High Performance Coating Options for Field Restoration of Factory Coil & Extrusion Coatings

Durability + Design Webinar
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Advantages of Air Dry Fluoropolymer Coatings

The presentation will discuss the long term advantages of using Ultra-High U-V durable fluoropolymer coatings for field and shop applications. This includes curtainwall restoration over factory applied coil & extrusion fluoropolymer coatings, architectural aluminum, along with structural steel. Topics include coating system options, fluoropolymer resin comparison & performance, application considerations & concerns, along with project profiles.

Learning Objectives

- **Review the different conventional coating types**
- **Understand most common types of fluoropolymer resins – FEVE & PVDF and applications methods**
- **Recognize where to use field applied/air dry fluoropolymer coatings**
- **Identify the challenges and application methods of field restoration.**

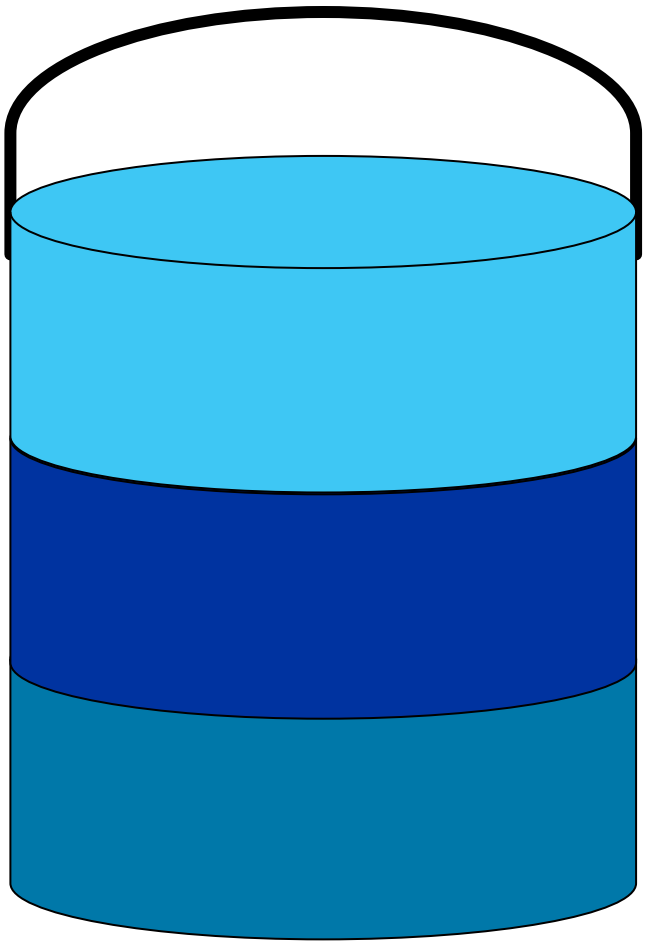
Common Coatings Types

Common Coatings Types

- Alkyds
- Acrylics
- Epoxy
- Urethane
- Polysiloxane
- Fluoropolymer

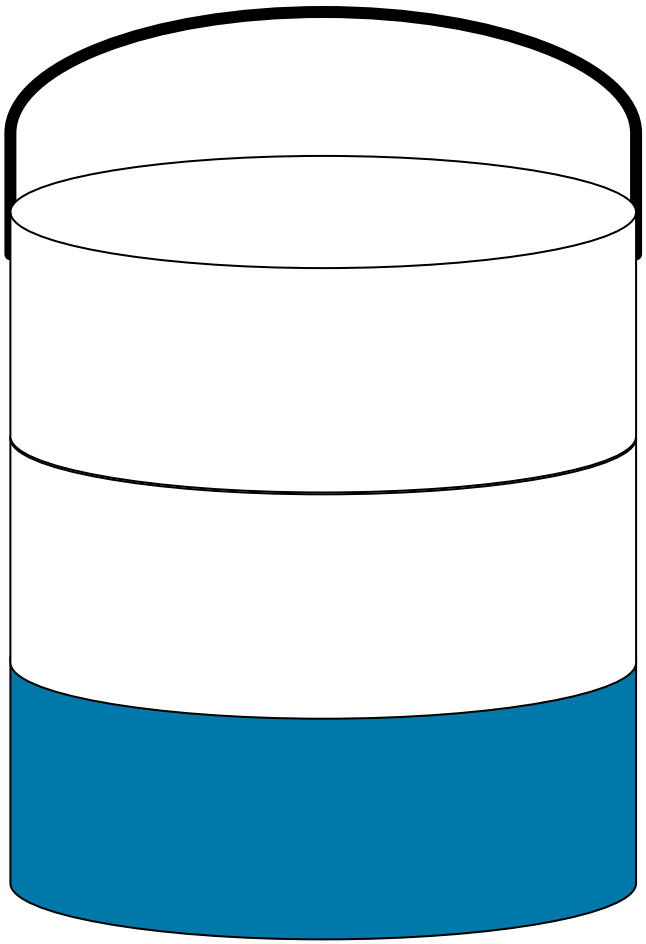
Coating Components

- **Comprised of 3 Elements**
  - Resin (also know as binder)
  - Pigment
  - Solvent



