

EMPIR Contracts - Reporting Guidelines
Part 2a – Writing a Technical Report (Progress)

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EMPIR Reporting Guidelines
Part 2a – Writing a Technical Report (Progress)

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

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1 Overview of the Technical Report (Progress)

1.1 Purpose

Part 2a provides guidance on how to write a technical report (progress). A technical report (progress) should be prepared as part of interim, periodic and final reporting by JRPs, SIPs and JNPs. This report provides EURAMET with an overview of progress towards the objectives of the project and an explanation of the work carried out, as well as summarising the work done in relation to the work plan. It enables EURAMET to monitor project progress, whilst providing the coordinator with a mechanism for reporting delays, deviations, their consequences and proposed corrective actions, and any ethical issues. Section 6 of this report is used by EURAMET as part of the process for amending Grant Agreements. This report also requests information on the work performed to meet the mid-term review's recommendations and information on the work performed to address the actions in improvement plans.

1.2 Scope

The technical report (progress) describes the progress a project has made within a specific reporting period (interim or periodic) with a focus on the successful completion of the project's objectives, and their associated tasks and deliverables, as stated in Section B1.b of the Annex 1. Outputs from any RMGs associated with the project should not be included in this report. All sections of the technical report (progress), except for section 6 which is not completed at final reporting, should be completed at periodic reporting. However, Sections 1 and 5 do not need to be completed at interim reporting. There are also a few differences in how JRPs, SIPs and JNPs should complete these reports. These differences are illustrated in the subsections below. This report has the following sections:

Section	Complete at
1 Summary (key highlights/issues/new stories)	Periodic reporting
2 Objectives (copied from Annex 1)	Interim and periodic reporting
3 Deliverables status and progress towards objectives	Interim and periodic reporting
4 Explanation of the work carried out within a reporting period (Task level reporting, consortium performance, post mid-term review recommendations/improvement plans)	Interim and periodic reporting
5 Summary of exploitable results and an explanation about how these will be exploited	Periodic reporting
6 Deviations from Annex 1 (tasks not fully implemented, the consequences and proposed corrective actions)	Interim and periodic reporting (do not complete this section at final reporting)
7 Ethical Issues (as per Annex 1 Section D3)	Interim and periodic reporting

1.3 When required

The technical report (progress) shall be provided at the reporting times specified in Annex 1 of the Grant Agreement, and the final technical report (progress) shall be provided to EURAMET 60 days after the end of the project.

1.4 Format

The technical report (progress) should be in English and submitted to the MSU as a Word file. Reporting Template [03 - Technical report \(progress\) template](#) should be used. The font for a technical report (progress) is Arial 10 with headings in bold.

2 Completing the Technical Report (Progress)

2.1 Cover page

Please complete the cover page in Reporting Template 3 as shown in the example below, including the project logo, number and short name in the box provided. Paste in the completed table from your publishable summary and amend the footer as appropriate by adding the month and year of issue.

Example: Cover page (for a JRP)

20IND99 MetroShine			
TECHNICAL REPORT (PROGRESS)			
Grant Agreement number	20IND99		
Project short name	MetroShine		
Project full title	Metrological approaches for improving the cost efficiency of machine polishing processes in industry		
Version of the latest contracted Annexes against which the assessment will be made	Annex 1:	V1.0	
	Annex 2:	V1.0	
Technical Report (Progress)	1 st <input type="checkbox"/>	2 nd <input checked="" type="checkbox"/>	3 rd <input type="checkbox"/> 4 th <input type="checkbox"/> 5 th <input type="checkbox"/>
Period covered (dates)	From	01 October 2020	To 30 June 2021
Project start date and duration:		01 January 2020, 36 months	
Coordinator: Bob Stefani, AAA		Tel: +89 652 777737777	E-mail: Bob.Stefani@aaa.com
Project website address: www.metroshine.org			
Internal Funded Partners:	External Funded Partners:	Unfunded Partners:	
1. AAA, UK	5. AFA, Czech Republic	9. LAA, Italy	
2. BBB, Germany	6. BGB, Portugal	10. MBB, Belgium	
3. CCC, France	7. CHC, Netherlands	11. NCC, Sweden	
4. DDD, Spain	8. DJD, Austria	12. PDD, Finland	
Linked Third Parties: 13. XYZ, France (linked to CCC)			
RMG1: FGH, Portugal (Employing organisation); AAA, UK (Guestworking organisation)			
RMG2: IJK, Netherlands (Employing organisation); BBB, Germany (Guestworking organisation)			
Report Status: CO Confidential, only for members of the consortium (including EURAMET and the European Commission Services)			
Technical Report (Progress)		1 of 15	Issued: August 2021

2.2 Table of Contents

The Table of Contents should auto-generate, but it will need to be updated once text has been added to the report.

2.3 Section 1: Summary (periodic reports only)

As the summary section is only completed at periodic reporting, it should also include all project work undertaken in the preceding interim reporting period (where interim reporting is applicable). The summary has 3 sub-sections: key highlights, delivery issues and potential news stories for promotional use on the EURAMET website. It should be a maximum of 500 words in length.

Key highlights: In the first paragraph describe the key technical (*JRPs only*), impact (*JRPs and SIPs*) or networking (*JNPs*) highlights including mention of the uptake and exploitation of the project's outputs by standards organisations, industrial, metrological, scientific and other user communities.

