

Deliverable 6.2 Data Management Plan (DMP)

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Executive summary

As a reminder, a data management plan (DMP) is a formal document that outlines how data are to be handled both during a research project, and after the project is completed. The goal of a data management plan is to consider the many aspects of data management, metadata generation, data preservation, and analysis before the project begins; this ensures that data are well-managed in the present, and prepared for preservation in the future. Dissemination opportunities, targeted audiences and key messages will be identified and updated regularly. For the preparation of present version of this deliverable (at the beginning of ATHOR project) a number of reference data management documentation have been consulted by the authors and reviewed for the purpose to produce a self-consistent high-quality plan, based on best practices and experiences that authors consider related.

This deliverable is the updated version of the deliverable D6.2 dedicated to data management principles of the ETN ATHOR project. Present deliverable outlines how the research data collected or generated during the project will be handled by the consortium during and after the ATHOR action. It describes which standards and methodology for data collection and generation will be followed, and whether and how data will be shared and preserved.

The Data Management Plan is an evolving document of a public type, and will gain more precision and substance during the course of the project. It will be revised, if needed, in order to keep the information up to date.

1. Data Summary

In order to organise the best management of the data generated during ATHOR project, and as a check list during the data collection/generation process, we should keep in mind the following key points:

- What is the purpose of the data collection/generation in relation to the objectives of the project?
- What types and formats of data will the project generate/collect?
- Will you re-use any existing data and how?
- What is the origin of the data?
- What is the expected size of the data?
- To whom might it be useful ('data utility')?

Starting in October 2017, ATHOR Data serve as a useful tool for researchers and engineers for a better understanding of thermomechanical behaviour of refractory linings used in I&S applications. The project covers all the main features of thermomechanical analysis of refractory linings including material characterization, impact of corrosion on thermomechanical properties, thermal shock resistance, modelling of non-linear thermomechanical behaviours, instrumentation of industrial devices and measurement in operation conditions.

The ATHOR project main objectives are directly linked to the **problematics of the refractory materials for the iron and steel-making industry (I&S)** - one of the most important sector of manufacturing and construction industry in Europe and in the world. A typical steel plant uses hundreds of types of refractories, each engineered for specific applications [American Ceramic Society Bulletin, Vol. 95, No.2]. It is therefore not surprising that refractories for I&S represent 60% of all refractory materials market today. While providing the top quality training in refractory materials and related fields for 15 young researchers and enabling close academia-industry cooperation, the principle objectives of this project are [Annex 1 of Grant Agreement 764987, part B page 7]:

- Explore the capability of advanced numerical modelling in order to design better materials and better refractory linings, consequently improving energy efficiency and thermomechanical properties of products
- Assist the European refractory and steelmaking industries to identify technological improvements by providing high performance characterization and modelling tools which can comfort their competitiveness
- Support the development of new characterization devices and modelling methods to offer solutions to current S/T challenges
- Assist the European refractory and steelmaking industries to identify technological improvements by providing high performance characterization and modelling tools, which can comfort their competitiveness.

Meeting these objectives requires cooperative work of all 15 ESRs together with their academic and industrial mentors. Each ESR will collect specific data, related to his PhD topic. As a result of exchanges within ATHOR consortium, it has become apparent to us that it is difficult to give an exact estimation of the kind and amount of data to be collected during the project. However, during the course of the project we plan to estimate the data, to be produced by each ESR, and produced as a result of other support activities such as project management and dissemination. Some preliminary results are accumulated in the table below.

Origin of the data			Purpose (in relation to the objectives of the project)	Type of data (formats), Data utility (Public or Not)
WP	Team	People		
Research activities: WP1, WP2, WP3, WP4	All consortium	ESR i (i = 1 to15)	Analysed Data: <ul style="list-style-type: none">Analysed literature reviewRefractory materials properties analysisQuantitative model results	MS Office/Open Office documents Public
		Supervisors (LSTC), WP1,2,3 4 Leaders with help of Project Manager	Research Raw Data: <ul style="list-style-type: none">Literature review (compilation of documents)Industrial and models materials to be studiedExperimental work descriptionRefractory materials and subsystem characterisationIn-situ temperature and strain fields measurementsModels construction and boundary conditions	MS Office/Open Office documents Just for ATHOR consortium
Training activities: WP5	Recruitment and Skill Progress Committee (RSPC) Training and Knowledge Transfer Committee (TKTC)	RSPC Chair TKTC Chair WP5 Leader	Lectures, Workshop: <ul style="list-style-type: none">PowerpointsVideo recordsE-Learning toolsMOOC	MS Office/Open Office documents Public
		Lecturers Project Manager with help of ESR i (i = 1 to15)	Training follow up: <ul style="list-style-type: none">PCDP documentsTraining planModels from elsewhere	MS Office/Open Office documents Just for ATHOR consortium
Dissemination activities: WP6	Training and Knowledge Transfer Committee (TKTC)	TKTC Chair WP6 Leader Project Manager	Communication, Outreach: <ul style="list-style-type: none">Interactive exhibitionDedicated short videosSeminars / NewslettersPosters / PresentationsPapers	MS Office/Open Office documents Public
		with help of ESR i (i = 1 to15)	Dissemination follow up: <ul style="list-style-type: none">Coming events listingDissemination planModels from elsewhere	MS Office/Open Office documents Just for ATHOR consortium
Management activities WP7	Management Team (MT)	Project Coordinator Project Deputy Coordinator	Project Description: <ul style="list-style-type: none">Objectives, PartnersWork Packages, PeopleESRs and their SubjectsPublic Deliverables	MS Office/Open Office documents Public
		Project Manager with help of ESR i (i = 1 to15)	Project rules, follow up: <ul style="list-style-type: none">Consortium AgreementFinancial statementsGantt, Actions planOrganisational aspect	MS Office/Open Office documents Just for ATHOR consortium

