# Achieve Operational Excellence with SPF

**Brian Cote', ICAA Spray Foam Task Force Chair**

# Topics

- **Considerations**
- **Production**
- **What could possibly go wrong?**
- **Yield**

# Considerations

Would you do it?

# Considerations (External)

- I google everything!
- I looked up Spray Foam and know all about it!
- Everything I smell bothers me.
- My children have asthma.
- My wife… husband is always sick.
- What else?

# Other Considerations (Internal)

- Number of passes
- Ventilation
- Pre Insulation work
- Trimming
- Masking

# Considerations

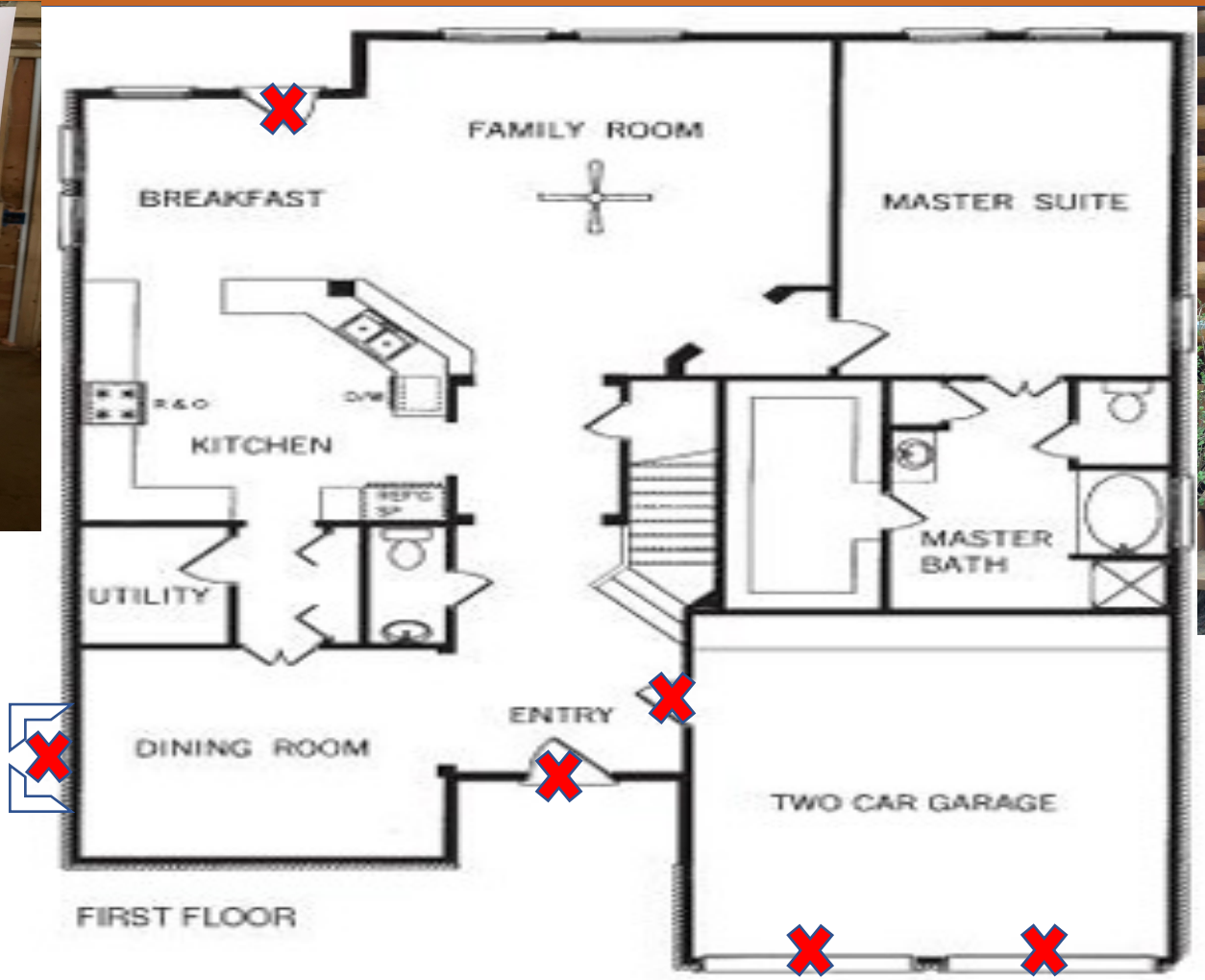


- Understand ACH.

In a room that measures 30’ X 30’ X 9” you would need 3 fans bringing air in and 4 exhausting air out to reach 40 ACH.

Has Re-Entry and Re-Occupancy been explained correctly?