Issues: In the second paragraph explain any delays or problems with the project's work and any resulting knock-on effects on the rest of the project. You should also comment on problems with specific deliverables / tasks. *This should not include issues that were caused by the coronavirus (COVID-19) pandemic, unless these could not be resolved by extending the project's duration. If your project has other, non-coronavirus (COVID-19) pandemic issues, please include these here.*

News stories: In the third paragraph briefly detail any items that you think could be used as news stories for promoting the work of your project and the programme on the EURAMET website homepage. Examples of past news stories include: prototypes being tested in industry, best paper awards and publications in prestigious journals. This list of examples is not exhaustive so please include everything that you think may be suitable as a potential news story.

Example: Section 1: Summary (periodic reports only)

1 Summary (periodic reports only)

Key highlights

In WP1 the newly developed metrology for AMR sensors has been used for the first time for the characterisation of industrial AMR sensors. The results have immediately opened up new paths for the improvement of industrial AMR field sensors. In WP2 new calibration facilities have been established and improved. First calibrations of industrial sensors from stakeholders in the new facilities have been carried out successfully. Furthermore, the strong interaction with stakeholders has led to a joint draft of a best practise guide for magnetic field measurements. In WP3 a first probe head for the wafer-scale inductive characterisation of magnetic thin film materials has been designed and tested. In WP4 the development of new standard problems for micromagnetic simulations is a further step towards more reliable micromagnetic simulation tools. In WP5 the realisation and simulation of graphene based nano Hall-sensors is an important step for the application of this promising new material for magnetic bead detection in bio-medical applications.

Issues

Part of Task 3.2 is delayed from November 2020 to February 2021 because the phantoms could not be produced in time. The phantoms have now been completed and the work is getting back on track. Another part of Task 3.2 is delayed from June 2021 to November 2021 because it took longer than expected to obtain the ⁹⁰Y-microspheres. It is expected that this task will end 3 months late. All other tasks are on schedule. The delays to Task 3.2 all relate to independent tasks within the project, therefore these delays will not have a knock-on effect on other tasks. However, these delays are resulting in a delay to deliverable 3, which is delayed from November 2020 to February 2021. Otherwise the deliverables are on schedule and there are no requests for changes to the scope of Task 3.2.

News stories

Industrial manufacturer Med GmbH has included the measurement technique developed in this project in their ceramic hip implant manufacturing process thereby doubling their productivity. In addition, the project's paper on "Infection associated with medical implants" has been published in the high impact journal *The New England Journal of Medicine*.

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2.4 Section 2: Objectives of the project (as per Annex 1)

Please insert the list of objectives from Section B1.b of your JRP, SIP or JNP protocol (Annex 1) into this section. An example is provided below:

Example: Section 2: Objectives of the project (as per Annex 1)

2 Objectives of the project (as per Annex 1)

The specific objectives are:

1. **To develop traceability to SI units for LNG flow meters** - through developing primary standards at NMIs in conditions relevant to the LNG industry and designing and testing systems for industrial scale calibration facilities (WP1 and WP2)
2. **To test and evaluate LNG quantity metering systems** – by an assessment of the uncertainties for the static and dynamic volume measurement technique supported by in-field comparisons between static (volume) and dynamic (flow) measurements and an investigation of cryogenic media and installation effects (WP1 and WP2)
3. **To improve LNG composition measurement systems** – via an assessment of different sampling systems (using industrial data) plus a comparison of sampling-based methods and a novel alternative optical method that assesses LNG composition directly (WP3)
4. **To reduce uncertainties in LNG density and calorific value calculations** – by the development of an advanced primary densitometer to measure the density of LNG with improved accuracy, validation against a pycnometer whose range will be extended and the development of improved equations of state used for density calculations (WP4)
5. **To facilitate the take up of the technology and measurement infrastructure developed in the project** - by the measurement supply chain (accredited laboratories, instrument manufacturers), standards developing organisations (ISO, CEN) and end users (transport and energy sectors). In particular to i) develop an ISO standard for cryogenic flow metering, including recommendations on water calibration transferability; ii) develop an ISO standard for the calculation of the methane number and iii) implement relevant deliverables from the three LNG projects as an annex in the GIIGNL handbook for LNG custody transfer (WP5)

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2.5 Section 3: Deliverable status and progress towards objectives

The ‘deliverable status and progress towards objectives’ table is used to show the status and progress towards completing the project’s deliverables and objectives as listed in the JRP, SIP or JNP protocol (Annex 1 of the EMPIR Grant Agreement). This table should be set up by the coordinator at the beginning of the project, and then updated at the end of each reporting period (including any deliverable/objective changes made in amendments to the EMPIR Grant Agreement). Deliverables should be listed in numerical order with their associated objective (activity delivering the deliverable), deliverable description, partners and delivery dates as per the list of deliverables in Annex 1. The remaining 3 columns should be completed as follows:

- **Actual delivery date to EURAMET:** enter the date (month and year e.g. Aug 2020) that the deliverable was submitted to EURAMET. Do not include dates after the end of the reporting period, even if delivery occurred during the 45/60 day period allowed for the preparation of the technical reports (progress). The latest date that can be included in this column is the final month of the project.
- *Please note* that at project completion, project reports may not be reviewed until all outstanding deliverables (with the exception of the impact and reporting deliverables) have been submitted to EURAMET.

