Maximizing Performance of FRP Equipment and Piping

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General Outline

- Mill Priorities
- Unique Character of FRP
- FRP Execution Plan
- What Challenges Execution
- The FRP Maintenance Assessment Plan (MAP)
  - Elements of a MAP
  - Getting the most out of your MAP
- Summary and Conclusions

Mill Priorities

- Personnel Safety……NO INCIDENTS!
- Maximize Production!
  - No leaks and failures!
  - Minimize down time!
  - Minimize lost production!

Mill Objectives and Concerns

- Capital and operating budget!!
- How can we get the most out of our equipment?
- What's the condition of my FRP piping or equipment?
- Can I get another year out of this system?
- When do we need to consider replacing?

Out of sight, out of mind?!?

Unique Character of FRP

FRP is a Composite Material

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FRP Execution Plan – Assumptions Made

- ~~Updated Equipment Specifications~~
- Qualifying and Selecting Vendors
- Detailed Engineering and Design
- QC checks in Manufacturing
- QA during Installation
- Testing
- Start-up

FRP Execution Plan – Assumptions Made

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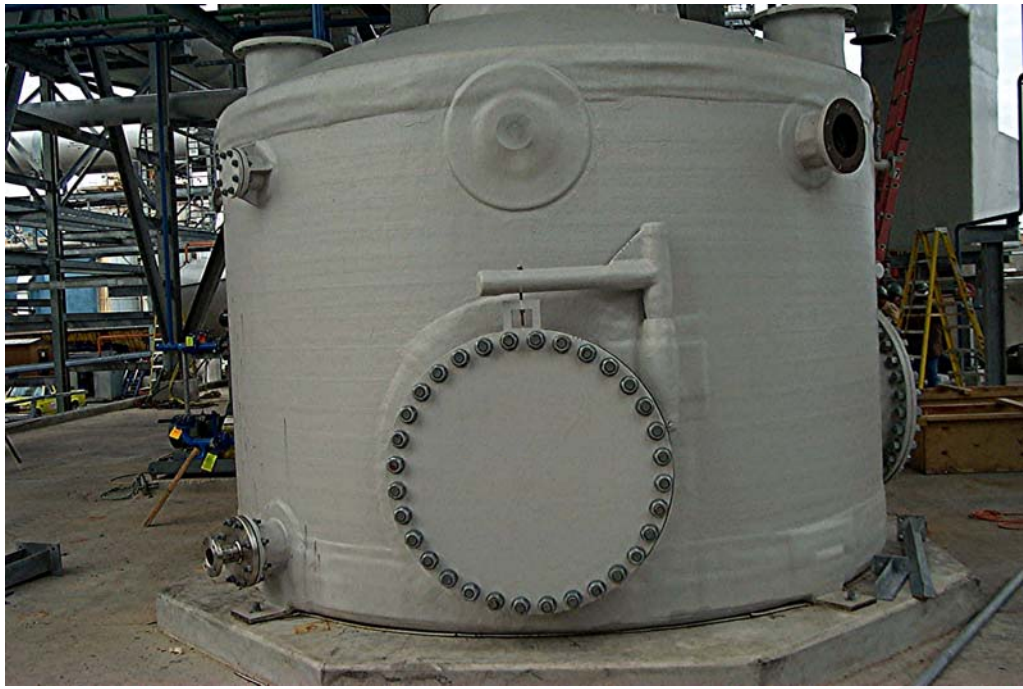

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Operating and Reliability

Maintenance Assessment Program

- Risk-Based Approach
- Current Condition Assessment
- Identifies Risks to Personnel and Operations
- Creates a Time History for Tracking
- Allows for Managing or Eliminating Risks

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Maintenance Assessment Program (MAP)

Likely you have a MAP for your steel piping and tanks.

Do you have a MAP for your FRP equipment as well???

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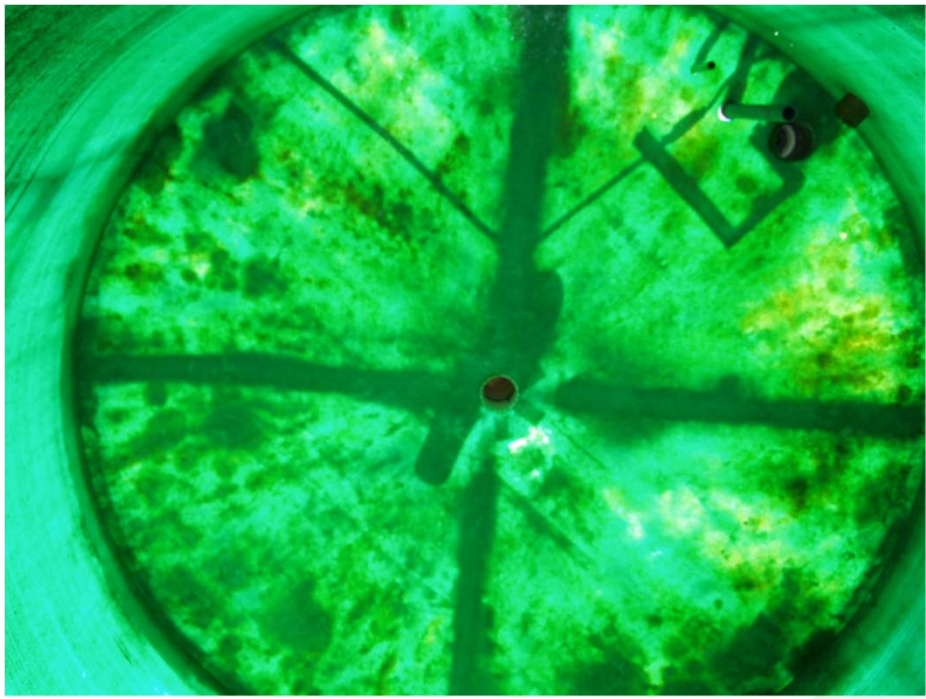
Maintenance Assessment Program (MAP)

Do you have a MAP for your FRP equipment???