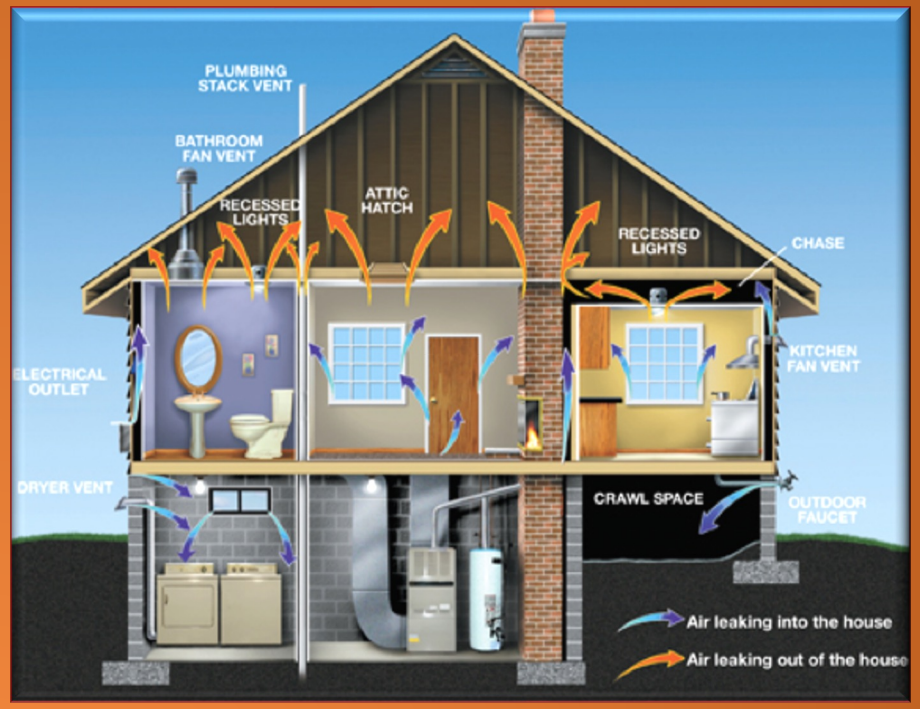
# Considerations

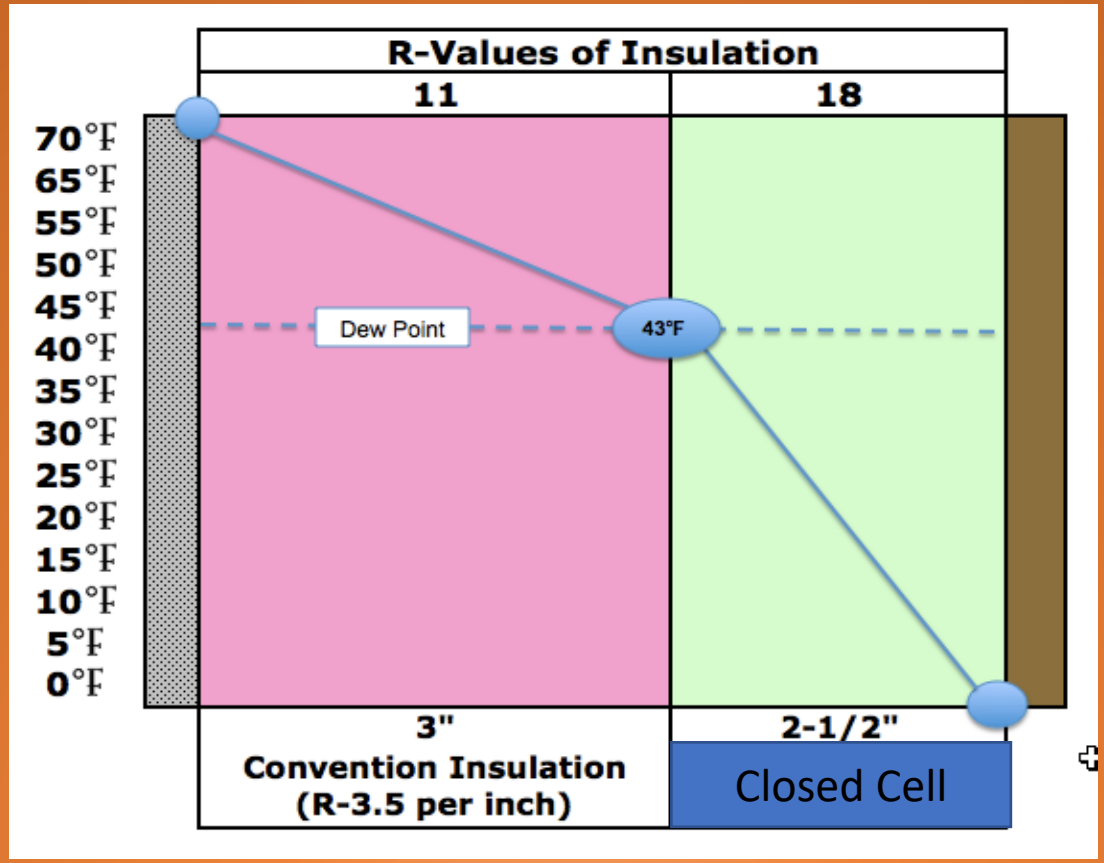

Bulkhead

# The House is a System, Sell the fact that we understand it!

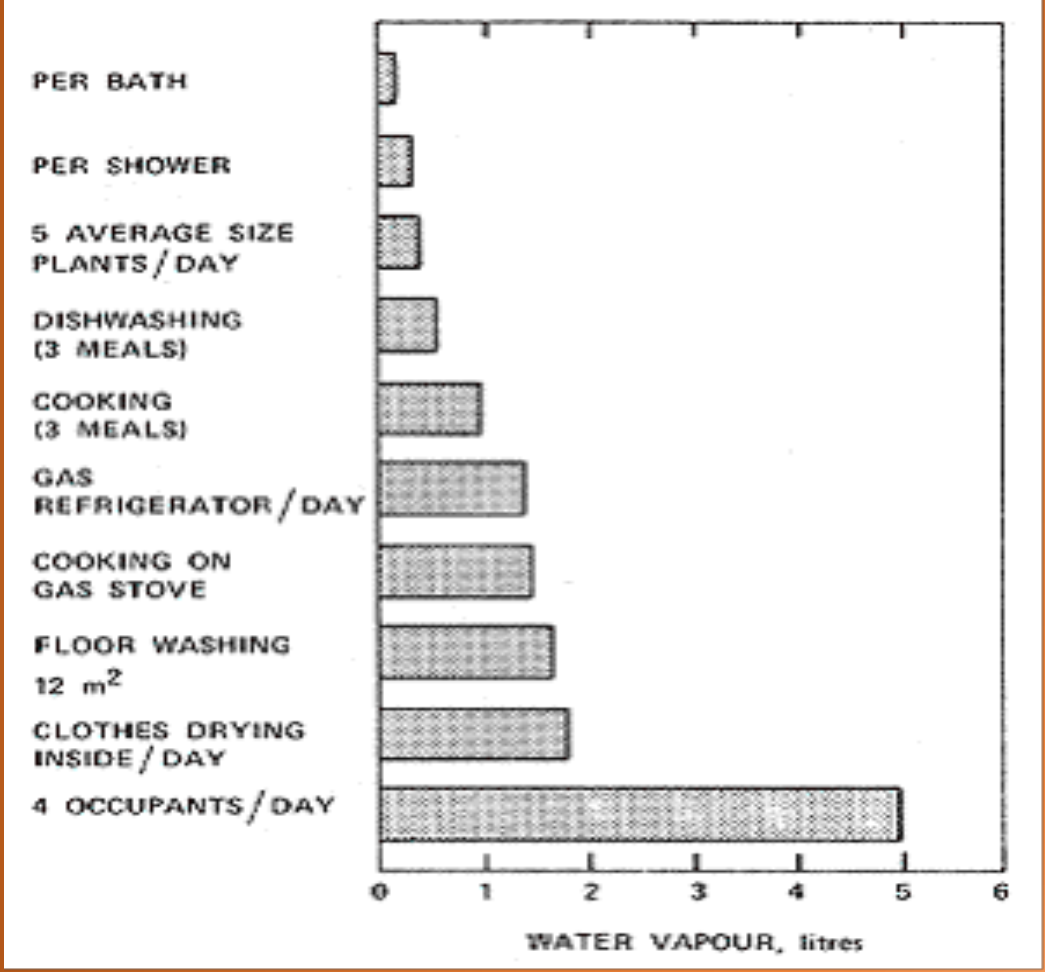
- Anything we change will change the way the system works.
- For instance, if we seal the attic we stop attic **Ex**filtration which then stops most of the **In**filtration.



Understanding Hybrids, not every manufacturer is the same!
Some of them do not approve it.



# How much water is in your house?




As much as 18+ gallons a week.

# In with the NEW
# Out with the OLD

# Production

Cartridge masks are expensive.  If you are using them correctly by changing them out every day it costs you $6200-$7000 a year per employee. Air is cheap.

One crew can cost you $14,000 in cartridges a year.

# Production

Manage your residuals (parts, gloves, suits, Etc.) How many dollars per set are you using? Add it up and then work on decreasing the number.  How many gloves, suits, gun parts are used per set? I have seen as much as $166.00 per set!

Your number x the amount of sets you use = ???

# Production

On average a company will  waste about $3,000 - $5000 a month in poorly managed production. Jobs not being ready, false starts, poor sales practices, poor Technician practices etc.

$4000 per month X 12 months = $48,000 per year.

# Production GPS

- Make sure someone is responsible for monitoring truck GPS systems.
- Have that person report inconsistencies daily or weekly to you.
- These should be spot checked every day.
- Determine if crews are spending too much time at fuel stops.
- Watch for unscheduled stops while in route.
- Are crews taking the most direct or timely routes to the job?
- If you have a GPS system on the trucks but never look at them then it is a wasted expense.
- "**Trust** but **Verify**".