- **Status:** enter a status statement from the list provided (i.e. inactive, on schedule, delayed to..., or completed & submitted to EURAMET) and ensure that this corresponds with the 'Delivery date', and with the list of deliverables in Annex 1.
- **Summary of the progress towards each deliverable and how the project's objectives are being met in this reporting period (one paragraph, include all partners):**
 - Describe in a single paragraph (**text only, maximum 250 words per deliverable**) the progress that each partner made towards its completion within the reporting period, matching text to the selected 'status'. **Descriptions should be provided for all deliverables where the associated task had at least one activity being undertaken during the reporting period (in this case a description should be provided, regardless of whether the activity delivering the deliverable to EURAMET was active or not, so that progress towards each deliverable and its associated objective(s) can be monitored).**
 - For partners who have been inactive in a deliverable during the reporting period, please state that they did not participate in the deliverable during the reporting period.
 - For deliverables that have been completed within the reporting period, include a statement on whether its target was met (or not) and describe progress towards the relevant objectives (as listed in the subsection above).
 - If there are discrepancies or delays to deliverables, the cause, impact and/or knock-on effects of these should be stated. *This might include delays that were caused by the coronavirus (COVID-19) pandemic. For such delays state that the cause was the coronavirus (COVID-19) pandemic and describe any knock-on effects.*
 - This column should be left blank for those deliverables that were reported as being completed & submitted to EURAMET in a previous technical report (progress).

If a deliverable has been amended and the amendment has been accepted by EURAMET, but the revised and approved Annex 1 (JRP / SIP / JNP protocol) has not yet been issued, amend the table according to the agreed revision and include a footnote to advise that the change has been accepted, stating the date when the change was requested or accepted. Only authorised changes to deliverables may be included.

Deliverables should be submitted to EURAMET on their due date as specified in the project's Annex 1: see EMPIR Reporting Guidelines Part 5.

Example: Section 3

3 Deliverables status and progress towards objectives

Relevant objective (Activity delivering the deliverable)	Deliverable Number	Deliverable description	Partners (Lead in bold)	Delivery date in Annex 1	Actual delivery date to EURAMET	Status <i>inactive, on schedule, delayed to..., or completed & submitted to EURAMET</i>	Summary of the progress towards each deliverable and how the project's objectives are being met in this reporting period (one paragraph, include all partners) (max 250 words per deliverable)
1 (A3.5.5)	D1	Validation report including a statement of uncertainty for an interferometric oil micromanometer to be used as a primary absolute and gauge pressure standard for the range up to 2 kPa with target uncertainty of $1 \text{ mPa} + 2 \cdot 10^{-5} \times p$	BBB , AAA, BBB,	Jun 2020	Jun 2020	<i>Completed & submitted to EURAMET</i>	
1 (A2.4.3)	D2	Paper on force-balanced piston gauges as primary and secondary absolute and gauge pressure standards for the range up to 15 kPa with a target uncertainty below $0.01 \text{ Pa} + 1.4 \cdot 10^{-5} \times p$ submitted to a peer-reviewed journal and a statement of uncertainty	EEE , BBB, CCC, FFF	Sep 2020	Sep 2020	<i>Completed & submitted to EURAMET</i>	The paper on force-balanced piston gauges as primary and secondary absolute and gauge pressure standards for the range up to 15 kPa with a target uncertainty below $0.01 \text{ Pa} + 1.4 \cdot 10^{-5} \times p$ was written by EEE, BBB, CCC and FFF and submitted to Metrologia. The statement of uncertainty was prepared, and this deliverable met its target of reducing the uncertainty to below $0.01 \text{ Pa} + 1.4 \cdot 10^{-5} \times p$. This contributed to objective 1 by enabling traceability to the SI.

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2 (A2.4.5)	D3	Report on the uncertainty for (state of the art) ship-based tank-gauging methods based on GUM principles	DDD , AAA, BBB, CCC	Aug 2021		<i>On schedule</i>	The components of the uncertainty budget have been determined by DDD with input from AAA and CCC. In the next reporting period full evidence of the uncertainty for (state of the art) ship-based tank-gauging methods based on GUM principles will be determined. The first steps have been taken towards achieving the goals of Objective 2 which is to improve the performance of tank gauging and flow metering systems. Once the uncertainty budget has been determined work will be able to start on the performance testing of the tank gauging and flow metering systems (as part of D4). BBB did not participate during this reporting period.
2 (A3.3.3)	D4	Calibration methods for positive and negative gauge pressure standards in the range -10^5 Pa to 10^4 Pa with an uncertainty of $3 \cdot 10^{-5} \times p + 1$ Pa	BBB , all partners	Aug 2022		<i>Delayed to Feb 2023</i>	Work has not started on this deliverable, but its completion will be delayed due to the coronavirus (COVID-19) pandemic . No knock-on effects are foreseen as we will follow the project's newly extended timeline.

