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

Jan 2014

Project Reference Number

NIA_NGGT0021

Project Registration

Project Title

Epoxy sleeves in place of heavy wall pipe

Project Reference Number

NIA_NGGT0021

Project Licensee(s)

National Gas Transmission PLC

Project Start

November 2012

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Tony Jackson (box.GT.innovation@nationalgrid.com)

Project Budget

£70,000.00

Summary

NTS pipelines are constructed in accordance with IGEM/TD/1 Edition 5, and the current edition stipulates the use of heavy wall pipe as protection against third party interference at road crossings. National Grid receives two or three requests a year to divert or install thick wall pipe for a new high density road. For example, planning revisions to the routing of the road scheme will lead to a road crossing a section of the pipeline without reinforcement of heavy walled pipe. The gas transmission system will also be impacted by the planned high speed rail link (HS2) between London and the West Midlands and will involving a number of additional diversions or additional pipeline reinforcement operations.

The options for reinforcement are limited to a pipeline diversion and stoppling operation and the inherent risks associated with type of operation and costs in terms of flow reduction and implications of buyback, give a strong case for further investigation into any alternative options. National Grid would like to evaluate the use of epoxy sleeves for providing the required level of protection against third party damage as an alternative to heavy wall pipe. An epoxy sleeve consists of two steel halfshells,

joined to encircle the damaged area, with the annular space filled with an epoxy grout. A significant amount of research throughout the 1990s has meant that epoxy sleeves are now a common solution for providing repairs to most types of damage including corrosion, gouges, dents, dent-gouge combinations, cracking and girth weld defects. However the research to date has not been directed at assessing the suitability of the technique for impact protection, both from a mechanical engineering and code compliance perspective. The project will therefore look to address issues such as:

- Does the epoxy clamp arrangement reduce the SMYS (specified minimum yield stress) in the pipework system to an appropriate level to allow the crossing of a road/railway?

- Does the arrangement introduce excessive stresses on the pipe-work system either side of the reinforcement?

- Given that the shell length is restricted by the rolling capability of a mill, will a gap be an issue or stress concentration factor? If so

how does this need to be designed out or managed?

- Will this extra metalwork put an extra strain on the CP system, especially if it is a significant length of reinforcement? Do we need to manage the potential for corrosion between the shell and carrier pipework?

- What thickness of shell and what thickness of grout would be required?

If the epoxy sleeves can be proven a viable alternative to thick wall pipe, then reinforcement work could be carried out with a significantly reduced safety risk associated with a diversion using stopple and bypass and employees working downstream of the stopple fitting. The operation also leaves the stopple fitting on the pipeline with an ongoing maintenance requirement and a long term risk of leakage. The project therefore will deliver a specific novel arrangement of existing equipment.

Third Party Collaborators

DNV

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

National Transmission System (NTS) pipelines are constructed in accordance with IGEM/TD/1 Edition 5, and the current edition stipulates the use of heavy wall pipe as protection against third party interference at road crossings. National Grid receives two or three requests a year to divert or install thick wall pipe for a new high density road.

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Method(s)

Firstly, a Feasibility Study to assess the use of epoxy sleeves in place of thick wall pipe at road crossings which will include:

- A summary of the IGEM/TD/1 requirements for road crossings, including protection, sleeves and thick wall pipe.
- A review of the technical development of the epoxy sleeve repair technology.
- An assessment of the compliance of epoxy sleeves with TD/1 requirements for road crossings.

The next stage is Feasibility Design for the use of epoxy sleeves to provide protection at a road crossing of No 28 Feeder in place of thick wall pipe.

Finally an evaluation of grout adhesion to research whether application of the grout directly over the FBE pipe coating will adversely affect its adhesion and hence compromise the performance of the grouted repair sleeve.

