



“FEVE Fluoropolymer Emulsions for Performance Improvement in Architectural Coatings”

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29th Western Coatings Symposium

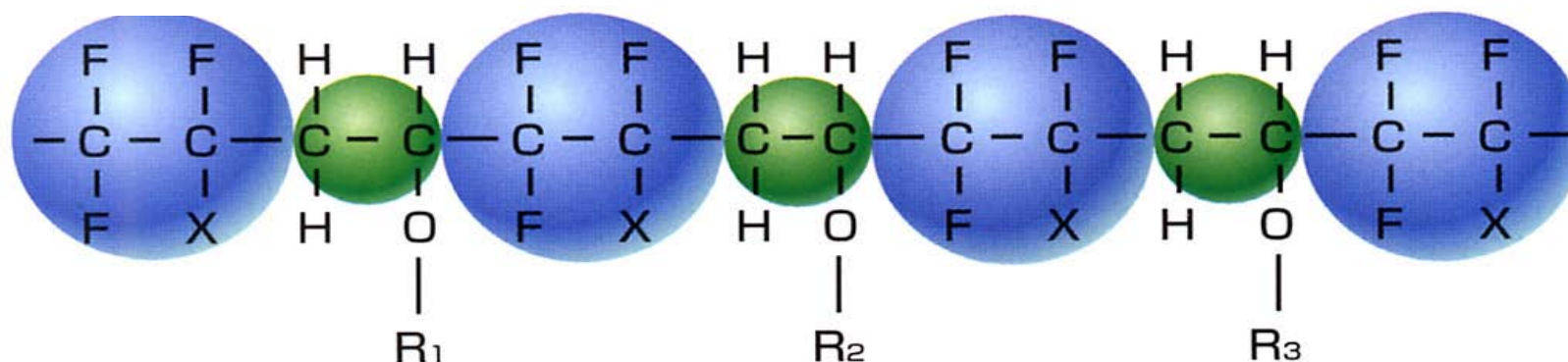
FEVE Fluoropolymer Resins

- “FEVE” is abbreviation for “Fluoroethylene Vinyl Ether” resins for coatings
 - Known for their high performance properties:
 - 1) Exceptional resistance to UV degradation
 - 2) Superior Chemical Resistance
 - 3) Excellent Thermal Resistance
 - Known for their unique formulation properties:
 - 1) Solvent soluble
 - 2) Can be cured at ambient temperature with isocyanates
 - 3) Can achieve high gloss formulations

Fluoroethylene Vinyl Ether (FEVE) Resins

 Fluoro Ethylene

 Vinyl Ether



FLUORINATED SEGMENTS: Weatherability, durability, chemical resistance

VINYL ETHER SEGMENTS: Gloss, solubility, crosslinking

Commercial Types of “FEVE” Resins:

1) *Solvent soluble resins* –

uses organic solvents for viscosity reduction;
predominantly cured with isocyanates; available as
resin solutions or as 100% solid resins

2) *Water-based emulsions* –

use vinyl ether macromonomers containing
polyoxyethylene (EO) units to create stable emulsions

FEVE Water-borne Emulsions

*****	<i>FE-4300</i>	<i>FE-4500</i>
<i>Solids (Wt.)</i>	50%	50%
<i>pH</i>	7 to 9	7 to 9
<i>Specific Gravity</i>	1.13	1.17
<i>MFT</i>	35°C.	28°C.
<i>Hydroxyl Value</i>	10	13

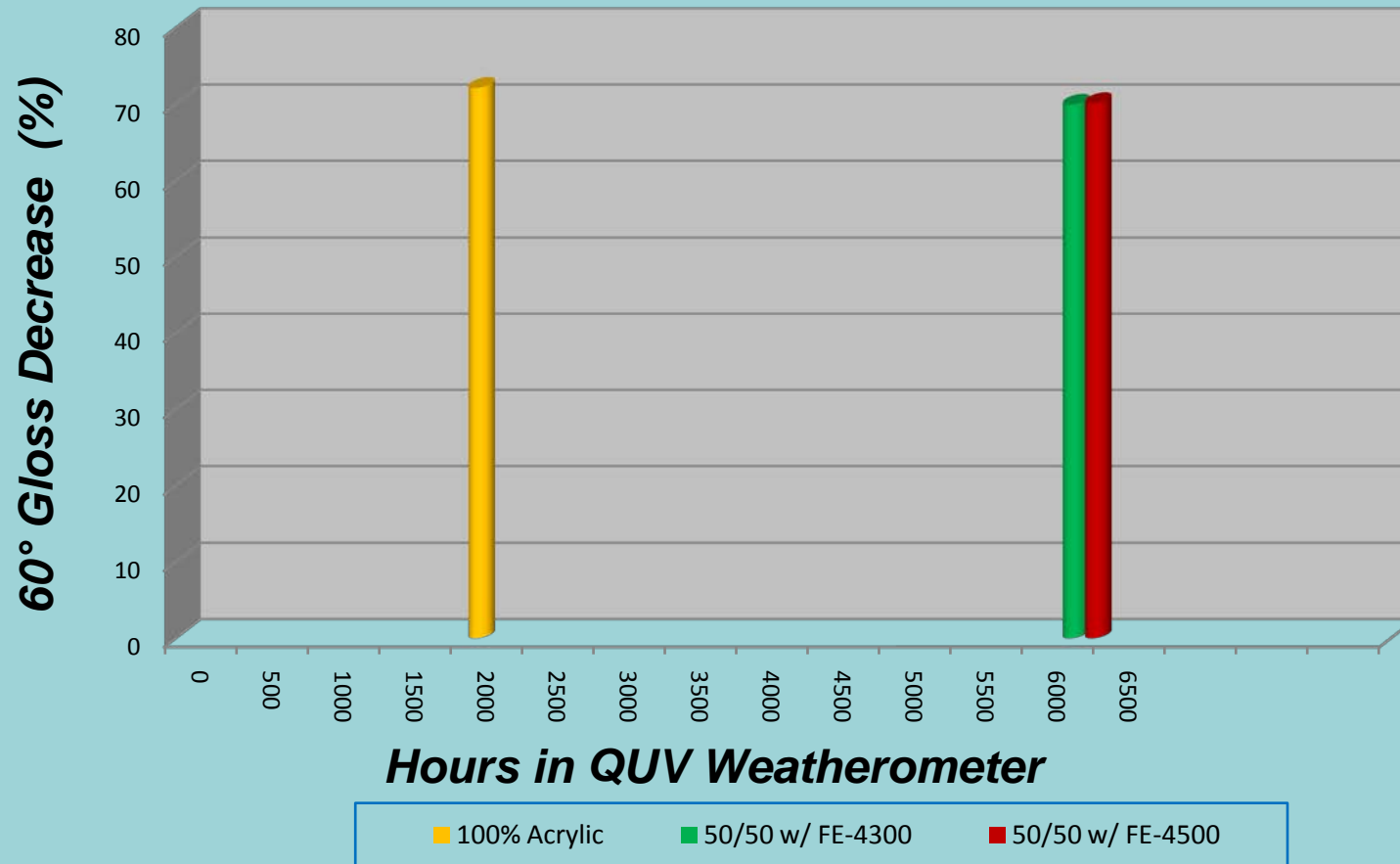
White House Paint Formulation Properties

<i>Solids (Volume)</i>	32%
<i>pH</i>	9.0 to 9.5
<i>TiO₂ Choice</i>	TiPure R-706
<i>PVC</i>	22
<i>Thickeners</i>	both cellulosic and associative
<i>60° Gloss Range</i>	50-65
<i>VOC</i>	1.24 #/gal. or 150 g/liter

