GRP pipework failures and NDT challenges

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GRP Pipework on UK CCGT Power Stations

UK Combined Cycle Gas Turbine (CCGT) plants have high water demand, primarily for steam condensation within cooling systems.

Cooling water pipework is typically HDPE or GRP/FRP, selected for corrosion resistance to treated cooling water.

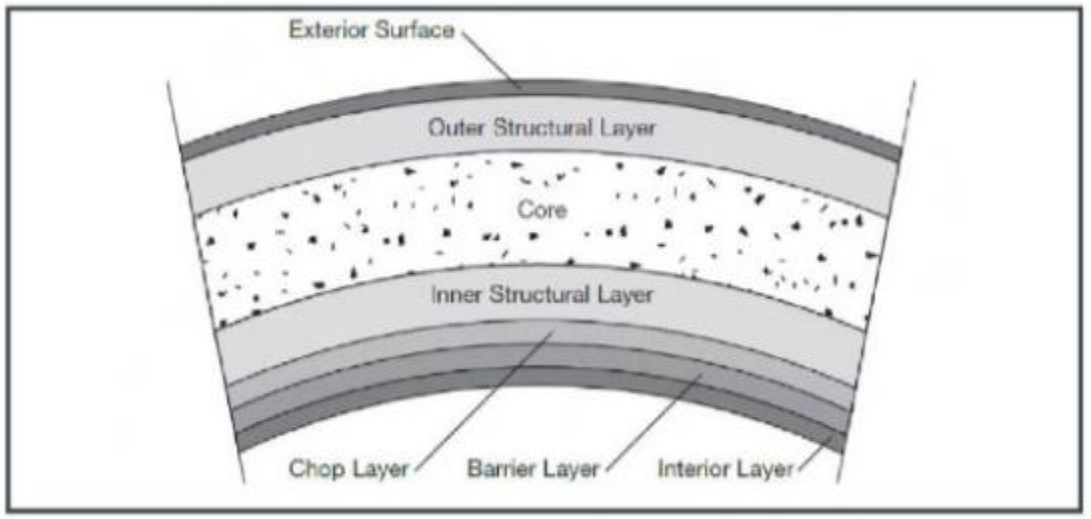
Most UK CCGT GRP cooling water systems are ≥20 years old and large diameter.

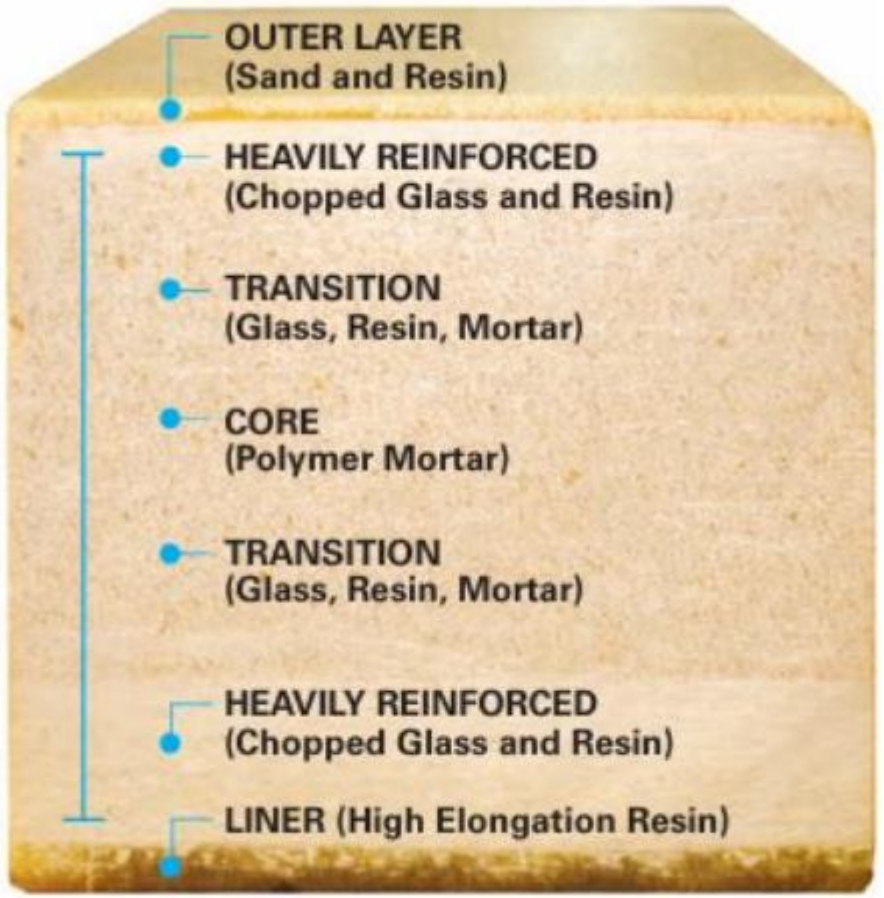
Over the past two years, multiple significant GRP pipe failures have disrupted operations at several UK CCGT sites.

