



**Arkansas Nuclear One (ANO)  
Carbon Fiber Reinforced Polymer (CFRP)  
Relief Request  
Pre-Submittal Meeting with NRC  
April 29, 2020**



# Agenda

Topic	Speaker
Introductions	NRC/ENTERGY/PUBLIC
Licensee Presentation Reason for Relief Request Overview of CFRP Technology Affected Service Water Piping ANO-Surry-STP Comparison Proposed Submittal Schedule Relief Request Content Precedent	ENTERGY
NRC Discussion	NRC
Opportunity for Public Comment	PUBLIC
Meeting Adjournment	NRC



# Introductions

- Licensee Attendees
  - ENTERGY/Arkansas Nuclear One (ANO) – Licensee
    - Riley Keele, David Bice (Regulatory Assurance)
    - Terry Freeman, Vince Bond, Bob Thweatt, Dan Sojka, Mike Hedgecock, Ryan Brumwell, Joel Cummins, Rocky Jones, James Reece (Projects)
    - Bryan Daiber, Tom Hatfield, Grant Flynn (Engineering)
    - Scott Thessing (Operations)
  - Structural Technologies, LLC – CFRP Composite System
    - Anna Pridmore, Emily Cernic, Leo Nadeau, Chris Burton
  - Simpson Gumpertz & Heger (SGH) – CFRP Designer
    - Rasko Ojdrovic



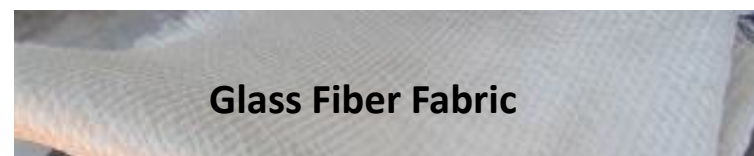
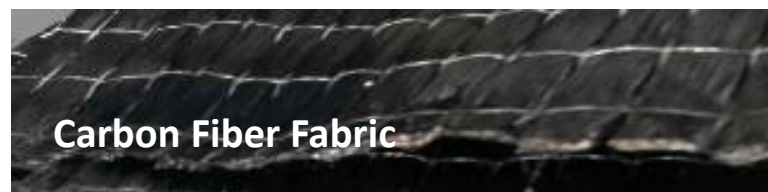
## Reason for the Relief Request

- Piping systems constructed of similar materials and transporting similar water have experienced degradation due to Microbiologically Influenced Corrosion (MIC).
- ASME B&PVC Section XI, “Rules for In-Service Inspection of Nuclear Power Plant Components”, Article IWA-4000, subparagraph IWA-4221(b)(1) states:

“An item to be used for repair/replacement activities...shall meet the Construction Code to which the original item was constructed.”
- ANO is submitting a relief request in accordance with 10 CFR 50.55a(z)(1) requesting approval to proactively use a CFRP Composite System because CFRP was not a material available for use in the original construction codes.

# Overview of CFRP Technology

- **CFRP Composite Repair System**
  - Carbon fiber fabric layers for strength and glass fiber layers for water-tightness and dielectric barrier.
  - Fabrics are saturated with a two-part epoxy and manually applied to the pipe wall
  - Once cured, the CFRP lining takes the place of the host pipe for resisting all loads
- **Quality Assurance/Quality Control**
  - 3<sup>rd</sup> Party inspection
  - Owner and Design Reps oversight
- **CFRP Operational Experience**
  - Multiple safety and non-safety related CFRP piping repair projects successfully completed on numerous large pipeline diameters







## Affected Service Water Piping

- Emergency Cooling Pond supply piping to each unit's Service Water system
- ANO-1 36" diameter, ANO-2 42" diameter
- Approximately 4,800 linear feet total
- Both ANO pipes are carbon steel and installed in soil
- ANO is considering two options for use of CFRP (dependent on installation time required and cost):  
1) install CFRP on entire pipe length and, 2) install new pipe on an alternate route while installing CFRP from the tie-in locations to the Intake Structures.  
In all cases, the CFRP will terminate on sound ASME Section III piping.



## ANO-Surry-STP Comparison

- Similarities between Entergy ANO, Surry, and South Texas Project (STP)
  - All subject piping is installed below grade
  - All three applications propose use of the same CFRP materials, design engineer, installation team, and Quality Assurance / Quality Control team
- Differences between Entergy ANO, Surry, and STP
  - Surry piping is carbon steel pipe encased in reinforced concrete
  - STP piping is Aluminum-Bronze
  - Entergy ANO piping is carbon steel



## ANO-Surry-STP Comparison

- In addition to pressure and other loads considered at Surry, the ANO analysis will consider external soil, surface live load, surcharge loads, and seismic loads that were not considered for Surry because of reinforced concrete encasement surrounding the pipe
- Similar to STP, ANO analysis will consider:
  - Stress due to bending of the buried pipe due to gravity loads, e.g., soil and live loads
  - Stress due to combined internal pressure and gravity loads
  - Buckling resistance of flexible pipe buried in soil
  - Longitudinal stress due to seismic, hydraulic and thermal loads for a pipeline buried in soil





## Proposed Relief Request Schedule

- Estimated Submittal to NRC: July 2020
- Estimated Requested NRC Approval Date: August 2021
- Construction Timeframe: Construction is estimated to begin as early as 2022.