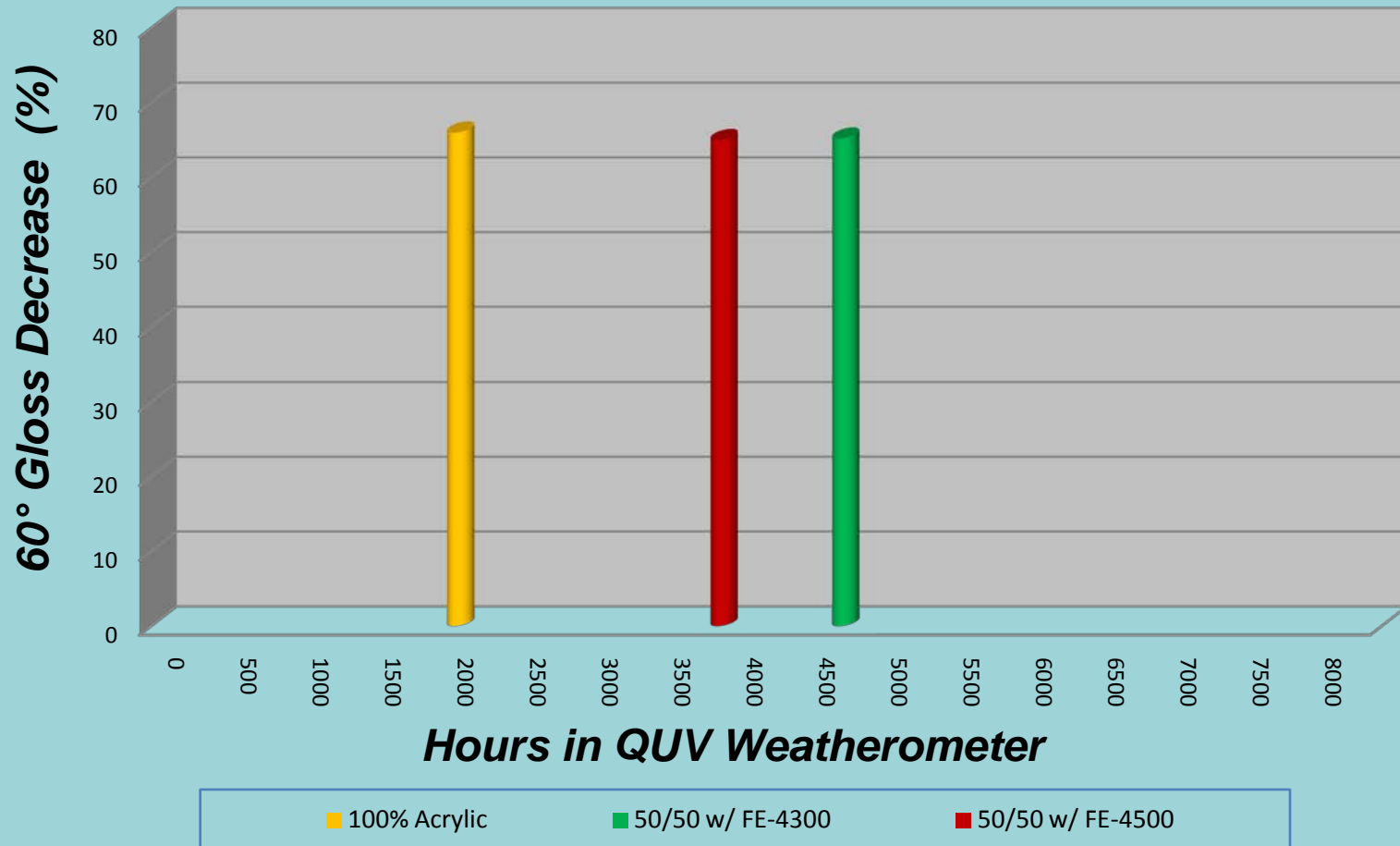
Testing procedure # 1 :

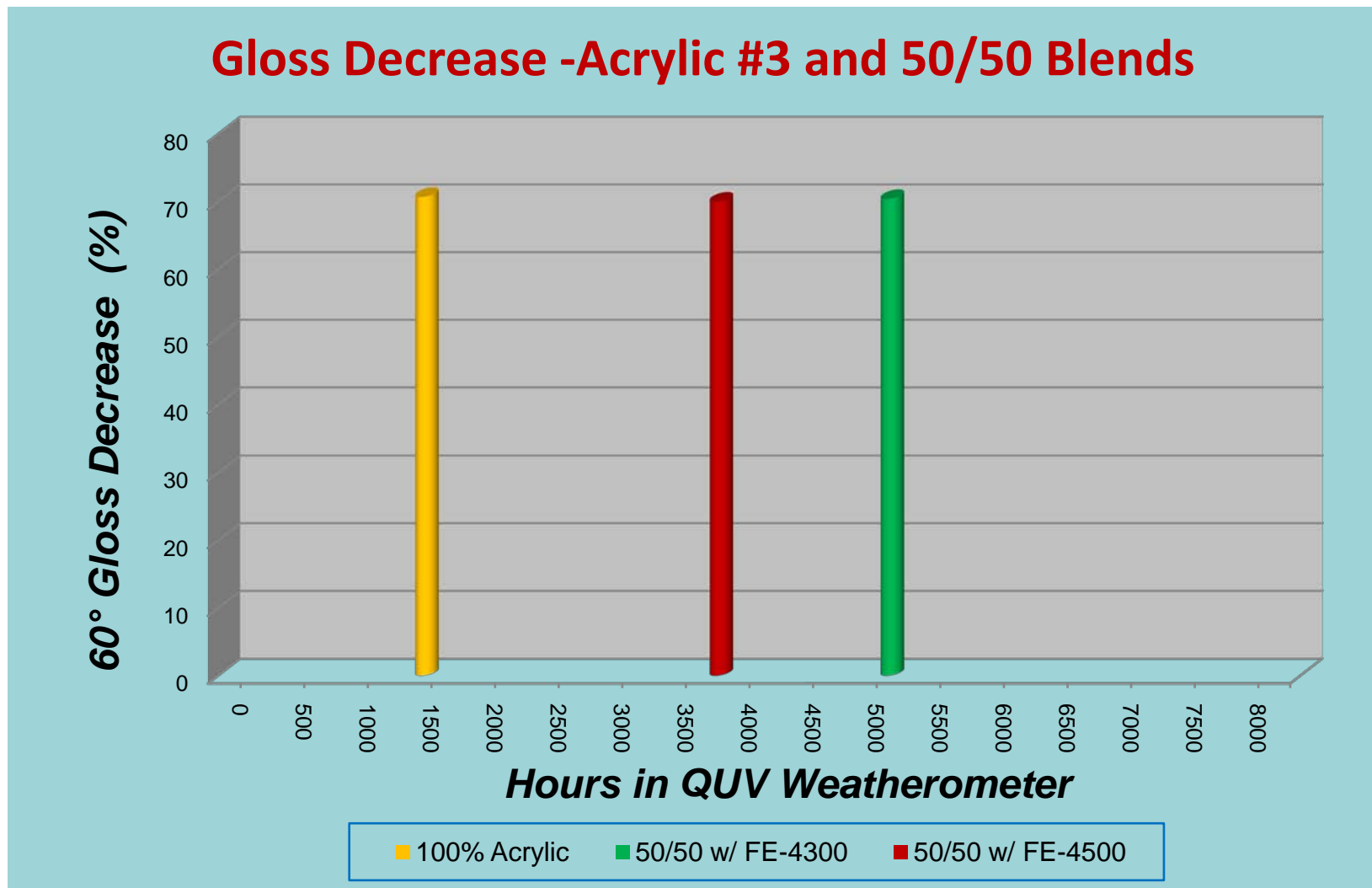
- 1) Blending of FEVE emulsions and 4 different acrylic emulsions to evaluate stability (3 weeks in 140°F. oven)
- 2) Manufacture of 3 *White House Paint* formulations for each acrylic emulsion:
 - a. **Binder** = 100% Acrylic Emulsion
 - b. **Binder** = 50% Acrylic Emulsion + 50% FE-4300 (FEVE Emulsion)
 - c. **Binder** = 50% Acrylic Emulsion + 50% FE-4500 (FEVE Emulsion)
- 3) Stability testing of all formulations (6 weeks in 120°F. oven)
- 4) Preparation of test panels (primed Al panels coated with 4 wet mils of coating)
- 5) QUV Weatherometer Exposure (UVA 340 Bulbs used)
 - a. **Test Cycle** = 8 hours UV light @ 60°C. + 4 hours condensation @ 50°C.

