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

Aug 2024

Project Reference Number

NIA2_SGN0066

Project Registration

Project Title

H100 Quantitative Risk Assessment for Emergency Purging

Project Reference Number

NIA2_SGN0066

Project Licensee(s)

SGN

Project Start

June 2024

Project Duration

0 years and 5 months

Nominated Project Contact(s)

Joseph Abazeri

Project Budget

£131,121.00

Summary

This project aims to conduct a quantitative risk assessment (QRA) to identify, quantify, and mitigate risks associated with direct and indirect purging operations from 32mm to 250mm diameter Polyethylene (PE) pipelines on the H100 Fife Neighbourhood Distribution Network. Current industry practice recommends indirect purging of Hydrogen gas systems in various situations to prevent the potential development of a temporary flammable atmosphere within the pipework. However, indirect purging is a non-routine operation (NRO) for most Gas Distribution Networks (GDNs). Indirect purging carries risks such as nitrogen sourcing and transportation challenges, delivery competencies, over-pressurization, and asphyxiation, which are not present during direct purging. Therefore, it is essential to understand the overall difference in risk between direct and indirect purging for hydrogen systems.

Third Party Collaborators

Kiwa

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

The H100 Fife Neighbourhood Distribution Network design includes newly laid polyethylene (PE) pipes, with sectorisation valves at the start and end of each street, and additional key valves at strategic locations on the network. If there is a public-reported event (PRE) or a loss of containment on the network, the highly skilled SGN team will respond to the incident, close the sectorisation valves, and purge that section of the network before and after replacement or repair works.

Current industry practice recommends indirect purging of Hydrogen gas systems in various situations to prevent the development of a

temporary flammable atmosphere within pipework. However, it's important to note that indirect purging is a non-routine operation (NRO) for the GDNs and is not without risk. Risks such as nitrogen sourcing and transport challenges, delivery competencies, over-pressurization, and asphyxiation are not present during direct purging, making it essential to obtain assistance from Kiwa to understand the overall difference in risk between direct and indirect purging.

Method(s)

This technical research project aims to identify, quantify, and mitigate risks associated with performing direct and indirect purging from 32mm to 250mm diameter Polyethylene (PE) pipelines for the H100 Fife Neighbourhood Distribution network.

The methodology for addressing this issue involves data collection on leaks from natural gas networks, methods of detection, and diagnosis of leak severity from GS(M)R and SGN database as well as stakeholder workshops. Additionally, prior work, from Hy4Heat, HyPurge, and other relevant work will be reviewed leading to the development of the QRA.

Scope

The project will consist of the following Work Packages(WP):

WP 1:

1. Carry out numerical analysis of the GS(M)R data.
2. Review current guidance on responses to leaks from natural gas networks, methods of detection, and diagnosis of leak severity, etc.
3. Consider the need for rapid response (or otherwise) in detail.
4. Run two workshops for different FCO / ELR teams (one from Scotland Gas Networks and one from Southern Gas Networks, to avoid group think)

WP 2:

1. Review prior work, from Hy4Heat, HyPurge, and other relevant work.
2. Develop a QRA for two overarching scenarios: direct and indirect purging.

- Evaluate event consequences / estimate potential accident frequencies.
- Estimate the impact of events.
- Estimate the likelihoods or probabilities.
- Evaluate the risk.

3. Consider a series of events with reference to:

- Risk of creation of hydrogen/air mixtures within the pipe.
- Risk of fire and explosion from any hydrogen cloud created.
- Risk of relighting leaks.
- Risk of direct vs indirect purge vs live repair for the smallest leaks.

WP 3:

1. Review the output of the QRA to identify scenarios of highest risk.
2. Consider the conditions that give rise to these scenarios, both individually and in comparison, with each other.
3. The outline response to these scenarios will be developed, drawing on the current responses to leakage scenarios with Natural Gas.
4. Reassess the frameworks used in WP1 and WP2.
5. Hold conversations with ELR teams to sense check the mitigations (via Teams).
6. Review the mitigations developed with a broader group drawn from the Peer Review Panel.

