Deliverable D3.2
Definition of demonstration or pilot case for the State-of-Knowledge processes, mechanisms and program

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Abstract

One of the four tasks in the PREDIS Knowledge Management (KM) work package (WP) is to preserve the existing knowledge in the area of pre-disposal activities. This task is fully align with the EURAD roadmap and the production of the Domain insight (DI) documents in the Theme 2 (Pre-disposal activities) is a responsibility of the PREDIS project. This deliverable (D3.2) provides an overview of the process of identifying and engaging the experts compiling the documents, production of the documents in a structured manor (using templates and a guidance to authors), and finally describe the review process, including socialisation of the finalised document (through lecturing and end-users feedback). Pilot case of domain insights (DI) document release is represented by DI 2.2.5 Transport, being produced in July 2022. Up to October 2022, 9 more teams agreed to develop and produce the remaining 11 Domain Insights, heading for 6 DI´s to be released by December 2022.

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Notification

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1. Introduction

The **PREDIS** project develops and increases the Technological Readiness Level (TRL) of treatment and conditioning methodologies for radioactive wastes for which no adequate or industrially mature solutions are currently available, including metallic materials, liquid organic waste and solid organic waste. The **PREDIS** project also develops innovations in cemented waste handling and pre-disposal storage by testing and evaluating. The PREDIS project targets the development and implementation of activities for pre-disposal treatment of radioactive waste streams other than nuclear fuel and high-level radioactive waste.

PREDIS is aligned with the EJP **EURAD** (European Joint Program on Radioactive Waste Management) in respect to the founding documents of EURAD (vision, roadmap, governance and implementation mechanisms), and is complimentary in predisposal activities with organisation of training courses and mobility training schemes to enhance sharing and preservation of knowledge.

One of the four tasks in the PREDIS KM WP is to preserve the existing knowledge in the area of predisposal activities. This task is fully aligned with the EURAD roadmap and the production of the KM documents (Theme Overview (TO), Domain Insight (DI), State-of-Knowledge (SoK) and State-of-the-Art (SotA)) in Theme 2 (Predisposal activities) is a responsibility of the PREDIS project. This deliverable (D3.2) provides an overview of the process of identifying and engaging the experts compiling the documents, production of the documents in a structured manor (using templates and guidance to authors), and finally describe the review process, including socialisation of the finalised document (through lecturing and end-users feedback).

2. Populating EURAD Roadmap

The EURAD roadmap, of which predisposal is one out of seven themes, is a generic framework to organise typical scientific and technical domain/sub-domains in a logical manner against different phases of a RWM programme (see the link Roadmap). It intends to support Member states when structuring implementation of their radioactive waste disposal. Compared to other existing roadmaps the added value of the EURAD/PREDIS roadmap is the combination of an expert view on a domain and related references to existing training (courses), infrastructures (for on-the-job training), needed competences (to realise implementation step) and guidance (structure, methods and lessons learned) from those that has experience of implementation.

