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

Mar 2019

Project Reference Number

NIA_SGN0142

Project Registration

Project Title

PhotonFix 4A - preparation for field trials

Project Reference Number

NIA_SGN0142

Project Licensee(s)

SGN

Project Start

March 2019

Project Duration

1 year and 2 months

Nominated Project Contact(s)

Hector E Salgado

Project Budget

£630,509.00

Summary

Anaerobic sealants for the gas industry have remained largely unchanged since the 1970s. Initially, each joint was excavated and then drilled to accept the sealant which was injected blindly into the body of the joint with the expectation of creating a seal. In recent years, robotic systems have been used to provide a similar deployment mechanism, drilling into the joint from inside the pipe, eliminating a high amount of excavation.

The existing products and systems have a number of fundamental issues which limits their applicability across the gas network. These include: having to rely on yarn being still present and functioning in the joint for the sealant to function, requiring every joint to be drilled and using uncontrolled capillary action for the sealant to penetrate into the joint. Care has to be taken when applying conventional sealants to prevent these sealants simply running out of the joint and pooling at the base of the pipe leading to potentially significant issues with pipe insertion, or other interventions at a later date. With these methods additional actions are required to demonstrate that a full seal has been achieved in each joint else one is heavily reliant on assumptions to claim pipe remediation. It is also understood that many sealants are often limited in their effectiveness in high traffic areas due to their insufficient flexibility. These existing products also are not applicable for use in all joint types leaving a gap in some areas of network remediation.

There is therefore a clear need for a system that can:
- Address all types of joints
- Address joints with failed seals, e.g. missing yarn
- Address ancillary issues such as cotter plates and disused service connections
- Demonstrate and validate that integrity has been restored to the system
- Minimise pooling of excess sealant in the pipe network
- Be suitable for high traffic areas (flexible sealant)
- Be suitable for use in all pipeline materials

Nominated Contact Email Address(es)

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Problem Being Solved

Historically, anaerobic sealants for the gas industry have remained largely unchanged since the 1970s. Initially, each joint was

excavated and then drilled to accept the sealant which was injected blindly into the body of the joint with the expectation of creating a seal. In recent years, robotic systems have been used to provide a similar deployment mechanism, drilling into the joint from inside the pipe, eliminating a high amount of excavation.

PhotonFix™ allows SGN to extend the range of pipelines that can be remediated through a 'no dig, no-drill' technology thereby reducing customer disruption and operational burden.

PhotonFix™ combines anaerobic and UV curing sealant know-how with a bespoke delivery module to create a flexible, triple barrier seal. It is exceptionally intuitive for operators to use because the process provides continual visual and pressure feedback during injection and the injection tools have been specifically developed to provide highly responsive control. The triple barrier seal provides a positive liquid filled blockage to the passage of gas resulting in a low permeability seal suitable for use with small gas molecules such as hydrogen. This makes PhotonFix a suitable sealant for use in the network of the future as de-carbonisation of the gas network is rolled out.
Stage 3 of the project saw the PhotonFix™ concept successfully demonstrated in Tier 2 and Tier 3 clean and dirty joints, notably being used to repeatedly seal field-aged, leaking 24" mechanical joints and sleeves as well as 15" lead yarn joints in the workshop. Key deliverables met were:

- Design and manufacture of a test bed suitable for 12" to 24" pipes
- Optimise the specification of the sealants to be used in the field
- Optimise the specification of a field ready UV light
- Optimise the specification for sealant application and sealant system

This stage PhotonFix™4A – preparation for field trials will aim to attain 'field ready' status by first securing accreditation of the sealing system, comprising sealant and representative module for use in the gas network (Stage 4A), and then adapting and interfacing the developed module with a selected transport/delivery system and field trialing in the live gas network (Stage 4B).

Method(s)

The development roadmap is now focused on moving towards the 'Business as Usual'. To get there, and to maximise the application opportunities (in terms of pipe size, pipe material, joint type and other features), the sealant needs to be qualified for a 50-year lifetime use, and application system (module plus sealant) needs to be demonstrated to be 'fit for purpose' so it may become field ready for the next stage.

Stage 4A – preparation for field trial will follow 8 work-packages as detailed in the Scope.

Scope

The programme of work for Stage 4A- preparation for field trials, is to carry out the necessary work to enable field trials to go ahead in Stage 4B. This comprises: the accreditation of the sealant so it is approved by OFGEM for use in the network and demonstration of the tooling module to deploy the sealant during accreditation. These processes will inform the tender exercise at the start of Stage 4B by providing specifications of the robotic transport / delivery platform to carry the module through the network and provide the specifications for service suppliers who will eventually deliver the network remediation service.

Stage 4A will:

1) Confirm the route to sealant and system accreditation through discussions with the Technical Services Provider (TSP) and review all relevant standards and identify any gap actions; (WP1)

2) Build the appropriate tools, a 6" deployment module for use in accreditation testing, and a larger module for 12" pipes to demonstrate operational effectiveness in a representative Tier 2 setting (WP2).

