Executive Director and/or its legal counsel.
Topics of Discussion

- Why are We Here
- General Safety Considerations
- Jobsite Setup
- Consumption VS. Yield
- Optimizing Process
Why are we Here?

- Comments from Applicators
  - Your yield is lower than my current product
  - How do I improve my yield
  - I can’t make it work

- Comments from Contracting Companies
  - I can’t afford to buy your foam
  - Your yield is lower than my current foam
  - If you lower your cost per pound....... 
  - My guys don’t like your foam
We’ve Come a Long Way........
Consider the following

According to Small Business Administration’s Office of Advocacy, four of the top reasons small businesses fail are;

- **Money**: Many small business owners underestimate the amount of money it takes.

- **Systems & Processes**: Creating SOP’S isn’t sexy, being inconsistent in how products and services are managed can lead to large losses that are commonly over looked till its too late

- **Poor Accounting Process**: 46% of small business owners reported they do not work with an accountant.

- **Evolution**: Initial success doesn’t mean continued success. Failing to monitor industry trends and evolve means being left behind.
In General Terms

If you are not measuring, how do you know where you are, and how to improve?

Peter Drucker:  "If you can’t measure it, you can’t improve it"

"Management is doing things right; Leadership is doing the right thing"
Which one of these affect the bottom line of your company?

- General Safety Considerations
- Jobsite Setup
- Consumption VS. Yield
- Optimizing Process
- Call Backs
- Lack of Preventive Maintenance
- Lack of Data
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*They all do!*
Start with the Obvious One - Yield

- Specific area covered at a specific depth by a specific amount of chemical
- Reported as:
  - Bd ft. / lb  This reporting unit allows foam-to-foam comparison
  - Bd ft. / set This reporting unit does not consider the total weight of the set

- The area (12” X 12” X 1” thick) covered by a specified volume or weight of chemical.

  OR

- A fictitious number provided to make my system look better than the product you’re using now....
Factors Affecting Yield

- How you report it
- How you use the number to compare foam systems
- Does NOT consider - R-Value / bd ft
- Does NOT consider - $$ / R-Value
Calculating Yield

Must include notations for;
- Substrate
  - Type
  - Texture
- Ambient Temp (outside)
- Environment Temp (spray area)
- Substrate Temp
- Elevation
- Equipment Settings
- Density (that day, that batch, etc)
- System Specific
Ambient Temperature / Substrate Temperature

Yield will vary with field conditions. This is a representation.
Ambient Temperature / Substrate Temperature

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Measure the Substrate Temperature
How to Calculate Yield

- Accurately measure the area (ft²)
- Area (ft²) X Total thickness (inches) = Total Board Feet required
- Use Historical Data
  - Same System
  - Similar Environmental Conditions
  - Similar Substrates
  - Same rig
  - Same crew
  - Need to look at how much chemical was consumed on those other jobs......
Trips and Traps

- Not including the ACTUAL opaque wall area (remove studs, windows, non-insulated areas)

- Not considering areas of the design which tend to “over-blow” (corners, hidden areas)
What Do I Measure?

30 ft. X 8 ft. wall section with 1 window

Method A

\[(30' \times 8' \times 3.8'') - (32'' \times 32'')\]

\[912 - 27 = 885 \text{ bd ft.}\]

Method B

\[(30' \times 8' \times 3.8'') - (32'' \times 32'') - (6.5 \times 8' \times 3.8 \times 1.75'') - (2 \times 30' \times 3.8'' \times 1.75'')\]

\[912 - 27 - 2.4 - 1.5 = 880 \text{ bd ft.}\]
Trips and Traps

- Not considering areas of the design which tend to “over-blow” (corners, hidden areas)
  - Truss Overhangs
  - Behind piping
  - Angular Corners
Yield vs Consumption: Is There a Difference

**How do CHANGEOVERS AFFECT YIELD**

Changeovers reduce the AMOUNT of chemical in a set of foam. Changeovers properly performed typically discard between 2 ½ and 4 gallons of material on a average foam rig.

**WHAT does it cost to do a CHANGEOVER**

With labor and material the average cost associated with change overs is 250.00.

**TIME USAGE**

Careful planning as to procedures for various activities such as pour ups, change overs, refueling, ordering of parts, job completion times, travel, prep, must be looked at to reduce down time and loss of schedule.
Changeovers

How many times in a month do you do a changeover?

<table>
<thead>
<tr>
<th># Times Changed</th>
<th>Total Month</th>
<th>Total Based on 8 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>$750</td>
<td>$6,000</td>
</tr>
<tr>
<td>5</td>
<td>$1,250</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

- If we as installers do not follow procedure closely and consume more material during a changeover are we contributing to additional revenue erosion?

