



COLDSPARK DRIVEN ENERGY AND COST-EFFICIENT METHANE CRACKING FOR  
HYDROGEN PRODUCTION

## D8.2. Data Management Plan (M6)

ColdSpark® project partner	SEID AS
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## Document Information

Deliverable title	Data Management Plan (M6)
Work Package number and title	WP8: Project management
Deliverable number	D8.2
Description	SEID AS together with Europroject will develop the data management policy of the project and will work closely with the partners to identify datasets produced taking into consideration any issues of ethics, privacy, confidentiality and IPR protection. EP will elaborate, in close consultation with SEID, the Data Management Plan (DMP) describing the project data management policy and specify any data sets that may endure embargo or be kept from publication.
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## Review History

Version	Date	Reviewer	Short Description of Changes
1	21/11/2022	Prof. Xin Tu, University of Liverpool	General review
2	22/11/2022	Jan Drotningvik, SEID	General review
3	29/11/2022	Maya Guevska, EP	Changes related to accessible data, additional formats

## Document Approval

Name	Role	Action	Date
Terje Hauan	Project Coordinator	<i>Approved</i>	29.11.2022

## Nature of the deliverable

R	Document, report (excluding the periodic and final reports)	
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patent filing, press & media actions, videos, etc.	
DATA	Data sets, microdata, etc.	
DMP	Data management plan	X
Ethics	Deliverables related to ethics issues.	

<b>SECURITY</b>	Deliverables related to security issues	
<b>Other</b>	Software, technical diagrams, algorithms, models, etc.	

### Dissemination level

<b>PU</b>	Public — fully open (automatically posted online on the Project Results platforms)	X
<b>SEN</b>	Sensitive — limited under the conditions of the Grant Agreement	

## ACKNOWLEDGEMENT

This report forms part of the deliverables from the project ColdSpark® which has received funding from the European Union’s Horizon Europe Research and Innovation Programme under grant agreement No. 101069931.

The ColdSpark® project will validate a novel non-thermal plasma technology to produce hydrogen at an industrial scale from methane, with a process energy efficiency of 79%, achieving a conversion rate of 85% aiming at zero CO<sub>2</sub> emissions. This will be achieved by designing an industrial-relevant reactor that leverages the best features of the non-thermal plasma technologies, gliding arc and corona discharge, to ensure high efficiency and scalability. The innovation addresses for the first time the critical step of matching the reactor with a pulsed power supply. It enables a perfect fine-tuning of the cracking process parameters, to find the right electron density and energy distribution in the plasma reactor, to maximise energy efficiency. The up-and-downstream gas management will be optimised to further contribute to the system’s compatibility with the existing infrastructure. The project will develop and test a novel plasma reactor at a lab scale and validate it in conjunction with the power supply at a large scale, pursuing the industry’s most power-efficient generation of hydrogen alongside high-value carbon. The technology will assess its application for both, natural gas and biomethane producers. A low energy cost (< 15 kWh/kg H<sub>2</sub> produced) without the need for catalysts and water, makes the proposed solution the most cost-competitive, environment-friendly, and less complex to implement. The reactor design and modularity bring lower CAPEX and OPEX and make it easily scalable and flexible. The project gathers the expertise of a mix of academic, research, and industrial partners from five countries, which bring both outstanding research and topic competence, as well as knowledge and access to the solution for end-user industries.

ColdSpark® is built on a strong consortium of 7 partners from Norway, Spain, Bulgaria, Germany, and the UK with SEID AS as a Coordinator.

More information about the project can be found at: [www.coldspark.eu](http://www.coldspark.eu)

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## EXECUTIVE SUMMARY

The current document describes how the data and documents re-used and generated during the ColdSpark® project implementation (and after) will be managed. The systems to guarantee the safety of the information are described. Types and formats of data obtained and generated during the project are listed. Data Management Plans (DMPs) are a key element of good research data management describing the life cycle for the data to be collected, processed and/or generated by the project and following the research FAIR principles. This document will be regularly updated until the end of the project.