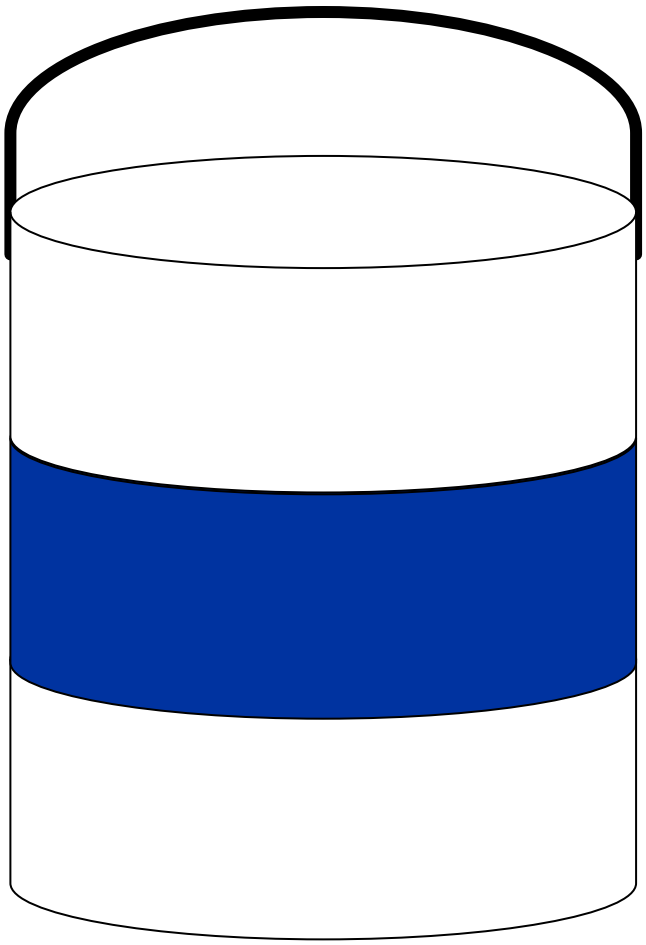
Coatings Resin

- **Functions as the glue of the coating**
- **Provides adhesion to the surface**
- **Provides chemical resistance**
- **Holds the coating together**
- **Most coatings are named after their resin system**
  - Acrylic, alkyd, epoxy, urethane, flouroploymer, etc.



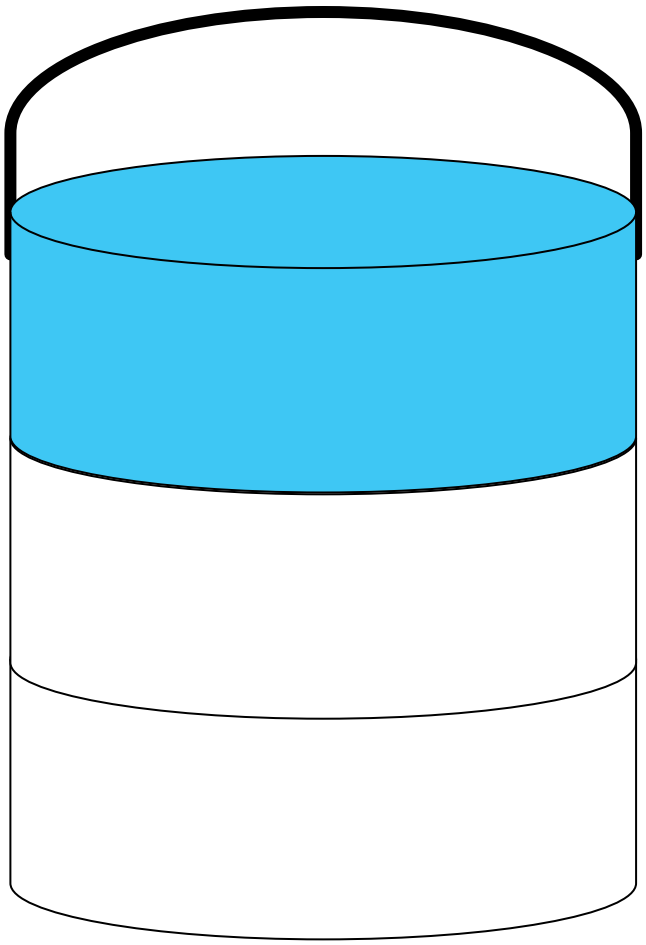
Coatings Pigments

- Solid particulates
- Decrease permeability
- Provide color
- Inhibit rust
- Increase U-V inhibition
- Reinforce film
- Reduce gloss
- Abrasion resistance



