Research, Development and Evidence Framework 2

PROPOSAL

Contractor's Name: NPL Management Limited

Call off Reference: RDE279

Sub-Lot Number: 3.1 (AQ analysis and expert services)

Date: 30/06/2023

1. Approach & Methodology

This proposal has been revised following further discussions with the Environment Agency. The Environment Agency decided that, due to budget restrictions and priorities, all requirements within Task 1 and Task 2 from Lot 3.1 were to be removed. The following therefore reflects requirements within Task 3, Task 4 and Task 5 from Lot 3.1. Furthermore, non-time costs associated with Travel and Subsistence have been removed, under the instruction that all meetings will be virtual. No budget has been allocated for report access. Any reports that need to be accessed to add value to the delivery of this project will be discussed and agreed with the Environment Agency at an additional cost to the project.

Task 3 - Specifications required for hydrogen monitoring techniques for anticipated locations and needs. (Lead: National Physical Laboratory)

The scope of the elements of the hydrogen system to be covered will be agreed at the start of the project, covering the main production/storage and use cases expected for the UK. A summary of the measurements required to determine hydrogen emissions from a set of key emission scenarios from this scope will be developed through the following sub tasks:

3.1 Agree characteristics to describe emissions and data requirements

A structured list of characteristics related to emissions and data requirements will be defined analogous to international activities around the regulation of methane emissions. This will ensure there is a common lexicon and framework in place to describe emissions and data requirements. This will include, for example:

Emission Scenarios:
- Physical characteristics
  - Size
  - Height
  - Type (point, area, component level etc)
- Leak parameters
  - Typical emission rate (rage)
  - Temporal: Constant, process (intermittent), unplanned, planned(maintenance)
- Related Functional element
  - Type of plant leak associated with (e.g., storage, process, compressor, etc)
- Data requirements
  - Purpose – e.g., reporting, leak repair
  - Timeframe (instantaneous, long-term average, time series)
  - Objective – locate leak, report site level emissions, etc
  - Determined Quantity – emission rate, concentration map etc
  - Uncertainty requirement

These characteristics will be defined to reflect parameters which will have a direct bearing on the capabilities that measurement technologies will need to have to measure these emissions to the accuracy required/specified. This activity will build on previous work NPL have undertaken to develop a taxonomic structure to characterize measurement needs, emission scenarios and measurement capabilities.

3.2 Characterize hydrogen emission scenarios

A list of typical emission scenarios based on the previous Fraser Nash report and other available literature, for hydrogen production, storage and an agreed list of use scenarios will be created. The emissions for these will be characterized according to the schema developed in 3.1. This will provide a taxonomy of hydrogen emission scenarios, with the key parameters of each emission assigned a typical value or range of values. The emissions scenarios will be grouped against typical infrastructure types, characterized as functional elements, a concept developed by NPL to characterize sub-site level component parts of an industrial site, grouped into spatial areas with common activities

3.3 Summarize Data requirements

The emission scenario landscape generated in 3.2, together with monitoring and reporting requirements, will be assessed to determine the data requirements arising from these cases. This will include characterizing a range of parameters defined in 3.1 including constraints on monitoring capabilities and quality assurance and uncertainty requirements.

3.4 Review potential methods for addressing monitoring requirements.

The combination of emission characteristics and measurement requirements developed in 3.2 and 3.3 will provide a landscape against which to assess the applicability of available measurement capabilities. The applicability of different types of monitoring methods available for hydrogen will be assessed against these requirements, to enable a specification for monitoring for different function elements to be developed. To carry out this task NPL will draw in its experience in monitoring methane emissions from the natural gas supply chain and other industrial sources, together with the emission taxonomy approach developed for methane monitoring. The potential for these methods to inform the development of UK Best Available Techniques (BAT) will be discussed with the EA.