## ABBREVIATIONS

Abbreviation	Meaning
EC	European Commission
EU	European Union
DMP	Data Management Plan
DM	Data Management
WP	Work Package
OR	Open Repository
PR	Project Repository
CR	Company Repository

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## 1. DATA SUMMARY

### 1.1. INTRODUCTION

The EU - funded ColdSpark® project aims to develop an innovative technology to produce sustainable hydrogen, and solid carbon from methane or biomethane. The project is based on non-thermal plasma technology that would crack methane, with zero CO<sub>2</sub> emissions, without the need for catalysts and water.

This deliverable - ColdSpark® Data Management Plan outlines which data will be produced and re-used during the project, the data management strategy, and their dissemination level. The plan mentions the current data management strategy - agreed upon by the consortium at M6 of the ColdSpark® project, and includes which standards and methodology is followed for data collection, generation, and preservation, and whether and how the data will be shared during and after the ColdSpark® project is finished. The security issues are also addressed in this DMP.

The plan is subject to change to further optimize the management strategy during the project lifetime and will be updated regularly and accordingly. There are no deviations from the description of this deliverable as given in Annex 1 of the Grant Agreement. The DM template in table format is distributed among partners and will be constantly updated.

### 1.2. WILL COLDSPARK® RE-USE ANY EXISTING DATA AND HOW

ColdSpark® project will re-use existing data that was produced earlier during the coordinator's technology development process for the past 25 years. These data are sensitive and will be available in the project's private repository, which is available with a dedicated account for the consortium partners. Non-sensitive data will be available as reports, presentations, and deliverables.

Project participants will deposit their non-sensitive data in an open-access repository and take measures to make the data available to third parties.

### 1.3. TYPES AND FORMATS OF DATA TO BE GENERATED OR RE-USED BY THE PROJECT

Since the research includes a variety of disciplines, the generated and collected data are diverse. The project will generate and regenerate data in the following formats: .xlsx, .docx, .csv, .txt, .pdf,

HTML, ASPEN files, Solid edge (.par, .psm, .asm, .dft, .pwd, .dwg, .dxf, .step, .stp), OpenScad (.scad),  
• SSI (\*.dat), AIA (\*.cdf), SSI ASCII (\*.asc), SAMPL (\*.SAMPL), TurboChrom (\*.raw), ChemStation (\*.ch). , Printed Circuit Board (PCB) use Altium designer.

For audio-visuals - JPEG, MP4, TIFF, PNG, MP3, M4V, WAVE.

Data analysis programs include Excel, Matlab, Origin, R and Python, Diffract EVA, Renishaw Raman, Mettler Toledo TGA etc. that comes along with instruments plus QtiPlot to plot the data.

## 1.4. PURPOSE OF THE DATA GENERATION OR RE-USE, ITS RELATION TO THE OBJECTIVES OF THE PROJECT AND USERS

### 1.4.1. PURPOSE

ColdSpark® is an EU-funded project that includes partners from universities, research organisations and commercial entities and focuses on technology/product development. Measurement and modelling data will be collected and generated by individual research groups of the consortium and beyond to the scientific community for further usage. Any data produced during the project could be of great significance in the future and these data must be well documented according to the accepted and trusted standards and could form the key pillar of science. The data includes raw data (measurement data) as well as calibrated data (final data), modelling data, etc. The data produced during the ColdSpark® project will bridge the gap between lab-scale experiments at universities and commercialising the product.

Data considered for open access include data related to modelling, techno-economic assessment etc. For example, the consortium expects that the following deliverables with relevant data be available to the public:

- Basic Aspen HYSYS models for lab and large-scale prototypes based on results from WP 1, WP 2, and WP 4 (D5.1)
- Techno-economic assessment (D6.4)
- Communication and dissemination final report (D7.5)
- Report on synergies with relevant initiatives, projects, and programmes (D7.7)
- Report on carbon market potential and business opportunities (D7.8)

### 1.4.2. EXPECTED SIZE

The file size of raw data will be less than 1 Terabyte during the project.

### 1.4.3. TO WHOM MIGHT YOUR DATA BE USEFUL ('DATA UTILITY'), OUTSIDE YOUR PROJECT?



The generated data will be useful for a broad audience including the scientific community, stakeholders, governmental bodies (Energy and environmental authorities), and commercial & industrial entities.

