



**Proven Technology...Advanced**

# CERA-CORR Systems, LLC



In House Engineering Staff  
Fully Trained and Competent Crews  
\$40 Million Plus In Combined  
Financial Capacity  
Largest Tile Lined Vessel  
Designer/Constructor In North  
America Outside of Power



## TAC

- Quality Driven – Dominant Canadian Market Leader
- In House Design/Build Capability
- 1000+ Concrete & Tile Lined Vessels
- 25 Yrs History

## UNIVERSAL BLASTCO

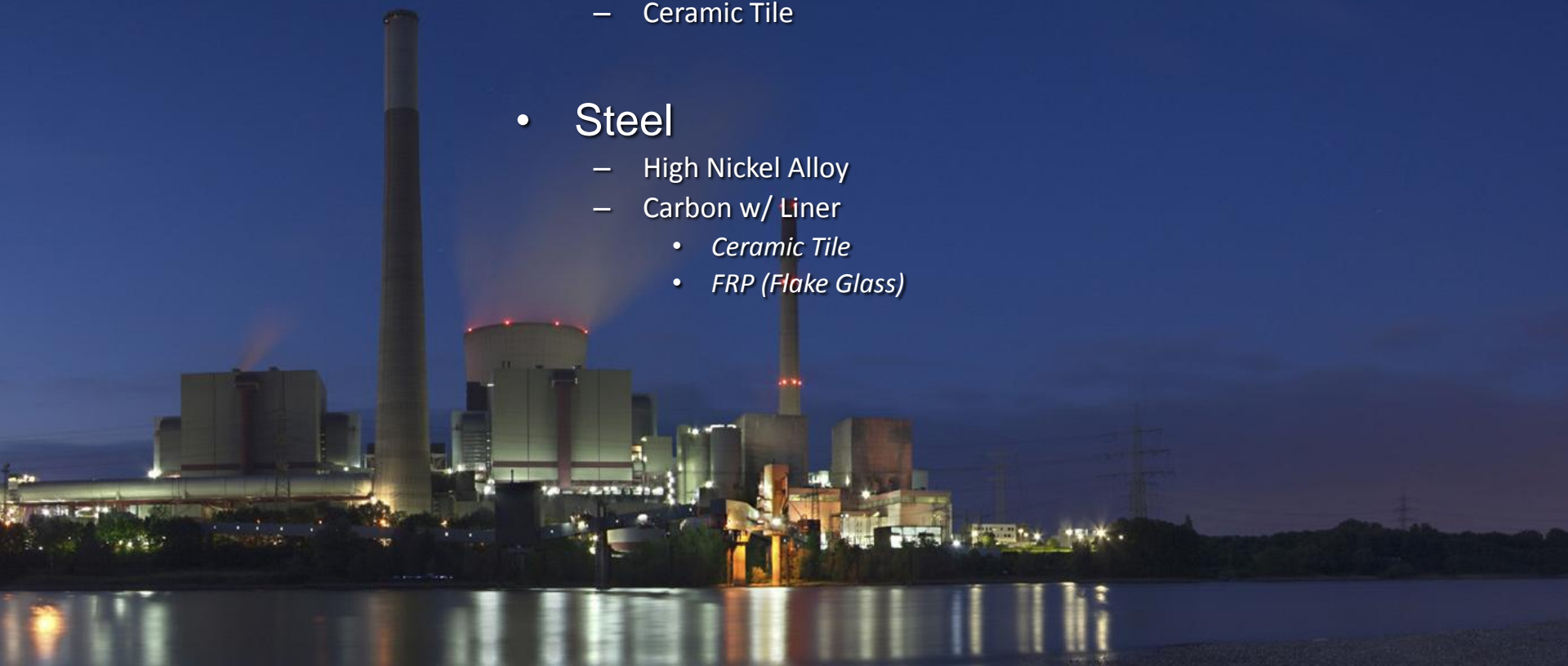
- US' Largest FGD Linings Contractor
- US Pulp & Paper's Largest Tile Lined Vessel Constructor/Linings Contractor
- QP-1/QP-2 Certification
- 25 Yrs History

