Guide 4: Writing Joint Research Projects (JRPs)

Important information about these documents

This call is being held ahead of any agreement from the Commission that relevant funding will be available. At present the relevant legislation is still under discussion in both Council and Parliament, and there is no certainty on the detailed arrangements for funding selected projects. The funding of any selected project, and the terms and conditions of participation in the projects, are dependent on completion of the legislative process and the subsequent contractual processes between the European Commission and EURAMET. Potential proposers act on this information at their own risk.

Background

Last year, EURAMET submitted a draft proposal to the EC for a further research programme to be established under article 185 of the Treaty on the Functioning of the European Union (TFEU) to follow on from EMRP and EMPIR. This was published by the EC at https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/european-partnerships-horizon-europe/candidates-digital-industry-and-space_en.

The initiative would be called the European Partnership on Metrology and would aim to create, by 2030, a sustainable and effective system for metrology at European level that ensures Europe has a world-class metrology system that:

- Provides metrology solutions, fundamental metrological reference data and methods, offering fit-for-purpose solutions supporting and stimulating European innovation and responding to societal challenges.
- Supports and enables effective design and implementation of regulation and standards that underpin public policies that address societal challenges.

The Commission commissioned an impact assessment into this proposal and 11 others in similar priority areas, and, based on those findings, published their own proposal for the Partnership, their response to the impact assessment and a draft of the Decision on 23rd February 2021. See:

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:89:FIN

https://ec.europa.eu/commission/presscorner/detail/en/ip_21_702

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021SC0035&qid=1614677899327

That draft Decision is currently under discussion in the European Council and the European Parliament.

Under the assumption that the Council and Parliament pass the basic act which would form the legal basis for this research programme, and that the participating countries named in the Draft Decision submit the required commitment letters, EURAMET is publishing these potential Selected Research Topics and draft guidance notes. These documents are not approved by the Commission nor will they lead to a binding decision by EURAMET e.V. for any further negotiation or funding. All published guides and templates are subject to amendment by the EC and EURAMET e.V. as further information becomes known.

CONTENTS

If you require further help or guidance after reading this document, please contact the helpdesk

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1 Scope

This document provides guidance on how to write a Joint Research Project (JRP) proposal under a potential European Partnership on Metrology Call. It should be noted that this information is provisional and subject to updates and change. It includes information on how to complete the templates and submit your proposal, and examples to help you write your proposal.

It does not include information on:

- eligibility, this is described in Guide 1: Admissibility and Eligibility for Partnership Calls
- resourcing and costing a proposal, this is described in Guide 5: Submitting Administrative Data for Partnership Projects
- the evaluation process for a proposal, this is described in Guide 6: Evaluating Partnership Proposals

2 Submission

You should submit your JRP proposal electronically via the Call webpages https://msu.euramet.org/calls.html before the Call deadline. For each complete proposal, the following documents must be combined as a single ZIP file and submitted:

1. Template 4: JRP protocol (required)
2. Template 5: Project Administrative Data (required)
3. Form 4a: Ethics issues self-assessment (required)
4. Form 4b: Security issues self-assessment (required)
5. Annex to Form 4a (requirement dependent upon the answers in Form 4a)
6. Letters of support (optional**). These should be collated together as a single unsecured pdf file, which should not exceed 6 MB in size. Letters of support should be from key stakeholders, not EURAMET TCs or EMN chairs, and the maximum number of letters of support that may be submitted is 20. The letters of support MUST include a cover page with a table which states each organisation providing a letter of support and the name of the signatory. Please note that letters of support submitted in an unsuitable format will not be provided to the referees by EURAMET.

** *While a letter of support from the Chief Stakeholder for Pre- and Co-Normative proposals is not a formal eligibility requirement, their expressed need sets the context for the evaluation of the proposal. Therefore, a letter from the Chief Stakeholder explaining that need, how their organisation will make use of the outcomes from the research, and confirming that they will be consulted regularly by the consortium during the project to ensure that the planned outcomes are still relevant, is very important information for the referees.*

This document includes page limits for some sections of your JRP proposal; the referees will be instructed to ignore any text over these limits.

If you wish to make corrections or amendments, you should resubmit a complete set of documents as a new ZIP file via the online submission system, indicating the original submission reference number.

Proposers should note that no other documents, other than those listed above, should be submitted, and any that are, will not be passed to the referees by EURAMET.

3 Participants

JRPs may include four types of project participant

1. Internal Funded Partner(s)
2. External Funded Partner(s)
3. Unfunded Partner(s)
4. And rarely, Affiliated Entities (previously known as Linked Third Parties)

If you think you will need to include an Affiliated Entity, please email EMPIR.msu@euramet.org and contact the EURAMET Management Support Unit (MSU) for advice.

The eligibility criteria for each type of participant are described in Guide 1: Admissibility and Eligibility for Partnership Calls. EURAMET will also make further checks to establish eligibility prior to issuing contracts.

Please note that for Pre- and Co-Normative Calls, EURAMET encourages proposals that include representatives from industry, regulators and standardisation bodies actively participating in the projects. The proposal must also name a “Chief Stakeholder”, which is not a member of the consortium, but a representative of the user community that will benefit from the proposed work. The “Chief Stakeholder” should write a letter of support explaining how their organisation will make use of the outcomes from the research, be consulted regularly by the consortium during the project to ensure that the planned outcomes are still relevant and be prepared to report to EURAMET on the benefits they have gained from the project.

In summary, for Pre- and Co-Normative Calls a “Chief Stakeholder” is expected to:

1. Provide input to the project
2. Monitor the project's progress to ensure that the work that is being carried out matches the stakeholder needs and the market demand
3. Be ready to take up the output(s) of the project which are expected to benefit their organisation.

Please note that after the end of the project “Chief Stakeholders” may be contacted by the EURAMET MSU regarding the impact the project has had on their organisation.

4 Completing the JRP protocol

All sections of Template 4: JRP protocol are mandatory, unless otherwise stated, and should be completed as detailed in the sections below.

The page limits given for a section MUST be adhered to using single line spacing and Arial font size 10 for the body text (text in the activity tables should be 9 pt, whilst other tables may be 9 pt or 8 pt). If the page limits are exceeded (for a section) then referees will be asked to disregard the text/information that is over the page limit. The mandatory page limits are summarised in the table below:

Section or sub-section	Maximum length
B1: Summary of the project	3.5 pages
B2.e Gender dimension	1 page
B2.f Open science	1 page
B2.g: Research data management and management of other research outputs	1 page
B3.a: Projected outcomes for industrial and other user communities	1 page
B3.b: Projected outcomes for the metrological and scientific communities	1 page
B3.c: Projected outcomes for relevant standards	1 page (excluding the table)
B3.d: Projected wider impact of the project	1.5 pages
B4.a: Overview of the consortium	1.5 pages for up to 15 partners, 2 pages for up to 20 partners, 2.5 pages for up to 25 partners

4.1 Title page

Please complete and remove the <>, and ensure that the data is consistent with that in Template 5: Project Administrative Data. The JRP proposal number and title must be the same as the published SRT number and title. If your proposal is selected for funding it will be issued with a new JRP number and you may revise the title during grant preparation (if required). You should include a proposed short name/acronym for your JRP (a maximum of 13 characters including spaces) and ensure that the proposed short name is consistent between Template 4: JRP protocol and Template 5: Project Administrative Data.

Please do **not** delete the automatic footers from Template 4: JRP protocol, Form 4a or Form 4b.

4.2 Glossary

A Glossary is optional and, if required, should be included before the table of contents.

4.3 Section A: Key data

4.3.1 Section A1: Project data summary and Section A2: Financial summary

In order to help proposers capture the necessary data, reduce duplication of data, and minimise errors, EURAMET have created Template 5: Project Administrative Data (an Excel workbook). The data entered in Template 5 automatically populates a number of worksheets containing tables that you should copy and paste into Section A1 and Section A2 in Template 4: JRP protocol.

Pasting tables from Template 5 into Section A1 and Section A2 in Template 4: JRP protocol		
Template 5 Worksheet	**Template 4: JRP protocol Section A tables**	**Notes**
A	Section A1 Coordinator contact details	Select the right hand column inside the table and copy. Ctrl V or Paste Special as "Formatted Text". Do not paste as "Picture".
A	Section A1 Chief Stakeholder contact details *** only for Pre- and Co-Normative proposals*	For Pre- and Co-Normative proposals select the right hand column inside the table and copy. Ctrl V or Paste Special as "Formatted Text". Do not paste as "Picture". For all other proposals the 'Chief Stakeholder' table and heading should be deleted.
B	Section A1 Participant details	Select the area inside the table and copy (excluding the column and row headings). Ctrl V or Paste Special as "Formatted Text". Do not paste as "Picture". Please delete any empty rows in the tables. If your project does not include Affiliated Entities (previously known as Linked Third Parties) then "table b. Affiliated Entities" should be deleted.
C	Section A2 Financial summary	Select the area inside the table and copy (excluding the column and row headings). Ctrl V or Paste Special as "Formatted Text" those cells that include data. Do not paste as "Picture" or re-paste the column or row headings. If your proposal includes any subcontracting, include one or two sentences under the A2 table explaining what will be subcontracted and why.

4.3.2 Section A3: Work packages summary

The information should be consistent with the work packages in Section C of Template 4: JRP protocol and the "WP months data entry" worksheet in Template 5: Project Administrative Data.

If your project includes an Affiliated Entity you must include the following sentence under the work packages summary table "Some of the staff working on the project at YYY are employed by the Affiliated Entity NNN. NNN will provide N months of labour resource overall to this project in WPX, WPY and WPZ. This resource is included in the table above." and you must identify the number of person months the Affiliated Entity will provide to each WP.

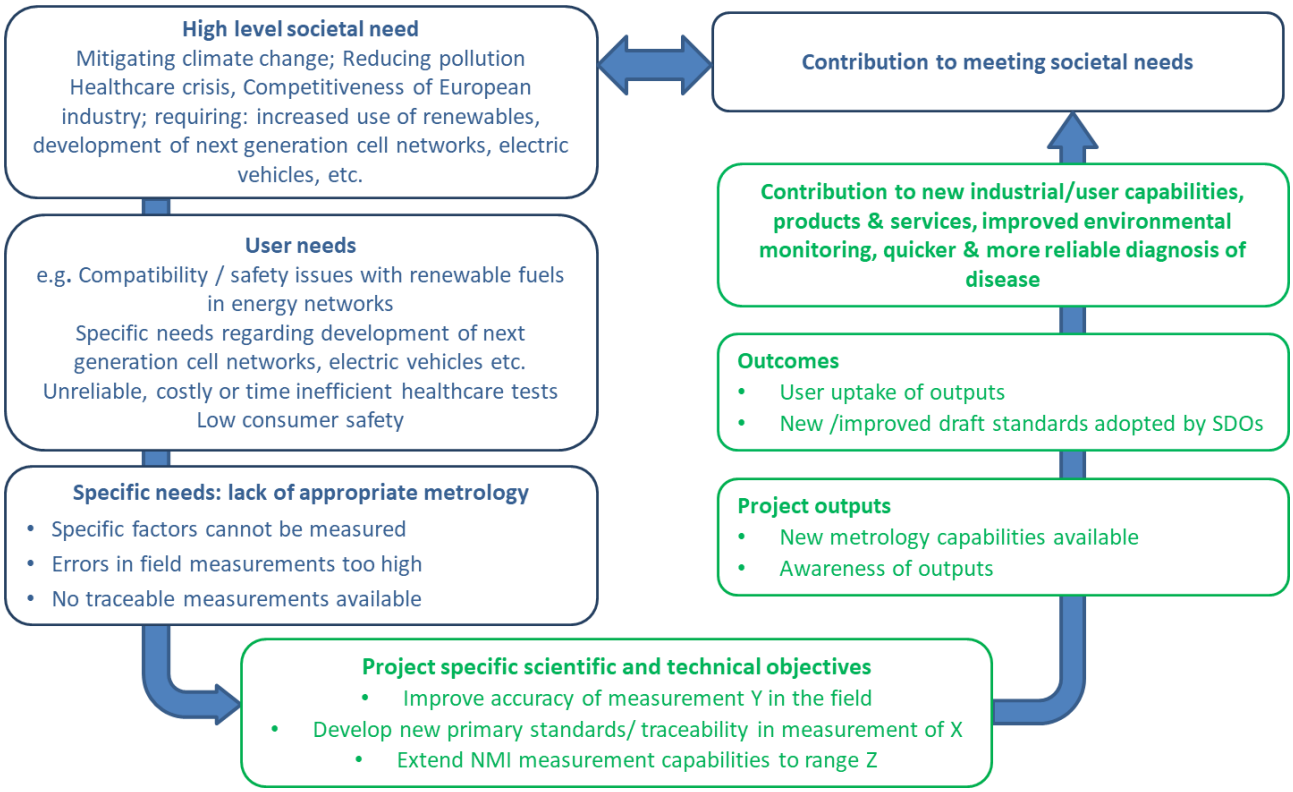
4.4 Section B: Overview of the research

Section B should be used to explain how your project addresses each of the 3 evaluation criteria ("Excellence", "Impact" and "Quality and Efficiency of the Implementation"). Proposers should therefore take note of the evaluation criteria (see 7.1).

Section B should tell a coherent story about the proposed project which should follow a logical flow from the high-level needs (e.g. to contribute to mitigating climate change, improve productivity in sector X), through to the specific user needs (problems encountered in specific types of companies or public agencies) that need to be addressed, through into the objectives of the project and the project outputs, then explain how the project's outputs will be used to generate the outcomes addressing the stakeholders' needs, and how this will subsequently contribute to addressing the top level needs or drivers (see diagram below). The links between

these different aspects should be clearly explained and the outcomes and benefits you describe should be specifically attributable to the outputs and aims of the project.

Please do not include any photographs in Section B. Diagrams should only be included if absolutely necessary and should be limited to one or two schematic diagrams. In addition, do not include lists of references in Section B. Lists of references should only be included in Sections E and F, as appropriate (see 4.12 and 4.13) and should not be included as footnotes in any section.



4.5 Section B1: Summary of the project

This section should be aimed at a non-specialist audience and must cover the need for the project, its objectives, its key technical outputs (what it will achieve), and the wider benefits to end users and society (who will be using the outputs, how will they be used and what difference this will make). The summary of the project should be a standalone and self-contained summary that can be read and understood without reading any other sections from the proposal.

The summary of the project should be no more than 3.5 pages in length and should have the following subsections with subheadings:

Subsection	Content
Overview (50-100 words)	This section should explain in three to five sentences the purpose of the project. It should provide a high-level overview of the project including the overall need, how the project will address this need and its measurement challenge(s), and the project's key outputs.
Need (150-300 words)	This section should explain why the project is being undertaken, but not the activities that will be carried out in the project. It should clearly explain (to a non-specialist audience) why improved measurements are needed and who needs them. It should clearly link to the project's scientific and technical objectives and explain the need for each of them. Where relevant, refer to European legislation, documentary standards, technology roadmaps etc. Your description should follow a logical flow from the high-level needs, through to the specific user needs that needed to be addressed via improved measurement capabilities. For example:

Subsection	Content
	• State the high-level societal need for the project, such as improving the competitiveness of European industry, mitigating the effects of climate change, or tackling global health issues. • Describe the overall need(s) of the end-users in simple language, such as new product development, improved process control, or compliance with regulation(s). Explain the specific measurement needs/problems faced by end-users, such as particular variables that cannot be measured, or problems caused by a lack of traceability.
Objectives (150-300 words)	This section presents the objectives (including the impact objective) in bulleted format for the project. These objectives should be the same as or align with those described in Section B2.a. To provide some context for the objectives, please begin with the overall objective of the project in one simple sentence prior to the bulleted objectives.
Progress beyond the state of the art and results (300-500 words)	This section should describe how the project will progress beyond the state of the art and the expected final technical outputs (results) of the project. This should be done for each objective (except the impact objective). If your JRP directly continues and develops the work undertaken in a previous project, please summarise the conclusions from that project.
Outcomes and Impact (400-1000 words)	This section should describe the impact the project is expected to have and the route from project outputs to impact. To do this please explain how the project will make a tangible contribution to addressing specific user needs (who the expected end users will be) and how this will in turn contribute to wider and longer-term impacts. The section should have the following subsections: • *Outcomes for industrial and other user communities* Summarise how relevant user communities e.g. in industry and in the public sector plan to uptake, exploit and use research outputs (e.g. new measurement capabilities, reference standards, devices, new knowledge, etc.). The text can be based on Section B3.a. • *Outcomes for the metrology and scientific communities* Summarise the direct effect your project will have on the metrological and scientific communities e.g. significant advances in the SI system or proposed changes to NMI/DI Calibration and Measurement Capabilities. The text can be based on Section B3.b. • *Outcomes for relevant standards* Summarise the impact your project will have on new or existing documentary standards that support the creation of the wider impacts. The text can be based on Section B3.c. • *Longer-term economic, social and environmental impacts* For the wider impacts, please explain the economic, social and environmental impact that your project will make across Europe (and internationally). You should provide details of who will benefit from the project, and which aspects of the project, stakeholder groups will benefit from. The text can be based on Section B3.d.

