Deliverable 11.5:

QA Procedures for the Generation of SoK Demonstration Cases

Work Package 11

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Executive Summary

This document Deliverable 11.5 "QA Procedures for the Generation of SoK Demonstration cases" (QA Procedure) defines procedures for planning and managing a system on the production of Domain Insights (DI) and State-of-Knowledge (SoK) documents.

The QA Procedure defines the following stages of SoK documents production process:

- initiation;
- drafting;
- review;
- finalisation and approval;
- socialisation;
- evaluation.

General requirements and work procedures for documentation are defined for each stage of the SoK documents production process.

The production of DI documents also includes the above defined stages, but the procedures for completing these stages are simplified. This is due to the fact that DI document production is intentionally done in an agile approach based on "learning by doing", where procedures are developed and tested in parallel to the production of the "pilot" documents. This approach shall make DI documents available quicker and lead to more feasible procedures than a sequential approach, where detailed procedures are developed first in theory and put to work only after that.

During the production of "pilot" documents, the flexible application of the QA Procedure is expected, with possible deviations from some of its provisions, if this leads to a more optimal process for production of SoK and DI documents.

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Glossary

Author

The expert involved in development of the SoK or DI document.

Assessment

The process, and the result, of analysing systematically and evaluating the hazards associated with sources and practices, and associated protection and safety measures. Assessment is often aimed at quantifying performance measures for comparison with criteria.

Criteria

Conditions on which a decision or judgement can be based. They may be qualitative or quantitative and should result from established principles and standards. See also requirement; specifications.

Domain

Level 3 of Goals Breakdown Structure (GBS). An area of activity, interest, or knowledge, especially one that a person, organization etc. deals with.

Domain Insights (DI)

Context documents that provide direct links for each knowledge domain to safety and implementation goals related to DGR requirements.

EURAD

The European Joint Programme on Radioactive Waste Management (EURAD). Also referred to as the 'Joint Programme'.

Expert

Someone widely recognized as a reliable source of knowledge, technique or skill whose faculty for judging or deciding rightly, justly, or wisely is accorded authority and status by their peers or the public in a specific well-distinguished domain.

Goals Breakdown Structure (GBS)

The EURAD goals breakdown structure is a thematic breakdown of knowledge and activities essential for radioactive waste management. It comprises Themes (Level 1), Sub-themes (Level 2) and Domains (Level 3), each formulated as goals. Although hierarchical and numbered, the knowledge and activities presented across the GBS should be considered collectively with no weighting to order of importance. Rather it is emphasised that there are many inter-dependencies and linked data across the GBS, where knowledge and activities can be centred in different ways, depending on the end user role and precise boundary conditions of the RWM programme to which the roadmap is applied.

Inception Report

The document containing information on detailed structure of a SoK document with detailing the requirements of each component of the structure, detailed work schedule for development of SoK

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document as well as distribution of functions between the authors with indication of key (responsible) expert.

Key Performance Indicators (KPIs)

Measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization.

Knowledge

Knowledge is the acquisition, understanding and interpretation of information. It is often used to refer to bodies of facts and principles accumulated by humankind over the course of time. Knowledge and information each consists of true statements, but knowledge serves a purpose: knowledge confers a capacity for effective action.

Knowledge Area

An area of activity, interest, or knowledge, especially one that a particular person, organization etc deals with.

Knowledge Management (KM)

An integrated, systematic approach of identifying, managing and sharing an organization's knowledge and enabling groups of people to create new knowledge collectively to help in achieving the organization's objectives.

Management system

A set of interrelated or interacting elements (system) for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner.

Qualification

Process of determining whether a system or component is suitable for operational use. Qualification is generally performed in the context of a specific set of qualification requirements for the specific facility and class of system and for the specific application.

Quality Assurance (QA)

Planned and systematic actions necessary to provide adequate confidence that an item, facility or person will perform satisfactorily in service. Or the function of a management system that provides confidence that specified requirements will be fulfilled.

Radioactive Waste Management (RWM)

All activities, administrative and operational, that are involved in the handling, pretreatment, treatment, conditioning, transport, storage and disposal of radioactive waste.

Responsible author

The author of SoK or DI document responsible for its finalisation.

![EURAD logo - European Joint Programme on Radioactive Waste Management]

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Review

Activity undertaken to determine the suitability, adequacy and effectiveness of the subject matter to achieve established objectives.

Reviewer

The expert involved in review of the SoK or DI document.

Roadmap

A high-level overview of a programme's goals, typical activities and knowledge needed to implement a RWM programme, from the generation of radioactive waste to disposal.

Screening

A type of analysis aimed at eliminating from further consideration factors that are less significant for the purpose of the analysis, in order to concentrate on the more significant factors. Screening is usually conducted at an early stage in order to narrow the range of factors needing detailed consideration in an analysis or assessment.

SoK document

The document describing the state of knowledge in a specific domain of EURAD Goals Breakdown Structure (GBS). Experts' view of the most relevant knowledge and associated uncertainties in a specific domain applied in the context of RWM programme. Short summary of scientific and engineering facts relevant to the domain. Typically SoK documents would use a relatively small number of key primary references and signposts out to further detail where necessary (i.e. relevant SoTA).

State of Knowledge (SoK)

Experts' view of the most relevant knowledge and associated uncertainties in a specific domain applied in the context of a radioactive waste management programme. Activities consisting of developing a systematic approach of establishing the state-of-knowledge in the field of RWM research.

State of The Art (SoTA)

Scientific facts underpinning the knowledge base. SoTA documents are oriented typically on a narrower scope and go into significant detail (e.g. focus on mechanistic or process-level understanding). They would not normally demonstrate the application of that knowledge. They typically include lots of technical references and are long documents.

Strategic Research Agenda (SRA)

Describes the scientific and technical domains and knowledge management needs of common interest between EURAD participant organisations.