## BLOME

- Industries' Most Comprehensive Corrosion Technology Product Line
- Continuous Technology Innovation
- Unlimited Chloride Resistance
- 35 Yrs History

# WFGD Scrubber Material Options

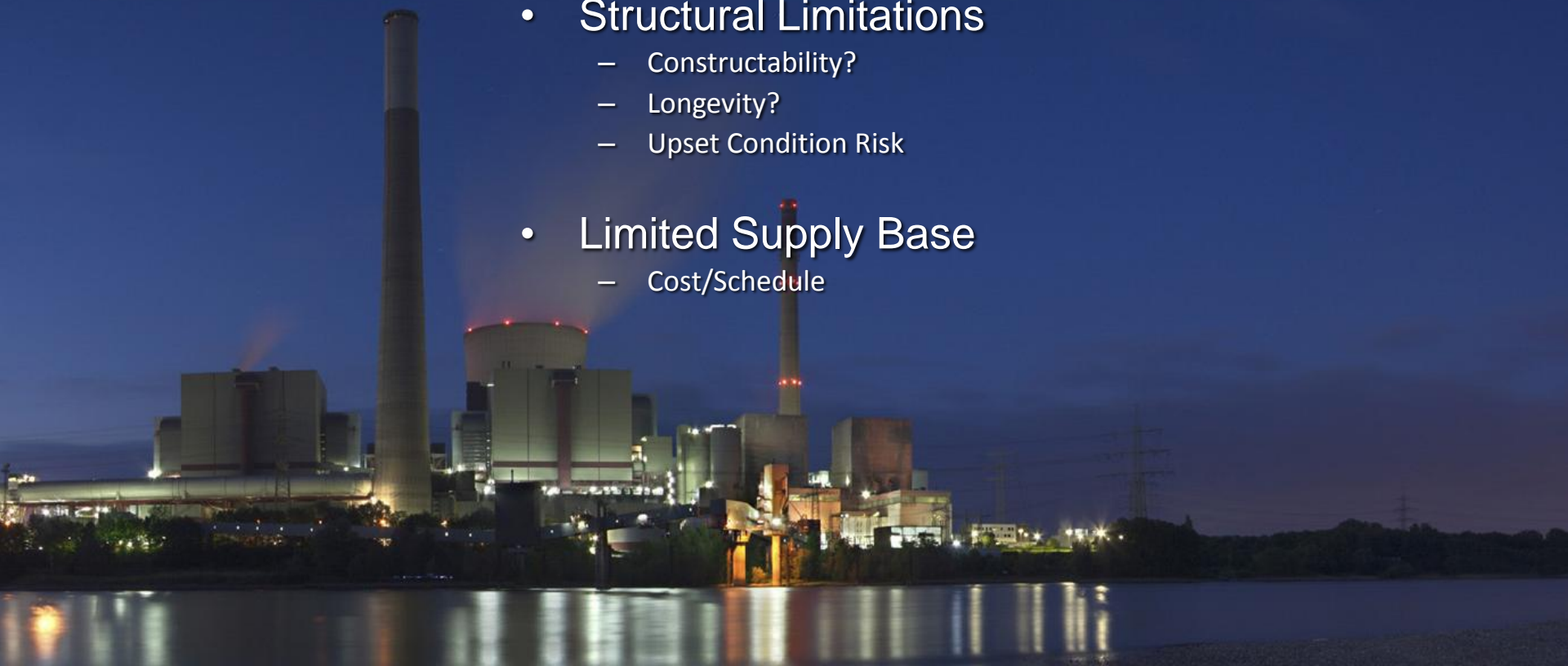
- FRP
- Concrete
  - Thermoplastic
  - Ceramic Tile
- Steel
  - High Nickel Alloy
  - Carbon w/ Liner
    - *Ceramic Tile*
    - *FRP (Flake Glass)*



