

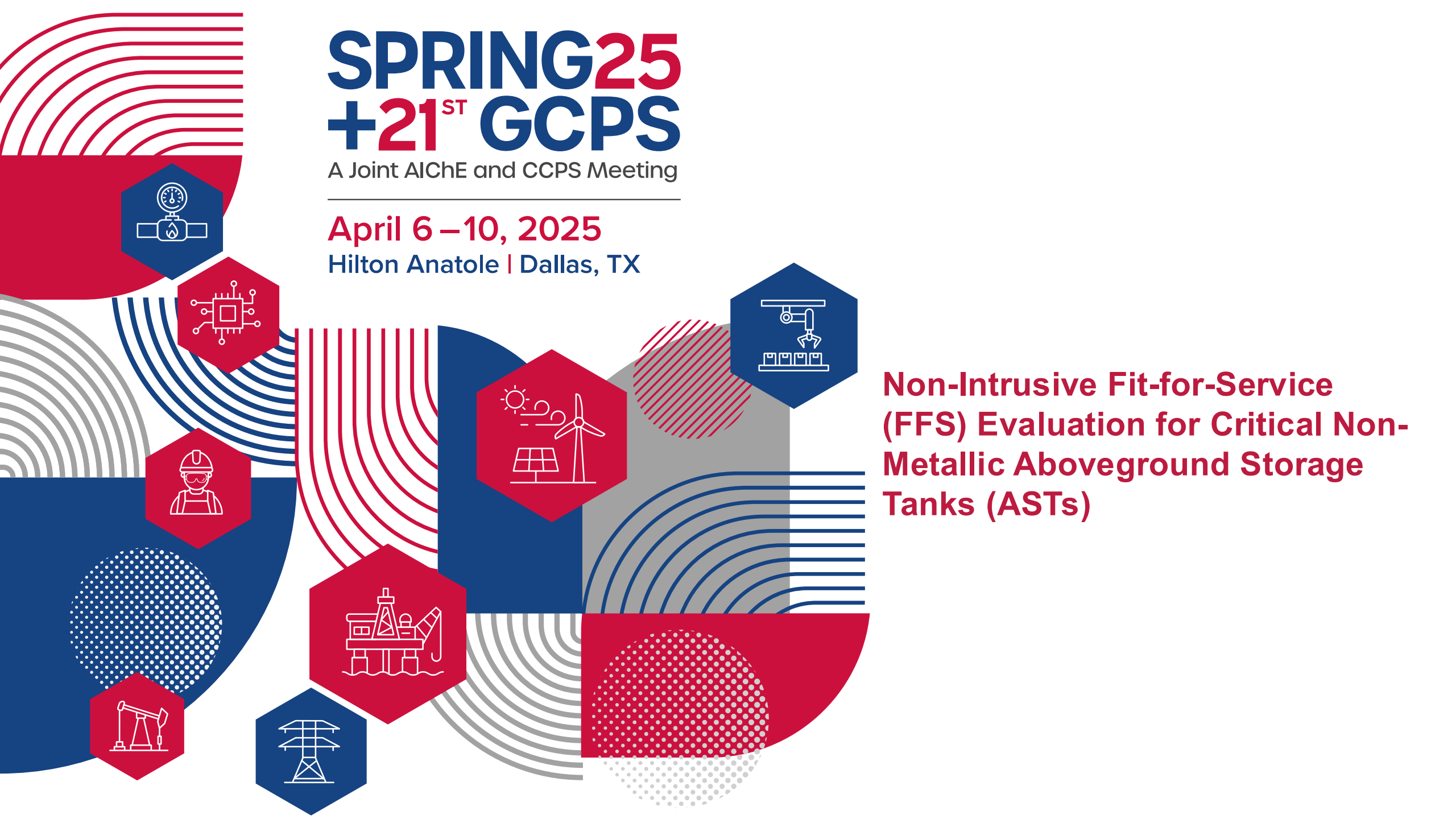
# SPRING25 +21<sup>ST</sup> GCPS

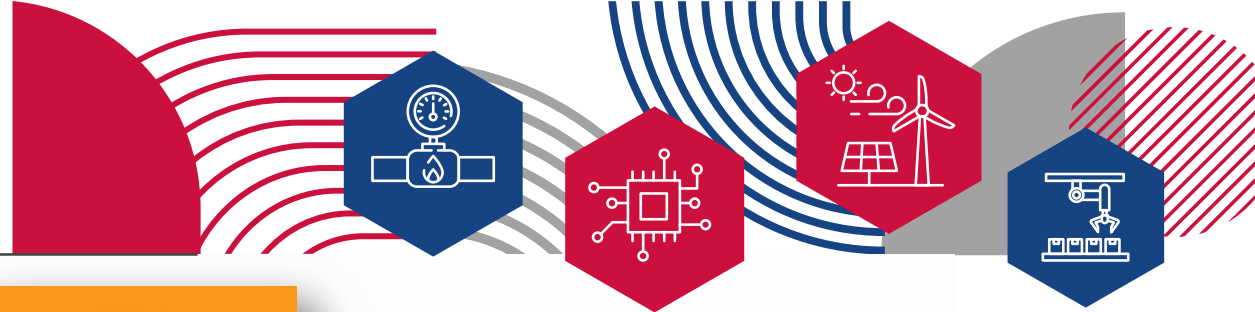
A Joint AIChE and CCPS Meeting

April 6 – 10, 2025

Hilton Anatole | Dallas, TX

**Non-Intrusive Fit-for-Service  
(FFS) Evaluation for Critical Non-  
Metallic Aboveground Storage  
Tanks (ASTs)**





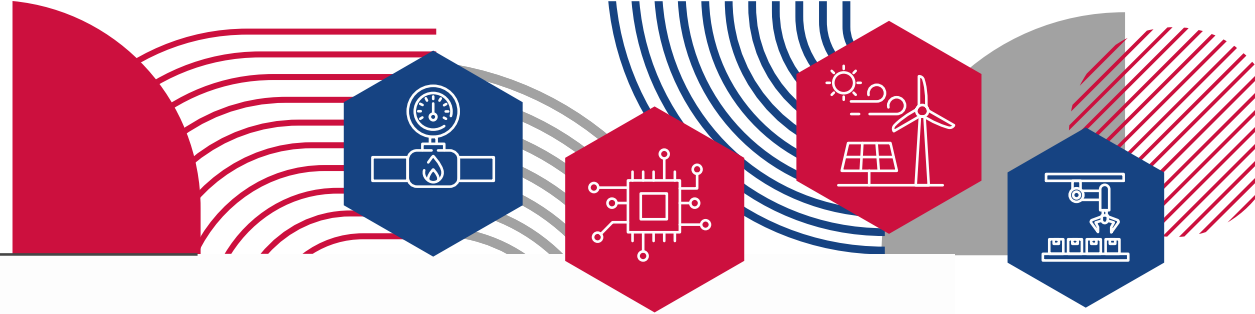
### **Ray Vermillion, P.E.**

- Ashland, Inc.
- Asset Integrity & Reliability Engineering Manager
- 35+ Years experience
- Field of experiences include expertise in the Corrosion & Metallurgical Engineering, Mechanical Integrity and Asset Reliability spaces within industries including downstream oil/gas, petrochemical, biopharmaceutical and specialty chemical manufacturing spaces.