Gloss Decrease - Acrylic #1 and 50/50 Blends

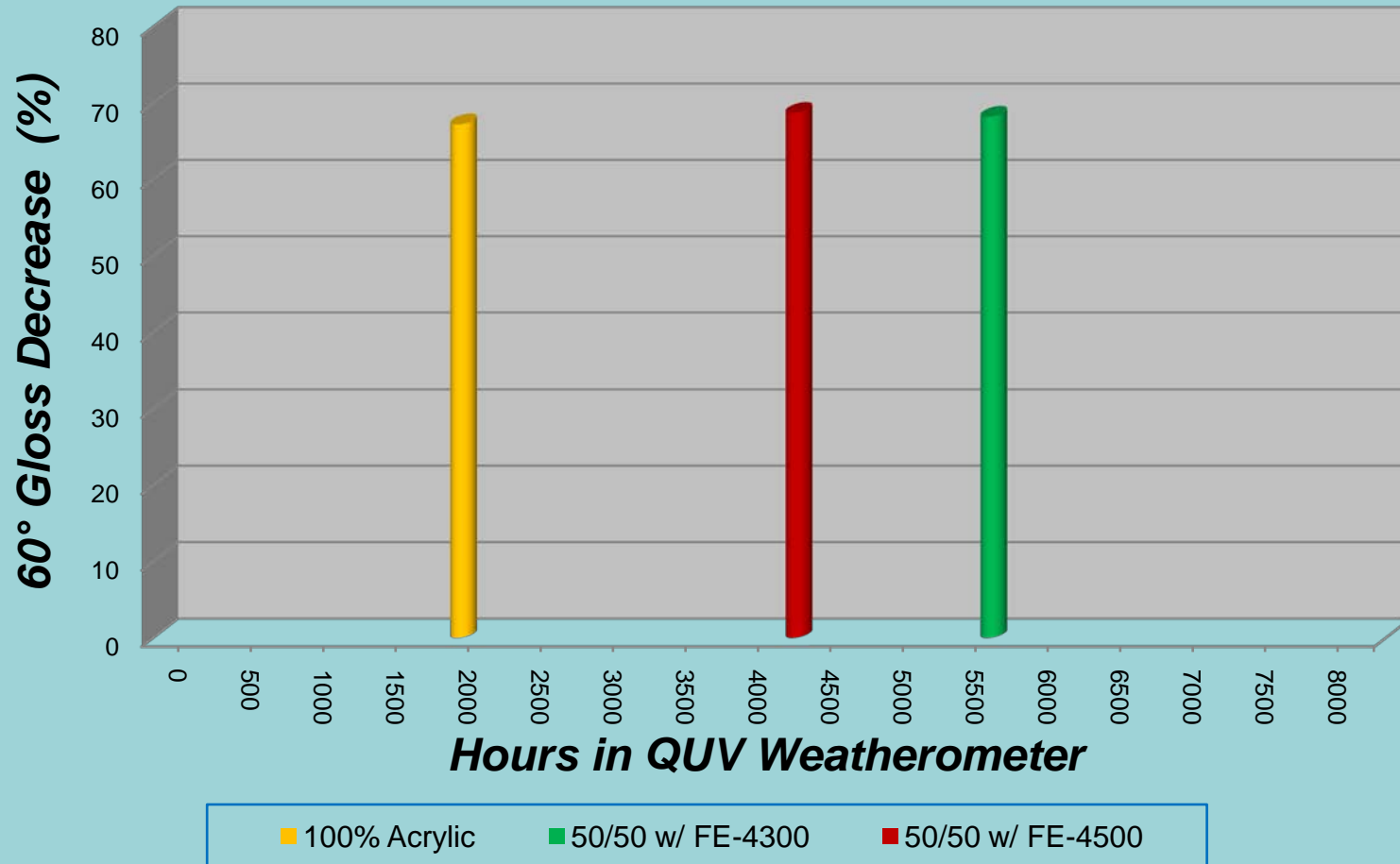


Gloss Decrease - Acrylic #2 and 50/50 Blends





Gloss Decrease - Acrylic #4 and 50/50 Blends

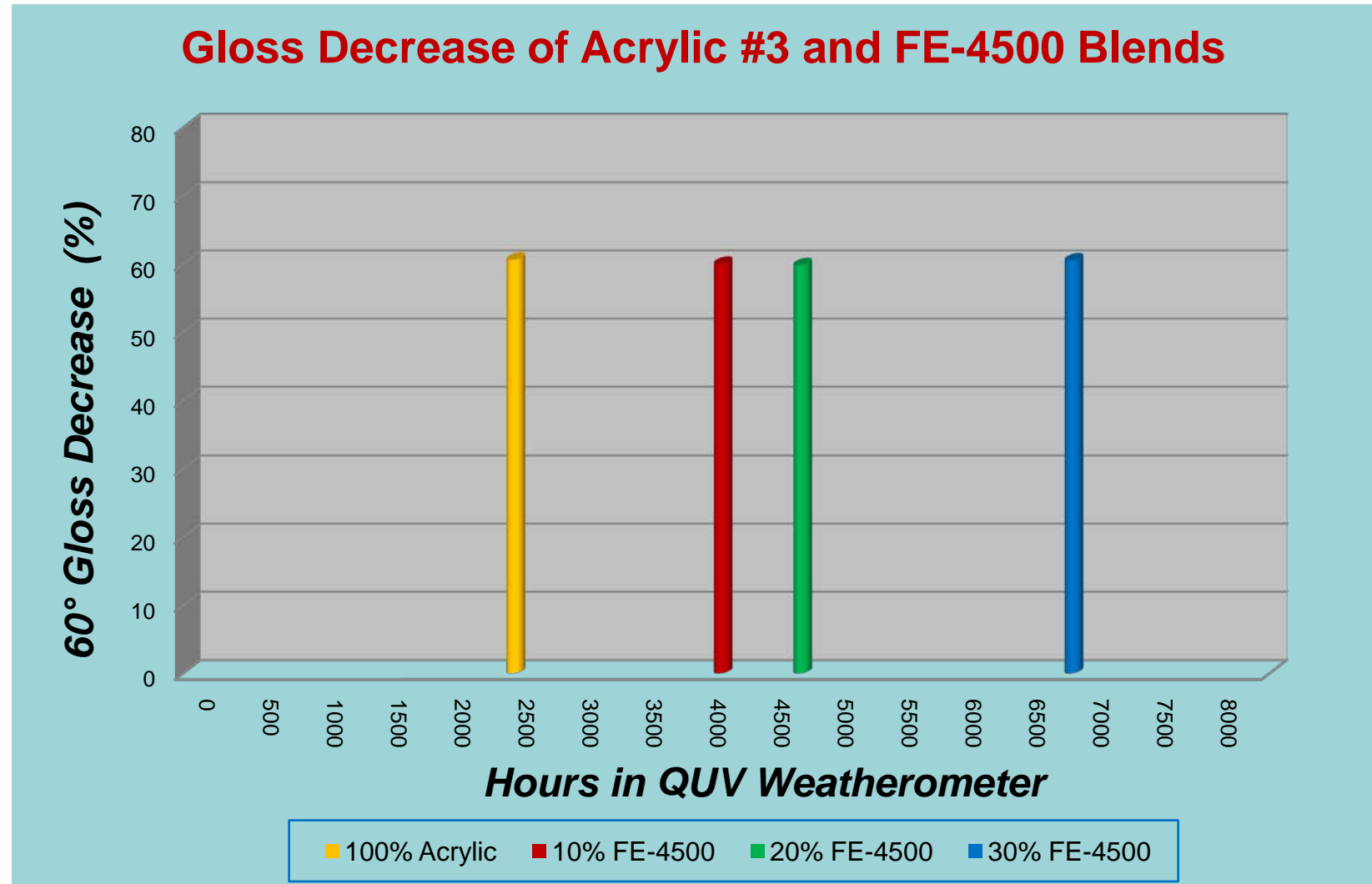


Red House Paint Formulation Properties

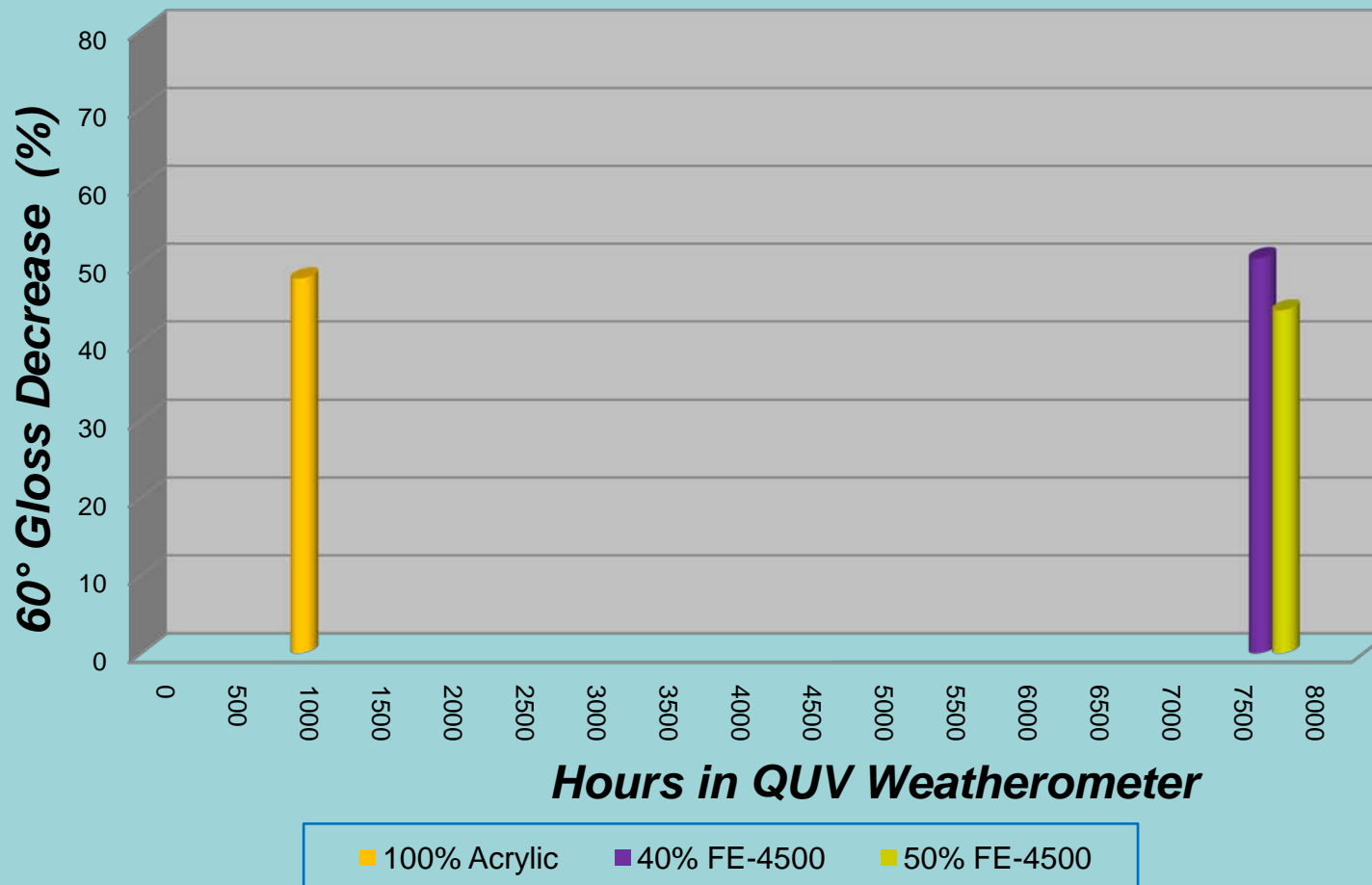
<i>Solids (Volume)</i>	36%
<i>pH</i>	9.0 to 9.5
<i>Pigment Choice</i>	Organic Red + Phthalo Blue (trace)
<i>PVC</i>	6.5
<i>Thickeners</i>	both cellulosic and associative
<i>60° Gloss Range</i>	50-65
<i>VOC</i>	1.24 #/gal. or 150 g/liter

Testing procedure # 2 :

- 1) Choose Acrylic Emulsion #3 as blending resin for Red HP formulation.
- 2) Manufacture of 6 **Red House Paint** formulations:
 - a. **Binder** = 100% Acrylic Emulsion
 - b. **Binder** = 50% Acrylic Emulsion + 50% FE-4500 (FEVE Emulsion)
 - c. **Binder** = 60% Acrylic Emulsion + 40% FE-4500 (FEVE Emulsion)
 - d. **Binder** = 70% Acrylic Emulsion + 30% FE-4500 (FEVE Emulsion)
 - e. **Binder** = 80% Acrylic Emulsion + 20% FE-4500 (FEVE Emulsion)
 - f. **Binder** = 90% Acrylic Emulsion + 10% FE-4500 (FEVE Emulsion)
- 3) Preparation of test panels (primed Al panels coated with 4 wet mils of coating)
- 4) QUV Weatherometer Exposure (UVA 340 Bulbs used)
 - a. **Test Cycle** = 8 hours UV light @ 60°C. + 4 hours condensation @ 50°C.