Table 1. Estimated data that will be collected during the ATHOR project

The success of the project very much depends on a clear and concise **data management methodology** and **the ability to easily share data between partners**. The sheer volume of the data that will be generated during this project poses significant challenges for the implementation of such a methodology. **The expected size is reasonable to assume that it will reach the hundred Gigabyte range.**

Main types of data to be generated in ATHOR can be approximately divided into **four different groups**:

- **Project rules and follow up data:** Grant and Consortium Agreements, Gantt Chart and Actions Plan, administrative and financial data, templates, surveys, management files

- **Research data:** it covers the data collected within the frames of the project subject including analysed data. In a research context, examples of such data include graphs and images, statistical data, parameters, experimental conditions, experimental observations, results of measurements etc. The focus will be made on the availability of this research data in digital form.
- **Data related to training activities:** Personal Career Development Plan (PCDP), Training & Visit Plan, Lecture notes, Powerpoints, Video Records, E-Learning tools, MOOC.
- **Data related to dissemination activities:** publications, presentations/posters, seminars/newsletters, dedicated short videos

These types of data include data of different confidentiality levels that can be schematically represented as in the Figure 1 (inspired by 5G! Pagoda D 1.2 - Open Data Management Plan, p.8). In this way, a dominant part of communication data and some part of research data are rendered public, while project data that ensures project's functioning is principally kept confidential (on MyCore).

The data generated by ESRs strongly depends on the individual doctoral projects, tools and research methods used within these projects. Whenever possible, the dataset will be made available online using the following formats:

- Text content: Acrobat PDF/A (.pdf); Comma-Separated Values (.csv); Microsoft Office or Open Office Formats (.docx, .xls, pptx, .odt, .ods, .odp); Plain Text US-ASCII/ UTF-8 (.txt); XML (.xml)
- Graphic content (.jpg, .png, .svg .tif, .tiff)
- Audio content (.aif, .aiff, .wav)
- Video content (.avi, .mp4)
- Modelling data (.mat)

The project will assume the principle of using commonly used data formats for the reason of compatibility, efficiency and access.