Coatings Solvents

- Reduce viscosity
- Assist in application
- Dissolve resin
- Assist in flow & leveling
- Assist in sag resistance



Acrylic Coatings

- Very good weathering & appearance
- Good flexibility & impact resistance
- Fast drying & low odor
- Low VOC
- Single component convenience

- Limited corrosion resistance & chemical resistance
- Application dependent on temp & humidity
- Low solids
- Limited heat stability

Alkyd Coatings

- Fair corrosion resistance
- Easy application
- One-pack convenience

- Slow drying
- Tend to yellow
- Poor chemical resistance

Epoxy Coatings

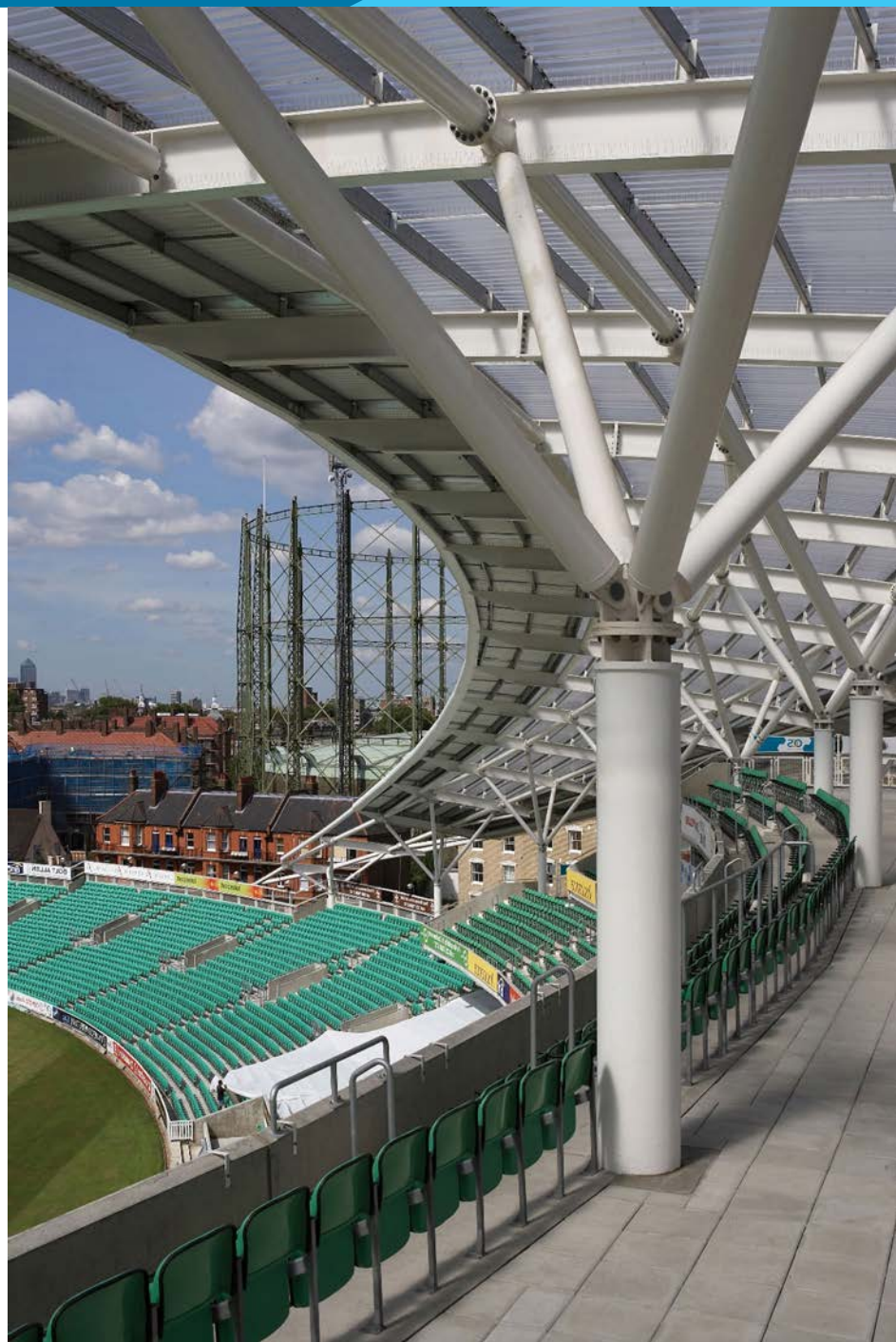
- **Excellent chemical & corrosion resistance**
- **Excellent adhesion & abrasion resistance**
- **Excellent film hardness & impermeability**

