



# Spray Foam Installations with Reduced Occupational Exposure Phase 1

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# 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.



# Overall Project Goals

- 3 Phase Project
- To Collect and Analyze Air Quality Data Which:
  1. Demonstrates the Chemical Exposure Reduction to Sprayers, Helpers and other Contractors During Spray Foam Installations
  2. Collect Supporting Data to Reduce Re-Entry Times
  3. Support Reconsideration of PPE for Other Trades in the Vicinity of the Installation of this Unique System.



# The Project

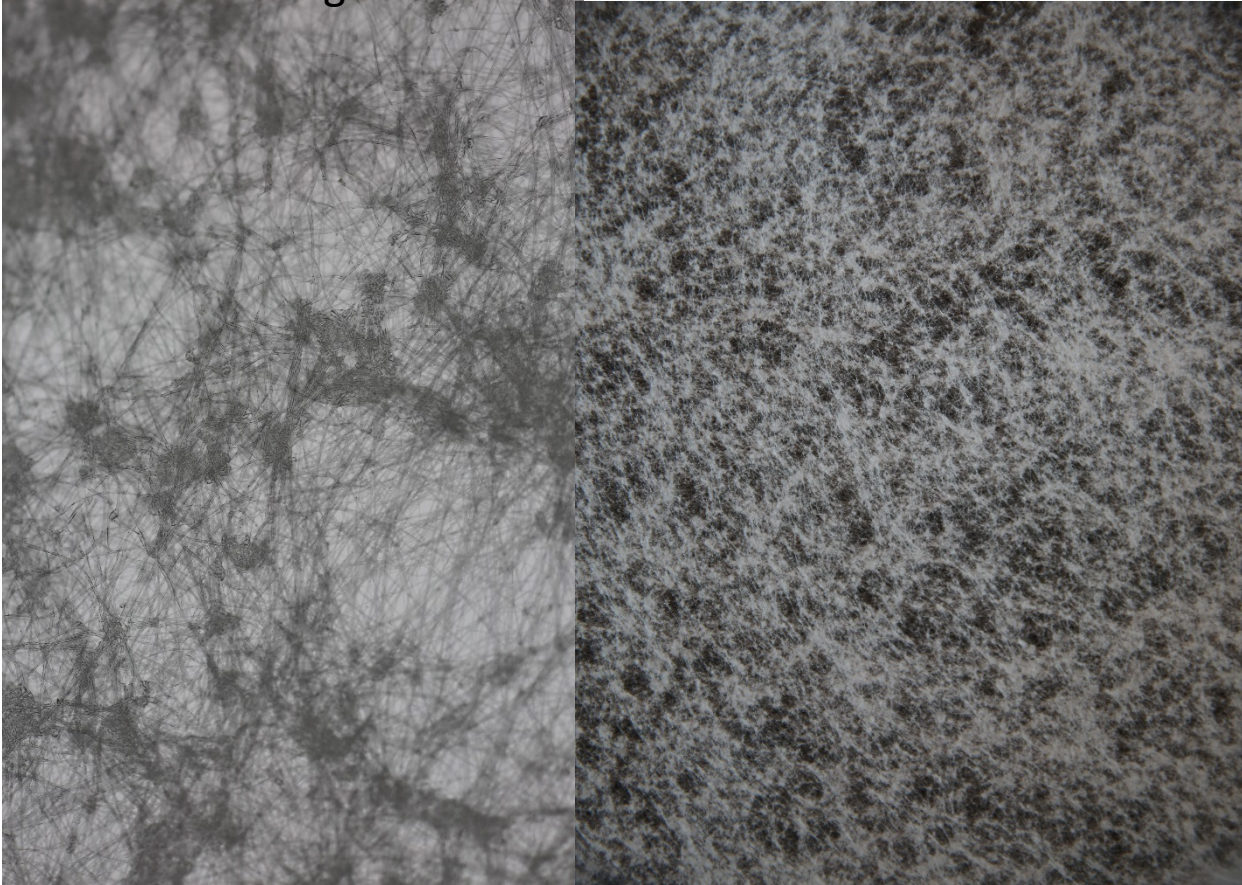
1. Uniquely Designed Membrane System
  - Climate Zone Specific
  - Patent Pending
2. Uniquely Formulated Half Pound Injection Foam
  - Non-Emissive – as per UL GREENGUARD GOLD® gas-phase testing
  - Self Compressing
3. Air Quality Measurements During and Following Foam Installation (Phases 1, 2 and 3)
  - 4,4-MDI, Amine Catalysts, TCPP
  - 3<sup>rd</sup> Party Collection and Analysis
4. Professional Data Interpretation and Professional Risk Assessment
  - Re-Entry Times / PPE