### **Geoff Clarkson, P. Eng.**

- UTComp, Inc.
- Chief Technical Officer & Inventor
- 40+ Years experience
- Field experiences include expertise in fixed and rotating equipment reliability and remediation broadly across mineral processing, pulp & paper, chemical processing. Targeted expertise has been developed in engineering of polymeric materials including NDE, assessment, remediation and design.



# France Facility – Site Background



Facility in operation since 1968; acquired by Ashland in 2008

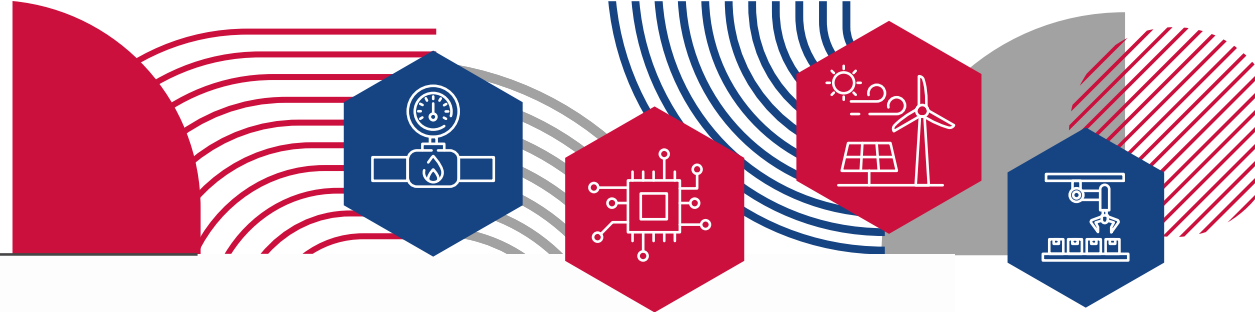
Key Capabilities:

- Cellulose polymer manufacturing
- Synthetic polymer manufacturing
- Distillation & Solvent Recovery
- Utilities/WWT Units

Producing multi-product lines:

- CMC (Sodium Carboxymethylcellulose)
- Aquaflow (Rheology Modifier)

