acquaint

BETTER INSIGHTS, SAFER PIPELINES

Validation sulphate attack

Rev	Description	Date	Prepared
01	Validation Sulphate Attack	2023-12-05	Acquaint

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1 Introduction

Asbestos cement (AC) pipelines have been widely used for various water distribution and sewage systems due to their cost-effectiveness, durability, and corrosion-resistant properties. However, over time, these pipelines can be vulnerable to chemical attacks, including sulfate attack. Sulfate attack leads to the degradation of the cement matrix, potentially compromising the integrity and longevity of the pipelines. Next to AC, also concrete sewer pipelines are susceptible to sulfate attack.

Acquaint BV has been at the forefront of the meticulous inspection of asbestos cement pipelines since the year 2016, employing state-of-the-art ultrasound technology to ensure a comprehensive assessment of these critical infrastructural components. Demonstrating a commitment to staying abreast of evolving inspection methodologies, the company has consistently utilized ultrasound as a sophisticated diagnostic tool in its assessments. Notably, in 2017, Acquaint BV made a pivotal discovery during their ultrasound inspections, identifying clear evidence of a sulfate attack in asbestos cement pipelines.

This white paper seeks to articulate the outcomes derived from Acquarius inspections concerning sulfate attacks observed in asbestos pipelines. The investigations employed a drill core sample for comprehensive validation of the findings.

2 Method

The Acquarius inspection was carried out on a pressurized wastewater asbestos cement pipeline, susceptible to potential degradation caused by sulfate attack over time. The particular pipeline under scrutiny exhibited evidence of sulfate attack at specific locations. To substantiate and confirm the findings of the inspection, the subsequent methodology outlined below was employed.

- A suitable site for field validation has been selected based on the results of the Acquarius inspection. For the specific locations the Acquarius inspection shows big anomalies in the wall of the pipe.
- A drill core coupon has been extracted from the crown of a pipe segment located at the suitable site.
- Phenolphthalein mixture is applied to the sides of the drill core coupon to indicate different states of degradation in different layers of the material.
- A caliper is used to measure the thickness of the various layers of the Asbestos cement.

3 Results & Discussion

3.1 Inline inspection

Ultrasound technology has been utilized on the Acquarius to obtain the wall thickness data for the chosen pipe segment. Figure 1 illustrates the normalized wall thickness distribution across the circumference of the chosen pipe segment. The visualization highlights a significant reduction in wall thickness, particularly near the crown of the pipe segment, specifically at 0 degrees.

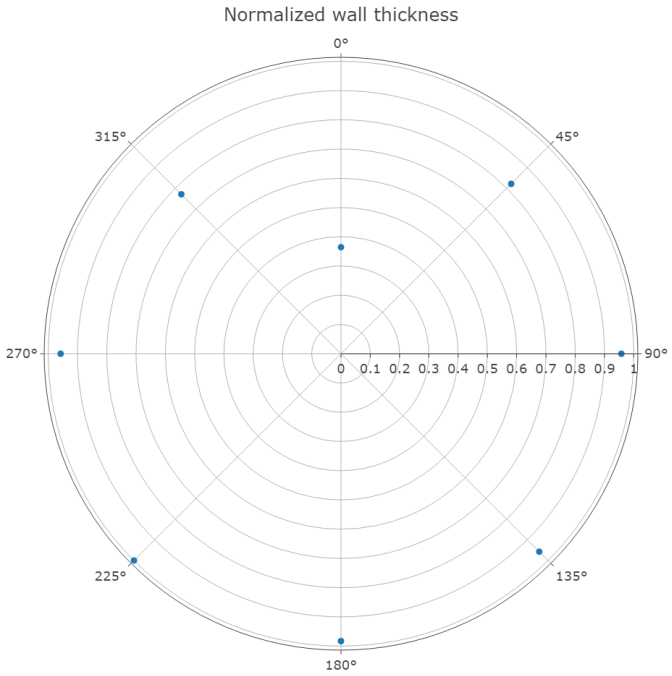

Figure 1 Inline inspection results

The inline inspection findings for the chosen pipe segment reveal a reduction in wall thickness by around 64%. With the initial wall thickness at 31 mm, this corresponds to an absolute decrease of approximately 19.8 mm. As a result, the anticipated remaining wall thickness for this particular pipe segment is 11.2 mm.