3 (A1.4.2)	D5	Recommendation report for the use of pressure balances as reference standards for barometric pressure, including a statement of whether the pressure balances achieved the target uncertainty of lower than $1.5 \cdot 10^{-5} \times p + 0.5$ Pa in the range 100 Pa and 200 kPa	DDD, AAA, BBB, CCC	Jan 2022		<i>Delayed to Jul 2023</i>	We have to report that there will be further delays in providing D5. Based on the current progress in Task 1.4, AAA will not manage to finish this report on time. It will take additional time to fine-tune the pressure balances for use as reference standards for barometric pressure and also the new XYZ is not yet available. AAA state that they expect to deliver D5 in July 2023. DDD, BBB and CCC did not participate during this reporting period.
4 (A4.4.4)	D6	Recommendations for the use of optical methods for pressure measurement in the range 1 Pa to 10^4 Pa for absolute, positive and negative pressure	DDD, all partners	Jun 2022		<i>Delayed to Jan 2024</i>	Work has not started on this deliverable, but its completion will be delayed due to the coronavirus (COVID-19) pandemic . No knock-on effects are foreseen as we will follow the project's newly extended timeline.
4 (A4.4.5)	D7	Measurement capabilities report including a statement of uncertainty for a calibration service for positive and negative gauge pressures in the range -10^5 Pa to 10^4 Pa of gauge pressure with an uncertainty below $3 \cdot 10^{-5} \times p + 1$ Pa	FFF, AAA, BBB, CCC	Aug 2022		<i>Delayed to Mar 2024</i>	Work has not started on this deliverable, but its completion will be delayed due to the coronavirus (COVID-19) pandemic . No knock-on effects are foreseen as we will follow the project's newly extended timeline.
4 (A4.5.2)	D8	Validation report including a statement of uncertainty for absolute pressure transfer standards for traceability of industrial vacuum gauges below 10 Pa with an uncertainty of ≤ 0.5 %	FFF, AAA, BBB, CCC	Dec 2022		<i>Inactive</i>	

n/a	D9	Evidence of contributions to new or improved international standards with a specific focus on recommendations for negative gauge pressure calibrations and the traceability of force-balanced piston gauges, to be submitted to EURAMET TC-M, CCM WG P, COOMET TC 1.6, DIN NATG-D, IMEKO TC 16 and accreditation authorities in Europe. Examples of early uptake of project outputs by end users	BBB , all partners	Dec 2022	n/a	n/a	n/a
n/a	D10	Delivery of all technical and financial reporting documents as required by EURAMET	AAA , all partners	Dec 2022	n/a	n/a	n/a
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2.6 Section 4: Explanation of the work carried out

Please list all tasks, excluding the ‘uptake and exploitation’ task (JRPs & JNPs only – as this is included in Section 5) and the ‘management and coordination’ tasks, in task number order in the ‘Explanation of the work carried out’ table and ensure that this table is up to date to the end of the reporting period including any task-related changes made in amendments to the EMPIR Grant Agreement). The columns in this table should be completed as follows:

- **Actual task completion date:** when each task is completed enter the date (month and year e.g. – Aug 2020) in this column. Please note that ‘Actual task completion dates’ must be within the reporting period. Do not include dates after the end of the reporting period, even if the tasks completed during the 45/60 day period allowed for the preparation of the technical reports (progress). The latest date that can be included in this column is the final month of the project.
- **Status:** enter a status statement from the list provided (i.e. inactive, on schedule, delayed to..., or completed) and ensure that this corresponds with the ‘Actual task completion date’, and with the ‘Explanation of the work carried out in each task in this reporting period’.
- **Explanation of the work carried out in each task in this reporting period:** these 2 columns are for summarising the progress towards the aim of each task in the reporting period and to explain any issues affecting the completion of the task (e.g. the cause of delays / deviations etc. and any knock-on effects).
 - **Summary of the progress towards the aim of each task in this reporting period**
 - **For active tasks:** summarise (text only, **maximum 700 words per task**) the overall progress made towards the aim of each task in this reporting period, **without reference to individual partners or specific activities** listed in the Annex 1, however for each task please arrange your paragraphs in logical activity order (where possible). The description should match the ‘status’ selected. Also for completed tasks include a statement of whether the task met its target or not.
 - For tasks that **completed in a previous reporting period or inactive tasks:** leave this column blank.
 - **Explain any issues affecting the completion of the task (eg describe the cause of delays / deviations etc. and any knock-on effects)**
 - **For delayed tasks,** please provide a revised task completion date, an explanation of the reason for the delay, and an explanation of how the consortium will get the task back on schedule (if possible).
 - **For deviating tasks** that will not meet their original targets please include explanations justifying the deviation from the original plan and any knock-on effects that this will have on other tasks.

This might include delays and deviations that were caused by the coronavirus (COVID-19) pandemic. For such delays and deviations follow the 2 bullet points above and state that the cause of the delays and deviations was the coronavirus (COVID-19) pandemic.

If a task has been added, amended or deleted (including a change to its end date), and the amendment has been accepted by EURAMET but the approved Annex 1 (JRP / SIP / JNP protocol) has not yet been issued, amend the table according to the agreed revision and include a footnote to advise that the change has been accepted, stating when this change was requested (if appropriate) and the date of acceptance. Only authorised changes to tasks may be included.

If you wish to include data, tables, histograms, or pictures to highlight the technical strength of the progress in this period, these may be included as a separate document containing this information. Inclusion of such an annex is optional.

