DATA MANAGEMENT PLAN

Grant Agreement number	21GRD02
Project short name	BIOSPHERE
Project full title	Metrology for Earth Biosphere: Cosmic rays, ultraviolet radiation and fragility of ozone shield
Data management plan	1st ☐ 2nd ☐ 3rd ☒

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The project has received funding from the European Partnership on Metrology, co-financed from the European Union's Horizon Europe Research and Innovation Programme and by the Participating States.

1 Data management plan

1.1 Data summary

Questions	Answers
1 Will you re-use any existing data and what will you re-use them for? State the reasons if re-use of any existing data has been considered but discarded.	The project will re-use internal data from the participants and publicly available data. The data will be re-used to validate the project results. This project re-used the following publicly available datasets: 1. **NIST electron stopping power data** These data (https://physics.nist.gov/PhysRefData/Star/Text/ESTAR.html) were used in A1.1.1 to estimate the stopping power of ^{90}Sr-source electrons in EJ-200 plastic scintillator. 2. **Muon stopping power data** These data from D. E. Groom N. V. Mokhov and S. I. Striganov, Atomic Data and Nuclear Data Tables 78, 183–356 (2001) were used in A1.1.1 and A1.1.2 to estimate the stopping power of muons in EJ-200 plastic scintillator. 3. **Energetic Particle Telescope (EPT) data** These data are publicly available on the Space Situational Awareness website of ESA http://swe.ssa.esa.int/space-radiation and were used in A2.1.7 and A3.3.6 for proton flux variations data. 4. **Solar Energetic Particle (SEP) Events Data** These data is used in A2.1.7 and A3.3.6 to see the impact of these events in the SCR data measured on ground. The list of the SEP events is available on https://umbra.nascom.nasa.gov/SEP/ 5. **Sunspot number data** These data were used in A3.3.6 to correlate proton flux variation during solar minima and maxima. The data was downloaded from http://www.sidc.be/silso/datafiles/. **6. Atmospheric sounding data** These data were used in A2.6.3 in the simulation to quantify the correlation between the SCR and atmospheric parameters, and PCR. The data was downloaded from https://weather.uwyo.edu/ upperair/sounding.html **7. Neutron monitor data** These data were used in A2.3.5 to analyse and compare the results of the SCR at Brussels site. The data was downloaded from https://www.nmdb.eu **8. Atmospheric model data** These data were used in A2.6.3 in the simulation to quantify the correlation between the SCR and atmospheric parameters, and PCR. The data was downloaded from https://doi.org/10.1029/2002JA009430

2 What types and formats of data will the project generate or re-use?	The majority of the data will be raw data in ASCII format. Additional data formats generated will be: Graphics: jpeg, tiff, png, Tables: opj, xlsx, csv Text: docx, pptx, pdf, tex, txt, netCDF
3 What is the purpose of the data generation or re-use and its relation to the objectives of the project?	The data and other research outputs generated will be from measurements, simulations, calibrations, comparisons, experiments and validations. It will be used to meet all four technical objectives of the project and, to deliver impact and facilitate the take-up of the project outcomes (objective 5). The data generated throughout the project have been structured into four thematic groups, with each group directly aligned to one of the project's specific objectives. **Group 1—Datasets to support the fulfilment of objective 1:** The datasets associated with Objective 1 contains field measurements and simulations used to determine the dependence of secondary cosmic rays (SCR) on primary cosmic rays (PCR) and key atmospheric parameters. The five published datasets include the Monte Carlo (MCNP) simulation model file, SCR (muon) dataset from the field measurements to validate the model on the correlation between SCR, PCR and atmospheric parameters, LIDAR data (air density, aerosol loading and dust concentration) collected during the field measurements and used to check the validity of radiosonde data and PARMA simulations used to validate the MCNP program. The MCNP input file defines the entire simulation model, including the geometry of the system, the materials, the particle source, the physics options, and the tallies used to record results. It specifies all regions and boundaries of the model, the material compositions and densities, the characteristics of the primary radiation source, and the relevant transport parameters. It also includes the numerical settings required for running the simulation, such as variance-reduction techniques and output tally definitions. In practice, the MCNP input file is a complete and self-contained description of the physical scenario being modelled. **Group 2—Datasets to support the fulfilment of objective 2:** The datasets associated with Objective 2 comprise the measurements and simulations used to quantify the correlation between primary cosmic rays, ground-level secondary cosmic rays, and solar UV radiation, as well as their dependence on anthropogenic gas emissions. They include traceable measurements of ground-level muon and neutron fluxes, terrestrial solar UV spectral irradiance, and total ozone column, obtained during four coordinated measurement campaigns at contrasting European sites (Athens, Brussels, Milešovka, and Lindenberg). These locations provide diverse atmospheric conditions, altitudes, and anthropogenic emission profiles, allowing a comprehensive assessment of environmental influences. A total of 22 datasets has been published on Zenodo. They contain coincidence muon count rates, neutron count rates, electron and high-energy photon count rates, Timepix flux data, and Array Spectrometer BTS2048-UV measurements of solar spectral irradiance (290–430 nm). The datasets also include total ozone column