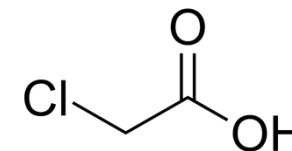




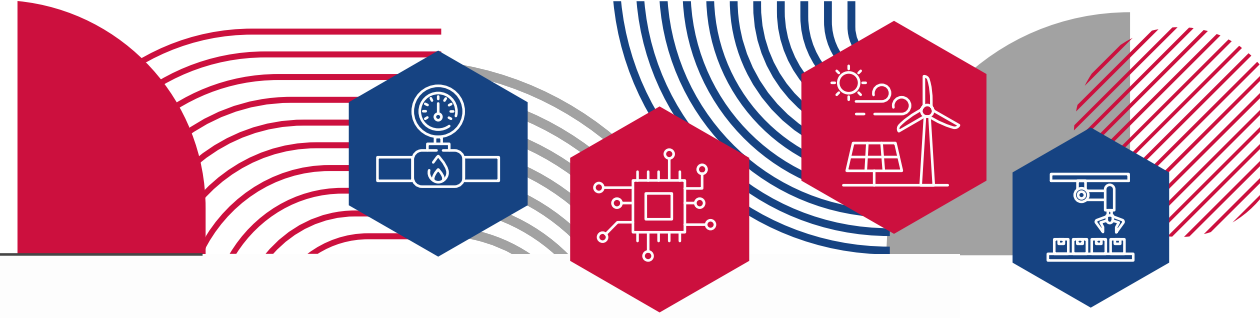
# France Facility – Challenges



Key precursor in CMC manufacturing is MCA  
Monochloroacetic Acid



Classified as an extremely hazardous substance  
per US Emergency Planning & Community Right-  
to-Know Act (42 U.S.C. 11002)



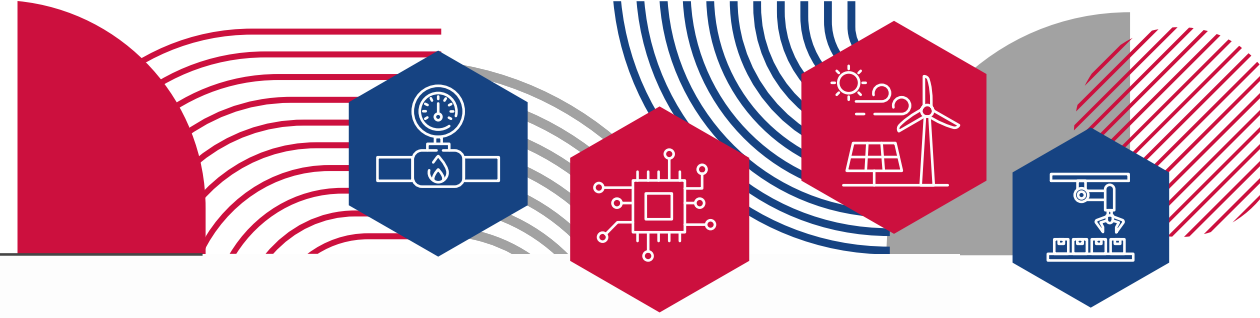
# France Facility - Challenges



MCA Stored on-site in 5 m x 8.5 m FRP composite AST.  
Challenges associated with:

- Chemical de-inventorying
- Lock-out/Tag-out (LOTO)
- Vessel Entry
- Personnel Safety
- Mechanical Integrity (MI) Assessment

Ashland's desire – find novel inspection solution to determine tank's MI while keeping equipment in-service and facilities/personnel safe



## MCA AST Background



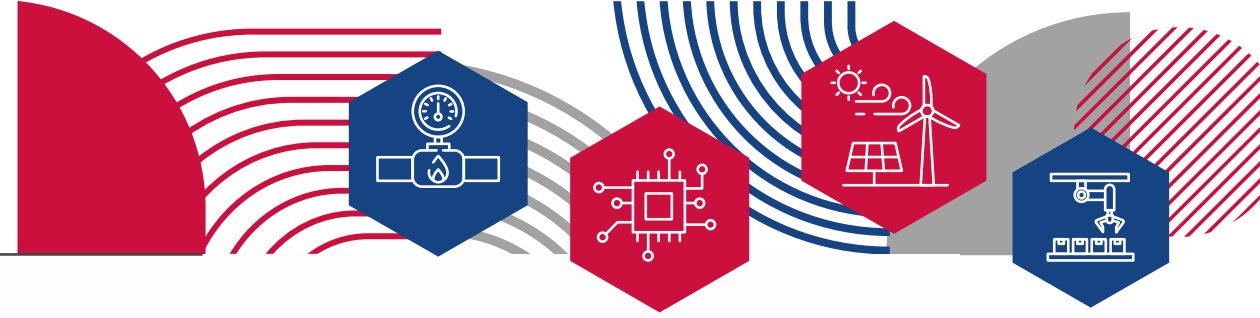
Designed & Constructed in 2002 in accordance with “Reservoirs et Appareils en Matieres Plastiques Renforces – Code de Construction” standard

Code includes quality assurance tests & inspections to ensure vessel complies with these standards, namely:

- Continual inspections during fabrication
- Spark-testing of welds in the PVC liner
- Hydrostatic testing

Following fabrication/installation, MI inspections for the tank have primarily relied on visual external inspections.