GRP Pipework Composition

Multiple manufacturing processes have been used for GRP pipework; for legacy assets, the original process and quality standard are often undocumented.

The HOBAS centrifugal casting method is common and exhibits consistent, repeatable material layer architecture.





GRP Pipework Failures

Several GRP failures have manifested as axial splitting at the 3 and 9 o’clock positions.

As these pipelines are typically buried, failures often remain undetected until surface flooding or a measurable loss of system pressure occurs.

Beyond safety and environmental risk, such failures interrupt cooling water supply, necessitating plant shutdown until repairs are completed.

Access to GRP Pipework

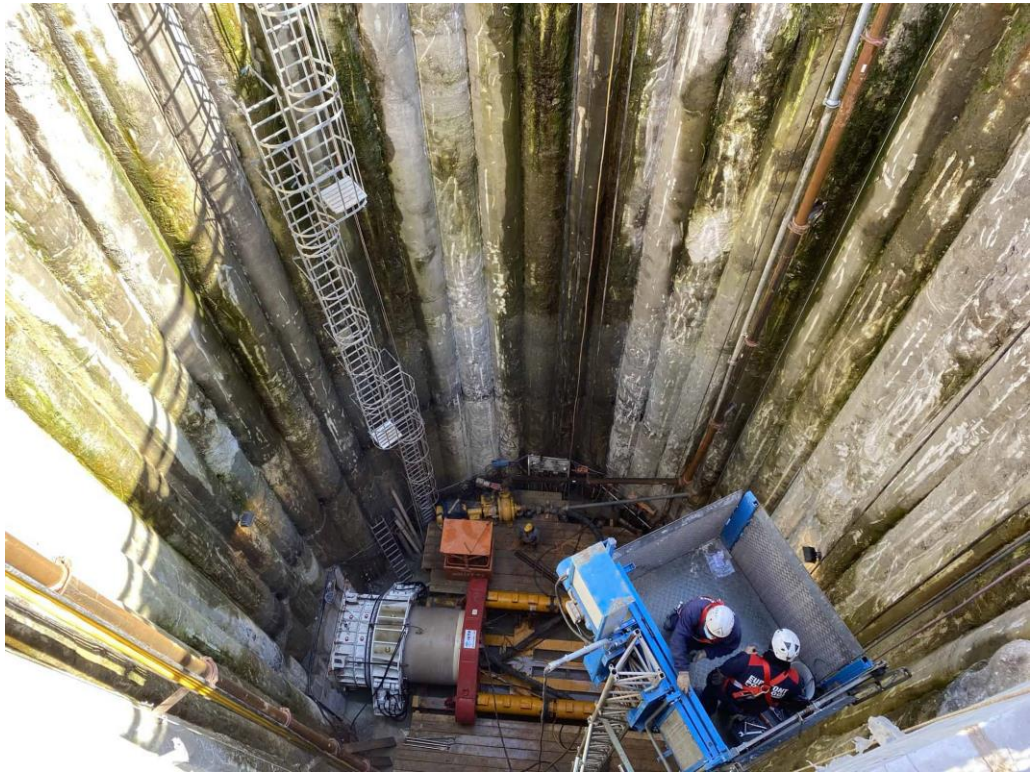
Buried GRP provides no external visual indication of deterioration or imminent failure.

Condition assessment is typically limited to internal RVI, often in constrained or partially submerged environments.

Ground-penetrating radar can assist location, but reliable condition assessment generally requires extensive excavation.

Excavated GRP is frequently covered with wraps or coatings, requiring significant surface preparation.

Even after preparation, surface roughness may remain excessive, complicating inspection and repair activities



NDT from **external** surface of GRP Pipework

External surface condition and intrinsic material properties significantly limit conventional NDT methods:

MT – Not applicable; GRP is non-conductive and non-ferromagnetic.

PT – Generally unsuitable due to surface roughness and material porosity.