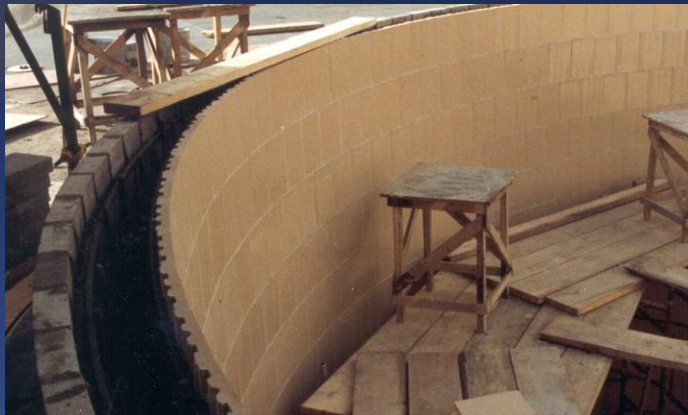


# FRP WFGD Scrubber Issues

- Excellent Corrosion Resistance
  - Unlimited Chloride Resistance
  - Moderate Abrasion Resistance
    - *Good Maintainability*
- Structural Limitations
  - Constructability?
  - Longevity?
  - Upset Condition Risk
- Limited Supply Base
  - Cost/Schedule



# Concrete WFGD Scrubber Issues



- Excellent Corrosion Resistance
  - Unlimited Chloride Resistance
  - Excellent Abrasion Resistance - Tile
    - *Good Maintainability*
  - Moderate Abrasion Resistance – Thermoplastic
    - *Limited Maintainability*
- Superior Longevity / Reliability
  - Leakage
- Limited Supply Base
  - Cost/Schedule/Quality Innovation



# Steel (Alloy) WFGD Scrubber Issues



- Limited Chloride Resistance
  - 2205 Issues
  - ZLD Consequences...C-276
- Excellent Abrasion Resistance
  - Good Maintainability
  - Poor Reliability & Longevity
- Limited Craft Personnel
  - *Cost / Schedule*
- Retrofittable w/ Lining