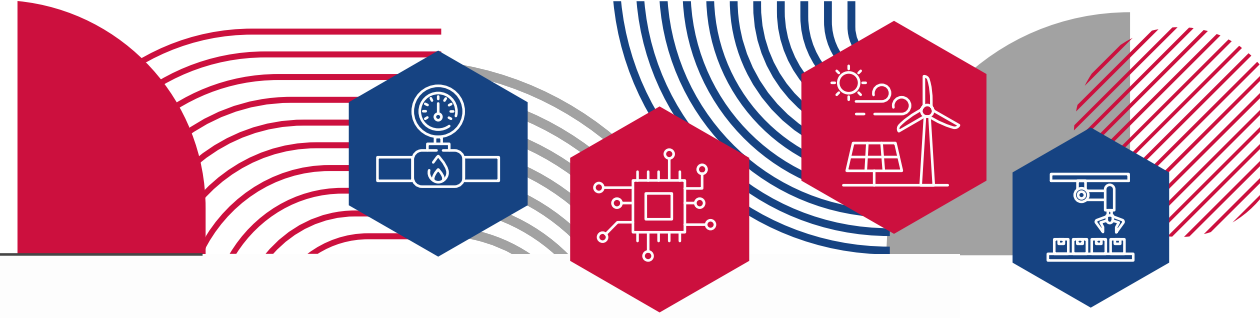


## Mechanical Integrity (MI)

Mechanical Integrity for metallic Aboveground Storage Tanks/Pressure Vessels well understood

- In-Service Inspection Guidance provided in API-510/API-653
- Non-destructive Examination (NDE) methods mature
- Fitness for Service Guidance provided in API-579
- Corrosion Damage Mechanisms provided in API-571

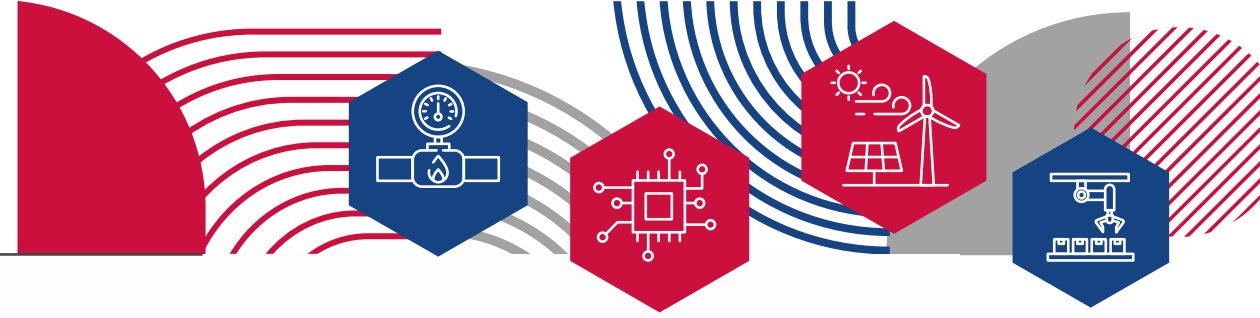
Key Question: What to do for non-metallic, i.e. PVC lined fiberglass reinforced plastic tanks?



## MI of FRP/PVC AST

MI and *FFS* is still a Structural Engineering Principle  
Requires *NDE* data that can be used in calculations.  
No engineering guidance in construction codes.  
New *NDE* and calculations required.