ET – Not applicable; non-conductive material prevents eddy current induction.

RT – Impractical for large diameters; requires simultaneous internal and external access.

UT – Potentially feasible; however, surface condition, attenuation, and heterogeneous laminate structure may limit transmission and defect detectability.

NDT from **internal** surface of GRP Pipework

The same fundamental material limitations apply; however, internal surfaces typically do not exhibit the external roughness issues.

MT – Not applicable; GRP is non-conductive and non-ferromagnetic.

PT – Generally unsuitable due to material porosity (surface roughness less limiting internally).

ET – Not applicable; non-conductive material prevents eddy current induction.

RT – Impractical for large diameters; requires simultaneous internal and external access.

UT – Potentially feasible; attenuation and laminate heterogeneity may still limit wave transmission and defect resolution

Selection of NDT Method

UT was selected, with the following considerations:

Calibration using representative GRP blocks or pipe sections

Use of appropriate probe frequency or advanced UT method to balance penetration and resolution

Scanning strategy to compensate for variable laminate thickness and orientation

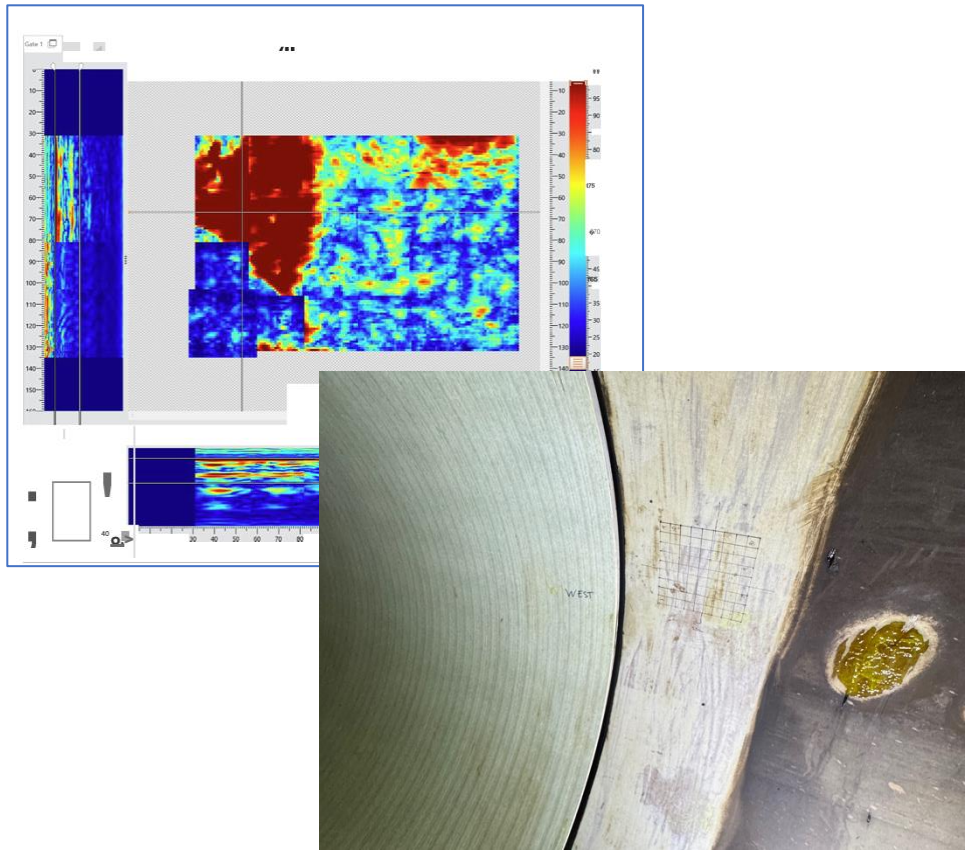