Please note that although this section asks for an explanation of the work carried out on a task by task basis, coordinators / project managers are advised to maintain their own reports on an activity by activity basis and it is also recommended that coordinators use a traffic light system to highlight delayed activities.

Section 4.1: Consortium performance

Complete the consortium performance section by either providing a statement confirming that all partners have contributed satisfactorily to the work specified in Annex 1 for this reporting period or list any exceptions to this by naming the defaulting partner(s) and the work that they were required to do.

Section 4.2: Mid-term reviews

The mid-term reviews section should only be completed once your project has had its mid-term review. Note that Support for Impact (SIP) projects will not have mid-term reviews. **If your project has an improvement plan, do not complete Section 4.2.1, only complete Section 4.2.2.**

Section 4.2.1: Work performed to meet the mid-term review's recommendations

EMPIR projects are assessed by independent experts at mid-term reviews. Their recommendations, on the improvements that need to be made by each project, are communicated to the coordinators by the EURAMET MSU in Evaluation Summary Reports. **This section relates specifically to the mid-term review's recommendations as stated in the Evaluation Summary Report from the mid-term review.**

- **For the column titled 'Recommendations'** you should state all of the specific recommendations from your project's mid-term review Evaluation Summary Report.
- **For the column titled 'Progress achieved':**
 - Describe progress towards meeting each recommendation. If any recommendations were met within the reporting period, clearly describe how this was achieved.
 - If any recommendations cannot be met on time, explain the cause, impact and knock-on effects of the delays and deviations.
 - Do not name individual partners in these descriptions unless they are specifically named in a recommendation.
 - Only include text in this column.

Section 4.2.2: Work performed to address the improvement plan

As an outcome from the mid-term reviews, some projects will be required to prepare an improvement plan. If your project requires an improvement plan this will be communicated to you by the EURAMET MSU. **Complete this section if your project has prepared an improvement plan.**

- **For the column titled 'Actions'** you should include all of the actions that are stated in the project's improvement plan.
- **For the column titled 'Progress achieved':**
 - Describe progress towards meeting each action. If any actions were completed within the reporting period, clearly describe how they were achieved.
 - If any actions cannot be met on time, explain the cause, impact and knock-on effects of the delays and deviations.
 - Do not name individual partners in these descriptions unless they are specifically named in the improvement plan.
 - Only include text in this column.

Example: Section 4: Explanation of the work carried out

4 Explanation of the work carried out

Task number & title <i>excluding the uptake and exploitation task (JRPs & JNPs only) & management & coordination tasks</i>	Task end date in Annex 1	Actual task completion date	Status: <i>inactive, on schedule, delayed to..., or completed</i>	Explanation of the work carried out in each task in this reporting period	
				Summary of the progress towards the aim of each task in this reporting period <i>(max 700 words per task)</i>	Explain any issues affecting the completion of the tasks (eg describe the cause of delays / deviations etc. and any knock-on effects) <i>(max 300 words per task)</i>
1.1 Development of all-gate defined tuneable-barrier pumps	Jan 2020	Jan 2020	<i>completed</i>		
2.2 Assessment of the pumping accuracy of SOI-CMOS devices	Mar 2020	Mar 2020	<i>completed</i>	The 'self-referenced' SOI-CMOS devices were provided from Task 2.1 for assessment. The pumping accuracy of the 'self-referenced' SOI-CMOS devices was assessed. The error detection investigation method proved to be a suitable method for assessing pumping accuracy. The target uncertainty of 0.1 ppm, at a current of ≥ 100 pA, was achieved.	None.
3.2 Monte Carlo modelling	Jun 2020		<i>delayed to February 2022</i>	The model developed in Task 3.1 has been further developed and used in this task. Work has commenced on performing the sensitivity analysis of external fields to phantom characteristics using the typical MRI exposure conditions defined in Task 3.1. The Monte Carlo model of the TDCR-Cerenkov detectors has been developed and validated using the code GEANT4. This model takes into account the influence of the ^{90}Y microspheres.	There was a delay in the production of the phantoms. The phantoms have now been completed and the work is getting back on track. However, the report on the sensitivity analysis will be further delayed

					<p>from August 2021 to February 2022.</p> <p>Also, work has yet to commence on the response of the TDCR detection system and on the identification and quantification of impurities in ⁹⁰Y microspheres because it took longer than expected to obtain the ⁹⁰Y-microspheres. It is expected that this report will now be delivered 8 months late. These delays should not have any knock-on effects on other tasks.</p>
4.1 IR radiation thermometry	Dec 2021		<i>on schedule</i>	<p>Work has commenced on designing an IR radiation thermometer with a tuneable operating wavelength. The operating wavelength parameters are being investigated and the IR radiation thermometer is being designed to work within the 500 °C – 1500 °C temperature range. Three draft technical drawings have been prepared thus far and improvements continue to be made as new results become available. The final technical drawing has yet to be completed, but it is expected to be ready on time.</p>	
5.2 Calibration standards	Dec 2021		<i>inactive</i>		<p>Work has not started on this task, but its completion will be delayed due to the coronavirus (COVID-19) pandemic. No knock-on effects are foreseen as we will follow the project's newly extended timeline.</p>
6.1 Knowledge Transfer	Dec 2021		<i>delayed to Jun 2022</i>	<p>A paper on the primary measurement method for ⁹⁰Y-microspheres was submitted for publication in the journal Cancer Biotherapy and Radiopharmaceuticals. Another paper on the HT-SPRTs and thermocouple non-uniqueness study between Al and Ag fixed points was submitted for publication in the Journal of Thermophysics.</p> <p>IEC: TC 65 SC 65B WG5 "Temperature sensors and instruments" a partner in this project chairs the subgroup, "Radiation thermometry" within the IEC technical committee and the working group "Applied</p>	<p>The completion of this task will be delayed due to the coronavirus (COVID-19) pandemic. No knock-on effects are foreseen as we will follow the project's newly extended timeline.</p>

