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

Jul 2014

Project Reference Number

NIA_WWU_017

Project Registration

Project Title

Iron Mains Condition Assessment System Phase 3

Project Reference Number

NIA_WWU_017

Project Licensee(s)

Wales & West Utilities

Project Start

July 2014

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Ian Marshall – WWU Project Manager (Lead) ian.marshall@wwutilities.co.uk, Lucy Mason – WWU Innovation Manager, Andy Newton – NGGD Innovation Manager

Project Budget

£2,809,964.00

Summary

The scope of Phase 3 is to:

1. Finalise and construct a live deployment ready prototype of the tool, live entry system, in pipe motive system, software and systems and reporting methods as well as the processes required to deploy and retrieve the tool successfully and cost efficiently.

2. Conduct trials to prove the tool, systems, processes and consistency of outputs. This will initially be don't through deployment into a re-pressurised (air or nitrogen) section of abandoned 12" cast or spun iron main to provide confidence of the tools suitability to be deployed into the live network.

3. Deploy the tool onto the WWU and NGGD live networks and conduct a minimum of 1 km of completed surveys.

4. Review the options to develop the tool for use in other diameter mains (initial work will focus on 12") and longer survey lengths.

5. Develop initial internal understanding of the results and potential impact on the networks as well as robust systems governing the requirement of the deployment of the tool following the completion of the project – this will be aided with the use of independent external consultants to validate the output of the tool and what the results indicate with regards to the impact on the integrity of the surveyed network.

Nominated Contact Email Address(es)

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Problem Being Solved

Today's gas distribution networks have been built up and developed from networks that date back over 100 years. For much of this time the material of choice for the manufacture of distribution mains was cast iron (either pit or centrifugally (spun) cast). As a result,

there is a significant volume of this legacy cast iron remaining in these networks that are still being utilised for the conveyance of natural gas. Cast iron is prone to corrosion and also, being an inherently brittle material, sudden catastrophic failure through fracture. When such failures do occur there is a sudden and uncontrolled release of gas, each of these failures, depending on the proximity, has the potential to cause gas to enter into a building whereby it can form a hazardous or explosive atmosphere endangering the consumer and general public.

Through this project Wales & West Utilities and National Grid are looking to take a proactive approach to understanding the actual condition of these mains, rather than to continue to rely on the reactive indicators used until now. This is to ensure the continued security of supply and safety of the consumer and general public under the new Iron Mains Risk Reduction Programme. This project is looking to develop a tool that will travel for extended lengths within tier 2 and 3 mains (9" and above) to determine their condition. This will be done by measuring corrosion depth / wall thickness on the inside and outside walls as well as the actual strain present in the pipe wall.

Knowledge of the asset condition, as determined from both the level of corrosion (loss in wall thickness) and strain in the pipe wall, will allow GDNs to:

- accurately determine the risk these mains pose to the public and the network,
- predict remaining life of the asset to a level of accuracy not previously possible
- allow for targeted, informed and innovative interventions to be undertaken in the most cost efficient manner

Method(s)

This project builds upon the initial development phases undertaken firstly through IFI and completed under the NIA registered project NIA_WWU003 and NIA_WWU007.

This project focuses on the adaptation of a specific Electro Magnetic Inspection (EMI) Versatile Array Technology into a tool to condition assess cast iron mains through the detection of corrosion and / or defects as well as the detection of induced strain within the main. This project is comprised of a number of distinct stage gated phases to adapt and further develop an existing commercial product originally developed for the nuclear industry. The phases are intended to take the technology from a desktop demonstration to a complete tool /system for the survey and condition assessment of extended lengths of cast iron mains (principally focused on tier 2 mains with a view to extending the technology to tier 3 as appropriate). An overview of the Phases involved in this development are detailed below:

- **Phase 1**: Development of technology from desktop demonstration into a basic prototype as a proof of concept; trialed and demonstrated in an 80 m section of abandoned 10" SI main. [COMPLETED under IFI]
- **Phase 2**: Development of proof of concept prototype into a full scale prototype with additional sensors and increased sensitivity for greater wall coverage / accuracy, increased survey speed and improved data processing. Trialed and demonstrated in 200 m section abandoned 12" SI. [COMPLETED IFI and NIA_WWU003]
- **Phase 3a: i)** Investigate the level of strain the tool will need to identify in a main for such strain to be cause for concern, through destructive testing of representative samples. **ii)** Conduct feasibility study to investigate options for inserting and extracting tool in and out of the mains to be surveyed. [COMPLETED NIA_WWU007]
- **Phase 3:** Develop the tool from the extended prototype of Phase 2 to a full scale system, with live entry system, software and processes. The tool will initially be tested on abandoned sections of cast iron mains pressurized with air or nitrogen before then being trailed on the live network with not less than 1 km of surveys completed. Independent consultants will be brought into the project to validate the outputs of the tool and implication on the gas network.
- **Phase 4:** Deployment onto the live network and further development for additional requirements to be determined following completion of Phase 3.

Scope

The scope of Phase 3 is to:

1. Finalise and construct a live deployment ready prototype of the tool, live entry system, in pipe motive system, software and systems and reporting methods as well as the processes required to deploy and retrieve the tool successfully and cost efficiently.
2. Conduct trials to prove the tool, systems, processes and consistency of outputs. This will initially be don't through deployment into a re-pressurised (air or nitrogen) section of abandoned 12" cast or spun iron main to provide confidence of the tools suitability to be deployed into the live network.
3. Deploy the tool onto the WWU and NGGD live networks and conduct a minimum of 1 km of completed surveys.
4. Review the options to develop the tool for use in other diameter mains (initial work will focus on 12") and longer survey lengths.