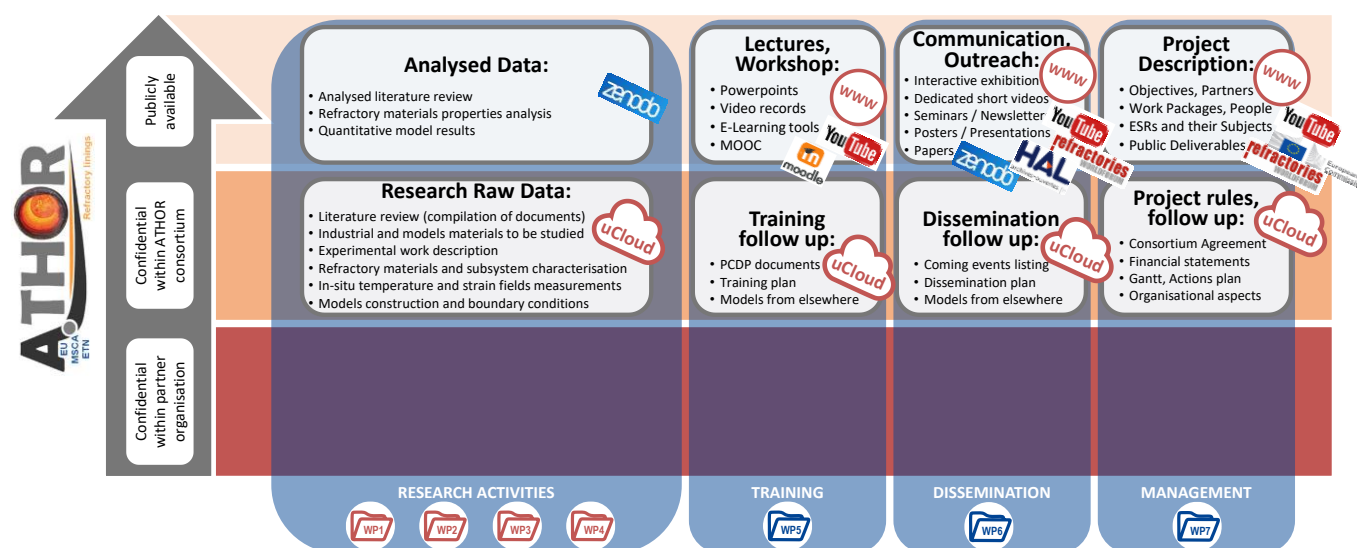


Figure 1. Distribution of ATHOR project data in the confidentiality grid

2. FAIR data

Findable, Accessible, Interoperable and Reusable

2.1. Data storage

The overall data produced and/or collected by each consortium member organisation has to be carefully stored and managed by this organisation. In a preliminary stage of production (and/or collection), a local storage by the authors is not excluded. When close to final version, all produced data have to be carefully stored by the authors in the **central repository** (MyCore) dedicated to ATHOR project by the coordinating university of Limoges. All local and central repositories are to be secured using the latest security protocols. The access to the central repository is regulated by the project coordinator and project manager. It is provided for project consortium and to other linked parties upon request from a project team. The **MyCore platform is hosted by CNRS servers**, regular files backup is ensured by the local informatics services, additional archiving is made by designated project members on hard drive supports. The main MyCore project repository is structured in the way, presented in the scheme of Figure 2.

MyCore, being the central “data bank” feeds other platforms linked to the project. For instance, as it has been mentioned in Deliverable 7.2, at current stage ATHOR Principle Investigators with the lead of RWTH academic pole are establishing an e-learning program “Eleonor” in the frames of Modular Object-Oriented Dynamic Learning Environment (Moodle) that is planned to be hosted by an RWTH server. Such Moodle platform will store educational material on the subject of ATHOR project in written and visual form. It will also have **two different access modes: private and public**. The confidentiality status of each document deposited on the platform will be defined by IP owners of the document.

In the frames of project data management, all participants attempt to follow best practices for data generation, storage and sharing, i.e. document changelog, unified name attribution and appropriate repository are kept as clear as possible. The documents are preferably shared within the consortium via indication of its placement in a database. To facilitate document evaluation and review, all deliverables and official documents are created in agreement with established templates for main MS Office formats.

Each Work Package or task leader is responsible for timely preparation of corresponding deliverables and required materials, while the project coordinator assumes the responsibility for management activities and project administration.

When a collection of data is ready to be published in public space, the last final version of these data currently stored on MyCore is upload on the most pertinent open access public platform. Depending of the type of data, our organisation is the following:

- **For project description:** ATHOR website (www.etn-athor.eu), Youtube Channel dedicate to ATHOR project, Refractories WorldForum (www.refractories-worldforum.com)
- **For research data:** Zenodo platform (<https://zenodo.org>)
- **For data related to training activities:** ATHOR website (www.etn-athor.eu), Youtube Channel dedicate to ATHOR project, Moodle platform dedicated to ATHOR project

ETN-ATHOR

- 1 – Proposal-Valuation-GA-CA
- 2 – Potential Additional Funds
- 3 – Team
- 4 – Gantt Chart-Actions Plan
- 5 – Meetings
- 6 – Supervisory Board (SB)
- 7 – Finance Committee (FC)
- 8 – Industry Advisory Board (IAB)
- 9 – Recruit. Skill Progress. Committee (RSPC)
- 10 – ESR Council (ESRC)
- 11 – Training & Knowledge Transfer Committee (TKTC)
- 12 – State of the Art
- 13 – WP1 - Improvement of measurements
- 14 – WP2 - Advanced characterization
- 15 – WP3 - Innovative modelling
- 16 – WP4 - Advanced measurements
- 17 – WP5 - Training, mobility
- 18 – WP6 - Knowledge Dissemination
- 19 – WP7 - Management Activities
- 20 – ESRs working space
- 21 – Dissemination
- 22 – Scientific Publications
- 23 – Deliverables and Milestones
- 24 – Image gallery
- 25 – Public

Figure 2. Directories tree of MyCore repository of UNILIM

- **For data related to dissemination activities:** ATHOR website (www.etn-athor.eu), Youtube Channel dedicate to ATHOR project, Refractories WorldForum (www.refractories-worldforum.com), CNRS Hal platform (<https://hal.archives-ouvertes.fr>), Zenodo platform (<https://zenodo.org>)

As regards the **research data**, the ATHOR project will use a repository such as **ZENODO**, as proposed by HORIZON 2020, to ensure the most efficient dissemination of the selected publishable information generated in the project (research publications and their data). This repository is recommended by the European Commission in order to unite all the research results arising from EC funded projects.