				radiation thermometry” within the VDI. Meetings of the respective standardisation bodies were attended and the outputs of the project were disseminated.	
6.2 Training	Dec 2021		<i>delayed to Jun 2022</i>		Work has not started on this task, but its completion will be delayed due to the coronavirus (COVID-19) pandemic . No knock-on effects are foreseen as we will follow the project’s newly extended timeline.
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4.1 Consortium performance

<p>Provide a statement confirming that all partners have contributed satisfactorily to the activities specified in Annex 1 for this reporting period</p> <p>OR</p> <p>List any exceptions to this by naming the defaulting partner(s) and the activities that they were required to do</p>	<p>All partners have contributed satisfactorily to the activities specified in Annex 1 for this reporting period.</p>
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4.2 Mid-term reviews (only complete this after a mid-term review has taken place)

4.2.1 Work performed to meet the mid-term review's recommendations (do not complete this section if your project has an improvement plan)

Recommendations (as stated in the Evaluation Summary Report from the mid-term review)	Progress achieved
<p>The consortium should strengthen cooperation among the partners, in particular in metrology, both in research activities and in co-authored publications.</p>	<p>The first two years of the project focused on the development of the methods required for making reproducible measurements. All partners have been strongly involved in this by providing training and well-characterised systems. Now that these methods have been developed the case studies are underway. Cooperation within the consortium has been strengthened through a number of staff exchanges between the partners and this helped to drive the research forward. They undertook preliminary joint experiments. Partners are meeting monthly to develop the first case study. When the mid-term review was undertaken the project had published 5 open access papers, but by month 27, 10 open access papers had been published, 5 of which are co-authored. Ongoing studies will lead to further co-authored publications.</p>
<p>The consortium should develop a strategy for promoting the timely uptake of the project's outputs, which should include the preparation of SOPs and the identification of the techniques which will be included in the metrological analyses.</p>	<p>A Royal Society Summer Exhibition proposal has been successful. This exhibition will be held in July 2022 and this is an excellent way to communicate the outputs of the project with the public. The exhibition lasts for a week at the Royal Society and it attracts tens of thousands of visitors. An XYZ Metrology Workshop proposal has also been successful. The 99th XYZ Metrology Workshop will be held 29-30 March 2023 in Ljubljana, Slovenia. This will be an excellent forum to discuss the outputs of this project. Additionally, the consortium has initiated discussions with industrial stakeholders and a demonstration has been scheduled. The consortium has developed a detailed Good Practice Guide "Sample Preparation for Metrology Instruments". This will be publicly available via the project website. The project's SOPs are currently being drafted.</p>
<p>The consortium should maintain a sustainable and strong leadership and partnership throughout the duration of the project and beyond.</p>	<p>The coordinator is on maternity leave and her deputy has taken over. The project is progressing extremely well and all of the objectives are expected to be achieved. The deputy coordinator has been involved in the project since its start and is therefore well acquainted with the work and partners. Now that the SOPs have been prepared, more focus will be put on the development of the case studies. The deputy coordinator is holding monthly teleconferences to ensure progress.</p>

4.2.2 Work performed to address the actions in the improvement plan (complete this section if your project has an improvement plan)	
Actions (as stated in the improvement plan)	Progress achieved
<p>Strengthening engagement with stakeholders, including test bench operators</p> <p>The aim of WP1 is to provide an overview of as many test benches as possible. The test bench operators will be involved and will provide information on their facilities.</p> <p>For further engagement with stakeholders, especially in the detailed planning of the calibration of the XYZ test bench, a stakeholder meeting will be held on 27 June 2021 in Paris, France.</p> <p>All stakeholders will be sent a project newsletter in the autumn of 2020 which will include the key results of the project. One aim of the newsletter is to inform stakeholders in advance of the planned calibration of the test bench at XYZ.</p> <p>A stakeholder web meeting is planned for the summer of 2020 to present the project's outcomes to the stakeholders.</p> <p>Finally, a 1-2-day stakeholder meeting is planned together with the final project meeting in July 2021. This will be the last opportunity to inform the stakeholders about the project's results. The meeting will be announced well in advance.</p>	<p>Stakeholder engagement was enhanced in WP1 as test bench operators were involved and provided information on their facilities. Overall, five new operators, in addition to the two within the consortium took part in this survey. As only ~12 test bench operators exist worldwide, this participation was impressive.</p> <p>A stakeholder meeting was held on 27 June 2021 in Paris, France. One major test bench operator (AABBCC, Italy) was present in addition to the two test bench operators from the consortium. Another test bench operator (DDEEFF, Finland) is using the results of the meeting, but was unable to participate. The meeting led to an exchange of valuable information between the consortium and AABBCC as well as the other stakeholders who were present. A similar exchange was initiated via email with DDEEFF.</p> <p>A newsletter was prepared and sent to the project's stakeholders on 15 October 2020. Stakeholders were informed about the forthcoming calibration of the test bench at XYZ.</p> <p>A stakeholder web meeting focusing on the results of WP5 (calibration procedure) was organised in June 2020.</p> <p>A final stakeholder meeting with presentations and practical demonstrations was held in July 2021. There were 74 attendees.</p>
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2.7 Section 5: Summary of exploitable results and an explanation about how they can/will be exploited (periodic reports only)