Please note that a preliminary Publishable Summary will be required for successful proposals and EURAMET will ideally use the summary in section B1 for that purpose. You should therefore exclude any confidential material, and references to the SRT and letters of support from the summary. The Publishable Summary will not include a list of references nor a glossary, hence any key reference documents should be detailed in full in the summary and any abbreviations should be explained.

Example B1: Summary of the project (Industry project)

Overview
Industries such as power plants, cleanroom technologies, petrochemical and pharmaceutical production and the storage of nuclear and toxic wastes, rely on absolute, positive and negative gauge pressure measurements in the intermediate range in order to support innovation, efficiency and safety in industrial production and processes, however this often pushes beyond the uncertainties and traceability available from the current measurement capability. The overall aim of this project is to enable the SI traceable measurement of absolute, positive and negative gauge pressure in the intermediate pressure range from approximately 1 Pa to 10^4 Pa. This project will include the production of primary and transfer standards for dissemination of the pressure scale and the development of appropriate calibration methods for high-accuracy state-of-the-art pressure devices in order to establish a calibration service in this pressure range.

Need
SI traceable measurement of absolute, positive and negative gauge pressure in the intermediate range is important for industries such as power plants, cleanroom technologies, petrochemical and pharmaceutical production and the storage of nuclear and toxic wastes. Reliable, accurate, traceable pressure measurements are needed for such industries as they are subject to strict international requirements with respect to safety, precision, sterility and performance. Therefore, to ensure traceability of measurements with

sufficient accuracy to meet the demands of industry, high-accuracy primary standards for disseminating the pressure scale in the intermediate range (from approximately 1 Pa to 10^4 Pa) need to be developed.

Low absolute, differential, positive and negative gauge pressure measurements all play a vital role in numerous industrial processes that demand high accuracy of positive and negative gauge pressure measurements at all stages of the traceability chain. Conventional calibration procedures applied to instruments for low differential pressures are also extremely dependent on weather conditions, especially the stability of atmospheric pressure; and often the target uncertainty level cannot be achieved. Therefore, alternative calibration approaches and techniques to ensure a constant low uncertainty, independent of ambient conditions need to be developed.

Further to this, the EU mercury strategy includes a comprehensive plan addressing mercury pollution both in the EU and globally. In addition, the amendment of Annex XVII to Regulation (EC) No 1907/2006 by the Commission Regulation (EU) No 847/2012 on 19/9/2012 restricts the use of mercury in barometers and sphygmomanometers for industrial and professional use from 10 April 2014. Measurement approaches therefore need to be developed that will support the replacement of primary mercury manometers which are still in use in many research institutions and reference laboratories.

Objectives

The overall goal of this project is to enable the SI traceable measurement of absolute, positive and negative gauge pressure in the intermediate pressure range from approximately 1 Pa to 10^4 Pa with an accuracy level of $3\times10^{-5}\ p + 0.005$ Pa in order to increase the efficiency of industrial productions and processes. The specific objectives of the project are:

1. **To develop and characterise primary and transfer pressure standards -** for the realisation and dissemination of the pressure scale in the intermediate range 1 Pa to 10^4 Pa. This will enable comparisons with both primary high pressure standards, e.g. dead-weight pressure balances and liquid column manometers, and primary vacuum standards, usually static and continuous expansion systems.
2. **To develop calibration methods for positive and negative gauge pressure standards in the range from approximately -10^5 Pa to 10^4 Pa** - in order to reduce the uncertainty of the pressure calibration down to $3\times10^{-5}\ p + 1$ Pa independent of variable ambient conditions, and in industrial conditions to better than $2\times10^{-4}\ p + 3$ Pa. This will enable accurate calibrations with a high level of accuracy that is independent of variable ambient conditions.
3. **To meet the EU restrictions of mercury use in measuring devices (barometers)** - replacement of primary mercury manometers with alternative pressure standards.
4. **To establish a calibration service in the range of approximately -10^5 Pa to 10^4 Pa of gauge pressure and approximately 1 Pa to 10^4 Pa of absolute pressure** – with an accuracy level sufficient for accredited calibration laboratories and industrial companies. This will be achieved by the development of state-of-the-art pressure measurement instrumentation such as force-controlled piston gauges with a resolution of 1 mPa.
5. **To engage with industries that utilise pressure in the intermediate range 1 Pa to 10^4 Pa** - facilitating the uptake of the technology and the measurement infrastructure developed by the project.

Progress beyond the state of the art and results

Primary and transfer pressure standards for dissemination of the pressure scale in the intermediate range

Primary pressure standards - dead-weight pressure balances and liquid column manometers - enable the pressure unit to be established in terms of the SI units kilogram, metre and second and traceability to be disseminated. The lower operating range of the dead-weight pressure balance is limited to approximately 5 kPa. The lowest pressure accurately measured with mercury manometers is approximately 1 kPa. Oil is an advantageous alternative to mercury due to its low density, low vapour pressure and much better stability of the free surface, but is not widely used because of a relatively large variation of the oil density with pressure. The project will go beyond this by the *in situ* measurement of oil density in a novel oil micromanometer.

New force-balanced piston gauges (FPGs) allow gauge and absolute pressures to be accurately measured from 15 kPa downwards to zero, but have only been used as secondary standards so far. This project will go beyond this by developing appropriate 3D flow models taking into account the molecular properties of gas. By combining these models with dimensional measurements carried out on piston-cylinders, for the first time their effective area will be determined as a function of variable pressure conditions. In this way the FPGs will be characterised as primary pressure standards.

Calibration methods for positive and negative gauge pressure standards in the range from approximately -10^5 to 10^4 Pa

To solve the problem of limited accuracy pressure calibrations due to unstable ambient conditions, new procedures and techniques will be developed for low differential pressures calibrations. This will reduce the calibration uncertainty down to $3\cdot10^{-5}\times p + 1$ Pa independent of variable ambient conditions and which will benefit accredited and industrial calibration laboratories.

EU restrictions of mercury use in measuring devices (barometers)

Mercury manometers are operated by very few European NMIs nowadays, but are still used by numerous calibration, industrial and research laboratories. European Commission Regulations restrict the use of mercury in barometers and sphygmomanometers for industrial and professional use. This project will enable users of mercury-containing pressure devices to meet the restrictions on the use of mercury in pressure measurements by identifying and evaluating alternative approaches. Within the project, two strategies will be followed: firstly investigation of alternative standards based on refractometry techniques, and secondly comparisons between mercury-containing and existing mercury-free pressure standards. The comparisons will be used to specify conditions and methods with which the alternative pressure standards have comparable or even better measurement capabilities than those of mercury manometers.

Calibration service in the range of approximately -10^5 Pa to 10^4 Pa gauge pressure and approximately 1 Pa to 10^4 Pa absolute pressure

Advanced FPGs, which accurately measure pressure in the range 15 kPa downwards to zero, can only be calibrated against dead-weight pressure balances or mercury manometers at pressures above a few kilopascals. Below these pressures, there are no alternative pressure standards. Therefore, by developing new reference pressure standards and calibration methods an adequate calibration service in Europe will be provided by this project. Currently, the traceability for industrial calibration services in the range of

approximately -10^5 Pa to 10^4 Pa gauge pressure and approximately 1 Pa to 10^4 Pa absolute pressure is insufficient. Thus, this project will develop a calibration service better than $2 \cdot 10^{-4} \times p$ + 3 Pa under industrial conditions.

Outcomes and Impact

The project will impact many industries such as power plants, cleanroom technologies, petrochemical and pharmaceutical production, and the storage of nuclear and toxic wastes. It will also improve the reliability and accuracy of low gauge, differential and absolute pressure measurements at NMIs, accreditation laboratories and with end users.

Outcomes for industrial and other user communities

The project will establish a new primary standard and support the dissemination of the pressure scale in the intermediate pressure range 1 Pa to 10^4 Pa. This will improve the reliability and accuracy of low gauge, differential and absolute pressure measurements at many levels from NMIs, to accredited commercial laboratories, to the end users. This traceability is the basis for more accurate pressure measurement (e.g. for the cleanroom technologies and processes) and will allow realisation of tighter tolerances of non-equilibrium conditions and, as a consequence, reduce energy consumption and costs without the loss of safety, sterility and precision. The costs of operations involving toxic and nuclear materials as well as the storage of environmentally dangerous toxic and nuclear wastes should also be reduced, and the safety of these processes increased.

The project will also establish an improved calibration service that will provide end-users with access to calibrations in the range 0 Pa to 15 kPa absolute pressure with uncertainties at the level $3 \cdot 10^{-5} \times p$ + 5 mPa. Such conditions will be beneficial for example for more efficient and safe use of airspace by aircraft and will provide access to improved capabilities for national and accredited laboratories in Europe and support consistency in measurement capabilities.

The project's outcomes will be disseminated to calibration laboratories and industrial stakeholders such as manufacturers of pressure measuring devices by organising workshops and presenting the project's results at conferences and in scientific journals. At least one international and one national workshop aimed at collaborators and stakeholders will be organised by the project for the measurement and traceability issues in the gauge and absolute pressure ranges below 15 kPa, improvement of pressure measurement accuracy under variable ambient atmospheric conditions and industrial environment. Knowledge will also be disseminated to end users through training courses and an advisory group consisting of industrial stakeholders will be established and will meet regularly to exchange information with the consortium and to ensure that the project is delivering relevant outputs and information for end users. The participation of industrial partners in the project will also help to align the project with industrial needs.

Outcomes for the metrological and scientific communities

Based on the project's results, a recommended *mise en pratique* for assuring traceability in the range 1 Pa – 15 kPa using FPGs in both absolute and gauge mode will be developed. This will create a large impact on calibration laboratories and will be presented to the accreditation authorities in Europe as well as to end users and manufacturers of FPGs.

In the area of FPGs, knowledge transfer from experienced NMIs to those less experienced on how to use these new types of instruments will be very beneficial. On a broader scope, the project will strengthen the collaboration of European NMIs and will increase their competitiveness and consistency by producing a draft calibration guide for the use of FPGs in both absolute and gauge mode (to be submitted to EURAMET for publication).

Further to this, improved calibration methods for positive and negative gauge pressure standards in the range from approximately -100 kPa to 15 kPa will be developed. A calibration guide for positive and negative gauge pressure standards will be drafted that will describe different calibration systems, conditions under which they are to be operated, procedures to be followed, the target uncertainties and the best working practices. The draft guide will be submitted to EURAMET and made available to end users.

Outcomes for relevant standards

The project will contribute to the implementation of European Commission Regulation (EU) No 847/2012 which restricts the use of mercury in barometers and sphygmomanometers for industrial and professional use. The execution of the Regulation will be facilitated by providing equivalent alternative non-mercury based pressure standards. It will also support the reduction in the number of mercury-containing pressure-measuring devices in Europe. In addition, the consortium will promote the results of the project within the standardisation community and will provide input into the standardisation process e.g. CCM WG P (Pressure), COOMET TC 1.6 "Mass and related quantities", DIN NATG-D Standard Committee Technical Basics - pressure, flow, temperature and IMEKO TC 16 "Pressure and Vacuum Measurement". For ISO, the standards relevant to the project that are in preparation/revision will be identified, and the work on these standards will be suggested to the appropriate working groups or committees.

Longer-term economic, social and environmental impacts

By improving the pressure scale at the NMI level in the range of lower gauge, absolute and differential pressure this project will provide a better measurement capability. In combination with new calibration methods, a more adequate dissemination of the unit "pressure" will also be obtained. Further to this, European calibration laboratories and industry should be able to engage with the new calibration services and to have their instruments calibrated within Europe without the need to send their devices to the US. This will meet the demand of industry to obtain high accuracy calibration services in Europe, whilst making calibrations less time and cost consuming.

The European mercury strategy [Commission Regulation (EU) No 847/2012 on 19/9/2012] restricts the use of mercury in barometers from 10 April 2014 which is an issue for research institutions and reference laboratories in the avionic industry and weather monitoring and forecast services, which all use mercury barometers. Many European NMIs also realise the pressure scale on low gauge, absolute and differential pressure using mercury based liquid column manometers and these devices usually contain 6 kg to 10 kg of mercury. Therefore, a new primary standard, using alternative manometric liquids such as oil, will fulfil the EU demands and reduce the risk of accidental environmental pollution by mercury.

As mentioned, many industries such as pharma-biotech, semiconductor, micro- and nano-technology, petrochemical, aviation, energy production, weather monitoring and forecast services will benefit from the project's output and this should strengthen the European industrial infrastructure for the development of new services and products (that rely on pressure). As a wider impact, Europe's innovative capacity should be increased, leading to higher employment and wealth for society. Finally, the project will improve collaboration between European NMIs, in particular, between smaller/less experienced NMIs and more experienced NMIs.

4.6 Section B2: Excellence

4.6.1 Section B2.a: Overview of the objectives

This section should describe the objectives of your project and it should be approximately half a page. A numbered list is required for your objectives and you should indicate which work package(s) address each objective. Objectives should be quantified e.g. parameters, ranges, materials and target uncertainties included where applicable. The list of specific objectives should be preceded by a sentence at the start of the section describing the overall aim of the project.

The description of the objectives should align with those in Section B1 (see 4.5) and with the SRT objectives. They may be the same as the SRT objectives, or they may be slightly revised or refocused. However, if there is a divergence from the SRT objectives, at the end of the objectives section please:

- Identify any SRT objectives or parts of objectives that the proposed project does not address and explain why
- Explain why any additional objectives (i.e. that are not part of the SRT objectives) are included.

Example 1: B2.a: Overview of the objectives (Green Deal project)

The overall objective of this project is to enable the SI traceable monitoring of radon (^{222}Rn) at low radon activity concentrations including calibration and radon mapping, in particular in support of the European Council Directive 2013/59/EURATOM (EU BSS). The project will contribute to the creation of a coordinated metrological infrastructure for radon monitoring in Europe.

The specific objectives of the project are:

1. To develop novel procedures for the traceable calibration of radon (^{222}Rn) measurement instruments at low activity concentrations (100 Bq/m^3 to 300 Bq/m^3) with relative uncertainties ≤ 5 % (k=1). As part of this, to develop new radioactive reference sources with stable and known radon emanation rates (WP1).
2. To investigate and to reduce the influence of thoron (^{220}Rn) and its progeny on radon end-user measurements and radon calibrations (WP2).
3. To compare existing radon measurement procedures in different European countries and from the results optimise the consistency of indoor radon measurements and soil radon exhalation rate measurements across Europe (WP3). To analyse and develop methodologies for the identification of radon priority areas (i.e. areas with high radon concentrations in soil, as defined in the EU BSS), including the development of the concept of a Radon Hazard Index (RHI), and to investigate the relationship between soil radon exhalation rates and indoor radon concentrations (WP4).
4. To validate traceability of European radon calibration facilities, and to publish guidelines and recommendations on calibration and measurement procedures for the determination of radon concentration in air (WP3).
5. To facilitate the take up of the technology and measurement infrastructure developed by the project by end users (regulators, radiological protection bodies and policy makers), standards developing organisations (ISO/TC45, CEN/TC351, ISO/TC85, CENELEC/TC 45, IAEA) and the measurement supply chain (accredited laboratories, instrumentation manufacturers).

Example 2: B2.a: Overview of the objectives (Normative project)

The overall objective of the project is to develop traceable measurement and characterisation methods for use in the standards being developed by ISO TC 197 “Hydrogen Technologies” and related groups. The specific objectives of the project are:

1. To provide a substantial contribution to the revision of standards in the ISO 14687 series (Hydrogen fuel - Product specification) in fuel cell applications for road vehicles. The contribution to be focused on measurement methods for the characteristics of hydrogen fuel in order to assure uniformity of the hydrogen product as produced and distributed. (WP1)
2. To provide a substantial contribution to the development of EN 16726 (Gas infrastructure – Quality of natural gas – Group H) by developing traceable measurement methods for the determination of the chemical properties of H_2/natural gas mixtures with different hydrogen levels in the blends. (WP2)
3. To work closely with the European and International Standards Developing Organisations, and the users of the standards they develop, to ensure that the outputs of the project are aligned with their needs, communicated quickly to those developing the standards, and in a form that can be incorporated into standards at the earliest opportunity. (WP3)

4.6.2 Section B2.b: List of deliverables

You should list your deliverables in the table provided in Template 4: JRP protocol. The deliverables should align with the project’s objectives in Section B2.a and hence the SRT objectives. There should be a maximum of 10 deliverables including 6-8 technical deliverables (approximately one or two deliverable(s) for each objective) plus a mandatory deliverable for impact and a mandatory deliverable for the completion of the project’s reporting.