Indeed, ZENODO¹ is an easy-to-use and innovative service that enables researchers, EU projects and research institutions to share and showcase multidisciplinary research results (data and publications) that are not part of existing institutional or subject-based repositories. Namely, ZENODO enables users to:

- easily share the long tail of small data sets in a wide variety of formats, including text, spreadsheets, audio, video, and images across all fields of science;
- display and curate research results, get credited by making the research results citable, and integrate them into existing reporting lines to funding agencies like the European Commission;
- easily access and reuse shared research results;
- define the different licenses and access levels that will be provided.

Furthermore, ZENODO assigns a **Digital Object Identifier (DOI)** to all publicly available uploads, in order to make content easily and uniquely citable and this repository also makes use of the OAI-PMH protocol (Open Archives Initiative Protocol for Metadata Harvesting) to facilitate the content search through the use of defined metadata.

Considering ZENODO as the repository, the short- and long-term storage of the research data will be secured since they are stored safely in same cloud infrastructure as research data from CERN's Large Hadron Collider. Furthermore, it uses digital preservation strategies to storage multiple online replicas and to back up the files (Data files and metadata are backed up on a nightly basis).

Therefore, this ZENODO repository fulfils the main requirements imposed by the EC for data sharing, archiving and preservation of the publishable data generated in ATHOR.

2.2. Making data findable, including provisions for metadata

In order to keep data findable, it is necessary to provide its metadata. Metadata is a systematic method for describing such resources and thereby improving access to them. Author, date created, date modified and file size are examples of very basic document metadata.

Considering the strongly interdisciplinary nature of the project, ATHOR's consortium favours the adoption of a broad and domain agnostic metadata standard that the EU recommends to its member states for recording information about research activity: the **Common European Research Information Format (CERIF) standard** is described at <http://www.eurocris.org/cerif/main-features-cerif>.

An additional advantage of a CERIF inspired standard is that ATHOR's DMP managing institution (University of Limoges) currently uses a research information system developed by Elsevier that implements the CERIF standard (PURE).

For publication data unique identifiers such as **Digital Object Identifiers (DOI)** will be used as it is one of the most common ways for data identification. The repositories such as **Zenodo or OpenAIRE** (Open Access Infrastructure for Research in Europe), one or both of which will be used for data publishing, already provide persistent identifiers for data sets.

¹ <http://www.zenodo.org/>

By one of the upcoming reporting periods, as soon as sufficient amount of data is produced within the project, consortium leaders will consider the distribution of survey template to all ESRs to collect the information on:

- Data set reference and name;
- Data set description;
- Data formats;
- Faced difficulties/risks while data collection and analysis;
- Standards and metadata
 - How is data created?
 - What standards or methodologies did you use?
 - How did you structure and name your folders and files?
 - How did you track the changelog?
- Data sharing;
- Archiving (storage and backup);
- Ethical issues;
- Other aspects (share of responsibilities within the team related to data lifecycle)

Currently, **all data is stored on the MyCore platform** and with the clear indication of data subject, authors and change log history when necessary.

2.3. Making data openly accessible

As mentioned in the previous section 2.1, after receiving the authorization of all concerned parties, the collected data will be deposited on repositories such as [OpenAIRE](#) or [Zenodo](#) allowing researchers to deposit both publications and data, while providing tools to link them.

It is expected that data related to the social media, to any publicity, designated courses, open access publications, survey results, public deliverables will be made openly available by default. It is agreed within the consortium that the information, that has to be **kept confidential within ATHOR will be marked with a special digital stamp with a mention “keep information private within ATHOR”**. Before any release of information, the authors of the document in question have to sign an **“Authorization letter”** clearly indicating his/her name, date, entity, the title of the document. A template of such authorization letter is available on MyCore: ETN-ATHOR\13 - Meetings\2018-02-21 - Kickoff\8 - Authorization letters. This procedure was considered compulsory to avoid IP conflicts within the consortium and violation of the rules of good scientific practice and protection of personal data.

For some cases, in order to avoid multiplication of desynchronized versions of the data related to the same action and to moderate the use of virtual storage space, the consortium considers to preserve and make public only metadata, while removing raw data itself. The virtual address of the main and unique dataset (MyCore platform) needs to be provided in parallel with metadata. In this way, the collected data remains findable and accessible.

Since the H2020 requirement for **Open Access publishing is fully embraced by ATHOR project**, the project will ensure both **“green”** (in addition to publication in subscription journals, the copy of an article is deposited into an institutional repository such as Research Repository UCD) and **“gold”** (publications available directly from the publisher after paying author's fees, envisioned in the project's budget) data publishing. In order to ensure easy availability of key data sets, ATHOR data will be classified into three specific categories as follows.

GOLD

Analysed data that has clear scientific significance, provides interesting results that have resulted in new understanding in the field, possibly supporting high impact journal publications. Such data will be made available online using a reliable, indexable repository that is compatible with the European Commission's OpenAire platform, such as FigShare.