What about contamination due to improper procedure?

Are we as installers CONTRUBITING TO IMPROVE PROCEDURE BY WORKING WITH OUR SUPERVISORS?

A LOSS IS A LOSS AND IT EFFECTS EVERYONE INVOLVED IN A BUSINESS
Consumption:

- The amount of chemical required to cover a specific area at a specific depth

- Reported as;
  - Number of strokes indicated on the machine
  - Lb’s of chemical consumed - based on the stroke count
  - lb’s of chemical consumed - depth gage, scale
HOW TO CALCULATE CONSUMPTION

- # of Strokes X Cylinder volume (check the manual from the manufacturer)

- 2,067 strokes (cycles)
- 1 stroke = 0.0272 gallons/stroke (Graco E-30)
- 2,067 X 0.0272 = 56.2 gallons consumed (A+B)
- Convert gallons to lb’s
- 56.2 gallons X (1.15 (Av. Sp Gr) X 8.34)= 540 lb’s of System (a little over ½ a set)
Specific Gravity is Found on the TDS...

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>A-PMDI ISOCYANATE</th>
<th>SEALECTION 500 RESIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Brown</td>
<td>Amber</td>
</tr>
<tr>
<td>Viscosity @ 77°F (25°C)</td>
<td>100 - 330 cps</td>
<td>150 - 300 cps</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.24</td>
<td>1.08 - 1.12</td>
</tr>
<tr>
<td>Shelf Life of unopened drum properly stored</td>
<td>12 months</td>
<td>12 months</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>50 - 100°F (10 - 38°C)</td>
<td>50 - 100°F (10 - 38°C)</td>
</tr>
<tr>
<td>Mixing Ratio (volume)</td>
<td>1:1</td>
<td>1:1</td>
</tr>
</tbody>
</table>
Factors Affecting Consumption

- Thickness of single pass
- Application technique
- Density - Core and In-Place
- Environmental Conditions
Application Technique vs. Consumption
Picture Framing and Leveling
4,200 brd. Ft. / set

Picture Framing
4,800 brd. Ft. / set

Full fill - One Pass
5,200 brd. Ft. / set

Yield will vary with field conditions. This is a representation.
Density Plays a BIG role in Yield
Density  - Why / When / How
Density - Why

- Verification of Manufacturer’s TDS performance
- Visual check of Foam Quality
- Adds to the Data Pool

**Understand the Difference between CORE Density and In-Place Density**
Density - When

- After Every Start Up
- After Every change of Batch/Lot
- After Every change of Manufacturer
- After Every Critical Component Change-out

** Understand the Difference between CORE Density and In-Place Density**
Density - How

- **Weight for a specific volume**  \( \text{lb’s/ft}^3 \)

- **Measure the Weight**  \( \text{OZ’s / Gm’s} \)

- **Measure the Volume**
  1. Water Displacement Method
  2. Scale (Ruler)

- **Do the Math**
  \[
  \frac{\text{gm} \times 1000}{\text{ML}} = \text{Kg/m}^3
  \]
  \[
  \frac{\text{Kg/m}^3}{16.4} = \text{lb/ft}^3
  \]
Factors Affecting Density

- Ambient Temperature
- Substrate Temperature
- Equipment Settings
  - Pressure
  - Temperatures
- Drum Handling
  - Loss of BA
  - Agitation
Job Site Considerations
Jobsite Safety Considerations

- Protect the worker (Yours and others)
- Protect the home owner / occupant
- Protect the onlooker
Levels of OSHA Required Protection

A - Engineered Controls
   - Ventilation
   - Isolation Enclosure

B - Work Practice Controls
   - Written, taught and practiced procedures

C - Administrative Controls
   - Supervision

D - Personal Protective Equipment
   - The last resort

OSHA Requires a Job Analysis for Every Task and Process
Example of a Job Safety Analysis Form

