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NIA Project Registration and PEA Document

Date of Submission

Mar 2014

Project Reference Number

NIA_SGN0029

Project Registration

Project Title

Bond and Bolt Saddle System

Project Reference Number

NIA_SGN0029

Project Licensee(s)

SGN

Project Start

April 2014

Project Duration

4 years and 11 months

Nominated Project Contact(s)

Hector Salgado, Innovation Project Manager

Project Budget

£96,977.00

Summary

The scope of this work is to design, develop and test a bespoke adhesive that will form a joint, which eliminates the need for the saddle to be plugged off. The solution has the potential to reduce the size of excavations required when completing branch drilling operations, which will in turn bring the time and cost savings that are already being achieved to a much wider range of applications. The project will:

- Design and develop proof of concept.
- Design prototype adhesives.
- Manufacture and test prototype adhesives in specially constructed test rigs.
- Select three adhesives for external testing.
- Conduct laboratory based study representative of in service conditions.
- Initial design of saddle flange incorporating the chosen adhesive.
- Manufacture specialist saddle flange assembly.
- Conduct a field trial of the three units on various mains sizes for product verification. SGN's Southern site location is yet to be determined.
- Produce a draft work procedure and technical report on the development of the equipment for review by SGN subject matter experts before final version is produced.
- Conduct a full scale assessment prior to transfer to business as usual.

A change request was submitted in February 2016 to allow for the required additional testing on the fittings secured by Bond and Bolt technology, post-installation. The initial test plan allowed for testing on live mains only. As the project has progressed, it has been determined that there is a requirement to carry out trials on dead mains before progressing to live field trials, these tests were

identified after the completed initial 1000 hrs of laboratory testing and could not have been foreseen prior to the project commencing. It has also been deemed prudent to remove the connection made on the dead mains and test them in laboratory conditions against the mechanical specifications identified in the first stages of the project. The additional testing may take a further ten months, resulting in an amended project end date of November 2016. This additional testing will also incur extra costs, which will be provided following determination via a thorough tendering process.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

From the 1850's up until the 1950's cast iron mains were used extensively across the United Kingdom (UK) gas distribution network. Now the gas industry has moved away from this source of material and is using steel and polyethylene. However a significant portion of cast iron mains is still in use today. At present across Scotia Gas Networks (SGN) there are some 20,647 kilometres of metallic mains <12" diameter that we maintain and connect to on a daily basis.

When conducting branch drilling operations to connect to or replace sections of mains, the full main must be excavated so that the drilling saddle can be safely secured to the pipe. Over the years many companies have looked to develop and market new products for drilling on the gas distribution networks. In the past SGN have utilised managed services and equipment to perform branch drilling operations, particularly on large diameter mains.

The technology already exists to temporarily bond a saddle to the crown of a metallic main without the need to expose the underside of the pipe. This is currently done using a bespoke two part epoxy adhesive that forms a high tensile joint, coupled with mechanical bolts. This process significantly reduces the size of the required excavation hence reducing time and cost.

This project will aim to develop a branch saddle joint capable of lasting fifty years. If this solution is achieved it will create substantial savings through a reduction in excavation size and the time taken to carry out a large connection, and significantly reduce the disturbance caused to the public whilst the work is being undertaken.

Method(s)

ALH Systems Limited are developing a sealing procedure for cast iron and steel pipes that will reduce excavations to carry out inspections and repairs and a critical aspect of the procedure is the use of adhesively bonded mild steel saddle plate to seal the pipe at the end of the process.

The purpose of this project is to provide evidence of the durability of joints prepared in the manner described above through a laboratory based study in which the residual strength of bonded joints is determined after exposure to environmental and load regimes representative of in service conditions. The study will investigate up to 3 different proprietary adhesive systems.

Scope

The scope of this work is to design, develop and test a bespoke adhesive that will form a joint, which eliminates the need for the saddle to be plugged off. The solution has the potential to reduce the size of excavations required when completing branch drilling operations, which will in turn bring the time and cost savings that are already being achieved to a much wider range of applications. The project will:

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Objective(s)

The objectives of the project are to:

- Design and develop proof of concept bond and bolt saddle system to be used in conjunction with the existing branch drilling equipment.
- Develop working prototype and carry out off site testing.
- Carry out field trials to comprehensively review the new solution in a live gas environment.
- Carry out a detailed cost benefit analysis for field trials.
- Provide relevant information to the other Network Licensees.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project are to:

- Consider a criterion relating to development of the product as well as practices.
- Develop operational practices to support a bespoke adhesive that will form a long lasting joint to improve a temporary bond and bolt saddle system.
- Identify the extent to which adhesive solution minimises the size of excavations required when completing branch drilling operations.
- Produce and disseminate learning around the expected cost and time reductions.
- Provide Network Licensee with the technical report produced, which will incorporate information on the research, development and field trialling of the new adhesive and saddle.

In order to determine whether this project has been successful or not at various stages, the project must progress through a number of stage gate milestones. SGN's Project Manager will evaluate the performance against the requirements before approving progress to the next stage..