GREEN

Analysed data that is relevant for the ATHOR partners and can be used to develop new processes and models within the project work plans. Such data will be shared in a searchable repository accessible by all partners, such as the project Online platform site (MyCore platform).

WHITE

Raw data or data that has been analysed but is not thought at this stage to be significant to either the project or wider community. Such data may still have unseen value and will be stored in a local, searchable archive that is protected against data loss.

Figure 3: Data management process for new data (from the [HIMALAIA](#) project DMP)

The management of ATHOR data requires standardised and timely reporting of data which can be shared within the project and with external stakeholders. The standard process for handling new data generated during the project is defined in Figure 4. This process will ensure that all data generated is captured and can be made available to both internal and external stakeholders if required. Stakeholders will also be able to see that data has been recorded in advance of processing and analysis and can prepare activities in advance of the publication of results.

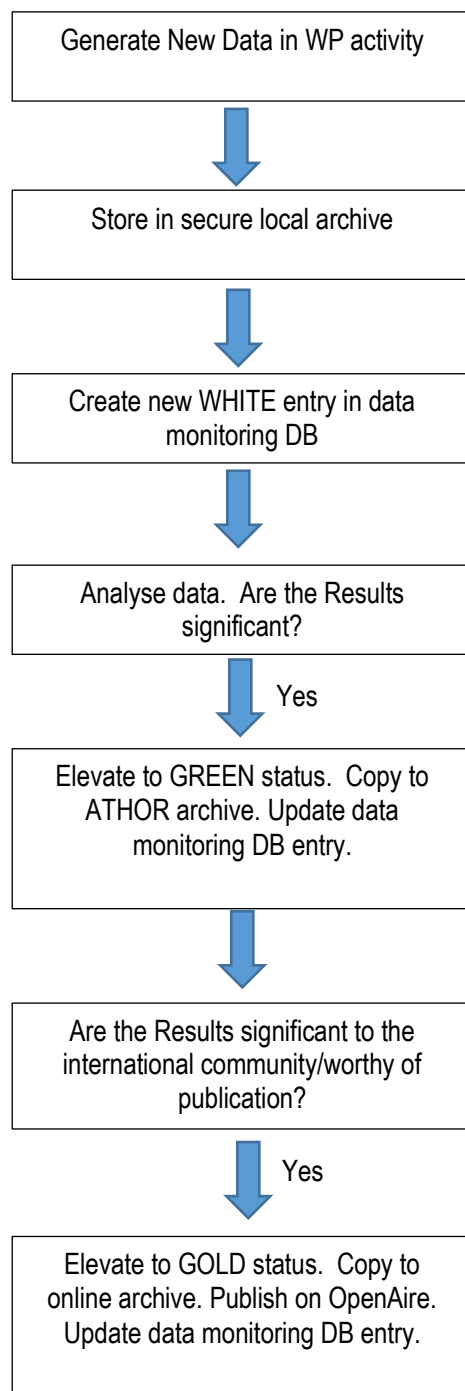


Figure 4 – Workflow for newly generated data (from the [HIMALAIA](#) project DMP)

While ensuring the internal data storage and backup, the project obliges to publish the public results through the following channels:

- **“Open data”** section of the project website: www.etn-athor.eu menu.
- **Zenodo** (<https://zenodo.org>) central repository recommended by the Horizon2020 online manual where public deliverables and publications will be uploaded and connected to the OpenAIRE platform. The advantage of Zenodo is that it is “open in every sense”, hence, there is no need to explore any kind of arrangement with this repository, neither documentation, nor data access committee to access the data uploaded.

Since there is no any sufficient scientific data produced within the ATHOR project yet, these data repositories are currently empty.

- **Diffuse or publish the appropriate type of data via ATHOR social channels**, i.e. Facebook, LinkedIn, YouTube, Twitter.

- National portals for data publishing, for instance <http://theses.fr/> in France for depositing doctoral thesis manuscripts.

2.4. Making data interoperable

As mentioned in section 1. “Data Summary”, in order to comply with interoperability and re-usability requirements and to facilitate the exchange between researchers and institutions, best practices for file formats will be used in ATHOR project. When possible, data will be rendered available in the format consultable with the help of free of charge software (for example Open Office formats for text documents). The depositors will also strive for using a standard vocabulary for all data types present to allow interdisciplinary interoperability.

2.5. Increase data re-use (through clarifying licences)

It is possible to license a produced dataset. To do so, it will be necessary to attach Creative Commons Licence, according to the following guidelines <https://creativecommons.org/choose/> or <http://ufal.github.io/public-license-selector/> by integrating the appropriate abbreviation into the shared file. Since no research data has been produced to date, the specific question of its re-usability by third parties or usability period is not fully developed in the current version of the DMP document.