- **Very poor U-V durability – chalk**
- **May have more stringent recoat parameters**
- **2-component – application can be more sophisticated**
  - Pot-life
  - Mix ratio
  - Induction time

Urethane Coatings

- **Typically acrylic or polyester**
- **Very good to excellent weathering / U-V resistance**
- **Good chemical resistance**
- **Very good abrasion resistance**

- **Limited corrosion resistance**
- **2-component – application can be more sophisticated**
  - Pot-life
  - Mix ratio
  - Induction time



Polysiloxane Coatings

- **Good corrosion and Abrasion resistance**
- **Good gloss & color retention**
- **2K & 1K versions available**
- **Reduced costs with fewer coats in system**

- **Corrosion resistance provided by primers**
- **2-component – application can be more sophisticated**
  - Pot-life
  - Mix ratio

Fluoropolymer Coatings

- **Unsurpassed U-V durability.**
- **Unsurpassed gloss & color retention**
- **Factory baked Coil / Extrusion Coatings**
- **Air-Dry Shop or Field Applied Coatings**

- **Corrosion resistance provided by primers / pretreatments**
- **2-component – application can be more sophisticated**
  - Pot-life
  - Mix ratio

Fluoropolymer

Fluoropolymer Resin

- **Chemistry cross-links fluorine and carbon for one of the strongest bonds available for coatings and other applications.**
- **Resins commonly used –**
  - Polyvinylidene fluoride (PVDF)
  - Fluorinated Ethylene Vinyl Ether (FEVE)

PVDF (Polyvinylidene fluoride)

- **The most common applications are factory applied coil and extrusion liquid coatings**
- **Resin also used in Powder Coats**
- **Air-Dry ambient cure coatings are available in both solvent and waterborne versions**

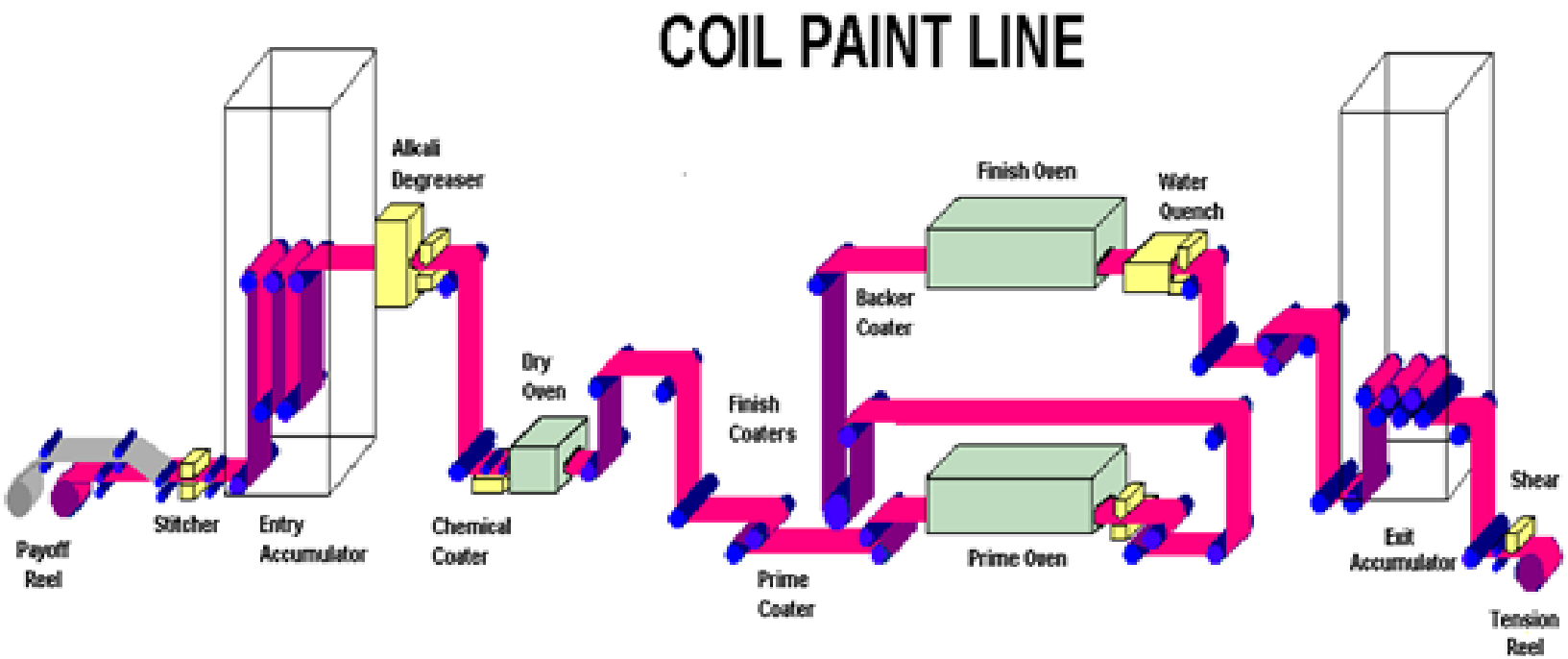
PVDF (Polyvinylidene fluoride)