Terms of Reference (ToR)

Description of what must be dealt with and considered when something is being done, studied, etc. Terms of reference show how the object in question will be defined, developed, and verified. They should also provide a documented basis for making future decisions and for confirming or developing a common understanding of the scope among stakeholders.

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Themes

Themes are large groupings of related Knowledge Domains typical in Radioactive Waste Management. They are the highest level of the EURAD Roadmap Goals Breakdown Structure (GBS).

Validation

The process of determining whether a product or service is adequate to perform its intended function satisfactorily. Validation (typically of a system) concerns checking against the specification of requirements, whereas verification (typically of a design specification, a test specification or a test report) relates to the outcome of a process.

Verification

Confirmation, through the provision of objective evidence that specified requirements have been fulfilled.

Work Package (WP)

A work package is a group of related tasks established within EURAD. Because they look like projects themselves, they are often thought of as sub-projects within the Joint Programme.

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1   Introduction

The European Programme on radioactive waste management (EURAD) has developed a Roadmap [1], which is essentially a representation of a generic radioactive waste management (RWM) programme enabling users and national programmes to access existing knowledge and the status of future and ongoing work (including research & development - R&D). According to the Roadmap [1], the overall knowledge in the field of RWM can be presented by a common structure for categorizing knowledge called **EURAD Roadmap Goals Breakdown Structure (GBS)** [2]. It comprises themes (Level 1), sub-themes (Level 2) and domains (Level 3), each formulated as goals. Themes are the highest level of the EURAD Roadmap GBS. Themes are divided into subthemes, which, in turn – into domains. A Domain is defined as an area of activity, interest, or knowledge, especially one that a particular person, organization etc. deals with. Although hierarchical and numbered, the knowledge and activities presented across the GBS should be considered collectively with no weighting to order of importance. Rather it is emphasised that there are many inter-dependencies and linked data across the GBS, where knowledge and activities can be centred in different ways, depending on the end user role and precise boundary conditions of the RWM programme to which the roadmap is applied.

The formal GBS exists to provide a common framework at the highest levels. Flexibility is offered at more detailed levels, primarily dependent on preferences of contributing domain experts. The importance or significance of the sub-theme/domain to implementation may dictate to some extent how many levels are needed (flexibility to add domains or levels).

The task of the EURAD Knowledge Management & Networking Programme [3] (EURAD, 2020) is to fill the framework that the GBS provides with content. One of the activities to achieve this is led by Work Package 11 – State-of-Knowledge (WP11 SoK) and aims to establish the current State-of-Knowledge (SoK) for all Roadmap domains (79 as of mid 2022). This means: collecting, compiling, preserving, capitalising of and providing open-access to knowledge generated in the field of RWM that can be extracted by present and future generations and by any interested end-users in Europe and beyond (for example Waste Management Organisations (WMOs), Technical Support Organisations (TSOs), Research Entities (REs)). In EURAD, '**State-of-Knowledge**' **(SoK)** is defined as "experts' view of the most relevant knowledge and associated uncertainties in a specific domain applied in the context of a RWM programme".

This SoK shall be captured and made accessible to the end-user through dedicated documents, namely, 1) short context **Domain Insights (DI)** documents and 2) **SoK documents**.

A DI document shall:

- – give a summary of existing knowledge on generic safety and implementation goals and provide a broad but not detailed overview of each domain relative to knowledge maturity, areas of uncertainty, and signpost to existing resources;
- – explain activities typical of the different phases of a RWM programme;
- – link to the Theme Overview document in the higher-level GBS structure;
- – link to available SoK documents (more detailed level document in GBS) that provides an experts' view of the most relevant knowledge and associated uncertainties (including areas of ongoing scientific and technological enquiry) in a specific domain applied in the context of a RWM programme;
- – give contextual information about how activities and knowledge associated with a domain impact long-term safety or practical implementation of a deep geological repository (DGR).

A SoK document shall address:

- – the issues of relevance for the safe disposal of radioactive waste by contextualising content relative to generic safety statements (safety functions);

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- the implementation of the disposal solution (up to the point where post closure safety starts and the facility is closed) by contextualising content relative to generic feasibility statements;
- the scientific and technological basis (i.e. what knowledge is needed 'broadly' for each domain and what knowledge is available, with signposts to most important reports);
- the importance to the overall safety case, safety significance.

State-of-Knowledge documents should include signposting to:

- a specific domain of available knowledge applied in the context of RWM programme;
- State-of-the-Art on scientific/technical knowledge that has been generated internationally over the past decades (EURATOM projects FP6, FP7, H2020), as well as the current status of understanding with respect to RD&D needs and potential impacts regarding implementation and safety; and
- relevant complementary scientific/technical resources developed/generated in the framework of, IGD-TP, SITEX-II, IAEA, OECD/NEA, national programmes, etc. that are publicly available. This includes training materials and initiatives, international guidance, active communities of practice, fora or expert networks.

All these documents shall be written by experts. Each individual SoK and DI document represents the views of the experts and is not a formal position of EURAD or its contributing organisations. To mobilise experts and to ensure that the documents and approaches are useful and in line with the overall EURAD aims, a close exchange between WP11, the other KM WPs, the PMO, Bureau, Colleges, and the EURAD community at large needs to take place.

In view of the above-mentioned, the system for capturing the SoK shall consist of:

- a set of SoK and DI documents, related to specific domains (79 domains as of May 2022);
- procedures and arrangements for interaction between these SoK and DI documents (connection between SoK and DI documents, hyperlinks etc.);
- procedures and arrangements for maintenance and improvement of the SoK system (gap analysis, collection and analysis of feedback, etc.).

To ensure the quality of each individual document as well as the overall SoK system, it is vital to establish and follow a quality assurance (QA) procedure. This is done in the framework of Task 4 "Quality Management Plan" of WP11 SoK. For this, the following is foreseen:

1) Establishing **quality assurance (QA) procedures** for the generation of the first SoK documents and DI documents (**Deliverable 11.5, this document**).

