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

Dec 2013

Project Reference Number

NIA_NGGT0046

Project Registration

Project Title

Manual Phased Array for small diameter offtake weld inspection.

Project Reference Number

NIA_NGGT0046

Project Licensee(s)

National Gas Transmission PLC

Project Start

December 2013

Project Duration

0 years and 5 months

Nominated Project Contact(s)

Robert Bood, box.GT.innovation@nationalgrid.com

Project Budget

£56,000.00

Summary

Last year, during grit blasting, a weld on a 2” offtake branch started leaking gas through a pinhole sized flaw. The subsequent investigation found that this was due to subsurface weld defects joining together to provide a gas path. The defects were not known about because small (around 2”) branch offtakes have weld geometries that prohibit inspection for subsurface defects via normally employed techniques such as radiography and manual ultrasonics. A small number of similar leaks have previously occurred and present a potential hazard to personnel. Also, without full weld inspection there is the potential for other defects to be present in these types of welds that could present integrity issues.

Manual Phased Array (MPA) is an advanced ultrasonic inspection technique that allows versatility in controlling the angle and focusing of the ultrasonic beam. In the hands of a skilled operator it has the capability to detect subsurface defects in components that are difficult or impossible to inspect using other techniques. MPA has not been used for these components in National Grid, and from discussions with inspection experts it does not seem to have been used for this elsewhere despite it having the potential to be successfully employed. This project will investigate if the technique can be used for inspection of welds on small offtake branches in the geometries typically used by National Grid.

Third Party Collaborators

DNV

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

An investigation found that subsurface weld defects enabled a gas leak to occur during grit blasting operations on a 2” offtake branch. Detection of these defects using normal NDT techniques such a radiography and manual ultrasonics is not feasible due to the geometry of the components. Such leaks present a risk to personnel and could also result in plant being shutdown until the failed component can be replaced.

Method(s)

Phase 1 – Feasibility Study (£56,000)

The first stage of his project will use the latest available Manual Phased Array (MPA) equipment and a highly skilled practitioner, to inspect four branch offtakes. The offtakes (two defect free, two with defects) will be made up for the project and the work will be conducted under laboratory conditions. It will be conducted as a research project rather than as a blind trial to enable the practitioner to experiment with combinations of transducer heads, operating parameters, signal processing etc.

The deliverable from stage one will be a technical report detailing the work undertaken, a review of the findings along with recommendations as to whether MPA can be used for inspection of these components.

Phase 2 – Methodology Development (not part of the £56,000, to be costed on completion of phase 1)

Further work will be required to develop the specific requirements to enable the technique to be used within National Grid. This will include items such as equipment specification, user guidance, best practice, probability of detection etc. It is anticipated that a blind trial under laboratory conditions and a field trial at an operational site will be required using a range of MPA suppliers.

Phase 3 – Business readiness (not part of the £56,000, to be costed on completion of phases 1 and 2)

This phase will embed the findings within the business through production of new, and modification of existing company policy, standards and work procedures to ensure fitness for purpose when implementing across the NTS.

Scope

Last year, during grit blasting, a weld on a 2” offtake branch started leaking gas through a pinhole sized flaw. The subsequent investigation found that this was due to subsurface weld defects joining together to provide a gas path. The defects were not known about because small (around 2”) branch offtakes have weld geometries that prohibit inspection for subsurface defects via normally employed techniques such as radiography and manual ultrasonics. A small number of similar leaks have previously occurred and present a potential hazard to personnel. Also, without full weld inspection there is the potential for other defects to be present in these types of welds that could present integrity issues.

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Objective(s)

The objectives of this project are to determine if MPA can be used to detect the presence of subsurface defects in the fillet and butt welds of small diameter branch offtakes, and if so, to develop the method into a fully specified practical technique.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Provide National Grid with detailed knowledge about the MPA technique and its applicability for use in the NTS in detecting defects in the butt and fillet welds of small branch offtakes.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Phase 1 will be laboratory scale work and phase two is likely to include further laboratory work with a field trial to demonstrate the technology in the working environemnt. The outcome of this project will be applicable across the whole of the NTS, in particular at AGI's and Compressor stations where there are many small diameter branch attachments.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The laboratory work will take place at the supplier premises. Field trials will take place on a National Grid Gas Transmission above ground installation.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£56,000 for phase 1

Costs for phases 2 and 3 will be dependant upon results from phase 1.

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)

If successful it is estimated that the cost saving will be approximately £25K per year; which is a saving of £200K over the 8 year revenue period. This is based on the prevention of 1 failure per year and that 1 injury every 10 years is prevented.

Please provide a calculation of the expected benefits the Solution

Base cost, of not inspecting, as per current method:

Assume 1 failure per year resulting in repair and supply issue costs of around £100K

And that 1 failure in 10 years will cause an injury at a cost of £1M (or £100K per year)

i.e. Total base cost of around £200K per year

Method cost of implementing the technique is

Assume 30 inspections per year at £5K per inspection, cost of £150K/year.

Assumes 1 repair per year at £25K

i.e. Total Method cost of £175K per year

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

This technique is replicable across the gas transmission and distribution systems.

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

It is expected that if successful, this service will be contracted to a third party supplier as and when required. There will be no further capital costs associated with the roll out of the Method.

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 learning can be employed on relevant network licensees on their pipework systems to inspect small diameter branch offtakes either during construction, or for inspection of existing ones.

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 aims to deliver benefits to the Infrastructure and Safe Working Practices areas within the Safety 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