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NIA Project Registration and PEA Document

Date of Submission

Jan 2014

Project Reference Number

NIA_NGGT0043

Project Registration

Project Title

MiniLog Stray Current Monitoring Devices for Cathodic Protection Re-Life

Project Reference Number

NIA_NGGT0043

Project Licensee(s)

National Gas Transmission PLC

Project Start

January 2013

Project Duration

2 years and 1 month

Nominated Project Contact(s)

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Project Budget

£20,000.00

Summary

The Minilog project is innovative as the product is capable of taking accurate readings over a period of time by switching between the CP system and the coupon installed beside the test post, this gives the potential for what were classed as defects to be re-classified as compliant or not under current CP guidelines (ECP2). The Minilog records true pipe to soil potential data, i.e. error free data, minimizing interference for detailed analysis by CP personnel to ascertain whether or not further investigation of possible defects is required. This will allow for many more defects to be quickly and safely closed and has the potential for significant business savings and increased security of supply.

Third Party Collaborators

Corroconsult UK Limited

Nominated Contact Email Address(es)

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Problem Being Solved

Steel pipelines provide a very low resistance electrical path to remote earth. Therefore they are often influenced by numerous sources of both AC and DC stray current including high voltage overhead cables, DC transit systems, impressed current CP (cathodic protection) systems, DC (direct current) machinery and effects during sunspot activity known as Tellurics.
Transient stray current effects are superimposed on top of the applied CP system and create significant CP measurement difficulties.
The effectiveness of CP systems is assessed by periodic measurement of the pipe to soil potential over the entire pipeline; this requires the applied CP system to be switched "ON" and "OFF" very rapidly to eliminate a measurement error due to the volt

drop associated with CP current flowing in the ground. However stray current cannot be switched off and may continue to deliver protective CP current to the pipeline. The consequence of all this is that it can be very difficult to assess whether the applied CP is effective or not. Minilog gives the facility to switch the pipe to coupon bond and record a robust and reliable "OFF" reading, (i.e. an error free measurement), without the influence of stray current.

A coupon as mentioned above, is a buried metallic element of known size which represents an uncoated area of pipeline, and can be used as a tool to measure the potential at a specific location because unlike the pipeline it does not have the ability to act as a large conductor due to its size.

CP data can only be classified against National Grid's set criterion through expert interpretation; this leaves the possibility for misinterpretation of data, which could result in the pipeline being classified as satisfactory when in reality it might not be. The follow on effects of this could mean that In-Line Inspection (ILI) inspections are carried out less frequently, allowing corrosion to propagate.

The benefit of using Minilog is that the level of CP applied can be assessed against the required protection criterion with a high level of confidence and the evidence retained for audit purposes. Subjective assessment is eliminated, and unnecessary costly excavations of coating defects in the areas influenced by stray current to prove by inference that the CP system is effective are not required.

Method(s)

Along a section of pipe where the level of potential is severely fluctuating due to stray current, it is possible to monitor the actual effectiveness of the CP system at a localized point by taking measurements from coupons installed on many CP test posts along the section of pipeline affected by stray current, thus removing the problem of the pipe being a large conductor. The Minilog system will allow CP technicians to take readings from these coupons over a period of time to build up a better picture of the actual CP conditions rather than a single manual reading, which would only give a value for the time of the reading.

Traditionally, to measure the 'on' and 'off' CP readings, a CP technician would have to travel to several TR (transformer rectifier) locations to fit interrupters which temporarily switch the CP system on and off. This then allows the technician to record how the stray current is affecting the true CP reading at a specific location between these TRs, namely where the CIPS (closed interval protection survey) data is showing large amounts of stray current interference. By switching the CP system on and off the stray current issue is removed because the reading for 'off' potential is only being taken from the metallic coupon rather than the pipeline itself.

This process takes time and will only permit on and off readings at the time spent at the specific location, so it does not allow for a suite of data to be collected over a period of time.

The MiniLog allows the CP technician to visit each site just twice. Once to fit the device into the test post the same way as they would with their standard testing equipment, and once more to retrieve the equipment at the end of the trial. This trial would take place typically over a 48 hour period taking readings every few seconds to allow our team to see a complete and accurate picture of the CP effectiveness at the given location. The device doesn't require interrupters to be fitted as it takes the 'off' potential reading by disconnecting the coupon from the pipeline and therefore the CP system, much the same as the interrupters do in the more traditional method.