### 1.5. ORIGIN/PROVENANCE OF THE DATA, EITHER GENERATED OR RE-USED

Data will be generated and collected by all research groups and by the coordinator (SEID AS) using different approaches and instruments. The project's experimental part will verify several parameters such as voltage, power, frequency, gas flow rate, reactor size, the distance between electrodes and the wall etc. These changes in parameters will produce varying outlet gas compositions and solid carbon properties. Several research groups already have performed similar measurements and modelling. Hence, their data will be implemented wherever required along with the proper citation.

A general overview of the data type and how the data is gathered for this project within the consortium include:

- **SEID AS**
  - Data type: Plasma electrical signals, power supply parameters (voltage, current, frequency), gas analysis data, emission spectra
  - Data gathered by: Oscilloscope, Gas chromatography (GC), spectrometer
- **University of Stavanger**
  - Data type: Gas-solid equilibrium analysis, Carbon characterization data, dynamic study on gas separation, Adsorbent characteristics
  - Data gathered by: Gas sorption instrument, scanning electron microscope (SEM), Transmission electron microscopy (TEM), Raman Spectroscopy, X-Ray diffraction (XRD), surface area, Gas separation test instrument, powder diffraction (PXRD), thermogravimetric analysis (TGA), surface area
- **NORCE – Aspen HYSYS modelling data**
- **University of Liverpool**
  - Data type: Plasma electrical signals, gas analysis data, carbon characterization, emission spectra
  - Data gathered by: Oscilloscope, GC, SEM, TEM, Raman Spectroscopy, XRD and spectrometer.
- **IREC**
  - Data type: Quantities of material and energy flows and yields, technical specifications of equipments (power rates, operating times, efficiencies), compositions in weight% of the mass, volume % (v%), ppm, recyclability rates,

databased (foreground data), the composition of H<sub>2</sub> streams, pressure, temperature

- Data gathered by: Research and literature revision (Background data), Foreground data by filling templates from experts in the core technology, GaBi Professional databases
- **IBBK - Market analysis**
- **Europroject**
  - Data type: Publicly available data from the European Commission's public repository CORDIS in relation to the involvement of other projects, initiatives, and stakeholders and from other publicly available sources; EP may use data from stock image banks.
  - Data gathered by: Research

Data produced as an outcome of the project and how this data is gathered by the consortium includes:

- **SEID AS**
  - Data type: Reactor performance parameters (gas flow rate, electrode configuration (electrode shape, distance between the electrode and the reactor wall), reaction sets.
  - Data gathered by: Data analysis, modelling, COMSOL Multiphysics
- **University of Stavanger**
  - Data type: Gas-solid equilibrium analysis, Carbon characterization data, dynamic study on gas separation, Adsorbent characteristics
  - Data gathered by: Gas sorption instrument, SEM, TEM, Raman Spectroscopy, XRD, surface area, Gas separation test instrument, PXRD, TGA, surface area
- **NORCE**
  - Data type: HYSYS
  - Data gathered by: Aspen HYSYS modelling
- **University of Liverpool**
  - Data type: Reaction performance, reaction sets
  - Data gathered by: Analysis of collected data, modelling
  - Data previously collected include reaction rate constants from the literature
- **IREC**
  - Data type: Quantities of material and energy flows and yields, technical specifications of equipment (power rates, operating times, efficiencies), compositions in wt% of the mass, v%, ppm, recyclability rates, databased (foreground data), the composition of H<sub>2</sub> streams, pressure, temperature

- Data gathered by: Research and literature revision (Background data), Foreground data by filling templates from experts in the core technology, GaBi Professional databases
- Data is previously collected from scientific journals and other recognized sources, recognized reports, EU reports and other recognized sources, readable documentation source
- EP
  - Data type: publicly available data, available organizational data from previous projects, stock image banks.
  - Data gathered by: Research

## 2. FAIR DATA

### 2.1. WILL DATA BE IDENTIFIED BY A PERSISTENT IDENTIFIER

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#### 2.1.1. WILL DATA BE IDENTIFIED BY A PERSISTENT IDENTIFIER

Data findability requires that data are well described and identified to ensure that users will find them. The data sets will be marked by persistent and unique identifiers such as Digital Object Identifiers. Thus, the data sets will also be citable, which increases the identifiability and visibility of ColdSpark®. Another persistent identifier that has been planned to use during the project is ORCID iDs.