values derived from spectral DNI UV measurements using the BTS2048-UV, ozone-sonde (balloon) profiles, ceilometer observations, and LIDAR measurements of air density, aerosol loading, and dust concentration. Additional data include ozone column measurements from a Brewer spectrophotometer, multichannel filter radiometer observations of downwelling global irradiance at six UV–visible wavelengths (305, 313, 320, 340, 380, and 395 nm), and temperature-stabilised UVB pyranometer measurements integrated over 280–320 nm. The collection further comprises data from the Energetic Particle Telescope (EPT), which provides differential flux measurements of electrons, protons, and helium ions in the Earth’s radiation belts across energy-resolved channels.

Group 3—Datasets to support the fulfilment of objective 3:

The datasets associated with Objective 3 contain the simulation outputs and experimental measurements generated to quantify the molecular processes relevant to ozone depletion and atmospheric dynamics. The 6 datasets published in Zenodo include collision cross-sections for natural atmospheric gases and key anthropogenic species, including CFCs, covering ionisation, excitation, and dissociation processes over the 10–2000 eV electron energy range. The datasets also provide absolute ionisation cross sections, dissociative electron attachment (DEA) and production rates of charged molecular fragments derived from validated computational models and laboratory experiments. All data have been organised into structured files to support integration into atmospheric chemistry models and to form a comprehensive, openly accessible database of electron–molecule interaction parameters.

Group 4—Datasets to support the fulfilment of objective 4:

The datasets associated with Objective 4 comprise the experimental and analytical data used to assess the potential health effects of combined secondary cosmic ray and UV radiation exposures at environmentally relevant levels, as well as under conditions simulating potential ozone-depletion scenarios. The 10 published datasets include measurements of cellular responses in healthy human cell lines exposed to controlled mixed-field irradiation, covering endpoints such as cell viability, DNA damage, DNA damage response (DDR) activation, genomic instability, cytotoxicity, and proliferation. The datasets also contain quantified radiation-field parameters (dose, flux, and spectral characteristics) required to correlate exposure conditions with biological outcomes, including radiation-type- and dose-specific transcriptional responses. In addition, they provide gene-expression profiles of stress-response pathways generated using established radiation-effect models and systems-biology approaches. Metadata are included for the RadPhysBio radiobiological database, supporting prediction of cell survival following ionizing-radiation exposure. The collection further contains detailed lists of biological samples, major experimental protocols, and reagents used in Objective 4 studies.

