

# Next-Generation Zero VOC Waterborne Acrylics for One-Coat Direct-to-Metal Applications

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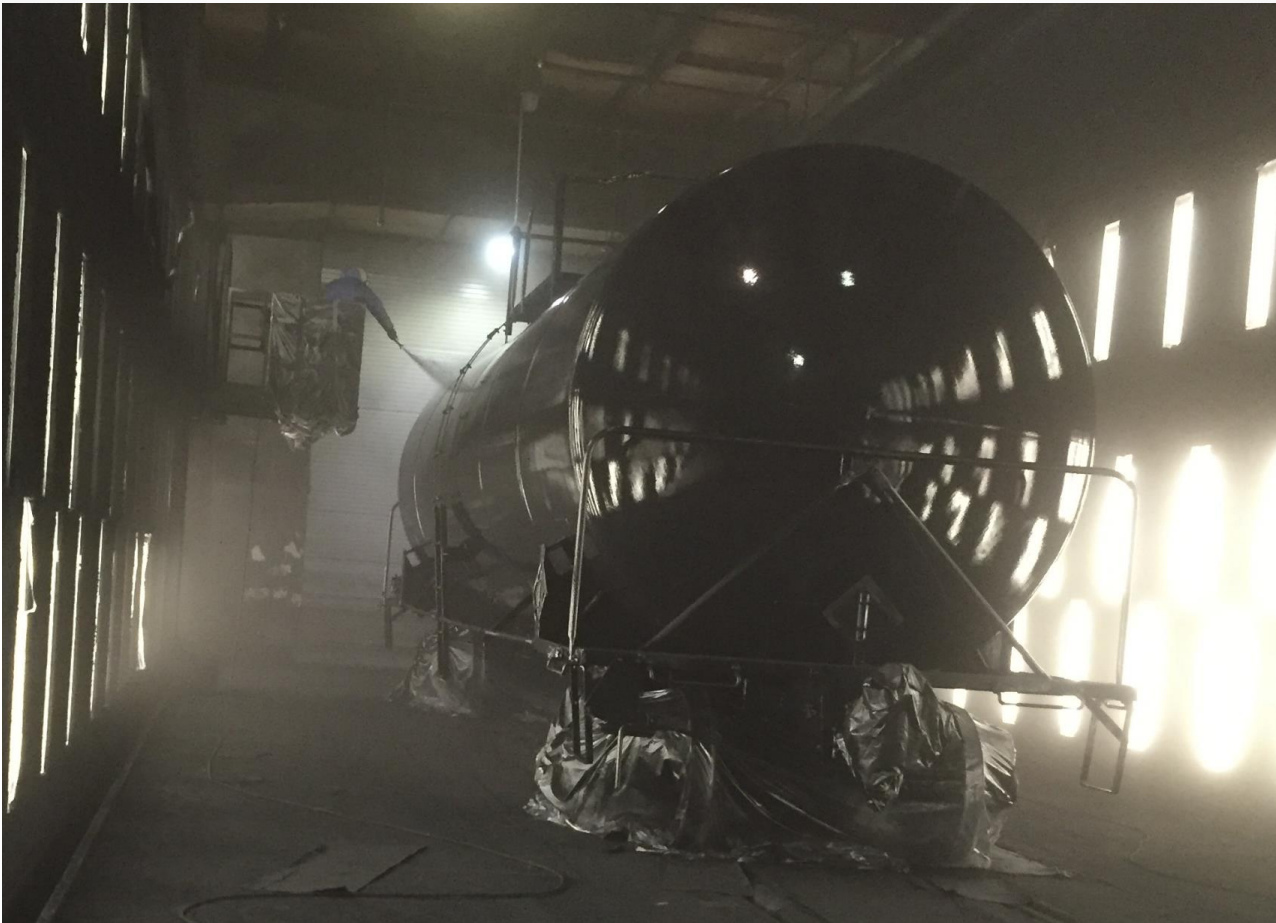
Presented to RSI/CMA 2016 Rail Expo & Technical Conference

Justin Rios- The Sherwin-Williams Co.



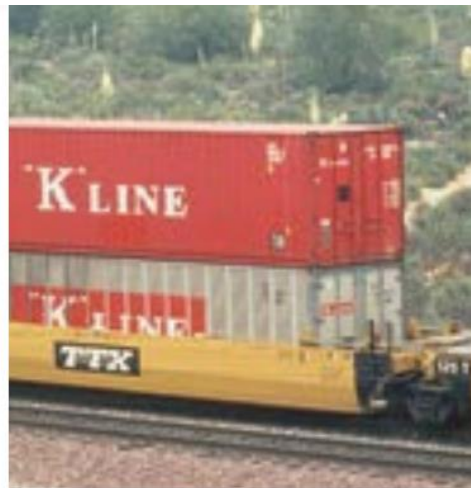
# Agenda

- Where are they Used?
- State of Waterborne Acrylics
  - Benefits
  - Challenges
- Next-generation Advances in Film Formation
- Performance characteristics



## Where currently used?

- Tank Cars
- Hopper Cars
- Gondola Cars
- Boxcars
- Intermodal Containers
- Storage Tanks
- Machinery & Right-of-Way Equipment



# State of Current WB acrylics

## Benefits

- Excellent color and gloss retention
- Resistance to chalking
- Flexibility and resistance to embrittlement
- Low Odor
- Easy Clean-up
- Easy application- 1K
- Low VOC
- Fast Dry