Section 5 is only completed at periodic reporting. It should include all the exploitable results generated in this periodic, and in any preceding interim, reporting period. If applicable, also describe any additional exploitation work undertaken below the table.

For JRPs and JNPs, this section should summarise the work undertaken in the Uptake and Exploitation task in your project's JRP/JNP's 'Creating impact' WP. As well as including details of the updates that you have made to your project's exploitation plan in this reporting period you should also describe activities undertaken to proactively encourage and facilitate the uptake and use of the project's outputs by relevant users in the industrial and public service communities. Such activities may include steps towards the development of commercial measurement services, the marketing and selling of reference materials, software or other outputs. It may also include the commercialisation of specific technologies developed in the project. **Note that this section relates specifically to the uptake and exploitation task i.e. you should not include dissemination (e.g. knowledge transfer and/or training) information in Section 5.** An example is given below:

Example 1: JRP and JNP		
5 Summary of exploitable results and an explanation about how they can/will be exploited (periodic reports only)		
Annex 1 Impact WP4 Task 4.3 Uptake and exploitation	Activity description (as in Annex 1) e.g. Exploitation plan, new measurement and consultancy services	Progress achieved
A4.3.1	An exploitation plan will be created at the beginning of the project and reviewed and updated at least at each project meeting.	The exploitation plan has been updated at each project meeting. In addition to the plans set out in the first version of the exploitation plan, one of the project's collaborators (Thermionicals Ltd) has expressed interest in commercialising the new laser-based procedure for testing Au/Pt thermocouples. Subject to the necessary IP arrangements, it is expected that Thermionicals Ltd will start using this procedure within the next six months.
A4.3.2	Uptake of the results from this project in future standardisation activities will be achieved through presentations at general meetings in IEC and VDI and by input for the revision of standards VDI 3511, part 4 "Radiation Thermometry" and IEC/TS 62492-1 "Industrial process control devices – Radiation thermometers".	The Au/Pt thermocouples reference function (Task 3.1) has been confirmed and DDD, who currently chair the subgroup, "Radiation thermometry" within the IEC technical committee and the working group "Applied radiation thermometry" within the VDI, included a point in the agenda, briefly presented these results and asked for comments from the other committee/working group members. A written report was also submitted for consideration by the committee and working group. It is anticipated that the revision of the standards VDI 3511, part 4 "Radiation Thermometry" and IEC/TS 62492-1 "Industrial process control devices – Radiation thermometers" will be completed by the end of the project.
A4.3.3	DDD, CCC and AAA will develop new draft CMCs for the new calibration	The survey of end users, which was undertaken to determine potential interest in

	services for low dose level miniature dosimeters based on the techniques developed in WP2 and will submit these draft CMCs to EURAMET TC-IR.	new calibration services for low dose level miniature dosimeters (based on the techniques developed in WP2), led to significant interest from 3 dosimeter manufacturers. Exactac GmbH, ProAvance S.A. and Divometer plc have subsequently joined the project's stakeholder committee and attended the project's workshop on the 'calibration of low dose level miniature dosimeters'. ProAvance S.A. asked AAA to undertake calibrations of their low dose level miniature dosimeters on a trial basis for the next two months. If this trial is successful, it is anticipated that AAA will be asked to continue performing these calibrations.
A4.3.4	Once the sensor is available from WP2 and WP3, 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 after the end of the project. It is intended that the sensor design will be patented after the end of the project.	The sensor is not yet available from WP2 and WP3. The e-service based on dedicated software for the unfolding of the raw read-out data to derive the time and position dose distribution is still planned to be launched after the end of the project, subject to a successful patent application.
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For SIPs, this section should summarise the exploitation work undertaken in the SIP's impact work packages. You should describe how the planned impact for the primary supporter, industry, and the metrology and standardisation communities is being realised by your SIP. An example is given below:

<p><i>Example 2: SIP:</i></p> <p>5 Summary of exploitable results and an explanation about how they can/will be exploited (periodic reports only)</p> <p>Progress achieved</p> <p>This SIP is on track to meet its exploitation objectives:</p> <p><i>In relation to objective 1:</i> The literature survey and the validation of the temperature, salinity and pH measurement models that were previously used in ENG99 WP3 are complete. Three IAPSW 1111 and ISO 2222 working group meetings were attended and members were informed about the aims of 20SIP99, in readiness for the dissemination of good metrology practice later in the project. IAPSW 1111 and ISO 2222 working groups will be informed about SI traceability and measurement good practice in the next reporting period. Written contributions and presentations on temperature, salinity and pH measurement techniques have been provided for use in the forthcoming standards of CEN TC9999 and CEN TC8888 (ie pr-EN 1111 and pr-EN 2222 which are expected to be published in 2021 and 2022 respectively).</p> <p><i>In relation to objective 2:</i> A one day workshop was held in Finland in July 2020 on 'best practices for the measurement of temperature, salinity and pH to ensure the effective implementation of IAPSW 12345 and ISO 6789. The workshop was attended by 34 equipment manufacturers and users of climate observation stations. Training on measurement best practice was provided for the following equipment manufacturers and users of climate observation stations: Relocatic bv, Jertils SARL, and Piethly Ltd. This approach increased these organisations' capabilities in traceable measurement and it ensured the effective implementation of IAPSW 12345 and ISO 6789. The paper titled 'Traceable on-line measurement of temperature, salinity and pH' will be submitted to the trade magazine <i>Earth Observer</i> by Dec 2021. Further training will be provided in the next reporting period.</p> <p style="text-align: center;">12 of 15</p>
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2.8 Section 6: Deviations from Annex 1 (tasks not fully implemented), the consequences and proposed corrective actions (do not complete this section at final reporting)

IMPORTANT NOTICE: Most of the EMPIR Call 2016–2019 projects were delayed by the coronavirus (COVID-19) pandemic. The EURAMET MSU is aware of these delays and will issue amendment letters to extend the affected projects. Therefore, this table should not include “deviations from Annex 1” that were caused by this pandemic. If your project has other, non-coronavirus (COVID-19) pandemic, “deviations from Annex 1” then do please include them in this table.

Please use the table in this section to provide an itemised list of any deviations from Annex 1, the consequences of these, and the proposed corrective actions that are required (eg to deliverables, scheduling, finance, partners, tasks etc.). Their effect on the project’s critical path, its deliverables and its overall impact must be included. Any corrective actions related to the budget workbook and Annex 2 should also be stated. Ensure that the delays/deviations specified in this section match those stated in Sections 3 and 4 of this report and that the whole consortium agrees to the proposed corrective actions.

Please note that all corrective actions should be included in the table, however, EURAMET will make the final decision as to which of the proposed corrective actions (if any) require an amendment to the Grant Agreement. As a guide, non-financial amendments are likely to include task level changes and/or changes to deliverable titles. Proposed changes to deliverable and activity dates are unlikely to result in an amendment to the Grant Agreement.

Coordinators are requested to pay special attention when reviewing deliverable progress in their penultimate report as it is the last opportunity to request an amendment. This section should not be completed at final reporting.

<i>Example: Section 6:</i> 6 Deviations from Annex 1 (tasks not fully implemented), the consequences and proposed corrective actions (do not complete this section at final reporting)		
Annex: Section: Deliverable: Task:	Summary of proposed corrective actions	Reason/justification for deviation
Annex: 1 Section: C Task: 1.2	Task end date to be changed from Oct 2020 to Jan 2022.	The change of end date is requested as the original end date cannot be fulfilled due to delays in Task 1.2. These were caused by the supplier ABC Instruments Ltd being unable to supply the MNO Thermocouple within the required deadline. The MNO Thermocouple was eventually supplied after a 12 month delay. This deviation will not affect the completion of the project’s objectives and other tasks will not be affected.
Annex: 1 Section: B1.c Deliverable: 2	Deliverable title to be changed from ‘Report on an advanced primary LNG densitometer system that produces reference data with an uncertainty of 0.02 %’ to ‘Report on an advanced primary LNG densitometer system that produces reference data with an uncertainty of 0.4 %’.	The change of deliverable title is requested as the original uncertainty of 0.02 % cannot be met. This change will allow us to focus on achieving a more realistic target uncertainty of 0.4 %. The primary LNG densitometer system will now be modelled using Monte Carlo models to help to achieve this uncertainty target. This deviation will not affect the completion of the project’s

	objectives and other tasks and deliverables will not be affected.
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2.9 Section 7: Ethical issues (as per Annex 1 Section D3)

The ethical issues table shown below should be completed for each technical report (progress), by deleting the “Yes or Not applicable” answers that do not apply and by selecting one of the two “Overall conformity with ethical requirements statements”:

Third countries	Yes
Ethical integrity	Yes
Data protection	Yes
Dual use	Yes / Not applicable
Environmental	Yes / Not applicable
Environmental and health and safety	Yes / Not applicable
Health and safety	Yes / Not applicable
Fair benefit-sharing	Yes / Not applicable
Export controls / Export issues	Yes / Not applicable
Use of humans/animals in research / Use of humans, cells and tissues, or animals in research	Yes / Not applicable
Requirement to complete an Ethics report during the project	Yes / Not applicable

Overall conformity with ethical requirements
<p>The coordinator confirms that this project has conformed with all of the necessary ethical requirements specified in the Annex 1 to the Grant Agreement.</p> <p>OR</p> <p>The coordinator confirms that this project has not conformed with all of the necessary ethical requirements specified in the Annex 1 to the Grant Agreement. The reasons for this are specified below:</p>

After completing the table, if applicable, describe how any ethical issues were addressed. This might include issues relating to Third countries, Ethical integrity, Data protection, Dual use, Environmental, Environmental and health and safety, Health and safety, Fair benefit-sharing, Export controls / Export issues or Use of humans/animals in research / Use of humans, cells and tissues, or animals in research.