# Relief Request Content

- Summary – Relief Request
- Scope and Schedule
- Definitions and Acronyms
- Materials
- Design
- Installation Methods
- Training
- Failure Modes and Effects Analysis
- Operating Experience
- Proprietary Affidavits

# Precedents

## Surry Unit 1 & 2



# Precedents

## Surry Units 1 & 2



# Precedents

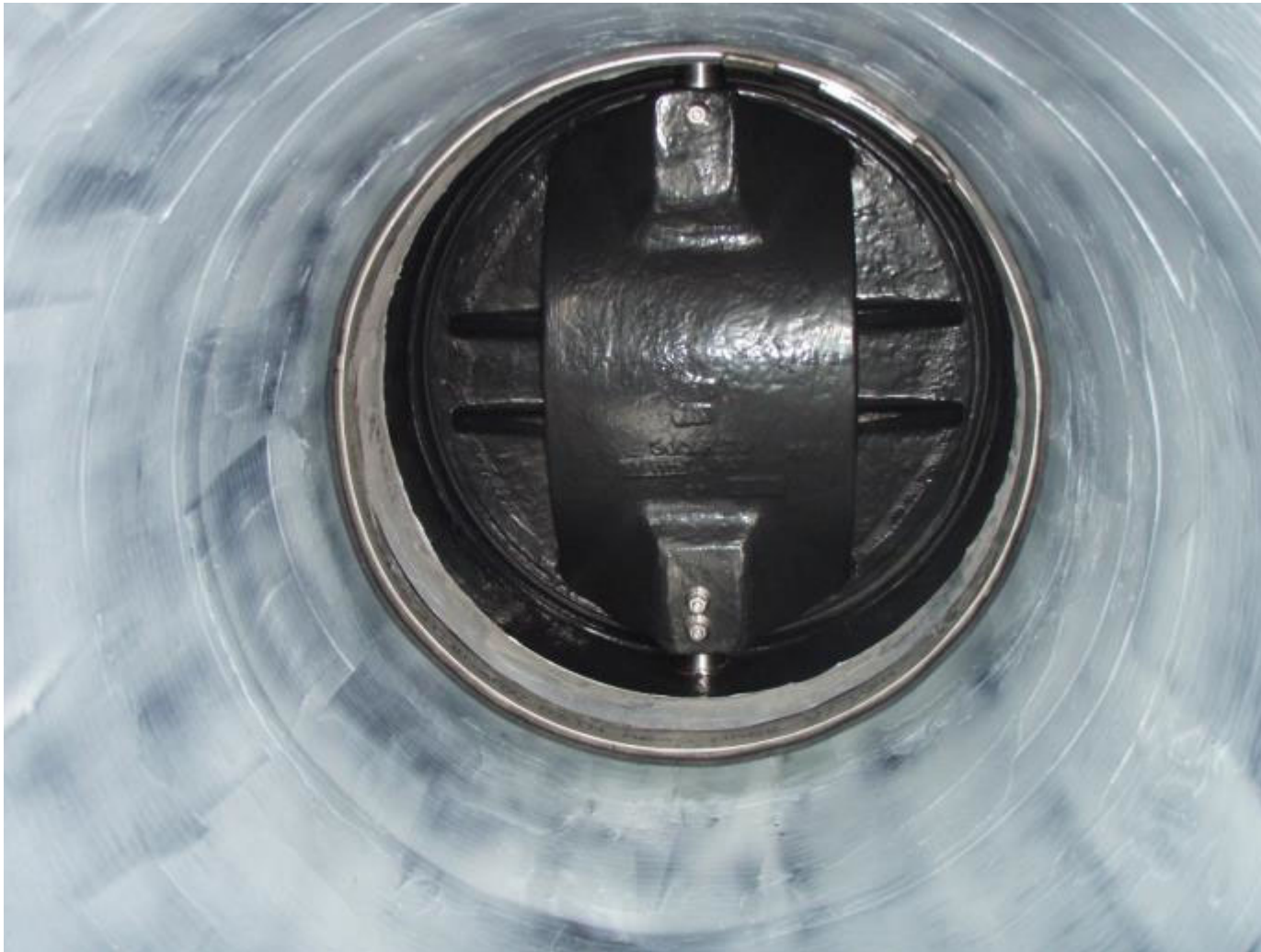
## Surry Units 1 & 2





# Precedents

## Surry Units 1 & 2







# NRC Discussion