The project re-used datasets from outside of the project for the purposes

	specified in question 1 above. Its relation to the objectives of the project is specified below: 1. **NIST electron stopping power data** Contributed to meeting objective 1. 2. **Muon stopping power data** Contributed to meeting objective 1. 3. **Energetic Particle Telescope (EPT) data** Contributed to meeting objectives 2 and 3. 4. **Solar Energetic Particle (SEP) Events Data** 5. **Sunspot number data** Contributed to meeting objective 3. 6. **Atmospheric sounding data** Contributed to meeting objectives 1 and 2. 7. **Neutron monitor data** Contributed to meeting objectives 1 and 2. 8. **Atmospheric model data** Contributed to meeting objectives 1 and 2.
4 What is the expected size of the data that you intend to generate or re-use?	The overall size of the data/research outputs is less than 500 GB.
5 What is the origin/provenance of the data, either generated or re-used?	Data originates from a variety of sources, including existing beneficiary data, data from the scientific literature, data from open access databases such as NIST (X-Ray Mass Attenuation Coefficients), data collected during project activities, and simulation data. The project generated 43 datasets. The provenance of the data generated is specified below: Group 1, 2, 3, 4 Datasets. The provenance and context of the data are documented. The data is accompanied by information on how it was captured (which instrument), how was processed and analysed. Re-used data The existing data originated from several sources, which included: participant's pre-existing data, data from the scientific literature, real-world measurement data and data from simulation experiments. The project re-used 5 datasets which originated from the following external sources (from outside of this project): 1. NIST electron stopping power data

	The dataset is downloaded from NIST https://physics.nist.gov/PhysRefData/Star/Text/ESTAR.html. 2. Muon stopping power data The dataset is published in the paper D. E. Groom N. V. Mokhov and S. I. Striganov, Atomic Data and Nuclear Data Tables 78, 183–356 (2001). 3. Energetic Particle Telescope (EPT) data These data is downloaded from Space Situational Awareness website of ESA: http://swe.ssa.esa.int/space-radiation 4. Solar Energetic Particle (SEP) Events Data The list of the SEP events is available on https://umbra.nascom.nasa.gov/SEP/ 5. Sunspot number data The data was downloaded from http://www.sidc.be/silso/datafiles/. 6. Atmospheric sounding data The data was downloaded from https://weather.uwyo.edu/ upperair/sounding.html 7. Neutron monitor data The data was downloaded from https://www.nmdb.eu 8. Atmospheric model data The data was downloaded from https://doi.org/10.1029/2002JA009430
6 To whom might your data be useful ('data utility'), outside your project?	The data will be suitable for use by other research groups working on topics related to ionizing radiation detection, atmospheric optics, aerosols and radiation protection. Data generated from tests and comparisons will benefit the space physics and atmospheric chemistry community (data from WP1, WP2 and WP3), radiobiology, preventive medicine, pathology- and oncology-communities (data from WP4), and regulators (e.g., health and environment regulatory bodies). Group 3 Datasets (data on ethanol and N2O) is used by the stakeholder Institute of Plasma Technology, Korea Institute of Fusion Energy, Gunsan (South Korea). Group 3 Dataset (data on CFCs) is used by the stakeholder Instituto de Física - Universidade Federal do Rio de Janeiro Group 4 Datasets are being exchanged and will benefit the stakeholder Institute of Radiobiology of the Bundeswehr in Munich.

1.2 Findable, Accessible, Interoperable and Re-usable (FAIR) Data

1.2.1 Making data findable, including provisions for metadata

Questions	Answers
7 Will data be identified by a persistent identifier?	The data and research outputs (protocols, reports, software,) are findable as each is identifiable with either a DOI, or other persistent and unique identifier. Where applicable, the metadata includes persistent identifiers for related publications and research outputs. The data / research outputs are deposited and published in trusted repositories located using the Registry of Research Data Repositories https://www.re3data.org/.
8 Will rich metadata be provided to allow discovery? What metadata will be created? What disciplinary or general standards will be followed? In case metadata standards do not exist in your discipline, please outline what type of metadata will be created and how.	The metadata created for all of the project's deposited datasets are open under a Creative Commons Public Domain Dedication (CC 0) or equivalent (to the extend legitimate interests or constraints are safeguarded), in line with the FAIR principles. The metadata provides information on the following: Description of the file (to help users understand what the file contain and how data need to be used); date of deposit; author(s); possible embargo; acknowledgement of the European Partnership on Metrology funding; grant project name, acronym and number; licensing terms; persistent identifiers and the authors involved. If any information has been unintentionally omitted from the README file, it will be added promptly upon discovery or when brought to our attention, and the file will be updated accordingly.
9 Will search keywords be provided in the metadata to optimise the possibility for discovery and then potential re-use?	Yes, the following search keywords will be provided for use with the deposited datasets: European Green Deal, BIOSPHERE, cosmic radiation, neutrons, muons, cross section, UV, ozone, cell, DNA, aerosols, temperature, density.
10 Will metadata be offered in such a way that it can be harvested and indexed?	Yes, the data/research outputs are deposited and published in trusted repositories located using the Registry of Research Data Repositories (https://www.re3data.org).