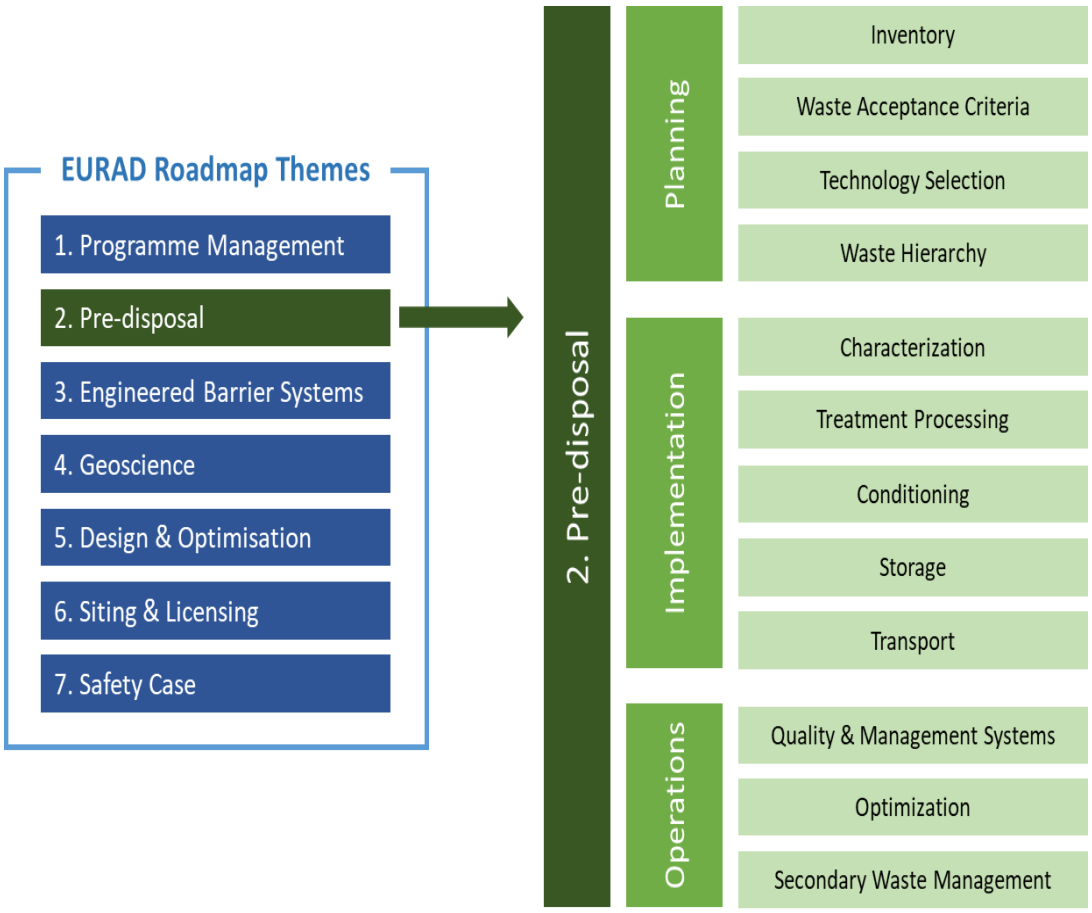

Figure 1. EURAD roadmap with the seven themes along the vertical axis, and PREDIS predisposal goal-break-down structure (from Theme to Sub-themes and Domains).

The PREDIS project is, in close collaboration with EURAD, responsible to develop the predisposal theme of the EURAD roadmap (Theme 2) and to populate it with corresponding predisposal activities. Thus, the PREDIS Management Team (WP1) and Knowledge Management (WP3) has developed the roadmap covering the predisposal activities, as shown in Figure 1. As can be observed in Figure 1, the Predisposal theme is divided into three Sub-themes that are further sub-divided into 12 domains.

Each theme, sub-theme and domain outlines what is needed to be executed in relation to the RW disposal implementation phases outlined below.

Phase	Typical phases of a Radioactive Waste Management Programme
1	Initiation: Policy, framework and programme establishment
2	Site Selection: Site(s) identification and selection
3	Site characterisation: Underground investigations and site confirmation
4	Construction: Facility construction
5	Operations and Closure: Facility operation and closure

Strongly coupled to the PREDIS roadmap structures built up in Task 3.1 ‘Development of Knowledge Management Programme (KMP)’, is Task 3.2 ‘State of Knowledge (SoK)’ responsible for populating the predisposal roadmap with State-of-Knowledge (SoK) documents having different levels of details depending on their level in the hierarchic roadmap structure. Coordination will be needed between WP2 and WP3 on the outcome of surveying end-users needs, specifically on identification of future R&D needs described in the PREDIS SoK documents and WP2 1st year’s gap analysis (Task 2.6 ‘Gap analysis’).