WP 4:

1. The outputs from the previous WPs will be synthesised - turning data into information. The mitigations will be contextualised to check the numerical outputs and ensure that the QRA matches reality.
2. Analyse the gaps in knowledge that the project identifies and develop work programmes to fill these gaps.
3. Use the Peer Review Panel to ensure broad industry agreement.
4. Disseminate the outcomes of the work to a broad audience within the gas industry, via the Final Report and a Final Workshop / Presentation.

Objective(s)

The objective of this project is to conduct a quantitative risk assessment (QRA) to identify, quantify, and address the risks involved in carrying out direct and indirect purging operations on Polyethylene (PE) pipelines ranging from 32mm to 250mm in diameter. The

project aims to reduce safety risks to the public and customers and facilitate the Network's transition to Hydrogen.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

A successful trial has the potential to introduce hydrogen as an alternative form of energy for heating to those who are not currently connected to the gas grid. This means that individuals who are financially unable to use natural gas to heat their homes may be able to use hydrogen instead. The project's outcomes will not negatively impact vulnerable customers but will contribute to a broader effort to make the gas network more environmentally friendly. Other projects will also examine how vulnerable customers can be included in this initiative.

Success Criteria

The success criteria for the project are the delivery of the following:

- Design and develop a QRA model to identify, quantify and mitigate risks on the H100 Fife Neighbourhood Distribution Network.
- Develop purging procedures for Hydrogen operations on the Network.
- Successfully disseminate the project outcomes to all relevant stakeholders

Project Partners and External Funding

SGN and Kiwa.

The project is fully funded via NIA.

Potential for New Learning

The project will identify, quantify, and mitigate risks associated with the H100 Fife Neighbourhood Distribution Network, providing outcomes which inform the H100 Fife Neighbourhood Cases for Safety. Kiwa will deliver comprehensive insights in a detailed report summarising the findings.

Scale of Project

A comprehensive QRA on the H100 Distribution Network is crucial for successfully delivering the H100 Fife Neighbourhood trial, thereby justifying the magnitude of the investment.

The recommendations from this work would, in turn, facilitate personnel training and delivery of Network operations during the H100 Fife Neighbourhood trial.

Technology Readiness at Start

TRL9 Operations

Technology Readiness at End

TRL9 Operations

Geographical Area

The project will be delivered at Kiwa laboratory, Cheltenham. The project will be representative of the H100 Fife Neighbourhood Distribution Network.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

SGN External - £98,365

SGN Internal - £32,756

Total - £131,121

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:

This project is an H100 Fife Neighbourhood Distribution network safety critical project which has the considerable benefit in facilitating the network transition to Hydrogen.

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)

N/A

Please provide a calculation of the expected benefits the Solution

N/A (This is a research project)

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

The QRA developed will be relevant and applicable to future Hydrogen Trials with a Gas Network up to 250mm PE.

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

N/A

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

This project aims to identify, quantify, and mitigate risks in relation to Hydrogen gas operations on the H100 Fife Distribution Network. The insights, procedures and strategies generated can benefit all future endeavours regarding the Network transition to Hydrogen. Findings from the project will be available to all relevant stakeholders through the ENA Smarter Networks Portal at https://smarter.energynetworks.org/

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

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.

This project is unique to the H100 Fife Neighbourhood project and aims to provide further evidence to support SGN operations on the H100 distribution network during emergencies and any future trials or wider rollout of hydrogen.

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

This project holds immense importance for the safety of the H100 Fife Neighbourhood Distribution Network operations. The H100 Fife Neighbourhood trials represent a highly innovative program that is unmatched in scale and replication worldwide.

Relevant Foreground IPR

N/A

Data Access Details

Information relating to the project will be published on the ENA Smarter Networks Portal at https://smarter.energynetworks.org/

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The H100 Fife Neighbourhood project and any associated enabling projects cannot be considered part of standard business operations due to their unique and groundbreaking nature, as well as the risks involved, which surpass typical business as usual activities for the Gas Distribution Networks (GDNs).

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

The NIA framework provides a robust and open structure to support this project and ensures the dissemination of results to all stakeholders. The transition of the GB Gas network to 100% Hydrogen stands as a pivotal step in the journey towards achieving net zero emissions.

This project has been approved by a senior member of staff

☑ Yes