

## NIA Project Registration and PEA Document

### Date of Submission

Dec 2016

### Project Reference Number

NIA\_NGGT0105

## Project Registration

### Project Title

Risk Assessment Methodologies for Pipelines and AGI's 2016

### Project Reference Number

NIA\_NGGT0105

### Project Licensee(s)

National Gas Transmission PLC

### Project Start

April 2016

### Project Duration

1 year and 1 month

### Nominated Project Contact(s)

Steve Potts (NGGT) & Luke Hollis (NGGD)

### Project Budget

£123,000.00

## Summary

High-pressure natural gas transmission system is a complex combination of buried pipelines and above-ground installations (AGIs), such as compressor stations and terminals. These assets present potential major hazards, such as fire risk, in the unlikely event of accidental releases of gas, due to a range of causes.

## Preceding Projects

NIA\_NGGT0007 - Risk Assessment Methodologies for Pipelines and AGI's

NIA\_NGGT0068 - Risk Assessment Methodologies for Pipelines and AGI's 2014

## Third Party Collaborators

DNV

## Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

## Problem Being Solved

The continuous management and improvement of safety risks on gas transmission pipelines and above ground installations requires development of wide ranging models and procedures. As the type of event which affects such assets is of low frequency, but extremely high consequences it requires accurate models to make safety decisions and keep risks as low as reasonably practicable.

Historically, the efficient development of these models and procedures has been coordinated through joint ventures. The maintenance and participation in these joint venture initiatives offers considerable benefits in terms of the latest thinking and best practice.

Proposed activities for 2016/17 are as follows:

- Hazard and Risk Assessment Methods for Gas Transmission Pipelines
- Data for Failure Frequency Estimation for Use in Risk Analysis
- Hazard and Risk Assessment Methods for Above-Ground Installations
- Parallel Pipelines
- Effectiveness of Safety Measures

## Method(s)

The activities shown below are broken down by contribution in 3 parts:

- National Grid Gas Transmission (NGGT)
- National Grid Gas Distribution (NGGD)
- Contribution from Partners (CFP)

Hazard and Risk Assessment Methods for Gas Transmission Pipelines:- **NGGT:** £22.0k **NGGD:** £22.0k **CFP:** £70.0k

Data for Failure Frequency Estimation for Use in Risk Analysis:- **NGGT:** £7.32k **NGGD:** £7.32k **CFP:** £24.6k

Hazard and Risk Assessment Methods for Above-Ground Installations:- **NGGT:** £13.75k **NGGD:** £13.75k **CFP:** £35.0k

Parallel Pipelines:- **NGGT:** £1.32k **NGGD:** £1.32k **CFP:** £8.4k

Effectiveness of Safety Measures:- **NGGT:** £1.16k **NGGD:** £1.16k **CFP:** £14.4k

## TOTAL:

- **NGGT - £45.55k**
- **NGGD - £45.55k**
- **CFP - £160.6k**

## Scope

High-pressure natural gas transmission system is a complex combination of buried pipelines and above-ground installations (AGIs), such as compressor stations and terminals. These assets present potential major hazards, such as fire risk, in the unlikely event of accidental releases of gas, due to a range of causes.

## Hazard and Risk Assessment Methods for Gas Transmission Pipelines

The PIPESAFE Joint Industry Project (JIP) provides the tools to assist National Grid in discharging its obligations by developing and refining techniques for quantifying the risk associated with pipeline assets. The group was founded in 1994 with collaboration between international partners. In the period covered by the current proposal (2016–17), the PIPESAFE JIP includes the following:

1. Implementation of a new crater fire model, refined to improve handling of complex failure modes (e.g. pipeline misalignment), validated by comparison with experimental data and observations from incidents.
2. Preparation of an updated version of PIPESAFE, which will be issued to all the Participants, incorporating the latest changes and improvements to the package.

## Data for Failure Frequency Estimation for Use in Risk Analysis

A key component of risk analysis is the predicted frequency of failure. Historical data provides an important means of ensuring that appropriate values are used, based on experience. However, an individual company rarely has sufficient experience for meaningful analysis of the frequency of major accidents. By pooling experience with other companies operating similar assets in similar ways, a combined body of data can be used which provides sufficient exposure for analysis of frequencies. The project includes National Grid's participation in two international Joint Industry Projects to facilitate the sharing of data by gas pipeline companies operating similar assets in similar ways, in order to provide sufficient data for investigation and analysis: Firstly, Failure Frequency Analysis (FFA) project – gas release incidents for onshore gas transmission pipelines and secondly, AGI Failure Frequency (AGIFF) project – gas release incidents for high pressure gas above-ground installations.