Gloss Decrease of Acrylic #3 and FE-4500 Blends

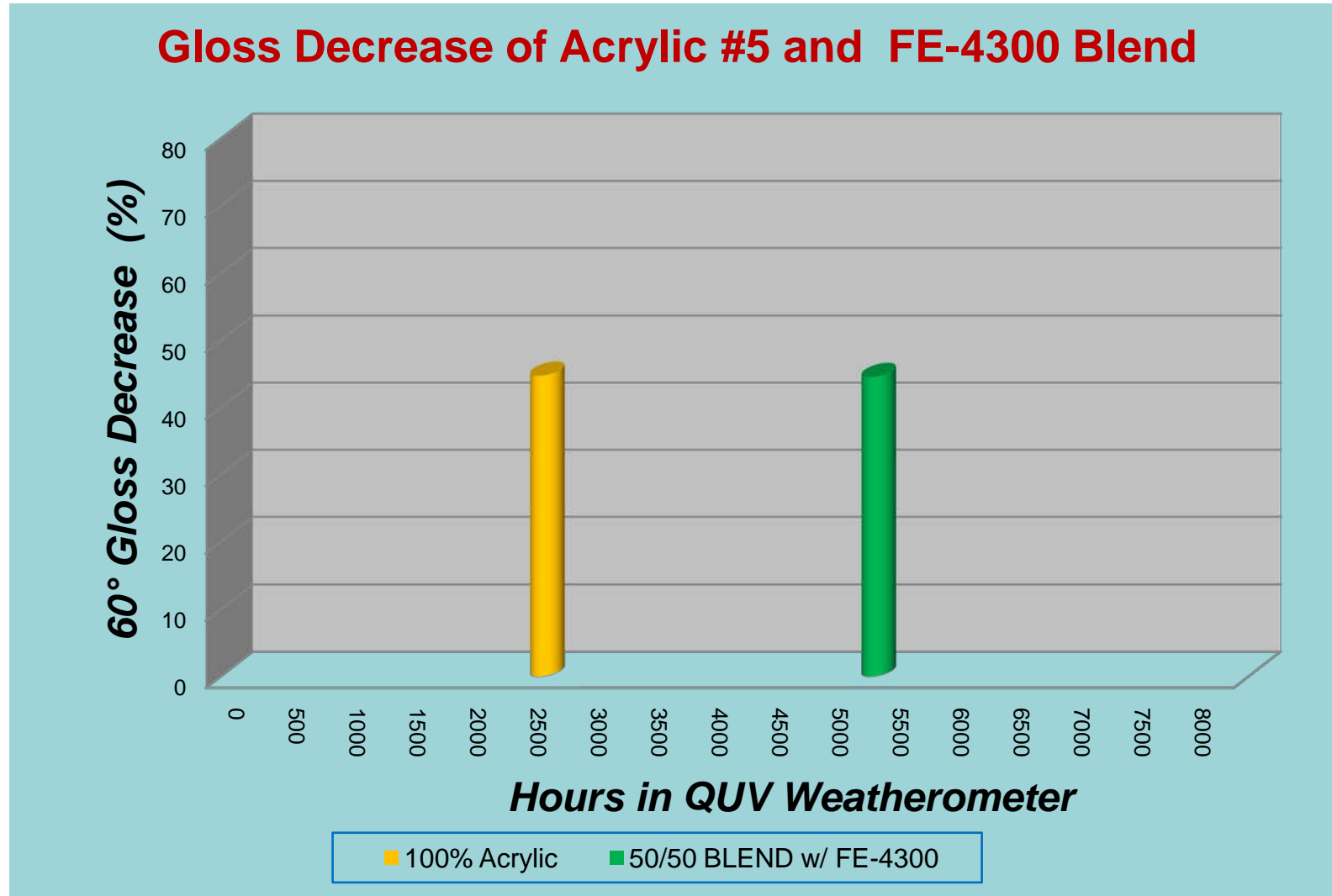


White DTM I/M Paint Formulation Properties

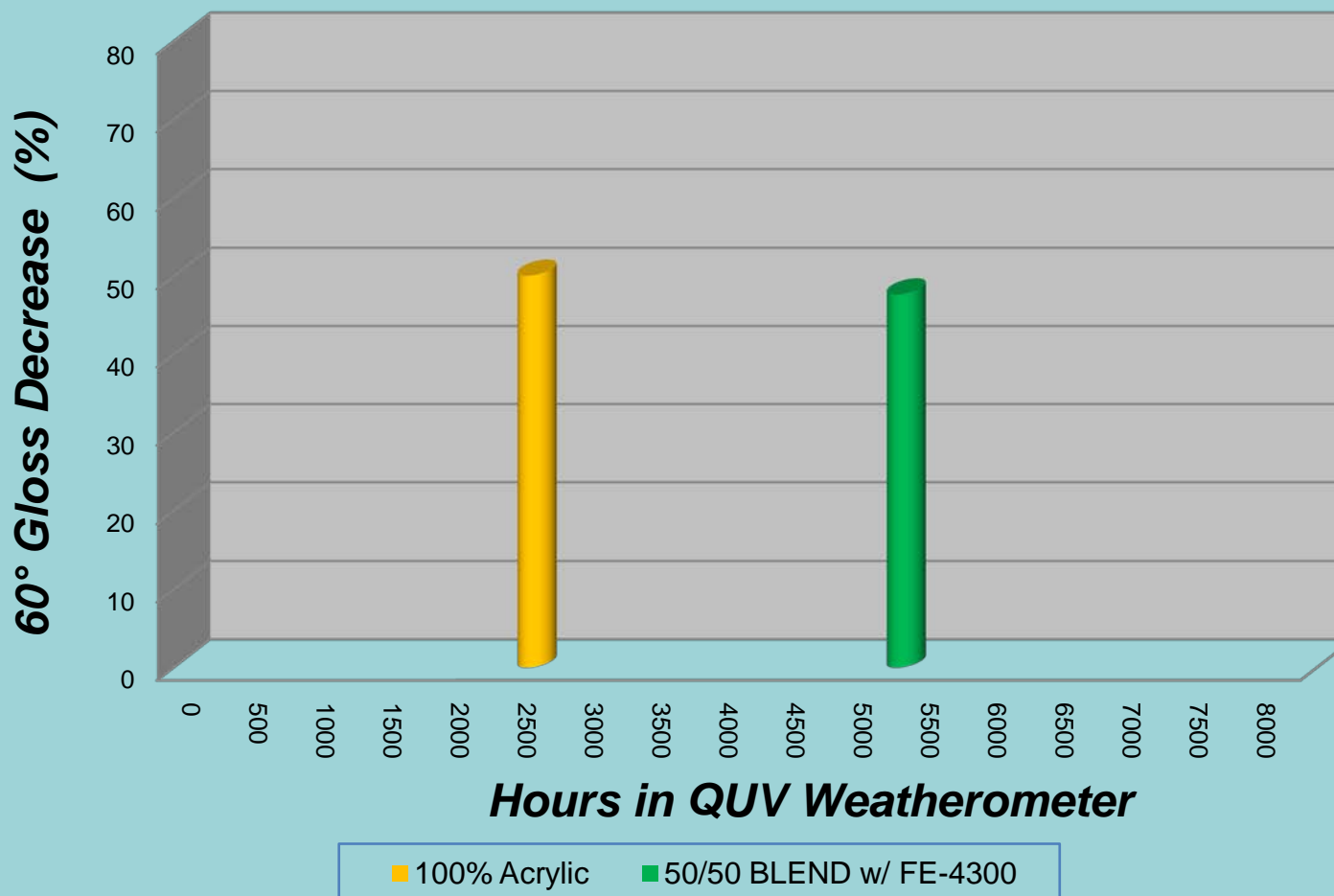
<i>Solids (Volume)</i>	38%
<i>FEVE Emulsion</i>	FE-4300
<i>pH</i>	9.0 to 9.5
<i>TiO₂ Choice</i>	TiPure R-706
<i>PVC</i>	18
<i>Thickeners</i>	associative-type
<i>60° Gloss Range</i>	60-80
<i>VOC</i>	1.24 #/gal. or 150 g/liter

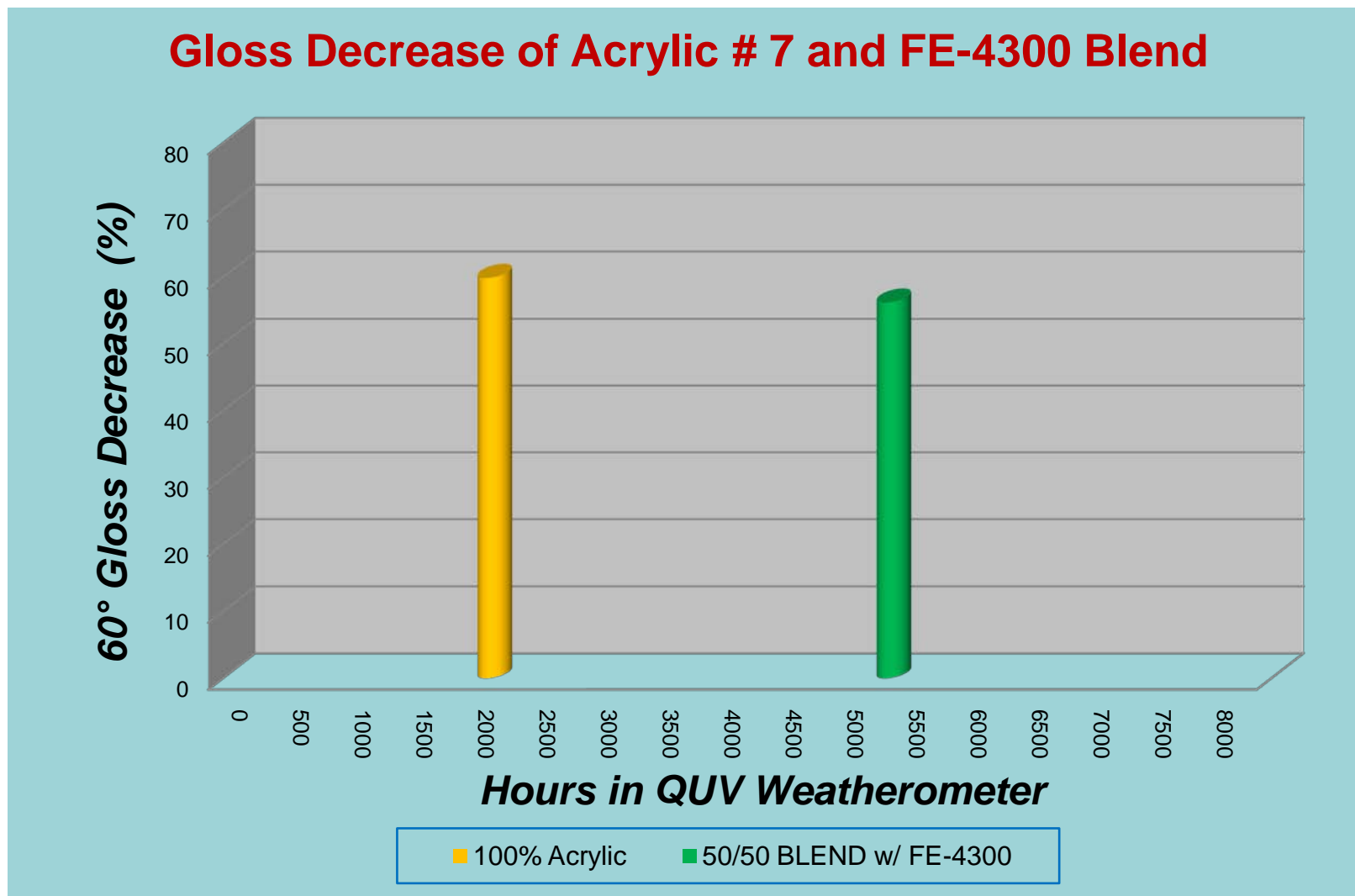
Testing procedure # 3 :

- 1) Choose 3 different acrylic emulsions from 2 manufacturers as blending resins for White DTM I/M Formulation. These acrylic emulsions are targeted for architectural metal finishes market.
- 2) Manufacture of 2 **White DTM I/M Paint** formulations:
 - a. **Binder** = 100% Acrylic Emulsion
 - b. **Binder** = 50% Acrylic Emulsion + 50% FE-4300 (FEVE Emulsion)
- 3) Preparation of test panels (primed Al panels coated with 4 wet mils of coating)
- 4) QUV Weatherometer Exposure (UVA 340 Bulbs used)
 - a. **Test Cycle** = 8 hours UV light @ 60°C. + 4 hours condensation @ 50°C.