1.2.2 Making data accessible

Questions	Answers
Repository:	
11 Will the data be deposited in a trusted repository?	The data and associated metadata, documentation and code has been deposited in trusted open access repository Zenodo.org. Currently deposited datasets: **Group 1** Five published datasets that include the Monte Carlo (MCNP) simulation model file, SCR (muon) dataset from the field measurements to validate the model on the correlation between SCR, PCR and atmospheric parameters, LIDAR data (air density, aerosol loading and dust concentration) collected during the field measurements and used to check the validity of radiosonde data and PARMA simulations used to validate the MCNP program. The MCNP input file defines the entire simulation model, including the geometry of the system, the materials, the particle source, the physics options, and the tallies used to record

Questions	Answers
	results. It specifies all regions and boundaries of the model, the material compositions and densities, the characteristics of the primary radiation source, and the relevant transport parameters. It also includes the numerical settings required for running the simulation, such as variance-reduction techniques and output tally definitions. In practice, the MCNP input file is a complete and self-contained description of the physical scenario being modelled. **Group 2** A total of 22 datasets has been published on Zenodo. They contain coincidence muon count rates, neutron count rates, electron and high-energy photon count rates, Timepix flux data, and Array Spectrometer BTS2048-UV measurements of solar spectral irradiance (290–430 nm). The datasets also include total ozone column values derived from spectral DNI UV measurements using the BTS2048-UV, ozone-sonde (balloon) profiles, ceilometer observations, and LIDAR measurements of air density, aerosol loading, and dust concentration. Additional data include ozone column measurements from a Brewer spectrophotometer, multichannel filter radiometer observations of downwelling global irradiance at six UV–visible wavelengths (305, 313, 320, 340, 380, and 395 nm), and temperature-stabilised UVB pyranometer measurements integrated over 280–320 nm. The collection further comprises data from the Energetic Particle Telescope (EPT), which provides differential flux measurements of electrons, protons, and helium ions in the Earth's radiation belts across energy-resolved channels. **Group 3** Six datasets were published in Zenodo. They include collision cross-sections for natural atmospheric gases and key anthropogenic species, including CFCs, covering ionisation, excitation, and dissociation processes over the 10–2000 eV electron energy range. The datasets also provide absolute ionisation cross sections, dissociative electron attachment (DEA) and production rates of charged molecular fragments derived from validated computational models and laboratory experiments. All data have been organised into structured files to support integration into atmospheric chemistry models and to form a comprehensive, openly accessible database of electron–molecule interaction parameters. **Group 4** A total of 10 datasets were published to trusted repositories. They include measurements of cellular responses in healthy human cell lines exposed to controlled mixed-field irradiation, covering endpoints such as cell viability, DNA damage, DNA damage response (DDR) activation, genomic instability, cytotoxicity, and proliferation. The datasets also contain quantified radiation-field parameters (dose, flux, and spectral characteristics) required to correlate exposure conditions with biological outcomes, including radiation-type- and dose-specific transcriptional responses. In addition, they provide gene-expression profiles of stress-response pathways generated using established radiation-effect models

