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NIA Project Registration and PEA Document

Date of Submission

Aug 2015

Project Reference Number

NIA_SGN0073

Project Registration

Project Title

Corrosion Mapping System for Buried Orpheus Regulator Modules – Phase 2

Project Reference Number

NIA_SGN0073

Project Licensee(s)

SGN

Project Start

August 2015

Project Duration

3 years and 0 months

Nominated Project Contact(s)

Mark Skeritt, Innovation Project Manager

Project Budget

£394,358.00

Summary

Phase 1 of this Project looked at the feasibility, design and development of a BSD which would enable the internal long range NDT inspection of buried Orpheus Regulator Modules without having to excavate or grit-blast the pipework.

Phase 2 of this Project involves collaboration with James Fisher Nuclear Limited (JFN) to design, manufacture and site trial the BSD; also completing the development of a long range NDT technique suitable for inspecting buried ORPHEUS Regulator Modules. The new BSD is expected to corrosion map 100% of the internal surfaces of 14", 16", 18", 20", 24" and 30" ORPHEUS regulator modules.

Site trials will be undertaken in the Scotland (SC) and South of England (SOE) Networks; all sites will be selected by SGN and jointly attended by SGN, JFN and a suitable Technical Service Provider (TSP) to assess suitability.

Nominated Contact Email Address(es)

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Problem Being Solved

Buried Orpheus Regulator Modules fall within the category of pressure systems operating above 0.5barg and are included within the Scope of the Pressure Systems Safety Regulations (PSSR) 2000.

To ensure the assets integrity is maintained, it is essential to fit Cathodic Protection (CP) and carry out regulatory monitoring. Where CP has not been applied or has failed, a detailed, regular Ultrasonic Testing (UT) inspection should be carried out at a frequency, not exceeding 6 years. This work is covered by the SGN Management Procedure for ensuring compliance with PSSR 2000; SGN/PM/PS/3, Appendix H and Examination Specification ES/94/10 Part 2.

Buried Orpheus Regulator Modules have a history of failed CP and where appropriate must be subjected to conventional non-destructive testing (NDT).

The current NDT inspection process involves the entire installation having to be carefully excavated and exposed, with the vessel and its associated pipework being grit-blasted to prepare the surface for NDT. It is then inspected and assessed for corrosion, prior to being repaired (if necessary), then re-painted; the excavation being reinstated at a later date.

The process is time consuming, typically taking around three weeks, and often complicated by other factors, such as road or footpath closures being needed. Therefore, to minimise completion times and the operational activities currently involved, it is considered prudent and appropriate to investigate and pursue the development of an alternative inspection method that requires no excavations or grit-blasting.

Method(s)

This new Method of inspection for buried Orpheus Regulator Modules involves the application of a 'Bespoke' Scanning Device (BSD), which can inspect 100% of the internal surfaces of ORPHEUS Regulator Modules of sizes ranging from 14" to 30".

The BSD is expected to be used in the following manner:

1. Readily transportable to site and readily assembled at site
2. Once the Orpheus Regulator Module has been made safe by SGN, trained operatives will secure the vertical axial (the tracking or rail that will be used to run the scanner up and down) within the Orpheus 'vessel' and mount the deployment head (UT probes and camera arrangement), ready to start scanning.
3. The deployment head will then be automatically guided around the entire internal surface of the Orpheus 'vessel' by a drive and guidance system. The guidance system designed to ensure the vertical line is maintained when the deployment head passes over the Orpheus Regulator Modules inlet and outlet orifices. It will also be capable of following the surface of the vessel bottom.
4. Once the deployment head has completed its run from top to bottom of the vessel, it will be retracted to its starting point at the top of the vessel, where it will then be re-deployed in a known repeatable, accurately controlled circular direction and locked before starting its next scan.
5. When all vertical paths have been completed, the deployment head will be adjusted to enable the head to traverse the entire internal surface of the Orpheus 'vessel' in a horizontal direction, thus allowing the scanning of any areas obscured to the vertical scan by 'cross pipes'

Scope

Phase 1 of this Project looked at the feasibility, design and development of a BSD which would enable the internal long range NDT inspection of buried Orpheus Regulator Modules without having to excavate or grit-blast the pipework.

Phase 2 of this Project involves collaboration with James Fisher Nuclear Limited (JFN) to design, manufacture and site trial the BSD; also completing the development of a long range NDT technique suitable for inspecting buried ORPHEUS Regulator Modules. The new BSD is expected to corrosion map 100% of the internal surfaces of 14", 16", 18", 20", 24" and 30" ORPHEUS regulator modules.

Site trials will be undertaken in the Scotland (SC) and South of England (SOE) Networks; all sites will be selected by SGN and jointly attended by SGN, JFN and a suitable Technical Service Provider (TSP) to assess suitability.

Shortly after the project commenced, and specifically following the receipt of additional technical details regarding the Orpheus Series 10 and Orpheus Series 4 modules, it came to light that there was a key manufacturing variation in how the vessel bodies had been constructed; in addition to the domed-bottomed version of the vessel, there was also a flat-bottomed version. It was also then established, through further consultation with the supplier, that the flat-bottomed versions were believed to be as prevalent within SGNs Networks, if not more so, than the domed-bottomed versions. Up until this point, all of the design work for the BSD had solely focused on achieving a comprehensive scan on an Orpheus vessel with a domed-bottom; therefore, to ensure that the BSD could be deemed fully able to meet all of SGNs requirements, it was necessary secure additional funding to allow for the design and manufacture of another version of the BSD to enable inspections to be carried out on SGNs 'flat-bottomed' Orpheus vessels. Further modifications to the BSD have also been identified, resulting in at least three more months being deemed necessary to complete the project and proceed to field trials.