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#### 2.1.2. METADATA

**Will rich metadata be provided to allow discovery? What metadata will be created?**

To identify the data, metadata and keywords will be properly defined as well as use standard identification mechanisms and naming conventions. The final calibrated data will be presented with related metadata and keywords, and with a unique file identifier.

**What disciplinary or general standards will be followed?**

The unique identifier will include the name of the data originator/institute, work package number, parameter, date of measurement, instrument name and version number. Since different scientific communities are participating in this project, the metadata will be distinct from each experiment measurement group and the modelling group. Each partner is responsible for their data, which includes security measurements depending on the organization's rules.

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#### 2.1.3. KEYWORDS TO BE PROVIDED IN THE METADATA TO OPTIMIZE THE POSSIBILITY FOR DISCOVERY AND POTENTIAL RE-USE

The reuse of data is an important target of ColdSpark® to encourage scientific investigation and discussions and promote innovation thereby resulting in the possible lead to new data production. Hence, the data in public open access will include keywords for optimizing effective reuse.

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#### 2.1.4. HOW METADATA CAN BE HARVESTED AND INDEXED

Some of the produced data that is open and non-confidential will be identified with metadata. Confidential data will be identifiable and located employing usual identification mechanisms for the consortium partners. Third parties will not be able to use these data when the project is completed.

### 2.2. ACCESSIBLE PROJECT DATA

The following access options and policies are planned:

#### **OR – Open repository** (e.g., Zenodo)

The project will use an Open Access repository for complying with the requirement of long-term open access to the public results of the project.

#### **PR – Project repository**

The project uses a password-protected repository on Microsoft Teams/share point, exploiting the security and backup services of the platform. Access to the folder is reserved for the project partners. Specific rules and structure are established in the Project Management Manual (D8.1.)

#### **CR - Company/Institution repository**

Each partner uses cloud and offline data storage solutions that must comply with the cybersecurity rules of the company/institution/organization. The access is limited to the company/institution/organization employees/contracted staff.

#### **Website of the project - [www.coldspark.eu](http://www.coldspark.eu)**

The public data generated by the project (dissemination and communication materials, public deliverables) are published in open access on the project website ([www.coldspark.eu](http://www.coldspark.eu)). The project website will remain online for at least 2 years after the project end.

#### **European commission repository - CORDIS**

Public deliverables and results are made available on CORDIS.

The coordinator is responsible for centralization and giving access to relevant repositories. Each partner is responsible for his data (security measurements depending on internal rules).

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### 2.2.1. DATA DEPOSITION IN A TRUSTED REPOSITORY

All research data and publications that include non-sensitive data will be deposited in a dedicated repository. Algorithms, protocols, and models will also be included in the repository. The suggested platform is Zenodo ([www.zenodo.org](http://www.zenodo.org)), which is a well-established open dissemination research data repository available for data, publications, and software. Another repository could include EC-supported repositories such as the Open Access Infrastructure for Research in Europe (OpenAIRE), the Registry of Open Access Repositories (ROAR), the Directory of Open Access Repositories (OpenDOAR) etc. It is the responsibility of each partner to provide and update the repository regularly for each data set. Suitable naming agreements and templates for the data sets will be discussed during the biannual project meeting in Barcelona, in December 2022.

GitHub, a development platform to host and review code and building software will be used as the repository for software. The data generated from OpenScad will also be deposited in GitHub.

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### 2.2.2. ARRANGEMENTS WITH IDENTIFIED REPOSITORIES WHERE THE DATA WILL BE DEPOSITED

Project partners are already working with the systems described above. Other suggested repositories will be explored and contacted. Suggestions can be discussed at any time during the project's lifetime, approval will be given during the official Project Meeting taking place every 6 months. It can be ensured that the data management will be in line with the FAIR principles, to ensure the required access and reuse of data.

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### 2.2.3. DOES THE REPOSITORY ENSURE THAT THE DATA IS ASSIGNED AN IDENTIFIER? WILL THE REPOSITORY RESOLVE THE IDENTIFIER TO A DIGITAL OBJECT?