Task 4: Summary of specifications and TRLs of existing hydrogen monitoring techniques (Lead: National Physical Laboratory)

NPL will review available commercial or near to market hydrogen emission measurement technologies, which are potentially able to address the measurement requirements defined in Task 3. This will include techniques which use a surrogate for hydrogen concentration measurement to assess the emissions – including acoustic and other measurement-based approaches. This work will build and leverage previous reviews of hydrogen measurement technologies undertaken by NPL and will include a literature review and assessment of instrumentation available from instrument suppliers. The capabilities, specifications and the TRL (focusing on TRL 7 and above) of the techniques will be summarized and commercial examples of technologies will be identified, together with likely cost (categorised into bands). The range of technologies will include those that work within air, and techniques that could be used to detect emissions within soil/subsurface and within water. Information on performance characteristics of the methods will be obtained where available. The range of performance characteristics will be based on those used by NPL to characterize methane emission monitoring methods and will be designed to support future standardization through MCerts performance specifications or through BS EN 15267 style performance testing, and to support future development of British Standards for hydrogen monitoring. A taxonomy of technologies will be prepared categorizing the different techniques identified by suitable typologies and including the available performance characteristics and an assigned TRL. They will be compiled as a spreadsheet or other suitable electronic form. A meeting (online or in person) will be held with the EA to discuss the findings.

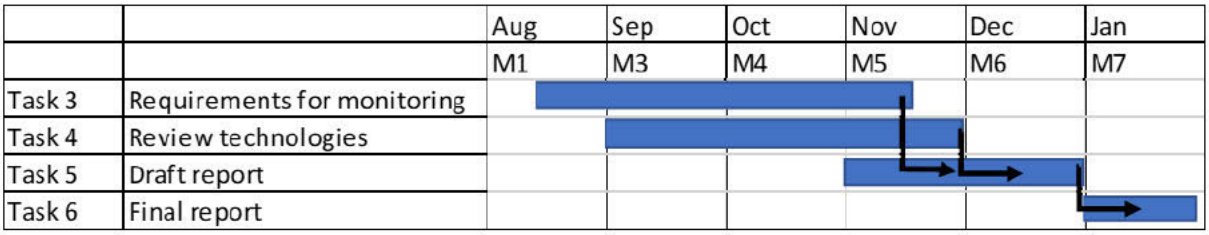
Task 5: Technical report (Lead: National Physical Laboratory)

The above summaries will be compiled into a technical report.

Note – the scope of Tasks 3, 4 and 5, will be limited to what is achievable within the time-costs associated with each Task, provided within Section 3 and Section 7.

2. Project Management (inc Project plan). A project plan may be provided as an attachment with your reply (delete if not required)

NPL's management processes are ISO9001 accredited. NPL operate a project management process and procedure (QPNPL/B/004 NPL Project Delivery Framework) to deliver all our projects. This ensures the appropriate level of management and oversight of all our work. The project will be managed by a project manager, the grade and experience of the project manager assigned to lead the project will be defined by a quantitative assessment of the level of risk of the project. The project manager will be supported by the project sponsor and delivery team. The project manager will chair monthly project reviews with the delivery team of the project addressing all the administrative, contractual and financial matters including taking decisions related to the contractual execution such as: requesting contract changes or re-negotiation, reallocation of works, responsibilities and resourcing and settlement of issues arising. The Project Manager will manage the project's risks to ensure timely and effective delivery of the scientific and technical objectives and deliverables. All risks will have a clearly identified owner and planned clearance date and will be managed in accordance with NPL's risk management procedure (QPNPL/B/008 Business Risk Management). The progress of the project in terms of costs, quality and time will be monitored continuously and reported internally at NPL via RAG (red-amber-green) reporting. Any issues arising during the delivery that cannot be addressed by the delivery team or Project Sponsor will be escalated for resolution though, in order: (1) NPL's departmental project portfolio review meetings or direct communication to the Departmental Head, (2) NPL's Operations Directorate's Sales and Operational Planning review meetings, (3) NPL's top-level Business Committee. NPL will report progress on monthly meetings and weekly emails as required by the Contract. The work plan for the project is as follows:



3. Proposed Staff who will do the work and briefly state previous relevant qualification/experience. Contractors experience of undertaking similar projects and accreditations (if requested).