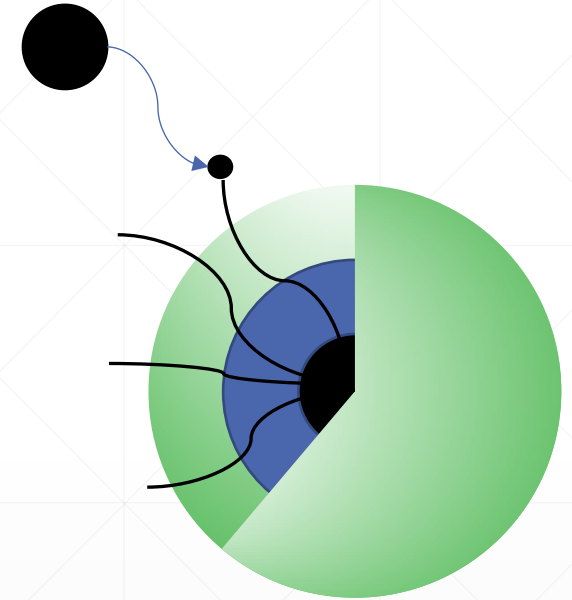
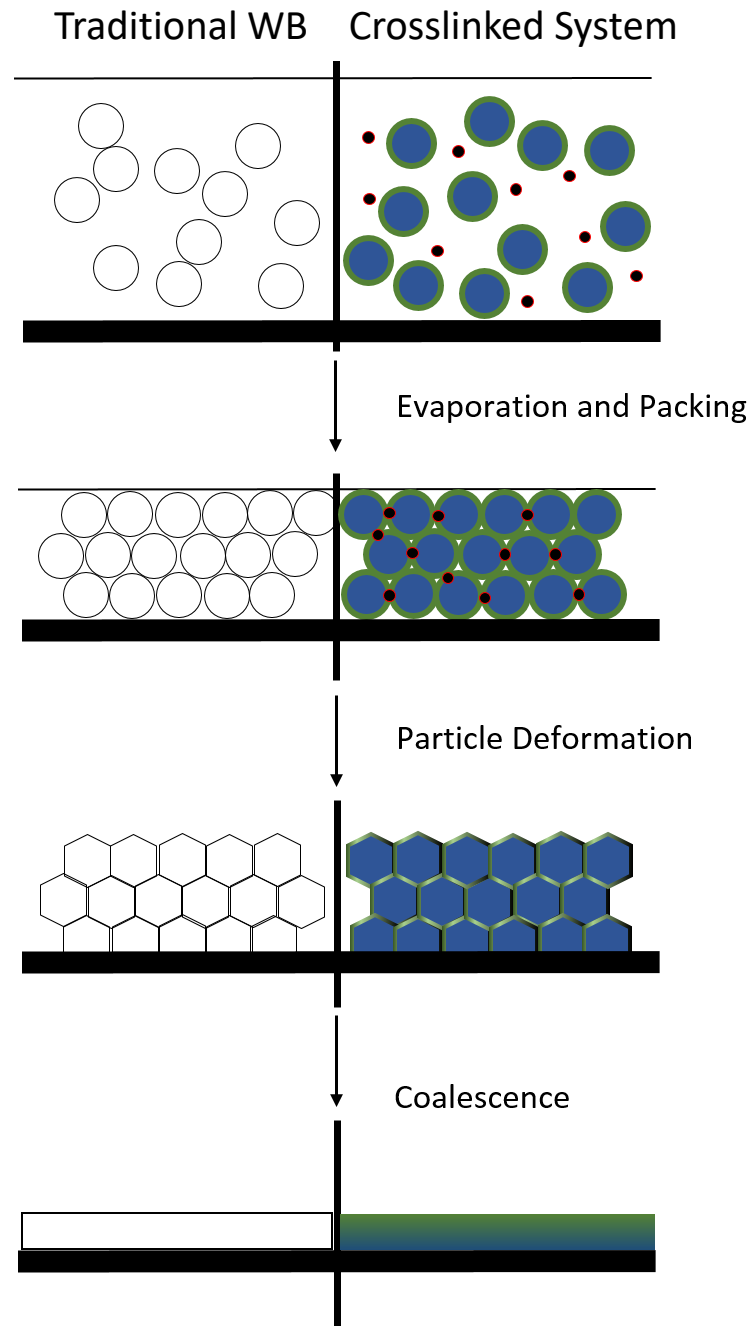
## Challenges

- Fast Drying in Extreme Conditions
  - Low temperature
  - High humidity environments
- Hardness
- Dirt Pickup Resistance
- Block Resistance
- High Film Build

