

NIA Project Registration and PEA Document

Date of Submission

May 2016

Project Reference Number

NIA_NGGT0096

Project Registration

Project Title

Seam weld identification

Project Reference Number

NIA_NGGT0096

Project Licensee(s)

National Gas Transmission PLC

Project Start

July 2016

Project Duration

1 year and 5 months

Nominated Project Contact(s)

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Project Budget

£109,000.00

Summary

The girth weld is relatively easily identified, both on the ILI (inline inspection) data and visually on the exposed pipe. Similarly, the seam weld of submerged arc welded longitudinal (SAWL) or helical (SAWH) pipe is readily identifiable. However for electrical resistance welded (ERW) or high frequency welded (HFW) pipes the seam weld can prove very difficult to locate visually. This is due to the manufacturing technique whereby the flash formed on the outside and inside surface of the bond line is removed to blend smoothly with the adjacent pipe.

Consistent and accurate determination of the seam weld position is important where pipes are being assessed for damage under the P/11 procedure or for proposed pipeline modifications (tapping etc.).

A critical stage of the P/11 assessment process is to determine whether any damage identified during inspection is coincident with the weld or heat affected zone (HAZ). This requires the positive identification of the girth weld and, if it is welded pipe, the seam weld.

Effective weld position determination techniques proposed by this project will have a significant impact on the accurate determination seam weld position leading to improved maintenance and integrity activities.

Third Party Collaborators

ROSEN

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

The inspection, assessment and repair of damaged pipelines are performed in accordance with the National Grid procedure T/PM/P/11. A critical stage of the assessment process is to determine whether any damage identified during inspection is coincident with the weld or heat affected zone (HAZ). This requires the positive identification of the girth weld and, if it is welded pipe, the seam welds.

A further issue is that for modification work on AGI (Above Ground Installation) sites it is necessary to identify the position of the seam weld in order to achieve seam weld offset in adjacent pipe lengths and also to avoid locating attachments onto the seam weld.

This programme will investigate potential methods / techniques for identifying the position of seam welds in high frequency resistance welded (HFW) or electrical resistance welded (ERW) pipe.

Method(s)

The programme will be conducted as a set of specific stages, each building to the respective milestone. The final output will be guidance document that can be introduced to the National Grid quality management system either as a stand-alone procedure or as part of an existing specification. Each stage is summarised below:

Stage 1 – Review of potential technologies (tools, techniques, guidance)

The aim of the review of potential technologies is to identify existing techniques; tools or guidelines that could be used to locate an ERW/HFI bond line. The review will include a literature survey to identify if there is any information available in the public domain. The review of any potential technologies will as a minimum, consider the following aspects:

- Experience required by the inspector
- Effectiveness of the technique
- Cost
- Access required
- Ergonomics
- Resources required
- Accuracy
- Limitations of the application
- Environmental aspects
- Suitability for on-site use

Other key aspects that will also be included within this stage are:

- Visual Characterisation
- Weld seam location
- Thickness Measurements
- Shape analysis
- Metallographic identification
- Alternative technologies

Milestone 1.1 - Identification of the potential technique(s) that can be used.

Milestone 1.2 - Technical review report.

Stage 2 – Development of a draft procedure or guidance document

Once potential techniques have been identified, a draft procedure/guidance document(s) will be developed. The aim is to develop a document that can be used as a guide during the validation trials. The procedure/guidance document(s) will define which methods will be used and how they should be applied in practice. The aim is set out a step by step guide that operators could use during the assessment. This report will be subject to further review following the feedback from the validation trials.

Milestone 2.1 – Issue of a draft procedure/guidance document covering each technique identified as meriting further investigation / assessment.

Stage 3 – Validation trials

Pipe from available National Grid stocks will be assessed, along with pipe from other sources of ERW/HFW pipe (such pipe manufacturers, test houses, and local stockists).

Milestone 3.1 – Completion of validation trails on stock pipe

Milestone 3.2 – Review of the validation trial results

Stage 4 Reporting

A final technical report will be issued to National Grid documenting the results from each stage and presenting the conclusions and any further recommendations. This report will incorporate the review report completed for Stage 1.

The draft procedure will be optimised based on the results of the validation programme and a final inspection procedure included in the final report.

Milestone 4.1 – Technical review report and justification of suitable technology.

