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NIA Project Registration and PEA Document

Date of Submission

Jun 2014

Project Reference Number

NIA_SGN0050

Project Registration

Project Title

Seeker Particles (Stage 2)

Project Reference Number

NIA_SGN0050

Project Licensee(s)

SGN

Project Start

July 2014

Project Duration

1 year and 0 months

Nominated Project Contact(s)

Stephen Tomlinson, (Innovation Project Manager)

Project Budget

£298,258.00

Summary

From the 1850's up until the 1950's cast iron mains were used extensively across Great Britain (GB) gas distribution network. Since then the gas industry has moved away from this source of material and is using steel and polyethylene. However a significant portion of cast iron is still in use today. At present across Scotia Gas Networks (SGN) there are some 20,000 kilometres (km) of metallic mains that are ageing, requiring inspection, repair or replacement.

Extensive investigation, has demonstrated that the majority of larger diameter tier 3 mains (18-48" diameter) are less likely to fail through cracks and fractures, and more likely to fail due to leaks within the existing joints.

In the past Network Licensees would either fully replace these ageing assets, which are a high cost activity, or aim to maintain them to prolong the asset life. To date the options available to repair large diameter joints have been limited to the use of mechanical joint clamps, encapsulation, or injection of anaerobic sealant into jute packing. While cheaper than full replacement, these repair techniques have a number of disadvantages including the costs incurred due to significant excavations and material requirements, and considerable disruption to SGN customers.

Nominated Contact Email Address(es)

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Problem Being Solved

From the 1850's up until the 1950's cast iron mains were used extensively across Great Britain (GB) gas distribution network. Since then the gas industry has moved away from this source of material and is using steel and polyethylene. However a significant portion of cast iron is still in use today. At present across Scotia Gas Networks (SGN) there are some 20,000 kilometres (km) of metallic mains that are ageing, requiring inspection, repair or replacement.

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Method(s)

Following on from Stage 1 (Concept Development) of this proposed 4 stage, project, stage 2 of the project will concentrate on application and assessment of different liquid sealants using the test rig developed in Stage 1.

Stage 2 of the project aims to deliver a range of tested options for sealing that are suitable for use in a live mains trial. This work can be summarised by three high level activities: joint sealing and assessment, sealant conveyance and integration of deployment tooling.

Joint Sealing and Assessment:

The joint test rig used in stage one will be used again to apply and assess the relative performance of a variety of different sealant types. The tests are to include representing environmental conditions that are found in live pipes. The results will be assessed with reference to long term stability of the seal given the fifty year target lifespan. The joint sealing aspect will review the materials and rate the seals in terms of:

- {C}· Overall quality for sealant type
- {C}· Bonding to the pipe wall
- {C}· Assessment and control of the make-up process of the seal to determine the resistance to gas break through
- {C}· Assessment of the strength of the seal in terms of flexibility of the seal and the joint after sealing
- {C}· Assess a wide range of joint types and environmental conditions
- {C}· Statement of the permanence of the seal

Sealant Conveyance:

The sealant conveyance aspect of the project will investigate how the sealant is to be managed prior to deployment. Steer Energy will investigate two options for sealant delivery. The first option is to make use of a pipeline tether the second is to localise the sealant in a reservoir on the platform itself. In both these cases the sealant muse be managed so that there is ready supply in the deployment head and that it cures only when it is in place, sealing the joint.

Integration of Deployment Tooling:

The integration of deployment tooling will focus on the requirement for mounting the tool heads onto 3rd party platforms with particular focus on integration with robotic platforms.

Scope

Definition of Overall Quality of Seal

This forms the background work on the requirements for sealing in the live environment. Building on work carried out in Stage 1, this

work will identify and list likely contaminant components found in the network. These contaminants will be included in the programme of work going forward. The long term requirements for the seal will be determined including the implications for a 50 year seal life. This work will also look for-ward to the required standards and possible compliance testing which will have to be adopted in Stage 3 of the project.

Selection and Development of Sealants

This Work Package will work with identified technology partners to optimise the sealants supplied. A number of different chemistries will be trialled and each system will be adapted for the proposed sealing strategies developed in Stage 1 of the project. The two strategies are: full cavity sealing whereby the joint cavity is completely filled and bridge sealing where a small volume of sealant is applied to the entrance of the joint to form seal. The performance of the sealants will be assessed in WP4. A process of selection, test and feedback requirements for improvement is to be used to reach an optimised solution.

Sealant Specific Tooling

Different sealant systems will require different tooling. This work will identify the correct tooling so that multiple seals can be carried out in a single run. This is particularly important for two part systems where sealant curing in the wrong place could result in blockages requiring retrieval and strip down of applicators. This work is likely to include deployment pumps to deliver the correct dosage of sealant to the injection head.