Objective(s)

This Project has the following 'key' goals and objectives:

- Manufacture a BSD suitable for use on SGNs distribution networks
- Creation of specific Risk Assessment Method Statements (RAMS) and Training Packages for use with the BSDs (UT) NDT procedure
- Undertake offsite and live field trials to ensure the new BSD meets SGN requirements
- Validation and approval of the BSDs Ultrasonic (UT) NDT procedure; confirming that this new procedure fully meets SGN requirements

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The key success criteria for the Project will be:

- Eliminating the requirement for excavating and reinstating buried Orpheus Regulator Modules when carrying out inspections
- Eliminating the requirement for grit blasting
- Eliminating environmental concerns arising from waste disposal issues caused by grit blasting and excavation
- Proving the potential to access a greater surface area for 95-100% NDT
- Demonstrating compliance with current industry legislation
- Reducing the operational time usually associated with the inspection of a buried Orpheus Regulator Module

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This Project cannot be carried out on a smaller scale; any smaller and there will be a risk of producing an insufficient quantity of data to allow for effective comparisons to be made, therefore making it extremely difficult to justify validation of the product.

· It is felt that a minimum of six field trials are needed; this should ensure a reasonably comprehensive assessment is undertaken for a reasonably broad range of sites.

· Three field trial sites will be selected in the South of England and three in Scotland; this selection of trials is expected to create enough data to allow a robust comparison and analysis to be made.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The field trial aspects of this Project will be carried out on six live sites on SGN's Scotland and South of England Networks; the specific location of each of field trial is yet to be determined.

Revenue Allowed for the RIIO Settlement

During GD1 it is estimated that SGN will spend approximately £53.1m on Gas Regulator Modules, which will largely cover replacements, maintenance and inspections. Whilst no direct saving is expected during the Project, it is anticipated that successful completion will have the potential to deliver savings, in regard to the time and money usually associated with safeguarding the integrity of buried network assets.

Indicative Total NIA Project Expenditure

The total Project expenditure is £370,359.00, 90% of which is Allowable NIA Expenditure (£333,323.00)

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 introduction of this newly developed NDT corrosion mapping system Project has the potential to deliver significant financial savings against the original method, if successful outputs are achieved.

Each GDN is estimated to spend around £40,000 to manage the maintenance inspections for each of their buried Orpheus Regulator Modules every six years. It is anticipated that the majority of the associated operational costs can be eliminated if this Project ultimately overcomes the problem of having to excavate, expose and grit-blast every buried Orpheus Regulator Module to assess its integrity.

It is expected that if successful, this Project could provide Network Licensees with an opportunity to make cost savings on their maintenance inspections and as a consequence allow cost savings to be made against their RIIO-GD1 allowances. This should in turn provide net financial benefits to customers as a result of the improvements made to the existing methods used for this type of maintenance inspection.

Please provide a calculation of the expected benefits the Solution

Phase 2 follows on directly from Phase 1, which was essentially the research and feasibility study for this Project; as Phase 2 progresses it will ultimately lead to the live field trials and final project appraisals needed to ensure the BSD and its associated (UT) NDT technique are fully compliant with industry standards and SGNs requirements.

At present SGN spends approximately £40,000 on every buried Orpheus Regulator Module requiring an inspection, which equates to around £1,400,000 every six years to ensure their buried Orpheus Regulator Modules remain compliant with industry standards.

If implemented successfully, the introduction of this new technique should have the potential to provide significant financial benefits. On

the basis that the costs currently associated with this type of inspection are around £40,000 per module and the new (UT) NDT technique is estimated at around £10,000 per module, then it is expected there will be cost savings of around 75% in comparison to the current costs associated with this work.

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

SGN records show we have approximately 35 buried Orpheus '10' Regulator Modules installed across our networks where this new inspection technique could be applied.

Basing the following assumptions on the current GDN geographical split across GB and the size of each GDN, then along with SGN's 35 buried Orpheus '10' Regulator Modules, it could be assumed that National Grid have approximately 70 buried Orpheus '10' Regulator Modules, with Wales & West Utilities and Northern Gas Networks having around 17 each. This gives an estimated total of around 139 buried Orpheus '10' Regulator Modules across GB which will all need inspecting every six years in accordance with current industry standards.

While this estimate provides an indication of potential applicability, it is important to note that it is also based on a number of 'unqualified' assumptions and is therefore subject to a large sensitivity margin. These figures are also based on averages and estimates, rather than real network data. Furthermore, the complexities associated with buried Orpheus Regulator Modules will vary from site to site, each site having a unique footprint which could be subject to by an array of positive and/or negative influencing factors.

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

There are assumed to be around 139 Orpheus 10 governor installations across GB and the cost of carrying out a site inspection using this newly developed NDT corrosion mapping system is estimated at around £10,000 per site (assuming an average of 2 streams per governor). Therefore, it would potentially cost around £1,390,000 every six years to inspect all relevant buried Orpheus 10 Regulator Modules.

This compares with the current, estimated, total expenditure of around £5,560,000 every six years for GB.

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

All Network Licensees will be able to use the learning from this project because the outputs will be presented in a clearly defined report that will be available to them on request. This will allow the GDNs to make informed choices, as to whether they may be interested in investing in this new 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)

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.

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