In order to have high quality SoK and DI documents that bring benefit, QA procedures are needed and applied. For that purpose, a QA Procedure is established and includes criteria, specifications, procedures for its implementation and control mechanisms. QA criteria reflect needs for end-users, including scientific excellence, inclusiveness, confidence levels and confidentiality levels. The QA Procedure will ensure that the SoK and DI documents are balanced and inclusive, provide the basis for next generation of experts to enter the field, contain the current scientific-technical SoK, and are fit for purpose in the overall KM Programme.

2) The ongoing development of the first SoK documents and DI documents will be actively monitored in the Task 4 of WP 11 SoK. As an important part, approaches to obtain feedback from the end-users of developed DI and SoK documents will be developed and applied to improve the effectiveness of meeting the needs of the end-users. Development of the Deliverable 11.10 "Feedback mechanism for Domain Insights, SoK documents and KM Systems – Methods and results" is scheduled for EURAD year 4.

The following chapters of this document describe the quality assurance (QA) procedures for the generation of the first SoK documents and the generation of initial DI documents. Simultaneously, in line with the agile and flexible "learning-by-doing" approach applied for the SoK and DI document

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development (see Section 2.1 of this QA Procedure), procedures can deviate from the procedures laid out herein, if seen fit by WP11 and the deviations should be based on reasonable arguments and necessities.

2 Planning of works with the SoK document production

This section covers the following issues:

– planning and managing of the system for SoK document production whithin the EURAD KM;

– process of development of SoK documents;

– general requirements to the structure of SoK documents;

– requirements and selection of experts (authors and reviewers).

The procedure for the production of DI documents is defined in the Appendix 1 of this QA Procedure. In some cases, according to the decision of the WP11 Team, the procedure for the production of DI documents given in the Appendix 1 of this QA Procedure can be used for the production of SoK documents.

2.1 Planning and managing the system for SoK document production

The EURAD vision foresees to provide SoK documents with experts' view for each domain of the GBS (79 domains as of May 2022). Planning and managing of the system for the production of SoK documents at current stage are carried out on the basis of an agile approach based on "learning by doing", where procedures are developed and tested in parallel to the production of the documents in a "pilot period".

> **EURAD Quality Management Plan [4]**
> WP11 SoK - Develop and agree a concept/methodology to capture the SoK through the use of a high level pilot case and latterly two more detailed demonstration cases on how to develop SoK documents (KPI - agreement and testing of methodology through a pilot example and 2 demonstration cases).

The first topics for the two SoK documents were identified as "Spent nuclear fuel" and "HLW and SF containers" [5]. Information on the development progress of SoK documents is continously monitored by the WP11 Team.

The "learning by doing" approach considering the experience of the first SoK documents production makes it possible to take the following reflections into account for planning further population of the KM system with SoK documents:

– availability of experts for the production of specific SoK documents and the ability of experts to perform this work within a specified time period;

– readiness of work results (deliverables) from different EURAD WPs and the ability to use these inputs in SoK documents.

2.2 Process of development of SoK documents (Initiation)

Before the start of activities on the development of a SoK document, the whole development process of the SoK document (initiation, development, review, approval, socialization and evaluation), including

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timeline, responsibilities (and their distribution between authors, if necessary), need to be specified. This process is determined by an initial discussion between the WP11 Team and author(s) on the above mentioned aspects of the document (in a kick-off meeting). The results of the discussion and decisions made shall be recorded in the minutes of the initiating meeting, in particular, on the following issues:

- name and number of the domain(s), according to the EURAD GBS;
- context of the selected domain(s);
- objectives;
- distribution of work between authors;
- target audience;
- scope/topics and preliminary structure;
- steps of development and approval;
- reimbursement and contracting;
- timeline;
- contacts and roles.

2.2.1 Context of the selected domain(s)

The name and number of the domain(s) according to the EURAD GBS that will be covered by the SoK document shall be presented. The place of the selected SoK domain(s) in the whole structure of EURAD GBS shall be presented. A link to the respective DI document(s) shall be provided.

2.2.2 Objectives

Objectives of the particular SoK documents shall be clearly defined and presented. The overall aim and approach is based on creating an entry-point for those wishing to access the specified 'Domain' Knowledge Base.

2.2.3 Target Audience

The target audience of the SoK document shall be clearly defined.
The SoK document should be strongly orientated towards RWM end-user requirements . Although the documents are intended to be widely accessible, the primary end-users are identified as (but not limited to):

- anyone working in RWM, non-specialists, generalists (external – to provide insight into the state of progress for implementing RWM);
- new entrants to the field / entering or transitioning to the RWM field and / or specific RWM domain (this includes early or middle career professionals working in advanced programmes or in programmes that have experienced a long pause/delay and/or high percentage of turn-over due to retiring staff);
- the scientific community, which will be aided by EURAD KM in the identification of future research needs, as well as training of new employees;
- early stage national programmes wishing to roadmap their own programme based on insights from advanced programmes

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    – advanced national programmes that face the challenges of generational change and need to capture the knowledge of retiring experts.

2.2.4 Scope/Topics and Preliminary Structure

The scope of the SoK document shall be clearly defined. The topics within the knowledge domain to be reflected in the particular SoK document shall be identified.
The preliminary structure of particular SoK document shall be defined (see also Section 3.2.3.2 in this QA Procedure).

2.2.5 Steps of development and approval

The steps of development and approval of a SoK document shall be specified, including the following steps:

– *Drafting*

The procedure for the planned development of draft SoK document shall be briefly described and consist of following (but not limited to):

o selection of information (knowledge) (see Section 3.2 of this QA Procedure);

o writing and presenting of information (knowledge) (see Section 3.2 of this QA Procedure);

o compiling the information (knowledge) collected by different experts (see Section 3.2 of this QA Procedure);

o drafting SoK document and editorial process.