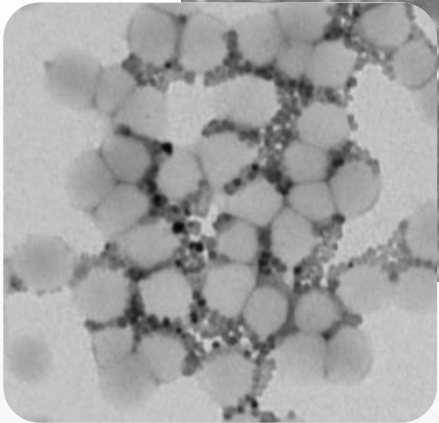
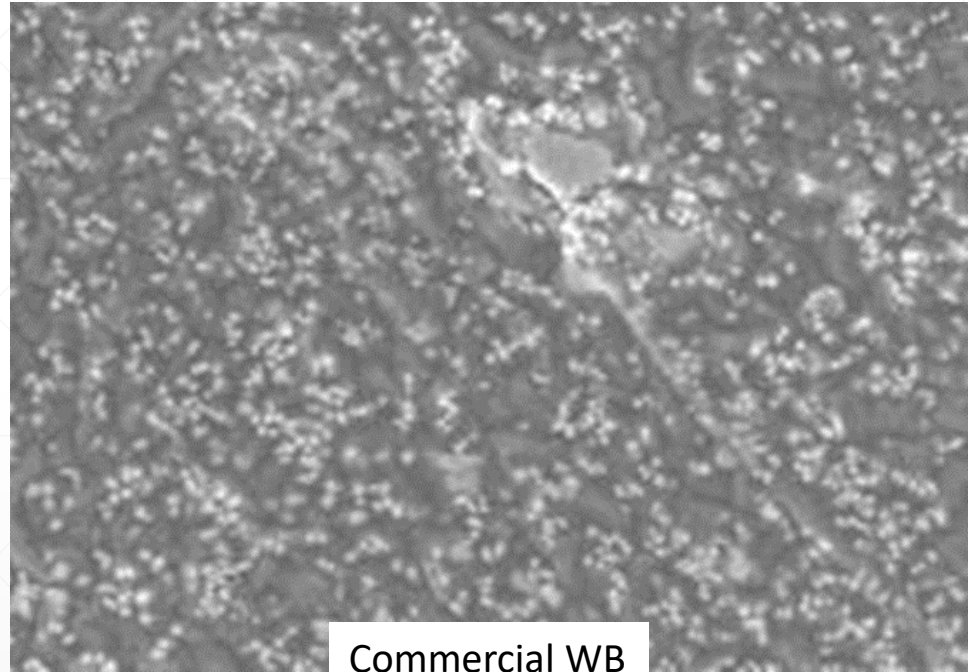
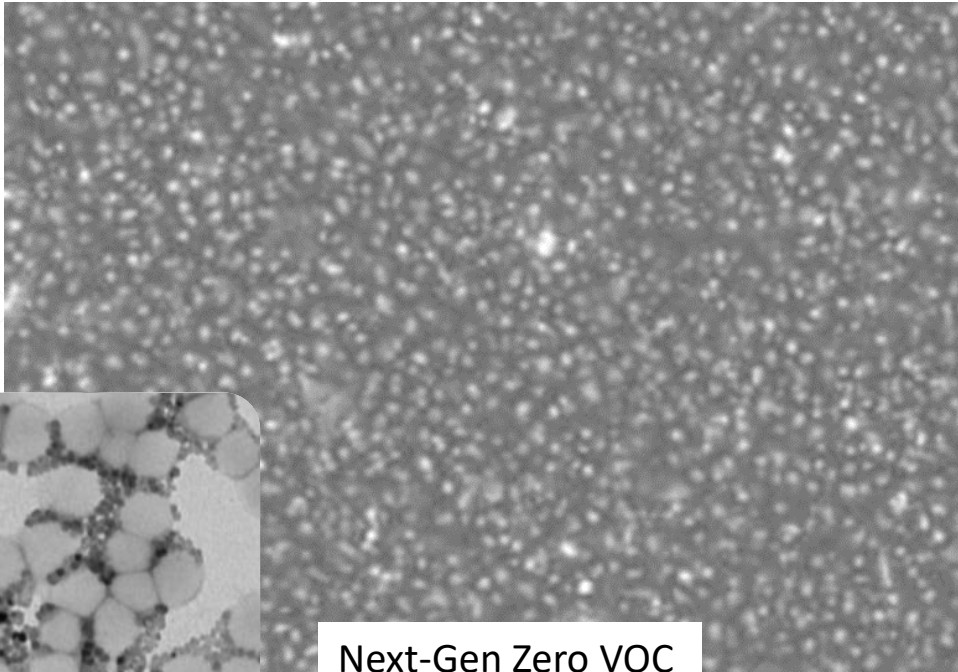
# **Advances in Film Formation Mechanisms**

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# Stages of Film Formation



# Film Formation of Current WB acrylics vs. Next-Generation Zero VOC



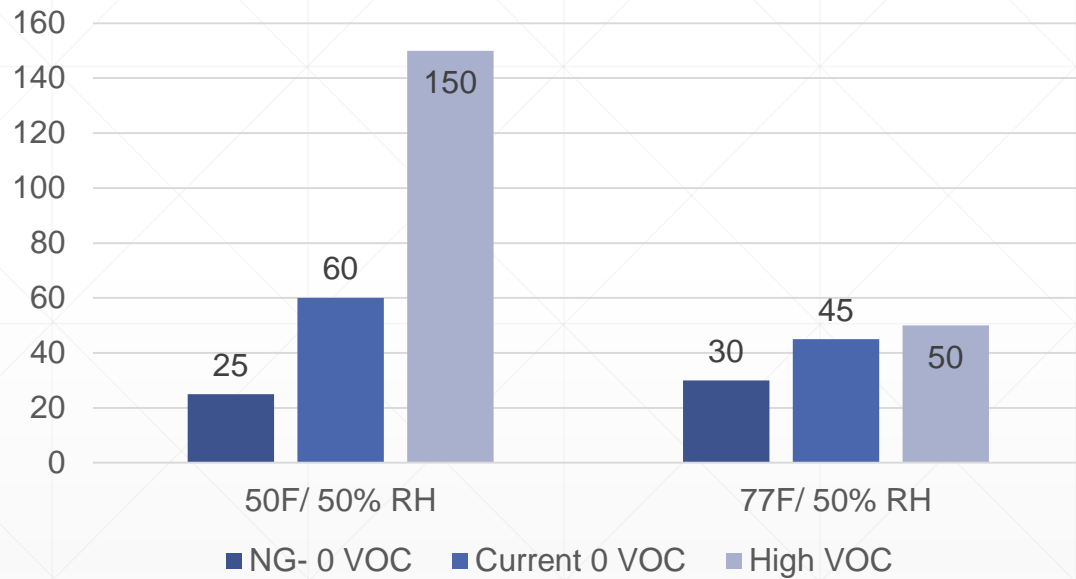
**Quality of film formation  
leads to exceptional  
properties**

