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 2017

Project Reference Number

NIA_CAD0013

Project Registration

Project Title

Multi-Occupancy Building Cured In Place Lining (NuFlow): Further Development of Technology for Gas Distribution Riser Systems

Project Reference Number

NIA_CAD0013

Project Licensee(s)

Cadent

Project Start

April 2018

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Hilary Buxton – Project Sponsor Declan Robinson - Senior User Project suppliers, Simon Daniels – Rosen Andrew Newton – Portfolio Manager Ashley Horn – Project Manager

Project Budget

£347,600.00

Summary

The objective of the project is to provide technical and operational assurance in areas relating to long term performance properties of the NuLine product. And subject to Network policy approval achieve permanent status of the NuLine product. This will be achieved by Rosen completing all required testing for approval of permanent status of the NuLine product identified by Rosen.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

There are a number of Multiple Occupancy Buildings (MOBs) across the country with gas risers. These risers - usually constructed of steel or copper, are coming to the end of their expected operational life, and to replace these using existing construction methods will be expensive, disruptive and time consuming. Development of an alternative method to either remediate or replace these systems is therefore required.

NuFlow is a forced air lining process using a non-invasive technique that applies an epoxy resin to coat the inner wall of the network pipework in situ rather than full replacement.

Previous work performed by Cadent, in conjunction with other UK gas distribution networks, has developed a draft Gas Industry Standard (GIS) for polymeric pipe lining systems. A review of the draft GIS specification conducted for Cadent identified requirements that are applicable for interim use and those that will only be required for a permanent renovation solution. Additionally, a gap analysis has been performed that identifies those requirements that can be demonstrated by Nu Flow for the Nu Line product, versus those that are not currently demonstrated.

Cadent has already achieved success with this technology with two field trails carried out, one on a redundant system and the second at (Hatherley Court) which was a MOB where customers had been off gas for several months due to asbestos complicating replacement works. Using NuFlow put the customers back on gas within 3 days under the auspices of G/23 and is currently subjected to quality assurance inspections, to date there has been no reported issue.

Cadent currently has another NuFlow project in flight (NGGD_0097) to build on the success of existing work completed and expand upon the learning already obtained to include copper piping within the product scope. This includes - Revision of G/23, Selection,

testing and qualification of a Copper to MDPE pipe connection fitting, Specification review and revision (GIS) and NuLine material and performance testing (Short term). Following this work a further (Cadent funded) construction project is planned for Q4 2017 at Langtree Walk. This construction project will also be supported and witnessed by Rosen who will produce a field trial report detailing key findings that will subsequently be used to update and further improve the field trail G/23 documentation.
Following the completion of project NGGD_0097 it is now proposed to complete the next and final project to achieve approval of the NuLine product as a permanent renovation solution.

Method(s)

The proposed project will build on the success of existing work completed to date (qualifying the efficacy of the product for interim use on the Gas Network)
Cadent are currently considering implementing this technology into its network to provide an alternative to replacement.
This project seeks to test the NuFlow product against a program of long term testing to qualify its efficacy for permanent use on gas riser networks.

Scope

2.1 Long Term Tensile Failure Strength

There is a requirement that the tensile creep strength at 23°C±2°C out to 30 years shall be determined for the Nu Line material in accordance with BS EN ISO 899-1 – Plastics – Determination of creep behaviour –
Part 1: Tensile creep. Test specimens shall be of the same shape and dimensions as specified in ISO 527-2 – Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics. It is assumed that the requirements for the test specimens to be used for determination of long term tensile failure strength shall be agreed between ROSEN and Nu Flow and the specimens supplied by Nu Flow.
The deliverable shall be a test report detailing compliance with Clause 3.7.5.1 of the draft Gas Industry Standard (GIS) for polymeric pipe lining systems