– *Review*

The procedure of review of the draft SoK document shall be briefly described here (see Sections 3.3 of this QA Procedure). The review shall check the compliance of draft SoK document with the defined scope/topics of the SoK document. Comments and recommendations for improvement and finalisation of SoK documents shall be elaborated and discussed between the WP11 Team and author(s).

– *Finalisation and Approval*

The procedure for the finalisation of the SoK document by the authors shall be briefly described (see Sections 3.3 of this QA Procedure). During finalisation of the SoK document, the comments and recommendations of the review shall be accounted. The finalized SoK document shall be sent by the WP11 Team to the Bureau and EURAD Coordinator for approval.

– *Socialization*

The procedure for socialization of the final SoK document across the RWM community shall be briefly described (see Sections 3.4 of this QA Procedure). It shall be defined here how WP11 Team will support appropriate socialisation of the developed SoK document to ensure it is well disseminated across the RWM community. The role by the author(s) in doing this, especially proactive socialisation among author(s)' expert networks, shall be defined here. The document will be published on the EURAD homepage.

– *Evaluation*

The procedure for evaluation of the SoK document shall be briefly described (see Sections 3.5 of this QA Procedure) and cover the following issues:
- review of the process and results for development of a specific SoK document;
- preparation of report;

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- application of the "lessons learned" basis to provide an optimised approach for following SoK activities.

2.2.6   Timeline

The timeline and deadlines for development of particular SoK document shall be indicated. Timelines and deadlines for the specific stages should be agreed between WP11 and the authors, approximately as follows (based on lessons learned):

- Initiation: Start – T_0 (kick-off meeting), Completion – T_0 + 2 weeks;

- Drafting: Start – T_0 + 2 weeks, Completion – T_0 + 2.5 months;

- Review: Start – T_0 + 2.5 months, Completion – T_0 + 3.5 months;

- Finalisation and Approval: Start – T_0 + 3.5 months, Completion – T_0 + 4.5 months;

- Socialization: Start – T_0 + 4.5 months, Completion – T_0 + 7.5 months;

- Evaluation (Preparation of Evaluation Report): Start – T_0 + 7.5 months, Completion – T_0 + 8.0 months.

2.2.7   Contacts and roles

The information of names and mail addresses of the author(s), WP11 contact persons, as well as EURAD Coordinator as a second contact, shall be provided.

2.3   General requirements to the SoK documents

The purpose of a EURAD SoK document is to provide a comprehensive overview about the current state-of-knowledge in a specific domain of the EURAD Roadmap/GBS, with a strong focus on providing essential knowledge for the implementation of RWM programmes.

The overall aim and approach is based on creating an entry-point for those wishing to access the specified domain knowledge base. It is not intended to be a comprehensive collation of everything ever known or developed in relation to the specified domain. Those seeking more specific details on the domain should be able to easily navigate to the extended knowledge base via high-quality references. Thus, the SoK document should contain a few signposts to relevant reports and sources. As the purpose of the SoK document is to capture knowledge considered most important for the implementation of RWM programmes, safety and engineering aspects that have been the focus of work over the past decades should be addressed. Importantly, statements on existing uncertainties and the maturity of existing knowledge should be included where applicable.

The SoK document should be strongly orientated and linked to end user requirements in the context of RWM.

The SoK documents generated by the experts shall be highly relevant and highly useful. They should provide maximum benefit for the end users and the implementation of their RWM programmes, thereby contributing to safe management and disposal of all types of radioactive waste.

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2.4 Experts (authors and reviewers)

In the framework of this QA Procedure, two categories of experts are engaged for development of the SoK documents:

− authors of the SoK documents;

− reviewers of the SoK documents.

This sub-section covers the following issues:

− general requirements for selection of authors and reviewers;

− procedures for selection of authors of SoK documents;

− procedures for selection of reviewers of SoK documents.

2.4.1 General requirements for selection of authors and reviewers

Experts are defined by the IAEA as someone widely recognized as a reliable source of technique or skill whose faculty for judging or deciding rightly, justly, or wisely is accorded authority and status by their peers or the public in a specific well-distinguished domain. As such, experts selected to produce a EURAD SoK fulfil such criteria, but they also:

− have shown high intellectual achievement, either academically or in applied work within industry;

− understand well the relevance and significance of their knowledge domain in the context of different safety cases for a range of RWM solutions (i.e. different concepts and waste groups) and are adept at communicating uncertainties in a balanced, generic way;

− are role models with world class vision, evidenced via commitment to a thriving community of practice, communicating and contributing to the continuation of their knowledge domain with personal dedication.

In addition to the above, the Responsible author (or writing group coordinator) preferably shall have the following skills:

− a very good command of written and spoken English;

− excellent inter-personal and leadership skills and ability to motivate others;

− ability to assure the co-ordination between all parties involved in the work.

2.4.2 Procedure for selection of authors of SoK documents

The procedure for selection of authors for the development of the SoK documents is defined as follows:

1) WP11 shall perform a pre-screening of authors (with the assistance of PMO and/or Bureau), which are capable to author a particular SoK document.

2) WP11 shall provide preliminary list of authors to the EURAD Coordinator, as well as the information about the domain(s) which the particular SoK document shall cover and information on author(s).

3) WP11 shall contact the selected author(s) and provide administrative and organizational information.

4) WP11 shall perform final communication with the authors to confirm their availability for participation and provide final list of authors to the EURAD Coordinator.

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5)   For EURAD external experts: EURAD Coordinator shall conclude agreements (see [6]) with selected authors for development of particular SoK document.

2.4.3   Procedures for selection of reviewers of SoK documents

1)   WP11 (with the assistance of PMO and/or Bureau) shall involve the Colleges for identification and selection of reviewers.

2)   WP11 shall select the reviewers based on inputs from the Colleges and provide final list of reviewers to the EURAD Coordinator.

3)   For EURAD external experts: EURAD Coordinator shall conclude agreements (see [6]) with selected reviewers for review of particular SoK.