# Production Spray Time

- A survey was conducted a few years ago by one of the major equipment manufacturers and it revealed that the average crew sprays about .3 of a set a day.

- What is being done the rest of the time?

# Production

How much should a crew spray in a day? There really is no “One” answer for this. There are many variables that go into this answer.

- How experienced is the crew?
- What type of job is it?  5” of closed cell in a stand up attic? A 18” crawlspace? 3” in a wall?  Etc.
- Drive time?
- Environmental conditions. (Cold weather, Hot attic, Etc.). (NO ONE is very productive under 32  degrees F.)
- Crew size?
- What else?

These are just a few question to ask. Most companies strive to install an average of 1 to 1.5 sets (100-150 gallons) a day.

# Production Chamber Size

AR5252

1.75 Gallons Per Minute @1200 PSI.

17.5 Pounds Per Minute.

78 Minutes to Spray an entire set of foam at 1000lbs/set.

Faster Flow= Less Control.

Hours of Clean Up.

AR4242

- 1.1 Gallons Per Minute @1200 PSI.
- 11 Pounds Per Minute.
- 111 Minutes to Spray an entire set of foam at 1000lbs/set.
- Slower Flow =More Control.
- Less Clean Up.

# Production Spray Time

Probably the most important item to manage is Spray Time on the job. If chemical is not being applied you are not making money. There is a simple way to check your crew or identify you best crews.

- Most spray foam machines now are able to track the amount of time the applicator actually is spraying. (called Spray Time).
- Keep track of the crews spray time every day for a month.  Average the numbers together. This will give you a good average of how much time they actually are spraying.
- This will also give you a baseline to start with for future monitoring of production.
- Have your production team spot check the spray time for each crew weekly.

