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

Oct 2020

Project Reference Number

NIA_NGGT0167

Project Registration

Project Title

Inline Flow Stop - Feasibility

Project Reference Number

NIA_NGGT0167

Project Licensee(s)

National Gas Transmission PLC

Project Start

October 2020

Project Duration

0 years and 6 months

Nominated Project Contact(s)

Dave Hardman, Kirsty McDermott

Project Budget

£109,080.00

Summary

Investigate the use of in line isolation tools on the National Transmission system. Work through the requirements for a policy update to allow the tools to be used and understand if a live trial is required based on the pre-work carried out by PRCI.

Preceding Projects

NIA_NGGT0152 - PRCI (Pipeline Research Council International) 2019

Third Party Collaborators

Pipeline Integrity Engineers Ltd

Nominated Contact Email Address(es)

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Problem Being Solved

Current business policies and processes stipulate that if construction and/or repair work is to be carried out on the National Transmission System (NTS) then network isolations are required utilising the valves present on the network. This allows an isolation to be achieved, stopping the flow and facilitating the vent procedures to make safe the area before work can commence. With the requirement to use the existing valves on the network to provide isolations also brings with it the challenge of potentially needing to isolate and vent large lengths of feeder to allow the work to continue depending on the operational valves in the vicinity. By creating these large isolations National Grid Gas Transmission (NGGT) must vent a considerable amount of natural gas to the environment and in many cases, work cannot continue as isolations cannot be given by the Gas Network Control Centre (GNCC) as the impact to the wider NTS is too great. An inline isolation tool is device which is inserted into the pipework via the PIG trap and is positioned by regulating the flow in the pipeline. When it is in position, grips are engaged on the internal pipe wall to ensure the tool cannot dislodge,

at this point the device creates a plug in the pipeline and stops the flow. The use of this device could substantially reduce the amount of pipework that is isolated and the impact on the wider NTS.

Method(s)

The inline isolation industry is well established globally and is used extensively offshore; however, these tools have never been used onshore in the UK. Various studies have been carried out on the impacts these tools have on the internal surface of the pipework and the stresses the pipeline is under. The most recent such study was completed by the Pipeline Research Council International (PRCI) of which NGGT is a member and have access to the reports and supporting evidence. During this PRCI funded project the impact of a variety of tools was summarised. In order to make use of the tools on the NTS the evidence should be reviewed with the specifics of the GB gas network in mind (likely steel grades, materials, construction methods and network layout to name a few variables). Once complete there may be the need to trial the tools on representative NTS pipeline to fully understand the impact of the grips and stresses on our pipelines.

As such there are two parts to this project:

- Inline Flow Stop – Feasibility (this PEA, summarised below)
- Inline Flow Stop – Live trial (potentially required following Feasibility work)

This project will be delivered by Pipeline Integrity Engineers (PIE) who have an extensive knowledge of the NTS and of inline isolation technology, it will comprise of 6 work packages:

WP1 – State of the art review

- Review of in-line isolation technologies (assessment of vendor techniques, capabilities, limitations, operational parameters etc) including PRCI tool review report

WP2 – Determine NGGT requirements

- Assess NG potential requirements for in-line isolation – diameters / grades / wall thickness's / pressures / number of applications etc.

WP3 – Vendor vs NG assessments

- Compare and contrast (WP1) and (WP2) to identify where overlaps exist and what would be required from the vendors to address any gaps.

WP4 - NGGT policy / procedure impact assessment

- Use output from (WP3) to assess impact on NGGT Policies and Procedures (but not drafting at this stage) – which documents would be affected and to what degree, identify any new documentation requirements, etc. High level impact assessment on NGGT policies and procedures

WP5 - Draft NGGT policy / procedure for inline isolation

- Document functional requirements for In Line isolation assessment and procedure for application. Amend existing documentation or draft standalone document

WP6 - Field trial requirements

- Scope offline and online test requirements (generic and specific location).