## **Hazard and Risk Assessment Methods for Above-Ground Installations**

The ORDER Joint Industry Project (JIP) involves an international group of gas companies collaborating on the development and maintenance of the ORDER software package for consequence and risk assessment of gas facilities including AGIs (Above Ground Installations). In the period covered by the current proposal (2016–17), an updated version of ORDER will be prepared, which will be issued to all the Participants incorporating the latest changes and improvements to the package and a summary report of the activities undertaken during the year will be issued.

## **Parallel Pipelines**

The Parallel Pipelines Group (PPG) Joint Industry Project was originally completed in 2001, and produced a tool (PROPHET) for assessing the possibility of interaction between parallel natural gas pipelines in the event of failure. Since the conclusion of the original project over 10 years ago, a number of possible refinements to the methodology were identified and pursued in a Phase 2 project, which has recently been completed. Recommendations were made for further work in a Phase 3 project, to address specific aspects including; implementation of pressure dependent crater model, review of heat loading and response for punctures within a ground crater and implementation of probabilistic approach. N.B. The PPG Phase 3 project is due to commence in 2016-17, but is not expected to conclude until later in 2017.

## **Effectiveness of Safety Measures**

Underground steel pipelines are subject to a variety of influences that threaten their integrity. Pipeline operators have a variety of physical and non-physical methods available to them to reduce the likelihood of these threats. Previously, the effectiveness of physical slabs (PE and Concrete) against third party interference has been investigated in Phases 1 and 2 of the Effectiveness of Safety-improving Measures (ESM) Project. This has led to the development of a fault tree. Following completion of Phase 2 of the project, pipeline operators have expressed an interest in quantifying the benefits of non-physical methods to protect pipelines against third party damage. N.B. The ESM Phase 3 project is due to commence in 2016-17, but is not expected to conclude until later in 2017.

## **Objective(s)**

Research into the enduring management of safety risks on pipelines and above ground installations. The project includes the implementation of the results via tools and methodologies that are aligned specifically to National Grid's needs but are also relevant to the UK gas industry, utilising the results of the international collaborations as appropriate.

## **Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)**

n/a

## **Success Criteria**

Through collaboration with other gas transmission companies, National Grid is able to demonstrate to the safety regulator, its customers and the general public, through its safety cases, that its knowledge of gas transmission hazards and risks is at the forefront of current thinking and therefore that its safety cases are credible and realistic. Such collaboration also allows National Grid to participate in, and benefit from:

the ongoing development of international best practice in risk management and shared learning from incidents.

## **Project Partners and External Funding**

n/a

## **Potential for New Learning**

n/a

## **Scale of Project**

Participation in collaboration research programmes such as PIPESAFE and ORDER allows National Grid Gas access to important research and development projects that could otherwise be more difficult to fund on an individual basis. This is a leveraged activity that offers extensive networking opportunities with other gas transporters and across the wider industry, and collaboration in these programmes will continue to play a key role in the enduring innovation portfolio. Specific research and development projects within this collaborative programme will address a subset of information or sites with application to all gas transmission/distribution assets.

## Technology Readiness at Start

TRL2 Invention and Research

## Technology Readiness at End

TRL4 Bench Scale Research

## Geographical Area

The results and knowledge gained from this collaborative programme will be applicable to the whole UK gas high pressure network.

## Revenue Allowed for the RIIO Settlement

None.

## Indicative Total NIA Project Expenditure

NG Gas Transmission NIA - £65,550.

NG Gas Distribution NIA - £57,444.

Total NIA - £123k

## 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 collaborative programme develops and applies techniques for quantifying the risk associated with pipeline assets and AGIs and investigating the effectiveness of a variety of approaches for reducing risk. Collaboration with these companies helps to reduce cost and to learn from the experiences of other pipeline companies and to share best practice. The main benefit of the project is in cost avoidance. The cost of a high pressure pipeline incident could be upwards of £50 million. The high pressure pipeline incident experienced at Ghislenghien in Belgium was hugely costly (many millions), including compensation payments, resource constraints, reputational damage and stricter regulation.

#### Please provide a calculation of the expected benefits the Solution

N/A - Research.

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

The Method is applicable across the gas transmission and distribution networks, both pipelines and above ground assets.

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

Roll out costs vary from no additional costs, where industry guidelines are updated to £100,000s where a licensee may wish to develop a specific tool to embed specific learning within an individual company.

### 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 optimize technical policy with applicability to improved asset management. Learning, where appropriate is fed through into Industry standards ( IGEM documents for example) which then becomes available as best practice for all relevant operators across the industry.

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

This collaborative programme of work sits within the Safety, Reliability, Environmental and Strategic themes under National Grid's Innovation Strategy.

- 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