Figure 2 shows the structure and content of the corresponding documents for each theme and their division into domains; Theme overview (TO) Domain Insights (DI), State-of-Knowledge documents (SoK) and (SotA) documents.

During the two first project years, the structure of the Domain Insight levels and their content was agreed on with the EURAD Roadmap advisory committee and EURAD WP11 SoK. Level 4 with State-of-Knowledge documents (SoK) and 5 with State-of-the-Art (SotA) structures are still to be developed in collaboration with the PREDIS WP leaders.

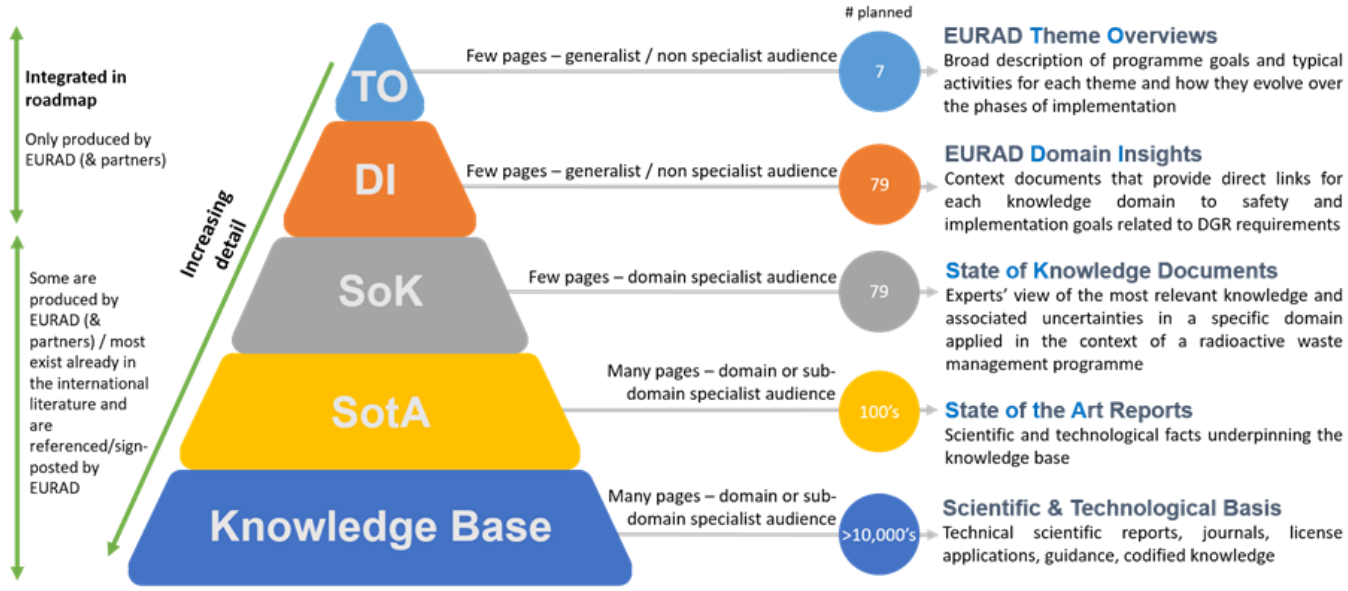

Figure 2. Document structure of each theme (Knuuti 2022).

EURAD, in joint effort with PREDIS develops Knowledge Management System (KMS), i.e., a systematic approach to capture and transfer knowledge to end-users in the field of radioactive waste management (RWM). The strategy and the approach is described in Knuuti et al. (Knuuti 2022).

2.1. Theme 2: Predisposal

Predisposal activities prior to geological disposal of waste (predisposal) should identify and deliver solutions to optimise the management of radioactive waste throughout the predisposal phases of the radioactive waste management programme.

Theme 2 is organised hierarchically in three levels (Figure 1). The levels correspond to the goal break down structure summarised in Table 1, with its topics aligned with the IAEA nomenclature and GSR 5 (IAEA 2009). The Level 2 sub-themes are categorised more extensively in the EURAD roadmap. Level 3 consists of 12 domains.