<table>
<thead>
<tr>
<th>SEQUENCE OF BASIC JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>RECOMMENDED ACTION OR PROCEDURE</th>
</tr>
</thead>
</table>
| 1. Pull/push full dumpster into hydraulic lift gate. | • Lower back, arm, and shoulder strains.  
• Pinched hand between gate and ceiling dumpster.  
• Hitting head on horizontal gate member. | • Repair/improve condition of lot pavement.  
• Install larger wheels or properly inflate existing wheels.  
• Push dumpster to move, pull to steer/guide.  
• Wear protective canvas or leather gloves.  
• Install plugs to drain water from dumpster.  
• Use a tugger or other motorized cart to move dumpsters. |
| 2. Raise hydraulic lift gate to "UP" position, dumping contents. | None observed. | None observed. |
| 3. Spray remaining trash residue from raised dumpster with water. | • Trash particles and water spray into eyes. | • ANSI approved eye or face protection when spraying/cleaning the dumpster. |
| 4. Lower hydraulic lift gate and emptied dumpster back to ground level. | • Crushing injury if a person is under the lowering gate. | • Install an automatic lowering alarm.  
• Install an emergency-stop button on gate frame.  
• Install a physical barrier across entrance of gate frame to prevent entry. |
| 5. Pull empty dumpster from the gate to the designated area for placement on the grounds. | • Lower back, arm, and shoulder strains. | • Repair/improve condition of lot pavement.  
• Install larger wheels or properly inflate existing wheels.  
• Push dumpsters to move, pull to steer/guide.  
• Wear protective canvas or leather gloves.  
• Use a tugger or other motorized cart to move dumpsters. |
Personal Protection Equipment

Jobsite Basic PPE - Everyone on the job must wear the basics

- Safety Glasses
- Gloves
- Coveralls
- Respirator as required
- Face shield
Engineered Protection Ventilation

OSHA recommends both supply and exhaust fans for balanced ventilation while spraying polyurethane foams.
SPFA/ACC/CPI recommends re-occupancy after at least 24 hours of completion of the job, and proper ventilation.
Jobsite Setup
Considerations for Set Up

- Soil Conditions
  - Permeable - use a plastic ground sheet and dykes (absorbent pigs)
  - Impermeable - dykes - protect the drains
  - Angle

- Access (routine and emergency) (other trades)

- Visibility

- Tripping Hazards (ladders, electrical power chords)

- East Side / West / North / South

- Noise Pollution

- Wind Direction - Overspray (Protect Everything)

- Wheel Chalk
Considerations for Set Up

- Job Box Location
- Warning and Hazard signs
- Potable Water (no eating or drinking on the rig)
- Document Station (SDS/Plans/Details/TDS/Application Guidelines)
- Portable Tool Box (Lockable Storage)
- Medical Station (eye wash, medical kit, shower)
Spill Management

Minor Spills

• Isocyanate (A-Side) **Spill kit on every rig**
  o Iso activator = water (90%)
  Concentrated ammonia (3 - 8%)
  Detergent (2%)
  o Mix the neutralizing solution with isocyanate
  o Let stand for 48 hours to allow carbon dioxide to dissipate.

• Resin (B-side)
  o Absorbent material such as kitty litter can be used
Spill Management

Major Spills

• In transit, if a spill occurs contact CHEMTEC - 1-800-424-9300 (24 hours) Toll free in the U.S., Canada and the U.S. Virgin Islands. English or Spanish, collect calls are accepted.

• If necessary, temporarily control Isocyanate gases by covering the spill with protein foam. Large quantities may be pumped into containers to be disposed of later.

• Spills at the job site are to be cleaned up as per the MSDS.
Set to Go........

Daily Tool Box Talks
- Safety review for the worked plan for that day
- Materials / Approvals / Documentation for the day’s work
- 1 Specific “topic of the day”
- Sign in sheet

Drinking and Eating
- Wash Stations / towels
- Garbage cans / lids

Housekeeping
- Clean up as you work
- Team “sweep” the area after each day (tools, scrap, paper)
Have your rig safety accessible set up

- SDS BOOK
- PPE For Rig
- Eye Wash
- ABC Fire extinguishers
- Safety Zone Markers
- Job PPE Warning Signs
Areas where spraying is conducted should be designated as a:

**NO SMOKING AREA**

Smoking in the presence of polyurethane foam, increases the risk of fire.
Safe Use & Handling

SIX STEPS TO FIRE SAFETY

1) Conduct a safety meeting with other trades
2) Post warning signs at the site
3) Remove combustible materials from Hot Work Site
4) Shield spray foam insulation with fire blanket when necessary
5) Provide fire watch with extinguisher and telephone nearby
6) Protect the installed foam with the required thermal or ignition barrier as soon as possible
Never Mix Iso and Water!
But - BEFORE we pull the trigger........
Gather Data

- Log Book
- Daily Consumption Report
- Activity Report

Capture every aspect of the project
- Environmental
- Material
- Application
How to Optimize Formulation Performance

- Establish a Set-Up process
  - What do I do first
  - What do I do next

- Read the Foam and React to what you See and Measure

- Refer To Your Notes from previous jobs

- Refer To the TDS - as a suggested starting point
Recirculation of Open Cell Chemicals