3   Procedures for development of a SoK document

The process for the development of a SoK document shall cover the following steps:

- Initiation;

- Collection of knowledge from different kinds of sources;

- Evaluation of information and its selection with regard to its suitability to be included in the SoK document;

- Writing and presenting the SoK document;

- Review and finalisation of the SoK document;

- Socialisation;

- Evaluation.

This section provides a set of criteria, requirements and procedures for quality assurance (QA) at all steps of the development of the SoK document.

3.1   Initiation

Prior to the start of development of a SoK document the kick-off meeting shall be held and results of discussions and agreements shall be recorded in the minutes of the initiating meeting (see Section 2.2 of this QA Procedure). Procedures for the "Initiation" step shall be the following:

1)   WP11 shall arrange the kick-off meeting with the author(s) and responsible author (writing group coordinator).

2)   WP11 (with support of the author(s)) shall develop the minutes of the initiating meeting (see Section 2.2 of this QA Procedure).

3.2   Drafting

3.2.1   Collection of knowledge from different kinds of sources

Information, to be included in the SoK document, can be collected from different kinds of sources, preferably open and free. It will not include internal notes within organisations, oral presentations of

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material that cannot be acquired from outside of the organisation, minutes of meetings, oral communications, agreements or confidential reports. These sources can include, for example:

- EURAD R&D and Strategic Studies (StS) WPs;

- international organisations in the field of RWM (e.g. IAEA, NEA);

- other information sources.

3.2.2 Evaluation of information and its selection with regard to its suitability to be included to the SoK document

3.2.2.1 Criteria for evaluation and selection of information regarding its suitability for the SoK document

The processes of evaluation of information and its further selection from the source by the experts for compiling the SoK document are recommended to be based on the following criteria:

- criteria for compliance of information with the minutes of the initiating meeting (see Section 2.2 of the QA Procedure);

- criteria for trust in the source of information (e.g., the following documents may be of a high level of trust: periodic scientific publications, official reports of the specific organisation);

- criteria for assessment of quality of information (reliability, authorship, contents, relevance, accuracy, novelty, objectivity, arrangement of information in a systematic order etc.) and of quality of references (links) to more detailed information to be included to the SoK document.

3.2.2.2 Criteria for compliance of information with the minutes of the initiating meeting

Information, which is intended to be included to the SoK document, firstly shall be checked whether it complies with the minutes of the initiating meeting (see Section 2.2 of the QA Procedure) developed for the particular SoK document.

3.2.2.3 Criteria for trust in the source of information

For assessment of information, it is also important to know from what source data are given.
Table 1 [7] provides the list and descriptions of quality-related factors, which are recommended to take into account at the selection of the source of information and referring to.

Quality-related factor	Description
Appropriate organisational unit	The source comes from the organisational unit formally vested with the right authority and competence
Appropriate project experience	The source has hands-on experience with the issue from past or ongoing projects
Appropriate external body	The source comes from the external organisation formally vested with the right authority and competence
Appropriateness to task	The goodness/badness of the fit between the source and the task; i.e., focus is on the relation between source and task, not on the source as such
Technical quality	The high/low technical quality of the information that can be obtained from the source, irrespective of the genesis and appropriateness of the source
Up-to-dateness	The up-to-dateness/outdatedness of the information provided by the source

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Representativeness	The extent to which the source is representative of the group it belongs to

Table 1 - The seven quality-related factors used in coding why information sources were discussed, selected, and referred to [7].

3.2.2.4 Criteria for assessment of quality of information

According to M. Tate [8] there are 5 basic criteria that need to be addressed in order to present information that can be identified as reliable:

- authority,
- accuracy,
- currency,
- coverage, and
- objectivity [9].

In Table 2, the criteria for assessment of quality of information are provided.

Criterion	**How It's Measured**
Authority	Is (are) the author (group of authors) of the information indicated?
Accuracy	Is the information correct in every detail?
Currency (Timeliness)	How up-to-date is information? Can it be used for real-time reporting?
Completeness (Coverage)	How comprehensive is the information? Is the information sufficient for the understanding of the issue and decision(s) making?
Objectivity	Does the information depend on the method of its fixation or on author's opinion? Does information reflect different points of view?

Table 2 – Criteria for assessment of quality of information

Authority - criterion presents a clearly "known" author, respectively the organization or group of authors, who are the owner of that data and information created based on good knowledge of the field [9].
Accuracy - criterion is the extent to which the information is reliable and error-free [9].
Currency - a criterion which expresses to-date information. To evaluate the validity/life of information it is important to know the time of information, but also the purpose of its further use [9].
Coverage (Completeness) – criterion that includes the breadth and depth of processing certain types of information, which depends both on the input and the expected output for the desired final result respectively [9].
Objectivity - criterion which reflects the extent to which information is presented without distortion by personal feelings, prejudices, or other by the author [9].

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3.2.2.5 Procedures for evaluation of information regarding the suitability/unsuitability of the information

Prior to using and processing information to be included in the particular SoK document, the experts are encouraged to perform analysis whether the specific information and/or reference (link) to the other source of information are suitable for the SoK document. The following algorithm of performing analysis for compliance with QA criteria and decision-making is recommended to be fulfilled by the authors:

1)   First of all, it is recommended to analyze information, which is intended to be included in the SoK document, whether it fully complies with all the requirements that were set in the minutes of the initiating meeting (see Section 2.2 of the QA Procedure) developed for the particular SoK document. The authors shall check the information on compliance with each item of the minutes of the initiating meeting developed for the specific SoK document according to the QA criteria given in Sections 3.2.2.1-3.2.2.2 of this QA Procedure.

2)   Secondly, the authors shall perform an analysis of compliance of the reliability of the source with the QA criteria described in Section 3.2.2.3 of this QA Procedure.

3)   Thirdly, the authors shall perform analysis of compliance of information itself with the QA criteria described in Section 3.2.2.4 of this QA Procedure.