Table 1: Goal break down structure of Theme 2 into sub-themes and domains.

Theme 2 (Level 1)	
2. In conjunction with waste generators, identify and deliver solutions to optimise the management of radioactive waste throughout the predisposal phases of the radioactive waste management programme (Predisposal)	
Sub-themes (Level 2)	**Domain insights (Level 3)**
2.1 Planning predisposal management of radioactive waste in close cooperation with waste generators (Planning)	2.1.1 Evaluate waste inventory from generators and existing storage, accounting for future waste generation and evolution (Inventory)
	2.1.2 Identify parameters and metrics for waste acceptance criteria through whole life cycle (Waste acceptance criteria)
	2.1.3 Assess potential technologies for the implementation phase, considering cost-benefit ratio and availability (technology selection)
	2.1.4 Evaluate options to apply the waste hierarchy to minimise waste volumes at higher impact inventory disposal levels (waste hierarchy)
2.2 Implementing predisposal management of radioactive waste to support key risk and hazard reduction, and to help reduce costs and save space at interim storage and disposal facilities (Implementation)	2.2.1 Sort, characterise, classify and quantify radioactive waste in accordance with requirements established or approved by the regulatory body (Characterisation)
	2.2.2 Minimise the quantity and volume of radioactive waste through pre-treatment and treatment (Treatment & processing)
	2.2.3 Stabilise waste by conditioning prior to long-term storage (Conditioning)
	2.2.4 Package waste accounting for future transport and deposition, and maintain safe interim storage of packages (Storage)
	2.2.5 Transport radioactive wastes between facilities in accordance with regulatory requirements (Transport)
2.3 Enhancing predisposal operations through iteration with waste generators and repository operators, to develop and deliver safe and cost-effective solutions (Optimisation)	2.3.1 Implement quality system and management system to ensure accurate detailed records of waste and package characteristics over their lifetime, from production until deposition (Quality & Management Systems)
	2.3.2 Evaluate potential for improving and optimising implementation phases with new technologies, to improve costs and environmental impact while

	maintaining safety and accounting for potential risk scenarios (Optimisation)
	2.3.3 Manage secondary waste streams produced during initial processing, for lifecycle approach (Secondary Waste Management)

2.2. Aim of Domain Insights (DI) documents

Domain insights document aim to describe, how that topic contributes to generic safety functions and typical overall optimisation goals and activities in this domain. The document should cover critical issues, information, data and/or knowledge in this domain. Furthermore, it should communicate maturity of knowledge and technology, as well as uncertainties and needed capacities (competences and infra-structures). Finally, it should also make references to existing guidance, training, networks and communities of practice.

The document should be concise and pointing to the available top-class references (IAEA, OECD NEA, SRA etc.). It should be pointed out that the KM documents are “living” documents and should be continuously adapted and updated as the state of knowledge changes.

A typical Table of content (TOC) of DI document is shown in Appendix 1.

2.3. Domain insight (DI) document pilot case

The top level, Theme Overview (TO) document of Predisposal activities was delivered in September 2021 (Holt 2021). Once the TO document was authored and agreed upon with the EURAD roadmap committee the next step was to produce a pilot Domain Insights document. In this process, a close collaboration between WP2 and WP3 has been developed, with the aim to interlink the content of PREDIS Strategic Research Agenda (SRA) and DI documents, as recommendations given in the DI are also valid and useful to be included in the SRA. SRA contributing actors of WP2 have been contacted as potential WP3 DI documents authors. In October 2022 different organisations (experts from organisations within the PREDIS consortium) have accepted to be leading author of all Theme 2 – Predisposal Domain Insights documents.