Sealant Testing

This work package forms the main body of work. The sealing systems selected in WP2 will be tested using relevant application tooling from WP3. Tests will be carried out to the specification of WP1. The majority of testing will be carried out using the test rig shown in Figure 2. A process of test, select and reject will be used for the test programme. A number of options are tested, the performance of a particular trait is assessed the best items are selected to be taken forward whilst poor performance is quickly rejected. In this manner optimised solutions are quickly developed. The outcome of this work will be the preferred sealant systems for field trials.

Long Reach Conveyance

This section examines how the overall supply of sealant is to be handled. This will consider if a reservoir of sealant is to be kept on the deployment platform or if a supply of sealant is to be provided by an umbilical. This work will draw on experience from the upstream oil and gas industry. Sealant delivery systems will interface to the tooling developed in WP 3 and take into account any specific activation systems required for the preferred sealants.

Integration with Platform Deployment

This will concentrate on linking the tooling developed in WP 3 to a robotic platform. This work will link with preferred robotic system manufacturers to smoothly interface systems for field trials.

Project Management & Reporting

A report detailing the in depth work carried out and any conclusions and recommendations will be delivered to SGN at the end of the programme of work. A monthly report will also be submitted to SGN, and four Steering Group meetings will be held during this project (1 x Kick Off, 2 x Interim Meetings, and 1 x Close Out). The Steering Group will most likely comprise of 2 individuals from each of SGN and Steer Energy.

Objective(s)

The objective at this stage of the project is to develop a liquid sealant for the repair of leaking joints from within a live pipe. This involves researching materials for the sealant as well as the tooling to apply the sealant into the joint, for deployment from a platform within the pipe. This must be deployed remotely or through a tethered system.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

- Successful production of a tested liquid sealant suitable for deployment from the inside of the pipe with a 50 year life expectancy.
- Suitable tooling to allow application of the sealant.
- Completed investigation and report into the potential of integration with a third party delivery platform.

- Completed study of sealant conveyance methodology to increase distance.
- Completed project reports.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This is a small scale project to determine the requirements and learning to allow for progression to Stage 3.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

This project will be undertaken off-site by Steer Energy at their premises.

Revenue Allowed for the RIIO Settlement

During RIIO-GD1 it is estimated that SGN will spend approximately £255.7m and £209.6m on emergency and planned repairs respectively on all mains. As this project is a feasibility study for a technology at a low TRL, it is not yet possible to determine whether revenue savings are likely during RIIO-GD1.

Indicative Total NIA Project Expenditure

The total project expenditure will be £298,258, 90% of which is allowable NIA expenditure (£268,432)

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)

As this project focuses on the early development of the technology it is difficult to quantify the potential financial benefits at this stage.

It is envisaged that deployment of this technology would lead to financial benefits in the following areas:

- Allow both proactive and reactive repair of pipe joints using discrete particles, improving efficiency of mains repair techniques and reducing costs.
- Avoided Public Reported Escapes, and associated costs, including excavation and reinstatement.
- Reduce SGN's costs (and carbon footprint) through reduced leakage of natural gas to atmosphere.
- Reduce excavation and reinstatement in public carriageways associated with current methods of joint repair and limit disruption to SGN's customers and members of the general public.

Please provide a calculation of the expected benefits the Solution

N/A

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

This project is designed to reduce leakage of gas distribution networks through the insertion of liquid sealants into the live gas environment. The focus area will primarily be metallic mains. SGN have approximately 20,000km of metallic mains across all range diameters. As a result, based on a 4:2:1:1 split the total length of mains across GB that this method could ultimately apply to in future years is approximately 80,000km.

The repair and maintenance of these mains are high cost areas for all Network Licensees and the project has been designed to develop potential solutions to clearly defined industry challenges. Therefore, this confirms how replicable the project is across the industry and how easily the technology could be rolled out.

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

There are no costs associated with sharing the conclusion and recommendations of this study with the other Network Licensees, which will be the first step towards roll out across GB. As stated above, the early technology readiness level means that it is not possible to estimate the costs of future deployment after successful completion of Stages 3 and 4 at this time.

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

All Network Licensees will be able to use the learning generated as the outcomes will be presented in a clearly defined report that focuses on providing possible solutions to address the objectives.

Following on from stage one of the project; this study will demonstrate suitable sealants for use in pipe environments, tooling that will allow conveyance of the sealant into the joint and also how to incorporate these aspects into a platform for deployment in pipe.

This will then allow Network Licensees to analyse internally where they foresee the benefits and whether they outweigh the costs and disadvantages of current methods of repairing leakage across metallic mains.

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

n/a

☑ 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