If the results of checking for compliance of information and its source with all the above-mentioned QA criteria are positive, the experts shall follow the next steps: processing of information and writing the SoK document with the obtained knowledge (see Section 3.2.3 of this QA Procedure). In case any of the authors has some doubts regarding the compliance with the above-mentioned QA criteria, he or she should arrange a meeting to discuss this with the other authors.

3.2.3 Writing and presenting the SoK document

3.2.3.1 Style of writing and scope of a SoK document

The SoK documents shall be oriented on higher level topics as identified in the Roadmap GBS. Typically the SoK documents would use a relatively small number of primary references and signposts out to further detail where necessary. While writing the SoK document, the experts shall fulfil the following general requirements for style, scope and contents:

1)   The scope of the SoK document shall be based on the broad principles of RWM
Each SoK document should be stand-alone (digital or printed version) – i.e. if printed it should make sense to someone working in the field of RWM. However, the degree of context should be minimised by adopting a concise writing style and good use of headers and sub-headers. The authors can assume that the end users will be using the SoK work in the field of RWM, not as Domain specialists, but as those familiar with the concepts and implementable solutions for geological disposal in a given host formation, for repository siting, construction, operation or closure, for near-surface disposal, interim storage, and waste conditioning and pre-treatment.
2)   The context of the SoK document shall be provided on the relevance of the SoK domain(s) to specific RWM solutions
Each EURAD SoK document reflects a generic view on the SoK for a particular Domain(s). Context should therefore be included about the significance of the Domain(s) for a range of waste management options with differences highlighted between waste types and volumes of waste, geological environments and disposal (and storage) concepts. If necessary or useful for illustration, context on national policy, legal and regulatory requirements may also be added, e.g. as part of implicit knowledge, as hyperlinks or written in the SoK itself. This can make it easier to filter or select the available SoK relevant to end-user's own programme requirements.
3)   The context shall be focused on what is important for implementation of RWM

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RWM programmes are primarily needs driven, focussed on knowledge generation to advance safety assessment and engineering feasibility (and optimisation) towards implementation. As such, each EURAD SoK document should be carefully contextualised by what is most important for implementers and safety concerns at any given phase in the EURAD Roadmap. This means contextualising the status of each Domain in the context of treatment in the safety case and engineering feasibility in terms of implementation readiness. It is anticipated that this can be done by including context to requirements (and general safety functions of typical disposal systems), but avoiding reference to safety evaluation or concept designs specific to national programmes. A specific section in the template is included to describe remaining uncertainties.

3.2.3.2 Content of a SoK document

The structure and content of different SoK documents is decided by the author(s). The present template for the content of a SoK document consist of 4 parts:

- Part 1: domain summary (general overview where concise outline of a subject or a situation to the specific domain is provided; key references);
- Part 2: domain engineering and safety significant considerations (safety significant features events and processes (FEPs) and key engineering considerations shall be defined; general description of each FEP shall be provided);
- Part 3: useful resources (active communities of practice; link to guidance; other useful resources);
- Part 4: version history (chronology of development of the SoK document).

This template might be used by authors to develop a particular SoK document.

The first SoK document "Spent nuclear fuel" [10] is published in the "Publication" section at the EURAD website (www.ejp-eurad.eu) and might also be used as an example.

3.2.3.3 Procedures for writing a SoK document

The following procedure shall be fulfilled during writing a SoK document:
1)   Authors shall develop the SoK document in accordance with the minutes of the initiating meeting for the specific SoK document (see Section 2.2 of this QA Procedure).
2)   The WP11 Team supports authors in the process of writing the SoK document.
3)   As far as each author provides his (her) contribution, the Responsible author (writing group coordinator) shall perform compilation. If the opinions of the authors differ from each other, it would be beneficial to reflect all the opinions in the SoK document.
4)   The responsible author (writing group coordinator) shall submit the draft SoK document to all authors and agree it with each author.
5)   After obtaining the agreement from each author, the Responsible author (writing group coordinator) shall submit the draft SoK document to WP11.
6)   The editorial process shall be performed to draft the SoK document. WP11 or other internal expert(s) might perform an editorial review of the draft SoK document (focusing on editorial and format). The draft of the SoK document shall be checked for compliance with the minutes of the initiating meeting for the specific SoK document. All comments and recommendations shall be sent to the responsible author (writing group coordinator) and taken into account.
7)   WP11 shall arrange the meeting with the author(s) and responsible author (writing group coordinator) to discuss results of the editorial process and further plans for submission of draft SoK document for review.
8)   The responsible author (writing group coordinator) shall submit the appropriately finalized draft SoK document to WP11. WP11 submits the final draft SoK document to the EURAD Coordinator.

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3.3   Review, finalisation and approval

3.3.1   Review of draft SoK document

The review process shall be implemented according to the following procedure:

1) The WP11 leader or EURAD coordinator shall submit draft SoK document to the Bureau with request to review by Colleges.
2) On the results of review of the draft SoK document, the reviewers shall prepare review comments and submit them to WP11, via the Bureau or EURAD coordinator if reasonable.

3.3.2   Procedures for finalisation and approval of SoK document

After the "review" step is appropriately fulfilled, the following process on finalisation and approval of the SoK document shall be performed:

1)   WP11 Team shall process the Review Report and submit it to the authors for taking into account the comments and finalisation of the SoK document.
2)   The responsible author shall submit the Review Report to all the authors who shall take into account the comments presented in the development of the revised SoK document.
3)   Each author shall provide the feedback to the responsible author.
4)   The responsible author shall compile the obtained feedback and finalise the SoK document;
5)   The responsible author, with the support of the other authors, shall prepare a response to the review comments to the draft SoK document.
6)   The responsible author shall submit the finalised SoK document and the responses to the review comments, to the WP11 Team.
7)   WP11 Team, in consultation with the Coordinator, PMO and Bureau, shall approve the finalised SoK document.

