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

May 2019

Project Reference Number

NIA_CAD0037

Project Registration

Project Title

Composite repairs for through wall defects on metal pipes

Project Reference Number

NIA_CAD0037

Project Licensee(s)

Cadent

Project Start

April 2019

Project Duration

2 years and 6 months

Nominated Project Contact(s)

Cadent Innovation Team

Project Budget

£200,687.00

Summary

Above ground pipework is exposed to the elements, resulting in possible degradation from corrosion; known as external metal loss. Support structures can concentrate rates of corrosion around the pipe as they often begin to corrode before the pipe. This technology can offer the potential of a permanent repair to pipe and reduce the number of costly replacements. A permanent repair will also offer significant reduction in environmental impact and reduce large scale works, protecting staff from higher risk activities and the public from increased disruption.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

Above ground pipework is exposed to the elements, resulting in possible degradation from corrosion; known as external metal loss. Support structures can concentrate rates of corrosion around the pipe as they often begin to corrode before the pipe. This technology can offer the potential of a permanent repair to pipe and reduce the number of costly replacements. A permanent repair will also offer significant reduction in environmental impact and reduce large scale works, protecting staff from higher risk activities and the public from increased disruption.

Method(s)

Stage 1 – Proposal of Standard and Verification Test Requirements
This will include a technical review to summarise the state of the art of current understanding and to prepare a proposal for a ‘standard repair’ that will then be verified by testing. The base line procedure proposed will enable future innovations and products to be assessed as well as qualifying a specific system for immediate application. The procedure will include methods to account for thermal loading and self-weight of pipes supported on, like river crossings.

Stage 2 – Measure Adhesion of Composite Repairs to Iron Pipes
This will include measuring bond strength achieved on cast iron, spun iron, ductile iron and steel lines prepared by both bristle blasting and hand tools.

Stage 3 – Stop-Gap Method Verification
The aim of this stage is to look at several techniques and quantify their capability to provide the temporary relief and also their suitability for use with a composite repair.
Stage 4 – Measure Energy Release Rate Achieved between Composite Repairs to Iron Pipes
The aim of this phase is to characterise a design methodology based on the bond performance in terms of an energy release rate.

Stage 5 – Full Scale Verification of Standard Design Including Stop-Gap Technique
During this stage, a further six tests will be completed on lines containing typical through-wall defects. The tests will therefore demonstrate the overall suitability of the standard design, its ability to work with the stop-gap techniques and its practical installation.

Stage 6 – Final Report
The results from the programme will be used to verify the proposed qualification framework is suitable and sufficient for identification and validation of repair approaches for iron lines. Additionally, a standard design for repairs to low, medium and intermediate pressure lines will be finalised for use in the field.

Scope

The project comprises six phases with the first phase being to baseline a standard method of composite repair including test requirements and a detailed test plan. The final phases of the project will progressively test the new standard and starting with yard trials at TEAM site, which will be reinforced in parallel with Cadent's G23 to form the basis of a Management Procedure for implementation of the repairs including selection of repair systems and competence of installers.

Objective(s)

1. Develop a standard design method for a composite repair for deployment on the low and medium pressure systems (including thermal and self-weight loads) where the damage has:
• not yet gone through-wall.
• resulted in a leak.

2. Measure bond strength achieved on cast iron, spun iron, ductile iron and steel lines prepared by both bristle blasting and hand tools.

3. Analyse several stop – gap methods and quantify their capability to provide the temporary relief and also their suitability for use with a composite repair.

4. Quantify the energy release rate achieved between composite repairs to iron pipes.

5. Verify the proposed qualification framework is suitable and sufficient for identification and validation of repair approaches for iron lines.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project success will be measured against the following criteria:
1. Quantification of how much simpler surface preparation methods affect adhesion of repairs and what implications this has regarding the performance of repairs.
2. The test methods proposed for verifying the standard designs are demonstrated to work reliably.
3. The project demonstrates composite repair technology to a sufficient degree of confidence to form the basis of a Management Procedure for implementation of the repairs including selection of repair systems and competence of installers.

Project Partners and External Funding

Total Cadent £ 200,687

Potential for New Learning

• Quantification of the effect of surface preparation on the performance of the repairs on iron substrates, how that will impact capability

of repairs and inform investment decisions.
• Suitability of over-wrap repairs for through wall metal loss on metal pipes, where severe corrosion is identified, and traditional grit blasting preparation has not been deemed suitable, to extend the asset life.

Scale of Project

The results of this project can be shared across all Gas Distribution Networks to maximize the benefits.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The UK mainland.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£200,687

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 current way to repair pipeline damage is using a full encapsulation epoxy filled steel shell. However, given the advances in composite technology over recent years, there is interest in the potential use of this system for the repair of other iron pipelines, both as an emergency repair system and as a 'long term' repair solution. Typical benefits include;
• A reduction in loss of revenue; the period over which the pipeline is operating at a reduced pressure until the repair is undertaken,
• Reduced repair costs; i.e., the process of design, fabrication (required for a steel shell), and installation,
• Security of supply; should an emergency arise, resulting in isolation of a section of the pipeline, the composite repair system will enable a quicker repair than a steel sleeve.

Please provide a calculation of the expected benefits the Solution

In the current state Cadent repairs iron pipelines using a full encapsulation epoxy filled steel shell, which for an IP main costs £179,100. It is anticipated that the new repair techniques will reduce this cost to £50,664.
This cost reduction assumes that a composite repair in iron pipelines will mitigate the need for bespoke fittings and will prevent loss of supply for our customers.

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

The project will develop a new understanding on the composite repairs that will be applicable for and implemented by all the GDNs

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

There will be no direct cost for GDNs associated with rolling out this project.

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 results from this project can be shared amongst all GDNs to reduce the costs of maintaining ageing network. And the life of iron pipes can be extended with composite repairs avoiding the need to replace the pipes.

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

Cadent is looking for methods and techniques to improve the service and mains replacement process, to reduce or minimise disruption to our customers and the general public with materials that are as practical, safe, and have similar or better longevity properties, but are cheaper to purchase.

☑ 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.

This project does not lead to unnecessary duplication as it is directly targeting repair techniques for throught wall defect in iron pipelines and these techniques are not currently proved within the gas industry.

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

This project is innovative (not business as usual) due to the exploration of new tools and techniques for dealing with repairs on iron pipe lines.

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

The Network Licensee will not fund this project as business as usual due to its innovative exploration of new techniques for dealing with repairs on iron pipe lines.

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

This project can only be undertaken with the support of the NIA as it directly looks to innovatively explore and test new and previously unused tools and techniques for repairing iron pipelines. The project directly targets specific operational risks linked to the repair and maintenance of iron pipelines, which currently in business as usual we cannot target. The project will also benefit all relevant network licensees that have ageing iron pipelines in their networks, and through the NIA learning will be shared amongst these licensees.

This project has been approved by a senior member of staff

☑ Yes