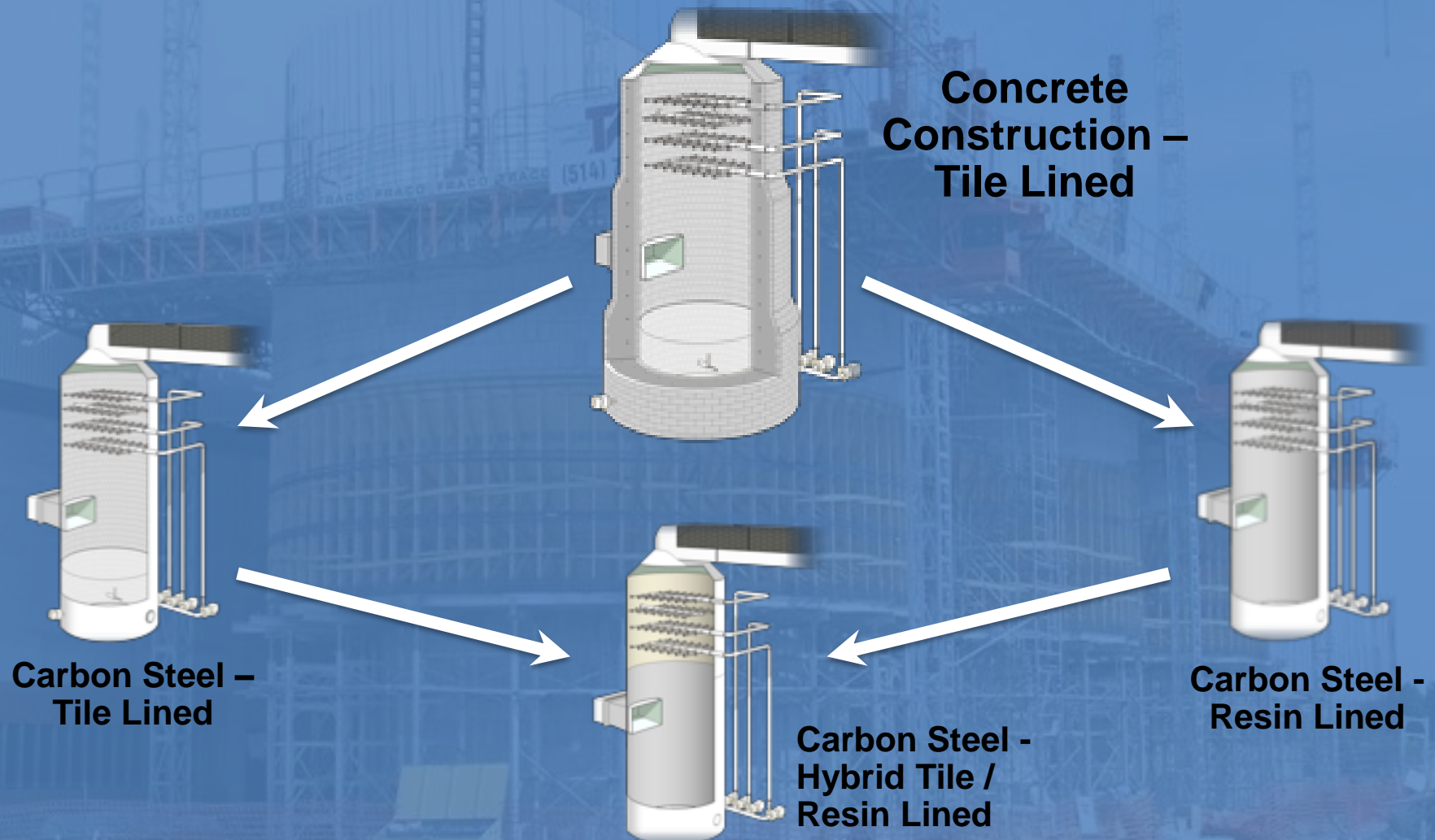
# Steel (Carbon) WFGD Scrubber Issues



- Excellent Corrosion Resistance
  - Unlimited Chloride Resistance
- Excellent Abrasion Resistance – Tile
  - Good Maintainability
- Good Abrasion Resistance – FRP (Flake Glass)
  - Good Maintainability
- Medium Reliability / Longevity
  - FRP Subject to Damage
  - Tile Dependent on Shell Stability



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# Scrubber System Comparisons

	Cost	Service Life	Expected Maintenance	Keys to Success
Carbon Steel / Resin Lined	Shell: \$100/ sf Lining: \$40/ sf \$140/ sf	15-18 Years	Every 8 Years	Surface Prep & cure (temp/RH mgmt) deflection
Carbon Steel / Tile Lined	Shell: \$100/ sf Lining: \$100/ sf \$200/ sf	18-20 Years	Every 15+Years	Strict tolerances on out of roundness & stiffness/deflection
Concrete / Tile Lined	Complete: \$350-400/ sf	25-30++Years	Every 20- 25+Years	Concrete design, sound engineering, construction QC / QA controls