Project Partners and External Funding

None

Potential for New Learning

This project aims to develop a solution to an existing problem that has never been adequately addressed before. The Project is expected to develop the following new learning for Network Licensees:

- Awareness of a method and product for branch drilling operations that can be used on the Low Pressure and Medium pressure networks across a range of sizes.
- Understanding of the time, costs and benefits of the method and product.
- Whether the methodology has the potential to be adapted to suit larger mains diameters.

Scale of Project

In order to ensure that learning associated with this project is maximised and that the future application of this technology is well understood, a sufficient off site testing review and product verification of the prototype will be carried out. Once the adhesive properties have been tested and deemed suitable, it will be field trialled using three prototype units in SGN's Southern district.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

Off site testing review and product verification of the prototype will be carried out by both ALH systems Ltd and Artis Consultants at their own facilities. Once the adhesive properties have been tested and deemed suitable, it will be field trialled using three prototype units in SGN's Southern district. This is yet to be identified.

Revenue Allowed for the RIIO Settlement

SGN's RIIO-GD1 Allowance for Replacement activities for both Scotland and Southern is £1,804.1m. It is likely that some of this expenditure can be saved from the introduction of the Bond and Bolt Saddle system.

Indicative Total NIA Project Expenditure

The total project expenditure is £96,977, 90% of which is allowable NIA expenditure (£87,279).

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)

In addition to the operational benefits of this project, the design, development and testing of a new bond and bolt saddle system to be used in conjunction with the existing branch drilling equipment has the potential to provide financial reductions through materials, labour and time spent on site.

On average it is estimated that around 6 branch drillings would be required to carry out a typical routine operation i.e. 8" double bag stop operation. The cost of this operation would be approximately £2,500, with the majority of costs associated with excavation, material, labour and reinstatement (£357 per branch operation).

The intention of the new bond and bolt system is to reduce the size of excavation and the associated labour and reinstatement costs. Combining all these factors it is assumed that the introduction of this new solution could potentially reduce the cost (above) by 15%. However, it is difficult to accurately quantify the actual financial benefit at this stage; as indicated by the low start TRL shows the Method is at an early stage of development and cost estimates will be refined as it is further developed.

Please provide a calculation of the expected benefits the Solution

Base Case Cost - £357 (Current solution/method of operation for one branch drilling)

Method Case Cost - £303 (Potential new solution/method of operation)

Therefore, £357 - £303 = £54 (Benefit Estimation for Development) per branch drilling completed using the new bond and bolt system.

Once the product has been trialed, an accurate cost analysis will be carried out using the field trial findings.

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

This project aims to design, develop and test a solution across a large variety of mains sizes ($\leq 12''$) covering both LP and MP. At present, it is difficult to ascertain an accurate assumption of the cost savings associated with this new equipment and methodology. However, we do know that SGN carried out approximately 34,200 branch drillings on metallic mains between 2'' and 12'' in their Scotland license area in the year up to September 2013.

Similar to SGN, the other Network Licensees have been provided with an allowance for Replacement in their RIIO-GD1 proposals and it is envisaged that this project does have the potential to be rolled out across GB and provide future savings in the capital and operational costs associated with Replacement activities on the network.

From the 34,200 branch drillings previously identified, it is envisaged that approximately 10% of these could adopt the new technology. If this figure was to be mirrored in future years and a 4:2:1:1 split was applied with reference to the size of each network, it is assumed that National Grid have approximately 6,840, and Wales & West and Northern Gas have 1,710 each, then it can be estimated that a total of 13,680 branch drilling operations will take place across Great Britain (GB) per annum where this project solution could be applied. Using the calculations above, the total savings for SGN could be £184,680 and £738,720 across GB per annum.

It must be noted that these figures and assumptions are based on averages and estimates rather than real network data and the nature of branch drilling across all Network Licensees and sites will vary, which could affect the potential to apply the method and the benefits of applying it. The main focus of this project is to design, develop and test a new technology solution and understand the potential benefits.

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

As the number of branch drilling operations can only be assumed at this time across GB (136,800) it is difficult to determine the exact roll out costs. There will be costs associated with sharing the results and learning of this project. SGN will continue to share project progress throughout the duration of the project with the other Network Licensees.

Upon successful completion, Network Licensees will make a decision on whether to implement this solution throughout their organizations. Excluding the cost of purchasing the equipment, it is anticipated that the only foreseeable costs will revolve around the training costs for operatives. At present it is unclear as to how many operatives will be trained and how Licensees would choose to deliver training. More accurate quantification of roll out costs will be possible if the TRL of the method is advanced.

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 benefit Network Licensees who currently carry out branch drilling operations on their network. If the project leads to successful development of a more cost effective and less disruptive solution to the problem, other Network Licensees will be able to use the learning generated to embed this new solution in their businesses, This will enable improvements to existing techniques, reduction in both the size of excavation and the cost of materials required as well as improvements in the disruption and time which our customers are without a gas supply.

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.

A review of all other Network Licensees' Innovation Funding Incentive Annual Reports and current NIA projects has been performed and no similar projects have been identified. A similar review of current academic literature has also been performed to avoid replicating previous work.

SGN have also engaged with the project supplier and the supplier has provided clarity that no unnecessary duplication of this project is currently being undertaken 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

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