5. Develop initial internal understanding of the results and potential impact on the networks as well as robust systems governing the requirement of the deployment of the tool following the completion of the project – this will be aided with the use of independent external consultants to validate the output of the tool and what the results indicate with regards to the impact on the integrity of the surveyed network.

Objective(s)

This phase will look to develop a tool, systems and processes that will have been proven in the live network. This phase will also look to collect sufficient useable data on iron mains condition, through the trials included within the scope of this phase, to aid the development of a use case, with appropriate consultation with external stakeholders, to guide and support the subsequent deployment of a production version of the tool.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

- Construction, completion and demonstration of a deployment ready tool, live entry system, software, systems and processes.

- Demonstration of tool and systems ability to deploy, operate, and be retrieved from a re-pressurised (air or nitrogen) section of abandoned main with simulated loads / flows as well as successful demonstration of the suitability and functionality of the failsafe mechanisms.

- Successful demonstration of the tool and associated systems in the live gas network with a minimum of 1 km of 12” mains successfully surveyed with a demonstration of the ability to generate reliable and consistent data from which investment decisions could be made.

- Validation of the outputs of the technique from the independent consultants.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Phase 1 of the project provided a proof of concept of the technology, developing the technology from a desktop demonstration into a basic prototype; tested and proved in 80 m of abandoned 10” spun iron main.

Phase 2 developed this basic prototype into a full scale working prototype for further validation in longer lengths of abandoned iron mains.

Phase 3A – Conducted destructive testing to estimate the strain levels that would be considered as a cause for concern if detected on surveys, this was found to be higher than initially expected and identifiable by the tool

- Conducted feasibility study to explore the options for live entry and exit as well as the options for motive power within the mains. The results from this have gone on to inform the design for phase 3.

Phase 3 – Develop the tool from demonstration prototype into a deployment ready tested and proven system ready for wider use on the live networks.

Phase 4 would involve the deployment onto the live network and further development for additional requirements to be determined following completion of Phase 3

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

UK mainland. Trials locations will be selected within WWU / NGGD geographic area or DVST locations as appropriate.

Revenue Allowed for the RIIO Settlement

The end product of this project will be a condition assessment system that will provide knowledge on the actual condition of the tier 2 population (principally, with potential to expand to other pipe size ranges in the future). As such any savings that could be expected from this project would be associated with the not needing to replace mains that have been found to be in good condition but were previously scheduled for replacement or the development of other innovative management techniques for these mains. As such the expected savings are solely reliant on the outcomes of the surveys following the deployment of the tool on the network and the survey of a statistically representative volume of mains.

Indicative Total NIA Project Expenditure

The expected total cost is £2,809,964, 90% of which is allowable NIA expenditure (£2,528,967.60).

WWU

External expenditure - DVST £994,000

External expenditure – Independent Consultants £60,000

Internal expenditure – £350,982

Total NIA - £1,404,982

NGG

External expenditure - DVST £994,000

External expenditure – Independent Consultants £60,000

Internal expenditure – £350,982

Total NIA - £1,404,982

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)

Knowledge of the actual main condition will allow GDNs to make informed decisions on the actions they take manage the risk from these mains. Allowing for informed, innovative solutions to be implemented at the most cost effect point at the assets life, or by justifying a mains continued operation. As such an accurate calculation of expected saving is impossible until the condition of the mains population has been assessed and intervention options identified.

Please provide a calculation of the expected benefits the Solution

Of the National Grid (NGGD) population of some 6400KM of Tier 2/3 pipes the following lengths have been 'allowed' under Ofgem's final proposal, 140KM of Tier 2 above the risk action threshold (£89M), 300KM of non-mandatory condition and 382KM of non-mandatory Tier 3 (£600M).

The use of the tool is initially targeted at Tier 2 >risk action threshold whereby the technology could be used to defer replacement or remediation.

A 1KM section of Tier 2 could be replaced at a cost of circa £500,000 (The allowed values are based on 3 bands, 9", 10-12" and 14-17", ranging from £500-800 per metre).

It is expected the development of a live entry system would enable the kit to enter the main with minimum disruption.

Assuming a distance of 500m either way from 1 location then the cost of excavation and cost of specialist team over the 2-3 days of survey would be anticipated to be circa £20-30000.

Given the expectation that a proportion of the Tier 2 pipes above the risk action threshold would be anticipated to be retained following DVST inspection, then out of the 140KM 'allowed' it is likely at least 5KM a year could be retained.

Therefore savings are likely to be in the order of >£2M pa.

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

This method and the tool developed could applied across the whole of GB, it is principally focused on tier 2 iron mains however it is expected that further development for tier 3 iron mains will occur and similar solutions may be subsequently developed for and

implemented on tier 1 iron mains should a requirement for this be identified.

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

The end result of this project will be a commercial product that will be available for all GDNs to employ at their discretion, the knowledge and learning gained from the trials of the product through development will be disseminated to the other networks through results gained and live demonstrations to help inform their decision on the requirement to implement the system following project conclusion.

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 learning generated will be in the form of a new tool for the condition assessment of cast iron mains. The results of this learning will be made available to all network licensees and the tool will be available for all networks to implement.

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 – learning can be applied by all Network Licensees therefore please refer to i) above.

☑ 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