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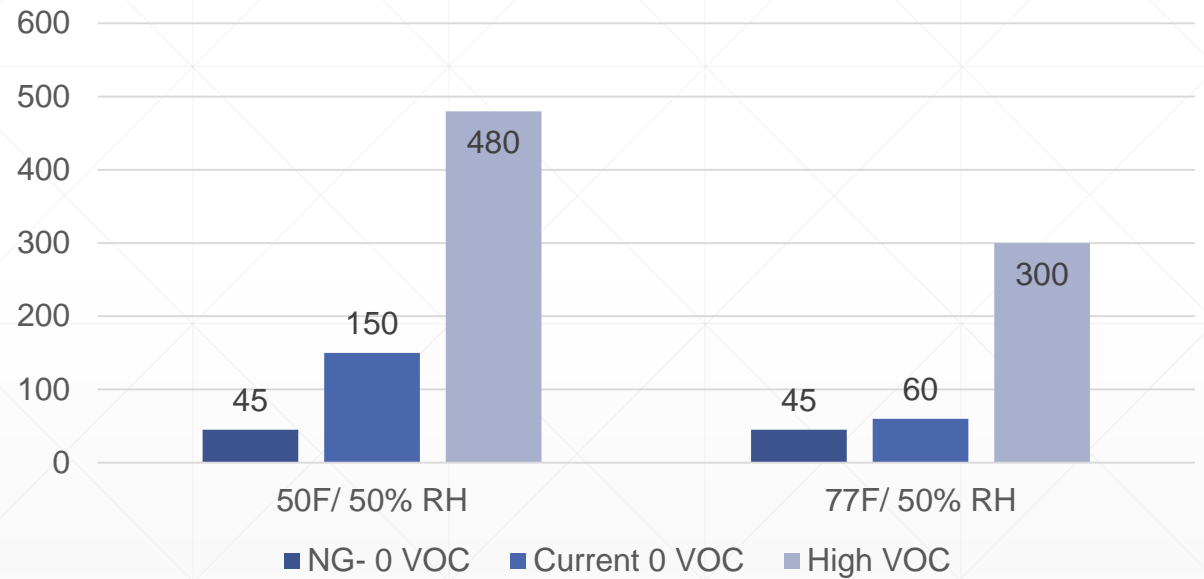


# Comparison of Cure rates of Current Waterborne acrylics and Next-Generation Zero VOC acrylics

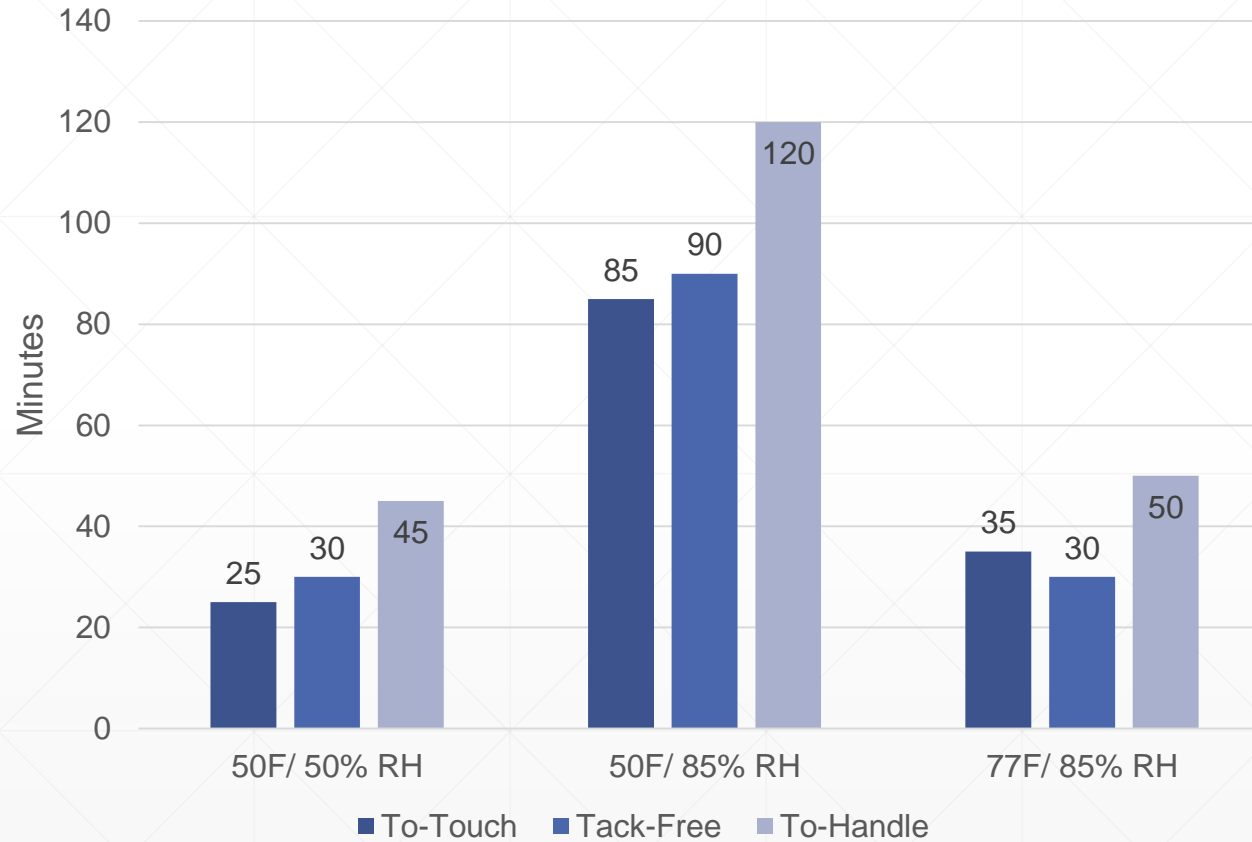
To-Touch (minutes)



