

NTS Pipeline Assessment

Phase 2

Project Summary Report

Report Covering Document

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Document Date	28/07/2026
Project Reference	NIA_NGT0261
Author	HK
Doc Reference	Pipeline Assessment Phase 2



Version History

Revision	Date	Description	Original Author	Editor	Approver
1.0	28/07/2026	Draft	HK		DH

Report Cover

Project Summary

This project expanded upon earlier hydrogen pipeline integrity research by improving the understanding of how existing gas transmission pipeline materials and welds perform when transporting hydrogen-natural gas blends. The project developed enhanced assessment methodologies, generated new material performance data and evaluated the potential operational impacts on the National Transmission System (NTS).

The outputs of the project provide National Gas with greater confidence in assessing the suitability of existing transmission assets for future hydrogen transportation and support future hydrogen repurposing and decarbonisation activities.

Work Package 1 – Additional and Refined Assessments

This work package developed and applied refined integrity assessment methodologies, including:

- Local pipeline stress assessments.
- Probabilistic fracture and fatigue assessments.
- Structural reliability assessment of seam and girth welds.
- Improved understanding of the effect of operating stresses on hydrogen performance.

Key Output: Improved probabilistic integrity assessment methodology and enhanced understanding of hydrogen-related pipeline reliability.

Work Package 2 – Data Input Refinement

This work package improved the quality of assessment inputs through:

- Mechanical testing of materials in hydrogen-natural gas blend environments.
- Collection and review of additional manufacturing and pipe mill data.
- Assessment of weld misalignment data and material properties.
- Generation of additional fracture toughness data.

Key Output: New material performance and manufacturing data to support more representative hydrogen integrity assessments.

Work Package 3 – Methodology Refinement

This work package refined integrity assessment techniques through:

- Investigation of sub-critical crack growth behaviour.
- Finite element modelling of weld misalignment effects.
- Review and refinement of assessment assumptions.
- Development of a National Gas hydrogen fracture and fatigue assessment guidance document.

Key Output: Standardised assessment guidance and improved understanding of crack growth and weld performance in hydrogen service.

Work Package 4 – Network Impact Assessment

This work package considered the wider operational implications of hydrogen-natural gas blends by:

- Assessing potential impacts of refined integrity assessments on network operation.
- Evaluating the likelihood of future operational constraints and mitigation requirements.
- Identifying opportunities to manage impacts through operational or engineering solutions.
- Informing future network planning and hydrogen deployment strategies.

Key Output: Improved understanding of potential network impacts associated with low-percentage hydrogen blending and future hydrogen transportation scenarios.

Overall Project Outcome

The project delivered improved fracture and fatigue assessment methodologies, new material performance data, enhanced understanding of hydrogen-related degradation mechanisms, a standardised engineering assessment framework and a high-level assessment of potential network impacts. Collectively, these outputs reduce uncertainty associated with future hydrogen transportation in existing transmission infrastructure and provide evidence to support future hydrogen projects and repurposing decisions.

The full study report contains significant amounts of commercially sensitive information, and is available upon request from National Gas Transmission. Please contact Box.GT.Innovation@nationalgas.com for further information.