# Production Spot Check

Graco InSite™ REMOTE REPORTING TECHNOLOGY

## Daily Report 2023-06-05

| Name | Reactor Model | Time of First Spray Data | Time of Last Spray Data | Daily Cycle Count | Materia Usage (gal) | Actual Spray Time (hrs) | Power On Time (hrs) | Temp A/B Set-point (°F) | Hose Set-Point (°F) | Pressure Set-Point (psi) |
|---|---|---|---|---|---|---|---|---|---|---|
| 033 | E-30 | -- | -- | 0 | 0 | 0 | 0 | --/-- | -- | -- |
| 034 | E-30 | 06:11:37 | 07:09:03 | 242 | 6.5 | 0.5 | 1.8 | 118/120 | 120 | 1250 |
| 035 | E-30 | -- | -- | 0 | 0 | 0 | 0 | --/-- | -- | -- |
| 036 | E-20 | -- | -- | 0 | 0 | 0 | 0 | --/-- | -- | -- |
| 037 | E-30 | -- | -- | 0 | 0 | 0 | 0 | --/-- | -- | -- |
| 357041062888428 | E-30 | 08:47:19 | 10:50:02 | 2010 | 55 | 1.8 | 2.4 | 123/122 | 123 | 1400 |

# Production Spray Time

- A good crew should spray 75% of the time they are on a job.
- Now push to increase the amount of spray time and lower the amount of down time.
- Remember, it takes less then 2 hours to empty a set of foam with a size 4242 mixing chamber. If a crew is on site for 6 hours then why is more product not being applied.

# Production Spray Time

**Stop time or breaks:**

- Do not allow crews to take a break at the same time. Stagger lunch so that someone is always applying chemical.

- Smoke breaks, should also be staggered to allow for someone to continue spraying.

**Extra or back up equipment.**

- Every truck should have 2-3 spray foam guns (ready to use) and parts to clean and repair them.

- Crews should have all of the extra parts to conduct minor repairs on the jobsite.

- Crews should be trained in how to fix miner repairs. (Gun, Drum pump, and hose repair) should never require a trip back to the warehouse and should only take a minimum amount of time to fix.

# Way's to Increase Spray Time On the Jobsite

**Crew Size:**

- Having the correct amount of employees on the job is important. A single reactor rig should have a minimum of 2 people and a dual reactor rig should have at least 3 people in the crew.

- Depending on the amount of prep or clean up it may be prudent to add more crew members for limited amounts of time.

- Some larger companies send out prep crews the day before to prepare the job. These employees will often also go back the day after to trim and clean.

- The spray gun should never sit. During lunch another member of the crew should be trained and continue to spray. In hot or cold weather the crew members should switch off every 30-60 minutes. This allows them to stay fresh and productive. This can also help with work comp as an employee that becomes tired from overwork on the job is more susceptible to injuries.

- "Pulling" employees from other divisions to "fill in" for the day is not productive. The sprayer will spend too much time directing them with tasks to keep them busy. Train a CREW and keep them together. Over time they will work as a well oiled machine and increase production and profits.

# Production
# Chemical Temperatures

**Chemical Temperatures:**

- Is the chemical in the drums at the optimal temperature before you leave the warehouse?
- Having to heat the chemical once the crew has arrived at the jobsite can take 1-2 hours. Calculate this over a year and it accounts for a large amount of lost production.
- Make sure chemical is stored in a conditioned area in your warehouse and kept at the proper temperatures.
- Remember your spray foam machine only has a Delta T of about 50 degrees. If the chemical is stored at 60 degrees and the processing temperature is 125 then the machine is not capable of heating the chemical enough. This will require longer recirculation times or loss in yield. Both attribute to loss profits.

# Production
# Manage Downtime

**Schedule downtime.**

- Schedule down time twice a year (Spring and Fall) to completely run through the spray foam rig and make major repairs as well and general upkeep. This will help eliminate down time on the job.

- Make sure crews are given time every week to conduct preventive maintenance. An hour a week every Friday could save hours of down time and job delays.

- Use your manufacturers to train the crews on how to repair equipment.