2.2 Chemical Resistance

It is a requirement for Nu Line to be resistant to chemical attack from synthetic gas condensate, odorants typically used by Cadent, monoethylene glycol used in the fogging process and lubricating oil which can enter the gas distribution system.
The Nu Line resin shall be subjected to an ageing regime of 1500 hours at 23°C in accordance with Table 2 of BS ISO 4437-1:2014 to quantify the influence of these chemical environments on hardness, volume, and tensile properties and shall show no signs of damage or breakdown.
It is assumed that the requirements for test specimens to be used for the chemical resistance tests shall be agreed between ROSEN and Nu Flow and the specimens supplied by Nu Flow.
The deliverable shall be a test report detailing compliance with Clause 3.7.5.2 of the draft Gas Industry Standard (GIS) for polymeric pipe lining systems.

2.3 Long Term Leak Sealing Performance – Lined Joints

Tests shall be conducted on tubular sections of 1 inch carbon steel pipe with single central straight screwed connectors slackened off to give a leakage rate of approximately 0.05m3/h. The tubular sections shall be lined using the Nu Flow technique.
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Post cure, and prior to any long term evaluation, the zero time liner leak strength shall be evaluated to give the pressure at zero time. Liner leak strength regression curves shall then be generated at selected temperatures and pressures aligned with ISO 899-1 methodology in order to determine 30 year leak strength at 23°C±2°C.
It is assumed that the requirements for the test specimens to be used for determination of long term leak sealing performance shall be agreed between ROSEN and Nu Flow and the specimens supplied by Nu Flow.
The deliverable shall be a test report detailing compliance with Clause 3.7.5.3 of the draft Gas Industry Standard (GIS) for polymeric pipe lining systems.

2.4 Long Term Sealing Performance – Hole Spanning

Tests shall be conducted on 1 inch steel and copper pipe which has been drilled through-wall and the hole plugged flush with the internal surface of the tubular using a stopper. Pipe sections shall be lined using the Nu Flow technique at the specified cure temperature.
Post cure, the stopper shall be removed, and prior to any long term evaluation the zero time liner leak strength shall be evaluated to give the pressure at zero time. Regression curves shall be generated at selected temperatures and pressures aligned with ISO 899-1 methodology in order to determine the 30 year hole spanning strength at 23°C±2°C.
It is assumed that the requirements for the test specimens to be used for determination of long term leak sealing performance shall be agreed between ROSEN and Nu Flow and the specimens supplied by Nu Flow.
The deliverable shall be a test report detailing compliance with Clause 3.7.5.4 of the draft Gas Industry Standard (GIS) for polymeric pipe lining systems.

Cadent has already achieved success with this technology with field trials carried out, one on a redundant system and another on a MOB where customers had been off gas for several months due to asbestos complicating replacement works. The use of NuFlow onsite allowed work to be completed within 3 days under the G23. This is currently monitered under this document and there has been no reported issues to date.
Following learning from these projects the NuFlow material and process have been refined to create a more consistent product that has built on the trials completed so far. To confirm the performance of this material, and process, we will undertake short and long term material testing to ensure it meets the required standard.

Objective(s)

The testing proposed has been recommended by Rosen for Cadent following the review of the GIS and completing a gap analysis to identify the testing requirements.
These are:
Long term assessment and assurance of the NuLine system including a test report detailing compliance with clause 3.7.5 of the draft GIS for polymeric pipe lining system in the following areas-
• Long term tensile failure strength - resin material property
• Chemical resistance – resin material property
• Long term leak sealing performance – Lined joints and hole spanning

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be deemed as a success by providing-
- Successful completion of the appropriate testing program.
- Network Policy have appropriate information to make an informed decision as to whether the product and process should be considered for 'permanent' status.
- HSE have appropriate information to make an informed decision as to whether the product and process should be considered for 'permanent' status.
- Ofgem agreeing acceptable outputs

