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NIA Project Registration and PEA Document

Date of Submission

Jan 2019

Project Reference Number

NIA_SGN0140

Project Registration

Project Title

Derivation of a Risk Based Approach to High Pressure Filter & Pig Trap Closure Inspection Frequencies

Project Reference Number

NIA_SGN0140

Project Licensee(s)

SGN

Project Start

January 2019

Project Duration

2 years and 3 months

Nominated Project Contact(s)

SGN Keith Ellison Project Lead Jon Todd Northern Gas Networks (NGN) Luke Hollis Cadent Daniel Wyatt Wales & West Utilities (WWU) James Gilliver National Grid

Project Budget

£781,397.00

Summary

Since the inception and introduction of the pressure systems safety regulations in 1999 the UK gas networks have inspected their filter population and pig trap population on fixed time periods of 6 and 12 yearly intervals for visual and MPI respectively in accordance with the current Written Scheme of Examination (WSOE). During this period the Networks are not aware of a single instance of a loss of containment caused through corrosion or fatigue crack growth on either asset type.

The majority of the filter population are manufactured from cast steel. The pig traps closures which are considered to be a critical component of the pig trap vessels are, historically, also manufactured from cast steel. It is worth noting though that in recent years there has been a move to the 'band-lock' closure which is manufactured from forged material.

When inspections are undertaken defects are frequently identified in the cast steel materials. Defects found then must be assessed to determine if they are within each operator's allowable defect size limits. If they are not within 'safe' operating limits a number of options are available to the Networks, typically:

- Increased monitoring
- Grinding repair
- Weld repair
- Replacement
- Hydrotest revalidation

These options can be very expensive to implement in terms of cost, time and HSE implications.

Due to the nature of the pressure vessels, particularly those manufactured from cast steel, there is increasing suspicion that many of the defects found during inspection are original manufacturing defects. Unfortunately, without the initial inspection records, it is impossible to substantiate this suspicion, but the project will look to prove that the defects are stable i.e. not propagating or growing at an extremely slow rate. In addition, it is also believed that the allowable defect size limits and the allowable grinding limits are unnecessarily conservative. The implications of this are:

- Unnecessary inspections are being undertaken

- Unnecessary assessments are being undertaken
- Unnecessary remediation and replacements are being undertaken

as a result of the above, significant additional costs are being incurred along with an additional unnecessary increase in HSE risk from additional driving and on-site activities.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

Since the inception and introduction of the pressure systems safety regulations in 1999 the UK gas networks have inspected their filter population and pig trap population on fixed time periods of 6 and 12 yearly intervals for visual and MPI respectively in accordance with the current Written Scheme of Examination (WSoE). During this period the Networks are not aware of a single instance of a loss of containment caused through corrosion or fatigue crack growth on either asset type.

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Method(s)

Development of a new tool, effectively a 'live' examination specification which will allow Users to update their WSoE's to reflect the revised Examination Dates which would consider past and future anticipated operational duty.

- Development of a risk based inspection regime for cast steel filter bodies and cast steel pig trap closures. The main risk contributor being considered will be fatigue crack growth.
- Development of less conservative allowable defect sizes.
- Development of less conservative grind repair limits

Scope

The work proposed below will be undertaken in 5 stages.

- 1) Data collection, interpretation & industry search Networks & NG.
- 2) Analytical (Defect Limits).

- 3) Validation Testing (Fatigue testing, Burst Testing, Metallography).
- 4) Development of tool to allow updating of WSoE's.
- 5) Detailed final report

Objective(s)

The objective of the scope of work are;

- Development of a risk based inspection regime for cast steel filter bodies and cast steel pig trap closures. The main risk contributor being considered will be fatigue crack growth.
- Development of less conservative allowable defect sizes.
- Development of less conservative grind repair limits

Development of a new tool, effectively a 'live' examination specification which will allow Users to update their WSoE's to reflect the revised Examination Dates which would consider past and future anticipated operational duty.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project will be reviewed by the Networks &NG against the following criteria:

- Project kick off data collection, interpretation & industry search Networks & NGGT.
- Analytical
- Validation testing
- Development of tool to allow updating of Written Schemes of Examination (WSoE's).
- A detailed final report is required on completion of the project. A Successful project should allow the Networks to develop a new defect acceptance and allowable defect limits to be feed into new examination specifications

Project Partners and External Funding

Cadent
Northern Gas Networks NGN
Scottia Gas Network SGN
Wales & West Utilities WWU
National Grid Gas Transmission NGGT

Potential for New Learning

The work proposed herein is new and innovative, and will provide the Gas Networks with the required confidence to use this methodology & the Tool going forward. Furthermore, the work undertaken will advance Industry knowledge and provide necessary support to future updates of standards.