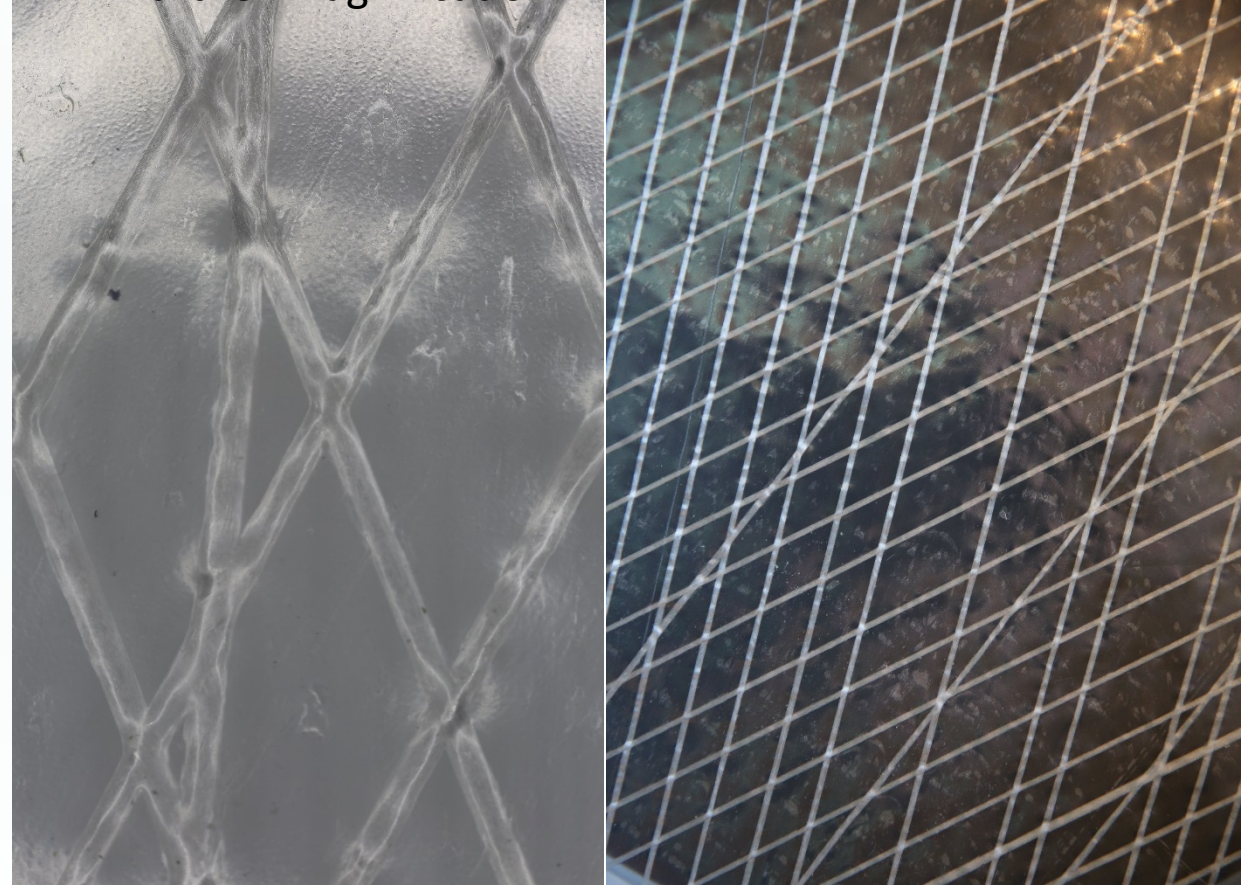
# Membranes

Further Magnification



**Polypropylene Web**

Further Magnification



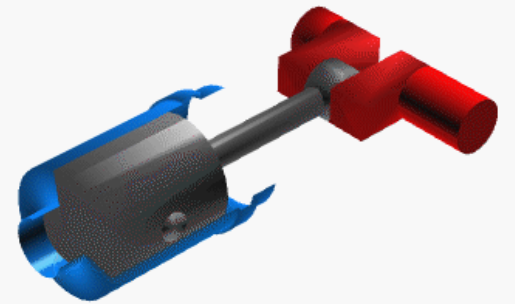
**Polyethylene Film®**



# Specifically Developed New Foam

## Class 1, Renewable, Open Cell Foam

- Half Pound Foam with GREENGUARD GOLD® Certification for Healthy Building Interiors within the U.S. and is therefore stated by UL to be suitable for use in rooms that house Children and the Elderly
- Based on a Newly Developed Self-Compressing Foam Technology which Reduces the Pressure Exerted on the Surfaces within an Enclosed Cavity – Even When Overfilled
- Only Half Pound Foam System with No OSB (back wall) Voiding when Used as Part of the Entire System
- Field Reports are Validating Actual Yields of 18,000bf