- Recirculation is important in processing
- Bring up the temperature of chemicals in drums
  - Equalizes viscosity of chemicals
  - Aids in increasing yield
  - Balance pressures before spraying
Mix the Resin

- Mixing of materials (B) is associated with OPEN CELL ONLY
- Mixing of materials (B) in the drum is required to keep an even solution. Mixing the resin (B) prevents possible separation due to heat
- Mixing causes aeration = improvement in yield
- Use electric mixer, Air mixer
The Proper Type of Mixer is Required

Must have electric motor larger than $\frac{1}{4}$ hp
Processing Open Cell

- Cannot spray over while steam is coming out
  - Leads to improper adhesion,
- Spraying on rising foam
  - Lead to blow off
- After spraying move on
  - Do not stand and watch the foam growth
- Air Purge gun
  - Air could blow the foam off the wall

- The three reactions
  - Polyurethane (Plastic formation)
  - Carbon Dioxide (Blowing reaction)
  - Steam Generation (Cell opening)

- The proper timing of these three reactions are crucial in optimal foam production (cell opening)"
- Controlling Steam evolution is critical in processing
Application Techniques

- Too hot = shrinkage
- Too cold = voids behind the foam
- Start at the bottom and spray a thin layer of liquid chemicals
- Don’t stop to watch foam expanding

Start at Bottom
Application Techniques

- Spray liquid-on-liquid
  - Avoid spraying on rising foam
  - Spraying on rising foam causes blow off

- Hold gun perpendicular (90° angle) to the surface

- Air purged guns - FUSION, PROBLER, GAP

- After spraying, move gun away from foam

Gun held perpendicular to substrate (90° angle)
Physics Review

High temperature of chemicals
  = more closed cells
  Shrinkage
  Faster plastics formation
  Less yield

Low temperature of chemicals
  Large cells
  Voids behind the foam
  Lagging of the plastic formation
  Less yield
Set back & shrinkage with Tight Cells

High temperature of chemicals
  = more closed cells
Shrinkage
Faster plastics formation
Less yield

The small Carbon dioxide molecules leaves the closed cell creating a negative pressure. ATM pressure collapses

Corrective action?

Lower hose heat
Voids behind foam

Low temperature of Substrate
  Large cells
  Voids behind the foam
  Lagging of the plastic formation
  Steam blows off the foam from substrate

Corrective actions (compensate for low substrate temperature)?
  ➢ Increase substrate temperature
  ➢ Increase the chemical temperatures
  ➢ Spray closer to substrate
Mixing Chamber Selection is Important

- **Size of mixing chamber dictates the output**

- **Larger the orifices the greater the flow**

- **Greater the flow, higher the Delta of the Pre-heaters Needed**
Call Backs

- Two Reoccurring Issues
  - Odor
  - Condensation
Call Backs

- Impact Project Scheduling - your next project
- Impact reputation (>10 days to remedy)
- Takes time to investigate
- Dealing with “finished” interiors

The “typical” cost of Residential Call Back Service Work is 5X - 10X the cost of the original project - all things considered.
Odor

- Ventilation during and after installation (Direct Control)
- Tighter Building Envelope (Indirect Control - Awareness)
  - Occupancy use
  - Ventilation of downstream construction
    - Painting
    - VOC producing/containing building materials
Condensation - After Installation

- R-Value requirements are based on ASHRAE “Climate Zones”
- Climate Zones look at 50-150 year temperature data and average
- Designs based on these outdoor temperatures do NOT address;
  - Elevation of the structure (in the valley or high on a hilltop)
  - Wind washing (Wind-chill effects)
  - Height of the building (4 stories)
- Sometimes the outside temperature is below the design temperature
- Did we put enough insulation in the wall/ceiling/roofline
- What type of insulation
  - Permeable or Impermeable
  - Application gaps/holes in corners

In Most Cases, the ability of the assembly to hold moisture and dry will overcome the typically small amount of condensation caused by “super cold” outside temperatures.
Call Backs - Final Word

- Treat Call Backs as an opportunity for training........
  - Something is missing, wrong or not properly understood
Summary

- We’ve touched on;
  - Jobsite Setup
  - Safety
  - Measurements
  - Yield
  - Density
  - Call backs
Summary

- We’ve touched on;
  - Jobsite Setup
  - Safety
  - Measurements
  - Yield
  - Density
  - Call backs

We Trust you will try to **USE** the information presented to Improve your Company **Bottom Line**
Thank You

Questions?