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NIA Project Registration and PEA Document

Date of Submission

Jun 2022

Project Reference Number

NIA2_SGN0022

Project Registration

Project Title

H100 Specific Fire & Risks

Project Reference Number

NIA2_SGN0022

Project Licensee(s)

SGN

Project Start

June 2022

Project Duration

0 years and 11 months

Nominated Project Contact(s)

Richard Beedell

Project Budget

£231,825.00

Summary

This project will investigate incidents that can occur following damage to a Hydrogen PE service and assess any change in risk from natural gas. The project will investigate the following:

- Fires Near Meter Box: using realistic scenario (wheely bin fire adjacent to meter box).
- Service Pipe Fires: compare the nature and visibility between natural gas and hydrogen fires.
- Gas in Ducts: investigate the potential for hydrogen gas tracking through ducts and other services and assess the difference in the risks from natural gas.
- Automatic Isolation Valves: investigate the use of Automatic Isolation Valve (AIV) systems for commercial buildings with hydrogen.

Additionally, the project will investigate the functionality of safety equipment and assess its reliability. Further risk mitigation measures may be identified.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

SGN is a leading proponent of developing the safety case of hydrogen to replace natural gas for heating and cooking in people's homes. SGN has identified and developed the scope of this project following a review of the H21 and Hy4Heat reports and has discussed these requirements with BEIS. The identified gaps that will be covered in this project will refine the risks to a Hydrogen Village Trial and will also be beneficial to the H100 Fife Neighbourhood Trial.

The QRA developed under the Hy4Heat programme used data from about 1000 specially collected records of FCO visits in 2019/20

and 960 records of GSMR reportable incidents from April 2016 to March 2020. The reportable incidents show that leaks external to a property account for approximately 80% of leaks. There is little evidence which demonstrates that hydrogen releases in the open are more hazardous than natural gas (although hydrogen is more readily ignited, the radiation from a hydrogen flame is much less than natural gas and a hydrogen flame is more likely to stay alight). However, some of the less obvious incidents that can occur following damage to a PE service should also be considered. This programme of work seeks to identify these less obvious incidents and to access the additional risks that could present with a change from natural gas to hydrogen. This would in turn further enhance the safety case and/or risk mitigation measures to be defined for these incidents.

Method(s)

SGN will subcontract Kiwa to perform this work. Kiwa has a long-standing relationship of working with SGN and value the relationship that has been built in supporting SGN in executing consistently innovative ground-breaking projects such as Opening up the Gas Market, HyHouse and the FEED study for H100 Fife.

Measurement Quality Statement:

The main approach of the project will be to replicate credible fire scenarios using 100% hydrogen. A test rig representative of a gas service pipe will be constructed by our contracting partner to undertake the suite of tests and provide evidence of the behaviour of such scenarios (risk assessment update, videos of tests, etc). This is important as it will allow SGN to further enhance the safety case and/or risk mitigation measures to be defined for these incidents.

Data Quality Statement:

Regular meetings will be held with key stakeholders and the supplier to agree the format for the sharing and storage of data. Kiwa's involvement in the project will ensure a consistent approach in the presentation of the evidence and data due to their involvement in previous H100 projects and their knowledge of PE services.

Scope

The proposed programme of works has been split into discrete work Packages (WPs). In each case the aforementioned incident data on external leaks in the distribution network is more deeply analysed and contextualised and the key issues determined.

WP1 – Third Party Fires Near Meter Box

The records of fire and explosion associated with PE mains almost exclusively concern third party fires and a number of the fires involved wheelie bins (4 out of 24 incidents), which when ignited have the potential to damage any PE service pipes in the area and meter boxes in close proximity. Evidence gathered during H100 Fife area surveys demonstrated that storage of wheelie bins in close proximity to the main incoming service pipe and/or gas meter box is commonplace.

To understand the risks associated with wheelie bin fires adjacent to gas meters, burn tests will be carried out with wheelie bins adjacent to semi-concealed meter boxes. During these tests, the functionality of excess flow valves will also be assessed to determine how reliable these are in the event of such a scenario. This will provide an assessment of the relative risk of isolating services at the ECV vs at the parent main as part of GS(M)R obligations. Comparative tests will be performed with both methane and hydrogen at a pressure of 65mbar.

WP2 – Service Pipe Fires

A series of five service pipe fire tests will be performed. These tests will be used to investigate the nature and visibility of both natural gas and hydrogen fires from service pipes and will also be used to confirm the performance of standard SGN fire resistant clothing with hydrogen and also compare this to the risk of ignition of ordinary clothes (as used by a DIYer). During these tests, the invisibility of hydrogen fires will also be assessed and methods of improving the visibility will be tested (e.g. use of Class D fire extinguisher). Filming of these tests will also form part of future training videos.