2.4. Engagement of experts for DI authorship

Following identification of the PREDIS roadmap sub-themes (as defined in the TO) an extensive search for experts was started. The goal and structure of the DI document require that it should be authored by a small team of 1-3 subject-matter experts that work in the area and have personal experience of the topic. It was advisable that the authors are familiar with the whole cradle to grave chain of RW disposal and acknowledged experts in the RWM field. The team should develop the topic as they consider it relevant, taking into account the PREDIS and EURAD roadmap to identify interphases to other topics.

At this point, VTT offered to produce the pilot Domain Insights on Transport (DI 2.2.5 in the PREDIS Roadmap). The development of the pilot DI was made as a joint effort between the PREDIS management team (MT) and KM to gain experience and to determine the time consumption of the individual DI production steps. The document was authored by VTT (Holt 2022) and was published in July 2022.

Further engagement of experts for the coming five DI, went through the PREDIS MT and R&D WP partners that were asked to identify subject-matter experts, within the PREDIS consortium or external to PREDIS, for each topic. Several meetings took place, discussing potential involvement and roles of authors for each domain Insight document. Firstly, three adverting DI production presentations were performed by WP3 team for all PREDIS audience in the first half of 2022. At each of the presentations WP3 presented the Roadmap structure, Theme 2 breakdown, DI goals and DI delivery process. Following that more focused meetings took place with pre-selected potential authors, looking for a potential consensus, will and expertise to contribute to DI production. Most often a leading author/institution has been agreed on the basis of mutual discussion of WP3 team – MT team – potential authors. Usually leading author/institution were selected, with potential contributors, if possible.

Based on that by the October 15, all the domain insight had been populated with dedicated authors, as can be seen in Table 2.

Table 2: Domain insight (DI) selected authorship

Sub-themes (Level 2)	Domains (Level 3, Domain Insights)	Leading Institution
2.1 Planning predisposal management of radioactive waste in close cooperation with waste producers (Planning)	2.1.1 Evaluate waste inventory from generators and existing storages, accounting for future waste generation and evolution (**Inventory**)	**NNL**
	2.1.2 Identify parameters and metrics for waste acceptance criteria through whole life cycle (**Waste Acceptance Criteria**)	**ENRESA**
	2.1.3 Assess potential technologies for implementation phase, considering cost-benefit ratio and availability (**Technology Selection**)	**BAM;** ENRESA, NNL-support
	2.1.4 Evaluate options to apply waste hierarchy to minimise waste volumes at higher impact inventory disposal levels (**Waste Hierarchy**)	**NNL,** CIEMAT Support
2.2 Implementing predisposal management of radioactive waste to support key risk and hazard reduction, and to help reduce costs and save space at interim storage and disposal facilities (Implementation)	2.2.1 Sort, characterise, classify and quantify radioactive waste in accordance with requirements established or approved by the regulatory body (**Characterisation**)	**SCK CEN;** ENRESA, BAM-support
	2.2.2 Minimise the quantity and volume of radioactive waste through pre-treatment and treatment (Treatment processing)	**SOGIN;** SUBATECH contribution
	2.2.3 Stabilise waste by conditioning prior to long-term storage (**Conditioning**)	**CEA**
	2.2.4 Package waste accounting for future transport and deposition, and maintain safe interim storage of packages (**Storage**)	**GSL,** COVRA supporting
	2.2.5 Transport radioactive wastes between facilities in accordance with regulatory requirements (**Transport**)	**VTT**
2.3 Enhancing predisposal operations through iteration with waste producers and repository operators, to develop and deliver safe and cost-effective solutions (Operations)	2.3.1 Implement quality system and management system to ensure accurate detailed records of waste and package characteristics over their lifetime, from Q+A (**QMS**)	**ENRESA**
	2.3.2 Evaluate potential for improving and optimising implementation phases with new technologies, to improve costs and environmental impact while maintaining safety and accounting for potenciál accident scenarios (**Optimisation**)	**Subatech,** GLS supporting
	2.3.3 Manage secondary waste streams produced during initial processing, for holistic operations (**Secondary Waste Management**)	**SCK CEN**

2.5.Domain insights document production

The DI document production process is outlined in Figure 3. Experience from production of the pilot DI document has helped us to streamline the production process of the 11 remaining Domain Insight documents.