ColdSpark® is planning to use the Digital Object Identifier as the persistent identifier. Zenodo assigns all publicly available data a Digital Object Identifier. This ensures that the uploaded data is easily citeable. Zenodo accepts any file format that provides easy storage of data produced.

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### 2.2.4. COLDSPARK® OPENLY AVAILABLE DATA – LEGAL, CONTRACTUAL, INTENTIONAL PARTNER-SPECIFIC RESTRICTIONS

Most data produced within the ColdSpark® project are sensitive and will be available within the relevant consortium. Publishable data will be deposited in the repository. This will follow the data-

sharing policy implemented in the Grant Agreement and the Consortium Agreement. This means that:

- Non-sensitive experiment data or modelling data generated within the project will be available on a dedicated project website within a specific period (e.g. three months) of data collection or production.
- Results are owned by the partner that generates them and hence has the right to evaluate these data and assign them whether they are sensitive or not.
- Confidential /sensitive data are available on a confidential level to the European commission.
- Background i.e., the data, know-how or information that is needed to implement the action or exploit the results has been given access according to Attachment 1 of the Consortium Agreement.

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#### 2.2.5. PERIOD OF AN EMBARGO (IF APPLIED) TO GIVE TIME TO PUBLISH OR SEEK THE PROTECTION OF THE INTELLECTUAL PROPERTY (E.G., PATENTS)

**Why and how long this will apply, bearing in mind that research data should be made available as soon as possible?**

If ColdSpark® deposits sensitive data under an embargo status in a repository, an end date for the embargo will be provided. There will be provisions in the repository to restrict access to the data until the embargo period ends and when the period ends, it will be available to the public automatically.

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#### 2.2.6. WILL THE DATA BE ACCESSIBLE THROUGH A FREE AND STANDARDIZED ACCESS PROTOCOL?

ColdSpark® data files will be deposited either as closed, open or with embargoed access. Access to metadata and data will be provided through the repository over standard protocols such as HTTP and Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH).

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#### 2.2.7. ACCESS TO THE DATA DURING AND AFTER THE END OF THE PROJECT IF RESTRICTIONS EXIST

Only project partners can access the data before the full disclosure of the data (data that will be available as public). Access will be managed by an ad hoc authentication system.

Part of the data produced will have restricted access during the project. These data will be freely accessible to the relevant partners. In case data cannot be shared (or required to be shared under restrictions), this will be stated in writing to the consortium, clearly separating legal reasons and agreed upon in a contract.

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#### 2.2.8. THE IDENTITY OF THE PERSONS ACCESSING THE DATA IS TO BE ASCERTAINED

Published data will be accessible to everyone without any restrictions or authentication requirements. ColdSpark® will monitor the classification of the user through a web form that would be filled out voluntarily.

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#### 2.2.9. DATA ACCESS COMMITTEE (E.G., TO EVALUATE/APPROVE ACCESS REQUESTS TO PERSONAL/SENSITIVE DATA)

There is no identified need for a data access committee since all regulations are explicit.

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#### 2.2.10. OPENLY AVAILABLE METADATA AND LICENCED UNDER A PUBLIC DOMAIN DEDICATION CC0, AS PER THE GRANT AGREEMENT

The non-sensitive metadata will be made publicly available and licenced under a public domain dedication CC0, as per the Grant Agreement. The metadata will contain adequate information to help users access the data.

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#### 2.2.11. HOW LONG WILL THE DATA REMAIN AVAILABLE AND FINDABLE? WILL METADATA BE GUARANTEED TO REMAIN AVAILABLE AFTER DATA IS NO LONGER AVAILABLE?

Generally, the data will be stored in file formats that have a high chance of remaining usable and findable for the long term. The datasets which will be available publicly will be stored in selected file formats. Metadata may remain available even after data is no longer available.

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#### 2.2.12. WILL DOCUMENTATION OR REFERENCE ABOUT ANY SOFTWARE BE NEEDED TO ACCESS OR READ THE DATA BE INCLUDED? WILL IT BE POSSIBLE TO INCLUDE THE RELEVANT SOFTWARE (E.G., IN OPEN-SOURCE CODE)?

All public data can be viewed and used by using well-known software tools. The Consortium preference will always be open-source software, links to any required software or documentation will be provided.