Deliverable descriptions should include parameters, ranges and target uncertainties where appropriate and must provide evidence of a tangible high-level project output, such as the key output of a work package. Please remember that each deliverable should be able to be sent to EURAMET and stored, and hence must be of a suitable format e.g. not a piece of equipment, website etc. Each deliverable must have been reviewed and approved by the whole consortium before being submitted to EURAMET by the coordinator.

Ideally each partner should be included in at least one deliverable (in addition to the mandatory impact and reporting deliverables where all partners are required).

For each deliverable you should also include the number of the activity (e.g. A1.2.5) where the deliverable is delivered to EURAMET in the first column of the deliverable table under the objective number(s).

Technical deliverables should be public, i.e. fully open; if any of the technical deliverables will not be public, then you should include the deliverable number after the table and identify the dissemination level based on the options below:

- SEN – Sensitive, limited under the conditions of the Grant Agreement
- Classified R-UE/EU-R – EU RESTRICTED under the Commission Decision No2015/444
- Classified C-UE/EU-C – EU CONFIDENTIAL under the Commission Decision No2015/444
- Classified S-UE/EU-S – EU SECRET under the Commission Decision No2015/444

Example 1: B2.b: List of deliverables (Green Deal project)

Relevant objective (Activity delivering the deliverable)	**Deliverable number**	**Deliverable description**	**Deliverable type**	**Partners (Lead in bold)**	**Delivery date**
1 (A1.2.5)	D1	Method for the traceable calibration of radon (^{222}Rn) measurement instruments at low activity concentrations (100 Bq/m^3 to 300 Bq/m^3) with relative uncertainties ≤ 5 % (k=1)	Calibration method	**BBB**	M36
1 (A1.4.8)	D2	Report on the influence of thoron on the radon monitors used in Europe including (i) procedures for checking their sensitivity to thoron, (ii) recommendations on the construction of radon monitors that are not sensitive to thoron and (iii) technical approaches aimed at reducing thoron-related bias in the radon signal in existing monitors	Report, Recommendations	**CCC**, BBB, AAA, EEE, FFF, GGG, HHH, III	M30
2 (A2.1.4)	D3	Paper on indoor and geogenic radon surveys in Europe, including their strategies, the methodologies employed, inconsistencies in the results, and potential methodologies to harmonise data and reduce inconsistencies submitted to an open access peer reviewed journal	Paper	**EEE**, AAA, BBB, DDD, III	M24
2 (A2.4.6)	D4	Report on the results from the on-site comparison of indoor radon measurements and geogenic radon measurements under field conditions together with recommendations to assist the implementation of the EU-BSS	Comparison report	**CCC**, AAA, BBB, DDD, EEE, FFF, GGG, HHH, III	M34
3 (A3.3.3)	D5	Guideline on the definition, estimation and uncertainty of radon priority areas (RPA)	Guideline	**FFF**, AAA, BBB, CCC, DDD, EEE, GGG, HHH, III	M27
3 (A3.5.7)	D6	Report on the concept and establishment of a Radon Hazard Index (RHI) including an RHI map of Europe showing areas with high geogenic radon potential and conclusions on the relationships and	Report	**FFF**, BBB, GGG, HHH	M34

		correlation between indoor Rn concentration and quantities related to geogenic Rn			
4 (A4.1.4)	D7	Validation report on the traceability of primary and secondary radon calibration facilities in Europe	Validation report	**EEE**, AAA, BBB, DDD, III	M34
4 (A4.2.4)	D8	Good practice guide on calibration and measurement procedures for the determination of radon concentration in air	Good practice guide	**EEE**, III	M34
5	D9	Evidence of contributions to the EU-BSS and to new or improved international standards and recommendations with a specific focus on ISO/TC85/SC2, CENELEC/TC45, IEC/TC45, IAEA-Nuclear Data, CEN/TC351/WG3, CCRI and EURAMET TC-IR. Examples of early uptake of project outputs by end users. Updated dissemination, communication and exploitation plan.	Reporting documents	**CCC**, all partners	M36
n/a	D10	Delivery of all technical and financial reporting documents as required by EURAMET	Reporting documents	**BBB**, all partners	M36 + 60 days

Example 2: B2.b: List of deliverables (Normative project)

Relevant objective (Activity delivering the deliverable)	**Deliverable number**	**Deliverable description**	**Deliverable type**	**Partners (Lead in bold)**	**Delivery date**
1 (A1.1.6)	D1	Calibration procedures for quadrupole mass spectrometers (QMS), specified for different end user use of QMS	Calibration procedures	**CCC**, AAA, DDD, BBB	M24
1 (A1.3.4)	D2	Report on the intercomparison of different QMS from different manufacturers, including recommendations for a standardised procedure for the general characterisation of the QMS	Comparison report	**CCC**, AAA, DDD, BBB	M30
1, 3 (A1.4.4)	D3	Letter from ISO TC 112 confirming that the results from JRP NRM99, related to QMS, have been incorporated in an approved Technical Specification TS 20175	Letter from the Technical Committee	**CCC**, AAA, DDD, BBB	M36
2 (A2.1.7)	D4	Report on a standardised measurement procedure and a statement of uncertainty for partial and total outgassing rate measurements	Report	**BBB,** III	M32
2, 3 (A2.2.8)	D5	Letter from ISO TC 112 confirming that the results from JRP NRM99, related to outgassing rate measurements, have been incorporated in an approved Technical Specification for TS 20177	Letter from the Technical Committee	**BBB**, III	M36
4 (A3.1.6)	D6	Evidence of contributions to new or improved international standards with a specific focus on, to be submitted to ISO TC 112 WG2 and DIN Technical Committee "Vacuum Technology". Examples of early uptake of project outputs by end users. Updated dissemination, communication and exploitation plan.	Reporting documents	**CCC**, all partners	M36
n/a	D7	Delivery of all technical and financial	Reporting	**CCC**, all	M36

		reporting documents as required by EURAMET	documents	partners	+ 60 days
The dissemination level for D3 and D5 'SEN – Sensitive, limited under the conditions of the Grant Agreement.					

4.6.3 Section B2.c: Need for the project

This section must explain a clear need for the project i.e. why the project is being undertaken. It should be approximately 1–1.5 pages in length and should explain the background to the need for the project, i.e. what the high level driver or issue is, what the need is and why improved measurement capability, measurement techniques and better measurements are needed and who needs them.

The explanation of the need for the project should link clearly to the project's objectives and explain the need for each of them. Ideally you should structure the section with a subheading for each objective.

The description should follow a logical flow from the high-level needs (e.g. to contribute to mitigating climate change, to improve productivity in sector X), through to the specific user needs (problems encountered by specific types of companies or public agencies or regulatory bodies) that need to be addressed via improved measurement capabilities at NMIs/DIs.

If your project continues the work undertaken in a previous JRP please summarise why further work is needed in this area.

You may also include evidence of support from the "end user" community (e.g. letters of support; see Section 2), but please note that all references to letters of support will be removed during grant preparation, therefore the need should be adequately explained without requiring reference to them.

Where relevant, you should refer to the European legislation, documentary standards, technology roadmaps etc. that need to be addressed. In addition, in SRTs for pre- and co-normative JRPs there may be a requirement for the proposed research to be justified by "clear reference to the measurement needs within strategic documents published by the relevant Standards Developing Organisation (SDO) or by a letter signed by the convenor of the respective TC/WG". In those cases, this section must fully explain the need expressed by the SDO, web links to the relevant SDO strategic documents must be provided, and any letter from the convenor of the respective TC/WG included in the letters of support.

For most proposals the need for the research extends beyond the metrology community, so you should clearly identify the potential stakeholder groups. If commercial organisations stand to benefit from the research, you should explain why it is appropriate for the potential European Partnership on Metrology to support this research rather than commercial organisations. Finally, you should explain why bringing together a critical mass of European expertise, will enable progress in this area; and why a non-collaborative approach would be less successful.

Please note that section B2.c should explain the need for the project and not describe what will be done to address the need (that is addressed in Section B2.d: 'Progress beyond the state of the art').

Example 1: Section B2.c: Need for the project (Green Deal project)

Radon is a radioactive, colourless, odourless, tasteless noble gas, which occurs naturally through geological based processes (geogenic) as an intermediate step in the normal radioactive decay chains through which thorium and uranium slowly decay into lead. Radon is produced by the radioactive decay of radium-226, which is found in uranium ores, phosphate rock, shales, igneous and metamorphic rocks such as granite, gneiss, and schist, and to a lesser degree, in common rocks such as limestone. Radon can also occur in ground water - for example, in some spring waters and hot springs. Radon gas is a health hazard and is often the single largest contributor to a person's background radiation dose, but due to differences in local geology, the level of the radon gas hazard differs from location to location. Despite its short half-life of 3.8 days, radon gas from natural sources can accumulate in buildings, particularly in confined or unventilated spaces. As radon decays it produces other radioactive elements known as radon progeny. Unlike gaseous radon, these radon progeny are solids and stick to surfaces, such as dust particles in air, which can then also cause lung cancer if inhaled.

European legislation

The European Green Deal espouses "a zero-pollution ambition for a toxic-free environment" for which an action plan has been adopted in May 2021. The European Green Deal also promotes improved enforcement of environmental regulations. Whilst radon is a naturally occurring gas, its presence and accumulation within housing and workplaces leads to a toxic environment at sufficient concentrations. The European Council Directive 2013/59/EURATOM (EU-BSS) which lays down basic safety standards (BSS) for protection against the dangers arising from exposure to ionising radiation, evokes new challenges for metrology and radon measurements and calibrations in Europe. EU member states are required to ensure that levels of relevant radon activity concentrations as laid down in the EU-BSS do not exceed 300 Bq/m^3, and are obliged to transpose the EU-BSS into national legislation by 2018 for immediate implementation.

According to the Council Directive 2013/59/EURATOM (EU-BSS), European member states are obliged to consider several aspects when preparing their **national radon action plan,** which is a strategy for conducting surveys of indoor radon concentrations. This requires reliable calibration and measurement methods for low radon activity concentrations between about **100 Bq/m^3 and 300 Bq/m^3**. A significant improvement in the metrological infrastructure in Europe in the field of radon calibrations at low activity concentrations is a prerequisite in order to be able to fulfil the EU-BSS requirements.

The EU-BSS will impact a range of stakeholders including those responsible for the transposition of the EU-BSS into national law and its implementation: from regulators and policy makers, professionals designing, performing, evaluating and interpreting radon surveys, radon instrument manufacturers to the construction industry. The construction industry needs to comply with national legislation and regulations related to the EU-BSS whilst their practical experience in implementing building codes is crucial in the assessment of its impact on society. Since national radon action plans (a major requirement of the EU-BSS) are also of considerable interest beyond the EU, as other countries are also concerned with radon control even if not committed to the EU-BSS.

Radon protection for European citizens

The objective of the new EU-BSS is to provide a sound and fair basis of radon protection for European citizens. Meeting this objective requires that all links in the radon protection "supply chain" – some of which are explicitly mentioned in the EU-BSS article on Rn action plans (article 103 and annex XVIII) - are quality assured. The chain consists of many conceptually different links, starting from appropriately designed Rn surveys, through metrologically sound measurements, to statistically reliable evaluation and interpretation, to the generation of aggregated objects such as "Rn priority areas" (RPAs), which are those areas that form the basis for certain actions envisaged and required by the EU-BSS. Since RPAs were introduced, their identification has been an important topic in all EU member and candidate states (and beyond, as some non-member states have also decided to adopt the regulation or parts of it).

Quality assurance of all steps in the radon protection chain is necessary, in particular given they are methodically different but have important potential economic and political impact.

Public health and economy

Radon is estimated to cause between 3 % and 14 % of all lung cancer cases depending on the average radon level in the country (WHO, Fact sheet N°291, 2014). For Europe, this corresponds to between 15,000 to 20,000 people per year dying of lung cancer caused by radon exposure. Accurate and reliable radon measurement data are necessary in order to optimise counter measures to reduce the public's exposure to radon and hence also to reduce the related follow-up costs. The greater the accuracy and reliability of the measurement data, the lower the risk that unnecessary or excessive counter measures will be implemented, with low radiological but high financial impact.

Moreover, member states need to define approaches, data and criteria to be used for the establishment of RPAs, for the cost-efficient delineation of areas with potentially high exposure to radon (EU-BSS, Article 103). Harmonisation of radon data at a European level is therefore of crucial importance for European member states as well as the development of methodologies for the identification of areas with potentially high exposure to radon. This is essential for an exchange of knowledge and comparable information on radon levels on a European level and to reduce economic barriers across Europe allowing instrumentation manufacturers to provide their instruments to a harmonised market.

Calibrations and traceability of radon measurements

Effective implementation of the EU-BSS will require accurate and reliable measurement of low radon activity concentrations. According to the BIPM key comparison database of calibration and measurement capabilities, there are currently only a few European facilities that offer radon activity calibrations, and all of them relate to very high radon activity concentrations (of the order of MBq/m^3), which are not relevant in the context of the EU-BSS. The established metrological procedure (primary standard) is to use a decaying radon gas standard in a defined volume for calibrations of radon activity concentrations above 1 kBq/m^3. Using this method for low activity concentration calibration is not practical, as it is time consuming and expensive due to the need for a radon gas standard for each calibration and specific very leak-tight chambers.

Thoron

The influence of thoron (^{220}Rn) on the radon (^{222}Rn) activity concentration measurements has already been observed with some radon monitors. This influence, if not properly corrected, can introduce bias in the radon risk estimates or can generate false alarms if these detectors are used to identify dwellings with radon concentrations that exceed reference/action levels. Detailed knowledge of the influence of thoron on radon measurements is however limited and techniques to correct for or to reduce its influence do not currently exist.

Radon priority areas

National or regional approaches chosen to identify areas with an observed or a suspected high probability of radon concentrations in buildings above the reference level (Art. 103, EU-BSS) can vary. One strategy relies on directly measured indoor radon data, others on indirect concepts based on the geogenic radon potential (e.g. based on soil radon exhalation rates). There are also different methods used to define the geogenic radon potential of an area. In order to ensure that radon data and decisions on the identification of RPAs are comparable regardless of the approach used, these methods need to be compared and standardised in order to provide comparable results with moderate uncertainties.

Harmonisation of radon measurement approaches and data

Measurements of radon concentrations have been conducted in Europe for years and while they have been subject to quality assurance by comparison exercises in the past (at least for relatively high radon activity concentrations), research needs be undertaken in order to harmonise the different radon measurement techniques (objective 3) and calibrations (objectives 1 and 5). These will apply in particular for solid-state nuclear track detectors that are the most common devices used for measurement in dwellings. This issue has been discussed on numerous occasions at conferences and in articles (recently, at the International Workshop of the European Atlas of Natural Radiation, Verbania, Italy, Nov. 2015), which proves the urgency for this topic. The current state of the art is that strong heterogeneities of radon data still exist in Europe.

The European Commission Joint Research Centre in Ispra, Italy, is responsible for the creation of European radon maps (as part of the European Atlas of Natural Radiation). The data harmonisation, aimed at by this project, will provide the possibility to combine radon measurements at a European level and to develop a consistent European radon map.

4.6.4 Section B2.d: Progress beyond the state of the art

This section, which should be approximately 1.5-2 pages in length, should describe the current state of the art in the technical area(s) of the project's research, and how your project progresses beyond the state-of-the-art, including the overall methodology, concepts, models, assumptions and interdisciplinary approaches that underpin your work.

You should structure this section into sub-sections for each of the scientific and technical objectives of the project and then describe the current state of the art and progress beyond for each of them. The current state of the art and progress resulting from the project should be clearly differentiated.

In describing the current state of the art you should explain why progress is required to meet the needs described in Section B2.c (see 4.6.3), including explaining whether parameters can be measured or if the measurement is possible but is inefficient, inaccurate, unreliable or time-consuming and stating the best uncertainties and/or range that can currently be achieved.

You should then describe how your project progresses beyond the state of the art in numerical terms, including target uncertainties or ranges and the methodologies that will be adopted. Where relevant, you should explain how the project's methodology complies with the '*do no significant harm*' principle (related to the six environmental objectives of Regulation (EU) 2020/852 (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32020R0852)). If your project directly continues and develops the work undertaken in a previous JRP please summarise the conclusions from that JRP and indicate how your project progresses beyond that project. In addition, if there are other closely linked JRPs please indicate how your proposal progresses beyond those projects.

For Pre- and Co-Normative projects, the progress beyond the state of the art relates to the establishment of data, methods and techniques that are suitable for implementation and regular use as part of the standardisation process or to underpin the development of new documentary standards.