2.6. Considerations for publishable information

Therefore, the ATHOR consortium, **guided by the Project coordinator**, will follow the following strategy (Figure 5): if the research findings result in a ground-breaking innovation, the members of the consortium will consider **two forms of protection**:

1. to withhold the data for internal use or
2. to apply for a patent in order to commercially exploit the invention and have in return financial gain.

In latter case, publications will be therefore delayed until the patent filing. On the contrary, if the technology developments are not going to be withheld or patented, the results will be published for knowledge sharing purposes, on the condition they are compatible with the confidentiality of the project.

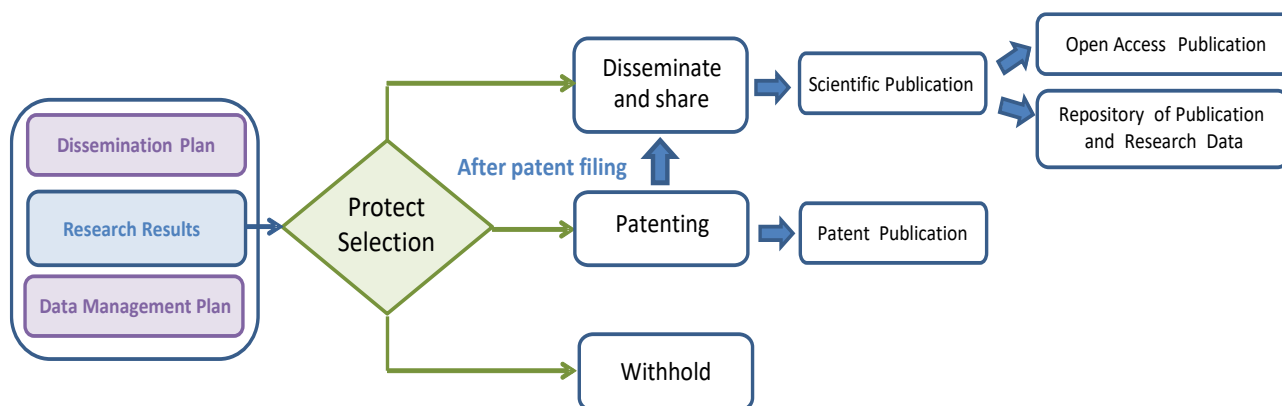


Figure 5. Process for determining which information is to be made public (from EC’s document “Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020)

Publications

One of the expected means to disseminate the RESULTS will be scientific publication.

Each publication will be approved beforehand in conformity with the intellectual property, confidentiality and publication provisions set out in the Consortium agreement. Relevant data necessary for the verification of results published in scientific journals can be made accessible on a case-by-case basis. The decision concerning the publication of data will be made by the decision-making bodies of the consortium. If possible, research data of public interest will be made accessible via the internet.

Process for validation of Publications:

The following procedure shall apply when articles/publications related to ATHOR are planned (see Figure 6). The objective of this process is to check that the publication is within the project scope/activities and also to keep track of the work disseminated. Partners are requested to comply with this process for all ATHOR related publications.

The project internal process to be followed in order to submit papers supported by (and acknowledging) ATHOR is as follows.

Before paper submission:

- The Partner wishing to disseminate information relating to ATHOR informs the other Partners via the Project Management Committee written notice 45 days prior to all publications, including abstracts.
- Any Partner may object to a publication within 30 days of notification. If this objection is upheld, the publishing Partner will:
 - extend the review period and delay the proposed publication for a period not exceeding 90 days
 - and/or modify the publication as requested
 - and/or delete any other Partner's confidential Information

After Acceptance:

- Notify the paper acceptance and send the final version to the Coordinator and the IAB.
- The project coordinator posts the communication on the **ATHOR MyCore platform**.
- The Coordinator sends a copy to the EC.

The Publication Submission template is available on the **ATHOR MyCore platform**.

Figure 6 illustrates the process for validation of publications.