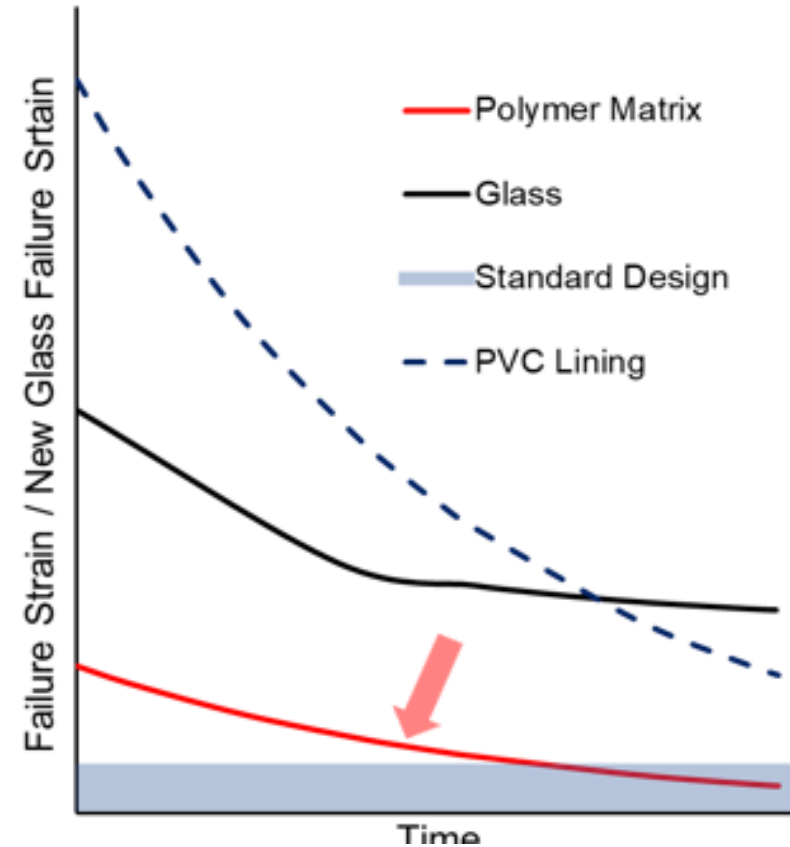
## Damage to FRP and PVC

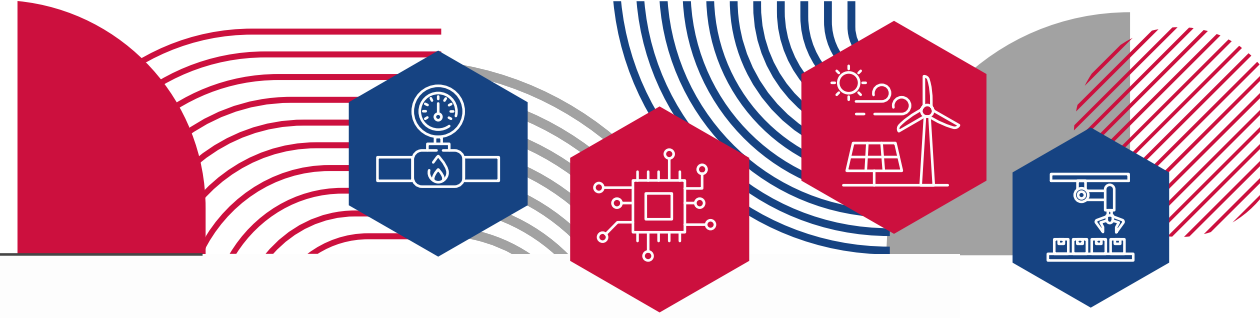
Mechanical properties are changed by all of chemicals, stress and strain.

FRP resin leads the way to crack 1<sup>st</sup>

Cracks in FRP resin will lead to more damage to reinforcement.

PVC is not a structural component.





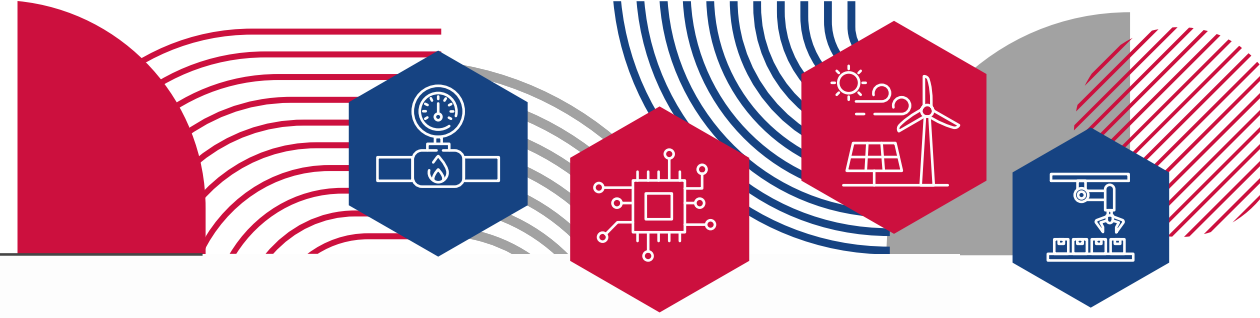
## Assessing FRP/PVC Structures

Quantitative and objective inspection data required for the FRP resin.

- NOT related to items inspected in fabrication.
- NOT related to tensile strength of FRP.
- Critical parameter is retained Young's modulus of FRP resin.

Evaluate using Engineering Criteria.

API 579 also requires an estimate of Remaining Life.



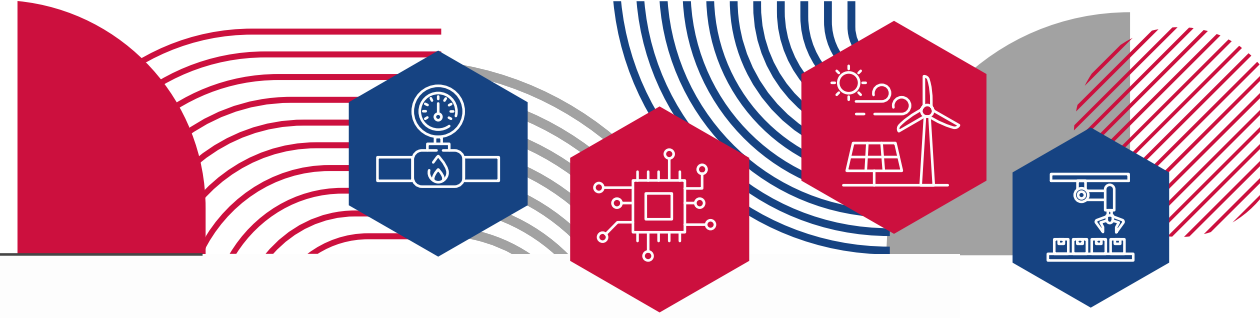
## Inspection

NDE method to detect changes to the FRP resin.

UT can provide Young's modulus along the pulse path.