Example 1: B2.d: Progress beyond the state of the art (Green Deal project)

Traceable calibration of radon (^{222}Rn) measurement instruments at low activity concentrations and radioactive reference sources with stable and known radon emanation rates (Objective 1):

Current state of the art

Under the EU-BSS, EU member states are required to ensure that levels of relevant radon activity concentrations do not exceed 300 Bq/m^3, hence effective implementation of the EU-BSS will require accurate and reliable measurement of low radon activity concentrations. Currently traceable radon measurements are only conducted at activity concentrations >500 Bq/m^3. The established metrological procedure (primary standard) is to use a decaying radon gas standard in a defined volume for calibrations of radon activity concentrations above 1 kBq/m^3. Using this method for low activity concentration calibration is not practical, as it is time consuming and expensive due to the need for a radon gas standard for each calibration and specific very leak-tight chambers. Better, more (long-term) stable and reliable sources and methods that are easier to use and could be used at more calibration facilities, need to be developed in order for traceable calibrations and measurements to be performed below this limit with reasonable uncertainties.

Progress beyond the state of the art

The project will develop new radioactive reference sources for ^{220}Rn (radon) and ^{222}Rn (thoron) with stable and known radon emanation rates for the realisation of reference fields for radon activity concentration in air. Novel procedures for the traceable calibration of ^{222}Rn (radon) measuring devices (active and passive monitors) in stable radon atmospheres at low activity concentrations (100 Bq/m^3 to 300 Bq/m^3) with relative uncertainties ≤ 5 % (k=1) will be developed.

Although an intercomparison of calibration for high radon activity concentrations has been conducted in the past, this was more than 10 years ago hence two new CCRI(II) comparisons of existing radon gas primary standards at different European NMIs/DIs for ^{222}Rn and ^{220}Rn in the range of a few kBq will be undertaken.

Influence of thoron (^{220}Rn) and its progeny on radon end-user measurements and radon calibrations (Objective 2):

Current state of the art

It has been observed that the presence of thoron and its progeny (^{212}Pb, ^{212}Bi+^{212}Po/^{208}Tl) can have an influence on radon activity concentration measurements. Although several scientific studies on the influence of thoron on radon measurements are available in the literature, this information is in general not harmonised and therefore not usable by end users and decision makers. Detailed knowledge of the influence of thoron on radon measurements is therefore limited and techniques to correct for or to reduce thoron's influence on radon activity concentration measurements do not currently exist.

Progress beyond the state of the art

The sensitivity of radon monitors and detectors to thoron will be evaluated, with traceability to a primary thoron system, and in addition the sensitivity of radon (thoron) monitors and detectors to radon and thoron under mixed radon + thoron atmospheres and under temperatures in the interval typical for the real environment (e.g. -15 °C to +60 °C) will also be investigated. Conclusions about the dependence of the signal on the specific environmental conditions (radon to thoron ratio, temperature, time variations of radon/thoron concentrations and temperature) will be drawn and the consequences for the design of radon surveys under real conditions (e.g. working places, soil gas etc.) will be considered and analysed. Separately, technical concepts and solutions will be proposed to firstly potentially correct the thoron-related bias to the radon signal in radon monitors and secondly to reduce the thoron-related bias to the radon signal in radon monitors through the use of membranes that act as a barrier to thoron.

Existing radon measurement procedures and approaches to optimise the consistency of indoor radon measurements and soil radon exhalation rate measurements across Europe (Objective 3):

Current state of the art

Radon surveys (both indoors and outdoors) and radon measurements are carried out differently in European countries, dependent on political decisions, the aim of the survey, the availability of resources and infrastructure, and these different methodologies and procedures may lead to inconsistencies, i.e. different values of the nominally same quantity. Intercomparisons on surface soil radon exhalation rates and radon concentrations in soil gas are rare and there are few laboratories whose results have been tested under in-situ conditions, and hence comparability of data cannot be not guaranteed.

Progress beyond the state of the art

Existing indoor and geogenic radon survey data will be analysed and evaluated in order (i) to identify the rationale and methodologies used, (ii) to identify the extent and possible sources of inconsistencies in the results of indoor radon surveys and (iii) to propose approaches to reduce inconsistencies and improve harmonisation of indoor and geogenic radon data. The project will carry out inter-comparisons of the magnitudes of surface soil radon exhalation rate and radon concentrations in soil gas, thus improving knowledge of the relationship between the two and also increasing the number of laboratories whose results have been tested under in-situ conditions. By comparing existing radon measurement procedures in different European countries, the results will be used to optimise the consistency of indoor radon measurements and soil radon exhalation rate measurements across Europe. Information about indoor radon and geogenic radon surveys in Europe regarding strategy, methodologies and their potential for use as a basis for implementation for the EU BSS will be provided to the relevant stakeholders, including results of the on-site inter-comparison exercise. Methodologies to harmonise indoor data (i.e. seasonal correction, short-term and long-term measurements) will be published.

Methodologies for the identification of radon priority areas, the development of the concept of a Radon Hazard Index (RHI), and the relationship between soil radon exhalation rates and indoor radon concentrations (Objective 4):

Current state of the art

As the definition of radon protection areas (RPA) in the EU BSS allows a wide range of interpretation, different concepts and methodologies have been proposed and some have already been adopted. Currently there are many approaches used to define geogenic Rn risk areas which usually form the basis for the definition of RPAs, and this leads to most data being incomparable as the models and concepts used are vastly different.

Progress beyond the state of the art

This project will analyse and develop methodologies for the identification of radon priority areas (RPA), to investigate the relationships between indoor Rn concentration and quantities related to geogenic Rn, including soil exhalation. The use of compact discs (CDs) and DVDs for retrospective radon measurements and their potential to define radon priority areas will be evaluated. These methods employ CDs or DVDs that are available in almost all public and private buildings in Europe as “detectors” and allow the average radon concentration to be assessed in retrospect, as well as systematic changes due to constructive (including energy-efficiency) interventions. New techniques for the measurement of radon exhalation from soil, based on liquid scintillation counting of polymers or track-etching of CDs, will be developed and evaluated. The aim is to analyse and develop methodologies for the identification of radon priority areas (i.e. areas with high radon concentrations in soil, as defined in the EU BSS), including the development of the concept of a Radon Hazard Index (RHI), and to investigate the relationship between soil radon exhalation rates and indoor radon concentrations. Definitions of radon priority areas (RPA) optimised to the radon action plan and their estimation optimised to the availability of the input data will be established, including strategies to deal with RPAs which have been defined inconsistently across borders. Finally, a methodology for a harmonised “radon hazard index” (RHI) will be proposed which could be used as a tool to help identify radon priority areas.

Validation of the traceability of European radon calibration facilities, and guidelines and recommendations on calibration and measurement procedures for the determination of radon concentration in air (Objective 5):

Current state of the art

The desire to improve and harmonise radon measurements in air has increased over the last decade or so, as radon activity concentrations in air measured with different radon monitors were found to be inconsistent with each other when the monitors were placed in the same environment. At present, secondary radon standards are calibrated at relatively high activity concentrations, however calibrations and measurements at low activity concentrations with sufficiently low uncertainties, as required in the context of the EU-BSS, are not available. The traceability and reliability of measurements at low radon activity concentrations by existing European radon calibration facilities e.g. NMIs/DIs, accredited laboratories, other calibration laboratories and universities is therefore unclear.

Progress beyond the state of the art

A validation of the traceability of existing European radon calibration facilities will be undertaken both by comparisons of the calibrations of radon measuring instruments in the range from 300 Bq/m^3 to 10 000 Bq/m^3 and by comparison of the secondary standards used by European radon calibration facilities in the range from 100 Bq/m^3 to 300 Bq/m^3 to the reference device calibrated in a reference radon

atmosphere traceable to a primary standard. Such calibrations in stable radon atmospheres will enable sufficiently low uncertainties to be achieved for low radon activity concentration measurements. Information about the validation of traceability of European calibration facilities for radon concentration measurement in air will be provided to all relevant stakeholders and guidelines and recommendations on calibration and measurement procedures for the determination of radon concentration in air will be published.

Progress beyond ENV57 MetroERM and IND57 MetroNORM

Within ENV57 MetroERM the focus was on the environmental monitoring of man-made radionuclides (e.g. ^{137}Cs, $^{239/240}$Pu, etc.). Only the influence of radon and its progeny on these monitoring measurements was considered, not the measurement of radon itself (e.g. the influence of radon progeny concentrations on dose rate detectors (Task 1.6 MetroERM)). In the scope of IND57 MetroNORM only very specific questions regarding the radon exposure of workers in waterworks and the emanation of radon from building materials were addressed (Task 3.3 MetroNORM). In this project the focus lies on the measurement of radon itself and all relevant exposure situations are considered (exposure due to radon in dwellings and workplaces).

4.6.5 Section B2.e: Gender dimension

Addressing the gender dimension in research and innovation content entails taking into account sex and gender in the whole research and innovation process. It is important that the gender dimension is addressed, for example, to understand why differences are observed between women and men in infection levels and mortality rates in the COVID-19 pandemic, to ensure that car safety equipment is designed to be suitable for a wide range of the population, to ensure that AI products developed do not spread gender and racial biases due to a lack of diversity in the data used in training AI applications, or to understand how and why climate change is affecting sex determination in a number of marine species risking extinction of certain populations.

This section (1 page maximum) should describe how the gender dimension (i.e. sex and/or gender analysis) is taken into account in the proposal's research and innovation content.

If you do NOT consider gender dimension to be relevant in your project proposal, please provide justification(s) explaining why this is the case.

Please note that gender dimension in research and innovation relates to the content of the planned research and innovation activities, and not to the gender balance in the teams delivering the project.

4.6.6 Section B2.f: Open science

Open science is an approach based on open cooperative work and systematic sharing of knowledge and tools as early and widely as possible in the process. Open science practices include, for example, (i) early and open sharing of research (for example through pre-registration, registered reports, pre-prints, or crowd-sourcing); (ii) research output management; (iii) measures to ensure reproducibility of research outputs; (iv) providing open access to research outputs (such as publications, data, software, models, algorithms, and workflows); (v) participation in open peer-review; and (vi) involving all relevant knowledge actors including citizens, civil society and end users in the co-creation of R&I agendas and contents (such as citizen science).

Please note that this topic does NOT refer to outreach actions that may be planned as part of communication, dissemination and exploitation activities.

This section (1 page maximum) should describe how appropriate open science practices are implemented as an integral part of the proposed methodology for your project. You should show how the choice of practices and their implementation are adapted to the nature of your proposed work in a way that will increase the chances of the project successfully delivering its objectives.

If you consider that open science practices are NOT appropriate for your proposed project, please provide justification(s) explaining why this is the case.

4.6.7 Section B2.g: Research data management and management of other research outputs

The management of research data and other research outputs is mandatory (there is no longer an option to opt out), however the principle that open access to research data should be '*as open as possible, as closed as necessary*' applies, i.e. there can be exceptions to open access to research data. Data will need to be deposited in a trusted repository that provides open access. A Creative Commons CCBY or CC0 (or equivalent) licence will be required to the open data, and the meta data requirements are the same as for publications (i.e.CC0 and PIDs).

This section (1 page maximum) should describe how the data generated/collected and the research outputs (excluding publications) produced during the project will be managed in line with the FAIR principles (Findable,

Accessible, Interoperable, Reusable). The description, which should be specific to your project, should address the following:

- Types of data/research outputs (e.g. experimental, observational, images, text, numerical) and their estimated size; and if applicable, their combination with and provenance of existing data.
- Findability of data/research outputs: Including the types of persistent and unique identifiers (e.g. digital object identifiers) and the trusted repositories that will be used.
- Accessibility of data/research outputs: IPR considerations and timeline for open access (if open access is not provided, you must explain why not); details of provisions for access to restricted data for verification purposes.
- Interoperability of data/research outputs: Standards, formats and vocabularies for data and meta data.
- Reusability of data/research outputs: Licences for data sharing and re-use (e.g. Creative Commons, Open Data Commons); availability of tools, software and models for data generation and validation, interpretation, and re-use.
- Curation and storage/preservation costs; partner, person or team responsible for data management and quality assurance.

Proposals selected for funding will need to develop and submit a detailed data management plan (DMP) for making their data and research outputs findable, accessible, interoperable and reusable (FAIR) as a reporting deliverable early in the project and to provide a revised version towards the end of the project's lifetime.

4.7 Section B3: Potential outcomes and impact from the project

This section is made up of four sub-sections, Sections B3.a (see 4.7.1), B3.b (see 4.7.2), B3.c (see 4.7.3) and B3.d (see 4.7.4), which should describe the expected outcomes and impact from the project.

- **Outcomes** are the expected effects and benefits from the project, over the short to medium term. Outcomes generally occur during or shortly after the end of the project. The results of a project should contribute to these outcomes, fostered in particular by the dissemination and exploitation measures of the project. This may include the uptake, deployment, and/or use of the project's results by direct target groups.
- **Impact** is the wider long-term effects and benefits on society (including the environment), the economy and science, enabled by the outcomes of R&I investments (long term). It refers to the specific contribution of the project to the expected wider impacts described for the programme. Impacts generally occur sometime after the end of the project.

You should be specific, referring to the effects of your project, and not to research and innovation in general in this field. Only include those outcomes and impacts where your project would make a significant and direct contribution and avoid describing very tenuous links to wider impacts.

When addressing the four sub-sections you should give an indication of the scale and significance of the project's contribution to the expected outcomes and impacts. 'Scale' refers to how widespread the outcomes and impacts are likely to be. 'Significance' refers to the importance, or value, of those benefits. Wherever possible, quantify your estimation of the effects that you expect from your project.

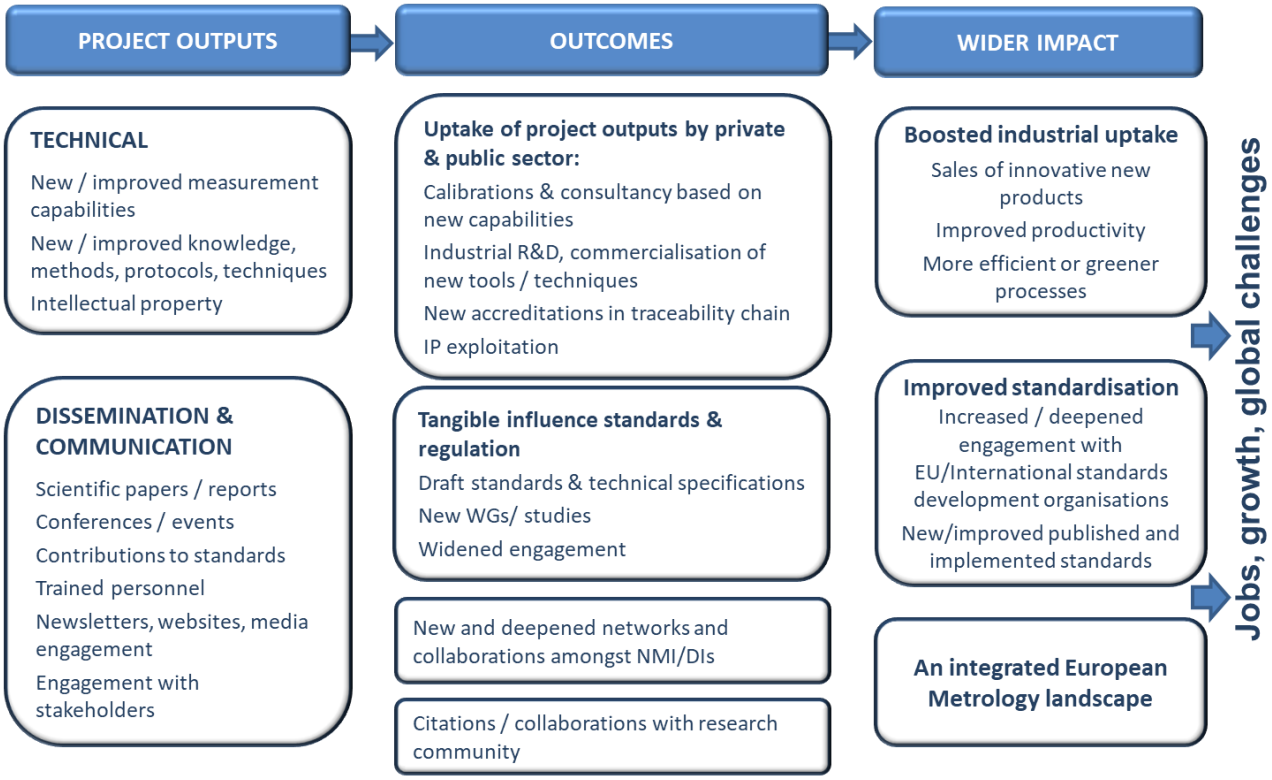
You should provide details of the **outcomes** in three areas (i) user uptake and use of project outputs amongst industrial and other user communities and (ii) uptake and use by the wider metrological and scientific communities and (iii) improved standards and uptake by the standardisation community, (respectively). Then in Section B3.d describe the **wider economic and social impacts** that your project will contribute to and the pathways (routes) to facilitate them.

You should describe how your project will make a positive difference to Europe (and internationally) by addressing the needs described in Section B2.c. This should not be a statement of what your project will do (i.e. you do not need in-depth technical details), but a statement of the benefits the project will bring to those who make direct use of the new measurement capabilities (**outcomes**) (such as reduced uncertainties, extended measurement ranges, new reference standards, new or improved methods, devices, new knowledge, etc.) and how these outcomes will contribute to the wider economic and societal benefits (**wider impacts**). You should also ensure that the outcomes and impact you describe can realistically be achieved by your project.