Scope

Isolations are required on the NTS in order to provide a safe environment to work when construction or repair/maintenance activities are undertaken. Valves are used for this purpose and provide a safe seal between pressurized gas pipework and a vented section where work is carried out. Transmission valves are significant assets and have been installed on the network when the gas feeders were installed. The asset life of the NTS is between 30 and 40 years old and in some places older, as such maintenance and construction activities are needed to ensure the network continues to provide its service of transporting large quantities of gas around the country. A typical example of this is as follows:

- An insulation joint (IJ) is used on the network to split the cathodic protection (CP) circuit between the site pipework and the feeder pipework. It is a small asset and is often located just after the pig trap as the feeder leaves the site.
- In many scenarios the next valve downstream from this point is at a block valve site 10-20 miles away. This would have to be closed and the section isolated for the IJ to be repaired or replaced.
- In some cases, this block valve has its own maintenance requirements and might not function fully, so the next block valve downstream is needed, increasing the isolation by another 10-20 miles.
- It is also becoming more evident that these activities cannot happen for a long period of time due to the large impact to the network of having feeders out of action.
- Once an isolation has been made the length of pipe needs to be vented, initially a recompression unit is used to take the high-

pressure gas out of the pipe and put it back in on the live side of the isolation. This can only happen down to 7 bar(g) with the remainder vented to atmosphere – adding to NGGT's operational emissions.

- An inline isolation tool could be deployed from the PIG trap, travel past the IJ and engage after 10-15m of pipework, significantly reducing the isolation, reducing emissions and allow the repair activity to be planned in as the impact to the wider NTS is low.

This is one scenario of many different asset repairs/replacements that could benefit from inline isolation and the construction part of NGGT (Capital Delivery) is keen to be able to use these tools in RIIO 2 to support the deliverability of the proposed 5 year plan alongside the benefits of reducing NGGT's emissions.

The work completed by PRCI on this subject included an industry-wide survey/report to identify the top three priority applications and detail requirements, plus carry out finite element analysis (FEA) of the pipeline under all defined plug isolation operating conditions. The outputs from this project support this PEA and potentially prevent the need to carry out these studies again so long as the test conditions are analogous to the pipework conditions in the UK. The study started in 2017 and compared tools from Pipeline Pressure Isolation Group (PPIG), STATS Group (STATS) and T. D. Williamson (TDW), however this NIA project will review the current state of inline isolation and include any new tools / advancements that have occurred since 2017. Following this, NGGT's requirements will be mapped against the tools and an understanding of what policies and procedures will need to be changed will be outlined. These changes will be drafted and presented to NGGT before the project concludes with a recommendation as to whether a live trial on UK pipework is required and how this could be facilitated.

Objective(s)

The objective of this NIA project is to summarise the work completed to date on onshore inline isolation tools and compare this to the requirements of National Grid Gas Transmission with an understanding of how the network was constructed and is managed today. Following this the policies and procedures that need to be amended to allow inline isolation tools to be used will be highlighted and any changes will be proposed to NGGT for inclusion. A live trial of the tools will be proposed if it is needed following this NIA but is not included in the scope of this work.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. A review and interpretation of work completed to date compared to the NTS
2. All relevant policies and procedures are updated to allow inline isolation tools to be used
3. A recommendation on next steps, whether a live trial is required or not.

Project Partners and External Funding

External Funding – Nil.

Potential for New Learning

The potential for learning from this project will be to what extent the current inline isolation tools can be used onshore within UK transmission pipelines. Additionally, it will review the work completed to date on the impact these tools have on the internal surface of the pipe and the stresses imparted on the pipework when engaged to understand if they can be used on UK onshore transmission pipelines.

Alongside an updated view of all inline isolation tools the project will recommend the relevant parts of NGGT's policies and procedures that will need to be updated in order for the tools to be used.

Scale of Project

Desk based only

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

Desktop based, no specific live trials will occur under this NIA although a recommendation on this will be provided at the end of the project.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£109,080

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)

If inline isolation tools are used on the NTS then the extent of the isolation will be significantly reduced due to the downstream block valves not requiring to be used. With a reduced isolation length the amount of natural gas that is vented to atmosphere will be reduced having an environmental and financial impact each time the tool is used.