Questions	Answers
	and systems-biology approaches. Metadata are included for the RadPhysBio radiobiological database, supporting prediction of cell survival following ionizing-radiation exposure. The collection further contains detailed lists of biological samples, major experimental protocols, and reagents used in Objective 4 studies.
12 Have you explored appropriate arrangements with the identified repository where your data will be deposited?	No. The data can be uploaded via standard procedures, without any special arrangements.
13 Does the repository ensure that the data are assigned an identifier? Will the repository resolve the identifier to a digital object?	The repository has assigned 43 DOI to the project's deposited datasets. Dataset DOIs **Group 1 datasets:** https://doi.org/10.5281/zenodo.15630977 https://doi.org/10.5281/zenodo.17787794 https://doi.org/10.5281/zenodo.17788643 https://doi.org/10.5281/zenodo.17787874 https://doi.org/10.5281/zenodo.17787919 **Group 2 datasets:** https://doi.org/10.5281/zenodo.17672252 https://doi.org/10.5281/zenodo.17672469 https://doi.org/10.5281/zenodo.17672532 https://doi.org/10.5281/zenodo.17672568 https://doi.org/10.5281/zenodo.17711826 https://doi.org/10.5281/zenodo.17719782 https://doi.org/10.5281/zenodo.17719914 https://doi.org/10.5281/zenodo.17720388 https://doi.org/10.5281/zenodo.17672605 https://doi.org/10.5281/zenodo.17716297 https://doi.org/10.5281/zenodo.17716338

Questions	Answers
	https://doi.org/10.5281/zenodo.17716421 https://doi.org/10.5281/zenodo.17708204 https://doi.org/10.5281/zenodo.17669815 https://doi.org/10.5281/zenodo.17671703 https://doi.org/10.5281/zenodo.17671746 https://doi.org/10.5281/zenodo.17671785 https://doi.org/10.5281/zenodo.17671901 https://doi.org/10.5281/zenodo.17794623 https://doi.org/10.5281/zenodo.17794650 https://doi.org/10.5281/zenodo.17699244 https://doi.org/10.5281/zenodo.17699505 **Group 3 datasets** https://doi.org/10.5281/zenodo.17432474 https://doi.org/10.5281/zenodo.12567564 https://doi.org/10.5281/zenodo.12604817 https://doi.org/10.5281/zenodo.12543568 https://doi.org/10.5281/zenodo.7801368 https://doi.org/10.5281/zenodo.16099577 **Group 4 datasets** https://doi.org/10.5281/zenodo.17695971 https://zenodo.org/records/17648436 (https://doi.org/10.1007/978-1-0716-4426-3_6) https://doi.org/10.5281/zenodo.15274235 https://doi.org/10.3390/antiox11112286 https://doi.org/10.3390/biology13050351 https://doi.org/10.5281/zenodo.12583211

Questions	Answers
	https://doi.org/10.5281/zenodo.12582567 https://doi.org/10.5281/zenodo.12547396 https://zenodo.org/records/15181918 (https://doi.org/10.3390/biom14010088) https://zenodo.org/records/15182030 (https://doi.org/10.3390/genes14122227)
Data:	
14 Will all data be made openly available? If certain datasets cannot be shared (or need to be shared under restricted access conditions), explain why, clearly separating legal and contractual reasons from intentional restrictions. Note that in multi-beneficiary projects it is also possible for specific beneficiaries to keep their data closed if opening their data goes against their legitimate interests or other constraints as per the Grant Agreement.	All the data that are needed to validate the results presented in scientific publications and in deliverables have been made openly available per default unless there is a specific reason not to publish the data. Other data may be made available on a case-by-case basis if it is relevant for third parties. The following data will not be made publicly available: – Data obtained with the permission of third parties, but the third parties have not agreed to make the data publicly available; – Data that compromise the protection of participant(s) intellectual property; Data which are commercially sensitive and cannot be shared.
15 If an embargo is applied to give time to publish or seek protection of the intellectual property (e.g. patents), specify why and how long this will apply, bearing in mind that research data should be made available as soon as possible.	The data used in scientific publications, posters and oral presentations have been made available for re-use. The project has deposited 43 datasets in Zenodo (see above).
16 Will the data be accessible through a free and standardised access protocol?	The data is accessible through a free and standardized access protocol of the chosen open access repository. The repository used by the project provides well described conditions for access: https://about.zenodo.org/policies/.
17 If there are restrictions on use, how will access be provided to the data, both during and after the end of the project?	No restriction on use is expected. However, users are asked to acknowledge the project and the source of the data each time they use the data publicly (e.g., in publications, presentations, etc.).
18 How will the identity of the person accessing the data be ascertained?	If necessary, an authentication system or a data on demand function will be provided.
19 Is there a need for a data access committee (e.g. to evaluate/approve access requests to personal/sensitive data)?	Data access will be coordinated by the Data Management Committee (DMC). The coordinator with the DMC will have the responsibility for the management of the data/research outputs and quality assurance.
Metadata:	