You should clearly explain what the outcomes and impacts will be and the pathway (route) to impact. You should explain:

- What the new measurement capabilities will be at the end of the project (**project outputs**) and how these will lead to benefits for the direct users of the new measurement capabilities, and who these direct users will be (**outcomes**) (Sections B3.a, B3.b and B3.c)
- How the **outcomes** will lead to wider economic and social benefits (**pathway (route) to wider impact**) such as, improving industrial productivity, mitigating climate change, supporting the implementation EC Directives (Section B3.d).

The outcomes and benefits you describe should be specifically attributable to the outputs and objectives of the project.



4.7.1 Section B3.a: Projected outcomes for industrial and other user communities

This section should be a maximum of 1 page and should describe the direct effect your project will have on the users of the new measurement capabilities e.g. in industry, businesses and in the public sector, including regulatory agencies.

The outcomes described in this section should relate to the uptake, exploitation and use of project outputs (new measurement capabilities such as reduced uncertainties, extended measurement ranges, new reference standards, methods, devices, new knowledge, etc.) by the early users of these outputs. These outcomes will begin in the short-term, (towards the end of the project and very soon after its completion). The beneficiaries are expected to be the people and organisations in the target user community, with which the project has had direct interactions, such as the project's non-NMI/DI partners, collaborators and stakeholders, project advisory board/stakeholder committee members etc. (particularly those in industrial and other user communities such as organisations that deliver public services such as hospitals or environmental monitoring).

You should describe your expected outcomes including: details of the organisations (specific organisations and types of organisations) that will benefit from the new measurement capabilities; which project outputs different types of beneficiaries will benefit from, as well as describing how you will ensure the maximum benefits are achieved. Please ensure that the outcomes and impact you describe in this section is consistent with the activities in your "Creating impact" work package (see 4.9.3).

Example 1: Section B3.a: Projected outcomes for industrial and other users (Industry project)

The project will develop a range of new pressure-related measurement capabilities at NMIs of direct relevance to industrial communities.

The project will establish a new primary standard and support dissemination of the pressure scale in the intermediate pressure range 1 Pa to 10^4 Pa. This will improve the reliability and accuracy of low gauge, differential and absolute pressure measurements at many levels from NMIs, to accredited commercial laboratories, to the end users. This traceability is the basis for more accurate pressure measurement (e.g. for the cleanroom technologies and processes) and will enable the realisation of tighter tolerances of non-equilibrium conditions and, as a consequence, reduce energy consumption and costs without loss of safety, sterility and precision. The project's results should also support the use of more neighbouring zones with individual pressure conditions which will offer new ways for process optimisation. The costs of operations involving toxic and nuclear materials as well as of the storage of environmentally dangerous toxic and nuclear wastes should also be reduced and the safety of these processes increased.

In addition, the project will establish an EU based calibration service that is expected to be competitive to that available in the USA. The calibration service will provide end-users with access to calibrations in the range 0 Pa to 15 kPa absolute pressure with uncertainties at the level of $3 \cdot 10^{-5} \times p$ + 5 mPa. This will be realised with state-of-the-art pressure measurement instrumentation such as force-controlled piston gauges with a resolution of 1 mPa. Such conditions will be beneficial for the more efficient and safe use of airspace by aircraft, for example through more reliable monitoring of aircraft vertical separation.

Dissemination of traceability from NMIs in the intermediate pressure range will provide access to improved capabilities for national and accredited laboratories in Europe and support consistency in measurement capabilities. Additionally, it will benefit the industrial companies that rely on such calibration services. Information on the calibration services will be disseminated via accredited bodies (for pressure) in Europe, calibration laboratories or, in Germany, via the Deutsche Kalibrierdienst (DKD)/committee of experts for pressure. Transportable medium vacuum range calibration equipment will also be created to provide a calibration service at an end user site.

To facilitate up take of the project's outputs there will be considerable engagement throughout the project with industrial stakeholders including manufacturers of pressure measuring devices as well as end users and calibration laboratories. The participation of industrial partners in the project and the establishment of a Stakeholder Community will also ensure that the project is aligned with industrial needs. In addition, at least one international workshop as well as seminars at the national level will be held to share project outputs and engage with the target user communities. Uptake of the new measurement capabilities developed in the project by partners and key stakeholders is expected during and shortly after the project. Early uptake will be among the accredited laboratories and the manufacturers of pressure measuring sensors instrumentation and equipment that relies on pressure measurements such as clean room equipment, process equipment for the energy sector and avionics instrumentation; enabling them to confidently demonstrate the performance of their products and ensuring they remain internationally competitive.

Finally, the project will create preconditions for the replacement of mercury-containing pressure-measuring instruments with mercury-free alternatives. The results will be provided to policy makers and stakeholders in European industry including the CCM Pressure Working Group, IMEKO TC 16, the project Stakeholder Committee and pressure subcommittees of the RMOs, weather monitoring and forecast services and airlines.

4.7.2 Section B3.b: Projected outcomes for the metrological and scientific communities

This section should be a maximum of 1 page in length and should describe the direct outcomes your project will have for the metrological and scientific communities.

In the metrological community, outcomes will include contributions to advances in the SI system, important inputs to high-level metrology committees such as the Consultative Committees, and/or changes (or proposed changes) to NMI/DI Calibration and Measurement Capabilities (CMCs) statements recorded in the BIPM Key Comparison Database (KCDB). In the scientific community, outcomes will include significant or widespread use of the project's outputs by the scientific research community, as indicated, for example, by highly cited publications or further significant collaborations with the scientific community. Please ensure that the impact you describe in this section is consistent with the activities in your "Creating impact" work package (see 4.9.3).

Example 1: Section B3.b: Projected outcomes for the metrological and scientific communities (Industry project)

Based on the project's results, a recommended *mise en pratique* for assuring traceability in the range 1 Pa - 15 kPa using force-balanced piston gauges in both absolute and gauge mode will be derived. This will significantly impact on calibration laboratories, as intervals and intermediate checks differ widely between laboratories and the evaluation of uncertainties during assessment requires a common understanding and general principle for assuring traceability. The recommendation is to be presented to the accreditation authorities in Europe as well as to end users and manufacturers of force-balanced piston gauges.

In the area of the force-balanced piston gauges (FPGs), knowledge transfer from experienced NMIs to those less experienced in how to use this new type of instrument will be very beneficial. It will help to raise their knowledge and measurement capabilities and will promote consistency within pressure metrology. On a broader scope, the project will strengthen the collaboration of European NMIs and will increase their competitiveness with NMIs outside Europe. Secondary accredited commercial laboratories will also gain a better calibration service from the European NMIs which will avoid the high costs and associated downtime associated with the calibration of their standards abroad and will increase their calibration capabilities. In particular, uncertainties and calibration techniques when using FPGs will be investigated and recommendations for ensuring the traceability of measurements with FPGs in the range 1 Pa - 15 kPa will be produced. A draft calibration guide for using FPGs in both absolute and gauge mode will be produced and submitted to EURAMET for publishing as a EURAMET calibration guide.

Improved calibration methods for positive and negative gauge pressure standards in the range from approximately -100 kPa to 15 kPa will be developed. A EURAMET calibration guide for positive and negative gauge pressure standards will be drafted that will describe different calibration systems, conditions under which they are to be operated, procedures to be followed, uncertainties aimed at and the best working practices. The draft guide will be submitted to EURAMET and made available to end users.

Research papers will also be submitted for publication in high impact peer-reviewed journals and as part of the knowledge transfer a workshop on intermediate pressure measurement will be organised and held, to which representatives of industry (both manufacturers and users), academic and NMIs will be invited.

4.7.3 Section B3.c: Projected outcomes for relevant standards

This section should be a maximum of 1 page (excluding the table) and should describe the outcomes your project will have for relevant documentary standards.

These standards should be at a European or International level and may be standards developed and published by formal standards developing organisations (such as ISO, CEN, OIML, CIE etc.) or important well-recognised industry standards (such as those developed by IEEE, etc.). If a standard has been mandated by the European Commission (usually in support of an EC Directive) or is a critical need specified by an industry body or standards committee this should be noted (and references provided).

The outcomes should be described in terms of expected tangible contributions to specific new or improved standards (or draft standards) or technical specifications that the project will contribute to. You should identify the most important documentary standards and the organisations/standards bodies/committees that will provide the **most likely pathway (route) to delivering the outcomes and impact** and which will be the focus of the project's research and dissemination activities regarding standards. It is also important to consider which standards are in need of updating or improvements and are due to be updated in the next 2 to 4 years (i.e. where the project can deliver impact).

You should indicate;

- Whether your consortium has existing links with the organisations/standards bodies/committees,
- Whether your consortium plans to build new links to organisations/standards bodies/committees,
- Which partners are involved and what they plan to do,
- How frequently the committee or working group meets.

Please ensure that the outcomes you describe in this section is consistent with the activities in your "Creating impact" work package (see 4.9.3).

Example 1: Section B3.c: Projected outcomes for relevant standards (Industry project)

The project will support the Commission Regulation (EU) No 847/2012 of 19.9.2012 which restricts the use of mercury in barometers and sphygmomanometers for industrial and professional use. The project will have a significant positive impact on the execution of the Regulation by providing equivalent alternative pressure standards. It will also support the reduction in the number of mercury-containing pressure-measuring devices in Europe without any associated disadvantages for industries currently using mercury manometers.

In addition, the consortium will promote the results of the project within the standardisation community and will provide input into the standardisation process (ISO, CEN, and EA). For ISO, the standards relevant to the project that are in preparation/revision will be identified, and the work on these standards will be suggested to the appropriate working groups or committees. However, this process can be very lengthy and will extend beyond the duration of this project.

The partners who are members of corresponding technical committees will inform them about the results of this project and will endeavour to ensure they are incorporated in any updates to the standards or guidelines (see table below). For example, the representatives on the corresponding committee or working group from the partners will jointly ask the chairperson to include a point in the agenda to briefly present the outputs of the project related to the working group activities and ask for comments from the other committee/working group members. Where appropriate a written report will be submitted for consideration by the committee or working group.

Standards Committee / Technical Committee / Working Group	Partners involved	Likely area of impact / activities undertaken by partners related to standard / committee
EURAMET TC-M	**BBB**, AAA, CCC, DDD, EEE, FFF, GGG, HHH, III, KKK, LLL	EURAMET TC-M meets annually in February-March. At the next meeting in 2016, the TC-M will be informed about ongoing activities in the project. A draft of a guideline for the calibration of force-balanced piston gauges will be

		presented at the TC-M meeting in 2017 and recommendations for negative gauge pressure measurements in 2018.
CCM WG P	**AAA,** BBB, CCC, DDD, EEE, FFF, GGG, HHH, III, KKK, LLL	CCM WG P (Pressure) usually meets every 3 years with the next meeting expected in 2017. CCM WG P will be informed about experience of negative gauge pressure measurements, alternative methods and results of supplementary comparisons. Based on this information, the inclusion of negative pressures in the list of key comparisons will be discussed. Information on potential transfer standards based on CDGs and force-balanced piston gauges gained within the scope of the project will be provided to CCM WG P to be taken into account in the organisation of future key comparisons.
COOMET TC 1.6 "Mass and related quantities"	**BBB**	COOMET TC 1.6 meets annually in September-October. At the next meeting in 2015, COOMET TC 1.6 will be informed about ongoing activities in the project. Based on the new measurement capabilities developed within the project, it will contribute to the activities of COOMET TC 1.6 on the standardisation of measurement methods for the saturated vapour pressure of oils and oil products.
DIN NATG-D Standard Committee Technical Basics - pressure, flow, temperature	**BBB**	BBB has been involved in this committee for several years and will attend committee meetings to disseminate the outputs of the project particularly in relation to the revision of standards DIN EN 13190 and DIN EN 837. The committee usually meets at least annually.
IMEKO TC 16 "Pressure and Vacuum Measurement"	**CCC**, AAA, BBB, DDD, FFF, GGG, HHH, III	IMEKO TC 16 meets every 2 to 3 years in connection with TC conferences and IMEKO World Congresses. CCC is the Scientific Secretary of IMEKO TC 16. Most partners are members of TC 16 and will take part in the TC 16 meeting and the next IMEKO World Congress to be held in Prague in September 2015 and to disseminate information about the ongoing project.

4.7.4 Section B3.d: Projected wider impact of the project

This section should help the referees understand why your project is important and it should be a maximum of 1.5 pages. You should describe the wider (i.e. longer-term) impacts that your project will contribute to and the routes to facilitate them (i.e. the links between the outcomes and the wider impacts).

For the wider impacts, please explain the **economic, social and environmental** impact that your project will make across Europe (and internationally). Where possible quantify each of the impacts numerically. You should also provide details of who will benefit from the project, and which aspects of the project each stakeholder group will benefit from.

If your project is expected to contribute to wider impact through EC Directives, regulations and/or legislation, you should provide details of this. Finally, describe how you will ensure that the maximum benefits and impact is achieved by your project.

Example 1: Section B3.d: Projected wider impact of the project (Industry project)

Economic impact:

By improving the pressure scale at the NMI level for low gauge, absolute and differential pressures this project will provide a better measurement capability. In combination with new calibration methods, a more adequate dissemination of the unit “pressure” will also be obtained. Further to this, European calibration laboratories and industry should be able to engage with the new calibration services and to have their instruments calibrated within Europe without the need to send their devices to the US. This will meet the demand of industry to obtain high accuracy calibration services in Europe, whilst making calibrations less time consuming and expensive.

The following industries will benefit directly from smaller uncertainties for low gauge, absolute and differential pressure measurement:

- The clean room condition is directly affected by smaller uncertainties of pressure measurement. To establish clean room conditions in e.g. pharmaceutical, semiconductor or nanotechnology industries different zones are separated by different local ambient pressure levels which prevent contaminated air entering a critical zone. With smaller uncertainties in pressure measurements, smaller pressure differences between these zones are possible which enables the use of more zones at a time but with the same resources in terms of energy and costs. This will make new more efficient, complex and energy saving clean room productions possible.
- In power plants, smaller uncertainties for low gauge, absolute and differential pressure measurement are relevant for safety, efficiency and costs. Such safety systems help to identify environmentally harmful or toxic leakage and prevent pipes or vessels from bursting. In this way they also protect the infrastructure and the environment. Therefore, efficiently controlled processes using measurands that avoid non-optimal operating conditions, will be more efficient, less cost intensive and they will avoid the production of unwanted by-products.
- Steadily increasing numbers of aircraft within European airspace have made it necessary to reduce the standard vertical separation (RVSM) between aircraft from 600 m to 300 m. Avionic altimeters use absolute pressure measurement for height detection, but only specially certified altimeters and autopilots are allowed to enter the RVSM airspace, and these need to be

calibrated traceably to the SI via NMI standards. In the future, an even more intensive usage of the airspace will consequently increase the need for smaller uncertainties of low absolute pressure measurements.

Environmental impact:

The European mercury strategy [amendment of Annex XVII to Regulation (EC) No 1907/2006 by Commission Regulation (EU) No 847/2012 on 19/9/2012] restricts the use of mercury in barometers from 10 April 2014 which is an issue for research institutions and reference laboratories in the avionic industry and weather monitoring and forecast services, which all use mercury barometers. Many European NMIs also realise the pressure scale for low gauge, absolute and differential pressures using mercury based liquid column manometers and these devices usually contain 6 kg to 10 kg of mercury. Therefore, a new primary standard, using alternative manometric liquids such as oil, will fulfil the EU demands and reduce the risk of accidental environmental pollution by mercury.

Social impact:

As mentioned, many industries such as pharma-biotech, semiconductor, micro- and nano-technology, petrochemical, aviation, energy production, weather monitoring and forecast services will benefit from the project's output and this should strengthen the European industrial infrastructure for the development of new services and products (that rely on pressure). As a wider impact, Europe's innovative capacity should be increased, leading to higher employment and wealth for society. Finally, the project will improve collaboration between European NMIs, in particular, between smaller/less experienced NMIs and more experienced NMIs.

4.7.5 Section B3.e: Summary of the project's impact pathway

In this section you should summarise the key elements of your project's impact pathway and the measures to maximise its outcomes and impact following the example and format in the table below.