## Phase 1

- Actual Building Structures
- Contractor Applied
- No Installed Ventilation During Installation
- Data Collections During Installation
- 3<sup>rd</sup> Party Collections and Analysis
- Real World Data, Leads to Phase 2

## Phase 2

- Data Based on Controlled Conditions
  - Air Exchange Rate of 1 /Hr
- 3<sup>rd</sup> Party Collections and Analysis
- Data Will Support Changes to Re-Entry Times

Today Completed  
Now Completed

GacoProFill

Air Quality Research Project



Phase 3

- Statistical Study of Multiple Homes
- Data Will Support Consideration of PPE Changes for Installers and Nearby Contractors

GacoProFilm

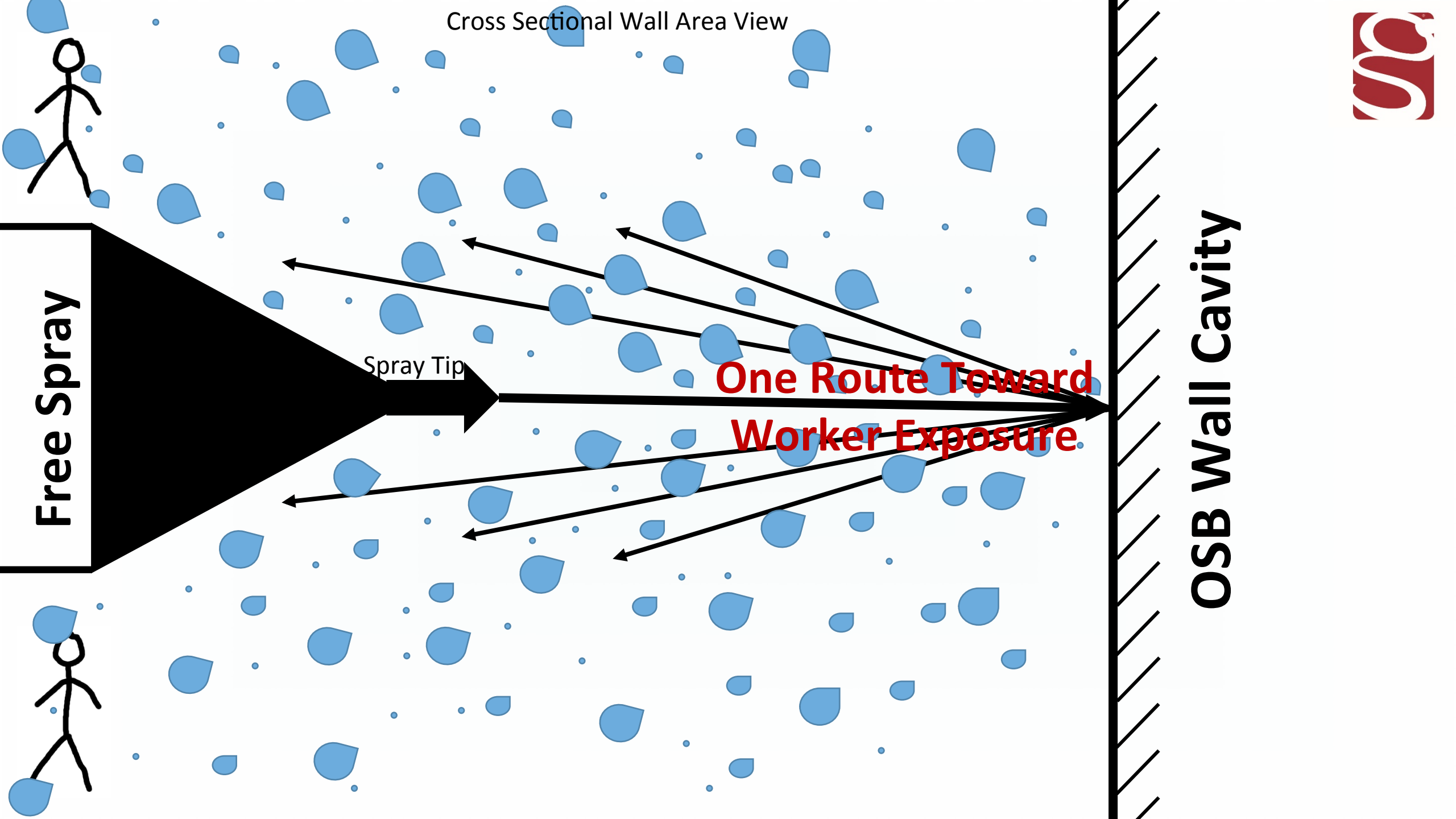
