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

Jun 2014

Project Reference Number

NIA_NGGD0019

Project Registration

Project Title

Pipeline Failure Rate Determination Due To Inland Natural Landsliding

Project Reference Number

NIA_NGGD0019

Project Licensee(s)

Cadent

Project Start

June 2014

Project Duration

1 year and 5 months

Nominated Project Contact(s)

Darren White - National Grid Gas Distribution Portfolio Manager, David Mccollum - National Grid Gas Transmission Project Manager

Project Budget

£107,875.00

Summary

The study will apply to the whole of the buried above 7 bar pipeline Network belonging to National Grid Gas Distribution and Transmission. The study will only consider natural landslides, i.e. it will not include landslides due to made up earthworks such as embankments and other man made hazards such as dams. It will also exclude impacts within the boundary fence of installations.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

World failure data indicates that natural landslides represent a significant threat to National Grid's above 7 bar pipeline network. The project will build on work that was previously carried out in 2005 with the British Geological Survey. Development and demonstration activity will help National Grid to better understand the risks of ground movement affecting the above 7 bar gas pipeline network in the UK and identify the locations that are at most risk so that suitable monitoring or remedial measures can be implemented.

Method(s)

Building on the work that was undertaken by National Grid in 2005, the project will utilise GeoSure geohazard data from the British Geological Survey (BGS), to assess the risk of landslide affecting the National Grid above 7 bar pipeline Network.

The GeoSure system will provide a 5 tier ranking of geohazard susceptibility using a low to high scaling methodology. The GeoSure classification system replaces a 6 tier landslide susceptibility ranking developed in 2003 for National Grid. BGS will be asked to support the project by providing:

- A landslide domain map.

- Revised landslide attributes for 86 landslide deposits.
- Landslide frequency decay values across the 5 GeoSure landslide susceptibility zones.

Using the above data the project will:

- Specify multiple landslide hazard conditions defined by attribute and associated probability of occurrence values.
- Identify the relevant pipeline parameters within these zones in terms of diameter, wall thickness, material, grade and operating pressure.
- Develop a numerical structural analysis model to determine the maximum strain level in the pipeline due to each imposed landslide condition.
- Develop a fragility curve assessment to convert each calculated strain level into a probability of girth weld failure.

Determine the likelihood of pipeline failure based on the relevant pipeline parameters and this calculation will be based on the predicted landslide size and frequency.

Scope

The study will apply to the whole of the buried above 7 bar pipeline Network belonging to National Grid Gas Distribution and Transmission. The study will only consider natural landslides, i.e. it will not include landslides due to made up earthworks such as embankments and other man made hazards such as dams. It will also exclude impacts within the boundary fence of installations.

Objective(s)

The objectives of the study are to enable National Grid to better quantify the risk of natural landslides affecting its high pressure gas network. This will support its asset management and risk assessment processes allowing National Grid to quantify the risk to the general public at specific locations and also to understand any potential impact on gas supplies. As a result of this work National Grid will be able to decide on locations where it may be appropriate to undertake monitoring to detect any potential earth movement, or undertake remedial measures to mitigate the impact of a natural landslide.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The successful completion of this project will result in a landslide domain map based on data supplied by the British Geological Survey for the geographical area of the National Grid pipeline network. A risk model will be developed that will allow National Grid to determine the likelihood of pipeline failure due to natural landslides at any given point on its above 7 bar pipeline network. The risk model will take account of the key pipeline parameters (i.e. wall thickness, diameter, pressure, and grade) and also take account of any known weld quality issues. The risks will be quantified for both pipeline leaks and pipeline ruptures.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project is based on the level of technical work that will be required to deliver the required outputs. There was an alternative option using a more simplified approach but this would exclude the landslide hazard variability due to the geographical distribution of landslide domains. It was considered that this more simplified approach would not deliver the level of detail required for National Grid to be able to appropriately quantify the risks.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be applicable to the footprint of National Grid's Gas Distribution and Transmission above 7 bar Network on mainland Britain.

Revenue Allowed for the RIIO Settlement

No Revenue Allowed for in the RIIO Settlement

Indicative Total NIA Project Expenditure

NGGD

£53,937.41 Indicative Total NIA Project Expenditure

NGGT

£53,937.41 Indicative Total NIA Project Expenditure

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)

It is estimated that based on European data collected by EGIG that the probability of a failure of the 12,000 km National Grid above 7 bar pipeline network as a result of landslide is approximately 0.2 per year and 50% of these failure are likely to be pipeline ruptures i.e. approx one in ten chances per year. The consequences of a pipeline rupture depends very much on location on the network where the failure occurs but previous National Grid cost benefit studies in this area have used a value of £6 million as being a conservative estimate of the likely impact of a transmission pipeline rupture. The transmission pipeline failure at San Bruno in California in 2010 is estimated to have cost the pipeline operating company PG&E $100s of millions in terms of compensation fines and restoration costs. Taking the £6 million conservative value multiplying it by 0.1 = £600 k per year, based on 40 year timeframe the total benefit on a risk averted basis is estimated to be £24 million

Please provide a calculation of the expected benefits the Solution

Please see above calculation.

Expected benefits as a result of the project are estimated to be circa £24 million over 40 years.

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

This Method could be applied to above 7 bar pipeline across the whole of the UK, the scale of which will vary upon Network Licensee.

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

It will cost National Grid approx £24k to purchase the relevant data from BGS plus other Networks would also have to purchase the Geosure data at an approximate cost of £60k for a five year licence. This applies to the 12,700 km of the National Grid above 7 bar network so on a pro rata basis it is estimated that it would cost of the order of approximately £6.5 k per 1,000 km of above 7 bar pipeline. This does not allow for any changes in pricing policy that BGS may apply.

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 techniques developed by the project would be equally applicable across other Network Licensee networks provided that they purchased the relevant landslide data from BGS.

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

Not applicable

☑ 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