3.2 Drill core coupon

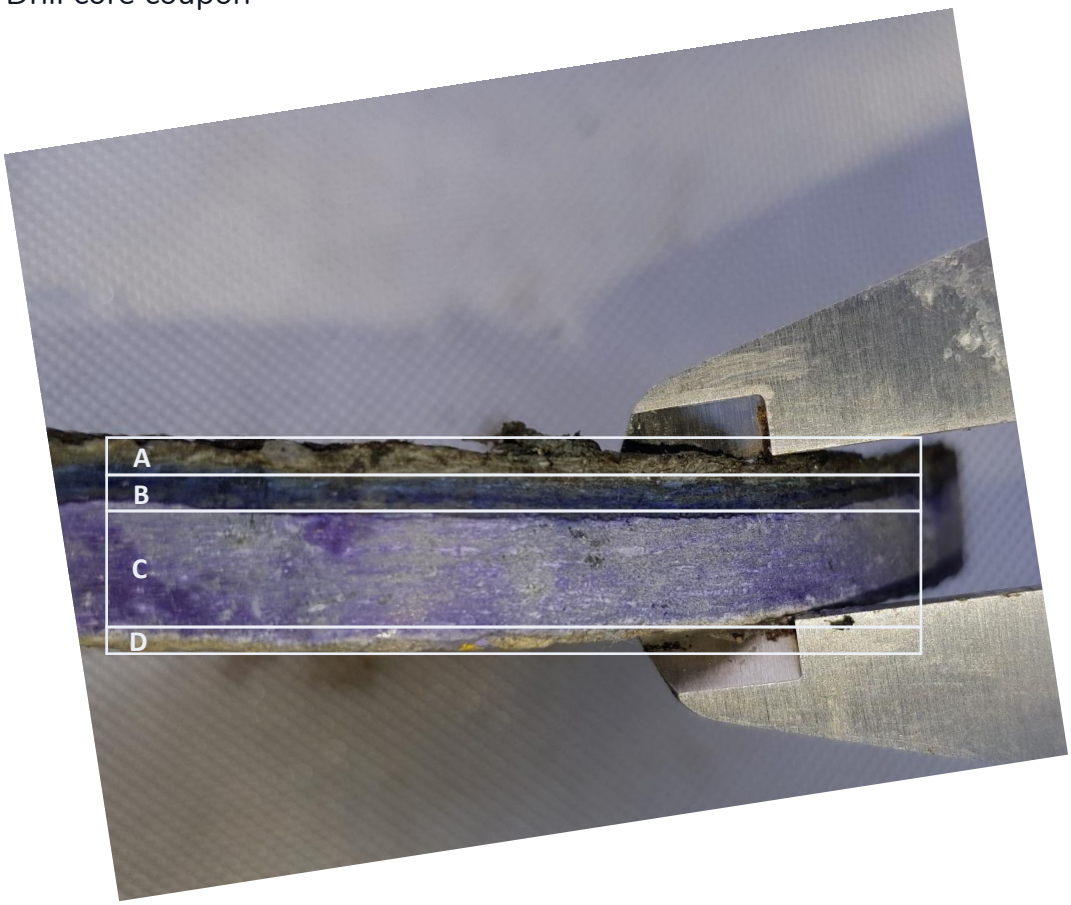

Figure 2 Drill core coupon.

Thickness:	Original wall thickness: 31mm Measured min: 11 mm		
A	Internal	1.5 mm	Deterioration
B		1.5 mm	Deterioration
C		7 mm	Unaffected
D	External	1 mm (max)	Deterioration

In contrast to the initial wall thickness, a reduction of 20 mm has been measured. The surface in area A exhibits conspicuous signs of porosity, suggestive of the occurrence of sulfate attack. In Layer B, there is a discernible transition between material that has been significantly affected and material that remains unaffected. Layer C showcases material that remains unaffected by the observed issues. Lastly, Layer D, situated on the external side of the pipe segment, also displays signs of impact, likely attributed to calcium leaching induced by the pipeline's environmental conditions.

4 Conclusion & Recommendations

In conclusion, the Acquarius ultrasound inspection has proven to be a validated and effective method for detecting sulfate attacks in asbestos cement pipelines. The removal of a drill core coupon from a pipe segment of the pipeline revealed distinct layers, with clear indications of sulfate attack in specific areas. The correlation between the ultrasound inspection results and the observed layers, including porosity in Area A and transitions between affected and unaffected material in Layers B and C, supports the reliability of the Acquarius ultrasound technology. Furthermore, the identification of external effects in Layer D, likely caused by calcium leaching from environmental factors, underscores the comprehensive nature of the Acquarius ultrasound inspection in recognizing complex degradation patterns. This validation underscores the significance of Acquarius ultrasound inspections as a robust and accurate tool for assessing and mitigating sulfate attacks in asbestos cement pipelines.