GacoProWeb

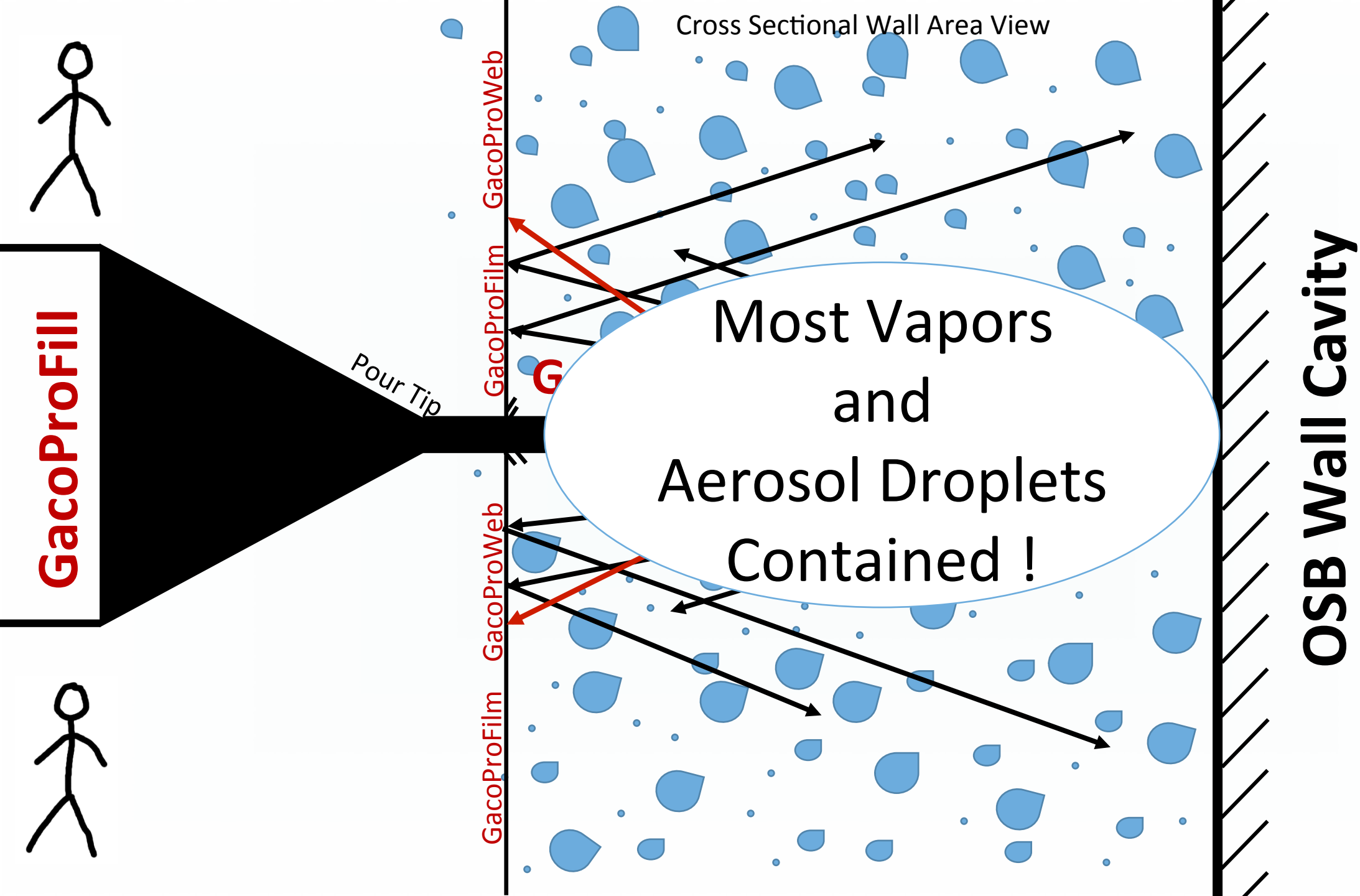
New System

Air Quality Research Project



## **Spray Induced Occupational Exposure**







# **A Video Introduction to GacoProFill**







# **Phase 1**

## **Field - Air Sampling**



# Field Air Sampling Job Details

	Home #1	Home #2	Cathedral Ceiling
Installation Type	GacoProFilm	Free Spray	GacoProWeb
Foam Used	GacoProFill	Conventional half-pound	GacoProFill
Foamed Wall Area	4,978 bd-ft	4,681 bd-ft	16,583 bd-ft
Wall Type (Wood Studs)	2x6 Vertical, OSB	2x6 Vertical, OSB	12" fill Cathedral Rafters, Lap Metal
ACH - Air Exchanges/Hour (no fans used)	0.070 upstairs 0.130 downstairs	0.400	0.042