Insulation Joint (IJ) replacement example from above
Existing case

- Assumed 15km between the IJ and the next operational ball valve downstream
- Venting cost

7bar/km = 4 tonnes of gas/km, total = 60 tonnes (recompression rig used to bring the pressure down initially)
£2,157/km - Cost of gas = £32,355

Use of an Inline flow stop tool

- Assumed the tool could be stopped 10m downstream of the IJ
- No requirement for recompression rig
- Venting cost

Venting cost 70bar/km = 43 tonnes of gas/km, total = 0.43 tonnes
£25.5k/km – Cost of gas = £255

Total savings = 59.57 tonnes of gas and £32,100.

According to the RIIO 2 business plan for NGGT it is planned that 41 IJs will be replaced over the 5 year period, therefore across RIIO 2:

Total savings = 2,442 tonnes of gas and a cost of gas of £1,316,100.

Notes

- The above scenario only covers the IJ replacements planned for RIIO 2 and not the savings that could be generated from other activities that the isolation tools could be used on. Examples include block valve replacements where existing valves could not be relied upon, diversions, inline inspection repairs and valve replacements.

- This is just the environmental aspect, as we do not know the final tool costs a comparison cannot be made of the overall costs.
- Recompression units are large assets which are in high demand, reducing the need for them on 'smaller' activities will free up the availability of them for larger schemes.
- Smaller isolations can be fitted into the delivery plan from the Gas Network Control Centre (GNCC) easier as the impact to the wider NTS is reduced. Often repair and replacement jobs are postponed or delayed as the outages required cannot be granted by GNCC for network resilience reasons.
- Smaller isolations will reduce the overall time it takes to complete the construction / repair tasks having an additional safety and cost benefit.

Please provide a calculation of the expected benefits the Solution

As this NIA represents a feasibility study into the use of the various tools it is not known how much the tools cost to operate and so a comparison of cost to deploy cannot be given.

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

Once approved the inline isolation tools can be used across the National Transmission System in any location that can be accessed via a PIG trap as this is the way the tools are inserted. This NIA has given an example of the repair or replacement of an insulation joint (IJ) on the NTS but (providing there is PIG trap access) there are many other assets that could be remediated in this way and have their isolations reduced. Such examples include valves, inline inspection defect repairs and diversions on the pipeline. Each of these will be carried out during RIIO 2 and the inline isolation tool could be used to reduce the environmental impact in many, if not all of these scenarios.

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

Feasibility project so unknown at this stage

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

Inline isolation tools have been used globally, however they have not been used onshore on UK transmission assets. This is also the case for the Local Transmission System (LTS) which is owned and maintained by the gas distribution networks (GDNs). The tools are made in a variety of sizes and can be used on lower diameters which are found in the LTS, this project will be of interest to the GDNs to reduce the extent of their isolations for construction and repair activities. Policies and procedures that are adhered to by NGGT are often used by the GDNs for the LTS and so this NIA will benefit other network licensees too.

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

Reliability and Maintenance and emissions reduction

☑ 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.

The existing project completed by PRCI on onshore inline isolation will be the basis for this project to ensure that no unnecessary duplication occurs in relation to the impact these tools have on the pipelines. This project will focus on the specific user cases of these tools on the UK NTS where they have not been used onshore before, additionally the tools have not been used on the LTS either.

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

Historically inline isolation tools have not been used onshore due to the reduced wall thickness of the pipelines when compared to offshore. Studies into exactly what impact these tools have on the internal surface of the pipe and advancements in the technology have helped to reduce these impacts although the true nature of these on the specific pipework in the UK has not been understood to date. For this reason, inline isolation has not been allowed onshore in the UK at transmission pressures. This project will review all the available material from previous studies and combine with a view of the NTS and the assets we operate to advise how these tools could be added to our policies and procedures.

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

It is still not fully understood how the impacts of these tools affect could affect the NTS and so without this knowledge the tools would not be approved for use. This project cannot be funded by the business as the risk of this project is that the impact is significant to the pipe surface and so the tools cannot be used.

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 feasibility project will focus on previously completed work on inline isolation tools and recommend how they could be incorporated into policy and procedure. This will benefit the wider gas networks as these tools could be used on the smaller diameter local transmission systems (LTS) currently operated by the gas distribution networks (GDNs). Any changes to the policies and procedures will affect the GDNs as they are shared and adopted by the other network licensees.

This project has been approved by a senior member of staff

☑ Yes