3) Carry out Accreditation Testing to the agreed standards (WP3)

4) Carry out material testing to demonstrate 50-year lifespan (WP4)

5) Carry out module 'fitness for purpose' testing to demonstrate the deployment methodology and inform the tender exercise for supply of equipment and services (WP5) (Note: the tender exercise is to be carried out at the start of Stage 4B).

6) Provide SGN with the technical files for accreditation and material testing to back up the use of the system as 'pipe remediation' (WP6)

7) Continuation of the protection of SGN's Intellectual Property (WP7)

8) Provide SGN with full reporting, three interim reports, and a final report are planned complete with presentations to the Steering Committee (WP8)

Objective(s)

The objective of the scope of work are;
· An accredited sealing system comprising a sealant and associated deployment tooling module to an agreed GIS standard for use in the UK Gas Network.

· Accredited material testing carried out on the sealant to demonstrate 50-year life span thus allowing pipe remediation.
· Confirmation of the system's ability to function in hydrogen and hydrogen blend products as well as natural gas.
· A stand-alone module suitable for use in 6" accreditation tests.
· A tooling module, developed to demonstrate platform mounted operation and system effectiveness in Tier 2 (12") pipes and in preparation for a tender exercise in Stage 4B to determine the deployment platform and service providers for field operations
· Continued protection of SGNs Intellectual Property

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria and outcome for Stage 4A will be;

· An accredited sealing system comprising a sealant and associated deployment tooling module to an agreed GIS standard for use in the UK Gas Network.
· Accredited material testing carried out on the sealant to demonstrate 50-year life span thus allowing pipe remediation.
· Confirmation of the system's ability to function in hydrogen and hydrogen blend products as well as natural gas.
· A stand-alone module suitable for use in 6" accreditation tests.
· A tooling module, developed to demonstrate platform mounted operation and system effectiveness in Tier 2 (12") pipes and in preparation for a tender exercise in Stage 4B to determine the deployment platform and service providers for field operations
· Continued protection of SGNs Intellectual Property

Project Partners and External Funding

Steer Energy Solutions ltd

Potential for New Learning

The work proposed herein is following the development from Stage 3. Stage 4A is innovative and will enable SGN to feel confident that the sealant and delivery system is fit-for-purpose and is certified for use on the SGN network. This will then allow the final stage 4B to carry out the field testing on SGN's network.

Scale of Project

This project will be developed within an off-site and workshop environment. The next phase will see field trials and the potential is enormous for mains remediation. It could be adopted by SGN as the main remediation method for mains between 9" and 15" (tier 2 mains).

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

Scotland Network and South Network

Revenue Allowed for the RIIO Settlement

As this project is the development phase of the overall project to raise the TRL level, the full potential savings that could be achieved under RIIO-GD1 will be determined upon completion of the next stage.

Indicative Total NIA Project Expenditure

The total project expenditure will be £473,000, 90% of which is allowable NIA expenditure; £425,700.

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 annual cost savings once this project is implemented is estimated to be around £2m per year.

Please provide a calculation of the expected benefits the Solution

A further fiancial analysis will be undertaken after this stage.

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

The project would potentially develop into new Gas Industry methodology and method for mains remediation. It could be adopted by other GDNs that have similar network makeup and issues.
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. Thus, this confirms how replicable the project is across the industry and the benefit for the various GDNs.

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

At this stage this level of detail is not available. However, it is something that would be considered and developed in the next Stage 4B – field trials.

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 work proposed herein is following the development from Stage 3. Stage 4A is innovative and will enable SGN to feel confident that the sealant and delivery system is fit-for-purpose and is certified for use on the SGN network. This will then allow the final stage 4B to carry out the field testing on SGN's network.

All Network Licensees will be able to use the learning from this project as the outputs will be presented in a clearly defined report that will be available on the smarter networks portal, allowing the network licensees to make informed choices as to whether to invest in this technology.

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

Stage 4A is innovative and will enable SGN to feel confident that the sealant and delivery system is fit-for-purpose and is certified for use on the SGN network. After Stage 4b involving field trials the full potential will be ascertained.

☑ 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 is not duplicated across the GDNs.

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

PhotonFix 4A is the next stage following the successful development of Stage 3. Once the sealant is certified and proved that it's fit-for-purpose, it will enable the next stage to be undertaken. This sealant system is innovative in that it used UV light to cure the sealant and it's combined with an anaerobic sealant. This has not been tried before in any GDN.

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

This project falls into the remit of NIA in that it meets the criteria and has been developed from the initial R&D stages 1 and 2.

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 NIA project has been developed from an initial low TRL (initially in Stage 1). At In In Stage 4A the TRL is 5 and will require significant investment to carry out the certification and all the work described in the scope above. This project is applicable to all the GDN's where the learning can be shared between the networks.

This project has been approved by a senior member of staff

☑ Yes