Questions	Answers
20 Will metadata be made openly available and licensed under a public domain dedication CC0, as per the Grant Agreement? If not, please clarify why. Will metadata contain information to enable the user to access the data?	The metadata will be licenced under CC0, except for the email addresses. The metadata will contain information that enable users to access the data.
21 How long will the data remain available and findable? Will metadata be guaranteed to remain available after data are no longer available?	The data will remain available and findable for the lifetime of the open access repository Zenodo.org, which is expected to be a minimum of 20 years.
22 Will documentation or reference about any software be needed to access or read the data and will this be included? Will it be possible to include the relevant software (e.g. in open source code)?	The data can be read and used with common commercial software (e.g., MS Office, Matlab) as well as with free software (e.g., Libre Office, Python, etc.). The project's 43 datasets which have been deposited in Zenodo can be accessed using common commercial software: a text editor, Microsoft Word and Excel (or open access Libre Office), pdf viewer, or python.

1.2.3 Making data interoperable

Questions	Answers
23 What data and metadata vocabularies, standards, formats or methodologies will you follow to make your data interoperable to allow data exchange and re-use within and across disciplines? Will you follow community-endorsed interoperability best practices? Which ones?	The datasets use the trusted repository's basic metadata schema for administrative data, which is compliant with the recommended standards used by DataCite (https://search.datacite.org/) and OpenAIRE (https://www.basesearch.net/). For individual datasets, the following discipline-specific vocabularies, standards, formats, and methodologies will be used: • GUM (procedure; subject-independent). • OBO foundry (MD schema; biological sciences). • DICOM (MD schema + file format; biomedical imaging). • NetCDF (file container format; subject-independent). • HDF5 (hierarchical file format; subject-independent). • INSPEC (vocabulary + classification; physics). • ISO 9001 (QM procedure; subject-independent). • TIFF (Tagged Image File Format, biological imaging) XLSX (File format; biological sciences).
24 In case it is unavoidable that you use uncommon or generate project specific ontologies or vocabularies, will you provide mappings to more commonly used ontologies? Will you openly publish the generated ontologies or vocabularies to allow their re-use, refinement or extension?	A Readme.txt file containing description of the parameters, and, if applicable, publication where the data is published is also attached to the records in txt format Depending on the feedback, the uploaded Readme.txt file can be updated and a new version of the record will be created.

25 Will your data include qualified references[1] to other data (e.g. other data from your project, or datasets from previous research)?	Yes, the project's datasets that have been deposited, and will be deposited (assuming the fact that new project and follow-up papers will appear) in the chosen repository (e.g. Zenodo), when applicable, will include qualified references to other datasets from the same project. Current datasets need no cross-referencing.