Scale of Project

This project will lead to the development of a risk based inspection regime & the development of a tool to enable the Examination Periodicities to be revised, the reduction of Defect Assessments required to be undertaken and the reduction in the numbers of filters & pig traps that may have to be scrapped

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The UK mainland.

Revenue Allowed for the RIIO Settlement

None.

Indicative Total NIA Project Expenditure

The project is to be wholly NIA funded. Split including internal costs
Cadent - £347,287.60

Scottia Gas Network SGN - £173,643.79

National Grid Gas Transmission NGGT - £86,821.89

Northern Gas Networks NGN - £86,821.89

Wales & West Utilities WWU - £86,821.89

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 Networks currently have approximately 1687 High Pressure (HP) Filters & 200 Pig Traps & have traditionally inspected these filter and pig trap populations on fixed time periods of 6 and 12 yearly intervals for visual and Magnetic Particle Inspection (MPI) respectively to fulfil compliance with the Pressure Systems Safety Regulations (PSSR) & are managed in accordance with the current Written Scheme of Examination these examinations are costly & when Defects are identified these then have to be assessed in accordance with the Defect Management Procedure DAM1 to determine if they are within the Networks allowable defect size limits, which result in either Increased monitoring, Grinding repair, Weld repair, Hydrotest revalidation or Replacement.

Please provide a calculation of the expected benefits the Solution

The potential cost benefits below are costed to show the potential savings however these are related to a number of actions and their interactions such as extending the examination frequencies, reduction in Defect Assessments being required & reduction of Filter & Pig Traps having to be replaced. It should be noted that under a risk based approach the inspection interval for some filters may reduce rather than increase. That said, it is expected, from experience, that the inspection interval will increase for the majority of filters.

Cost Benefit Analysis Filters	(£)
MPI Cost/filter frequency 12 yr (£) 4000	
Visual Cost/filter frequency 6 yr (£) 0	
Assessment Cost (£) 2000	
Replacement Cost (£) 30000	
Current	
Number of filters 1687	
No of replacements 21.53846	646153.8
MPI/YR 140.5833	562333.3
Visual/yr 0	0
Assessments/yr 140	28000
Total Annual Cost (£)	1488487
Revised	
Average MPI frequency 18 yrs	
Average visual frequency 6 yrs	

Assessments/yr 84.35	168700
replacements/yr 13.496	404880
MPI/YR 93.72222	374888.9
Visual/yr 0	0
Total Annual Cost (£)	948468.9
Total Annual Saving (£)	540018.3

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

The project will develop new Gas Industry methodology and a tool that will be applicable and implemented across all the Networks demonstrating compliance with the PSSR Legislation.

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

There will be no direct cost for the Networks with rolling out this project. The methodology developed along with the tool will be shared across all the Networks

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 new and innovative and will provide the Gas Networks with the required confidence to utilise the new frequencies of Examination, reduction of Defects identified having to go through the Defect Assessment Procedure and the tool to manage the periodicity of the Examinations all the networks are taking part in this project therefore all networks will be involved in generating the outcomes. This will be shared throughout the Networks and additionally shared with the HSE.

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.

All Networks are collaborating on this project therefore duplication will be prevented.

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

HP Filters & Pig Traps have traditionally been inspected on fixed periodicity of 6 and 12 yearly intervals since the inception of the Pressure Systems Safety Regulations & with consultation of the HSE these frequencies have been set across all the Networks that were previously part of British Gas.

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 aims to address long term issues of the fixed periodicity of Examinations that are carried out for compliance with the PSSR regulations due to these being the same across the Networks it was felt that this should be a collaboration to ensure that the HSE were also approached with this new methodology and that it is managed to comply with the Legislation.

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 a low TRL and involves carrying out complex studies & evidence from across the Networks although the project should deliver operational savings it is difficult to make an accurate assessment without actually having undertaken the investigation, which is a risk to the networks. 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