- **Thermoplastic Dispersion Resin - PVDF**
  - Developed in the 60’s by Pennwalt Chemical
  - Cloudy, milky appearance of resin, low solubility
    - limited color space with bright colors
    - limited gloss capabilities (40 degree maximum)
  - Maximum 70% fluorocarbon content
    - Modified with acrylics or polyesters
  - Cures physically, Must be baked at high temperature (400-450)
  - Air Dry Products include waterborne and solvent versions
    - Some Air Dry versions have limited availability, due to VOC levels

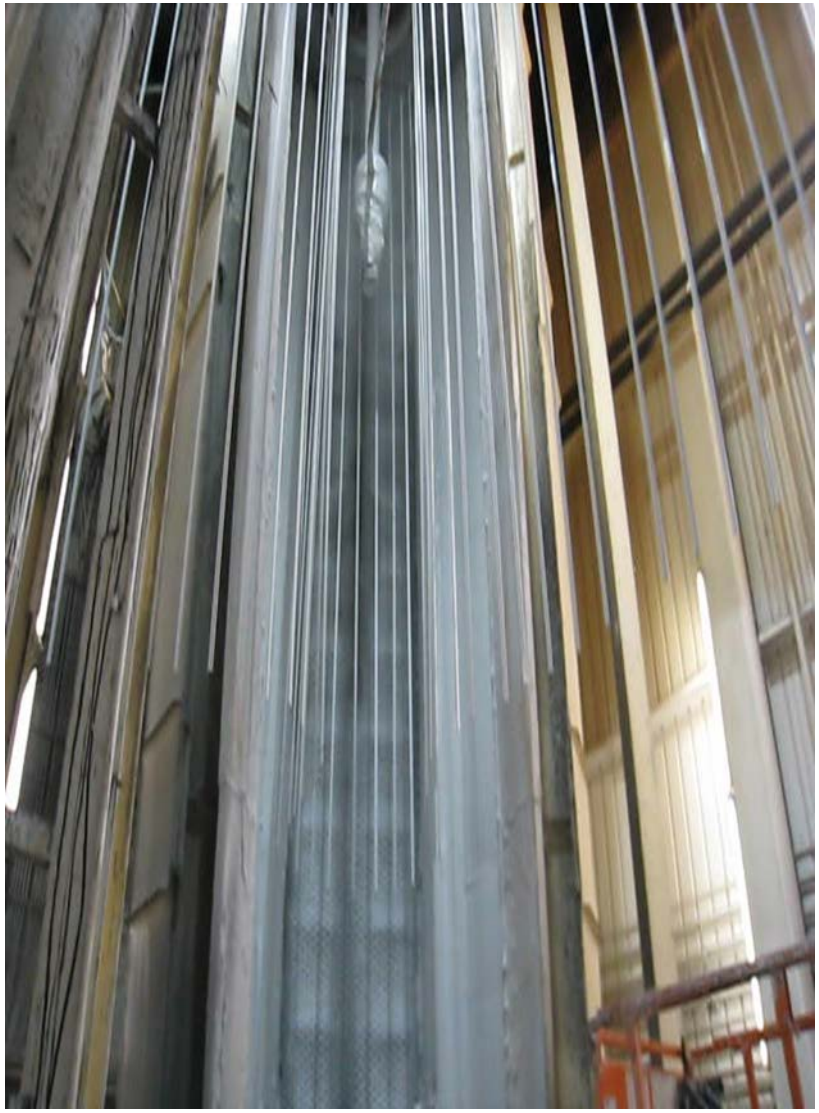
Most Common PVDF Application Methods and Types of Products Coated

- **Coil**
  - Metal roofing
  - Metal building panels, column covers, building sheet
- **Extrusion**
  - Store fronts, curtain walls, windows and louvers
  - Door and window frames, railings and trim
  - Poles, exterior light fixtures and fences
  - RV components

Coil Paint Line Application



Vertical Line - Extrusions



Horizontal Line

Horizontal Line

FEVE (Fluoro Ethylene Vinyl-Ether)