Scope

NTS pipelines are constructed in accordance with IGEM/TD/1 Edition 5, and the current edition stipulates the use of heavy wall pipe as protection against third party interference at road crossings. National Grid receives two or three requests a year to divert or install thick wall pipe for a new high density road. For example, planning revisions to the routing of the road scheme will lead to a road crossing a section of the pipeline without reinforcement of heavy walled pipe. The gas transmission system will also be impacted by the planned high speed rail link (HS2) between London and the West Midlands and will involving a number of additional diversions or additional pipeline reinforcement operations.

The options for reinforcement are limited to a pipeline diversion and stoppling operation and the inherent risks associated with type of operation and costs in terms of flow reduction and implications of buyback, give a strong case for further investigation into any alternative options.

National Grid would like to evaluate the use of epoxy sleeves for providing the required level of protection against third party damage as an alternative to heavy wall pipe. An epoxy sleeve consists of two steel halfshells, joined to encircle the damaged area, with the

annular space filled with an epoxy grout. A significant amount of research throughout the 1990s has meant that epoxy sleeves are now a common solution for providing repairs to most types of damage including corrosion, gouges, dents, dent-gouge combinations, cracking and girth weld defects. However the research to date has not been directed at assessing the suitability of the technique for impact protection, both from a mechanical engineering and code compliance perspective. The project will therefore look to address issues such as:

1. Does the epoxy clamp arrangement reduce the SMYS (specified minimum yield stress) in the pipework system to an appropriate level to allow the crossing of a road/railway?
2. Does the arrangement introduce excessive stresses on the pipe-work system either side of the reinforcement?
3. Given that the shell length is restricted by the rolling capability of a mill, will a gap be an issue or stress concentration factor? If so how does this need to be designed out or managed?
4. Will this extra metalwork put an extra strain on the CP system, especially if it is a significant length of reinforcement? Do we need to manage the potential for corrosion between the shell and carrier pipework?
5. What thickness of shell and what thickness of grout would be required?

If the epoxy sleeves can be proven a viable alternative to thick wall pipe, then reinforcement work could be carried out with a significantly reduced safety risk associated with a diversion using stopple and bypass and employees working downstream of the stopple fitting. The operation also leaves the stopple fitting on the pipeline with an ongoing maintenance requirement and a long term risk of leakage. The project therefore will deliver a specific novel arrangement of existing equipment.

Objective(s)

The project looks to assess the use of epoxy sleeves to provide pipeline protection at road crossings.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Knowledge pertaining to Epoxy sleeves as a viable, fit for purpose alternative to thick wall pipe on the National Transmission system (NTS).

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The feasibility study, feasibility design and the work on the grout adhesion will allow National Grid to assess whether epoxy sleeves are a viable alternative to heavy wall pipe. A proposed installation of the sleeve on the network will then become a project embedded within the business.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The solution would be applicable across the NTS.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

IFI - £44k
NIA - £26k

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)

This project is contributing towards a saving of £15m in avoidance of one diversion. However, cost avoidance is not limited to a single diversion and could therefore realize further significant savings.

Please provide a calculation of the expected benefits the Solution

Costs associated with specific works on the base case solution involving a pipeline diversion have been estimated in the region of £20m. A diversion to install heavy wall pipe requires gas flows to be reduced whilst welding is carried out and the stopples fitted. The installation of an epoxy sleeve could be carried out without interrupting flows providing a continued service to customers at an estimated cost of £5m.

Although the previous number of diversions has been approximately two / three per year, there is an additional impact on National Grid of the High Speed Rail Link (HS2) phase 1 project to link London and the West Midlands. If the HS2 project does go ahead there are five main high pressure pipelines that go
underneath the HS2 rail track, which is regarded as a 'high density traffic route' and therefore the installation of heavy wall will be required to protect the pipeline. The potential benefits of an epoxy sleeve solution are therefore not limited to the example given above. Whilst the safety and network operational benefits are key, it is also worth noting heavy wall pipe can be up to twice as expensive per metre.

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

The applicability of the solution will be dependant on the number of reinforcements required and the specific pipeline location.

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

Roll out costs will be specific to each application.

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

Learning will be used to update and inform industry guidelines as well as company procedures and specifications.

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

The projects fits within “third party interference” under the Safety theme.

☑ 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