# Production

**Jobsite Production.**

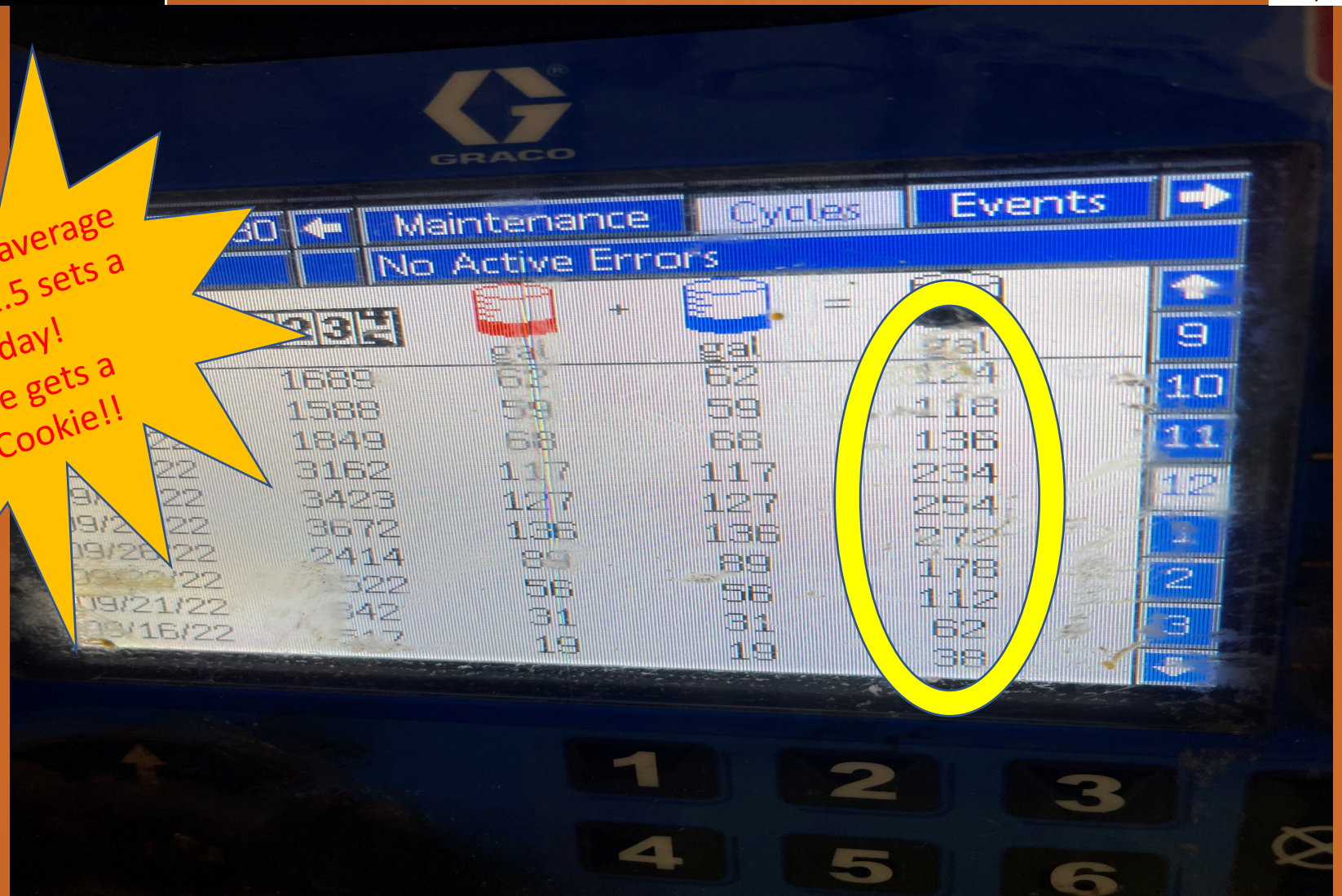
- Upon arriving at the jobsite, spray foam operations should commence within 30 minutes.
- While one crew member conducts final preparations of the equipment, the other should be masking and prepping the start location on the job.
- Once the spray foam application starts, the other crew member can continue to prep the remaining parts of the jobsite.
- Crew members should switch off spray operations every 30-40 minutes.
- One great motivator is to have the person spraying also trim/clean up the area that they sprayed before switching off. The better the spray application the less clean up/trimming required, thus, more rest time a crew member will have between spraying.

# Production

**Start Keeping track of your crews spray time and production.**

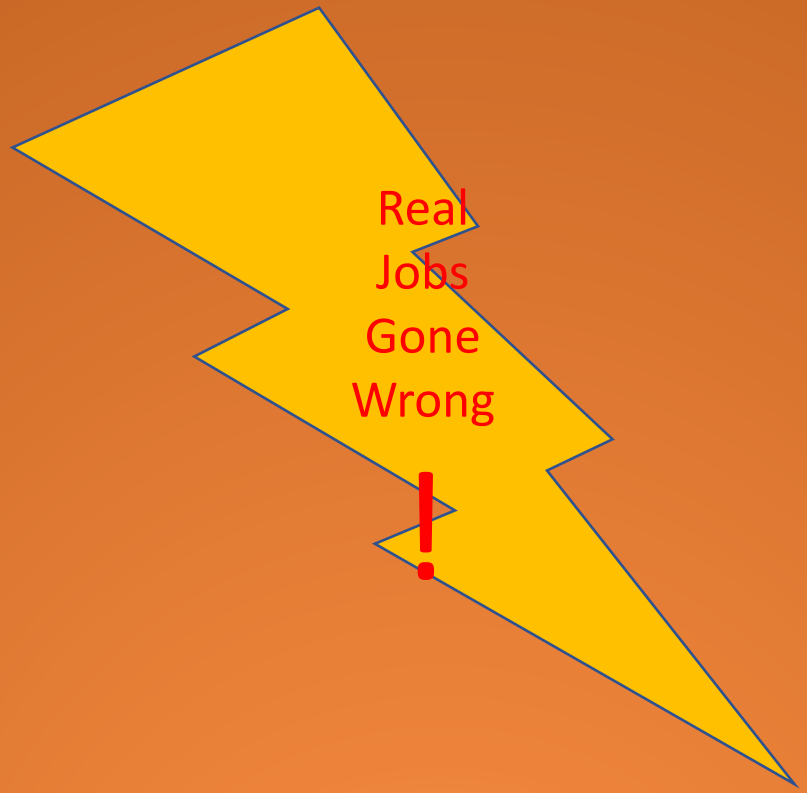
- Give awards or bonuses to crews that hit milestones or are consistently over the goals set.
- Post the production in areas that others can see.
- Make a competition out of it.
- Have fun, keep it safe, make higher profits with limited liability.

# Production


GRACO
Maintenance
Cycles
Events
No Active Errors
10 day average over 1.5 sets a day!
He gets a Cookie!!

# Production

Generator fuel loss. An audit of 50 different companies was conducted on the amount of time an SPF truck generator runs against the amount of time the crew is spraying. The audit revealed an average crew runs the generator for approximately 6.5 hours yet only applies product for 2.5 hours.


Real
Jobs
Gone
Wrong
!

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FLASH AND BATT SIMPLE INTERIOR WALL JOB.

There was no mention of masking. 3 extra days to prep.

JOB SOLD AS R-19 SPRAY. (2.80" OF FOAM)

Brick Ties were 1 inch.

Lack of communication between the builder and the sales person..