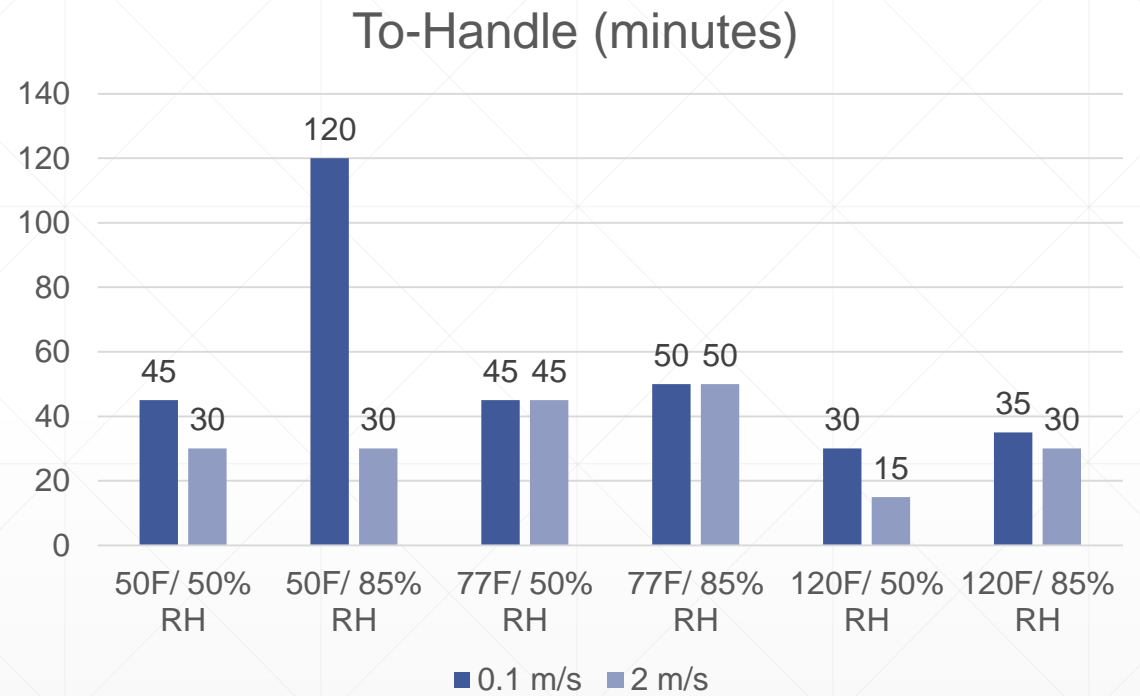
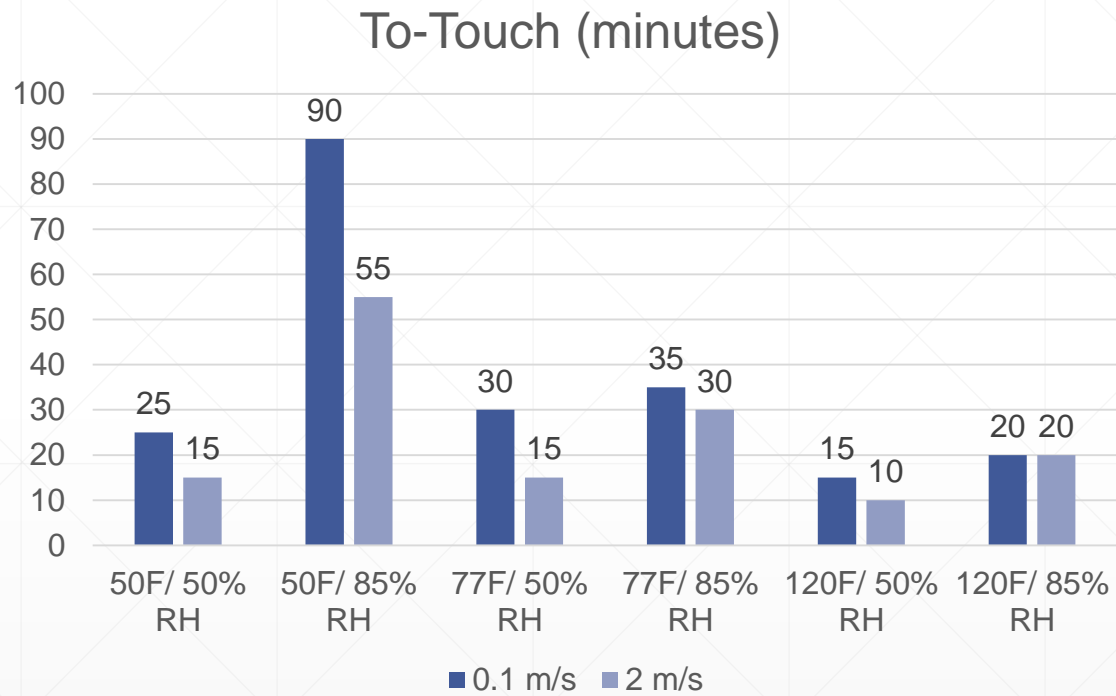
To-Handle (minutes)