1.2.4 Increase data re-use

Questions	Answers
26 How will you provide documentation needed to validate data analysis and facilitate data re-use (e.g. readme files with information on methodology, codebooks, data cleaning, analyses, variable definitions, units of measurement, etc.)?	A short README file (e.g. Markdown) has been provided together with the data, in order to enable data analysis and to facilitate data re-use.
27 Will your data be made freely available in the public domain to permit the widest re-use possible? Will your data be licensed using standard re-use licenses, in line with the obligations set out in the Grant Agreement?	The data were licensed under the latest available version of the Creative Commons Attribution International Public License (CC BY) or a license with equivalent rights as set out in the Grant Agreement. Users will be required to acknowledge the consortium and the source of the data in any resulting publications. Alternatively, the Creative Commons Public Domain Dedication License (CC 0) will be used. The project's 43 datasets which have been deposited in Zenodo include the following licenses (where necessary): Creative Commons Attribution 4.0 International
28 Will the data produced in the project be useable by third parties, in particular after the end of the project?	Data published in open-access journals is usable by third parties after the datasets have been deposited in Zenodo. The data that do not relate to peer-reviewed publications will be made available for re-use on a case-by-case basis.
29 Will the provenance of the data be thoroughly documented using the appropriate standards?	Yes, the provenance and context of the data will be thoroughly documented to meet relevant standards using the Provenance and Context Content Standard (PCCS) Matrix. Data has been accompanied by information on how they were captured, processed, analysed, and validated. Other information that enables interpretation and use will also be provided. If any information has been unintentionally omitted from the README file, it will be added promptly upon discovery or when brought to our attention, and the file will be updated accordingly.
30 Describe all relevant data quality assurance processes.	Data quality has been and will be assured through several quality assurance procedures: • Repeated and comparison measurements. • Adherence to standards for data recording.

[1] A qualified reference is a cross-reference that explains its intent. For example, X is regulator of Y is a much more qualified reference than X is associated with Y, or X see also Y. The goal therefore is to create as many meaningful links as possible between (meta)data resources to enrich the contextual knowledge about the data. (Source: https://www.go-fair.org/fair-principles/i3-metadata-include-qualified-references-metadata/)

Questions	Answers
	• Use of controlled vocabularies and standard terminology. • Metrological characterisation of the measurement set-ups. • Validation of the data collected. • Provision of test results along with the data. • Peer-review of publications based on the data.
31 Further to the FAIR principles, DMPs should also address research outputs other than data, and should carefully consider aspects related to the allocation of resources, data security and ethical aspects.	The estimated costs for making the (data and) other research outputs FAIR are 2,000 € (personnel costs) (see question 34). The costs for making other research outputs FAIR are included in the project's budget and will be claimed if compliant with the Grant Agreement's conditions. The consortium's Data Access Committee will also have overall responsibility for managing other research outputs (see question 36). Where feasible, long-term preservation will be ensured by depositing the other research outputs in repositories. The Data Access Committee will decide on a case-by-case basis on which other research outputs will be deposited and for how long. *Security of other research outputs* All participants are either accredited to, or work in compliance with, the ISO 17025 standard on the "General requirements for the competence of testing and calibration laboratories". The participants will store other research outputs on their organisations' networks, which are protected by firewall, backups etc. Other research outputs will also be stored in the project's SharePoint environment, with password-protected login. Deposition in public repositories will provide additional security as they have multiple replicas in a distributed file system which is backed up on a nightly basis. This project will not generate sensitive other research outputs. The other research outputs will be safely stored in open access repositories. *Ethical aspects* There are issues that could impact on the sharing of other research outputs. • Information relating to other research outputs acquired from third parties, e.g. manufacturers, will not be shared without their explicit consent. • Information relating to other research outputs collected by the consortium at commercial sites will not be shared without the site owner's explicit consent. Ethical considerations will be duly addressed if any indications of potential ethical issues emerge.The project will not share other research outputs with identifiable personal information. Sensitive information relating to the other research outputs will be collected, separated as soon as possible and kept secure. Please also see the information provided in section 1.3 below.

1.3 Other research outputs

Questions	Answers
32 In addition to the management of data, beneficiaries should also consider and plan for the management of other research	The software developed in the project will be released under a GNU-GPL license.