WP3 – Gas in Ducts

The change from natural gas to hydrogen is expected to significantly increase the risks of gas tracking through and alongside ducts and other services both upstream and downstream of the ECV. In this work package, tests will be performed to investigate the impact of tracking and identify the optimal mitigation solution for different leakage rates. The tests will consider tracking in ducts between telecom boxes (which is a scenario that is expected to be most susceptible to gas tracking) and also along a telecom duct into a property. The tests will investigate whether the accumulation of gas in a confined space arising from a below ground adjacent gas leak is likely to be materially different between natural gas and hydrogen. This work will provide information to assist SGN and telecom infrastructure providers to update and optimise their flammable gas in duct risk procedures and assessments. The likelihood of a viable ignition source within one of these boxes will also be considered in the analysis.

In a second part of this test programme, suction devices (e.g. Tornado equipment) will be trialled as a method to assist the removal of leaked gas in a confined space.

The experiments will be repeated with different leak rates and sizes of cabinet. At least 20 sets of data will be generated.

WP4 – Automatic Isolation Valves

Within the Hy4Heat Safety Annex the use of excess flow valves is limited to 20 m³/h. Above this value any leakage has the potential to create significant flammable clouds; the safety Annex thus calls upon the use of Automatic Isolation Valve (AIV) systems for commercial buildings or larger domestic properties.

Whilst such systems can be used with all flammable gases, they have not been demonstrated with hydrogen. This work package will investigate their use with hydrogen and ensure that it functions in accordance with the manufacturers claims. Most of the work will consist of re-analysing work from previous projects (e.g. HyHouse project, Hy4Heat DNV data) to determine likely detection levels. This will then be confirmed in tests where four off plywood rooms will be constructed and levels of hydrogen up to 50,000ppm produced in individual rooms. This will demonstrate the actuation of an AIV at an appropriate pressure.

Objective(s)

This programme of work seeks to better understand the consequences and to assess the additional risks that could present with a change from natural gas to hydrogen of the following less obvious incidents:

- Third Party Fires Near Meter Box
- Service Pipe Fires
- Gas in Ducts

The project will also assess risk mitigation measures which could lead to a reduction in risks such as the use of Automatic Isolation Valves systems.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

A successful trial has the potential for the roll out of hydrogen as a form of energy for heating to those currently not connected to the gas grid. This could mean those financially not able to use natural gas to heat their home may be able to with hydrogen. The outcomes of the project will not adversely affect vulnerable customers but feeds into a wider piece of work to decarbonise the gas network. Other projects will explore how vulnerable customers will not be left behind on this journey.

Success Criteria

The key success criteria of the project include:

- Support hydrogen trials by further developing the safety case
- Develop understanding of risks relating to hydrogen fires and mitigation measures.
- Develop understanding of risks relating to gas tracking with hydrogen and mitigation measures.
- Generate data that can be used to update and optimise procedures and risk assessments.
- Provide data that can be used for future training.

Project Partners and External Funding

Kiwa and SGN.

Project wholly funded through NIA

Potential for New Learning

The project will help develop the safety case for using hydrogen and learnings will be available in a report from Kiwa.

Scale of Project

This project will be a combination of industry research and full-scale testing.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project will aim to be representative of the whole of the GB network.

Revenue Allowed for the RII Settlement

Not Applicable

Indicative Total NIA Project Expenditure

SGN External – £208,643

SGN Internal – £26,660

Total – £231,825

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:

The identified gaps that will be covered in this project will refine the risks to a Hydrogen Village Trial and will also be beneficial to the H100 Fife Neighbourhood Trial. The deeper knowledge of hazards and how the risks change with hydrogen will help mitigate risks in the future rollout of hydrogen.

Additionally, the tests will investigate the functionality of safety equipment that will be used in trials and assess its reliability. Where required, further risk mitigation measures will be identified.

How the Project has potential to benefit consumer in vulnerable situations:

Not Applicable

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)

Not Applicable

Please provide a calculation of the expected benefits the Solution

There is a lot of work ongoing to identify the most effective route to achieve the net zero targets set by the UK and Scottish governments and this project is one of the many that is aiming to better understand the risks of converting the existing gas networks to 100% hydrogen. Converting the UK gas networks to 100% hydrogen has the potential to save millions of pounds with minimal gas customer disruption versus alternative decarbonisation solutions.

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

The risks that the project is studying will be common to any hydrogen trial or for when hydrogen is rolled out for heating nationally.

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

There will be no costs for rolling out the method. The product is deeper knowledge of hydrogen risks.

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 will further develop knowledge of hydrogen hazards compared to natural gas by analysing more specific scenarios. This will allow the safety case to be further refined and will help to reduce the risk of a hydrogen rollout even further. 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)

Not Applicable

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 will build on previous work in this area and has been discussed with key stakeholders (I.e BEIS) to ensure there is no duplication of work. The findings from the project will be shared with all key stakeholders.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

Not Applicable

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

Part of the novel study into using 100% hydrogen network.

Relevant Foreground IPR

Not Applicable

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

This project isn't being funded as business as usual because it is deemed an essential part of the 100% hydrogen trials process which is a key step towards conversion of the existing gas network to 100% hydrogen.

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 offers a robust, open framework to support this work and ensures the results are disseminated to all licenses. The conversion of the GB gas network to 100% hydrogen is a key step on the road to net zero.

This project has been approved by a senior member of staff

Yes