The National Physical Laboratory (NPL) is the United Kingdom's National Metrology Institute, an internationally respected and independent Centre of excellence in research, development and knowledge transfer in measurement and materials science. Annually, it delivers over £75M of research and knowledge transfer programmes. Its resources include over 450 technical and scientific experts, spanning a wide range of disciplines; 36,000m² of laboratories and many unique facilities. The Emissions and Atmospheric Metrology Group (EAMG) has over 30 years of making environmental measurements from industrial processes and ambient environments. It has a comprehensive suite of tools for assessing fugitive emissions and a proven track record of providing traceable measurements. NPL's delivery of this project will be led by Principal Research Scientist, [redacted] Senior Research Scientists [redacted], and Higher Research Scientists [redacted] and [redacted]

[redacted] is technical lead for emissions related projects in EAMG and will provide technical oversight and quality review for this project. [redacted] has over thirty years' experience with NPL, covering many aspects of environmental monitoring. He is science lead for emissions research activities in the Emissions and Atmospheric Metrology Group and a recognised international expert in emissions monitoring methods. [redacted] is experienced in the development of international standards defining BAT for monitoring, he has been involved in drafting a number of ISO and CEN standards. [redacted] is Chairman of CENTC264, the CEN Committee for Air Quality which is responsible for the development of the European reference emissions monitoring methods. He is also convenor of three CEN TC 264 working groups (WG9, WG23 and WG38) and an active member of a number of other WGs and is chair of the UK BSI mirror group EH/2.

[redacted] has ten years' experience in scientific research and 5 years' experience in emissions measurement. Having completed a PhD in Atmospheric Chemistry, [redacted] has a comprehensive background knowledge of both the physical and chemical properties of the Earth's atmosphere. As an experienced laser user, [redacted] joined NPL's DIAL team as an optical systems expert in 2016. At NPL, [redacted] has partaken in

numerous campaigns and has accumulated over 100 days of experience in the field. In addition to his role as a DIAL team member, [redacted] has been the technical lead for projects to further develop a long-term technique for monitoring methane emissions. As part of this project, [redacted] has developed skills in atmospheric dispersion modelling and reverse dispersion modelling. Neil is also an experienced OGI user who has both co-ordinated and partaken in various validation studies, testing technology against the US EPA's OOOOa standard. [redacted] PhD is an applied nuclear physicist with 25 years of experience in analytical techniques applied to industry, environment, hydrology and geochemistry. Expert in X-ray techniques, SEM, ICPMS, ICPOES, AA and nuclear spectrometries. Specialized in monitoring and modelling the dispersion of radioisotopes, heavy metals and other pollutants. Specific experience in the development of analytical methodologies for complex samples (trace analytes, complex matrices, dynamic systems, spectral or chemical interferences, among others).

[redacted] is a higher scientist with experience in the design, build and testing of lasers and the management of laser laboratories. [redacted] has acted as the lead expert for the systems engineering assessments for the military utility of systems and concepts. [redacted] has managed several programmes from the initial scoping and definition phases through to detailed design, development and field trials.

Employee CVs can be made available upon request.

	National Physical Laboratory (NPL)			
3	[redacted]	[redacted]	[redacted]	3
3	[redacted]	[redacted]	[redacted]	10
3	[redacted]	[redacted]	[redacted]	10
4	[redacted]	[redacted]	[redacted]	3
4	[redacted]	[redacted]	[redacted]	5
4	[redacted]	[redacted]	[redacted]	15
5	[redacted]	[redacted]	[redacted]	1
5	[redacted]	[redacted]	[redacted]	3
5	[redacted]	[redacted]	[redacted]	5
Project Management	[redacted]	[redacted]	TBC	2

4. Risk

Note: *This section is to be used to detail any risks relevant to the project i.e. Programme deliverable dates, data, consultees etc.*

ID	Risk	Mitigation(s)	Severity (1-5)	Likelihood (1-5)	Score (1-25)
1	Sufficient information on emission measurement scenarios not available	Previous work and extensive knowledge base on emissions from natural gas, together with links to other hydrogen based activities provides basis to derive information on hydrogen measurement scenarios.	4	2	8

2	Lack of available hydrogen measurement technologies	Previous work has identified candidate technologies that are expected to be at suitable TRL levels during this project. Identification of gaps in capability is a valuable output.	3	3	9

5. Health & Safety (only complete if requested in defined evaluation criteria)

6. Sustainability (only complete if requested in defined evaluation criteria)

As this project is largely desk-based, we do not anticipate any negative sustainability impacts resulting as a direct result of the work within this project.