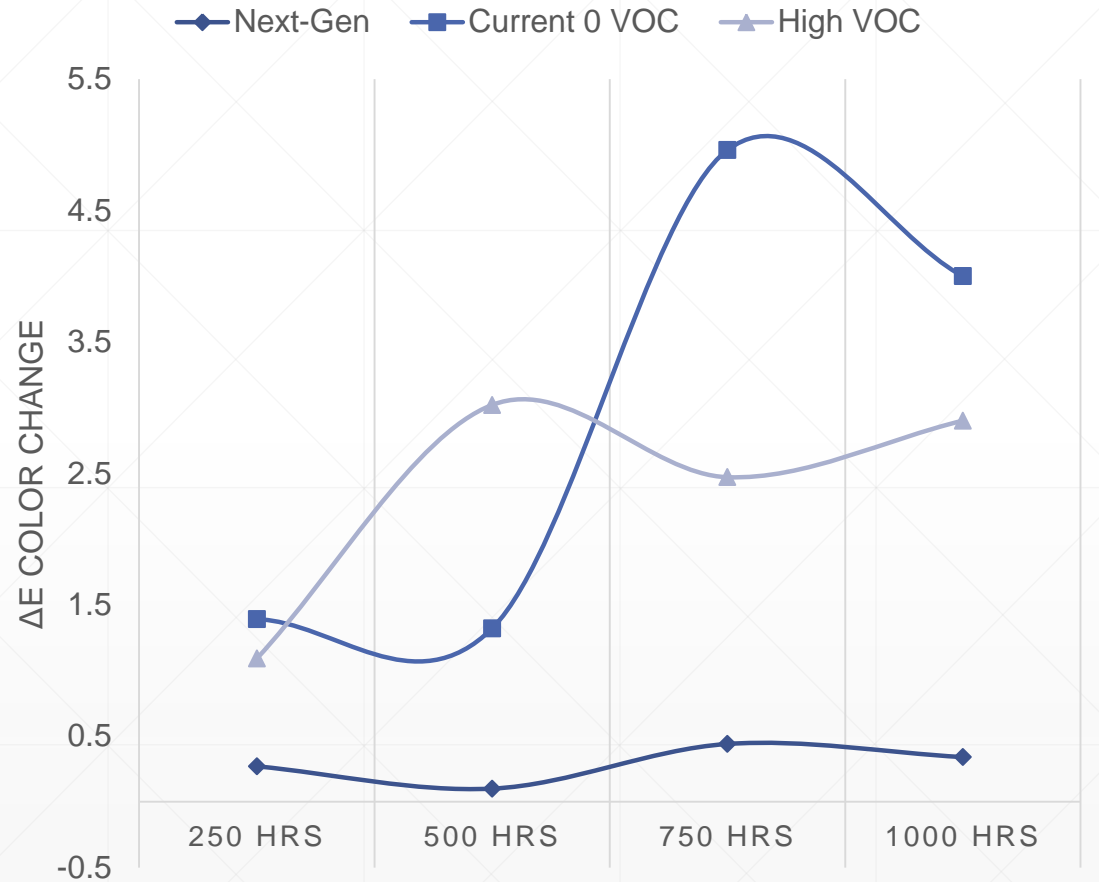
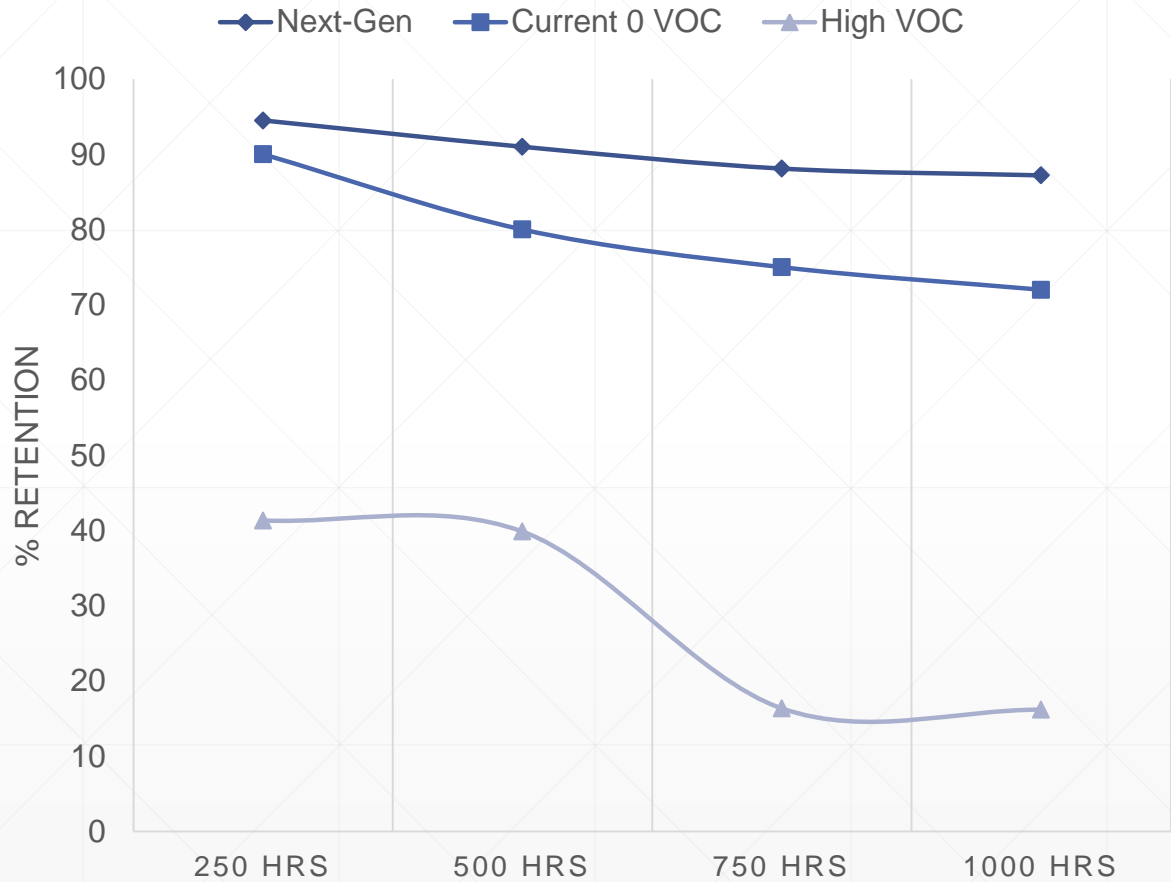
# Next-Generation Zero VOC Drying at High Humidity, Low Temperature



# The Effect of Temperature, Humidity and Air Flow in Dry-to-Touch and Dry-to-Handle of the Next-Generator Zero VOC Waterborne Acrylic