- **Available in liquid for factory applied Coil & Extrusion Coating applications.**
- **Resin is also available in powder.**
- **Air-Dry ambient cured versions are available in fluoropolymer-urethane hybrid coatings and fluoropolymer topcoats.**

FEVE (Fluoro Ethylene Vinyl-Ether)

- **Thermoset Solution Resin - FEVE**
  - Developed in 1980 in Japan by Asahi Glass Co.
  - Resin is crystal clear, high degree of solubility
    - Metallics, including “one coat” Mica/Pearls.
    - Wide range of gloss (30 to 80 degrees)
  - Cures chemically through polymerization
    - Air Dry and baked films are chemically identical (Field applications weather the same as baked finish)
  - 100% Fluorocarbon Resin or Blended with Urethane Resin
    - no modifying resins are necessary

PVDF versus FEVE Comparison

- **Gloss**
  - PVDF is limited to 10 - 50% gloss
  - FEVE is available in 30 – 80% gloss

- **Hardness (scratch & abrasion resistance)**
  - PVDF – Liquid version has relatively softer films
  - FEVE – Harder films good for high traffic areas
  - Powder Versions – Both qualities have harder films

- **Layers of Coating**
  - PVDF are all primer/topcoat systems
  - FEVE can be a one coat system

Coating Selection Considerations

- **Durability of the Coating is a function of….**
  - Binder Selection
  - Pigment Selection
    - Inorganic versus organic pigments
    - Metallics – require clearcoat
    - Micas – require barrier coat to protect primer
  - Intermix versus Tint Base system
    - Obey the color rules to achieve most durable color
    - Best match versus most durable match
  - Cost
  - Location
  - Expected lifetime of service and performance requirements

Life Cycle Cost Advantages

- **Initial applied cost of FEVE-based topcoat:**
  - 5-10% higher than standard polyurethane topcoat
- **FEVE-based topcoat life expectation:**
  - 25+ years
- **Expected maintenance of standard polyurethane topcoat in this time frame:**
  - 2-3 repainting cycles
- **Additional costs of repainting:**
  - Asset downtime
  - Labor costs
  - Material costs
- **Relevant life cycle cost is dollars/sq.ft./year**

QUV Accelerated Weathering

- 80 Gloss Fluoropolymer (FEVE type) versus Urethane (aliphatic)
- 3000 Hours QUV-313B

South Florida Exposure Site

Air-Dry/Ambient Cure Fluoropolymer Coatings

Uses for Air-Dry / Ambient Cure Fluoropolymer Coatings

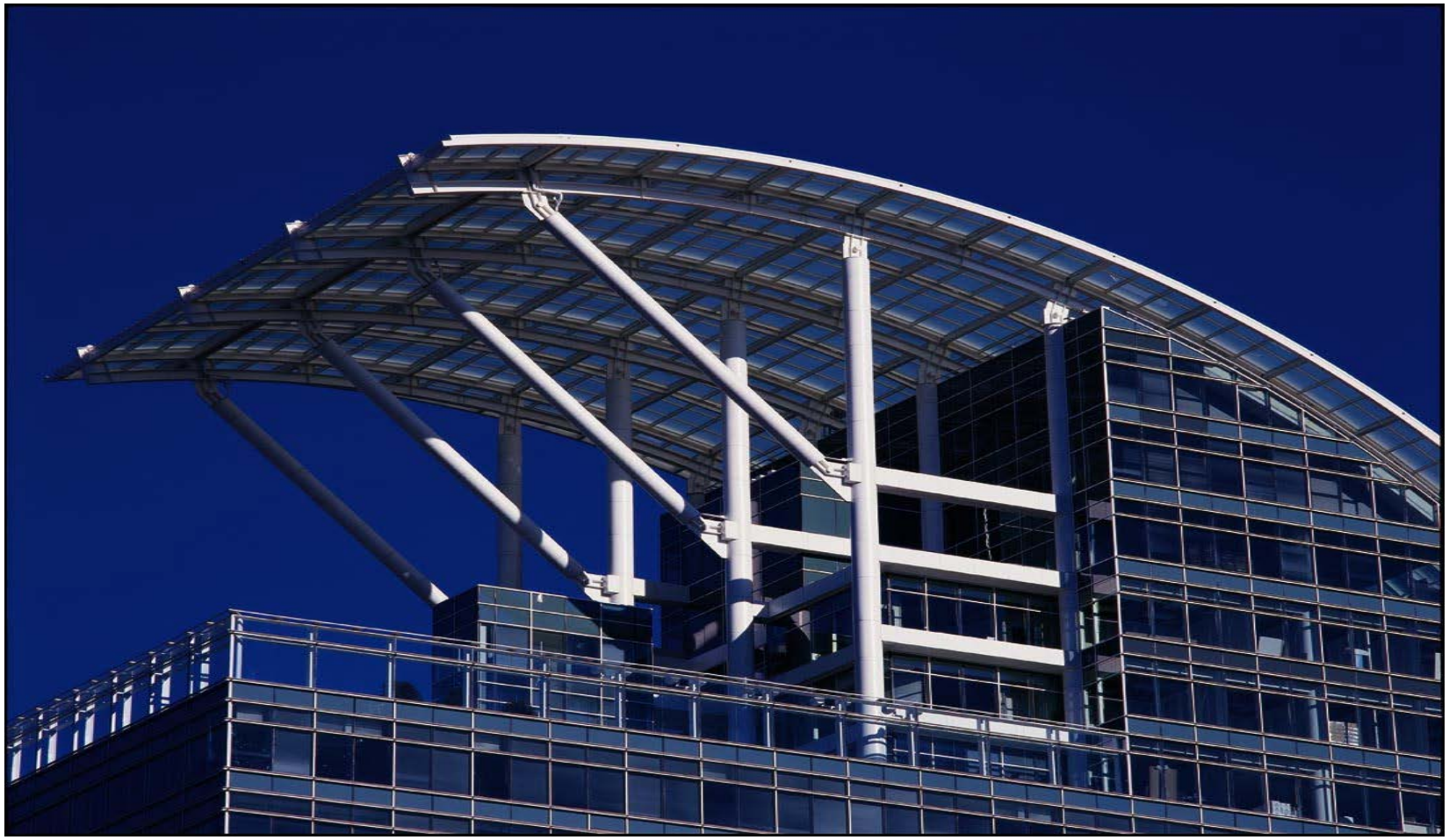
- **Curtainwall Restoration / Building Facades**
- **Window Mullion restoration**
- **Standing Seam Roof Restoration**
- **Architectural Metal**
- **Structural Steel**