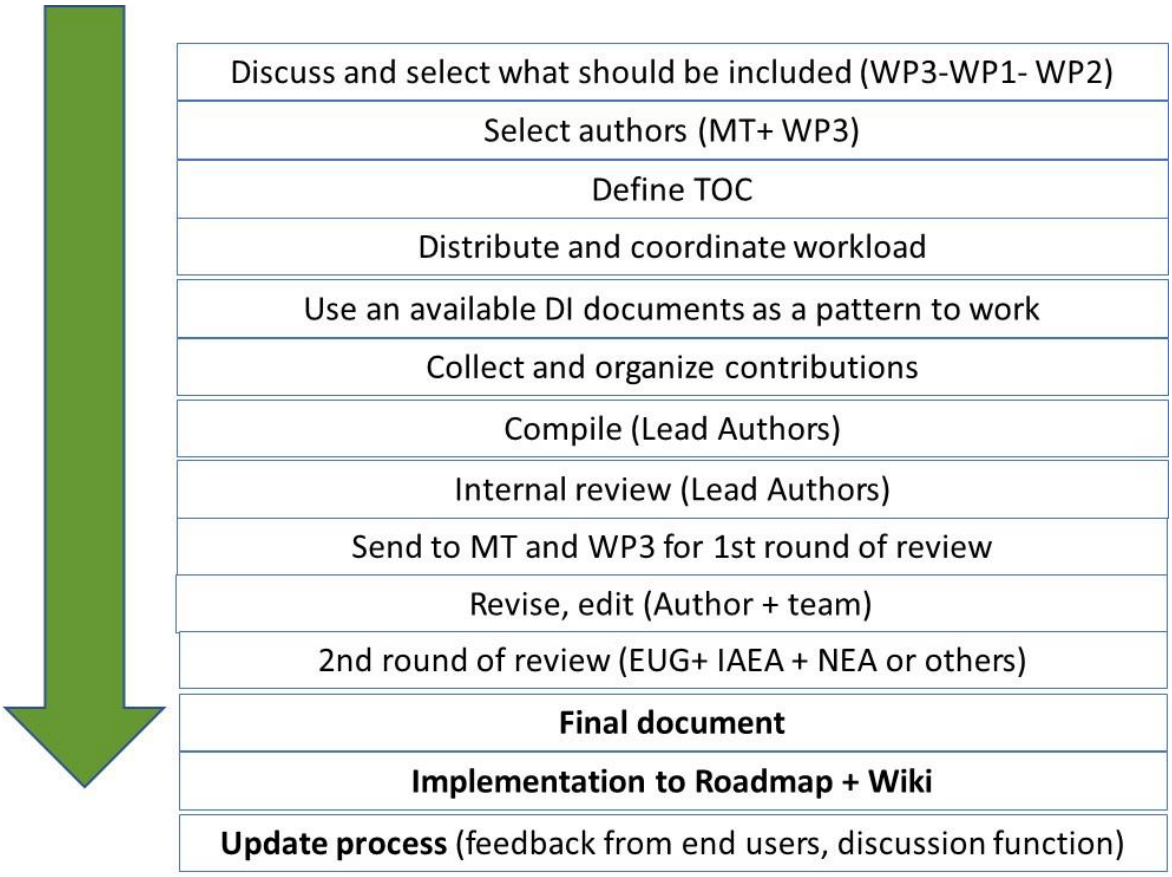

Figure 3. DI document production scheme.

The production of the remaining DI and SoK documents will be done in a collaboration between PREDIS experts in the R&D work packages and the KM WP (administering the production). The timeline for the production of the domain insights is relatively strict, with first six DI´s to be finalised during 2022 and the rest until the end of PREDIS (Fig. 4). The production of other SoK documents (SoK and SotA) that are linked to the Roadmap will run in parallel with the DI´s, but must be finalised before 2024.