Do you know what the current condition of your FRP equipment is? For sure??



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Elements of an FRP MAP

The Basics

- Equipment ID
- Description
- Manufacturer
- Dimensions
- Installation Date

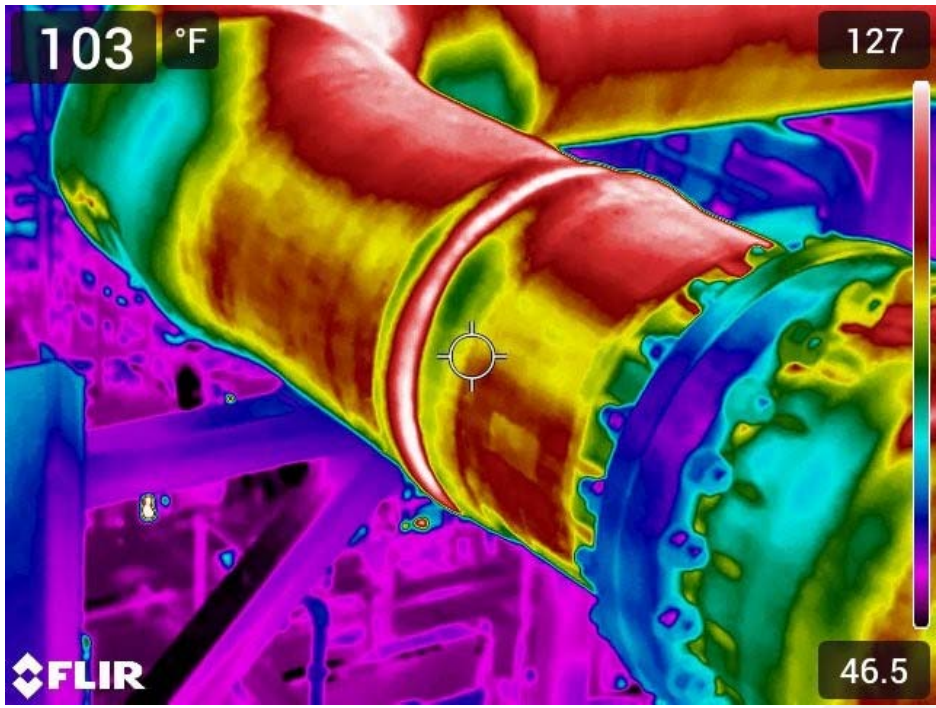
Elements of an FRP MAP

The Service

- Contents/Chemistry
  - Liquid/Gas
  - Chemical
  - Concentration
- Materials of Construction
  - FRP Resin
  - Lining Material
  - Corrosion Barrier Thk
  - Structure, FW or HLU

Elements of an FRP MAP

- Condition Tracking
  - Build a Time History of Equipment
  - Current Condition
  - What to Monitor
  - Remaining Service Life Projection
- Planning
  - Next Piping Boroscope in 2025
  - Plan to Reline Next Outage
  - Budget to Replace Scrubber, 2024
  - Next Inspection



Example FRP MAP

Unit Maintenance Assessment Program										
Bleach Plant										
Vessel ID # 2301-A			Vessel Size				Materials of Construction			
Name	Manufacturer	Drawing No.	Diameter, Ft	Height, Ft	Installation Date	Service - Contents	FRP Resin	Lining	Corrosion Barrier Thk	Structure, HLU or FW
Chlorine Dioxide Storage Tank	XYZ Plastics Company	VL-2010-103048-01	28	36	1990	Liquid Chlorine Dioxide	Hetron 980	NA	500 mils	0.875”-1.2"

Design Press, PSIG	Vacuum, PSIG	Design Temp, °F	Inspection Reports	Date of Last Inspection	Projected Remaining Life	Next inspection
2	-5	100	Shop Inspection Reports	2020	4	2024
			2005, Inspection Report			
			2010, Inspection Report			
			2015, Inspection Report			
			2020, Inspection Report			

Full Reline in 2006. Second reline in 2015.
Current Condition of Equipment: Lining OK, but lining is beginning to show wear. Chlorine Butter on all surfaces. Repaired two cracks in liner near bottom knuckle.

Planning Notes: Re-examine in 2025. Prepare estimate for relining or replacement.

1) Plan to inspect during next Turnaround, 2024.

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Benefits of an FRP MAP

- Know your Risks
- Don’t Get Caught off Guard
- Be Prepared
- Make Informed Decisions
- Advanced Planning
- Minimize Loss Production

Reducing Hazards and Maximizing Production is the Objective!

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How do you Ensure Reliability?

Advanced Planning and Preparation

- Prescriptive Equipment Specs
- Qualify Quality Vendors
- Pipe Stress Analysis
- Vendor Calc Review
- Fabrication Shop Inspections
- FRP QA during installation

Total Maintenance Assessment System

Service Life Management

- Operational Controls
  - Document Changes to Operation
- Piping Site Audits
- Outage Condition Assessments
- Sampling
  - Destructive Testing
  - Non-destructive Testing
- Documentation and Tracking

A MAP can help to fulfill RAGAGEP requirements!
(Recognized and Generally Accepted Good Engineering Practices)

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Summary

- A MAP reduces Risk and Liability to the Mill
- Improves Mill Safety
- Improves Equipment Reliability
- Maximizes Production
- Extends Equipment Service Life

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An FRP Maintenance Assessment Program reduces risk to personnel and equipment. Helps to Maximize Service Life and Production!

Thank You!

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