JOB SOLD AS INTERIOR WALLS.

No mention of exterior work.

Job delayed to get staging.

Impossible Spray.

2 extra days to do the work

JOB TICKET STATED INTERIOR WALLS.

No mention of high work.

Exterior work.

Extra masking.

1 extra day to do the work


## A SIMPLE CEILING JOB

No mention of exterior, high work, cars, traffic, parking, etc., etc., etc.

False start, Extra half day of work. Upset owner.

NO MENTION OF BLOCKED AREAS

Extra trip and time due to a different system needed.

NO MENTION OF BLOCKED AREAS.

Extra trip and time due to a different system needed.

NO MENTION OF HIGH WORK.

Extra day.

DOUBLE JOISTS LEAVE A 1.5" GAP. NO TIME ALLOWED FOR EXTRA WORK.

Extra 2 days needed on project.

NOT PREPARED FOR EXCESS CAN LIGHTS (35)

Extra trip and time.

## SIMPLE BASEMENT WALL JOB.

Work area to far away for truck

No mention that the job needed an extension ladder

2' of water in the hole.

No lights

A basketball court?? High walls etc.

3 Extra days

# WE ARE LIABLE FOR DAMAGE

False start, home owner was not informed.

## NO MENTION OF A BAD DRIVE.

Waited 2.5 hours to have the dirt moved from driveway to get into the job. The road was too far.

Lost time.

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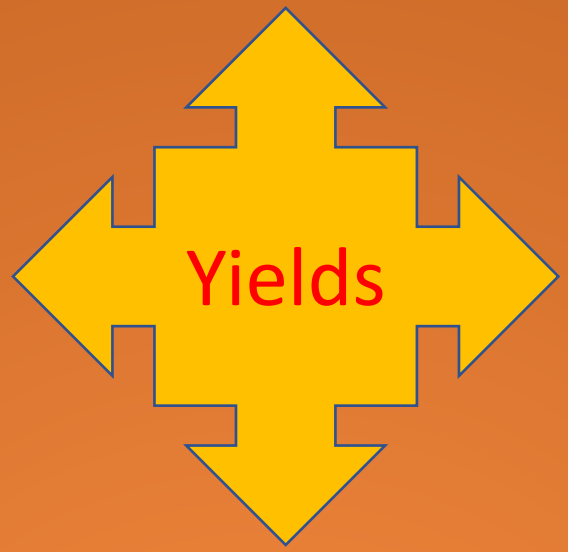
# The real story Behind



# Yield

- Understanding yield is one of the most important aspects of Spray Foam profitability.
- There are actually 3 yield types to understand.
- Theoretical, Actual and Percentage.
- **Theoretical Yield** is a perfect application, The best case scenario, typically achieved under laboratory conditions at a manufacturers facility. (Usually what the manufacturers sales person is going to try and sell you on). 100%
- **Actual Yield** is the real world application. This is what the installer actually gets every day. It is affected by atmospheric temperatures, humidity, moisture, substrate and chemical temperatures as well as processing parameters and mixing chamber sizes. An installer who does everything correctly will be able to get their actual yield close to the Theoretical numbers.
- **Percentage Yield**, (also known as efficiency) is the difference between Theoretical and Actual yields. Once you have this number the idea is to train your employees to consistently close the gap between the first two.

# How Does It Work?

- If the stated yield of your closed cell product is 5000 bft (Theoretical Yield).
- But the (Actual Yield) in the field is 3500 bft.
- Your Percentage Yield is 70%. (70% of 5000 is 3500).
- The crews goal is to increase the 70% yield to eventually get as close to the Theoretical yield as possible.

- If the stated yield of your Open cell product is 20,000 bft (Theoretical Yield).
- But the (Actual Yield) in the field is 14,000 bft.
- Your Percentage Yield is 70%. (70% of 20,000 is 14,000).
- The crews goal is to increase the 70% yield to eventually get as close to the Theoretical yield as possible.

# Examples of Areas That can Affect Yield

Usual areas where yield is effected.

- Material left in the drum and not used.
- Too many lifts (passes).
- Cold Chemical/Substrate or Temperatures.
- Test spray or change over waste.
- Overspray and over filling.
- Off Ratio
- Incorrect temperature and or pressure settings on the reactor.
- Incorrect mixing chamber size.
- Too high density.
- Moisture (on the substrate and or in your lines).
- Using or allowing chemical to expire.
- The closer to the expiration date the less the yield.

# Yield

The same square footage was sprayed by the same sprayer on the same job.

- On the left they used an AR4242. On the right they used an AR5252.
- There was 6 times as much waste with the AR5252.
- It took the sprayer 56 seconds longer to spray with an AR4242.
- It took the helper 16 minutes longer to trim and clean up.
- This was one room, now calculate the loss by the size of the house. Which costs you less?

# Yield

Let's look at the importance of Open Cell processing. During an audit of 25 locations we concluded that most of them do not process the product correctly and they have upwards of 40% waste.  All Open Cell products must be kept warm. The warmer the barrels to start, the better the yield. Typically the chemical in the barrels needs to be heated through recirculation up to 80+ degrees. Mixing on most Open Cells is critical. This along with Spray Tip size, experience and technique can make or break a company with these products. Because they are harder to manage, spraying too thick is common. The audit showed 100% of the crews observed sprayed 25-40% too thick. Thus causing a large loss in yield.

Example: If you use 100 sets of Open Cell in a year and average 30% waste you would be losing approximately 30 sets.

Training, processing and choosing the correct product for the application are important items with Open Cell profitability.

# Why is Depth Control Important?

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Closed Cell Example.