SPECIFIC NEEDS	EXPECTED RESULTS	DCE MEASURES
What are the specific needs that triggered this project? Electronic components need to become smaller and lighter to match the expectations of the end-users. At the same time there is a problem with sourcing key raw materials which has an environmental impact.	*What do you expect to generate by the end of the project?* Publication of a **scientific discovery on transparent electronics**. **New product**: More sustainable electronic circuits. **Three PhD students trained.**	*What dissemination, communication and exploitation (DCE) measures will you apply to the results?* **Exploitation of the new product**: Patenting the new product; Licencing to major electronics companies. **Dissemination towards the scientific community and industry**: Participating at conferences; Developing a platform on material compositions for industry; Participation at EC project portfolios to disseminate the results as part of a group and maximise the visibility vis-à-vis companies.
TARGET GROUPS	**OUTCOMES**	**IMPACTS**
Who will use or further up-take the results of the project? Who will benefit from the results of the project? **End-users:** consumers of electronic devices. **Major electronic companies:** Samsung, Apple, etc. **Scientific community** (field of transparent electronics).	*What change do you expect to see after successful dissemination and exploitation of project results to the target group(s)?* **High use of the scientific discovery published** (measured with the relative rate of citation index of project publications). **A major electronic company** (Samsung or Apple) **exploits/uses the new product** in their manufacturing.	*What are the expected wider scientific, economic and societal effects of the project contributing to the expected impacts outlined in the work programme and call scope?* **Scientific:** New breakthrough scientific discovery on transparent electronics. **Economic/Technological:** A new market for touch enabled electronic devices. **Societal:** Lower detrimental impact on the climate from the manufacturing of electronics (including through material sourcing and waste management).

4.8 Section B4: The quality and efficiency of the implementation

4.8.1 Section B4.a: Overview of the consortium

This section should be a maximum of 1.5 pages for proposals with 15 partners or less (up to 20 partners a maximum of 2 pages, and up to 25 partners a maximum of 2.5 pages) and should explain how the consortium brings a balance of skills and high quality experience to the project. You should explain how your consortium makes the best use of the available capabilities and if there are any duplicated skills or facilities between your partners, you must justify this. Similarly, if a few partners dominate particular parts of the project this should be explained.

You must explain the contribution of all partners on a partner by partner basis, demonstrating that they each have a valid role, even if it is a small role in the project. If the proposal includes an Affiliated Entity (previously known as a Linked Third Party), please include details at the end of the information about the partners. Please do not name individual people nor include collaborators.

Example: Section B4.a: Overview of the consortium

The consortium brings together the leading European NMIs and DIs in high-accuracy pressure metrology, and they are complemented by a number of research institutes and companies that bring in their specific knowledge and experience. In total, 9 NMIs/DIs, 3 universities and 1 company are included.

- **BBB** has expertise operating liquid column micromanometers, mercury manometers and micromanometers, force-balanced piston gauges of Furness Rosenberg Standard (FRS) type, static and continuous expansion systems, state-of-the-art density measurement capability, used e.g. in the Avogadro project, and facilities for dimensional measurements on piston-cylinders, modelling the rarefied gas flow in the piston-cylinder gap, application of optical methods for dynamic vacuum measurements. BBB will coordinate this project and participate in all technical WPs. Further to this BBB has experience in coordinating previous pressure related EMRP projects (JRP IND99 MEASURE).
- **AAA** has experience operating force-balanced piston gauges (FPG) of 8601 type, possesses a continuous expansion system covering the pressure range up to 3 Pa, and has expertise in the adjustment of the piston in cylinder by a capacitance measurement method and in weather-independent pressure calibration approaches, calibration and measurement of low pressures using CDGs. AAA's expertise will primarily be used in WP2 and WP3.
- **CCC** has facilities in the intermediate pressure-to-vacuum range, such as a primary mercury column, a force-balanced piston gauge, and static and dynamic expansion systems. These capabilities, which will be utilised in WP1 and WP2, are important in the characterisation of pressure standards for use as alternatives to mercury manometers.
- **DDD** can calibrate force-balanced piston gauges against state-of-the-art pressure balances operated in gauge and absolute pressure mode. In particular it has experience in the measurement of negative gauge pressure by different methods (WP2) and has piloted comparisons of negative gauge pressure measurements (WP4). DDD also has experience in standardisation work and thus the development of recommendations and norms for negative gauge pressure calibrations, and this experience will be utilised in WP5.
- **EEE** has a background in the laser spectroscopy of atoms notably with atomic beams and vapour cells for tests of fundamental physics, the measurement of fundamental constants and surface physics related to mass standards. It also supervises work on flow metrology and collaborates in projects related to the measurement of the Boltzmann constant via acoustic thermometry. EEE has capability in the assessment of methods for negative gauge pressure calibration as well as the evaluation of alternative pressure standards (WP3).
- **FFF** has primary standards in the intermediate pressure-to-vacuum range such as pressure balances, non-rotating piston gauges of FPG- and V1600D-type, static and continuous expansion systems, facilities and expertise in liquid density measurements. FFF will contribute to the experimental study of force-balanced piston gauges as secondary standards (WP2), development and characterisation of transfer standards for the intermediate pressure range (WP4) and analysis of oils suitable for liquid column micromanometers (WP1).
- **GGG** has pressure balances, force-balanced piston gauges of FPG and FRS type, a static expansion system as well as a measurement capability for measuring the refractometric index of gases using Fabry-Perot techniques which can be used for the investigation of alternative systems for pressure measurement by optical methods in the range 1 Pa to 10^4 Pa. GGG will participate in all technical WPs. Having close contacts with related industries, GGG will coordinate engagement with industries that utilise pressures in the intermediate range from 1 Pa to 10^4 Pa and facilitate the uptake of the technology and measurement infrastructure developed by the project in WP5.
- **HHH** has facilities for the measurement of the density of oils at variable gas saturation conditions and pressures, as well as for the measurement of oil viscosity with the uncertainty levels that meet the requirements of the oil micromanometer to be developed within WP1.
- **III** has special facilities and experience in measuring the kinetics of gas absorption and desorption which are required to study potential manometric oils and to predict their density dependence on gas pressure change and time. III has low absolute and gauge pressure standards which will be used for the characterisation of CDGs in the range from 10 Pa to 100 kPa in WP2.
- **JJJ** has expertise in modelling gas flow in the viscous, transient and molecular regimes based on the Direct Simulation Monte Carlo (DSMC) method and approximations based on the Boltzmann kinetic equation. This knowledge is required for the analysis and primary characterisation of the force-balanced piston gauges in WP2.
- **KKK** has experience and instrumentation for vacuum generation and measurement, leak testing and vacuum technology, high vacuum gauge calibration, reference leak calibration and leak testing. The measurement capabilities of KKK are useful for the development and characterisation of transfer pressure standards in the intermediate pressure range to be carried out within WP4.
- **LLL** possesses a force-balanced piston gauge of FPG type and has their specific dimensional measurement techniques and methodology for the effective area calculation which will be applied to characterise their FPG as a primary pressure standard in WP1.
- **MMM** is a worldwide company providing calibration facilities and service for pressure and vacuum to global leaders in industries such as aerospace, automotive, chemical, electronics, energy, pharmaceutical and telecommunications. MMM's participation in the

project is important for producing impact in industries that utilise pressures in the intermediate range from 1 Pa to 10^4 Pa and for facilitating the uptake of the technologies and measurement infrastructure developed by the project in WP5.

4.9 Section C: Detailed project plans by work package

This section should describe the technical work planned to meet the objectives described in Section B2.a and to deliver the summary list of deliverables in Section B2.b.

Your proposal must contain:

- A maximum of 5 technical work packages
- 1 “Creating impact” work package (mandatory)
- 1 “Management and coordination” work package (mandatory).

PLEASE NOTE that each work package should have a clear aim, be suitably challenging, and explain how the research goes beyond the current state-of-the-art. Each work package should also demonstrate that the project is collaborative, and therefore should usually have a good balance of partners. In addition, unless stated, it is expected that the activities within the work packages will be carried out using the equipment available at the partners and under their supervision.

Please do NOT include any photographs, diagrams or lists of references in Section C. **Special case of similar work in one or more other proposals**

In previous Calls there have been occasions where projects addressing different SRTs require similar work. In such cases, you should treat the work as part of your own project, but you should also identify in the relevant tasks where there is synergy with another proposal. Should both projects be selected for funding the overlapping work in each of the projects will be examined and an appropriate resolution will be reached to avoid double funding. It will therefore simplify grant preparation if you design the work in such a way that the potential duplicate work could be removed with minimal changes.

4.9.1 Section C1: Technical work packages

You should choose a suitable and concise title that describes the work in the work package. Then provide a brief overview of the work package, which is a maximum of half a page and includes;

- The aim of the work package, including target uncertainties and ranges (where appropriate). If applicable this can be the same as the relevant objective(s) in section B2a,
- A brief overview of the background for the work package and tasks,
- How the tasks of the work package fit together, and the aims of the tasks. PLEASE NOTE that the task aims must match those stated in each task.

4.9.2 Section C1.a: Technical tasks

You should choose a suitable and concise task title that describes the work/aim of the task. Then describe the aim of the task including the target uncertainties. This should be a maximum of 2 short paragraphs ONLY.

For each task use the activity table format in Template 4: JRP protocol. Using this table, describe the activities that will be undertaken and the role of each partner in the activity. You should include target uncertainties, the number of samples, parameters and selection criteria etc. Where an activity relies on input from another activity, the text should include reference to that dependency. You should also include the end date of each activity e.g. M15, under the activity number in the first column. Activities should be scheduled so that all necessary inputs will be available in time. All partners involved in the activity should be mentioned in the activity text and listed in the appropriate column, with the lead partner in bold text.

For each deliverable in Section B2.b you need to include an activity for the submission of the completed deliverable to EURAMET (see the examples for guidance).

Finally, if an Affiliated Entity is included in your project, they should not be mentioned in the activities. Instead, a sentence similar to “The Affiliated Entity NNN will work with partner BBB on this task.” should be included under the activities table.

Example 1: Technical tasks (Industry project)

Task 3.1: Development of methods for the accurate, weather-independent calibration of low gauge pressure instruments

Frequently, the calibration uncertainty for gauge pressure measuring instruments is much larger than the accuracy of the instruments themselves and the uncertainty of the reference standard, due to the instability of the atmospheric pressure. Therefore, the aim of this task is to develop methods for the accurate calibration of instruments that measure low gauge pressure in such a way that results are independent of ambient atmospheric conditions and provide a measurement uncertainty in industrial conditions better than $2\ 10^{-4} \times p + 3$ Pa.

Activity number	Activity description	Partners (Lead in bold)
A3.1.1 M11	CCC will carry out tests of reference atmospheric pressure stabilisation when calibrating an existing precision gauge pressure measuring instrument against an existing FPG. A hermetic chamber capable of enclosing both the FPG and the calibrated gauge will be used. The calibration results as well as the pressure fluctuation records will be compared by CCC with those obtained under normal/ambient laboratory conditions.	**CCC**
A3.1.2 M18	BBB will carry out tests with a variable volume chamber that is open to the atmosphere or controlled by a pressure controller and used as a source of ambient reference pressure. BBB will use the variable volume chamber to calibrate an existing precision gauge pressure measuring instrument against an existing FRS piston gauge. The calibration results as well as the pressure fluctuation records will be compared by BBB with those obtained under normal/ambient laboratory conditions.	**BBB**
A3.1.3 M22	III will build sensors and electronics that are hermetically sealed and backfilled with nitrogen, in order to prevent humidity influencing the sensor signals. III will provide the sensors and electronics to CCC, who will test the performance of the new sensors and electronics at variable conditions using their hermetic chamber. CCC will provide the results of the tests to III as a statement of the capability of the sensors and electronics.	**CCC**, III
A3.1.4 M24	Using input from the tests in A3.1.2-A3.1.3, EEE will analyse the influence of environmental conditions and their uncertainty on low gauge pressure instruments. From the results EEE will design appropriate methodology (including a pressure circuit) for calibrating low gauge pressure measuring instruments independently of the environmental conditions and with a measurement uncertainty in industrial conditions better than $2\ 10^{-4} \times p + 3$ Pa. EEE will provide the methods to BBB, CCC and III who will review and agree them.	**EEE**, BBB, CCC, III
A3.1.5 M24	CCC, BBB, EEE and III will review the calibration methods from A3.1.4 and will send them to the coordinator. Once the calibration methods have been agreed by the consortium, the coordinator on behalf of BBB, EEE and III will then submit them to EURAMET as **D3**: '*Calibration methods for accurate, weather-independent calibration of low gauge pressure instruments with an uncertainty in industrial conditions better than* $2\ 10^{-4} \times p + 3$ *Pa'*.	**CCC**, BBB, EEE, III

4.9.3 Section CN-1: Creating impact

This work package should include all partners in a wide range of activities to maximise the outcomes and impact of the project by disseminating the outputs of the project, communicating, and particularly encouraging their uptake and exploitation by end-users.

- **Communication** should promote the project throughout its full lifetime. The aim is to inform and reach out to society and show the activities performed, as well as the use and the benefits the project will have for citizens.
- **Dissemination** is the public disclosure of the project's results by appropriate means, other than resulting from protecting or exploiting the results, including by scientific publications in any medium.
- **Exploitation** is the use of results in further research and innovation activities other than those covered by the project, including among other things, commercial exploitation such as developing, creating, manufacturing and marketing a product or process, creating and providing a service, or in standardisation and regulatory activities.

The planned measures should be proportionate to the scale of the project, include concrete actions to be implemented both during and after the end of the project, identify the target groups and describe the proposed channels to interact with these groups. You should ensure the work package includes adequate and appropriate links with the end-user community, as well as ensuring there are adequate and appropriate links with stakeholders in standards developing organisations (and their relevant committees and working groups), regulatory bodies and industrial/policy advisory committees. You should also establish a project advisory group or stakeholder committee, in order to support interaction with the end-user community and to ensure the project can meet their needs. Please note that the follow up of the exploitation and uptake activities will continue after the end of the project.

You should provide a brief overview of the work package (maximum of third of a page). It is recommended that you structure your work package into 2 tasks:

Task N-1.1 **Dissemination and communication** This task should include a wide range of activities such as establishing a stakeholder committee or advisory board, establishing and maintaining a project website, good practice guides, articles in the popular press, presentations at conferences and workshops, work with standards developing organisations, producing open access peer-reviewed publications, organising and delivering workshops or training courses (including web or e-based training) and modules developed within the project but delivered as part of wider training activities e.g. as part of a university course, communications to the wider community via social media or other channels, press releases etc.

PLEASE NOTE: ALL peer-reviewed scientific publications MUST be open access (see Article 17 and Annex 5 – Specific Rules (Article 17) of the Model Grant Agreement). The activity related to open access peer-reviewed publications should clearly indicate the target number of open access papers the project will produce and the number of these that will be collaborative publications. All papers must be submitted with the relevant meta data. In March 2021 the Commission launched 'Open Research Europe' a no-fee, open access, peer-reviewed publishing venue for EU-funded research (see https://open-research-europe.ec.europa.eu/), which provides a route for publication.

Task N-1.2 **Exploitation and uptake** This task should describe your plans to proactively encourage and facilitate the uptake and use of the project's outputs by relevant users in the industrial and public service communities. This may include the development of commercial measurement or consultancy services, submission and / or publication of new or revised CMCs, new accreditations or certifications, the production or marketing and selling of reference materials, software or other outputs, inclusion of key inputs into new or revised draft technical specifications or documentary standards or regulations or legislation, the incorporation of key data into public databases or reference sources including the SI, adoption of Good Practice Guides or methods by end users. It may also include the commercialisation of specific technologies developed in the project. Where these are protected by formal intellectual property (IP) such as patents you should describe the strategy for this and produce a plan for managing and exploiting the IP.

Under the activity table you should include the sentence "All IP and potential licencing/exploitation will be handled in accordance with the Grant Agreement and the Consortium Agreement."