MAUT of GRP

1. An effective volumetric NDT technique was required for the testing of GRP pipework.

2. The Dolphitech Matrix Array Ultrasonic Testing system was trialled in the Workshop and at Site.

3. Shown to be adequate in detecting planar flaws parallel to the surface in GRP pipework, such as delamination.

4. System was not suitable for bulk pipework screening, and more suited to scanning small areas.



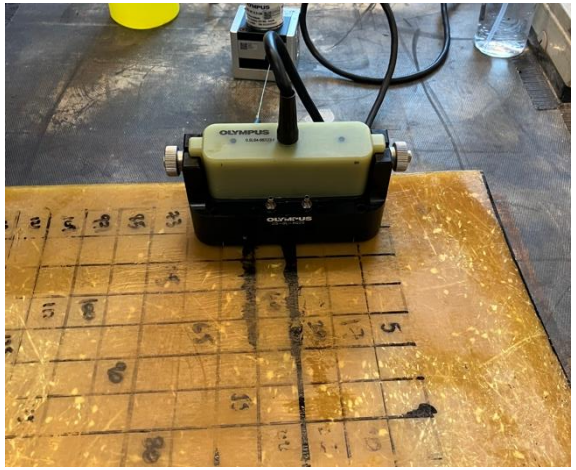
PAUT of GRP

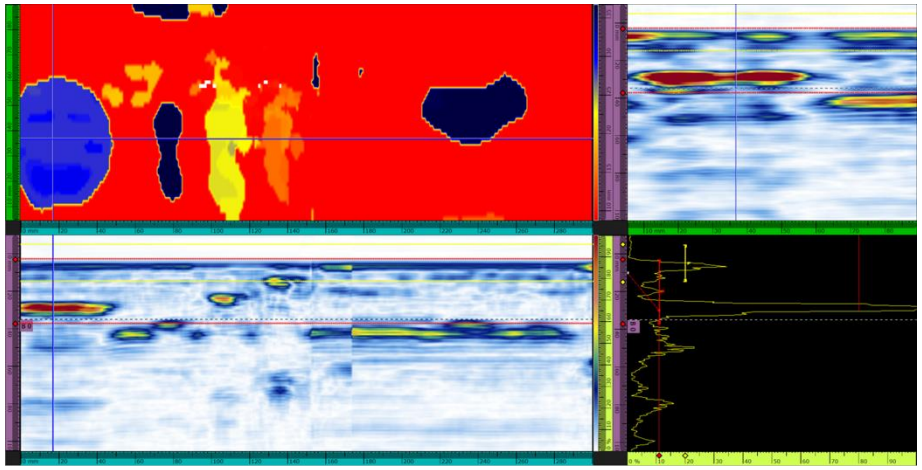
1. An effective volumetric NDT technique was required for the testing of GRP pipework.

2. Low Frequency PAUT was trialled in the Workshop, Site trials planned for 2026

3. Shown to be adequate in detecting planar flaws parallel to the surface in GRP pipework, such as delamination, in the workshop.

4. Site trials required to determine if suitable for bulk pipework screening.



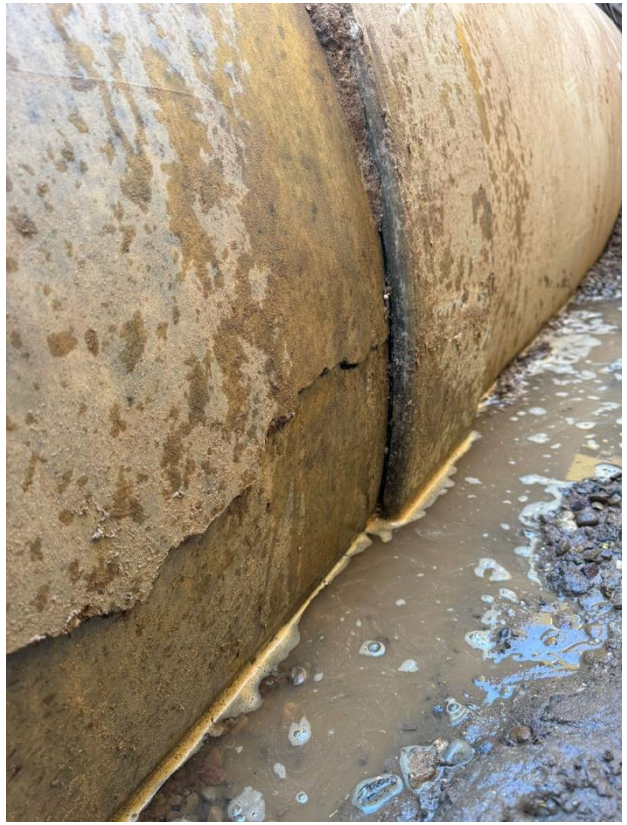


The Challenge – Bulk Scanning of Large Areas

1. An effective volumetric NDT technique was required for the testing of large areas of GRP pipework.

The Challenge – Angled UT for Axial Flaws

1. An effective volumetric NDT technique was required for the testing of GRP pipework for axial flaws perpendicular to the surface.

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