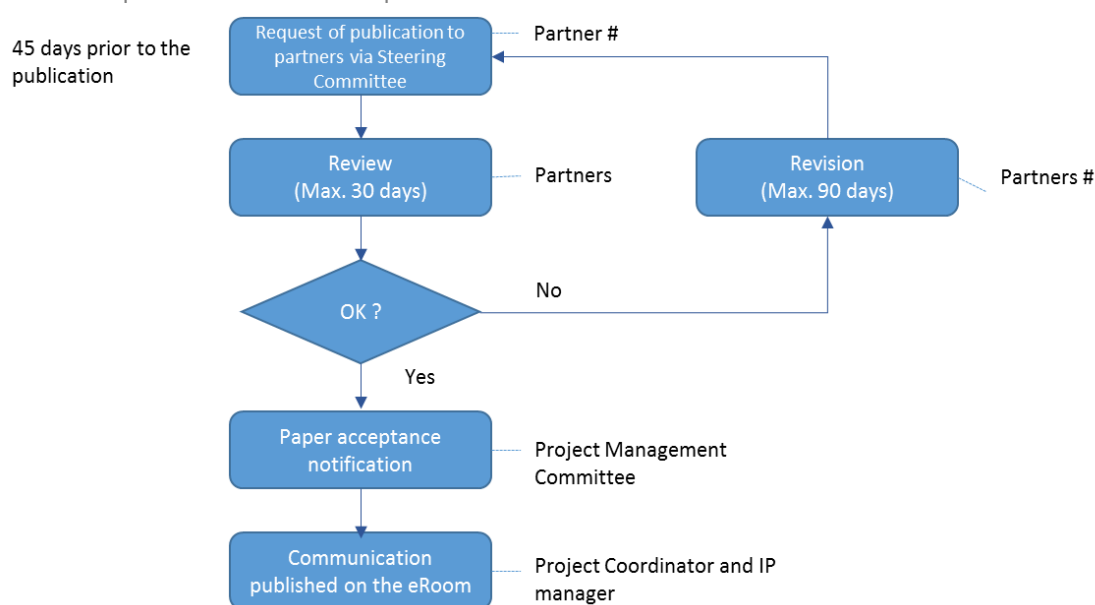


Figure 6: Process for validation of publications

Methodology

Here we provide a list of the publishers of journals potentially considered for the publications to be generated in the ATHOR project:

- Engineering Structures,
- Construction and Building Materials, Computers & Structures,
- International Journal of Plasticity, Ceramics International,
- Civil Engineering,
- Journal of the European Ceramic Society,
- International Journal of Solids and Structures, European
- Journal of Mechanics,
- Computer Methods in Applied
- Mechanics and Engineering, Metallurgical and Materials
- Transactions B, Materials and Design.
- Etc/

It is expected that **at least three reviewed papers per ESR** will be published as a consequence of the project results.

All the publications and their related research data when publishable will have to acknowledge the European Commission and the HORIZON 2020 project funding, as follows:

“This work is supported by the funding scheme of the European Commission, Marie Skłodowska-Curie Actions Innovative Training Networks in the frame of the project ATHOR - Advanced THERmomechanical multiscale modelling of Refractory linings 764987 Grant.”

3. Allocation of resources

Generally, it is hard to predict the cost of data management activities, as many activities are an integral part of standard research activities and data analysis. Ideally, it is necessary to estimate the time or cost needed for activities related to data collection, data entry and transcription, data validation and documentation and the cost of preparing data for archiving and re-use. Those resources that include time and effort costs i.e. search costs, maintenance of technical infrastructure, individual preparation effort needed to use the infrastructure etc. are so-called non-monetary costs. Since ESRs and management team are the main producers of datasets in the project, all these costs are related to them. ATHOR consortium expects that monetary costs for FAIR data will be minor and will be mainly related to “gold” publishing of the articles, maintenance of hosting university servers for MyCore and Moodle and engagement of external workforce for producing multimedia dissemination material.

Regarding the question of long-term data preservation, no specific arrangements has been done in the consortium yet. However, with a great degree of confidence, it can be confirmed that it is the project coordinator with the help of local UNILM resources who will play the major role in this task.

4. Data security

The security of the central MyCore repository and all other partner repositories is provided and guaranteed by the respective centres for information processing of these universities.

Access to the MyCore database is managed by the coordinator and project manager. It is provided for project members and other parties upon request from a project team. This space is password protected and the security of this platform is guaranteed by the Informatics Systems Direction (DSI) of Limoges University. Regular back up of all data stored on UNILIM servers is ensured. The backup of MyCore data is performed by the Limoges University server, the history of the content can be traced back to up to three months. The selected data, deposited in MyCore space, will remain also available for 3 years after the end of the project.

In addition, if the project uses Zenodo repository for data sharing, its safety is guaranteed according to the product description (See <https://zenodo.org/features>)

5. Ethical aspects

According to the Annex 1 of Grant Agreement 764987 - Part B – p. 32, the ATHOR Consortium has taken into account all requested ethics issues. For example, the most common ethical issues include:

- the involvement of children, patients, vulnerable populations,
- the use of human embryonic stem cells,
- privacy and data protection issues,
- research on animals and non-human primates.

It also includes the avoidance of any breach of research integrity, which means, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct.

More precisely, all the activities carried out under the ATHOR project comply with ethical principles and relevant national, EU and international legislation, for example the Charter of Fundamental Rights of the European Union and the European Convention on Human Rights. The tasks for ATHOR only concern basic research activities and the project does not involve humans, animals or cells. Due to the fact that the main domain of the ATHOR project activity is related to materials science with the focus on refractory materials, the risk of having ethics issues during the project is extremely limited. Either way, within the ATHOR DoA Part A, the workpackage 8 is devoted to the ethics issues which sets out the 'ethics requirements' that the ATHOR project must comply with. One deliverable will be provided: D8.1 NEC - Requirement No. 1. In the framework of D8.1, all beneficiaries and partner organisations must confirm that the ethical standards and guidelines of Horizon2020 will be rigorously applied, regardless of the country in which the research is carried out.