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### 2.3. INTEROPERABLE PROJECT DATA

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#### 2.3.1. DATA AND METADATA VOCABULARIES, STANDARDS, FORMATS OR METHODOLOGIES FOR DATA INTEROPERABILITY DATA EXCHANGE AND REUSE WITHIN AND ACROSS DISCIPLINES? WILL YOU FOLLOW COMMUNITY-ENDORSED INTEROPERABILITY BEST PRACTICES? WHICH ONES?

Based on the scientific topics, the consortium partners will adopt metadata vocabularies and standards. The metadata vocabulary, standards, and methodologies include XML, .txt, etc.

ColdSpark® provides experimental results that will be useful to an international scientific community, and hence, will use international calibration standards, and SI units for measurements and will use commonly accepted data standards to optimize decision making. The data standards implemented will avoid the improper use of data and would enforce stricter data standards that would contribute to a predefined set of instructions that would always be imposed whenever data access protocol must be implemented.

A detailed data set description will be provided. This includes a description of the data generated, including the objective and technical approach to approve the association of our data sets with specific research. Information will be provided on data types and the data set's estimated size.

A persistent identifier of the data sets and a link to where the data sets can be directly accessed including the terms -of use or licence under which they can be accessed or reused will be provided.

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#### 2.3.2. USE OR GENERATION OF UNCOMMON PROJECT-SPECIFIC ONTOLOGIES OR VOCABULARIES AND AVAILABILITY

ColdSpark® will not use or generate uncommon project-specific ontologies.

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#### 2.3.3. QUALIFIED REFERENCES TO OTHER DATA

ColdSpark® will most likely include qualified references to other data from consortium partners' previous research.

### 2.4. INCREASE DATA RE-USE

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#### 2.4.1. HOW DOCUMENTATION WILL BE PROVIDED TO VALIDATE DATA ANALYSIS AND FACILITATE DATA RE-USE

The information will be provided through readme files, analyses, and variable definitions.

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#### 2.4.2. AVAILABILITY IN THE PUBLIC DOMAIN TO PERMIT THE WIDEST RE-USE POSSIBLE

**Will the data be licensed using standard reuse licenses, in line with the obligations set out in the Grant Agreement?**

Public deliverables are automatically published in the EC public domain, CORDIS and will additionally be available on the project website and Zenodo. Non-sensitive data produced from ColdSpark® will use creative common licences such as CC BY-SA, CC BY-NC or CC0 licences depending on the data/document.



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#### 2.4.3. WILL THE DATA PRODUCED IN THE PROJECT BE USEABLE BY THIRD PARTIES, IN PARTICULAR AFTER THE END OF THE PROJECT?

All publicly available data and products produced or used in the project are encouraged to be used by third parties as soon as possible. Third parties may be allowed to use the data in agreement with the data owner and will have the likelihood to either cite data and publications or offer co-authorship to the data owner. Data reuse will increase the impact and visibility of the research and will provide credits for the researchers involved, provide resources for training and education, and reduce the costs of duplicating the data. This reuse, however, will be per the Grant Agreement and the Consortium Agreement.

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#### 2.4.4. WILL THE PROVENANCE OF THE DATA BE THOROUGHLY DOCUMENTED USING THE APPROPRIATE STANDARDS?

Yes, the data provenance will be thoroughly documented. This will also provide essential information for determining data quality and reliability and will facilitate data reproducibility. This benefits data user, who is usually different from the data producers.

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#### 2.4.5. DESCRIBE ALL RELEVANT DATA QUALITY ASSURANCE PROCESSES

The quality of the data is an important issue as all data are shared within the consortium and used for different purposes such as in technology and research development. Each partner has established quality assurance procedures, that include calibration with international standards. Moreover, the consortium intends to apply versioning of the products and data to promote the re-usability of the data for the longest period possible. All public data will be stored in data repositories and hence, it will be available and re-usable indefinitely.

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#### 2.4.6. FAIR PRINCIPLES, CONSIDERATION OF RESEARCH OUTPUTS OTHER THAN DATA AND ASPECTS RELATED TO THE ALLOCATION OF RESOURCES, DATA SECURITY AND ETHICS

All partners are involved in developing the data management plan and are responsible that the documents and files they upload are complying with the overall guidelines mentioned in the Grant Agreement and the Consortium Agreement.