The benefits of using Minilog are that it not only switches between the pipeline and the coupon automatically without the need to travel to several locations, but it is also discreet enough to fit inside a standard CP test post and be left unattended for a period of time, allowing more definitive evidence to be collected.

The classification of CP defects where stray current is evident can only be done using interpretation by CP experts, so it is clear that by building up a larger catalogue of data over a longer period of time this interpretation will be far more reliable, and will undoubtedly be an effective way of categorizing areas where further investigation is required, or proving that the section of pipeline is within the CP protection limits set out in ECP2, the National Grid standard.

More time is required than was initially anticipated for the analysis and internal review before progressing to the last stage of work on this project.

Scope

The Minilog project is innovative as the product is capable of taking accurate readings over a period of time by switching between the CP system and the coupon installed beside the test post, this gives the potential for what were classed as defects to be re-classified as compliant or not under current CP guidelines (ECP2). The Minilog records true pipe to soil potential data, i.e. error free data, minimizing interference for detailed analysis by CP personnel to ascertain whether or not further investigation of possible defects is required. This will allow for many more defects to be quickly and safely closed and has the potential for significant business savings and increased security of supply.

Objective(s)

The objective of the project is to demonstrate and evaluate the benefits of the Minilog product.

This will enable National Grid to close out CP defects which have arisen following routine CIPS activities. There is currently a significant backlog of defects which require investigation, and manual investigation of these defects is not practical. Minilog would potentially prove the off-potential and effectiveness of the CP system by providing a larger catalogue of detailed data rather than relying solely on expert interpretation to confirm wether or not the readings require further investigation. This will also provide more effective working time across the team to improve overall performance.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be successful if the polarised potential of the sections of pipeline with stray current can be identified. This will allow for accurate, reliable, and consistent defect analysis of stray current defects.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project is a simple small scale project but with a clear potential to make significant cost savings and improvements to the CP system and how it is effectively managed.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will take place at various locations across the entire National Transmission System.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£20,000

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)

Potential savings = £186k

Please provide a calculation of the expected benefits the Solution

The project will be successful if the polarised potential of the sections of pipeline with stray current can be identified. This will either highlight the pipeline section as requiring further investigation, or could provide the data required for the section to be safely classified as compliant in line with ECP2.

The true cost savings provided by this project will not be clear until a trial period has been carried out and evaluated, however the savings are expected to be significant and almost instantaneous. There are currently in excess of 98 defects to be investigated at the time of writing this paper for which the use of Minilog could potentially prove the most effective method of initial investigation.

An estimate of these savings is as follows:

Method cost – use of MiniLog approximately £2k. This cost is based on two working days for one man; one to travel to site and fit the Minilog, and one to retrieve the Minilog once sufficient data has been collected. This is a worst case scenario depending on the geographic location of the pipeline under investigation. The higher cost amount includes appointing a contractor to install a coupon at the location if there is not already one installed. This equates to a total worst case scenario cost of around (98 x 2,000) £196,000.

Base Cost – In a near worst case scenario (worst case being pipeline leakage) the stray current could potentially be incorrectly classified as satisfactory, and subsequently allow corrosion to propagate to a level which would require excavation following routine In-Line Inspection, this could be several years after the incorrect classification of the CP defect. The cost of an ILI investigation varies between £10,000 - £200,000 depending on several factors such as the requirement for a pressure reduction prior to mechanical excavation, and the use of specialized technicians to investigate the corrosion and take appropriate action depending on its severity.

Assuming 50% of defects require excavation and an average of £78,000 per excavation is used.

Total costs = 98/2 *78,000 = £3,822,000

As previously stated; the only way of classifying stray current defects from CIPS data is through expert interpretation, so by collecting more data this classification can be carried out more accurately. For the purpose of this paper if an incorrect classification rate of 10%

is assumed, this will allow a potential cost saving figure to be calculated.

£3,822,000*0.1 = £382,200

Following the calculations above, the potential savings could be in the region of (382,200 – 196,000)= £186,200.

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

Minilog would be used across the NTS pipeline asset.

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

Following an investment of £20,000 through NIA funding, it is expected that another £20k would be required to roll out the technology if the NIA work is successful.

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 project will confirm whether the MiniLog system can deliver expected benefits for pipelines with cathodic protection.

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

The project is aligned to optimizing asset management within the Reliability theme.

☑ 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