*Attenuation-based Ultrasound (UAX):* A-Scan magnitude + time

Not yet included in UT Certification and Training



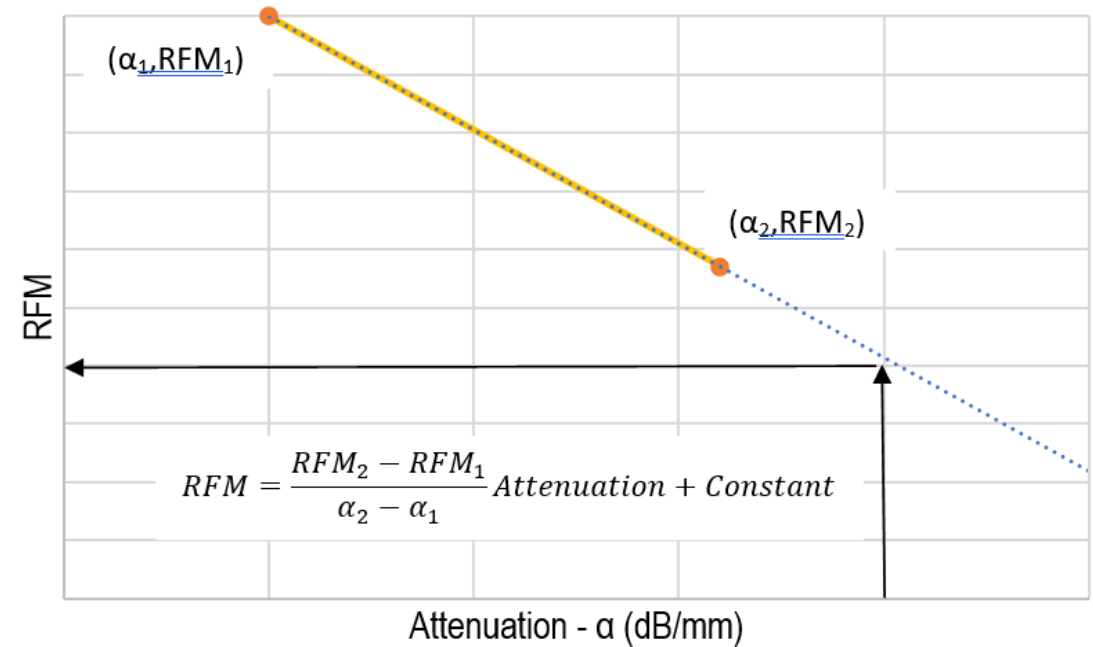
## Inspection

Changes in Flexural Modulus are a proxy.

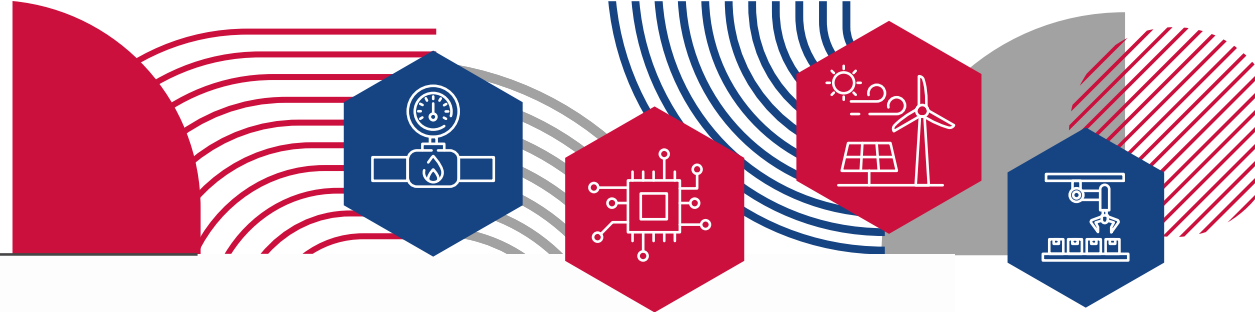
$$RFM = \frac{\text{Current Flex Modulus}}{\text{New Flex Modulus}}$$

Also:

*Polymer Damage Status = PDS*





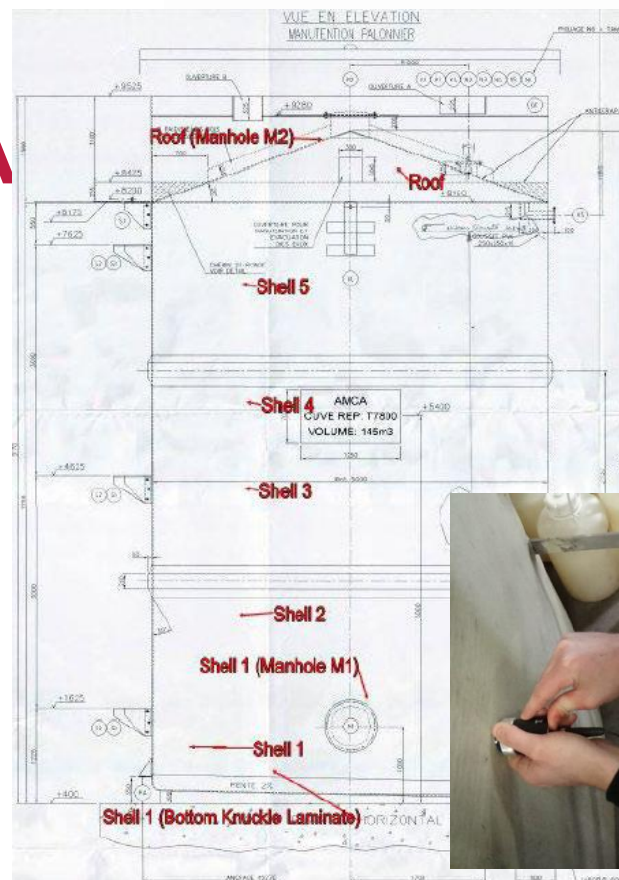


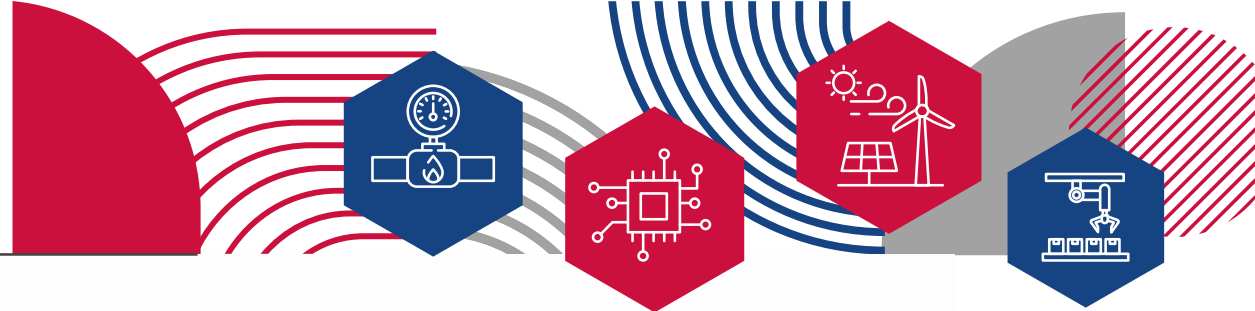
## Inspection of the MCA

Systematic inspection of areas

At least 30 UT readings per.

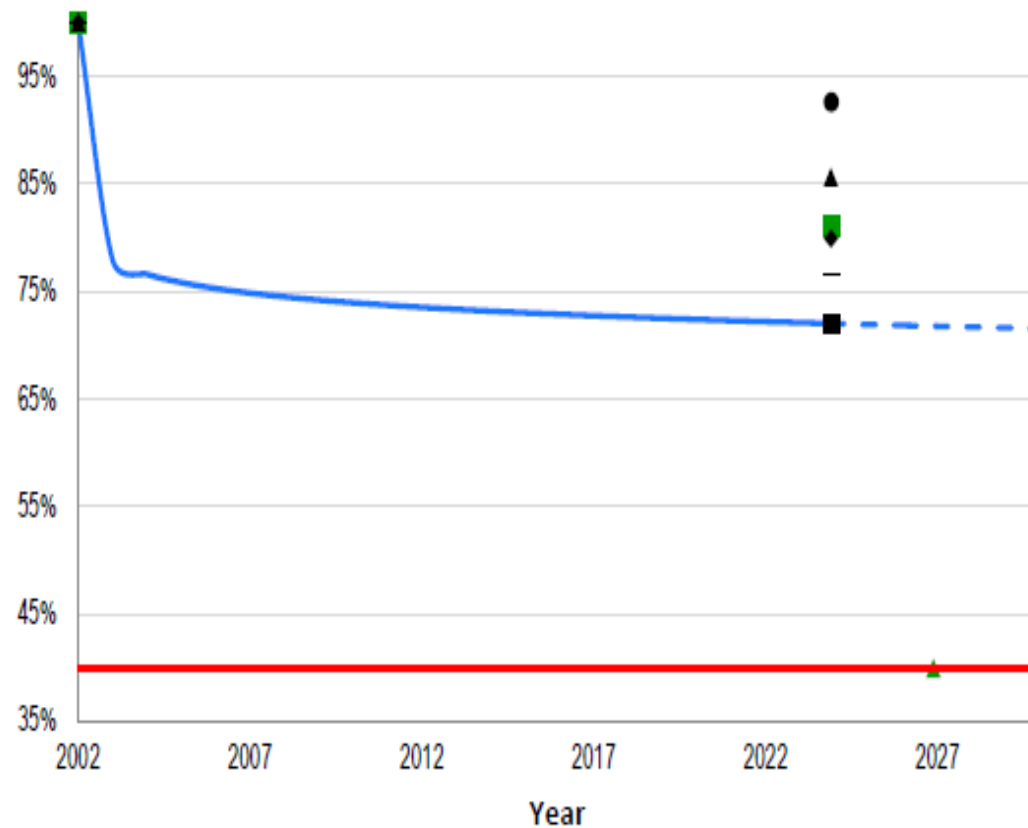
Focus on highest stress,  
chemical exposure, PVC weld  
vulnerabilities