ATHOR's partners are not planning to use any harmful material, or process which likely emits harmful materials. They do not use elements that may cause harm to the environment, to animals or plants. In any case, all the partners will follow their internal protocols to treat any material according to the national law and EU legislation. In that way, all chemical waste is collected and processed by a central university facility in the Universities involved within the ATHOR project. All wastes are recycled or appropriately deposited. Moreover, their respective researches do not deal with endangered fauna and/or flora /protected areas.

No tests on humans or animals are planned.

ATHOR'S partners will not use nano-material in their research and they do not do harm to the environment.



6. Appendix 1.

Deliverables and milestones focused on data in ATHOR within the scientific and technical Work Packages:

WP	Objectives related to data	Deliverables focused on data	Milestones focused on data
WP1	<ul style="list-style-type: none"> To improve existing methodologies and develop new methodologies for thermal and mechanical characterization of refractories. In one hand for full field strain measurement, optical techniques and associated experimental protocols will be optimised either to target low strain level quantification or limit the degradation of the accuracy due to harsh environment (very high temperature). In the other hand for thermal measurements, techniques based on classical thermocouples and infrared cameras will be combined to optimise the accuracy of the obtained temperature field and take into account the surface emissivity variation influence. This includes the development of ambitious set-ups at laboratory scale as well as in-situ devices for measurement on industrial linings in service. 	Reports related to <ul style="list-style-type: none"> Methodology for temperature measurements in industrial linings. First strain fields from laboratory testing Devices ready for thermo-physical properties characterisation Devices for mechanical characterisation at laboratory scale Devices for thermomechanical tests on subsystems Instrumentation tools for measurements on industrial devices 	<ul style="list-style-type: none"> Review and result validation on experimental methodologies
WP2	<ul style="list-style-type: none"> To generate a powerful and accurate database for materials properties which is mandatory for pertinent modelling approaches to be developed in this WP. This involves the characterisation of thermal and mechanical properties for all temperature ranges (from 20°C up to 1500°C) at different scales from raw materials to brick level including mortars for joint. In addition, the effect of corrosion by metallurgical slags on those properties will also be considered. 	Reports related to <ul style="list-style-type: none"> Description of microstructures and evolutions. Fundamental corrosion mechanisms and influencing factors Full database with thermal material properties and publication of some results Mechanical data for the finite element simulation. Evaluation of influence of corrosion on the mechanical behaviour at room temperature and elevated temperature Input for the simulation of thermal and mechanical behaviour of joints. 	<ul style="list-style-type: none"> Review and result validation on microstructure investigation Review and result validation on materials properties

WP3	<ul style="list-style-type: none"> To produce dedicated modelling methods and numerical tools to optimize the design of industrial refractory linings. The different proposed approaches cover all the scales that impact the thermomechanical refractory lining behaviour: from the material scale (i.e. microstructure) to the industrial lining (structural computation). The multiscale approach will be developed from micro to macro to establish the models and then, in the reverse way, from macro to micro to optimize each scale from the final vessel requirements point of view. 	Reports based on <ul style="list-style-type: none"> Discrete element model of a typical refractory microstructure, Benchmark of the different thermomechanical behaviour models in commercial software applied to refractories, Model for the creep of refractory, Model of the multi-physic behaviour of refractory at high temperature, Non-linear homogenization methods, Model of the non-linear behaviour of masonry at high temperature, Model of the laboratory pilots, Comparison between the methods for masonry computations, Models of the industrial structure, Critical material and lining (geometry, layout...) parameters for the structure's lifespan, 	<ul style="list-style-type: none"> Review and result validation on modelling at microstructure scale Review and result validation on modelling at large scale Report on material and lining critical parameters for the structure's lifespan
WP4	<ul style="list-style-type: none"> To characterize refractory masonry experimentally to get data for validation of advanced analysis methods, as well as for subsequent simulation of industrial problems to allow industrial device optimization. The selected materials and structures will be characterized under different conditions, and their thermal and mechanical properties will be investigated under complex limit conditions. A large and comprehensive experimental campaign is expected. It ranges from the characterization of the microstructure of materials to the full-scale industrial steel ladle. The aim is to gather a database allowing proper calibration and validation of advanced numerical models developed in WP3. The 3D pilot scale and the full-scale models investigation will provide unique valuable data for the calibration and validation of the numerical macro-models. 	Reports based on: <ul style="list-style-type: none"> Thermomechanical characterization of refractory microstructures finished, Thermomechanical characterization of refractory materials finished, Thermomechanical characterization of subsystems finished, Thermomechanical characterization of 3D pilot model finished In-situ measurements on industrial steel ladle finished 	<ul style="list-style-type: none"> Review a result validation on subsystems investigation Review and result validation on laboratory 3D pilot model Review and result validation on in situ measurements of industrial devices