3.4   Socialisation

The step "Socialisation" shall be implemented after the SoK document is approved by Bureau.
As it is stated in [3], one major asset of EURAD KM are the people that constitute the EURAD community. This community can bring together top experts and professionals from all areas of RWM with end-users interested in knowledge.
Socialisation of SoK activities within EURAD community will bring added value for the KM end-users, now and for future generations. Ultimately, it is the end-users needs that dictate the KM strategy and constitute the benchmark for success. In view of this, the SoK document shall be shared with RWM community, in particular end users and experts, through networking.
The "Socialisation" step shall be performed according to the following procedure:
1)   WP11 Team with the PMO support shall disseminate the SoK document to defined end-users with the help of EURAD partners. The coordinator will publish the SoK document on the EURAD homepage and announce it to the EURAD community (e.g. via the EURAD newsletter).
2)   WP11 Team shall import the SoK document into the Wiki to foster exchange and discussion of the document.
3)   In agreement with the authors, WP11 jointly with WP13 (Training & Mobility) and PMO are encouraged to organise a lecture with associated discussion on the subject of the SoK document.
4)   WP11 shall encourage the authors in dissemination of SoK document among experts community.
Based on the learning-by-doing principle, the experience gained on the results of socialisation of the first SoK documents shall be used as input for further processes of socialisation of future SoK documents to be developed within the appropriate SoK domains.

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3.5   Evaluation

At this step, WP11 shall evaluate the process of the development of the SoK document and prepare recommendations on optimisation of further SoK production activities based on lessons learned (MS 245 and MS333). The evaluation process shall be implemented according to the following procedure:

1)   WP11 shall review the process and results of development of the particular SoK document.

2)   WP11 shall interact with the authors and reviewers of the SoK document in order to obtain feedback and take into account their experience and opinions on the process and results of the development of SoK document.

3)   WP11 shall assess the lessons learned during development of particular SoK document and provide recommendations on optimised approach for following SoK documents production activities (MS245 and MS333).

4)   WP11 shall arrange the closing meeting to discuss results of evaluation process for optimisation of further SoK production activities. The results of evaluation process, disscusions and decisions made from the meeting shall be recorded in the minutes of closing meeting.

The minutes of closing meeting shall contain, in particular, the following:

− the processes of development of the SoK document;

− challenging issues during the development of the SoK document;

− lessons learned during development of the SoK document;

− recommendations on providing an optimised approach for following SoK activities.

4   Conclusion and outlook

This document Deliverable 11.5 "QA Procedures for the Generation of SoK Demonstration cases" defines the general procedure for planning and managing of a system for production of DI and SoK documents. The overall procedure for planning and managing of a system for production of SoK and DI documents is based on a "case by case" approach. The "case by case" approach (considering the experience of first SoK and DI documents production) makes it possible to take into account the following issues at planning further filling the KM system with documents:

− challenges in involvement of experts for production of SoK and DI documents;

− availability of experts for the production of specific SoK and DI documents and the ability of experts to perform this work in different periods of time;

− it is an interaction on an individual level, where each expert might have specific requirements;

− status of developments in different EURAD WPs and the ability to use these developments in SoK documents.

For the monitoring of the ongoing development of the SoK and DI documents, it will be usefull to define Key Performance Indicators (KPIs) for the activities of engaging experts for production of SoK and DI documents, the production itself, dissemination of knowledge and, obtaining of feedbacks in the framework of WP11.

As an important part, feedback mechanisms need to be developed and applied to improve the expert engagement, SoK and DI production processes. This feedback will serve as valuable input for all activities in WP11 and beyond.

The following activities on development of feedback mechanisms shall be planned:

− definition of the feedback needs from the end-users point-of-view;

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- developement of appropriate methods for active and passive feedback;

- definition of targeted feedback groups to be addressed. These groups can vary, depending on the topic and the implementation phase of the programme;

- continuous application of feedback methods;

- regularly evaluation and obtaining of feedback to DI and SoK production, KM programme and other (also KM WPs).

All of the above targets anticipate close collaboration with other KM WPs and external actors (e.g. IAEA, as well as other international research initiatives, national WMOs, TSO, research entities, regulators, waste generators and civil society representatives).

Developed mechanisms, approaches and results of obtaining feedback from the end-users will be reported in *Deliverable 11.10 "Feedback mechanism for Domain Insights, SoK documents and KM Systems –Methods and results"* and *Milestone 334 "Recommendations on integration of feedback mechanism into the KM programme",* which are scheduled for the EURAD year 4.

The developed SoK and DI documents are to be included in the EURAD Wiki, access to which has been granted to EURAD community. The end-users and EURAD community have the possibility and invited to provide feedback and discuss developed documents at the EURAD Wiki.

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Appendix 1: Procedure for development of a DI document

1. Simplified procedure

For the production of DI documents (and some SoK documents), the simplified procedure given in this appendix can be used when deemed reasonable with regards to effort, outcome and the quality of the final document is not expected to be diminished. This is due to the fact that DI document production is intentionally done in an agile approach, where procedures are developed and tested in parallel to the production of the documents in a "pilot period". This approach shall make DI documents available quicker and lead to more feasible procedures than a sequential approach, where detailed procedures are developed first in theory and put to work only after that. The decision to apply the simplified procedure for the production of a DI or SoK document shall be made by WP11 at the WP meeting and recorded in the relevant minutes.

2. Planning of works with the DI document production

Before the start of activities on the production of a DI document, it shall be determined the whole process of development of the DI document (initiation, development, review, approval, socialisation and evaluation), including timeline, responsibilities (and their distribution between authors, if necessary), etc. When the potential author(s) for the production of the DI document is identified, WP11 initiates a kick-off meeting with the author(s) to discuss the whole procedure for the production of the DI document and get a clear understanding of the expectations for a particular DI document. WP11 with author(s) shall discuss and agree on:

- context of the selected Domain(s);
- objectives of the particular DI document;
- distribution of work between authors;
- target audience;
- scope/topics and preliminary structure of the DI document;
- steps of development and approval of the DI document;
- reimbursement and contracting;
- timeline;
- contacts and roles.