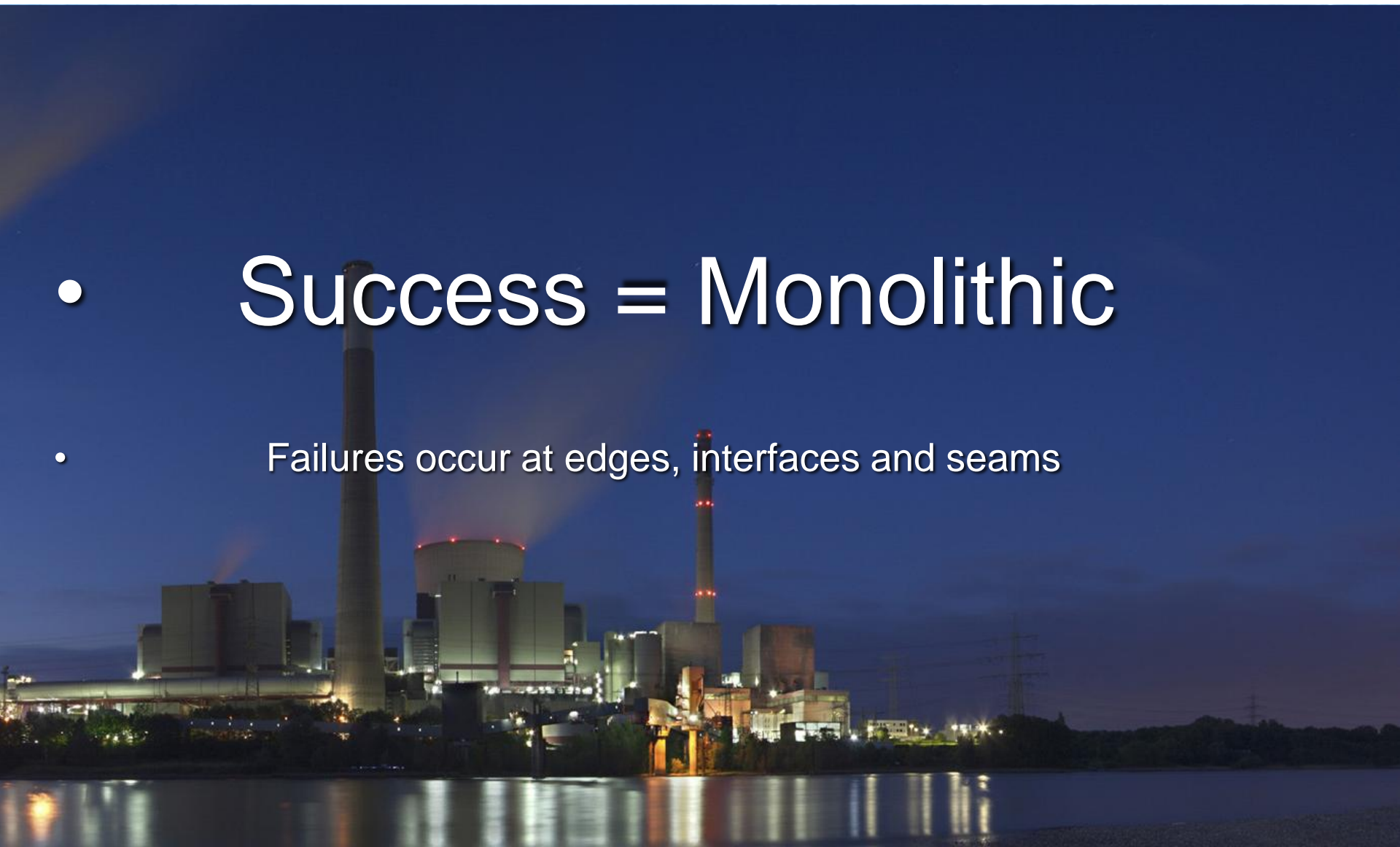
# WFGD Scrubber Pinch Points

- FRP
  - Time Will Tell – Stress / Fatigue
  - Structurally Limited by Material Properties
- Concrete
  - Stop the Leaks
  - Compress the Schedule
- Steel
  - Alloy
    - *Cost/Performance – Long Term Negative*
  - Carbon
    - *Need Effective Lining Installation Controls*