Job calls for 1 set at a cost of $1500.00
3” depth.

| Inches applied | Extra used | | Based on 200 sets per year. |
|---|---|---|---|
| | | | Amount of loss. |
| 3" | - | | - |
| 3.5" | 14.3% extra | | $42,900.00 loss |
| 4" | 25% extra | | $75,000.00 loss |

Open Cell Example.

Job calls for 1 set at a cost of $1200.00
5.5” depth.

| Inches applied | Extra used | | Based on 200 sets per year. |
|---|---|---|---|
| | | | Amount of loss. |
| 5.5" | - | | - |
| 6" | 8.4% extra | | $20,160.00 loss |
| 6.5" | 15.4% extra | | $36,960.00 loss |
| 7" | 21.5% extra | | $51,600.00 loss |

# Yield

78 samples of the finished product were taken from many locations across the US. Density testing was conducted on the samples  The results showed that the majority of the crews were applying product too dense. Density affects the yield of a set of product. If the density is high the yield goes down resulting in dollars lost. The products tested were closed cell with densities of 2.0 to 2.1 lb.  Of the 78 samples taken the average density yielded 2.5 lbs. with a high of 4.1 and a low of 1.7 lb. Typically for every point high a loss of 100 bft will be seen.

**Example**: A set of foam yields 4000 bft at 2.0 density. If the crew sprays the product at 2.1 density the yield will be 3900 bft, 2.2 equals 3800 bft and so on. The audit showed a loss of 500 bft per set average.

If you spray 100 sets a year that would be a loss of 12.5 sets a year. At $2000 a set, that would equal $25,000 lost dollars.

# Why is Monitoring your Density Important?

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Open Cell

The effect of incorrect density is critical to your yields and profits.

| Density | Set Weight | Theoretical Yield in bft. | Actual Yield in bft. | | |
|---|---|---|---|---|---|
| Open Cell | | | 60% | 70% | 80% |
| | 1000 lbs | | | | |
| 0.3 | | 40,000 bft | 24,000 | 28,000 | 32,000 |
| 0.35 | | 34,286 bft | 20,571 | 24,000 | 27,429 |
| 0.04 | | 30,000 bft | 18,000 | 21,000 | 24,000 |
| 0.45 | | 26,667 bft | 16,000 | 18,667 | 21,333 |
| 0.5 | | 24,000 bft | 14,400 | 16,800 | 19,200 |
| 0.55 | | 21,818 bft | 13,091 | 15,273 | 17,455 |
| 0.75 | | 16,000 bft | 9,600 | 11,200 | 12,800 |
| 0.8 | | 15,000 bft | 9,000 | 10,500 | 12,000 |
| 1 | | 12,000 bft | 7,200 | 8,400 | 9,600 |

# Why is Monitoring your Density Important?

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Closed Cell

| Density | Set Weight | Theoretical Yield in bft. | | Actual Yield in bft. | |
|---|---|---|---|---|---|
| | 1000 lbs | | 60% | 70% | 80% |
| Closed Cell | | | | | |
| 1.7 | | 6059 bft | 3,235 | 3,941 | 4,647 |
| 1.8 | | 5667 bft | 3,000 | 3,667 | 4,333 |
| 1.9 | | 5316 bft | 2789 | 3,421 | 4053 |
| 2 | | 5000 bft | 2600 | 3,200 | 3800 |
| 2.1 | | 4714 bft | 2429 | 3,000 | 3571 |
| 2.2 | | 4545 bft | 2273 | 2,818 | 3364 |
| 2.5 | | 3800 bft | 1880 | 2,360 | 2840 |
| 2.8 | | 3286 bft | 1571 | 2,000 | 2429 |
| 3 | | 3000 bft | 1400 | 1800 | 2200 |

The effect of incorrect density is critical to your yields and profits.

# Example of one Manufacturers product

| Density | Average Expected Yield (bd ft) |
|---|---|
| .42 | 20,280 |
| .44 | 19,500 |
| .46 | 18,525 |
| .48 | 17,940 |
| .50 | 17,160 |
| .52 | 16.575 |
| .54 | 15,795 |
| .56 | 15,210 |
| .58 | 14,820 |
| .60 | 14,235 |
| .62 | 13,845 |
| .64 | 13,260 |
| .66 | 12,870 |

# How to Check Density in the Field

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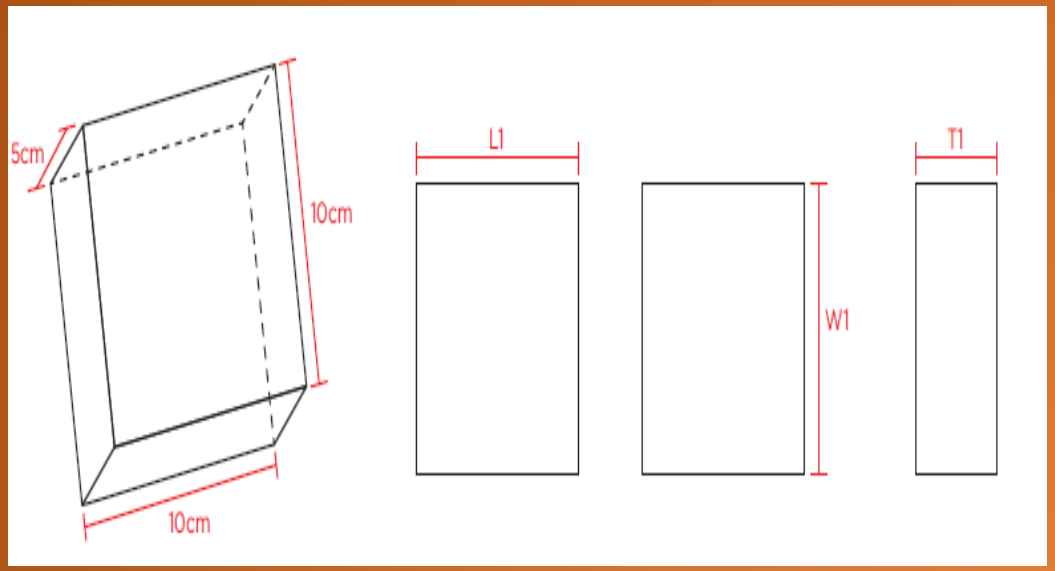
## How to Check Open Cell Density