The content of the issues from the specified list is described below in Sections 2.1-2.7 of this Appendix 1. The results of the discussion and agreement shall be recorded jointly by the WP11 Team and the author(s) in the form of minutes of the kick-off meeting.

The information provided in the minutes of the kick-off meeting can be used by WP11 Team for further planning of the DI document review, evaluation of the results of production of the document, etc.

2.1 Context of the selected Domain(s)

The place of the selected DI domain(s) in the structure of EURAD GBS shall be presented by WP11. A link to the respective SoK document(s) shall be provided.

2.2 Objectives

Objectives of the particular DI document shall be clearly presented by WP11. The overall aim and approach is based on creating an entry-point for those wishing to access the specified 'Domain' Knowledge Base.

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2.3 Target Audience

The target audience of the DI document shall be clearly defined by WP11. See Section 2.2.3 of this QA Procedure.

2.4 Scope/Topics and Preliminary Structure

The scope and preliminary structure of the DI document shall be defined. The topics within the EURAD GBS domain to be reflected in the particular DI document shall be identified.

2.5 Steps of development and approval of the DI document

The steps of development and approval of the DI document shall be specified, including the following steps:
– Drafting;
– Review
– Finalisation and approval;
– Socialisation;
– Evaluation.

2.5.1 Drafting

The procedure for the planned development of the draft DI document shall be briefly described and consist of following (but not limited to):

1) The author(s) shall develop the DI document in accordance with the minutes of the kick-off meeting for the specific DI document and recommendations of the Roadmap authors quick start guide.
2) The WP11 shall support author(s) in the process of writing the DI document. The author(s) shall periodically inform WP11 about progress and changes.
3) The author(s) shall submit the DI draft document to WP11.
4) The editorial process shall be performed to the draft DI document. WP11 Team or other internal expert(s) might perform an editorial review of the draft DI document (focusing on editorial and format). The draft of the DI document shall be checked for compliance with the minutes of the kick-off meeting for the specific DI document. After taking into account comments and recommendations in the appropriately finalised draft DI document, author(s) shall submit this document to WP11.

2.5.2 Review

The review process shall be implemented according to the following procedure:

1) The WP11 Leader shall submit the draft DI document to selected reviewers, if agreed upon via the EURAD Coordinator.
2) Upon the review of the draft DI document, the reviewers shall prepare review comments and submit them to the WP11 via the Bureau and/or EURAD Coordinator if agreed upon.

2.5.3 Finalisation and approval

The finalisation and approval processes shall be implemented according to the following procedure:
1) WP11 shall process the review comments and submit them to the author(s) for taking into account the comments and finalise the DI document.
2) The author(s) shall prepare a response to the review comments to the draft DI document and submit it with the finalised DI document to WP11.
3) WP11, in consultation with the Coordinator, PMO and Bureau, shall agree on the finalised DI document.

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2.5.4 Socialisation

The socialisation process (see also Section 3.4 of this QA Procedure) shall be implemented after the DI document is approved and shall be performed according to the following procedure:

1) WP11, with support of PMO, shall disseminate the DI document to defined end-users, asking for feedback.
2) WP11 shall import the DI document into the Wiki to foster exchange and discussion of the document.
3) In agreement with the authors, WP11 jointly with WP13 (Training & Mobility) and PMO are encouraged to organise a lecture with associated discussion on the DI document.
4) WP11 shall encourage the authors in dissemination of DI documents in their expert community.

2.5.5 Evaluation of production process

The evaluation process (see also Section 3.5 of this QA Procedure) shall be implemented according to the following procedure:

1) WP11 shall review the process and results of the development of the particular DI document.
2) WP11 shall interact with the authors and reviewers of the DI document in order to obtain and take into account their experience and opinions on the process and results of the development of the DI document.
3) WP11 shall assess the lessons learned during development of particular DI document and provide recommendations on an optimised approach for future DI document production.
4) WP11 shall arrange the closing meeting to discuss results of the evaluation process for optimisation of further DI document production activities. The results of the evaluation process, disscussions and decisions made from the meeting shall be recorded in the minutes of the closing meeting.

The minutes of closing meeting shall contain, in particular, the following:
– processes of development of the DI document;
– challenging issues during the development of the DI document;
– lessons learned during development of the DI document;
– recommendations on providing an optimised approach for future DI documents production.

2.6 Timeline

The timeline and deadlines for the development of particular DI document shall be indicated. The schedule for the development of particular DI document shall be defined between WP11 Team and author(s) at the kick-off meeting. The start of planning is counted from the kick-off meeting.

If not agreed otherwise between the authors and WP11, timelines and deadlines for the specific stages should be approximately as follows:

Initiation - 2 weeks;
Drafting - 2 months;
Editorial processing - 2 weeks;
Review – 1 month;
Finalisation after review: 2 weeks.

2.7 Contacts and roles

At the kick-off meeting, the procedure for the production of DI document and the procedure for communication between all involved parties (WP11 Team, author(s), EURAD Coordinator) shall be discussed. The information on names and mail addresses of the contact persons is entered into the minutes of the kick-off meeting.

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3.   Production of a DI document

Further development of the DI document shall be carried out according to the procedure agreed upon at the kick-off meeting and recorded in the minutes of that meeting (see paragraphs 2.1-2.7 of this appendix).

As the DI document develops, the WP11 Team shall support the author(s) in the process of writing the DI document and the author(s) shall periodically inform WP11 Team about progress and changes.

If the opinion and vision of a DI document of the author(s) differ from the opinions of the WP11 Team, or if there are problems with the writing of a DI document, the EURAD Coordinator, PMO and Bureau might be involved to find a compromise.

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