Project Partners and External Funding

Cadent – 90% of project will be funded by NIA
Project Partner – Rosen

Potential for New Learning

The results from this project will allow Cadent and other GDN's to understand the long term performance of the NuLine product and subsequently whether it is fit for purpose as a permanent renovation solution

Scale of Project

This project will help further understand how this technology can or should be used (interim/permanent) as an alternative to replacement of gas riser networks.
The scale of this project is to undertake the associated long term assessment of the NuLine product over a 13 month Period (3 month contingency) with an expenditure of £219,301.42. This timescale has been set out by Rosen to allow sufficient time to fully determine the long term performance of the product in line draft Gas Industry standard for polymeric pipe lining systems.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

This project will not incorporate any field trials in the network, all testing will take place at Rosen's testing facility in Newcastle upon Tyne.

Revenue Allowed for the RIIO Settlement

No Specific RIIO deliverable output.

Indicative Total NIA Project Expenditure

Total expenditure will be £347,600.

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)

This project has an indirect financial benefit to the customer, assuming positive outcomes of the long term performance testing and subject to Network Policy approval this product would enable a permanent renovation solution for Cadent's internal and external riser network
Perceived benefits are:
• Less time on site, less time 'off gas' for customers
• Reduced GSOP payments made to customers
• Reduced excavations
• Reduced need for welders
• Reduced requirement for physical riser replacement in turn saving time and costs
• Reduced requirement for scaffolding/access equipment.
• Customer Satisfaction (quicker, less intrusive)
• Reduced number of visits to monitor corroded riser pipes/extension of time between surveys on risers that have been remediated.
• An alternative option to replacement where constraints for example access, safety, architectural and aesthetical.
There is currently very limited data on costs for this technology, to date the costs for the NuFlow procedure at the last job for refurbishing 16 supply points at Hatherly Court cost approximately £2000 per supply point. However the next proposed job at Langtree court which is to refurbish 133 supply points is estimated at £500 per supply point. This is excluding any other associated costs associated with these jobs.
Commercially, the rates are expected to stabilise once a contract is agreed and this will be based on volume, it is currently believed that the savings for the NuFlow technology will be 25%-50%.

Please provide a calculation of the expected benefits the Solution

It is assumed that the average cost per dwelling (using 12 dwellings per riser) will be approx. £2,500 - £3,000 (This will include estimated GSOS payments for customers off gas).

The Target Cost using NuFlow will be approx. £1,000 - £2,000. This will be dependant on the rate of application on the required site.

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

All Network Licensees have Multi Occupancy buildings with Gas riser systems. Therefore this technology could be rolled out across all gas networks in the UK.
Current scope for this technology mainly focuses on MRB's with the potential to increase this further. It is anticipated that this technology could penetrate 30% of the workstack.

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

Cost can only be clarified on completion of this project subject to the technology achieving a permanent status and subject to policy approval.
This technology is likely to be a brought in service by the GDSP's. Therefore there would be no cost associated with training however startup costs need to be considered.
Costs would need to be agreed on a commercial basis but these would be based on volume. Currently Volumes are unknown until the technology receives permanent status and is approved by Network policy.
All learning will be shared by other GDN's therefore they could follow suit.

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

Project outputs will be shared with other GDN's

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

Currently there is no approved method available to allow the permanent lining of gas riser systems. The only other available alternative is to replace these using existing construction methods will be expensive, disruptive and time consuming
☑ 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 technology is new and novel within the gas industry and there is currently no development of this type of technology in the UK.

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

There is currently no other available technology of this type with the UK gas industry.

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

There are significant risks and uncertainties as to whether this technology is able to pass the required tests and as such does not form part of any BAU process.

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

The technology being developed was originally designed for the water industry therefore quality assurance and acceptance testing is required to further qualify it for permanent use in the gas network. Current risks are to obtain HSE acceptance of technology as a semi structural remediation system and agreement of an acceptable output with regulator Ofegm.

This project has been approved by a senior member of staff

☑ Yes