# Comparison of QUV Weathering of Current Waterborne acrylics and Next-Generation Zero VOC Waterborne Acrylics



# Excellent Decal properties

- Time-To-Decal under two hours



# Comparison of Corrosion Weathering of Current Waterborne Acrylics and Next-Generation Zero VOC Waterborne Acrylics



Commercial High VOC

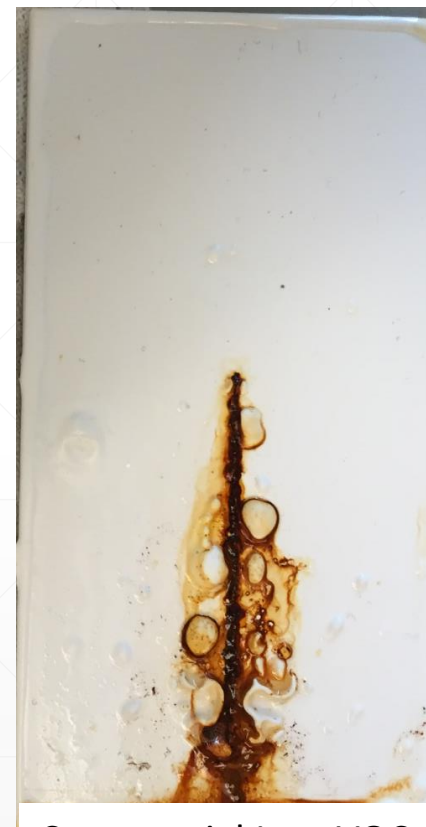


Commercial Low VOC

**500h**



Next-Gen Zero VOC



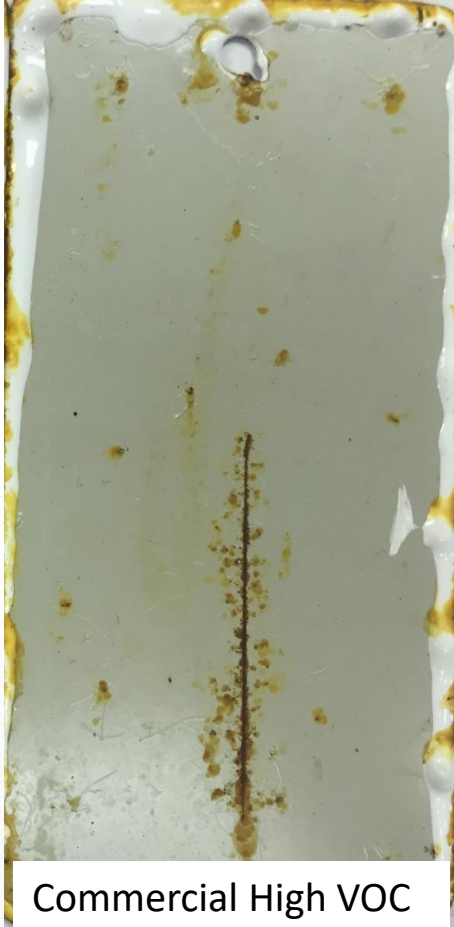
Commercial Low VOC



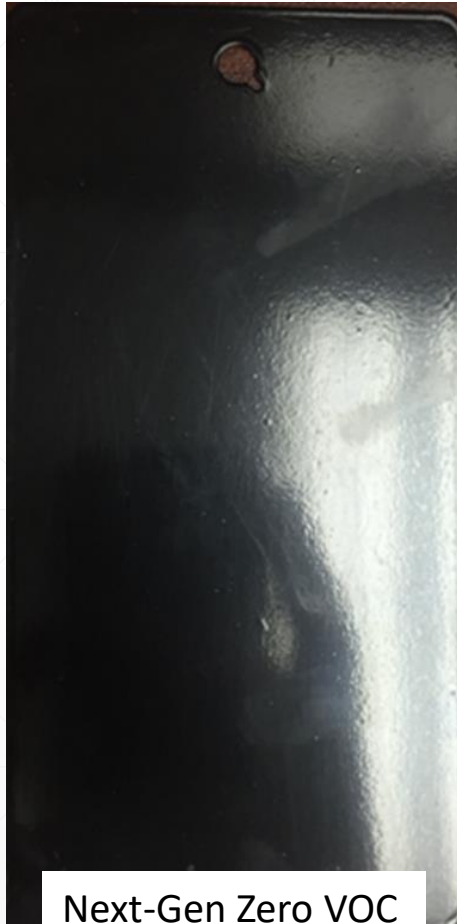
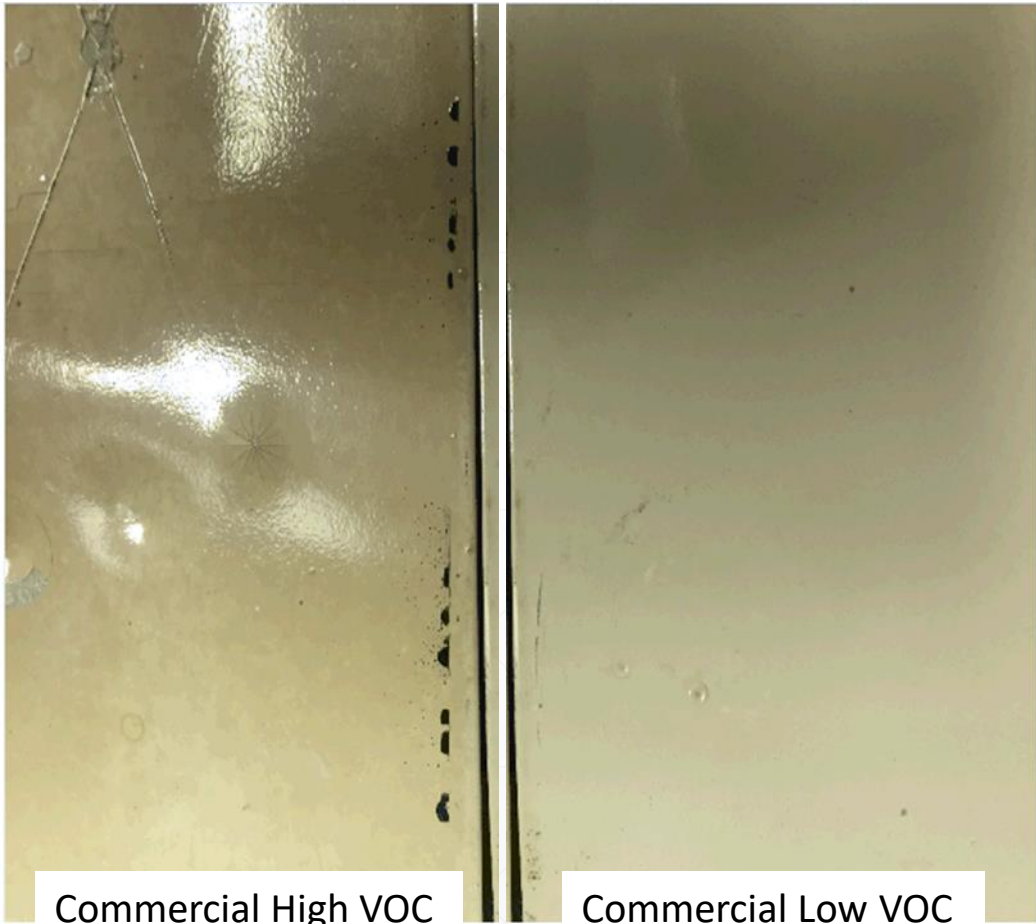
Next-Gen Zero VOC