Questions	Answers
outputs that may be generated or re-used throughout their projects. Such outputs can be either digital (e.g. software, workflows, protocols, models, etc.) or physical (e.g. new materials, antibodies, reagents, samples, etc.).	The new calibration methods, and protocols produced by the project have been published in the project deliverables and when applicable, have been deposited in Zenodo. The data sets published in Zenodo have been published under a Creative Commons Attribution 4.0 International license.
33 Beneficiaries should consider which of the questions pertaining to FAIR data above, can apply to the management of other research outputs, and should strive to provide sufficient detail on how their research outputs will be managed and shared, or made available for re-use, in line with the FAIR principles.	As far as possible, the FAIR data approaches specified in questions 7-30 above will be applied to the management of this project's other research outputs. This commitment will be met by placing the new methods, and protocols in a repository in line with the requirements of the project's consortium agreement.

1.4 Allocation of resources

Questions	Answers
34 What will the costs be for making data or other research outputs FAIR in your project (e.g. direct and indirect costs related to storage, archiving, re-use, security, etc.) ?	The estimated costs for making the data and other research outputs Findable, Accessible, Interoperable and Re-usable (FAIR) are 2,000 € (personnel costs). These costs have been kept to a minimum by using a free repository (Zenodo) and by making only relevant data and other outputs FAIR.
35 How will these be covered? Note that costs related to research data/output management are eligible as part of the European partnership on metrology grant (if compliant with the Grant Agreement conditions).	The costs for making the data FAIR are included in the project's budget and will be claimed if compliant with the Grant Agreement's conditions.
36 Who will be responsible for data management in your project?	Data Management Committee (DMC). This committee consists of the project coordinator, WP leaders and selected partners. DMC will have overall responsibility for the management of data/research outputs and quality assurance. The coordinator will lead this committee and will be responsible for coordinating updates to the data management plan. The committee will be responsible for deciding on a case-by-case basis which data/research outputs will be kept and for how long, for organising backup and storage, archiving, and for depositing the data/research outputs within the chosen repositories.
37 How will long term preservation be ensured? Discuss the necessary resources to accomplish this (costs and potential value, who decides and how, what data will be kept and for how long)?	Long term preservation will be ensured by depositing the data within repositories (Zenodo, PTB's Open Access Repository, Harvard Dataverse Repository). There are no costs associated with the long-term preservation of the data in these repositories. The Data-Management Committee (DMC) will decide on a case-by-case basis on what data will be kept and for how long.

1.5 Data security

Questions	Answers
38 What provisions are or will be in place for data security (including data recovery as well as secure storage/archiving and transfer of sensitive data)?	All partners are either accredited to, or work in compliance with the ISO 17025 standard. The partners will store data on their organisations' networks, which are protected by firewall, backups etc. Data will also be stored in the project's SharePoint environment, with password-protected login. An enhanced data security will be provided by the usage of multiple copies of the files.
39 Will the data be safely stored in trusted repositories for long term preservation and curation?	Yes, the chosen repositories are certified for long term preservation and curation.

1.6 Ethics

Questions	Answers
40 Are there, or could there be, any ethics or legal issues that can have an impact on data sharing? These can also be discussed in the context of the ethics review. If relevant, include references to ethics report(s) and the ethics section in the Annex 1.	The work has been reviewed and approved by the EPM ethics committee. If ethical issues are identified, DMC will contact MSU for advice. Issues that could impact data sharing: • Data acquired from third parties, e.g., manufacturers will not be shared without their explicit consent; • Data acquired together with collaborators will be subject to the Letter of Agreement signed between the consortium and the collaborator.
41 Will informed consent for data sharing and long-term preservation be included in questionnaires dealing with personal data?	Data acquired from third parties such as national and international organizations and QA provider will not be shared without their explicit consent. If any sensitive data are collected, they will be separated as soon as possible and kept secure.

1.7 Other issues

Questions	Answers
42 Do you, or will you, make use of other national / funder / sectorial / departmental procedures for data management? If yes, which ones (please list and briefly describe them)?	Data management will be compliant with: • The research data policy of EPM and with European laws (e.g., GDPR); • Institutional guidelines; Scientific community guidelines.

2 Open science: research data management

Statement	Put an X in the box to confirm	Or, list any exceptions to this
All participants have adhered to the requirements of the project's GA and CA with respect to open science: research data management (GA Article 17 and its Annex 5) for this reporting period	☒	