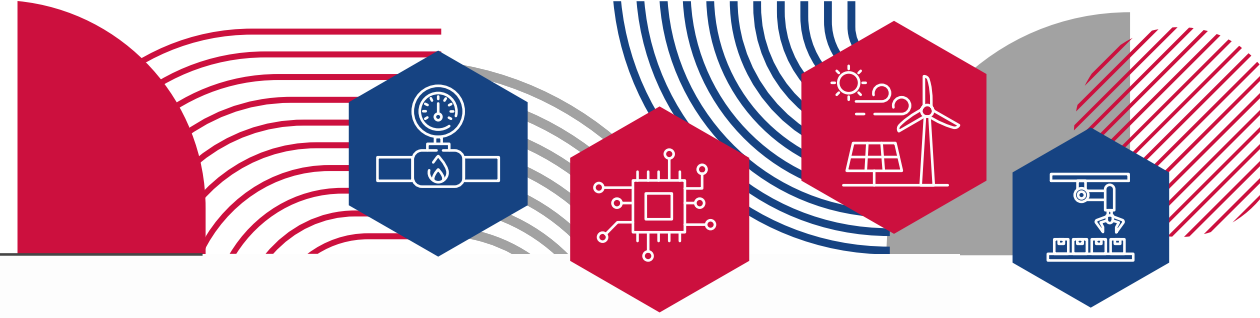




## Results

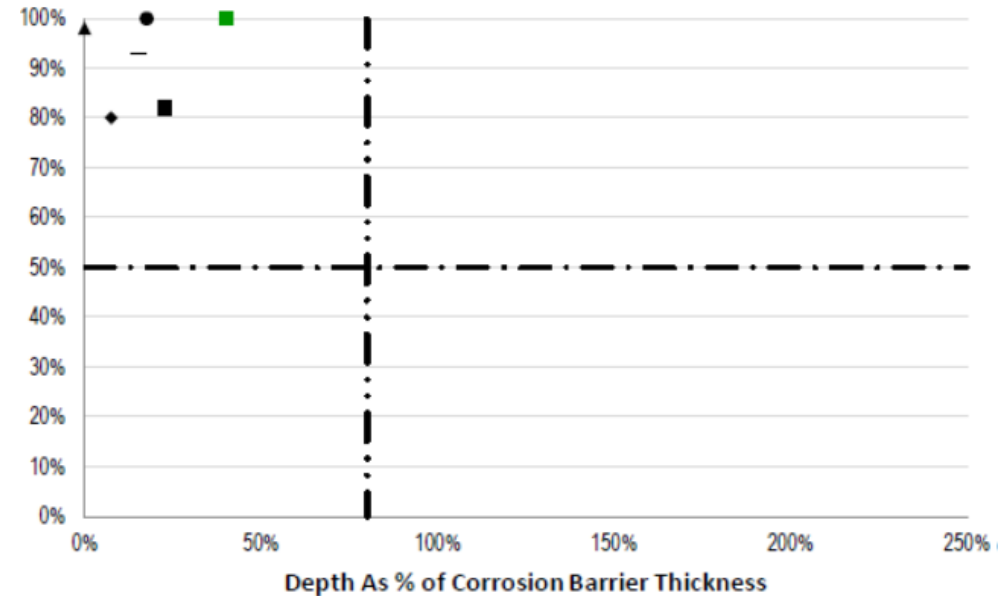
MCA Tank is Fit for continued service.  
Remaining Life can be estimated.

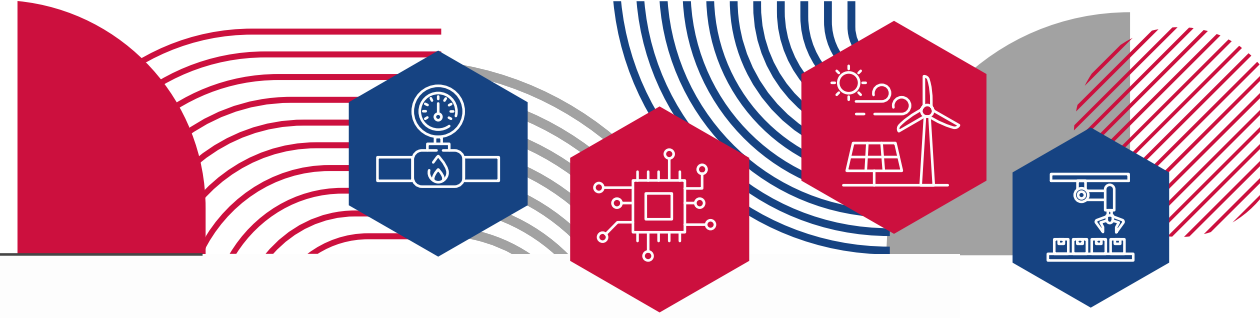




## An Added Benefit – PVC Condition

Minor chemical damage to PVC is also detected from the same UT readings.





## Benefits & Conclusions

Equipment, whose conditions = unknown represent unique challenges

- Site/personnel safety
- Environmental compliance
- Business continuity

Goal: Understand MI of assets/risks associated with operating assets

Prior to the application of the inspection offered by UTCComp, questions as to the mechanical integrity of our MCA RFP Storage Tank largely left unanswered with the potential for costly equipment replacement strategies as a way in which to address and mitigate this gap

Use of novel examination allowed evaluation and confirmation of tank's safety and fitness-for-service without the need to consider equipment replacement. Tank inspection was <5% of equipment replacement costs.