**1000h**

# Comparison of Corrosion Weathering at 1000h



# High Heat Resistance at 400°F



System	Hardness	Direct Impact	Indirect Impact
Next-Gen Zero VOC	H	160	160
Commercial High VOC	H	30	10
Commercial Low VOC	H	80	60

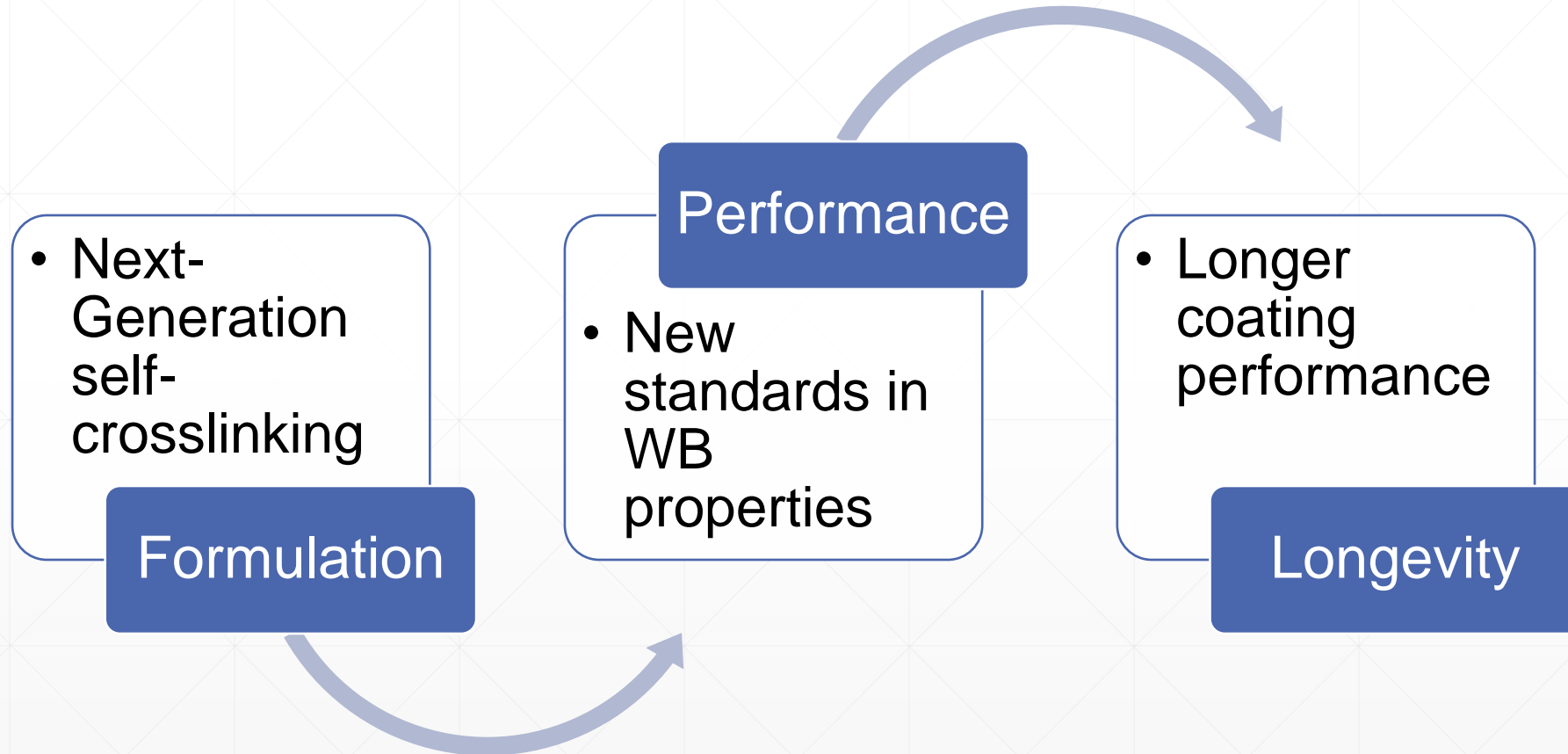


# Chemical Resistance

- Fair- 6h little/no effect
- Good- 24h little/no effect
- Excellent 5 day little/no effect

Chemical	Result
50% NaOH	Excellent
25% Phosphoric Acid	Excellent
50% Sulfuric Acid	Excellent
Conc. Ammonium Hydroxide	Excellent
Mineral Spirits	Good
Conc. HCl	Excellent
10% Nitric Acid	Excellent
IPA	Excellent
25% Potassium Hydroxide	Good

# Conclusion



# Thank you!

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