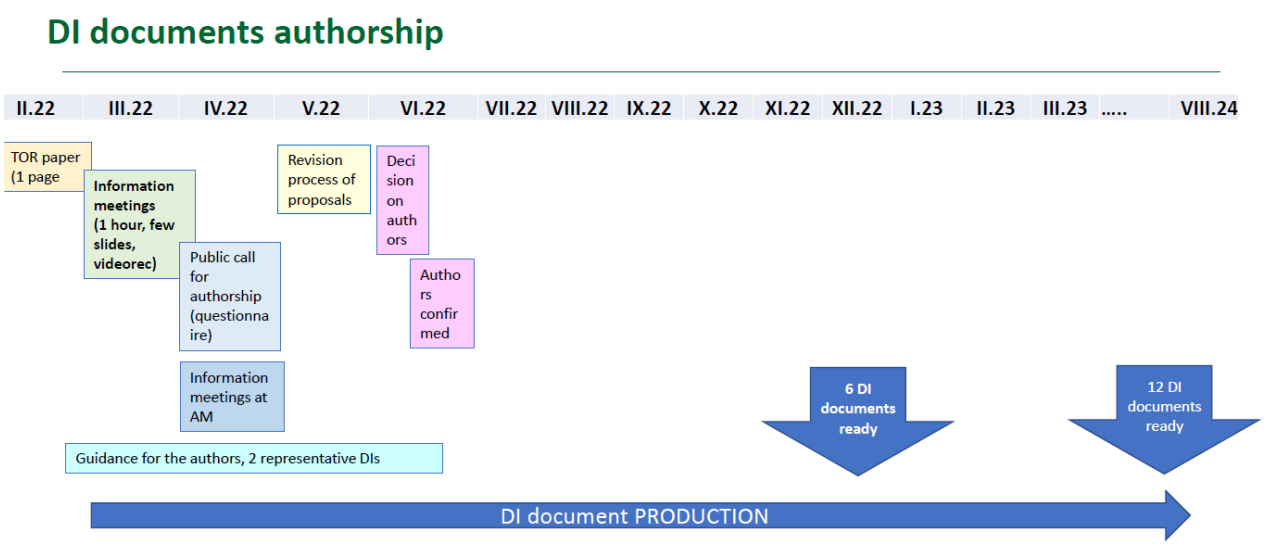

Figure 4. Planning of the 12 Domain Insights document production.

2.6. Review process

The review of the produced DI documents will be done in three rounds; (i) with the author(s), (ii) the WP3 partners, and (iii) PREDIS partners and external users.

The 1st round of review will be done internally with the author or author´s team.

The 2nd round will be performed by WP3 team and the PREDIS management team. After implementation of comments and revisions the mature draft will be issued and sent for an external review by members of the End-User Group, IAEA, OECD/NEA , EURAD WP11 and if necessary other expert group.

After the 3rd review round and revision of the document, it will be released for official publication. The procedure of document development, including the review process, is outlined in Fig. 3.

Finally, once reviewed and approved, these documents would then be made available on the public part of the EURAD Wiki. Strategy and description of EURAD Wiki development is available in Knuuti et al. (Knuuti 2022).

2.7. Update process

As mentioned above, knowledge management documents are “living” documents. The state of knowledge is changing constantly, therefore, it is aimed, to continuously update the KM documents. The EURAD Roadmap Wiki with the KM documents will be developed further, taking into account feedback from end-users and experts. Further on, Wikis have a built-in discussion function that allows users to comment on individual documents and the overall KM approach. The editing function allows users to participate easily as content creators or editors. As stated earlier, end user feedback and engaging the RWM community as active participants to KM via various functions is crucial (e.g., as authors, reviewers or by pointing out the necessity for update a document).