Milestone 4.2 – Final issue of the procedure/guidance document.

CC1 June 2017: Delays in delivery of Milestones 1 & 2 due to availability of project lead and issues obtaining pipe samples have led to a change control request of 6 months. The new timelines will enable the supplier to source necessary pipe samples, book the inspection kit required and ensure availability of the project lead for the remaining milestones.

Scope

The girth weld is relatively easily identified, both on the ILI (inline inspection) data and visually on the exposed pipe. Similarly, the seam weld of submerged arc welded longitudinal (SAWL) or helical (SAWH) pipe is readily identifiable. However for electrical resistance welded (ERW) or high frequency welded (HFW) pipes the seam weld can prove very difficult to locate visually. This is due to the manufacturing technique whereby the flash formed on the outside and inside surface of the bond line is removed to blend smoothly with the adjacent pipe.

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Objective(s)

The aim of this project is to investigate if additional inspection technologies (techniques, tools or guidelines) exist, or can be developed that National Grid engineers or inspectors could implement on site to enable identification of the ERW/HFW bond line and its position around the pipe circumference.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The deliverable will be guidance document that can be introduced to the National Grid quality management system either as a stand-alone procedure or as part of an existing specification.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project will be a combination of a desktop study (Stages 1,2,4) and experimental validation trials (Stage 3).

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

All the work in this project will concentrate on National Gas Transmission network pipe assets.

Revenue Allowed for the RII Settlement

None

Indicative Total NIA Project Expenditure

£109,000

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

In the event that the ERW /HFW seam cannot be identified on a corroded section of pipe the damage would be treated as worst case and assumed to interact with the seam weld. To National Grid management procedure T/PM/P/11 the damage would therefore be classified as extreme and a repair required. For this type of damage there are 2 options:

1. Fit an epoxy repair shell – the preferred method of repair is to fit an epoxy repair shell as this can be fitted with a pressure reduction down to 20% of the specified minimum yield stress. A repair shell for a standard 24 inch pipe with a length of three times the diameter is estimated to be £16,000.
2. Replacement pipe section – in certain circumstances it may not be possible to fit an epoxy repair shell for example due to configuration of pipework or due to the additional loads the shell may place on the pipework. In these circumstances it is necessary to replace the pipe section.

The above scenarios do not take into account any costs associated with the pressure reductions required to fit an epoxy shell or to isolate the pipework for the cut out and replace option.

Please provide a calculation of the expected benefits the Solution

The research will identify a suitable method for locating the longitudinal ERW / HFW seam weld on pipelines and pipework. If this can be done this will reduce the requirement to fit epoxy shells and also reduce lost time on site where the inspectors are looking for the seam and awaiting advice.

For each application where the inspection method can be used it is estimated the following savings could be made

£16,000 cost for fitting an epoxy shell

£1200 in lost time (delays whilst trying to find the seam weld assuming 2 men at £600 per day)

Across pipelines and above ground installations it is considered that on a per annum basis the research could have a saving of 3 epoxy shells. This would result in an annual saving of £51,600. The use of the inspection method would be ongoing and savings would be made each year going forward.

It should also be noted that there has been one occasion in 2013 where a section of pipe on above ground pipe had to be cut out due to the unknown location of the ERW / HFW seam weld. On this occasion a saving of at least £60k could have been made if the seam

could have been located.

Please provide an estimate of how replicable the Method is across GB

The project will provide a framework for the determination of seam weld position in HFW and ERW pipe. This will be universally applicable across National Grid's Transmission network and other licensee networks where HRW and ERW pipes are installed.

Please provide an outline of the costs of rolling out the Method across GB.

The learning from the project will be disseminated via National Grid's usual Engineering Bulletin and Procedure update mechanisms

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

- A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).
- A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)
- A specific novel operational practice directly related to the operation of the Network Licensees system
- A specific novel commercial arrangement

RIIO-2 Projects

- A specific piece of new equipment (including monitoring, control and communications systems and software)
- A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven
- A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)
- A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology
- A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution
- A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

The output of the project will be a technical framework for the determination of HFW and ERW position determination. This framework will be applicable to any HFW and ERW pipeline.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

The project will contribute to NGGT's Reliability innovation strategy objective.

- Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

- Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

n/a

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

n/a

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

n/a

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

n/a

This project has been approved by a senior member of staff

Yes