Example: WPN-1: Creating impact

Task N-1.1: Dissemination and communication

Activity number	Activity description	Partners (Lead in bold)
AN-1.1.1 M36	The project will create a Stakeholder Committee of at least 20 members including CCM and BIPM representatives, balance and weight manufacturers and national accreditation and legal metrology bodies, representing at least 12 European countries. The aim of the Stakeholder Committee is to clarify the needs of the various interested parties and to feed these into the project. Interaction of the Stakeholder Committee will be achieved via a central website (see below) and ad-hoc meetings will be held at suitable events where the committee are in attendance.	**AAA**, all partners
AN-1.1.2 M36	A project webpage will be created on BBB website with public access and a part restricted for partners only. The webpage will be regularly updated with information such as project reports, papers published by the partners, project meetings. The part of the website with restricted access will be dedicated to exchange information and reports throughout the project. It will also include a digital archive of all presentations, reports and papers from the project.	**BBB**, all partners
AN-1.1.3 M36	The partners plan to present at least 15 papers at the following international conferences; • XXII IMEKO world congress (Canada, 9-14 September 2023) • TEMPMEKO (Autumn 2023 Milan Italy, 2024) • Metrologie 2023 (Paris, France) • NEWCONF 2025 (tbc) Further relevant conferences may be identified during the project.	**CCC**, all partners

<table>
<tr><td>AN-1.1.4
M36</td><td>The partners will submit at least 9 papers to open access peer-reviewed journals during the project (all these open access peer--reviewed papers are identified in activities in the technical WPs). Target journals include Metrologia, International Journal of Physics, Measurement Science and Technology.
The expectations are that at least 7 out the 9 open access publications will be the result of a collaborative effort from partners from different countries.
The authors of the open access peer reviewed papers will clearly acknowledge the financial support provided through the Partnership as required by EURAMET.
The authors will ensure that the following meta data is submitted and included for each paper in accordance with Clause 29.2 of the Grant Agreement:
• Funder name: European Partnership on Metrology
• Funder ID: To be confirmed
• Grant number: Project number and project short name</td><td>CCC, all partners</td></tr>
<tr><td>AN-1.1.5
M36</td><td>The partners will present the project to at least 5 professional workshops/exhibitions. The target conferences/exhibitions include
• Prometia events (Autumn seminar; EIT Raw Material Events)
• International Congress for Battery Recycling (ICBR) (September meeting)
• E-Mobility & Circular Economy (EMCE) Summer meeting
The speakers at the conferences will clearly acknowledge the financial support provided as required by EURAMET. The authors will ensure that all data presented will be in accordance with the IP terms of the Grant Agreement.</td><td>EEE, all partners</td></tr>
<tr><td>AN-1.1.6
M36</td><td>To enable other stakeholders to understand and have access to the results of the projects 3 articles will be submitted to the popular press or trade journals such as Physics World, Environment Weekly and Energy Today.</td><td>CCC, all partners</td></tr>
<tr><td>AN-1.1.7
M34</td><td>A project flyer as well as a project poster will be prepared addressing all relevant information about the project and the partners in the beginning of the project. The texts will be written for non-specialist audience. Special emphasis will be on promoting the importance of the basic principles of metrology and its implication for TCE measurements. The flyer and poster will be available for download on the website for all partners. The flyer will mainly be used as a handout during project presentations at conferences and will be added to letters and emails (as a pdf-attachment) for communications with all non-project partners. The project poster will be used to present the general outline of the project during minor conferences and meetings not mentioned below.
A biannual e-newsletter will be produced and sent by email to the stakeholders and other collected contacts (starting at the kick-off meeting and ending at the final meeting). The e-newsletter will also be available in the news section of the webpage. The e-newsletter will cover general information about the project, partners, project results and upcoming events.</td><td>DDD, all partners</td></tr>
<tr><td>AN-1.1.8
M36</td><td>Information on the results of the project will be disseminated to a range of standards bodies and committees and feedback sought (see details below and in the table in Section B3.c).
<table>
<tr><th>Standards Committee / Technical Committee / Working Group</th><th>Partners involved</th><th>Likely area of impact / activities undertaken by partners related to standard / committee</th></tr>
<tr><td>CEN TC/140/WG10</td><td>AAA, CCC</td><td>This CEN WG meets annually in March and it has a specific remit for the standardisation of reference method(s) for the in vitro testing of the susceptibility of bacteria, with importance in human infections, to antimicrobial agents. It also has a remit for standardisation in the field of bacteriology relating to the performance of antimicrobial susceptibility devices which are used for testing the susceptibility of bacteria to antibiotics in most medical laboratories.
AAA and CCC will discuss with the DIN secretariat whether the WG could develop a new programme of standards to capture the specific guidance generated by the project.</td></tr>
<tr><td>JCTLM, WG1 Nucleic Acid Review Team</td><td>AAA, CCC</td><td>The JCTLM NA review team meets annually in December and reviews “higher order” molecular diagnostic RMs and reference measurement procedures for clinical molecular diagnostic tests for approval and listing on the JCTLM database.
CCC, with support from AAA, will submit a JCTLM nomination for a reference method for the quantification of antimicrobial resistant microbes by nucleic acid amplification techniques.</td></tr>
</table></td><td>CCC, AAA, DDD, EEE</td></tr>
</table>

	CCQM Nucleic Acid Analysis Working Group (NAWG)	**AAA**, DDD, CCC, EEE	NAWG meets biannually in April and October and coordinates international comparison studies to facilitate the development of traceable and comparable measurement capabilities for nucleic acids. AAA, with support from DDD, CCC and EEE, will propose a CCQM NAWG study to evaluate capability for viral measurement by PCR methods.
	The representatives on the corresponding committee or WG from the partners will jointly ask the chairperson to include a point in the agenda to briefly present the outputs of the project related to the WG activities and ask for comments. Where appropriate a written report will be submitted for consideration by the committee or WG.		
AN-1.1.9 M36	The partners will produce and publish 3 good practice guides on the project website. • Good practice guide on the selection of appropriate optical instrumentation for optical roughness measurements with CM, CSI and FV. • Good practice guide for stitching of microscopic images under special consideration of roughness and dimensional measurements • Good practice guide for the estimation of measurement uncertainty for optical roughness measurements with CM, CSI and FV They will be advertised by email distribution and through the stakeholder committee, direct contact with stakeholders and the networks of the consortium. The guides will be targeted in particular at industrial end users.		**AAA**, all partners
AN-1.1.10 M36	CCC with support from all partners will set-up an on-line Discussion Group on LinkedIn in order to exchange information among the members of the project and the end-users. This Discussion Group will be used to promote the latest information from the project to end-users and on the project webpages (A5.1.2). Other social media platforms like Twitter will also be used for promoting the latest achievements obtained by the project.		**CCC**, all partners
AN-1.1.11 M36	To approach the wider public at least two press statements will be released: one at the beginning and one at the end of the project and others during the project when results need to be shared with the public. The press release will be disseminated through the participating NMIs and DIs.		**DDD**, EEE
AN-1.1.12 M36	The partners are linked with and are members of various scientific, metrological and industrial networks. These networks will be used to gain additional contacts with potential stakeholders. Therefore, partners will actively engage in various networking activities. Links to the relevant user networks will be also sought and created or expanded. The following networks were identified for further activities: • The Verein Deutscher Ingenieure (VDI/VDE) – supplying networks and platforms within Germany • The Danish knowledge network: The Academy of Technical Sciences – Society of Process- and Production Engineering. (atv-semapp.dk) • Holland High Tech (www.hollandhightech.nl) – aligning public-private activities in the Netherlands and facilitating the development of key enabling technologies for solutions to the grand societal challenges • ENE2017 – 90743 – REDC "Towards ideal thermoelectricity'' Networks of Excellence in Spain • PhotonicNet (Innovationsnetz Optische Technologien) • DGaO: Deutschen Gesellschaft für angewandte Optik • European Optical Society • European Metrology Network on Advanced Manufacturing		**BBB**, all partners
AN-1.1.13 M31	Two workshops for stakeholders will be organised and held during the project. During the first day of the kick off meeting at BBB a special 0.5 day session will be dedicated to a workshop for the stakeholder community. European NMIs and DIs that are not partners, accredited laboratories and temperature instruments manufacturers will be invited. The target number of delegates will be approximately 30. A second stakeholder workshop (1-1.5 days' duration) will be organised and held in M30 at CCC. The workshop will be open to all NMIs, instrument manufacturers and accredited laboratories. The workshop will present the results achieved by the project but will allow time for discussion of the results with all the participating stakeholders and instrument manufacturers. The target number of delegates will be approximately 50. The workshops will be promoted by advertisement on the project website (AN-1.1.2), the partner's websites and through the project's Stakeholder Committee (AN-1.1.1).		**BBB**, all partners
AN-1.1.14 M26	A two-day training course will be organised and held on the day preceding the second stakeholder workshop in M25, probably at CCC. The training course will be targeted at medical physicists, stakeholders (industrial, national authorities etc.) and will focus on the new methods and techniques developed in the project for use in hospitals and clinics. The target number of delegates is between		**CCC**, all partners

	15 and 25. The training course will be promoted by advertisement on the project website (AN-1.1.2), the partner's websites and through the project's Stakeholder Committee (AN-1.1.1).	
AN-1.1.15 M36	A video for e-training on the use of the new methods for quality controls will be developed by CCC and EEE and made available to stakeholders on the project website (AN-1.1.2). It will also be promoted on the partner's websites and through the project's Stakeholder Committee (AN-1.1.1).	**CCC**, EEE

Task N-1.2: Exploitation and uptake

Activity number	Activity description	Partners (Lead in bold)
AN-1.2.1 M36	An exploitation plan will be created at the beginning of the project by CCC with support from all partners and reviewed and updated at least at each project meeting.	**CCC**, all partners
AN-1.2.2 M36	DDD, CCC and AAA will introduce new calibration services for low dose level miniature dosimeters based on the techniques developed in WP2. DDD, CCC and AAA will also develop new draft CMCs for the new calibration services for low dose level miniature dosimeters and will submit these draft CMCs to EURAMET TC-IR.	**DDD,** CCC, AAA
AN-1.2.3 M36	Once the sensor is available from WP3 and WP4, an e-service based on dedicated software for the unfolding of the raw read-out data to derive the time and position dose distribution will be launched by CCC, BBB and DDD.	**CCC**, BBB, DDD
AN-1.2.4 M36	CCC, BBB and DDD will explore the options for patenting or licencing the sensor design after the end of the project.	**CCC**, BBB, DDD
AN-1.2.5 M36	A database of dosimetry data will be generated by the project. The database will be in an open format and will be ready to use by manufacturers of dosimeters, modellers of dosimetry data, as well as developers and users of dosimetry modelling software. The database will be deposited in an accessible repository and will be built according to the FAIR data strategy. Efforts will be taken AAA, BBB and CCC together with industry partners and regulatory bodies to ensure that the data will be convertible into formats used by different end users.	**AAA**, BBB, CCC
AN-1.2.6 M36	BBB, CCC and EEE will actively contribute to the development of technical reports and/or standards on TLM/TLA as developed by CIE TC 2-89 and CIE TC 1-83 (or its successor) via their involvement in the respective TCs. They will also actively liaise with key members of the committee with the aim that the project results will be incorporated into the revision of the CIE standards S023 and S025.	**BBB, CCC, EEE**
AN-1.2.7 M36	The project's Chief Stakeholder chairs committee IEC TC62/SC62A which oversees the standards IEC 60601-1 and IEC 62464-1, the major standard pertaining to clinical MRI. The Chief Stakeholder will be informed about the project outcomes, including the Good Practice Guides (containing a proposal for a new clinical qMRI normative standard), and the report on the multi-site study performed using the phantoms developed in the project, and the protocol used. CCC and EEE will work with the Chief Stakeholder to develop a NWIP for a new clinical qMRI normative standard for potential adoption by the committee.	**CCC**, EEE

All IP and potential licencing/exploitation will be handled in accordance with the Grant Agreement and the Consortium Agreement.

4.9.4 Section CN: Management and coordination

This work package must involve all partners as each has to contribute to project reporting and should attend project meetings. It is recommended that you structure your work package into 3 tasks:

Task N.1 Project management

Task N.2 Project meetings

Task N.3 Project reporting The dates for the submission of reporting documents will depend upon the duration of the JRP. However, there must be 2 periods and hence 2 periodic reports. Therefore, for a 36 months JRP reporting documents must be submitted at months 9, 27 (+ 45 days) and 18, 36 (+ 60 days). You should also include an activity for the reporting for the midterm review.

Under the activity table you should include the sentence "Formal reporting will be in line with EURAMET's requirements and will be submitted in accordance with the Reporting Guidelines."

Please note that some of the project reporting requirements and timings are still subject to change or confirmation.

Example: WPN: Management and coordination

Task N.1: Project management

Activity number	Activity description	Partners (Lead in bold)
AN.1.1 M36	The project will be managed by the coordinator from AAA, who will be supported by the project management board consisting of one representative from each partner, including the leaders of each work package. The members of the project management board will guide the project, attend the project meetings, organise the progress meetings at their local institutes and call additional meetings if needed to ensure the overall project's success.	**AAA**, all partners
AN.1.2 M36	The work package leaders will report on the on-going progress of the project to the coordinator by e-mail and telephone conferences.	**AAA**, BBB, CCC
AN.1.3 M36	The coordinator, with support from the partners, will manage the project's risks to ensure timely and effective delivery of the scientific and technical objectives and deliverables.	**AAA**, all partners
AN.1.4 M36	The consortium will ensure that any ethics issues identified are addressed.	**AAA**, all partners

Task N.2 Project meetings

Activity number	Activity description	Partners (Lead in bold)
AN.2.1 M2	The kick-off meeting involving all partners will be held approximately one month after the start of the project, at AAA.	**AAA**, all partners
AN.2.2 M36	There will be five formal project meetings. These meetings include the kick-off, mid-term (around M18) and final meeting (around M36). In addition, two further meetings will be held around M9 and M27. The meetings will be held prior to reporting. The meetings will review progress and will be used to ensure partners are clear as to their role for the next period. The location of the meetings will rotate among the partners. Where possible, meetings may be held as satellite meetings to important conferences or committee meetings.	**AAA**, all partners
AN.2.3 M36	In addition, technical meetings of work package groups may be held whenever necessary and will be arranged on an ad-hoc basis.	**AAA**, all partners

Task N.3 Project reporting

Activity number	Activity description	Partners (Lead in bold)
AN.3.1 M1	One month after the start of the project a publishable summary will be produced and submitted to EURAMET.	**AAA**, all partners
AN.3.2 M6	Six months after the start of the project a data management plan (DMP) and a dissemination, communication and exploitation plan (DCE) will be produced and submitted to EURAMET.	**AAA**, all partners
AN.3.3 M36 +60 days	Following Articles 19 and 21 and the data sheet of the grant agreement, information will be submitted to EURAMET, in accordance with the procedures issued by them to enable EURAMET to comply with its obligations to report on the programme to the European Commission. • Progress reports will be submitted at months 9, 27 (+ 45 days), 18, 36 (+ 60 days). • Impact/Output reports will be submitted at the same times. All partners will provide input to these reports and the coordinator will provide these and updated publishable summaries to EURAMET.	**AAA**, all partners
AN.3.4 M36 +60 days	Periodic Reports (including financial reports and questionnaires (if applicable)) will be delivered at months 18 and 36 (+ 60 days) in accordance with Articles 19 and 21 and the data sheet of the grant agreement. All partners will provide input to these reports and the coordinator will provide these to EURAMET.	**AAA**, all partners
AN.3.5 M36 +60 days	Final Reports (including updated data management plan, updated dissemination, communication and exploitation plan and results ownership list) will be delivered at month 36 (+ 60 days) in accordance with Articles 19 and 21 and the data sheet of the grant agreement. All partners will provide input to these reports and the coordinator will provide these to EURAMET.	**AAA**, all partners
AN.3.6 MX ***not NRM***	The project will be subject to a midterm review in Spring 2024. Reports (project self-assessment, updated publishable summary and presentation) will be delivered prior to the midterm reviews for Call 2021, following the schedule detailed by EURAMET for the specific review. All partners will provide input to these reporting documents and the coordinator will provide the documents to EURAMET.	**AAA**, all partners
AN.3.6 MX	The project will be subject to a midterm review in Spring 2024. Reports (project self-assessment, updated publishable summary, presentation, and letter from the Chief Stakeholder) will be	**AAA**, all partners

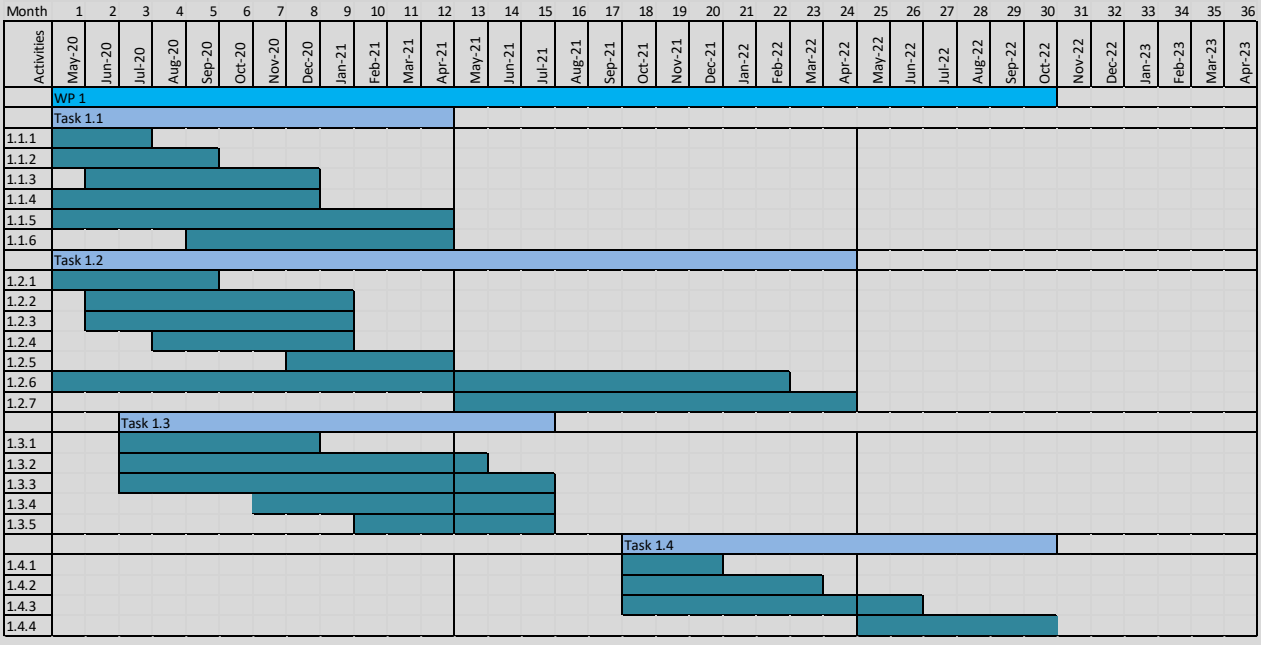
NRM only	delivered prior to the midterm reviews for Call 2021, following the schedule detailed by EURAMET for the specific review. All partners will provide input to these reporting documents and the coordinator will provide the documents to EURAMET.	

