Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Apr 2016

Project Reference Number

NIA_NGGT0093

Project Registration

Project Title

Ultrasonic testing of thin wall pipeline girth welds using high frequency probes

Project Reference Number

NIA_NGGT0093

Project Licensee(s)

National Gas Transmission PLC

Project Start

April 2016

Project Duration

0 years and 5 months

Nominated Project Contact(s)

Alan Kirkham, box.GT.innovation@nationalgrid.com

Project Budget

£10,000.00

Summary

Thin walled pipes are increasingly required to be tested non-destructively to the requirements of National Grid Standard T/SP/NDT/2 which then refers to BS EN ISO 17640.

Conventional ultrasonic testing (according to BS EN ISO 17640) limits thicknesses that can be examined to less than 8mm. Similarly, the draft phased array standard BS EN 13588 goes down to 6mm. Smaller thicknesses are frequently inspected by radiography,

The main purpose of this work is therefore to examine whether the normal manual ultrasonic procedures used in the standard can be applied with minimum modification to inspect arc welds in thin sections can improve on this. The reason that the 8mm limit applies in most cases is that it is not possible with thinner sections to apply standard UT probes because they cannot approach the weld close enough nor can the beam be easily defined. The modification to the standard procedure adopted is to allow the use of high frequency 10MHz angled beam probes.

Third Party Collaborators

GB Inspection Systems Ltd

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

National Grid applies Non Destructive testing (NDT) to the requirements of T/SP/NDT/2 within this document BS EN 17640 is the reference standard for the requirements of manual Ultrasonic.

BS EN ISO 17640 contains standard ultrasonic inspection techniques for ferritic steel welds. The techniques in general include scans with different angles from either side of the weld.

The minimum thickness noted in this standard is 8mm. However there are an increasing number of applications involving smaller thicknesses and these cannot strictly be inspected by these methods. Because of this there is a need to use radiography for the thinner pipe weld inspections.

Radiography is a none preferred method because of the Health and Safety issues around its use as well as potential environmental concerns. Within National Grids policies radiography is only used when there is no available alternative, if this project is successful then the use of radiography can be reduced further.

Method(s)

Within the NDT profession if is recognized that the use of higher frequency probes can improve the inspection of thinner materials. By carrying out a number of controlled inspection on thin wall pipes (4mm to 8mm) and using higher frequency probes the hope is that this will demonstrate that the required scanning sensitivity can be achieved to enable the use of Ultrasonic weld inspection down to 4mm wall thickness.

Scope

Thin walled pipes are increasingly required to be tested non-destructively to the requirements of National Grid Standard T/SP/NDT/2 which then refers to BS EN ISO 17640.

Conventional ultrasonic testing (according to BS EN ISO 17640) limits thicknesses that can be examined to less than 8mm. Similarly, the draft phased array standard BS EN 13588 goes down to 6mm. Smaller thicknesses are frequently inspected by radiography,

The main purpose of this work is therefore to examine whether the normal manual ultrasonic procedures used in the standard can be applied with minimum modification to inspect arc welds in thin sections can improve on this. The reason that the 8mm limit applies in most cases is that it is not possible with thinner sections to apply standard UT probes because they cannot approach the weld close enough nor can the beam be easily defined. The modification to the standard procedure adopted is to allow the use of high frequency 10MHz angled beam probes.

Objective(s)

To determine if by using higher frequency probes acceptable results can be achieved to allow there use on thin wall pipe weld inspection.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Tests will be carried out on a range of thin wall pipe samples using High frequency probes, the results will be compared to conventional test probes, and a report produced to compare the results.

Subject to successful demonstration the technique this will feed into the update of T/SP/NDT/2 for National Grid and allow the extension of ultrasonic and reduce the need for radiography.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

If this investigation is successful the use of ultrasonic can be utilized on thin wall pipe diameter. It could be used by all UK Gas Transmission and Distribution companies on future in service inspection and construction projects.

Technology Readiness at Start

Technology Readiness at End

TRL5 Pilot Scale	TRL8 Active Commissioning

Geographical Area

If fully successful this technique could be employed across all UK Gas Transmission and Distribution systems.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

NIA funding - £10,000

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)

The use of site radiography is always a more expensive option than ultrasonic testing, to mobilize a radiographic crew for a day is typically £700 plus a cost of film for each weld tested, ultrasonic mobilization is lower at £250 and no additional costs, this becomes more relevant when the requirement is to test only a small number of welds at a location, there is also the cost of disruption of surrounding operations that are required to be stopped during the use of radiography which is not a requirement when carrying out ultrasonic.

Please provide a calculation of the expected benefits the Solution

Based on a saving that Radiography is 3 to 4 times higher an estimate of inspection of thin wall welds costing £20k per annum the saving will be £15k for the remainder of the RIIO period will be the same as previous years. This equates to a total saving of £60k (£15k x 4 years).

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

This new technique, if fully successful, could be rolled out to the majority of the Gas Transmission pipeline construction and in service inspection projects.

The technology could also be used by the Gas Distribution companies also.

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

Roll out costs would involve the procurement of further sets of probes, which are less than £3,000 per set.

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

If the technology is viable the learning could be used by all Gas Transmission and Distribution operators to provide an alternative safer and environmentally friendly weld inspection method.

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

Using traditional radiography has potential risk to the environment by a) exposing the environment to high levels of ionizing radiation, and b) the chemicals used in the production of the radiographic image on the film are potentially harmful and so by using Ultrasonic these can be removed.

This project will deal with one of our environmental challenges National Grid Gas Transmission faces and will be assigned to the Environment theme.

☑ 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