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

Jan 2014

Project Reference Number

NIA_NGGD0018

Project Registration

Project Title

Thin Walled PE Liners

Project Reference Number

NIA_NGGD0018

Project Licensee(s)

Cadent

Project Start

January 2014

Project Duration

1 year and 5 months

Nominated Project Contact(s)

Declan Robinson – Innovation Project Manager

Project Budget

£226,197.00

Summary

The scope of work for this second stage is split into discrete Tasks:

TASK 1 – Investigate Liner Collapse Mechanisms

The purpose of this task is to develop greater understanding of liner collapse mechanisms and installation, and findings used to develop requirements for the Finite Element Analysis (FEA).

TASK 2 – Finite Element Analysis

In this task, finite element analysis will be employed to model a number of the scenarios developed in Task 1. This will enable a number of liner / host main combinations to be investigated.

TASK 3 – Design of Electrofusion Parameters for SDR 33 and SDR 51 Pipe

Perform a series of tests to prove the feasibility of welding high SDR PE100 materials. The work will design an electrofusion procedure for joining low wall thickness (SDR 33 and SDR 51) pipe using electro fusion couplers. TASK 4 – Purchase PE Pipe

Purchase of PE100 pipe and associated fittings in order to perform the buckling tests. These tests will be performed on pipe of 315 mm or 355 mm diameter (depending on availability).

TASK 5 – Buckling Tests

Perform a trial to assess the required external pressure to collapse thin wall PE100 (SDR 33 and 51). Further testing will be done to characterise the resistance to buckling when exposed to external pressure.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

The UK gas industry is being encouraged to adapt its engineering and operational planning to conform to more precise monitoring of aged pipeline assets, so as to ensure an economic strategy of replacement and refurbishment. The legacy of larger diameter iron mains is likely to require targeted refurbishment rather than total replacement. This opportunity permits a different approach to polyethylene (PE) pipe technology, which is currently based upon free standing, fully structural pipe designed for open ground installation.

Where a large plastic pipe is to be used predominantly as a lining for an existing ferrous main, the cast iron (CI) pipe can be expected to retain some structural integrity and so protect the inserted pipe from ground loading and third party interference. Consequently, there can be a substantial revision of design concepts. Large PE pipes of a higher than usual SDR can still have a substantial absolute wall thickness and be capable of being constructed by established methods such as fusion jointing. However, the potential assembly and operation of high SDR pipes has not been exploited in the gas industry as in the water and drainage industry.

Further work is needed to determine the potential opportunity for this approach and to properly indicate engineering solutions to issues that might limit its adoption.

Stage 1 of this project, which was completed under the Innovation Funding Incentive, looked at issues associated with manufacturing, installation, commissioning, operation and maintenance of lining materials. In addition this work defined a revised range of PE wall thicknesses designed for LP and 2 bar applications for refurbishment of large diameter (above 8”) iron pipes.

In looking at the design requirements to resist internal pressure and external collapse forces it was identified that the GIS LC8-31, B.17 requirement for collapse resistance to a 5m head of water may not be met. Further work is required to understand liner collapse within an outer constraining shell.

Method(s)

This project will entail research and development activity to investigate liner collapse mechanisms, finite element analysis, trial of Electro Fusion Parameters for SDR 33 and 51 Pipe, and buckling test laboratory trials.

Scope

The scope of work for this second stage is split into discrete Tasks:

TASK 1 – Investigate Liner Collapse Mechanisms

The purpose of this task is to develop greater understanding of liner collapse mechanisms and installation, and findings used to develop requirements for the Finite Element Analysis (FEA).

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Objective(s)

To identify and develop solutions to issues that might limit the introduction and operation of polymeric pipes, with a much lower wall thickness than those currently supplied to GIS specifications, for use as liners within CI pipes. At large diameters, PE pipes to GIS specification consume a large quantity of material. For the refurbishment of large iron pipes (tiers 2 and 3), it is believed that linings fabricated at reduced wall thickness can be made entirely fit for purpose with a consequent improved economics of material consumption. The objective of this project would be to identify and indicate engineering solutions to issues that might limit pipeline construction procedures or long term performance of pipe with revised dimensions.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Success of this project would be the ability to provide planning and installation engineers with proposals for a revised plastic pipe technology that makes far more efficient usage of resources, whilst maintaining the proven advantages of all-welded PE pipe construction.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The scale of this project is limited to that of development and a series of controlled trials, all of which is deemed necessary in order to fully understand liner collapse within an outer constraining shell.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

Macaw Engineering offices – Newcastle upon Tyne

Revenue Allowed for the RIIO Settlement

No Revenue Allowed for in the RIIO Settlement

Indicative Total NIA Project Expenditure

£226,197 Total NIA Project Expenditure

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 cost of pipe production is related to the price of resin – less resin means cheaper pipes.
- Thinner wall pipes lead to less weight to transport to site
- A revised approach to pipeline maintenance strategy signifies an opportunity to develop more economic renovation technologies

A potential saving of at least £250k has been identified – based on pipes purchased in the size 250mm – 630mm

Project Benefits Rating = 8/25

Please provide a calculation of the expected benefits the Solution

Potential saving of £250k:-

- Based on tones of pipe purchased in sizes 250mm – 630mm
- Assuming a position where SDR26 pipe becomes acceptable for open cut installation between 250mm – 630mm inclusive up to 2bar
- Assuming similar SDR33 for insertion compared to the current SDR33 requirements
- Assuming only 10% of that reduced tonnage to reflect a reduced RIIO activity in Tier 2 and 3 ranges
- Multiplying the calculated tonnage by the current cost/tonne of PE polymer of £1500/tonne

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

As above

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

1. Asset data changes to recognise new SDR – work in progress

2. A need for training – managers, supervisors, main layers, service layers and Escape repair crews.

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 from this project will be published in the form of an output report and can be used by relevant Network Licensees in understanding the issues associated with manufacturing, installation, commissioning, operation and maintenance of metallic distribution pipe lining materials.

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

Not applicable

☑ 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