In-general, NPL are actively working to improve on our Environmental Policy. The Sustainability Team at NPL is working on the development of a Sustainability Strategy, building on the circular economic model which aims to achieve high levels of sustainability and align with the environmental goals set out by the Government.

7. Cost Proposal
Please use day rates, including any applicable discounts, as agreed under the framework contract. A full cost schedule may be attached to support the costs summarised below.

Task No.	Name	Framework grade	Day rate	No. of Days or part thereof	Cost
3	[redacted]	[redacted]	[redacted]	3	[redacted]
3	[redacted]	[redacted]	[redacted]	10	[redacted]
3	[redacted]	[redacted]	[redacted]	10	[redacted]
4	[redacted]	[redacted]	[redacted]	3	[redacted]
4	[redacted]	[redacted]	[redacted]	5	[redacted]
4	[redacted]	[redacted]	[redacted]	15	[redacted]
5	[redacted]	[redacted]	[redacted]	1	[redacted]
5	[redacted]	[redacted]	[redacted]	3	[redacted]
5	[redacted]	[redacted]	[redacted]	5	[redacted]
Project Management	TBC	[redacted]	[redacted]	2	[redacted]
				Total Staff Costs	[redacted]
Expenses (please detail type i.e. travel, accommodation etc.)		Budget reserviced for paid access to useful technical reports			[redacted]

Total Expenses Costs [redacted] **Overall Costs**	£47,542
By signing this form NPL Management Limited agree to provide the services stated above for the cost set out in your Cost Proposal and in accordance with the Research, Development & Evidence Framework 1 Conditions of Contract.	
Contractor Project Manager:	TBC (NPL only assign a Project Manager once project award notification has been received). Project Managers do not have the delegated authority to sign off proposals
[redacted] **Signature:**	[redacted]
Date:	31/07/23

3.0 Order Form

3.1 The following document is to be completed by the Contracting Authority and sent to the Contractor for counter signature to form a Call-Off contract.

Research, Development and Evidence Framework 2 **ORDER FORM**
To be completed by Contracting Authority Project Manager and sent to Contractor for countersignature. PLEASE INCLUDE ENTIRE DOCUMENT
Project title: Hydrogen Leakage **Call off Reference: RDE279** **Atamis project ref (if applicable): N/A** **Date: 31/07/2023**

THE Contracting Authority: Environment Agency, Horizon House, Deanery Road, Bristol, BS1 5AH

THE CONTRACTOR: National Physical Laboratory, Hampton Road, Teddington, TW11 0LW

[Contracting Authority guidance: This Order Form, when completed and executed by both Parties, forms a Call-Off Contract. A Call-Off Contract can be completed and executed using an equivalent document or electronic purchase order system.

APPLICABLE FRAMEWORK CONTRACT

This Order Form is for the provision of the Call-Off Deliverables and dated 31/07/2023. It's

issued under the Research Development & Evidence Framework Agreement reference 30210 for the provision of project number RDE279: Hydrogen Leakage.

CALL-OFF SUB-LOT: 3.1 (AQ analysis and expert services)

CALL-OFF INCORPORATED TERMS The following documents are incorporated into this Call-Off Contract. Where numbers are missing we are not using those schedules. If the documents conflict, the following order of precedence applies:

1. Defra Framework Terms and Conditions;
2. Request for Proposal;
3. Proposal;

No other Supplier terms are part of the Call-Off Contract. That includes any terms written on the back of, added to this Order Form, or presented at the time of delivery.

CALL-OFF CONTRACT START DATE: 31/07/2023

CALL-OFF CONTRACT EXPIRY DATE: 31/01/2023

CALL-OFF PERIOD: 6 months

For and on behalf of the Supplier: For and on behalf of the Buyer:

Signature: [redacted] Signature: [redacted]

Name: [redacted] Name: [redacted]

Role: [redacted] Role: [redacted]

Date: 01/08/2023 Date: 31/07/2023