1) Density is vital to achieving proper yields with the Spray Foam products we use. High density will produce lower yields. (Example: if a .5lb density product is applied at .6lbs it can mean as much as 1000 bft loss in yield). Lower densities will produce unstable products. It is important to periodically check the density of the product you apply to achieve maximum yields with minimum liability. Some examples of items that can affect density are Temperature, Pressure, and Mixing Chamber size. Below is an example of how to check the density of Open Cell products.

2) Weigh and record the sample in grams.

3) Cuts made in the field tend to be irregular: therefore the foam sample must be measured a minimum of 4 times in 4 locations per side. (4 different measurements for Length, Width and Height). Measure the Length, Width, and Height in centimeters. Average each group and record the average for the Length, Width and Height.

# How to Check Density in the Field




## How to Check Open Cell Density

| Weight in grams | Length in centimeters | | Width in centimeters | | Height in centimeters | | Conversion factor to pounds cubic foot | |
|---|---|---|---|---|---|---|---|---|
| | L1 | 10.1 | W1 | 9.9 | H1 | 5.4 | Always 62.4 | |
| | L2 | 10.2 | W2 | 9.8 | H2 | 5.3 | | |
| | L3 | 10.1 | W3 | 9.6 | H3 | 5.5 | | |
| 5.70g | L4 | 10.1 | W4 | 9.8 | H4 | 5.5 | | |
| | L5 | | W5 | | H5 | | | |
| | | | | | | | | |
| | Average= 10.125 | | Average= 9.775 | | Average= 5.425 | | | |
| | | | | | | | | |
| | | | | | | | | |
| Grams | ÷ Length | | ÷ Width | | ÷ Height | | × pcf 62.4 | = Density |
| | | | | | | | | |
| 5.70g | 10.125cm | | 9.775cm | | 5.425cm | | 62.4pcf | 0.66lb density |

# How to Check Density in the Field

## How to check the density of Closed Cell

Proper densities are very important to your daily application. By applying product at too high a density you lose yield. By applying product at too low a density you lose product stability. There are a few simple ways to check density. First you need a sample of foam at **least 5 grams** in weight. Next you will need a 1000 ml graduated cylinder. Lastly a gram scale accurate to 0.00 grams.

NOTE: Samples should be taken after they are completely cooled down. If a sample is taken the day of application, it is ok to conduct the testing that day.
Remove your sample. Cut away the top, bottom and side skins so that you have the core of the product. (Skins add density) the manufactures stated density is always without skins. Make sure there are no pass lines in the sample.

Weight your samples and record the results. Example : (9.57 grams)

## How to check the density of Closed Cell

Next fill the graduated cylinder to a start point amount. (Usually 600-700ml). Record that amount. Example : (700 ml)

Now place your sample into the cylinder and push it down into the water until it is submerged. Remember, whatever you use to push the sample down has density so only submerge the foam until it is covered with water. Record that result. Example : (945 ml)

Subtract the start point reading from the submerged reading to get your displaced ml amount. (945ml – 700ml = 245 ml.)

Now take the weight of the product, divide it by the displaced ml amount and multiply it by 62.4.
9.57g divided by 245 ml = 0.039 X 62.4 = 2.43 lb. density.

NOTE: you will always multiply by 62.4. That number never changes.
NOTE: the larger the samples, the more accurate the results.
NOTE: for every 0.1 you are high in density expect to lose approximately 100 bft.

# Troubleshooting

**DENSITY IS TOO LOW**:

- Substrate is too hot. This will allow for foam cells to expand more than they should.
  **Action**: Adjust the machine settings and your technique until the proper density is achieved.
- Off-ratio foam, A rich.
  **Action:** Check screens and determine why system is A rich. Follow your IBP “Troubleshooting Flow Chart”.
- Not allowing for product to cool down between passes.
  **Action:** Wait until product has cooled to under 100 degrees before adding another pass. Follow manufactures recommendations.
- Reactor pressures or heat are too high.
  **Action:** Adjust settings and or move to a smaller mixing chamber.
- Passes are too thick.
  **Action:** Remove the low density product and re apply.

# Troubleshooting

**DENSITY IS TOO HIGH:**

- Substrate is too cold.

  **Action**: Adjust the machine settings and your technique until the proper density is achieved.
- Reactor pressures or heat are too low.

  **Action:** Adjust setting and or move to a smaller mixing chamber.
- Drums are too cold.

  **Action:** Switch out to a warmer set of drums or warm drums up. Note: warming up drums takes hours. It cannot be done in a short amount of time. **Never** point or use a flame heater at a drum to warm it up.
- Lack of Hose insulation or hose is not heating properly.

  **Action:** Make sure your hose insulation is intact. Diagnose and fix hose heat issues.
- Passes are too thin or too many.

**Action:** Make sure your passes are as close to the manufactures suggested thickness. Avoid multiple thin passes. Practice and train yourself to apply passes at the correct thickness.

# Questions?