## Air Quality Methods Used

- 4,4-MDI – Collected with a dry sampler followed with analysis by LC/MS
- TCP and amines are collected onto XAD-2, then are analyzed by GC/NPD



Industrial Hygienist – Ready to Start



Helper – Being Outfitted with Air Sampling Equipment







## Polyethylene Film

Side by Side Homes



Before Installation



After Installation



Storage Shed



Before Installation



After Installation



## Polypropylene Web









**NO TRIMMING  
LESS LABOR  
NO MESS  
NO DUST EXPOSURE**

**No Trimming Gives  
a 15-20% Yield  
Increase**





Sprayer After Installation  
**Polypropylene Web**



Sprayer After Installation  
Free Spray



Sprayer After Installation  
**Polyethylene Film**

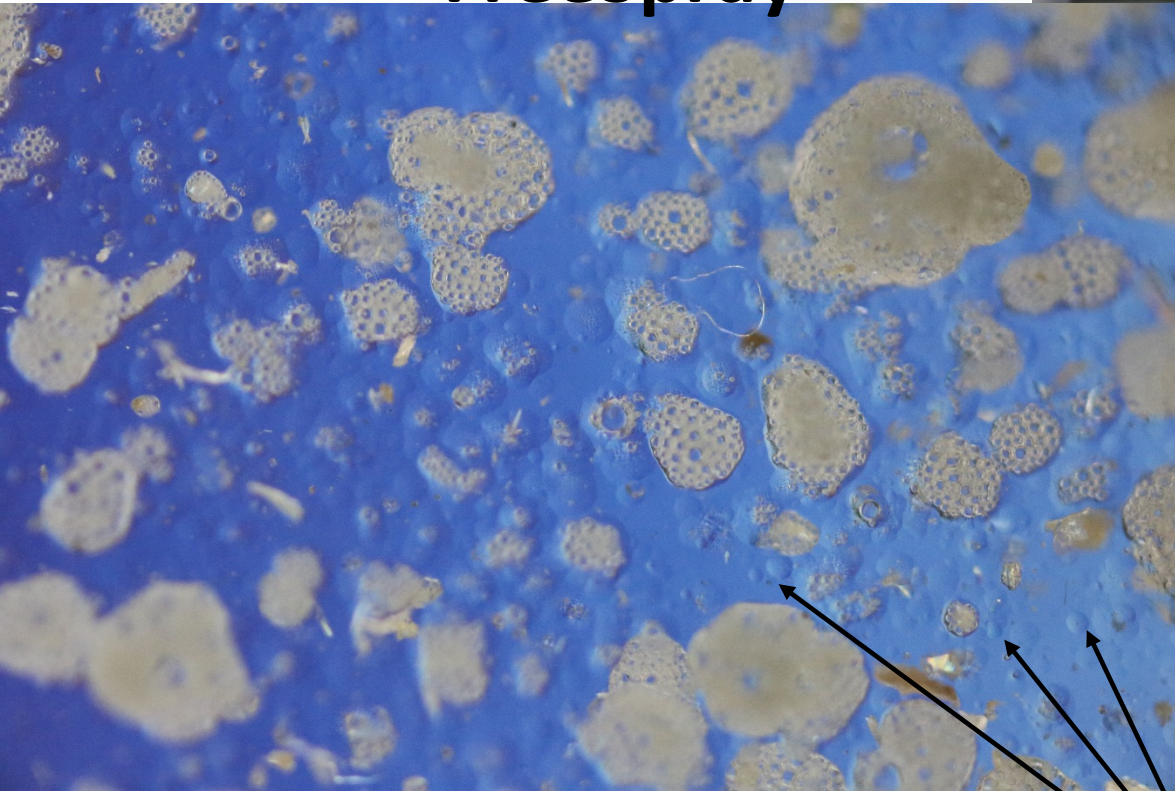




# Overspray on Face Shields



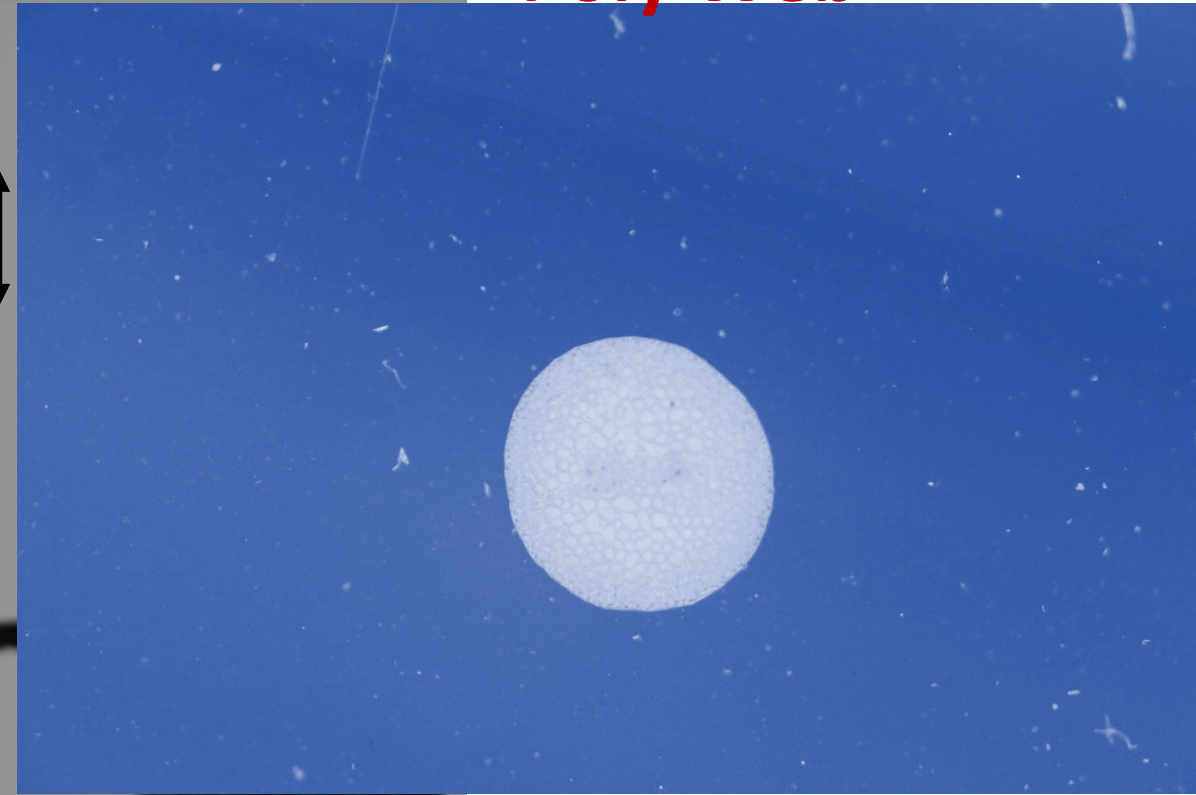
**FreeSpray**



1mm



**Poly Web**





# Occupational Foam Chemical Exposure Limits:

• **BDMAEE** Amine - ACGIH TLV-TWA 0.05ppm  
(continuous 8 hr time-weighted average exposure value)

• **TCPP** – none NA

• **4,4-MDI** – OSHA Permissible 0.020ppm  
(ceiling value)

• **4,4-MDI** – ACGIH TLV-TWA 0.005ppm  
(continuous 8 hr time-weighted average exposure value)