Gloss Decrease of Acrylic #6 & FE-4300 Blend



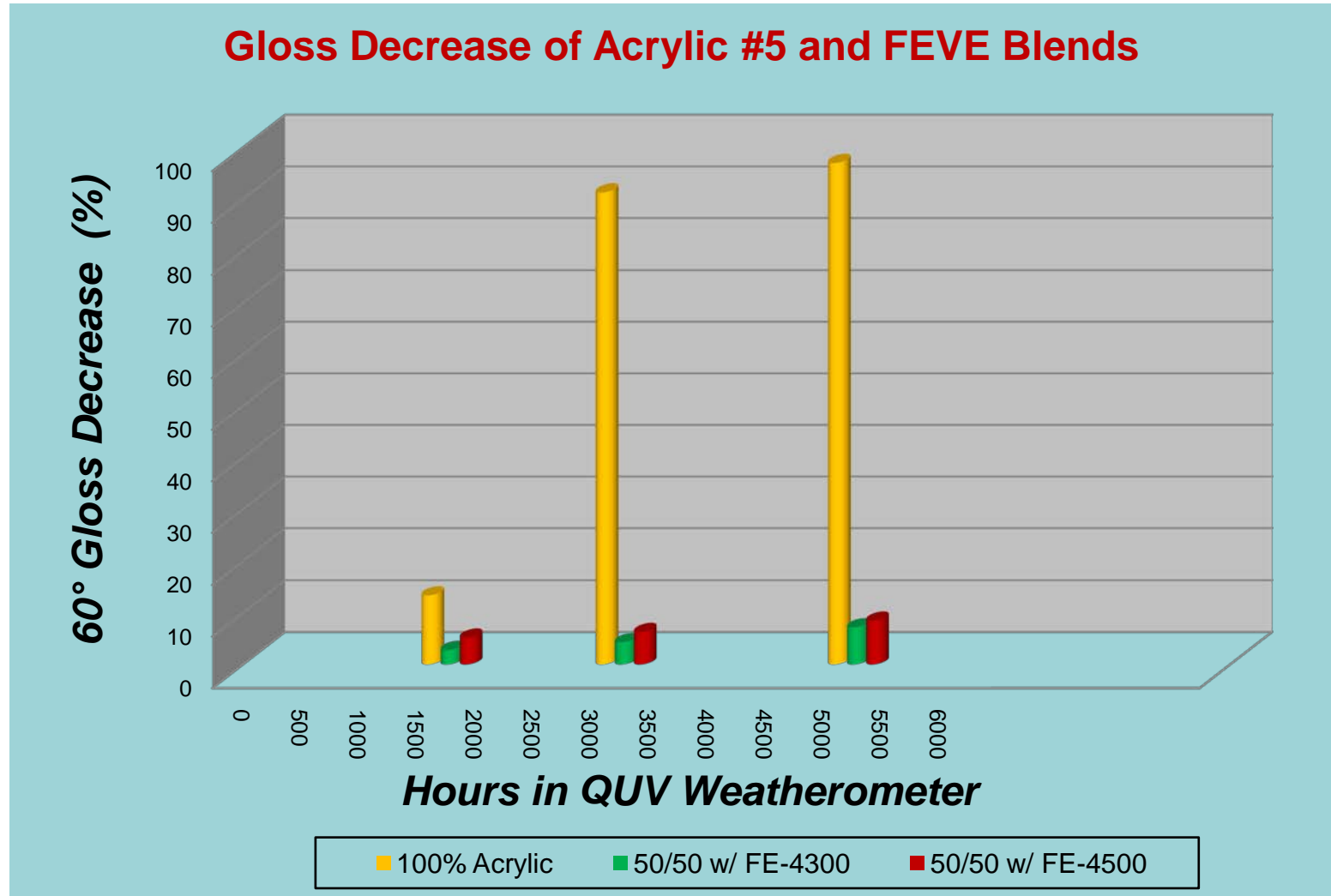


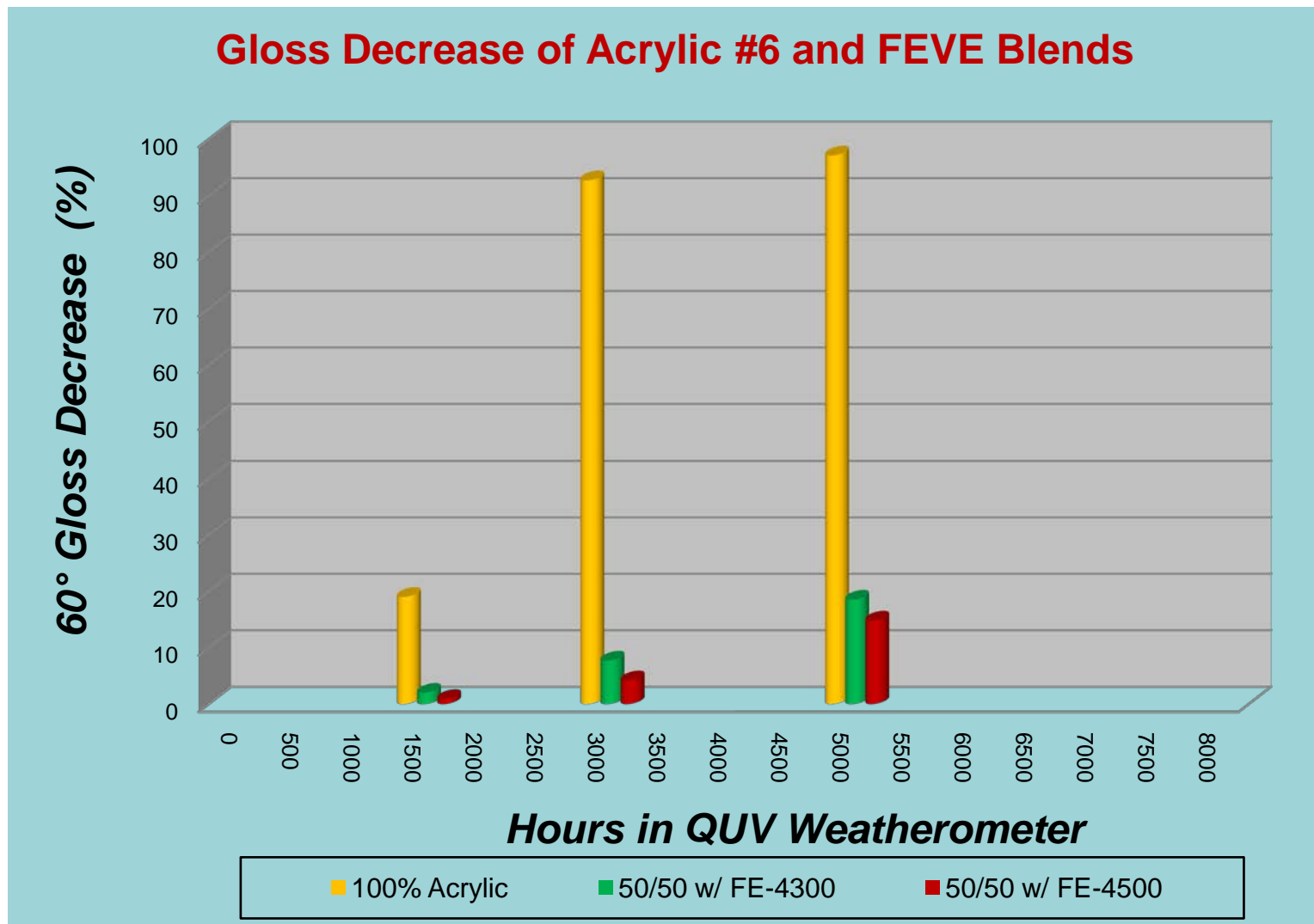
Black DTM I/M Paint Formulation Properties

<i>Solids (Volume)</i>	36%
<i>FEVE Emulsions</i>	FE-4300 and FE-4500
<i>pH</i>	9.0 to 9.5
<i>Pigment Choice</i>	Tint-Ayd CW5331 Masstone Black
<i>PVC</i>	2.7
<i>Thickeners</i>	associative-type
<i>60° Gloss Range</i>	60-80
<i>VOC</i>	1.24 #/gal. or 150 g/liter

Testing procedure # 4 :