Shop Application

Field Application

High Rise Building Restoration Steel Spandrel Panels

Skylight and Curtainwall



High Rise Building Restoration Aluminum Composite Panels

Coating Anodized Aluminum

Standing Seam Metal Roof

Recoating of Existing PVDF

Structural Steel

Success Factors

Surface Preparation

- **Overcoat system versus removal.**
- **The lifespan of any coating is directly related to the degree of surface prep performed.**
- **Due diligence is critical when overcoating existing coatings.**
  - Determine integrity of existing coating.
  - Compatibility – factory baked PVDF coatings are traditionally difficult to gain adhesion to.
  - Compatibility with structural sealants is limited, work sequence is a factor in long-term success.

Existing Coating/Application Environment

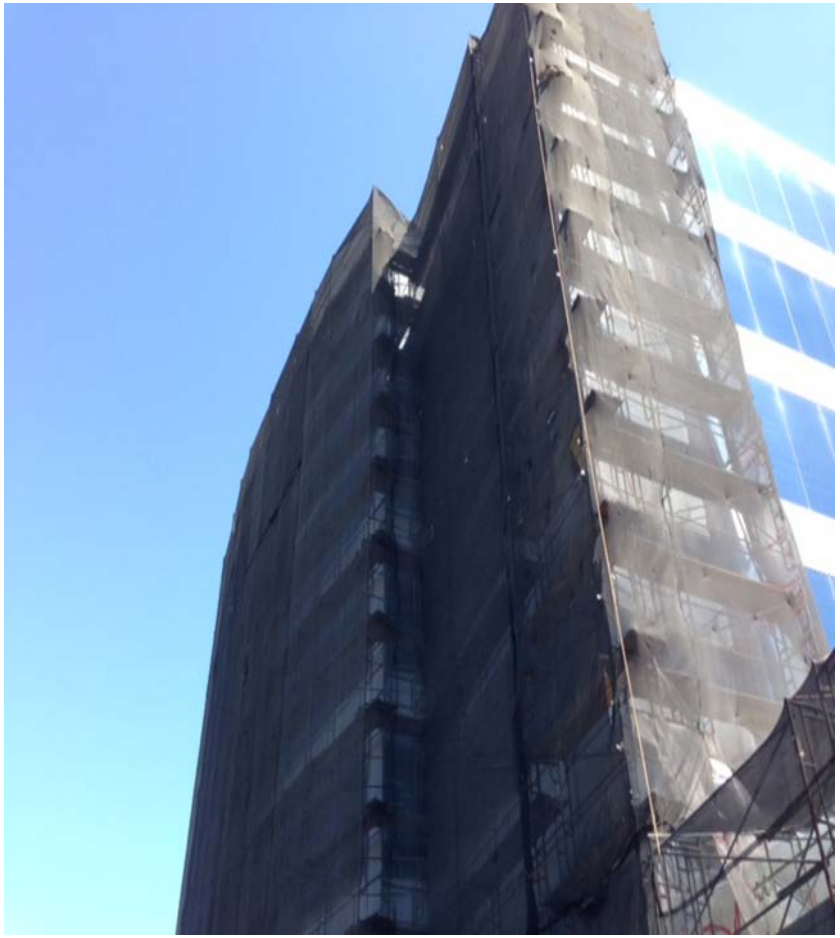
Different Existing Substrates

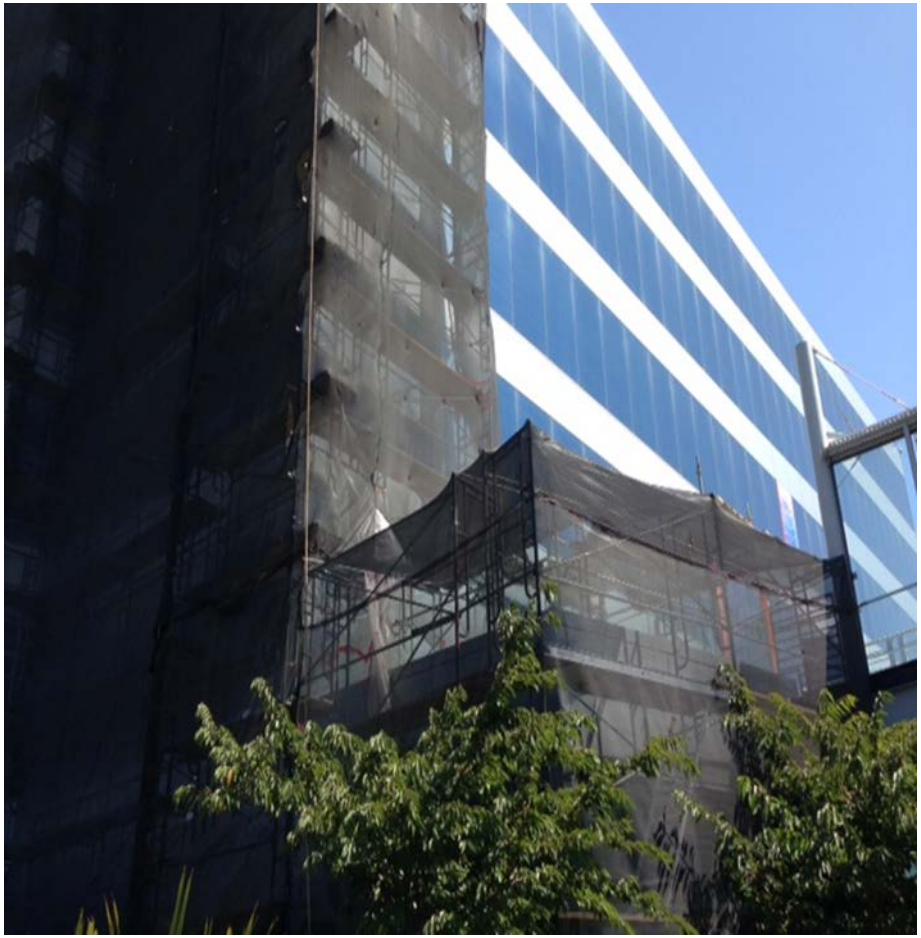
Application

- **Exotic pigments – Mica, Pearlescent, & Metallic topcoats typically require conventional air-spray or HVLP for optimal appearance.**
- **Brush & Roll versus Spray Application Considerations.**
  - Solid colors can be applied either way.
  - Customer expectations of finish.
  - Urban environments
- **Wind Control**
  - Containment to control overspray & dryspray.

Pearl/Mica/Metallic Colors

Wind Protection





Wind/Overspray Protection

Service Environment

- **Seacoast Environment – Corrosion risk increased with humidity, salt, wind, and other considerations.**
  - Advanced Surface prep – abrasive blasting preferred method where corrosion risk increased.
  - Corrosion Resistant Coating Systems – 3-coat zinc / epoxy / fluoropolymer coating systems preferred over 2-coat surface tolerant coating systems.
- **Severe U-V Environments - Fluoropolymer clear-coats available for added protection.**
- **Coating systems designed for expansion / contraction caused by excessive temp changes.**

Exposure Site – Corrosion Testing

Service Environment

Summary

Summary

- **FEVE is the next-generation architectural coating technology.**
- **Its chemical make up produces un-matched weatherability and long service life.**
- **It also allows versatility in terms of substrate (adhesion) and field or shop application (able to cure at room temp.)**
- **It achieves a wide and bright array of colors.**
- **Last but not least, FEVE coatings can protect and maintain the initial luster and aesthetics of a project for 20+ years.**

Questions

The next 10 minutes will be focused on discussing the course material.