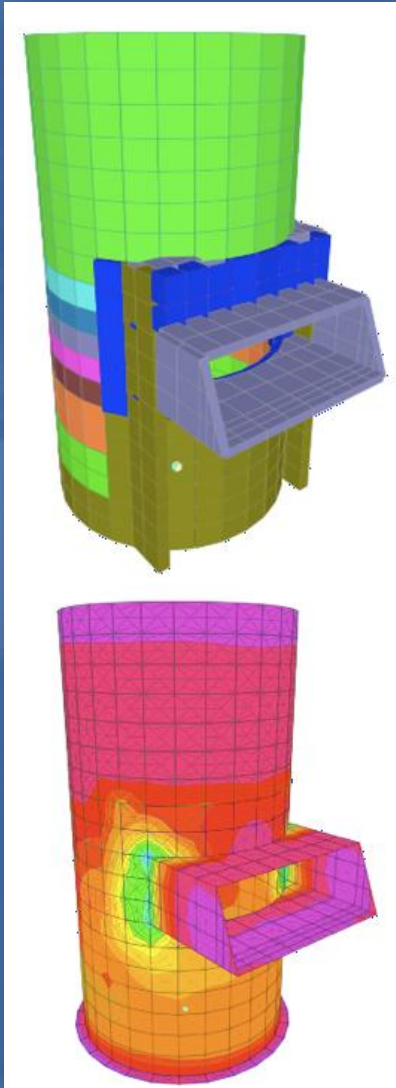
# WFGD Scrubber Corrosion Control

- Success = Monolithic
- Failures occur at edges, interfaces and seams





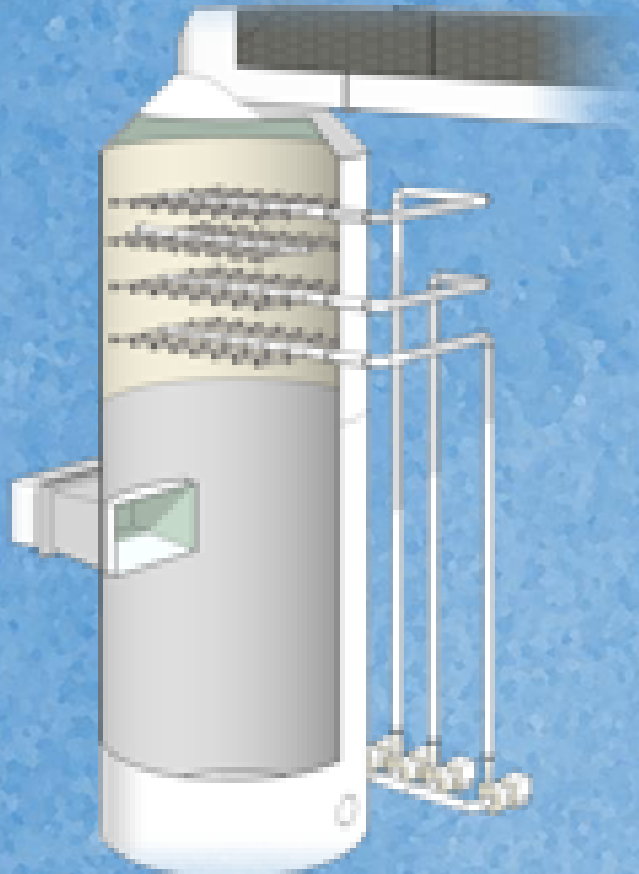
# Concrete w/ Integral Tile Scrubber Advancement



- Monolithic Vessel
- FEA Supported Engineering
  - *Harmonized Confirmation of Empirical Thermal Data*
  - *Seismic, Soil & Wind Condition Accommodations*
- Quality - Precise Execution of Design
  - *Precision reinforcement placement*
- Innovative Construction Execution Schedule
  - *4 ft/day vertical run (vs 1ft/day)*

# CS w/ Tile / Resin Lining Advancement

## **Carbon Steel- Hybrid Tile/Resin Lined**



- **Monolithic Lining**
- **Optimized Cost / Schedule**
- **New Paradigm in Installation Process Control & QC**
- **“Monolithic” Warranty**
  - **10 Year Turnkey**



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