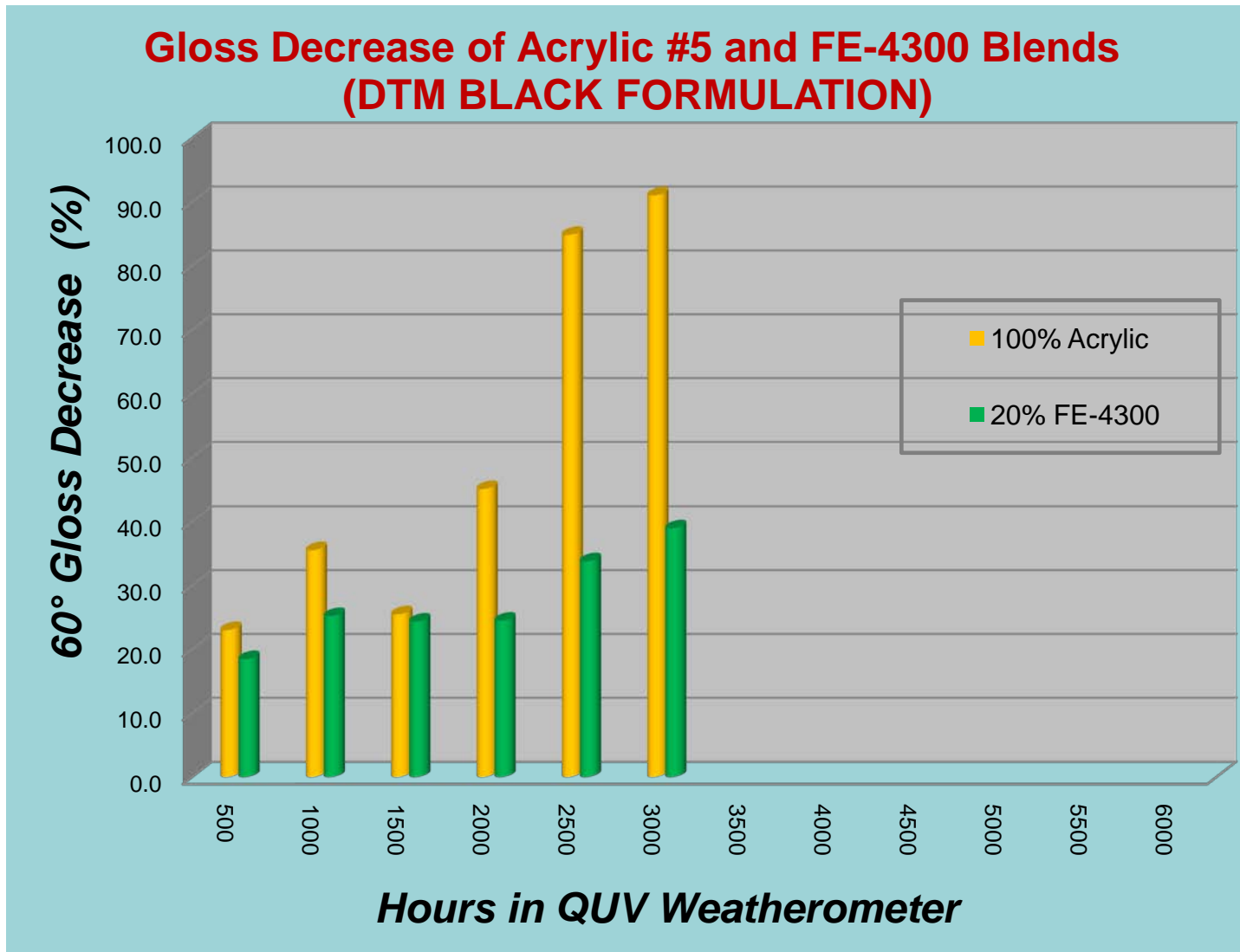
- 1) Choose Acrylic Emulsion # 5 and Acrylic Emulsion # 6 as blending resins for Black DTM I/M Formulation.
- 2) Manufacture of 3 **Black DTM I/M Paint** formulations for each Acrylic:
 - a. **Binder** = 100% Acrylic Emulsion
 - b. **Binder** = 50% Acrylic Emulsion + 50% FE-4300 (FEVE Emulsion)
 - c. **Binder** = 50% Acrylic Emulsion + 50% FE-4500 (FEVE Emulsion)
- 3) Preparation of test panels (primed Al panels coated with 8 wet mils of coating)
- 4) QUV Weatherometer Exposure (UVA 340 Bulbs used)
 - a. **Test Cycle** = 8 hours UV light @ 60°C. + 4 hours condensation @ 50° C.