The partners deliver datasets and metaset and the costs involved in the allocation of resources, data security and ethical aspects are included in the project budget.

### 3. OTHER RESEARCH OUTPUTS

#### 3.1. MANAGEMENT OF OTHER RESEARCH OUTPUTS THAT MAY BE GENERATED OR RE-USED THROUGHOUT THEIR PROJECTS

Examples of other research outputs:

- Digital (e.g., software, workflows, protocols, models, etc.)
- or Physical (e.g., new materials, antibodies, reagents, samples, etc.).

The partners deliver datasets, and metadata produced or collected during ColdSpark® will be managed according to the rules described in Annex 1. The project coordinator will lead the accomplishment of the Data Management Plan and track the agreement of rules as documented in this plan.

### 3.2. FAIR DATA PRINCIPLES AND MANAGEMENT OF OTHER RESEARCH OUTPUTS

Agreements on standards, quality level and sharing practices will be defined within the consortium. Strategies will be developed to store the data and other research outputs over a defined period to ensure their availability and re-usability after the end of the ColdSpark® project.

## 4. ALLOCATION OF RESOURCES

### 4.1. COSTS FOR MAKING DATA OR OTHER RESEARCH OUTPUTS FAIR

The generation, use and storage of data require both monetary and human resources. Server costs, repository costs, quality assurance, data maintenance, security, and human resources would be included in these costs. In addition to the development and hosting of the data infrastructure that enables the consent with FAIR principles, all consortium partners have allocated a dedicated budget that will be covered by the EU funding and will be paid individually by the data-generating parties.

### 4.2. DM RESPONSIBILITIES

The partner who generates the data is the owner of the data and will be responsible for the data access, and storage as described in the Grant Agreement and the Consortium Agreement. Data will be available on the selected repository, and it is the responsibility of the data owners to upload and update them in time along with the required quality standards. The coordinator will monitor the data management of partners and remind them regularly to update the repository. DM is included in a dedicated project task (WP 8, Task 8.3), responsible partners: SEID AS and Europroject Ltd.

### 4.3. LONG-TERM PRESERVATION, NECESSARY RESOURCES AND DECISION-MAKING

During the ColdSpark® project, public data will be available in repositories. Zenodo will be used as the open-source repository. According to their policies, items will be retained for the lifetime of the repository. This is currently the lifetime of their host laboratory CERN.

## 5. DATA SECURITY

### 5.1. PROVISIONS FOR DATA SECURITY (INCLUDING DATA RECOVERY AS WELL AS SECURE STORAGE/ARCHIVING AND TRANSFER OF SENSITIVE DATA)

The coordinator uses Microsoft 365 Business premium with storage in Europe and has an online backup solution. Also, use extra security and backup from EMP Secure. A two-factor security on user accounts is implemented. Raw data is archived on a local server in the partner's lab, calibrated data is shared through Microsoft Teams and SharePoint.

### 5.2. SAFELY STORED DATA IN TRUSTED REPOSITORIES FOR LONG-TERM PRESERVATION AND CURATION

ColdSpark® will store data in Zenodo. According to their policy, data files and metadata are backed up nightly and will be replicated into multiple copies in the online system. Restricted access files will also be stored in Zenodo with the ability to share access with others if requirements are met.

## 6. ETHICS

### 6.1. ETHICS OR LEGAL ISSUES THAT CAN HAVE AN IMPACT ON DATA SHARING

No ethical issues are expected from the data generated in the ColdSpark® project.

### 6.2. INFORMED CONSENT FOR DATA SHARING AND LONG-TERM PRESERVATION

Whenever the ColdSpark® project implements surveys, or questionnaires dealing with personal data, or collects personal data for any other reason, for example, attendance during organised meetings, European General Data Protection Regulation (GDPR) will be applied and used as a reference and the user will be informed about the use of personal data. The beneficiaries will process personal data under the Agreement in compliance with the applicable EU, international and national law on data protection (ARTICLE 15-Data Protection).

ColdSpark® will not transfer personal data to other entities and the only use will be for sending information to the users (e.g., email address) about project progress. The users will be provided with preferences to change their consent and ask for being removed from the communication channel.