# Air Measurement

## A. Conventional Free Spray

1. Sprayer
2. Helper

## B. GacoProFilm

3. Sprayer
4. Helper

## C. GacoProWeb

5. Sprayer
6. Helper

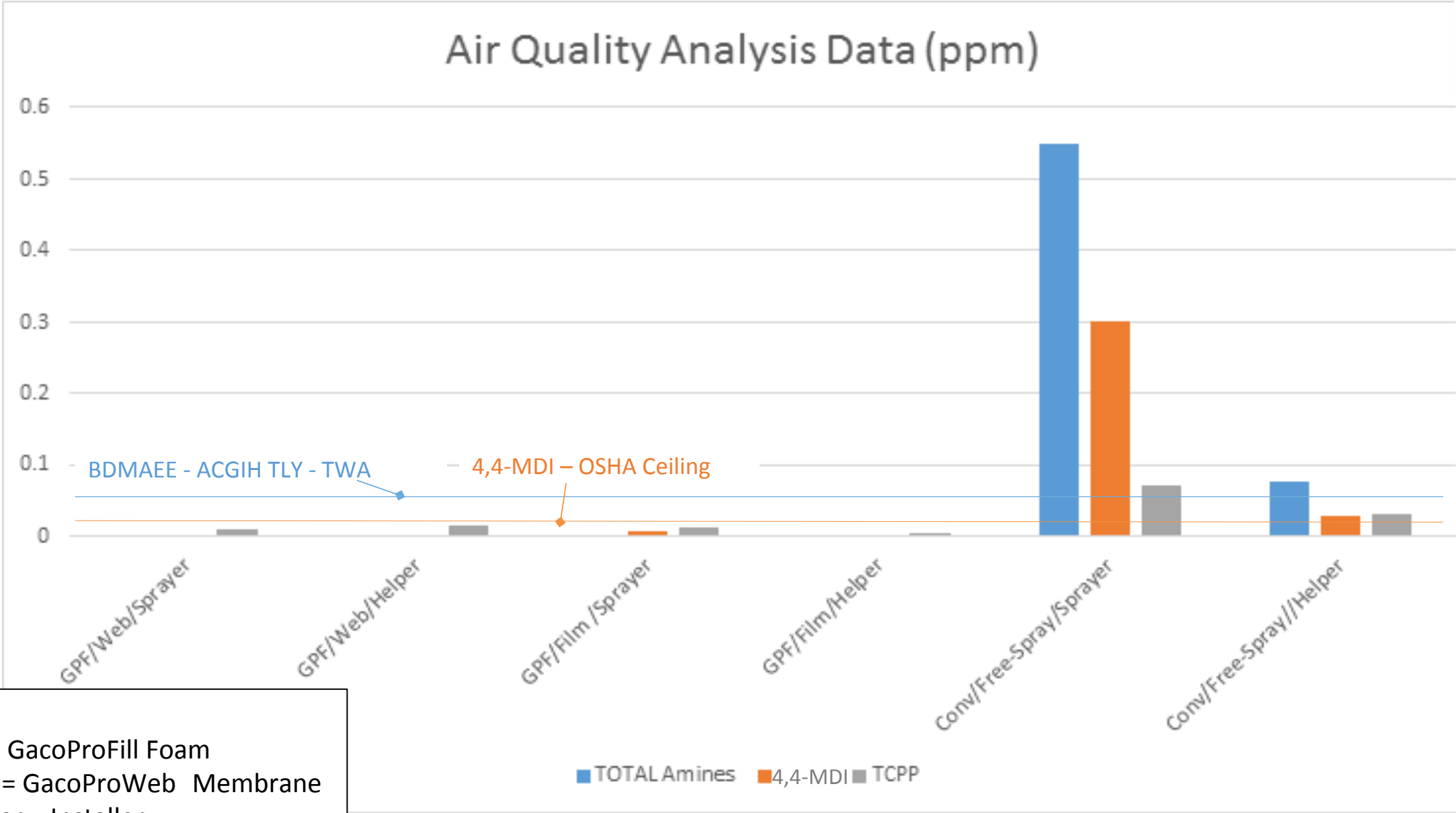
## **Chemical Targets:**

- 1. 4,4-MDI,**
- 2. TCPP,**
- 3. Amines**



# The Results

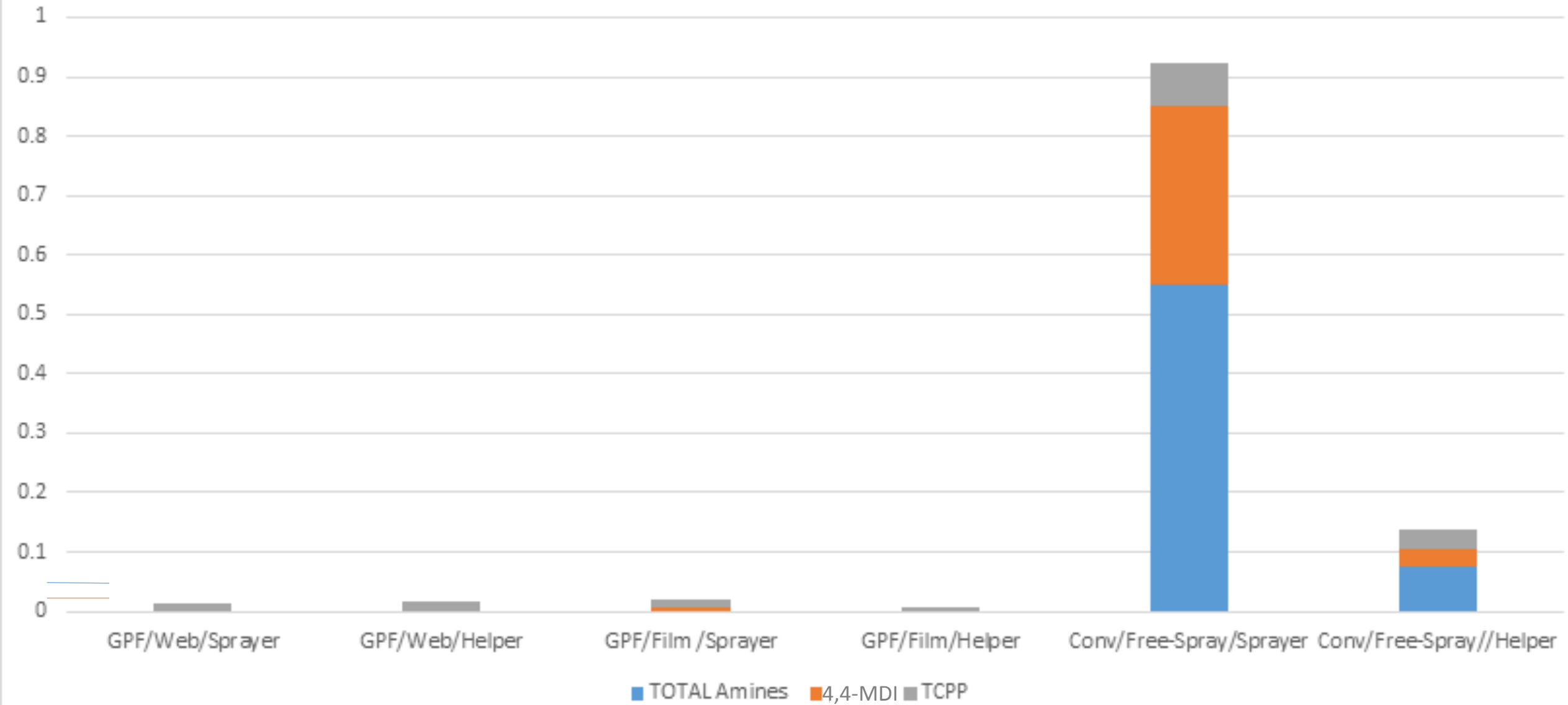
COMPARATIVE RESULTS



# Stacked Emissions



Air Quality Analysis Data (ppm)





# Specific Results – Amines\*

	Installer	ProFill Reduction vs Conventional Foam Spray	Helper	ProFill Reduction vs Conventional Foam Spray
Conventional Free Spray**	0.41 ppm		0.06 ppm	
Conventional Free Spray***	0.14 ppm		ND	
GacoProFilm	ND	-100%	ND	100%
GacoProWeb	ND	-100%	ND	100%

ND = Below Detection Limits

\* *One amine catalyst used in the conventional foam was proprietary and therefore was not included in the air sampling study.*

\*\* *Reactive Amine*

\*\*\* *BDMAEE*

BDMAEE Amine - ACGIH TLV-TWA -  
0.05ppm - (continuous 8 hr time-weighted  
average exposure value)





# Specific Results - TCPP

	Installer	ProFill Reduction vs Conventional Foam Spray	Helper	ProFill Reduction vs Conventional Foam Spray
Conventional Free Spray	0.070 ppm		0.030 ppm	
GacoProFilm	0.011 ppm	-84%	0.015 ppm	-50%
GacoProWeb	0.013 ppm	-81%	0.005 ppm	-83%

There are no exposure limits  
established for TCPP





# Specific Results – 4,4-MDI

	Installer	ProFill Reduction vs Conventional Foam Spray	Helper	ProFill Reduction vs Conventional Foam Spray
Conventional Free Spray	0.3000 ppm		0.0300 ppm	
GacoProFilm	0.0076 ppm	-97%	0.0008 ppm	-73%
GacoProWeb	0.0010 ppm	-99%	0.0003 ppm	-99%

OSHA Permissible – 0.020ppm – (ceiling value),  