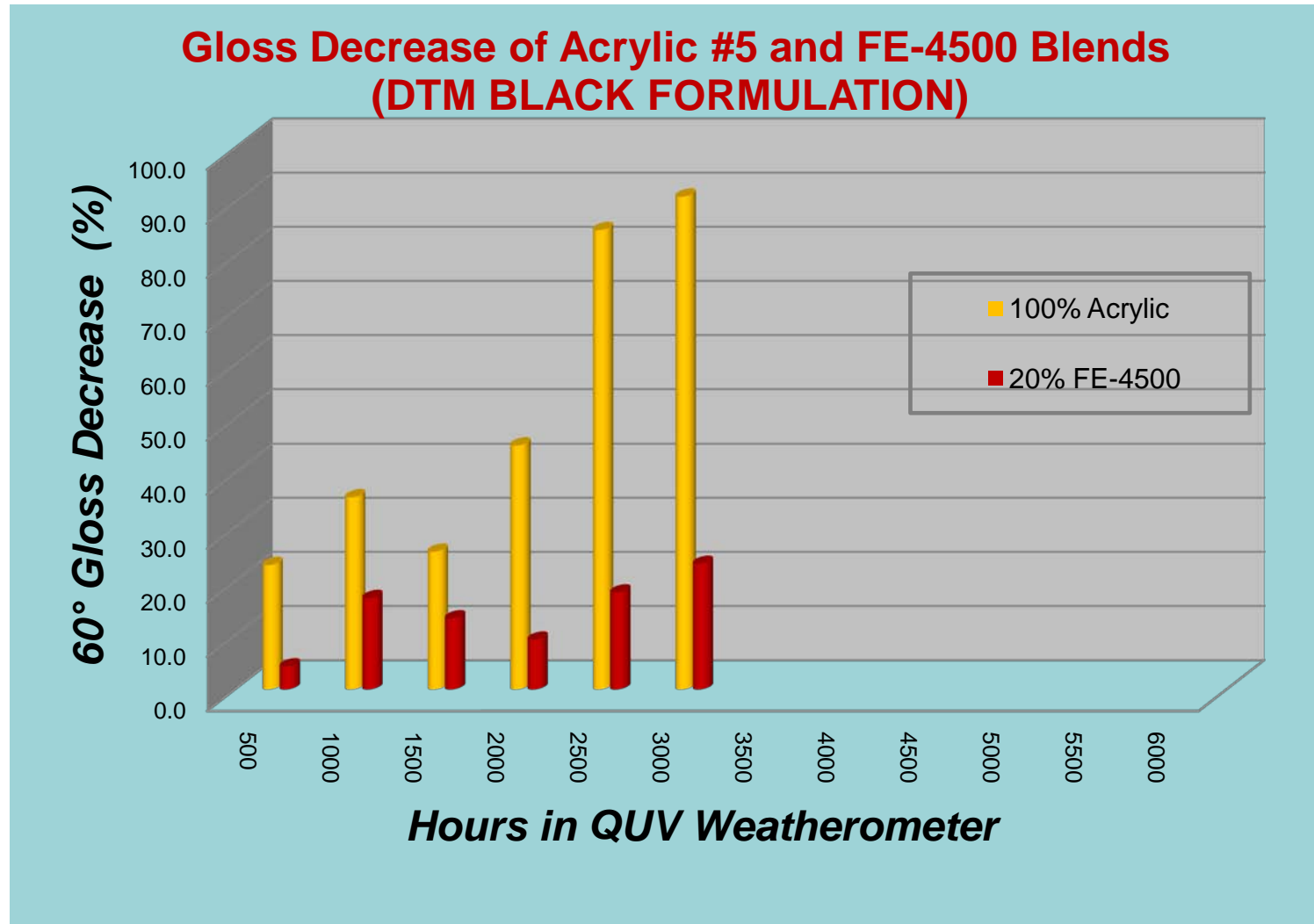


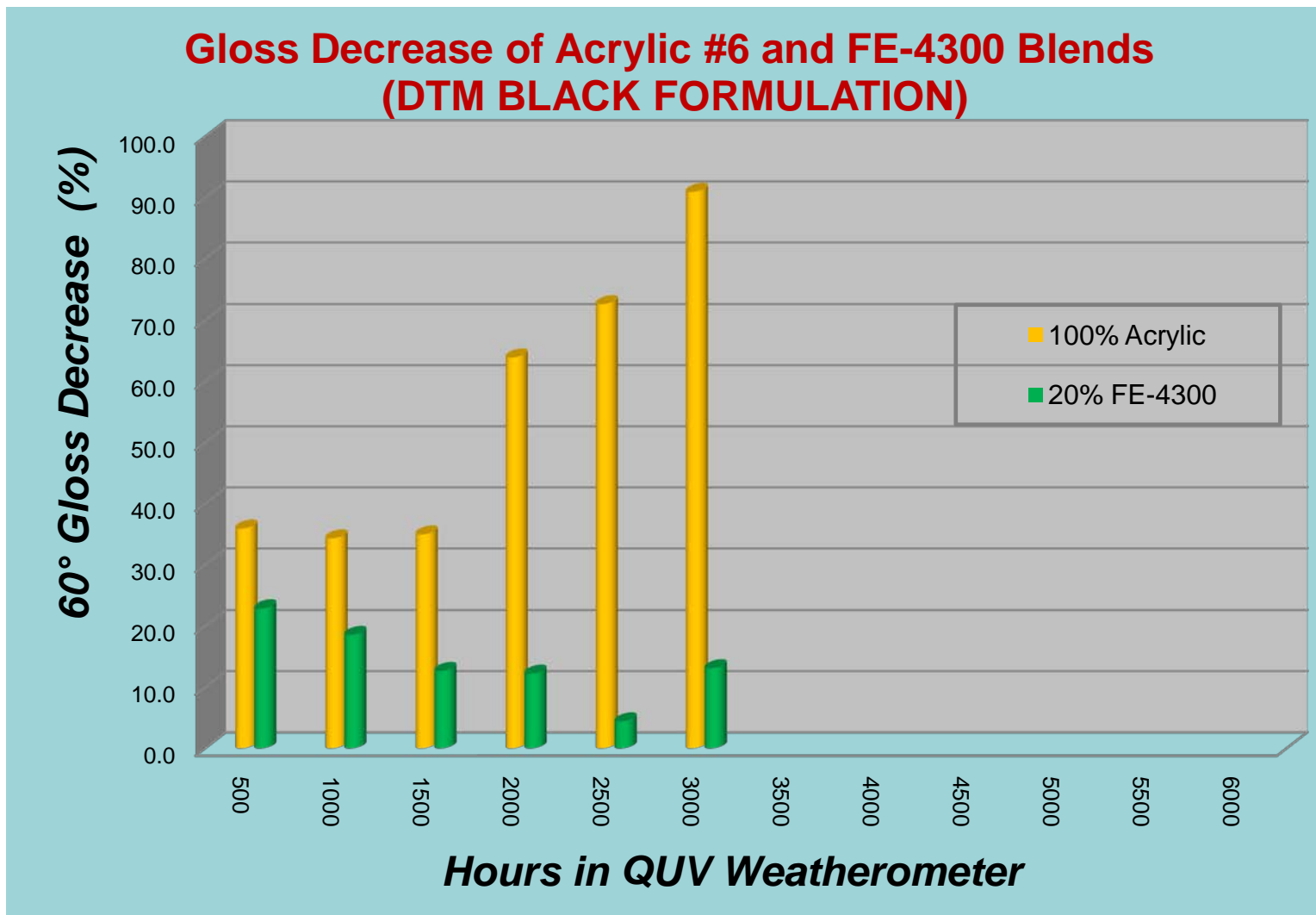


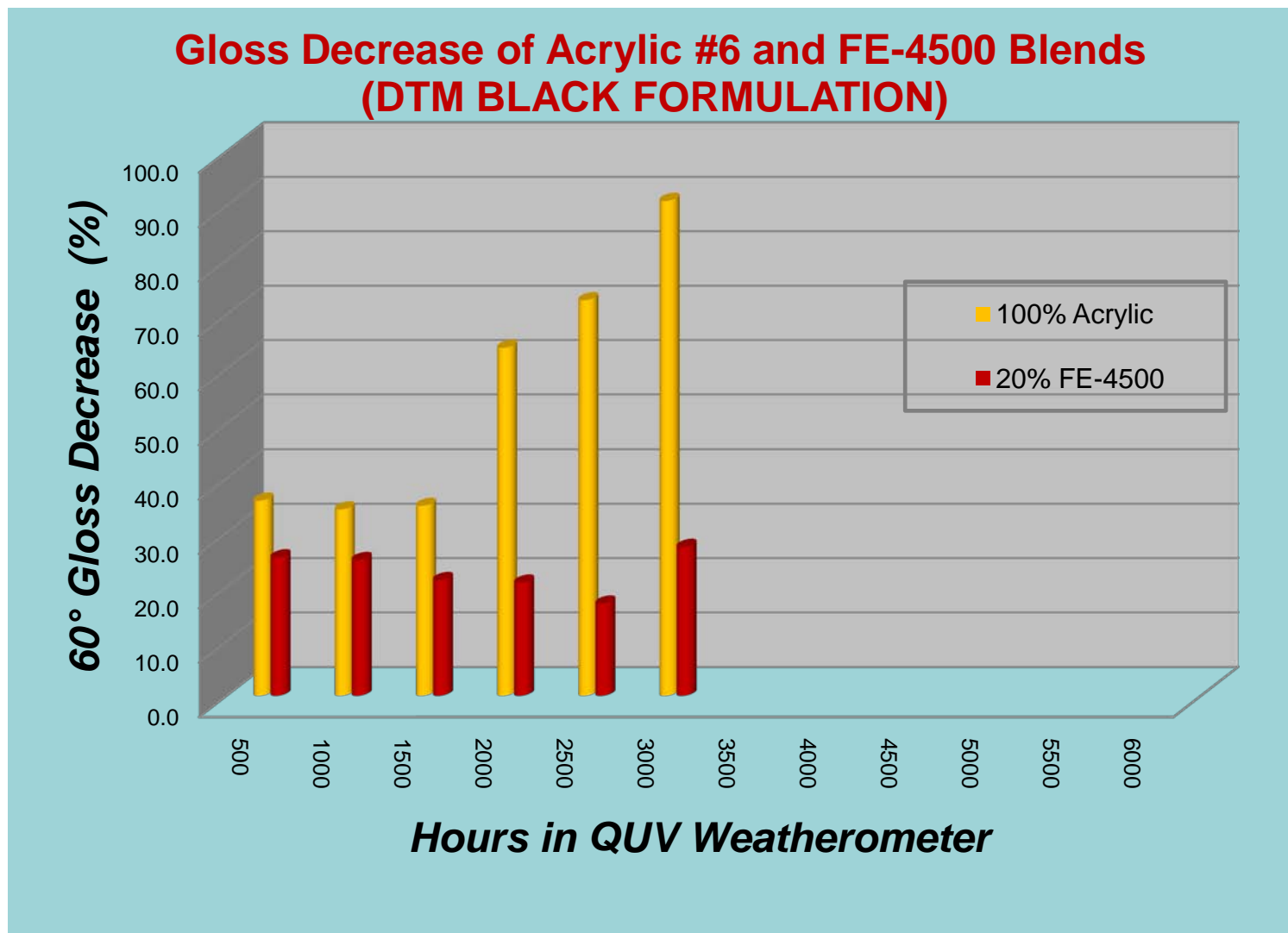
Testing procedure # 5 :

- 1) Choose Acrylic Emulsion # 5 and Acrylic Emulsion # 6 as blending resins for Black DTM I/M Formulation.
- 2) Manufacture of 3 **Black DTM I/M Paint** formulations for each Acrylic:
 - a. **Binder** = 100% Acrylic Emulsion
 - b. **Binder** = 80% Acrylic Emulsion + 20% FE-4300 (FEVE Emulsion)
 - c. **Binder** = 80% Acrylic Emulsion + 20% FE-4500 (FEVE Emulsion)
- 3) Preparation of test panels (primed Al panels coated with 8 wet mils of coating)
- 4) QUV Weatherometer Exposure (UVA 340 Bulbs used)
 - a. **Test Cycle** = 8 hours UV light @ 60°C. + 4 hours condensation @ 50° C.









Continuation of Project:

- 1) Testing of *50 g/liter* House Paint Formulations
- 2) Testing of tinted Deep Base DTM I/M Formulation with *lower percentages of FEVE emulsions* as the binder
- 3) Testing of *Clear Hi-Gloss Concrete Sealer Formulation* with the FEVE emulsions replacing a percentage of the acrylic emulsion

Conclusion:

Inclusion of FEVE emulsions in architectural coating formulations can **increase gloss retention** and therefore prolong the aesthetic properties and the film integrity of these coatings, thereby increasing their life cycle and increasing the time between recoating exterior structures.

Thank you
for your
Attendance!