Formal reporting will be in line with EURAMET's requirements and will be submitted in accordance with the Reporting Guidelines.

4.10 Section CN+1: Gantt chart

The Gantt chart can be produced using MS Excel (preferable) but it must show the duration of each work package, task, and activity (by month). Please do NOT include lists of partners involved or the title for work packages or tasks.

Example: CN+2: Gantt Chart



4.11 Section D: Risks and risk mitigation

This section should be completed using the tables in Template 4: JRP protocol. You should separate your risks into 2 categories:

Section D1 **Scientific/technical risks** (problems related to the research)

Section D2 **Management risks** (problems with staff, IP etc)

PLEASE NOTE that where a collaborator is providing access to their facilities or equipment or an 'Affiliated Entity' is included in your proposal you should include specific risks associated with their involvement.

Technical risks should be considered on a task by task basis, although some tasks may be grouped for identical or similar risks. There may be more than one risk per task. You should also consider any risks arising as a result of the ethics or security self-assessments for your proposal (see sections 5 and 6 for further information). For each risk, you should identify:

- What the risk is
- What could the consortium do to decrease the likelihood of the risk occurring (mitigation)
- What is the likelihood of the risk occurring even after the mitigation measures (high, medium or low)
- What impact the risk occurring would have on the project and the level of severity (i.e. the relative seriousness of the risk and the significance of its effect, expressed as high, medium or low)
- What the consortium could do if despite the mitigation the risk still occurs (contingency)

Example: Section D1 scientific / technical risks

Risks (description)	Likelihood, impact and severity of occurrence	Mitigation i.e. what the consortium will do to decrease the likelihood of the risk occurring	Contingency i.e. what the consortium will do if despite the mitigation the risk still occurs
Tasks 1.1-1.4: Technique A: Gas pressure deforms the capacitor, increasing the measurement uncertainty of capacitance in an unknown way	Likelihood after mitigation: Medium Impact: Incorrect measurement of the capacitance will affect the uncertainty of the main result, potentially beyond 10^{-6}. Level of severity: Medium	Time will be spent on the capacitor design and this will significantly reduce this risk. Detailed investigations of the material properties and comparison of different capacitor designs will be carried out in parallel with theoretical simulations. A “go/no-go” review will assess the feasibility of overcoming the risks relating to capacitor design and use.	Should the resulting capacitor design be ambiguous, an independent laboratory could provide additional independent checking. This checking would take an additional 8 weeks.
Task 2.2: Technique B: The molar mass and the ideal gas heat capacity ratio of the gas cannot be determined with the target uncertainty of < xx %	Likelihood after mitigation: Low Impact: The uncertainty due to molar mass and heat capacity will affect the uncertainty of the constant, potentially beyond 10^{-6}. Level of severity: Medium	Published data values are available and should be suitable for use. If the published values have too high an uncertainty, the lead partner will determine more accurate values anchored to an absolute calibration.	Even if the uncertainties for the molar mass and the ideal gas heat capacity ratio of the gas are higher than the target, it is highly likely that this will still represent significant progress beyond that which is currently available.
Task 2.3: Poor quality of radionuclide materials for production of selected standard sources (e.g. due to impurities)	Likelihood after mitigation: Medium Impact: Some selected radionuclides cannot be used. Level of severity: Low	A number of suppliers will be identified early in the project. If the purity of the radionuclides appears to be an issue different/more suppliers of radionuclide materials will be used with emphasis on their purity.	Additional purification of radionuclide materials will be performed in the partner’s radiochemical laboratories.
Task 3.1: Reference clock or distribution system fails	Likelihood after mitigation: Medium Impact: Number of possible comparisons will be smaller. Level of severity: Low	Time and frequency distribution is a key task of the participating sites. Reference clocks and microwave distribution systems are available at all partners and two partners have more than one system thus providing some back up.	If the equipment at one participating station fails, the equipment at the other three participating institutes will still be available enabling a reduced number of optical clock comparisons to be made.
Task 3.2: Unable to obtain access to collaborators’ or end-users’ facilities to evaluate the project devices	Likelihood after mitigation: Low Impact: Verification of the results on-site will not be possible. Level of severity: Low	Partners will contact collaborators at the start of the project to ensure that there are enough collaborators that have initially indicated their willingness to provide access to suitable facilities so that the device can be tested on at least one site.	In the event that none of the collaborators can/will provide access to suitable facilities, the partners will hire a foundry and test the devices.
Tasks 3.3: End user installations are not available for on-site testing	Likelihood after mitigation: Medium Impact: Unable to undertake in-situ / on-site testing and reduced use of results by end-users. Level of severity: High	The on-site testing will be planned in such a way as to avoid any interruption of the production process. Measurement results will be published as per agreement with end-users.	If, after mitigation, this cannot be achieved, the consortium will discuss the situation with EURAMET and re-scope this WP. Simulation of in-situ / on-site testing will be considered as an alternative solution.

Example: Section D2 management risks

Risks (description)	Likelihood, impact and severity of occurrence	**Mitigation** i.e. what the consortium will do to decrease	**Contingency** i.e. what the consortium will do if despite

		the likelihood of the risk occurring	the mitigation the risk still occurs
Key personnel are lost to the project	Likelihood after mitigation: Low Impact: The loss of key team members would create difficulties in delivering the project, or specific tasks or deliverables. Level of severity: Medium	None of the team members are planning to leave or retire within the project. The grouping of experts within the consortium should minimise the areas where knowledge is held by a single person. All the partners will identify backups for key workers wherever possible to reduce the overall risk to the project. Project plans will be shared within the consortium and results and methodology will be documented.	If a key member leaves the project, then the partner concerned will be responsible for appointing a replacement. However, this may still lead to a delay in delivery.
Complexity of managing a large consortium	Likelihood after mitigation: Medium Impact: Failure to fully cooperate or communicate effectively within the consortium could endanger efficient delivery of the project. Level of severity: Low	The partners are all experienced with complex multinational projects. Many have previously developed close relationships through collaborating within other European consortia. Regular communication and feedback will ensure that potential problems are identified early and that all partners are clear on their roles.	WP leaders will play an important role in flagging up potential problems to the coordinator and the project management board, who will then decide on the best course of action to take. If necessary, work will be reassigned to an alternative partner, or parts of the work re-scoped in agreement with EURAMET.
Inter-dependencies between technical activities and tasks are too complex	Likelihood after mitigation: Medium Impact: Tasks are delayed, or it is not possible to deliver them. Level of severity: Medium	Technical meetings run by WP leaders have been scheduled to ensure proper sharing of knowledge. The interdependencies between tasks will be considered at meetings to ensure that this is addressed properly in the planning of the work. The technical WPs will be closely managed by their WP leaders to ensure that they deliver their own outputs.	In most cases, activities on the critical path have some overlap in time and thus a delay in the output of one deliverable does not necessarily cause an immediate delay in another.
Problems dealing with Intellectual Property (IP) ownership and/or exploitation might occur and could be a source of potential conflict	Likelihood after mitigation: Medium Impact: Disagreement between the partners could delay the project (in implementing the work and publishing results). Level of severity: Low	All partners will sign the grant agreement and consortium agreement, which includes IP clauses.	Independent arbitrators will be used in the event of disagreement between partners.
The Affiliated Entity does not deliver their key parts of the work	Likelihood after mitigation: Low Impact: Parts of the project may not be delivered effectively. Level of severity: Low	Partner YYY will work with the Affiliated Entity to ensure that they are aware of their obligations. Under the terms of the grant agreement partner YYY would be liable for the relevant parts of the project if the Affiliated Entity defaults.	If partner YYY also defaults on their obligations, then the other partners become liable. The tasks affected would have to be reassigned or re-scoped in agreement with EURAMET.
A collaborator fails to provide access to facilities or equipment	Likelihood after mitigation: Low Impact: The consortium may not be able to complete the planned work, or the work might need to be delayed until another collaborator or alternative access to facilities or equipment is found.	The coordinator or relevant partner will liaise with the collaborator early in the project regarding access to the facilities' / equipment. All collaborators are professional organisations and experienced in working in projects. Each WP leader will work closely with	The WP leader will work with the coordinator to find an alternative collaborator or alternative access to facilities or equipment.

	Level of severity: Low	each associated collaborator to report any issues back to the coordinator. Project meetings are held every 9 months, so any issues will be discussed at these meetings.	
Activities are delayed due to delayed input from previous EMPIR projects e.g. 18TTT05 Squiggle	Likelihood after mitigation: Medium Impact: Activities may not be completed within the timeline of the project, resulting in incomplete activities. Likelihood after mitigation: Medium	The coordinator and WP leaders of this project will maintain good contact with the coordinators and WP leaders of the previous EMPIR projects to ensure tasks are progressing as planned and information can be disseminated in a timely manner. Partner CCC is involved in 18TTT05 Squiggle and is coordinating this project (respectively) and so communication should not be an issue.	The coordinator and WP leaders will work to find a way to reduce or simplify the information required to prevent delays. If necessary, work will be re-scoped, in agreement with EURAMET.
The onsite facilities of partners, and/or access to public/commercial services or sites is restricted for a period of time during the project due to an extraordinary event or situation that is beyond the partners' control e.g. COVID-19	Likelihood after mitigation: High Impact: Activities and deliverables are delayed, or no longer able to be completed. Level of severity: High	In most cases, activities on the critical path have been scheduled to have some overlap in time and thus a delay in the output of one activity will not necessarily cause an immediate delay in another.	Where possible, work will be reassigned to an alternative partner, or rephased, therefore minimising delays and technical deviations that would have a negative impact on the project. If necessary, the consortium will contact EURAMET to discuss options according to the grant agreement.
Organisation of workshops and joint demonstrator activities in a post- or trans-COVID world	Likelihood after mitigation: Medium. Impact: Failure to show the outputs at workshops or through joint demonstrator activities risks reducing the knowledge transfer and impact from the project. Level of severity: Low	It is difficult to know when/if the COVID travel restrictions will be removed. Some flexibility is built into the tasks and activities with nominal locations and dates, but these will be reviewed nearer the time and the consortium will decide on the appropriate locations of such activities e.g. to take advantage of/cope with moved external events.	Alternatives such as webinars or online meetings can be used.

4.12 Section E: Operational capacity

The operational capacity of all partners in a proposal to deliver the project will be assessed by the referees under the 'Quality and efficiency of the implementation' criterion as part of the evaluation process. Section E requests information on each partner in order to allow the referees to make their judgement on whether each partner has the necessary basic operational capacity to carry out their proposed activities.

For each partner, you should write a description, including key roles and contributions (usually no more than half a page per partner) and include:

- A brief description of the organisation and persons who will be primarily responsible for carrying out the proposed research
- A very brief description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work
- A list of up to five relevant previous projects or activities, connected to the subject of the proposal
- A list of up to five relevant open access publications , widely-used datasets (FAIR and '*as open as possible, as closed as necessary*'), services or other achievements relevant to the call and project

- A description of any third parties that are not represented as partners, but who will nonetheless be contributing towards the work (e.g. providing facilities, computing resources). This description is only required for third parties which supplement the infrastructure of a partner – it should NOT include collaborators.

For the proposed coordinator please also include evidence of their experience in managing similarly complex and large projects.

Please note that if your project is selected for funding this section will be deleted before the grant agreement is issued.

4.13 Section F: References

References, other than those identified under the individual partners in Section E, should be listed in this section. Please only include key references.

4.14 List 4: Checklist for Template 4

To help you complete your JRP proposal and avoid some common issues identified with proposals submitted to previous Calls, the EURAMET MSU has produced List 4: Checklist for Template 4. The purpose of List 4 is to help proposers to review their completed JRP protocols and to check that all required information is included prior to submission. In addition, List 4 also includes checks to help proposers ensure that all required information is included in the Form 4a: Ethics self-assessment (and its associated annex where applicable) and the Form 4b: Security self-assessment (see 5 and 6 below).

5 Ethics self-assessment

As required under Horizon Europe, each consortium must complete an ethics self-assessment questionnaire (Form 4a). Guidance on completing the self-assessment, together with associated examples and information on ethics in general, can be found in the Commission's document 'How to complete your ethics self-assessment' (https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/guidance/how-to-complete-your-ethics-self-assessment_en.pdf). Please note that some of the proposal sections referred to in the Commission's guidance will differ from those in Template 4: JRP protocol. If you have identified any issues in the ethics issues table in Form 4a (i.e. the answer to any question is YES), then you must indicate in the box adjacent to the question on which page(s) in your JRP protocol further information relating to that ethics issue can be found.

In addition, if the answer to any question in Form 4a is YES, then you must perform an ethics self-assessment in accordance with the guidelines "How to Complete your Ethics Self-Assessment". You must provide the information requested below in a separate Word document (labelled as 'SRT no Form 4a Annex') in addition to the Form 4a and Form 4b (see 6 below). The Word document should include 2 sections 'Ethical dimension of the objectives, methodology and likely impact' and 'Compliance with ethical principles and relevant legislations'.

The 'Ethical dimension of the objectives, methodology and likely impact' section should explain in detail the identified issues in relation to:

- objectives of the activities (e.g. study of vulnerable populations, etc.)
- methodology (e.g. clinical trials, involvement of children, protection of personal data, etc.)
- the potential impact of the activities (e.g. environmental damage, stigmatisation of particular social groups, political or financial adverse consequences, misuse, etc.)

The 'Compliance with ethical principles and relevant legislations' section should describe:

- how the issue(s) identified in the ethics issues table will be addressed in order to adhere to the ethical principles and
- what will be done to ensure that the activities are compliant with the EU/national legal and ethical requirements of the country or countries where the tasks are to be carried out. Remember that for activities performed in non-EU countries, they should also be allowed in at least one EU Member State.

The completed Form 4a, together with the Word Annex to Form 4a should be submitted in the zip folder as part of the proposal.

6 Security issues self-assessment

As required under Horizon Europe, each consortium must complete a short security self-assessment questionnaire (Form 4b) and submit it in the zip folder as part of their proposal. The aim is to identify if the proposed activity will use and/or generate information which might raise security concerns. If you have identified any issues in the security issues table in Form 4b (i.e. the answer to any question is YES), then you must indicate in the box adjacent to the question on which page(s) in your JRP protocol further information relating to that security issue can be found.

7 Evaluation

7.1 Evaluation criteria

The evaluation criteria for proposals are:

1. Excellence.
2. Impact.
3. The quality and efficiency of the implementation.

1. Excellence The following aspects will be taken into account, to the extent that the proposed work corresponds to the SRT: • Clarity and pertinence of the project's objectives, and the extent to which the proposed work is ambitious, and goes beyond the state of the art. • Soundness of the proposed methodology, including the underlying concepts, models, assumptions, inter-disciplinary approaches, appropriate consideration of the gender dimension in research and innovation content, and the quality of open science practices, including sharing and management of research outputs and engagement of citizens, civil society and end users where appropriate.
2. Impact The following aspects will be taken into account, to the extent that the proposed work corresponds to the SRT: • Credibility of the pathways to achieve the expected outcomes and impacts specified in the work programme, and the likely scale and significance of the contributions due to the project. • Suitability and quality of the measures to maximise expected outcomes and impacts, as set out in the dissemination and exploitation plan, including communication activities.
3. Quality and efficiency of the implementation The following aspects will be taken into account, to the extent that the proposed work corresponds to the SRT: • Quality and effectiveness of the work plan, assessment of risks, and appropriateness of the effort assigned to work packages, and the resources overall • Capacity and role of each participant, and extent to which the consortium as a whole brings together the necessary expertise.

All JRP proposals are evaluated against the evaluation criteria in Form 6c: JRP Evaluation. Referees will evaluate each proposal as submitted and not on its potential if certain changes were to be made.

If referees identify shortcomings (other than obvious clerical errors) in the proposal, they will reflect these in a lower score for the relevant criterion.

Proposals with significant weaknesses (e.g. that prevent the project from achieving its objectives or with seriously over-estimated resources) will not receive above-threshold scores.

Further details of the evaluation process can be found in Guide 6: Evaluating Partnership Proposals at https://msu.euramet.org/. The evaluation of JRP proposals in 2021 will be held as virtual review conferences (i.e. online meetings).