ACGIH TLV-TWA – 0.005ppm – (continuous 8 hr time weighted average)



# Conclusions

- This field-study demonstrates that the GacoProFill system dramatically reduces occupational chemical levels in the vicinity of the foam installation.
- Resulting occupational exposure amine levels were below detection capabilities
- GacoProFill occupational exposure 4,4-MDI levels were below OSHA permissible, even during the foam installation process. In 3 of 4 cases it was also below the ACGIH-TLY-TWA for 8hr exposure.
- This data suggests that alternative and available open cell installation methods exist that create a safer worker environment for the installation of polyurethane foam – especially regarding potential isocyanate exposure.



# Next Steps – Phases 2 and 3

- We Have Now Completed a Similar Study in a Controlled Climate Chamber
  - 1ACH – as a worst case scenario
  - Measured air quality for 48 hrs after foam installation
  - Determine Re-Entry Time Reduction Potential
- We Now Plan to Repeat a Similar Study in Multiple Home Installations
  - Include replicates for statistical significance
  - Determine PPE Reduction Potential based on Professional Risk Analysis



# Acknowledgements

- Rick Wood – Industrial Hygiene Consultant
  - Project Organization
  - Air Measurements
  - Analysis Oversight
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  - Support
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  - Project Management
  - Oversight
  - Sprayer Helper 😊
- Various Additional Members of the Gaco Western Spray-Foam Sales and Technical Teams



Thank You !