2.8. Socialisation of DI

The socialisation of the Domain Insights document aims to improve knowledge dissemination and to get end-user feedback on the document content. Dissemination of the pilot DI Transport was made through publication on the PREDIS and EURAD webpages. The socialisation of the DI content will be made through a 1-hour lecturing that is open to public and arranged in the frame of PREDIS KM training activities. The length of the lecture will depend on the complexity of DI topic.

Moreover, the DI will be incorporated into the EURAD Roadmap and EURAD Wiki that is open to EURAD and PREDIS partners and where further discussion/development of the content can be made through the Wiki chat function.

References

EURAD European Joint Programme on Radioactive Waste Management, https://www.ejp-eurad.eu/

Roadmap EURAD Roadmap https://www.ejp-eurad.eu/roadmap

Guide EURAD Roadmap Guide, https://www.ejp-eurad.eu/roadmap

Holt 2021 Erika Holt, PREDISPOSAL ACTIVITIES PRIOR TO GEOLOGICAL DISPOSAL OF WASTE; THEME OVERVIEW: In conjunction with waste generators, identify and deliver solutions to optimise the management of radioactive waste throughout the predisposal phases of the radioactive waste management programme, EURAD, version: 1.0 issued on 20 September 2021 at https://www.ejp-eurad.eu/sites/default/files/2022-07/EURAD%20Roadmap%20Theme%202_Predisposal_2022-07-01.pdf

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IAEA 2009 Predisposal Management of Radioactive Waste, General Safety Requirements, IAEA Safety Standards Series No. GSR Part 5. (2009), https://www-pub.iaea.org/MTCD/publications/PDF/Pub1368_web.pdf

Knuuti 2020 Knuuti T., Tatomir A., Göbel A., Franzen C., Abbasova D., Arnold Th., Brendler V., Fuzik K., Capturing the state-of-knowledge in EURAD knowledge management. EPJ Nuclear Sci. Technol. xx, xxx (2022) (in press; Sciences, 2022; https://doi.org/10.1051/epjn/2022030)

PREDIS 2020 EC Project: Predisposal management of radioactive waste (2020-24). https://predis-h2020.eu/

Appendix 1: Domain insights document

Table of Contents (TOC)

[No. Domain insight 1; Domain Insight]

Author: John Z.

Reviewers:

Change history:

Version	Date	Person	Change
0.1	21.12.2021	Person	original

Overview

Text (1 page max – summary of scope)

KEYWORDS:

predisposal, xxxxxxx

KEY ACRONYMS:

YYY

VVVV

Typical overall goals and activities in the domain insight of 'xxx'

This section provides the overall goal for this domain, extracted from the EURAD Roadmap goals breakdown structure (GBS). This is supplemented by typical activities, according to phases of implementation, needed to achieve the domain goal. Activities are generic and are common to most regional and geological disposal programmes.

Domain Goal	
Domain No. XXX	
Domain Activities	
Phase 1: Planning and Programme Initiation	xxxx.
Phase 2: Program Implementation	xxxxx
Phases 3-4: Program Operation/Optimisation and Closure	xxxx

International legislation

This section describes an international legislation, dedicated to the DI topic.

Generic safety issues

This section describes the safety precautions associated with radioactive material transport issues during each of the three phases noted in the table of Section 1. They are described with respect to a waste management program, addressing predisposal activities (prior to final geological disposal).

Critical issues, information, data or knowledge in the domain of 'XXX'

Maturity of knowledge and technology

This section provides an indication of the relative maturity of information, data and knowledge for the domain of transp9ort. It includes the latest developments for the most promising advances, including innovations at lower levels of technology maturity where ongoing RD&D and industrialization activities continue to improve.

Past R+D project on 'XXX'

Past IAEA and/or European Commission funded projects that have partially addressed radioactive waste transport have included….

Uncertainties

Lessons learnt

Guidance, training and communities of practice

This section provides links to resources, organisations and networks that can help connect people with people, focussed on the domain of transport.

References and Future Reading: